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IN THE SUPREME COURT OF OHIO

LEAGUE OF WOMEN VOTERS OF OHIO, *et al.*, *Relators*, *v.* OHIO REDISTRICTING COMMISSION, *et al.*, *Respondents*.	Case No. 2021-1193

AFFIDAVIT OF FREDA J. LEVENSON

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FILED IN CASES NOS. 2021-1198 AND 2021-1210

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Affidavit of Freda J. Levenson

I, Freda J. Levenson, having been duly sworn and cautioned according to law, hereby state that I am over the age of eighteen years and am competent to testify as to the facts set forth below based on my personal knowledge and having personally examined all records referenced in this affidavit, and further state as follows:

1. In the above-captioned case (No. 2021-1193), the Ohio Supreme Court has entered an order providing that parties shall file any evidence they intend to present no later than Friday, October 22, 2021.

2. I am one of the counsel for Relators in the above captioned matter, Case Number 2021-1193.

3. The documents contained in the attached Appendix of Exhibits are true and correct copies of the expert affidavits and exhibits filed by Relators in *Bria Bennett, et. al. v. Ohio Redistricting Commission, et. al.*, Case No. 2021-1198, and *The Ohio Organizing Collaborative, et. al. v. Ohio Redistricting Commission, et. al.*, Case No. 2021-1210. The Index copied below names each document and states where it appears in the Appendix.

ITEM	**DESCRIPTION**
1	Affidavit and Expert Report of Michael S. Latner and Exhibits
2	Expert Affidavit of Dr. Jonathan Rodden and Exhibits

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Freda J. Levenson
Signed on 2021/10/22 20:29:31 -8:00

Freda J. Levenson

Signed at Columbus, Franklin, Ohio
City County State

Sworn to and subscribed before me this 10/22/2021 day of October 2021.

Theresa Michelle Sabo
Commission # 2016-re-619622
Electronic Notary Public
State of Ohio
My Comm Exp. Nov 28, 2021

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IN THE SUPREME COURT OF OHIO

THE OHIO ORGANIZING COLLABORATIVE, *et al.*, *Relators*, *v.* OHIO REDISTRICTING COMMISSION, *et al.*, *Respondents*.	: : : : : : : : : : : :	Case No. 2021-1210 **APPORTIONMENT CASE** Filed pursuant to S.Ct.Prac.R. 14.03(A) and section 9 of Article XI of the Ohio Constitution to challenge a plan of apportionment promulgated pursuant to Article XI.

AFFIDAVIT AND EXPERT REPORT OF MICHAEL S. LATNER

I, Michael S. Latner, having been duly sworn and cautioned according to law, hereby state that I am over the age of eighteen years and am competent to testify as to the facts set forth below based on my personal knowledge and having personally examined all records referenced in this affidavit, and further state as follows:

1. I am a Professor in the Political Science Department at California Polytechnic State University. My research focuses on representation, electoral system design, and statistical methods in elections and in designing electoral districts. I have extensive experience with redistricting and have specialized in analyzing electoral district maps for compliance with constitutional and statutory requirements, which includes analysis of partisan advantage present in district maps. I have been retained to give my opinions concerning the General Assembly district plan adopted by the Ohio Redistricting Commission in September 2021. A table of the contents of my opinions appears below.

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BACKGROUND & QUALIFICATIONS

2. As I averred in my prior affidavit attached to the relators' complaint in this apportionment case. Over the past two decades, I have analyzed the properties of various types of electoral systems across the globe, the impact of the 2011 redistricting cycle on representation in Congress, the causes and consequences of redistricting across state legislatures, and have conducted numerous analyses of the ways that electoral rules have shaped electoral outcomes in state and local elections in the United States. A copy of my curriculum vitae is attached as Exhibit A.

3. I teach courses in Voting Rights and Representation; Campaigns and Elections; Political Participation; Democracy, Design and Public Policy; and Quantitative Methods in Political Analysis. I also serve as a voting rights Senior Fellow at the Union of Concerned Scientists' Center for Science and Democracy, one of the nation's largest non-partisan science advocacy organizations. In the last ten years I have given dozens of speeches, interviews, and presentations on quantitative political analysis of electoral districts and how to analyze partisan advantage. I have also written and contributed to peer reviewed papers and books on the topic of electoral district maps, a list of which is included on my curriculum vitae.

4. I have been invited as an expert to speak at several universities on the topic of redistricting and gerrymandering, including the University of California Hastings School of Law and Emory University School of Law. My first co-authored book on the topic, *Gerrymandering in America*, which has received over 100 academic citations, was also cited for our measures of the magnitude of partisan bias produced in the 2011 redistricting cycle in an amicus brief by political science professors submitted to the United States Supreme Court in *Gill v. Whitford*, 138 S. Ct. 1916 (2018). *See* Brief for Political Science Professors as Amici Curiae 3. This

portion of the amicus brief was cited by Justice Elena Kagan in her concurrence. *See* 138 S. Ct. at 1941.

5. I am familiar with and have studied Article XI of the Ohio Constitution.

6. As noted, I have been asked by the relators to analyze the General Assembly district plan adopted on September 16, 2021 (the "Enacted Plan") by the Ohio Redistricting Commission (the "Commission"), and to analyze whether it complies with Article XI of the Ohio Constitution. To conduct this analysis, I rely on total population data from the 2010 and 2020 Decennial Census and 2016-2020 election data from the Voting and Election Science Team (VEST) datahub,[1] unless otherwise noted. These data, including shapefile data, are publicly available through several repositories and mapping projects.[2] I have also reviewed several other plans for comparison, including the Republican caucus plan introduced by the Commission on September 9, 2021, the Democratic caucus plan, and maps from the Ohio Citizens' Redistricting Commission.

7. I am receiving compensation for my study and testimony at an hourly rate of $250 per hour. My compensation is in no way dependent on the outcome of the dispute.

SUMMARY OF MY OPINIONS

8. The Enacted Plan systematically disfavors Democratic voters by drawing the boundaries for House and Senate districts in an asymmetric manner that minimizes the number of legislative seats that Democrats can win with a given percentage of statewide votes, while retaining a larger number of seats that Republican can reliably win with same percentage of statewide votes. This disparate treatment of voters based on party preference has the effect of

[1] https://dataverse.harvard.edu/dataverse/electionscience.
[2] I obtained data from the following:
Redistricting Data Hub: https://redistrictingdatahub.org/data/about-our-data/#pl.
Dave's Redistricting App: https://davesredistricting.org/.

entrenching a veto-proof supermajority in both chambers of the legislature. It gives Ohio voters highly unequal ability to alter or reform their government by electing candidates who support their policy positions. Put simply, the Enacted Plan has the effect of giving Republican voters more weight and thus more power to elect candidates and influence policy than it provides Democratic voters.

9. The Enacted Plan shows that the person or persons who drew the House and Senate maps intended to treat Ohio citizens differently because of their voting history, political associations and affiliations, and to burden voters who vote for Democratic candidates because of those political associations and affiliations. The House and Senate district maps favor Republicans for reasons other than adherence to Article XI's requirements and Ohio's political geography. Rather, the maps reflect discretionary choices that the map drawers made to increase Republican voters' advantage over Democratic voters. The highly asymmetric and disproportionate benefits that accrue to Republican voters under these maps did not occur by chance or accident.

10. The proportion of House and Senate districts in the Enacted Plan that favor or disfavor a political party or that party's voters, based on statewide state and federal partisan general election results during the last ten years, does not correspond, much less correspond closely, to the statewide preferences of the voters of Ohio. To the contrary, the Enacted Plan disproportionately favors Republican voters relative to the statewide preferences of Ohio voters. The person or persons who drew the Enacted Plan could have produced more proportionate maps while also adhering to the other requirements of Article XI.

OVERVIEW OF PARTISAN GERRYMANDERING

11. Partisan gerrymandering occurs when members of a political party in control of redistricting manipulate the geographic boundaries of electoral districts in a manner that systemically advantages their party. The goal of partisan gerrymandering is to secure an advantage in future elections in good and bad election cycles alike. Effectively gerrymandered districts can give one party control of a state legislature or a congressional delegation for a full decade, even in swing states that have a closely split electorate, where both parties can win statewide depending on political winds.

12. There are two main techniques employed in gerrymandering: "packing," which wastes votes by unnecessarily concentrating the constituents of the disfavored party into a small handful of districts, and "cracking," which splits constituents of the disfavored party across several districts where they cannot form an electoral majority.[3] In both instances, the votes for the disfavored party are wasted and the votes for the favored party are strategically distributed to create seemingly close contests in a large number of districts that nonetheless have been drawn to produce reliable electoral majorities.[4]

13. A partisan gerrymander generates what is called "partisan bias." Partisan bias is the difference between the share of seats that a party receives for a given vote share, and the seat share that the other party would receive for the same vote share. A biased map enables the advantaged party to win seats in the legislature with a smaller vote share than what the disadvantaged party needs.

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[3] Bernard Grofman and Cervas, Jonathan, (2020), "The Terminology of Districting". Available at SSRN: https://ssrn.com/abstract=3540444, p.14.
[4] *Ibid*.

14. The harms caused by partisan gerrymandering are well documented. Recent research provides empirical evidence that voters' associational rights are diminished: partisan bias in districting plans is associated with the disfavored party contesting fewer districts, with candidates for the disadvantaged party having weaker resumes, and with lower donor support.[5] Conversely, the favored party need not put resources into contesting packed districts, allowing for efficient political expenditures. In other words, gerrymandering severely shrinks the geography, and the number of communities, where meaningful inter-party political competition takes place.

15. The bias that is manifested through partisan gerrymandering also has negative policy and social consequences. When the ideological representation of individual districts is distorted, that distortion shapes the composition of legislatures and the policies that they produce.[6] In turn, research has shown that social policy and health outcomes are impacted by legislative bias, with biased legislatures exhibiting less responsiveness to the health needs of statewide constituencies.[7] Because government policies typically apply statewide, it is the entire population that is potentially harmed by gerrymandering. For example, gerrymandered state legislatures have gone further in enacting restrictive election laws that potentially impact all voters within a state, and they were less likely to expand voting opportunities amid the COVID-19 pandemic.[8]

16. Partisan gerrymandering is a fundamental assault on the principle of democracy. It replaces rule by the people with rule by entrenched partisan interests that choose district

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[5] Stephanopoulos, Nicholas and Warshaw, Chris, (2019). "The Impact of Partisan Gerrymandering on Political Parties" Available at SSRN: https://ssrn.com/abstract=3330695 or http://dx.doi.org/10.2139/ssrn.3330695

[6] Caughey, Devin, Chris Tausanovitch, and Christopher Warshaw.(2017) "Partisan Gerrymandering and the Political Process: Effects on Roll-Call Voting and State Policies." *Election Law Journal: Rules, Politics, and Policy* 16, no. 4 (December 2017): 453–469.

[7] *Gerrymandering the States*, Ch.6.

[8] *Ibid.*

boundaries and empower certain constituencies at the expense of others. In other words, it gives unequal voting power to voters based on party association and preference. Partisan gerrymandering can effectively determine electoral outcomes, in spite of changes in voter support and variable turnout. In addition to the harms it causes to democracy, gerrymandering causes direct, material harm to voters in the form of distorted policy outcomes. Finally, by protecting politicians from accountability, gerrymandering contributes to the erosion of support for democratic government and the rule of law, fueling the rise of authoritarian governance.[9] Accordingly, the overwhelming—if not unanimous—consensus among political scientists is that a system that provides for minority rule or creates unequal voting rights is no longer a democracy or a government instituted for the equal protection and benefit of its citizens.

ANALYSIS AND OPINIONS

I. The Proportion of Districts in the Enacted Plan That Favor a Political Party Does Not Correspond with the Statewide Preferences of the Voters of Ohio

17. The people of Ohio have enshrined proportionality as a constitutional requirement for drawing assembly districts. As a general matter, the principle of proportionality means that the number of seats won by political parties in a parliament or assembly should correspond with or be broadly proportionate to the number of votes cast in support of those parties.[10]

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[9] Ozan O. Varol, (2015). "Stealth Authoritarianism", 100 *Iowa L. Rev.* 1673; https://ilr.law.uiowa.edu/print/volume-100-issue-4/stealth-authoritarianism/.

[10] Douglas Rae (1967) *The Political Consequences of Electoral Laws.* New Haven, CT/London: Yale University Press; Michael Gallagher, "Proportionality, Disproportionality, and Electoral Systems" *Electoral Studies,* (1991), 10, 1; Arend Lijphart (1994) *Electoral Systems and Party Systems. A Study of Twenty-Seven Democracies 1945–1990.* Oxford University Press; G. Bingham Powell (2000) *Elections as Instruments of Democracy: Majoritarian and Proportional Visions.* Yale University Press; David Farrell (2001) *Electoral Systems. A Comparative Introduction.* London: Palgrave.

Proportionality is a scientifically accepted concept that can be measured by the degree to which an electoral system or district scheme reflects the statewide preferences of voters.[11]

18. Broadly speaking, political scientists assess the proportionality of an electoral district map by comparing how the proportion of votes cast for a party relates to the proportion of seats that the party would be expected to win. A simple illustration demonstrates the principle of proportionality and how it can emerge in an election. Imagine a 5-seat state assembly, with 100 voters in each district and two parties (A and B) competing for seats. In an election, Party B wins narrow 51 percent/49 percent victories in districts 1, 2 and 3, but loses badly in districts 4 and 5, where Party A voters are heavily concentrated. Looking at the state as a whole, Party A is preferred by a 59 percent majority of voters, but Party B has won 60 percent of the assembly seats. See Table 1. Since the number of seats won by Party A does not correspond closely to the statewide voter preferences, the map is not proportional, and actually violates the principle of majority rule in this case. The difference between the percentage of votes (41 percent) and the percentage of seats (60 percent) won by Party B is the level of disproportionality in this election: 19 points.

[11] Interest in the relationship between votes cast and seats won can be traced back to the origins of election science. See, for example, John Stuart Mill, "Of True and False Democracy: Representation of All and Representation of the Majority Only" in *Considerations on Representative Government* (1861). For a more recent treatment, see Matthew Shugart and Rein Taagepera, "The Number of Parties and Proportionality: Two Key Tools for Analysis" in *Votes from Seats: Logical Models of Electoral Systems.* (2017, Cambridge University Press).

TABLE 1

How Disproportionality Emerges

Differences between the proportion of votes and seats won produce disproportionality.

SEATS	PARTY A VOTES	PARTY B VOTES	PARTY A SEATS	PARTY B SEATS
1	49	51	0	1
2	49	51	0	1
3	49	51	0	1
4	75	25	1	0
5	75	25	1	0
Statewide	59%	41%	40%	60%

Table 1. Disproportionality Illustration

19. Although there are various ways to measure proportionality,[12] Section 6(B) of the Ohio Constitution specifies a particular one. Under Section 6(B), the Commission must draw a map where "[t]he statewide proportion of districts whose voters, based on statewide state and federal partisan general election results during the last ten years, favor each political party correspond[s] closely to the statewide preferences of the voters of Ohio." Accordingly, I tailored my analysis to determine whether the Enacted Plan comports with Section 6(B).

20. My analysis proceeds in four steps. First, I calculate the statewide preferences of the voters of Ohio, based on statewide state and federal partisan general election results during the last ten years. Second, I calculate the statewide proportion of districts whose voters favor each political party, based on the same set of statewide elections for which data is publicly available. I do this for the House, the Senate, and for the General Assembly as a whole. Then, to

[12] Taagepera, R. *Predicting Party Sizes: The Logic of Simple Electoral Systems.* (2007) Oxford University Press.

determine whether the two figures "closely correspond" to each other, I calculate the difference between those two figures. Finally, I compare that difference to both to the previous legislative map and to other maps submitted to the Commission.

21. I start by calculating the statewide preferences of the voters of Ohio based on statewide state and federal partisan general election results during the last ten years. I find that the average results of statewide Democratic and Republican vote shares from 2012 through 2020 are 45.9 percent and 54.1 percent, respectively. See Table 2.

TABLE 2

Statewide Preferences of Ohio Voters

RACE	DEMOCRATIC VOTES	REPUBLICAN VOTES	DEMOCRATIC SHARE	REPUBLICAN SHARE
2012 Presidential	2,827,709	2,661,439	51.5%	48.5%
2012 Senate	2,762,766	2,435,744	53.1%	46.9%
2014 Governor	1,009,359	1,944,848	34.2%	65.8%
2014 Attorney General	1,178,426	1,882,048	38.5%	61.5%
2014 Auditor	1,149,305	1,711,927	40.2%	59.8%
2014 Secretary of State	1,074,475	1,811,020	37.2%	62.8%
2014 Treasurer	1,323,325	1,724,060	43.4%	56.6%
2016 Presidential	2,394,164	2,841,005	45.7%	54.3%
2016 Senate	1,996,908	3,118,567	39.0%	61.0%
2018 Governor	2,070,046	2,235,825	48.1%	51.9%
2018 Senate	2,358,508	2,057,559	53.4%	46.6%
2018 Attorney General	2,086,715	2,276,414	47.8%	52.2%
2018 Auditor	2,008,295	2,156,663	48.2%	51.8%
2018 Secretary of State	2,052,098	2,214,273	48.1%	51.9%
2018 Treasurer	2,024,194	2,308,425	46.7%	53.3%
2020 Presidential	2,679,165	3,154,834	45.9%	54.1%
Sum of votes	30,995,458	36,534,651	45.9 %	54.1%
Divided by number of races	16	16		
Composite (2012-2020)	1,937,216	2,283,416	45.9%	54.1%

Table 2. Statewide Preferences of Ohio Voters

22. Next, using 2016-2020 precinct-level election data from the Voting and Election Science Team (VEST),[13] (the only years for which I was able to obtain publicly available precinct-level results), I determined the statewide composite: 46.4 percent Democratic and 53.6 percent Republican. I then calculate the statewide proportion of districts whose voters favor each political party. The composite precinct votes were assigned to districts to calculate average district-level vote shares, which determined seat shares. I allocated a district to a political party whenever that party has an average two-party vote share above 50 percent. Four House Districts (15, 23, 36, 72) are within 0.5 percent of the majority two-party vote share. I allocated these seats to the party that receives a majority despite the tight margins.

A. Analysis of the Proportionality of the House Map in the Enacted Plan

23. Applying this method, the enacted House district map yields 64 districts for Republicans (64.6 percent of districts) and 35 seats for Democrats (35.4 percent of districts). See Table 3. By contrast, under a proportionate map, 54 seats (54.1 percent) should favor Republicans and 45 seats (45.9 percent) should favor Democrats. Given that the composite results from 2016-2020 are slightly more favorable to Democrats, the disproportionality would be even more pronounced if the analysis was limited to those years rather than 2012-2020.

[13] VEST provides the most comprehensive, composite precinct-level data and is regularly used by social scientists and public mapping projects. While data on statewide voter preferences is available for the 2012, 2014, 2016, 2018, and 2020 elections, precinct-level VEST data is available only for the elections in 2016, 2018, and 2020. I am not aware of any other source for precinct-level data for the 2012 and 2014 elections. Due to these data limitations, I projected seats won based on data from 2016, 2018, and 2020, and I compared these seats won with statewide composite voter preferences drawn from the 2012, 2014, 2016, 2018, and 2020 elections.

TABLE 3

Estimated Seat Shares for Enacted Plan

	REPUBLICAN	DEMOCRATIC
Statewide vote	54.1%	45.9%
Enacted House seats	64	35
Enacted House seat share	64.6%	35.4%
Enacted Senate seats	24	9
Enacted Senate seat share	72.7%	27.3%

Table 3. Estimated Seat Shares for Enacted Plan

24. To determine whether the parties' statewide vote share "corresponds closely" with the seat share in the House, I look to the difference in relative seat share between Democrats and Republicans and the difference in actual number of seats. Here, the difference in relative seat share is 11 percent: 65 percent of the House seats favor Republicans, even though only 54 percent of votes cast were for Republicans. That translates to 10 additional seats that favor Republicans in the House as compared to a fully proportionate map.

25. The Commission was presented with other plans that featured less disproportionality and were materially compliant with Article XI.[14] The Ohio Citizens' Redistricting Commission ("OCRC") House map, for example, has a near proportional allocation of seats (55.6 percent of seats favor Republicans with 54.1 percent of the vote). The OCRC map

[14] Specifically, I examined the extent to which the district boundaries split counties, municipalities and townships, and did not observe deviations from the priorities as laid out in Sections 3 and 4. While the numbering of the OCRC districts is not ordered in the same format as the Enacted Plan, the county- and municipal-level criteria appear to have been met.

demonstrates that the Commission could have introduced and enacted a more proportionate map if it had attempted to do so.

26. The enacted House map is also less proportional than last decade's legislative map, which was enacted before the Ohio Constitution was amended to expressly require proportionality. My published research on the consequences of gerrymandering in state legislatures demonstrates that Ohio enacted some of the most biased districting plans in the country in 2011.[15] The average historical disproportionality for the House over the last decade is approximately 9 percent. See Figure 1.

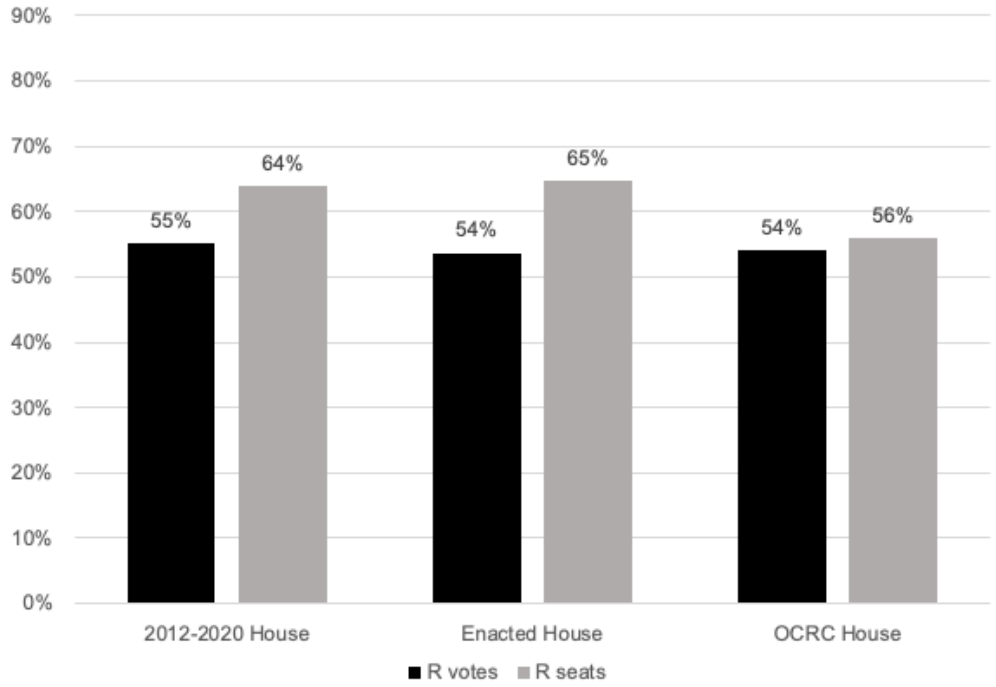

Figure 1. Disproportionality in 2012-2020, Enacted, and OCRC House Maps

27. Accordingly, I conclude that the statewide proportion of districts in the enacted House map whose voters favor each political party does not correspond, much less correspond closely, to the statewide preferences of the voters of Ohio.

[15] *Gerrymandering in America*, pp. 88-94; *Gerrymandering the States*, pp. 191-207.

B. Analysis of the Proportionality of the Senate Map in the Enacted Plan

28. I also analyzed the enacted Senate map for similar evidence of disproportionality, and arrived at a similar conclusion: the Senate map fails to meet Section 6(B)'s proportionality requirement.

29. There are 33 seats in the Ohio Senate. Elections are staggered so that 16 or 17 members are elected in every even-year election. Under Section 6(B), 18 seats (54.1 percent) should favor Republicans, while 15 seats (45.9 percent) should favor Democrats. Under the enacted map, however, 24 seats (73 percent) favor Republicans and 9 seats favor Democrats (27 percent). See Figure 2. The difference between the Republican statewide vote share and Republican seat share in the Senate is 19 percent, which translates into six additional seats that favor Republicans in the Senate.

30. As with the enacted House map, the Commission was presented with other maps that featured less disproportionality. The OCRC Senate map has a disproportionality of just 1 percent: 55 percent of Senate seats favor Republicans for a 54.1 vote share. Had the Commission attempted to comply with Section 6(B), it could have introduced and passed a substantially more proportional map.

31. From a historical perspective, the enacted Senate map is also more disproportionate than the 2012-2020 Senate map. The average historical disproportionality for the Senate over the last decade is approximately 17 percent. See Figure 2. At 19 percent, the enacted Senate map's projected disproportionality is worse than the 17 percent average level of disproportionality measured in last decade's Senate map

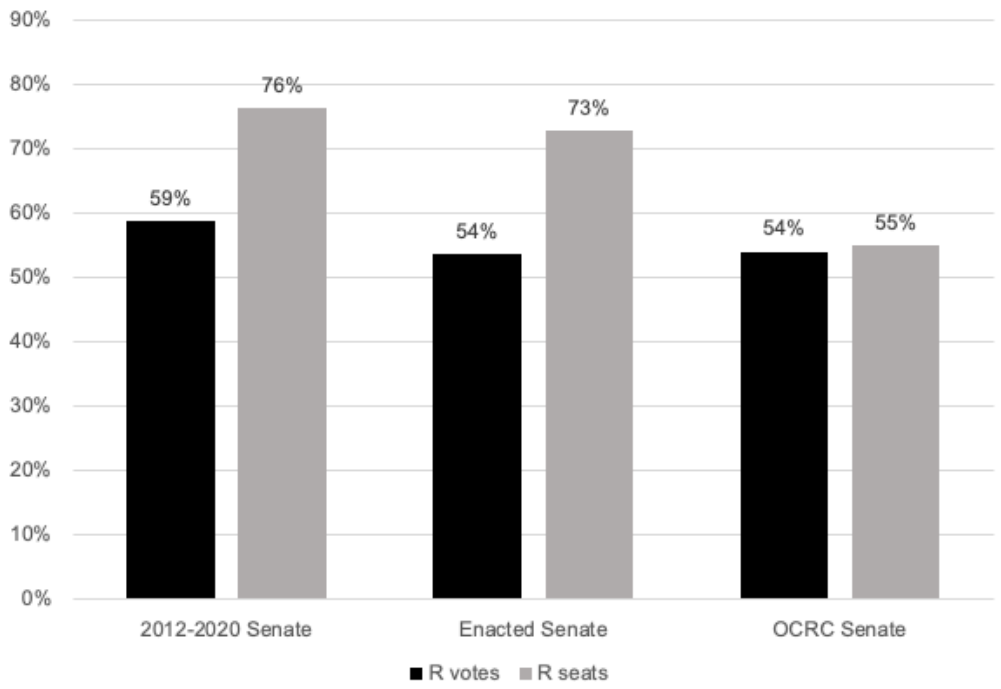

Figure 2. Disproportionality in 2012-2020, Enacted, and OCRC Senate Maps

32. Accordingly, I conclude that the statewide proportion of districts in the enacted Senate map whose voters favor each political party does not correspond, much less correspond closely, to the statewide preferences of the voters of Ohio.

C. Analysis of the Proportionality of the Enacted Plan as a Whole.

33. Finally, I combined the two preceding analyses to determine the proportionality of the Enacted Plan as a whole. There are 132 General Assembly districts in Ohio and, in the Enacted Plan, 88 favor the Republican Party (67 percent) and 44 favor the Democratic Party (33 percent). Under Section 6(B), 71 seats (54.1 percent) should favor Republicans, while 61 seats (45.9 percent) should favor Democrats. This level of disproportionality is unusually high by any standard.[16]

[16] Matthew Shugart and Rein Taagepera (2017), p.69. For example, proportionality for the U.S. House of Representatives is typically within 5 percent of vote shares.

34. Accordingly, I conclude that the statewide proportion of districts in the Enacted Plan whose voters favor each political party does not correspond, much less correspond closely, to the statewide preferences of the voters of Ohio.

D. Analysis of the Commission's 8(C)(2) Statement.

35. I have also been asked to review the Article XI, Section 8(C)(2) Statement issued by the Commission (the "Statement"). Section 8(C)(2) required the Commission to "include a statement explaining what the commission determined to be the statewide preferences of the voters of Ohio and the manner in which the statewide proportion of districts in the plan whose voters, based on statewide state and federal partisan general election results during the last ten years, favor each political party corresponds closely to those preferences," as described in Section 6(B).

36. The Statement indicates that the Commission calculated the statewide preferences of the voters in Ohio by calculating two numbers: (1) the number of statewide state and federal partisan elections won by Republican and Democratic candidates, respectively, over the last ten years; and (2) the number of votes cast for Republican and Democratic candidates, respectively, in statewide state and federal partisan elections over the last ten years. According to the Commission's calculations, Republican candidates won 13 out of 16 statewide state and federal partisan elections, or 81 percent of such elections, while Democratic candidates won 3 out of 16 such elections, or 19 percent. As for votes cast by voters, the Commission found, as I did above, that the average statewide proportion of voters favoring Republican candidates during that period was 54 percent and the statewide proportion of voters favoring Democratic candidates was 46 percent. On this basis, the Commission concluded that "the statewide proportion of voters favoring statewide Republican candidates is between 54% and 81% and the statewide proportion of voters favoring statewide Democratic candidates is between 19% and 46%."

37. The Commission stated that it adopted a plan that contains 85 House and Senate districts (64.4 percent) favoring Republican candidates and 47 House and Senate districts (35.6 percent) favoring Democratic candidates out of a total of 132 General Assembly districts.[17] Because 64.4 percent is between 54 percent and 81 percent, the Commission concluded that "the statewide proportion of districts whose voters favor each political party corresponds closely to the statewide preferences of the voters of Ohio."

38. Neither election science nor any reasonable definition of the phrase "statewide preferences of the voters of Ohio" supports the Commission's conclusion that the Enacted Plan is proportional.

39. As noted, Section 6(B) indicates that the benchmark for proportionality should be the "statewide preferences of the *voters* in Ohio." The Commission's approach—which included a measure that looks not to votes cast but statewide offices won—lacks a basis in Section 6(B)'s text.

40. Moreover, although there are several accepted statistical measures to estimate proportionality,[18] not a single such measure of which I am aware leaves votes cast out of the equation. For good reason: to say that the ultimate *outcome* of a statewide election reflects the statewide preferences of the voters is to disregard all the *voters* who cast a vote for the candidates who did not win. Also, it ignores differential turnout from election to election. If the Republican Party won five statewide elections with 50.1 percent of the vote and the Democrats won zero elections over the same time period, under the Commission's proportionality logic, that

[17] The composite data I use project 88 seats favoring Republicans and 44 favoring Democrats. Minor differences in the attribution of precincts to districts, used to estimate seat shares, can result in seats being attributed to different parties in very competitive districts. That said, even using the Commission's seat shares, the disproportionality of the Enacted Plan remains substantially high relative to comparison plans.
[18] Matthew Shugart and Rein Taagepera, (2017), Ch. 4

would mean that the statewide preference of the voters of Ohio is to elect Republicans to 100 percent of the districts in the state. Thus, under the Commission's reasoning, the election margins are irrelevant, and the 49.9 percent of votes not cast for Republican candidates are literally discounted. Because the Commission relied upon an invalid measure of proportionality to conclude that the Enacted Plan is proportional, and because the Enacted Plan lacks proportionality when assessed under valid measures, the Commission's Section 8(C)(2) statement should not be credited.

E. Conclusions About the Proportionality of the Enacted Plan

41. I conclude that the Enacted Plan violates Section 6(B) because the proportion of districts in the enacted plan that favor the Republican Party does not correspond closely with the statewide preferences of the voters of Ohio. The plan can be expected to provide the Republican Party approximately 67 percent of the seats in both chambers of the General Assembly—a veto-proof majority—even though only 54 percent of votes cast in statewide elections over the past decade favored Republican candidates. The average disproportionality for the Enacted Plan is estimated to be 11 percent for the House and 19 percent for the Senate. This is a high enough level of disproportionality to allow a party to win majority control over the General Assembly with a minority of votes, as has been demonstrated in two elections in the last decade. It is also significantly higher than other plans presented to the Commission, and higher than the average disproportionality seen in last decade's maps that were not subject to proportionality or other partisan fairness requirements.

II. The Enacted Plan Favors Republican Voters and Disfavors Democratic Voters

42. I have analyzed the Enacted Plan and conclude that it discriminates against voters who support the Democratic Party, to the advantage of voters who support the Republican Party.

I use statistical, comparative, and geographic analysis to determine whether the Enacted Plan favors or disfavors one party's voters over others. First, I determine the degree to which the Enacted Plan exhibits asymmetry in the allocation of seats for votes. Second, I compare asymmetries across two comparison plans: the plan proposed by the state Democratic Caucus, and a "unity" map proposed by OCRC. These other plans are useful for two reasons: (1) because, as mentioned, they are materially compliant with the Ohio Constitution; and (2) because they were presented to the Commission during the map-drawing process and could have been introduced. Accordingly, analysis of these plans helps establish whether the Commission could have drawn a less biased plan. Third, I analyze the geography of boundary choices in the Enacted Plan and the aggregation of House districts into Senate districts to identify the source of bias and the sorting of populations in the Enacted Plan. Fourth, I evaluate the amendments that were made to the plan between the time it was introduced and the time it was passed to determine whether those amendments feature a partisan bias. Finally, I look to whether Section 6(C)'s compactness requirement could explain the partisan bias in the Enacted Plan.

A. Partisan Asymmetry Analysis

1. Partisan Symmetry Overview

43. The primary metric I adopt in this section is partisan symmetry, a broadly accepted metric used by political scientists to measure partisan bias.[19] The principle of partisan symmetry requires that a districting system award the same number of seats to each party's

[19] Barry Burden and Corwin Smidt, "Evaluating Legislative Districts Using Measures of Partisan Bias and Simulations, *Sage Open*, 10, 4, 2020; https://doi.org/10.1177/2158244020981054; Anthony J McGann, Charles Anthony Smith, Michael Latner, Alex Keena, "A Discernable and Manageable Standard for Partisan Gerrymandering" *Election Law Journal*, 14, 4, 2015; John F. Nagle. "Measures of Partisan Bias for Legislating Fair Elections", *Election Law Journal*: 2015. pp. 346-360.http://doi.org/10.1089/elj.2015.0311.

candidates for the same share of statewide votes they receive. Originally developed by Andrew Gelman and Gary King, the measure has a long history of peer-reviewed scientific application.[20]

44. Partisan symmetry differs from proportionality, which I discussed above, in fundamental ways. In a two-party system, the principle of partisan symmetry requires that the number of seats won by a party when it receives a certain percentage of the statewide vote will be the same for each party, while the principle of proportionality requires that the number of seats won by a party correspond with or be proportionate to the number of votes cast in support of those parties. The question posed by a partisan symmetry analysis, in other words, is how many more (or fewer) seats does one party get for some share of the statewide vote as compared to what another party gets for that same statewide vote share.

45. Scientifically accepted measures of partisan symmetry follow logically from the principle that an electoral system should treat voters equally regardless of with which party they choose to associate, and that the party that wins the most votes should win the most seats.[21] I estimate symmetry in two ways: (1) a simple numeric formula (*S*) that can be calculated by hand,[22] and (2) a computational model of symmetry with statistical confidence intervals. The computational symmetry models estimate symmetry in the seats-votes function across a range of vote shares, while *S* measures symmetry in the distribution of support for parties across the districts that each party wins.

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[20]E.R.Tufte, (1973). "The relationship between seats and votes in two-party systems." Bernard Grofman and Gary King, "The Future of Partisan Symmetry as a Judicial Test for Partisan Gerrymandering after *LULAC v Perry*" *Election Law Journal*, 6,1,2007. Available at https://gking.harvard.edu/files/jp.pdf; *American Political Science Review*, 67, 540–554; Andrew Gelman and Gary King, "Estimating Incumbency Advantage Without Bias" *American Journal of Political Science*, Vol. 34, No. 4, pp. 1142-1164, November 1990, Available at SSRN: https://ssrn.com/abstract=1084180; Available at https://gking.harvard.edu/files/jp.pdf*American Political Science Review*, 67, 540–554.

[21] McGann, et.al., "A Discernable and Manageable Standard for Partisan Gerrymandering".

[22] This metric was first developed by Anthony McGann, during the writing of *Gerrymandering the States,* p. 30.

46. To calculate the simple measure of symmetry, *S*, I take the districts that are 5 percent above or below the statewide average of party support, and determine what proportion of those districts favor Democrats and what proportion favor Republicans. That is, a plan's bias under *S* equals the proportion of seats with Democratic vote share above five percent of the Democratic average minus the proportion of seats with Republican vote share above five percent of the Republican average. Put simply, *S* tells you whether a districting plan creates more Republican or Democratic leaning districts relative to the party's statewide average. A negative value for *S* means Republicans are advantaged while a positive value means Democrats are advantaged. In this report, simple *S* symmetry is charted graphically in the form of histograms. See, e.g., Figure 3. A symmetrical plan would show similar distributions of districts on either side of the vertical line denoting the average vote share; an asymmetrical plan would give the favored party more districts past the line denoting the average vote share for the party.

47. For the computational models, I calculate partisan symmetry for the plans, but instead of assuming uniform vote swing across districts, I impute random "noise" (up to five points) in 1,000 simulations of district vote distributions to reflect the idiosyncrasies and perturbations that occur in real elections over time. The procedure also allows me to calculate confidence intervals to provide estimates of statistical significance. In this report, the computational model is charted as a seats/votes S-curve function. See, e.g., Figure 3.

2. Partisan Symmetry in the House Map

48. Table 4 below shows the two measures of symmetry for the enacted House, Democratic Caucus, and the OCRC maps. Once again, I use available 2016-2020 precinct-level election data from the Voting and Election Science Team (VEST) for the calculations.

49. Both measures of symmetry show an approximate 15 percent seat advantage for Republican voters under the Enacted Plan. Moreover, the enacted House map is two to three

times as biased as comparison maps. When compared to historic measures, this level of bias suggests that the enacted House map is more biased than nearly three-quarters of state legislative maps drawn in the 2011 redistricting cycle.[23] The computational model also shows that this bias is substantial and statistically significant at the 95 percent confidence level. See Table 4.

TABLE 4

Symmetry in Enacted House and Comparison Maps

	SIMPLE S	ASYMMETRY	(95% CONFIDENCE)
Enacted House	−15	−15.39	(5.87)
Democratic House	−4	−6.37	(5.64)
OCRC House	−5	−8.11	(5.35)

Table 4. Symmetry in Enacted House and Comparison Maps

50. The extent of asymmetry in the enacted House map suggests that if Democrats were to win the same vote share as the Republicans average, 54 percent, they would still not win majority control of the Ohio House. As Table 5 shows, subtracting 8 percent from the Republican vote share in each district and giving it to Democrats yields 49 seats under the Enacted Plan, one seat short of a majority. By contrast, with 54 percent of the vote share, Republicans are expected to win a 64-seat veto-proof supermajority.

[23] Historical measures are found in *Gerrymandering the States*, pp.198-201.

TABLE 5

Seats and Seat Share for Both Parties Receiving 54 Percent of the Statewide Vote*

	STATE VOTE SHARE	SEATS	SEAT SHARE
Democratic voters	54%	49	49%
Republican voters	54%	64	65%

*Under uniform vote swing in each district.

Table 5. Seats and Seat Share for Both Parties Receiving 54 Percent of the Statewide Vote

51. The next set of graphs illustrate the two symmetry scores and provide a straightforward way of observing asymmetries in districting plans. The logic of symmetry requires that districting plans allocate district seats in equal numbers to parties with comparable levels of district-level support. That is, a histogram of a symmetric plan looks the same on both sides of the statewide party vote share average. In terms of a seats/votes function, the curve of seats won to votes won should intersect at the 50 percent point (50 percent of seats for 50 percent of votes).

52. Figure 3 provides a hypothetical example of what a perfectly symmetric (and proportional) districting plan looks like. In the figure, there are six competitive districts, with Party A winning between 45 and 55 percent of the vote. On either side of the six-seat column, there are five districts where Party A wins between 55 and 65 percent, and five districts where Party B wins between 55 and 65 percent, and so on. Both parties receive an equal share of districts (38 percent) 5 percent or more above their statewide average (50 percent). The symmetric distribution of districts necessarily produces a symmetric seats-votes function, as shown in the panel on the right. You can see that if Party A wins 60 percent of the vote, it

receives 71 percent of the seats, but Party B also receives 71 percent of seats with 60 percent of the vote.[24]

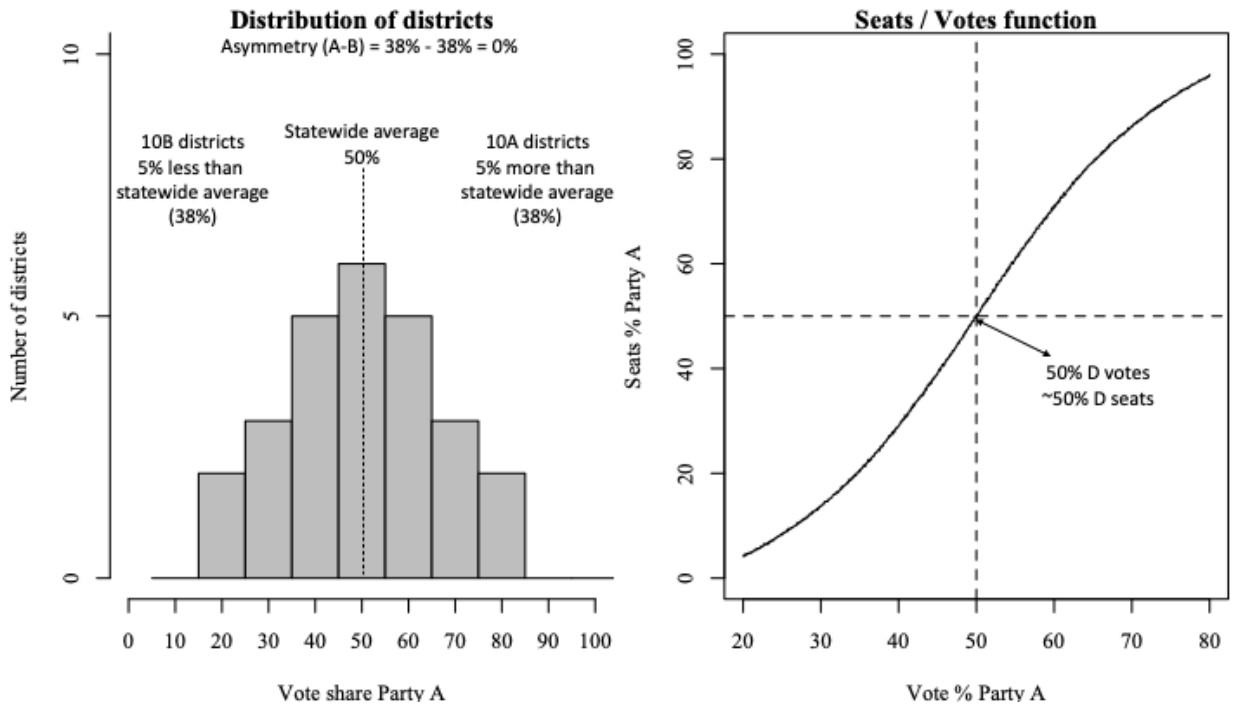

Figure 3. Hypothetical Symmetric Plan

53. For the enacted House map, Figure 4 illustrates the Simple *S* calculation, showing how the distribution of districts is skewed in favor of Republican voters. The histogram shows that Republicans win 47 percent of seats with more than 5 percent of their statewide vote share, compared to 32 percent of Democratic seats, an asymmetry of 15 percent. In fact, Republican voters have been drawn into 30 districts where they are expected to form 55-65 percent of the electorate. Democratic voters reach about half of that number with an equivalent range of support. Further, Democratic voters have been drawn into far more packed districts where they are expected to form more than 75 percent or of the electorate (visible on the far right of the

[24] Note also that the histogram need not be centered on 50 percent of the vote to be symmetric. The median district might have Party A winning, say, 70 percent of the vote (in a state dominated by Party A), but that would produce an identical seats-votes function: if there was a 20-point swing away from Party A and it only won 50 percent of the vote, it would still receive 50 percent of the seats.

histogram). Republican voters have been drawn into only one district where they are expected to form more than 75 percent of the electorate. Overall, the seats/votes function also demonstrates this bias. With 50 percent of the Democratic vote share, Democratic candidates are expected to yield only 42 percent of House seats on average, under the Enacted Plan.

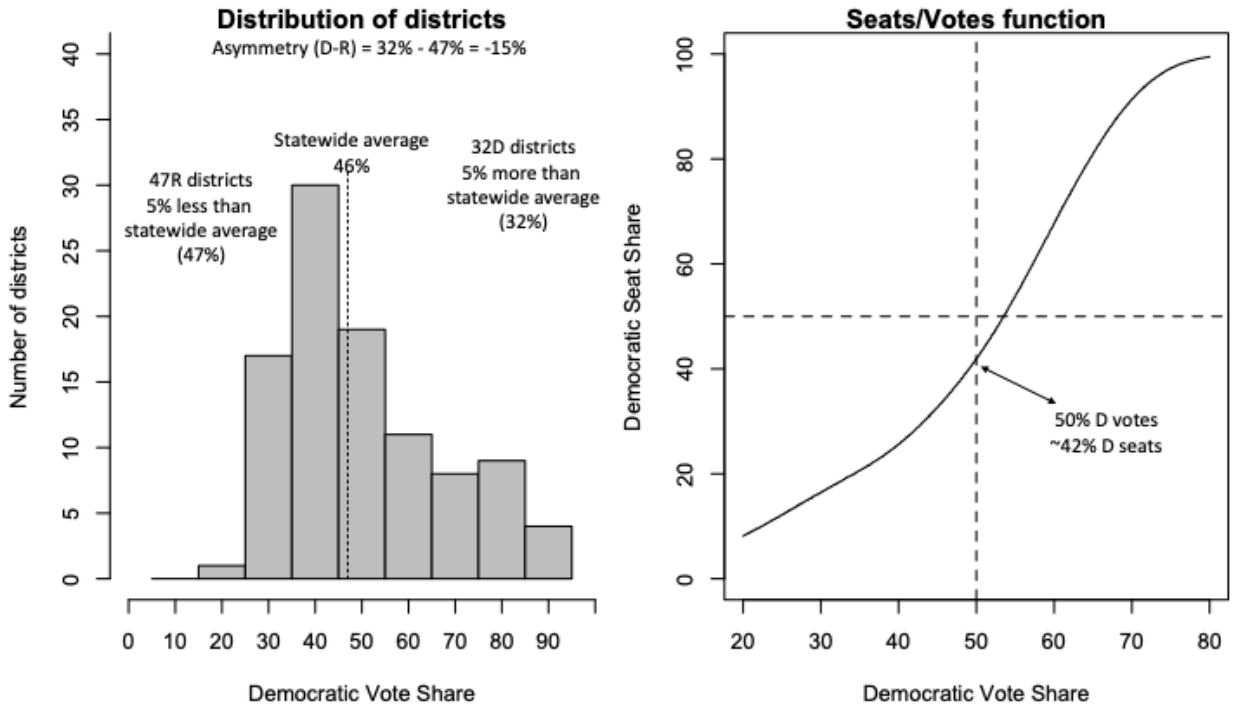

Figure 4. Histogram and Seats/Votes Function Under the Enacted House Map

54. For comparison, the histogram in Figure 5 shows that the OCRC map is visibly more symmetric. Democrats win more than twice as many districts in the 55-65 percent range. The overall asymmetry is reduced, with the proportion of seats won by Democrats and Republicans with five percent or more of their statewide support only differing by five percent (42 percent and 47 percent, respectively).

55. As shown in the seats/votes function, Democrats are much closer to winning a majority of seats with a majority of the statewide vote. The plan still deviates in favor of

Republicans at more extreme vote swings (Republicans would gain more than 75 percent of seats with 60 percent of the vote, compared to a 60 percent seat share for Democrats), but the results are far more symmetric and closer to proportional for the 45-55 percent vote range where elections in Ohio typically occur.

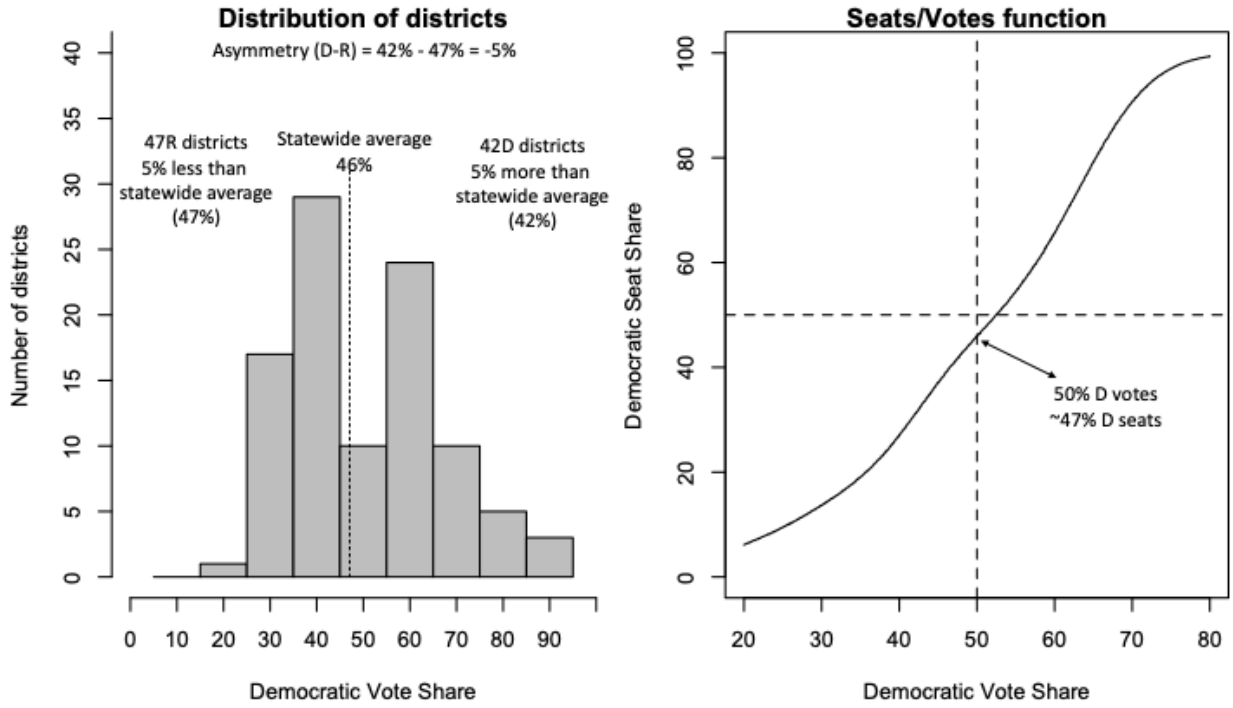

Figure 5. Histogram and Seats/Votes Function Under the OCRC House Map

56. Other professional nonpartisan redistricting assessment groups have also measured bias in the enacted House map and have likewise concluded that it is biased in favor of Republican voters. PlanScore,[25] a project of the nonpartisan Campaign Legal Center that allows people to score the partisan, demographic, racial, and geometric features of districting maps, estimates that the enacted House map favors Republicans in over 90 percent of plausible election

[25] PlanScore, Ohio State House: https://planscore.campaignlegal.org/plan.html?20210927T160848.177071909Z. Note that this page is incorrectly labeled "State Senate" but the figures are for the State House. PlanScore limits the calculation of symmetry scores to what they consider competitive plans. One reason the computational symmetry model I employ provides statistical confidence intervals is to reduce the likelihood of making false inferences from uncompetitive plans. At any rate, Ohio partisan vote shares are competitive, with historic vote shares typically falling within the 45-55 percent range.

districting scenarios, and that it exhibits extreme bias by historical standards. Similarly, the Princeton Gerrymandering Project, directed by Professor Sam Wang, who has been influential in developing metrics of partisan bias,[26] gives the enacted House map a grade of "F" on fairness, based on simulations that assess symmetry and changes in partisan support.[27]

3. Partisan Symmetry in the Senate Map

57. My analysis of the enacted Senate map demonstrates that, rather than attenuating partisan bias by balancing out the bias of underlying House districts, the aggregation of three House districts into each of 33 Senate districts builds off of and further exacerbates the bias in the enacted House map.

58. Like the 2011 House map, the Senate map implemented after the 2010 Census was among the most biased state legislative plans produced in the last redistricting cycle.[28] The newly enacted Senate map is also substantially and significantly biased against Democratic voters. See Table 6. The symmetry measures indicate a 15 to 17 percent seat advantage for Republican voters. For comparison, neither the Democratic Caucus nor the OCRC Senate maps show statistically significant levels of asymmetry. In other words, there were less biased options available for designing a Senate map, and the Enacted Plan incorporated politically motivated choices.

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[26] Sam S.H Wang, (2016), "Three Practical Tests for Gerrymandering: Application to Maryland and Wisconsin." *Election Law Journal*; DOI: 10.1089/elj.2016.0387.
[27] Princeton Gerrymandering Project, Ohio Final House Map: https://gerrymander.princeton.edu/redistricting-report-card?planId=rec1ovrNKW7xjVsKb. This is a source of information that is generally and widely relied upon by political scientists who study partisan bias in electoral maps.
[28] *Gerrymandering the States*, pp.198-201.

TABLE 6

Symmetry in Enacted Senate and Comparison Maps

	SIMPLE S	ASYMMETRY	(95% CONFIDENCE)
Enacted Senate	−15	−17.34	(10.48)
Democratic Senate	−12	−8.34	(9.52)
OCRC Senate	−9	−6.48	(9.22)

Table 6. Symmetry in Enacted Senate and Comparison Maps

59. Table 7 simulates a uniform swing of eight percent in favor of Democrats, so that they receive 54 percent of the statewide vote, and compares it with the performance of Republicans under a 54 percent Republican statewide vote share. The Democratic Party would win 18 seats with 54 percent of the vote, narrowly exceeding the 17 seats needed for a majority. With the same vote share, Republicans would control 24 seats, nearly three quarters of Senate seats.

TABLE 7

Senate Seats and Seat Share for Both Parties Receiving 54 Percent of the Statewide Vote*

	STATE VOTE SHARE	SEATS	SEAT SHARE
Democratic voters	54%	18	55%
Republican voters	54%	24	73%

*Under uniform vote swing in each district.

Table 7. Senate Seats and Seat Share for Both Parties Receiving 54 Percent of the Statewide Vote

60. This level of Republican advantage in seat share suggests that, under the enacted Senate map, if a bare majority (50 percent plus one vote) of Ohio voters supported Democratic

candidates in future elections, Democrats would likely not win a 17-seat bare majority in the Senate. See Figure 6. This is a consequence of the skewed allocation of seats that can be observed in a histogram of the enacted Senate map. Whereas Republicans are expected to win 14 of 33 Senate districts with five percent or more of their statewide vote share, Democrats only obtain nine of 33 districts, a 15 percent difference in favor of Republicans. And similar to the enacted House map, there are three Senate districts (15, 21, 23) that Democrats are winning by higher than a 75 percent margin, with no comparably lopsided victories for Republicans, because their voters have been distributed more efficiently by the Commission.

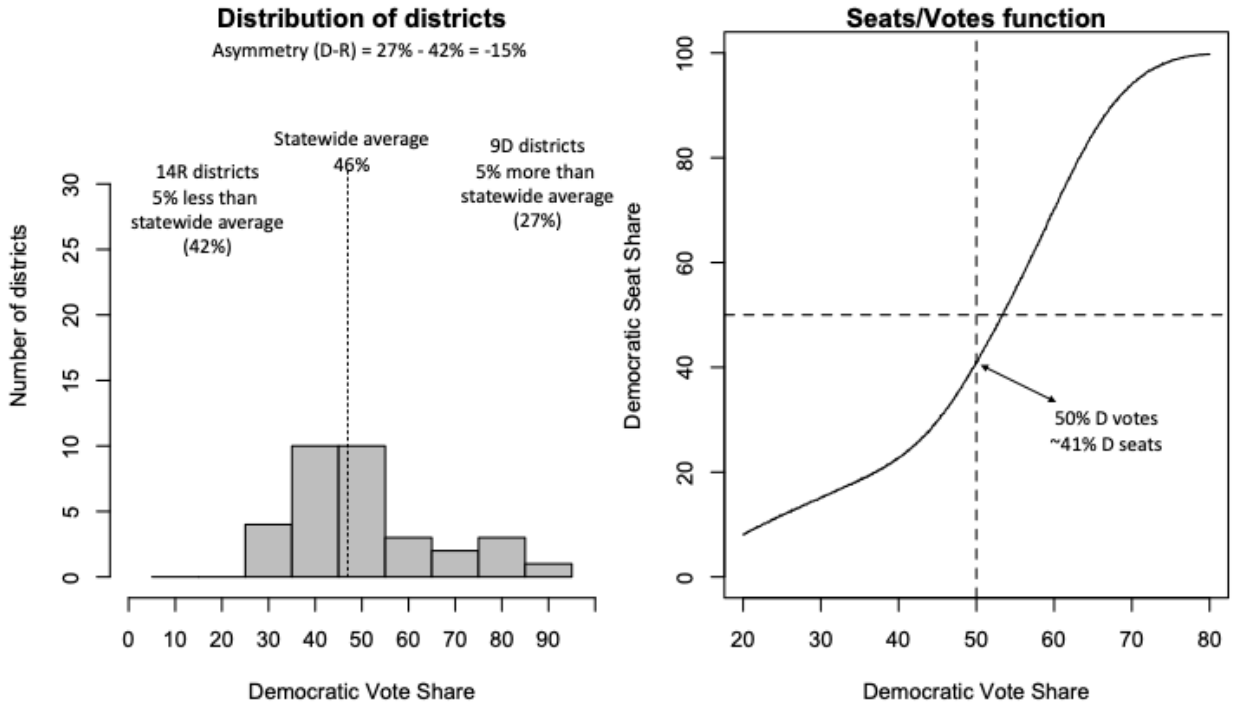


Figure 6. Histogram and Seats/Votes Function Under the Enacted Senate Map

61. For comparison, graphing the distribution of districts by Democratic vote share and the seats/votes function of the OCRC Senate map illustrates its greater symmetry, and demonstrates that drawing a more symmetric map was possible. Democrats win more seats with

55-75 percent of the two-party vote, and correspondingly fewer Democratic districts are packed with 75 percent or higher Democratic voters. See Figure 7.

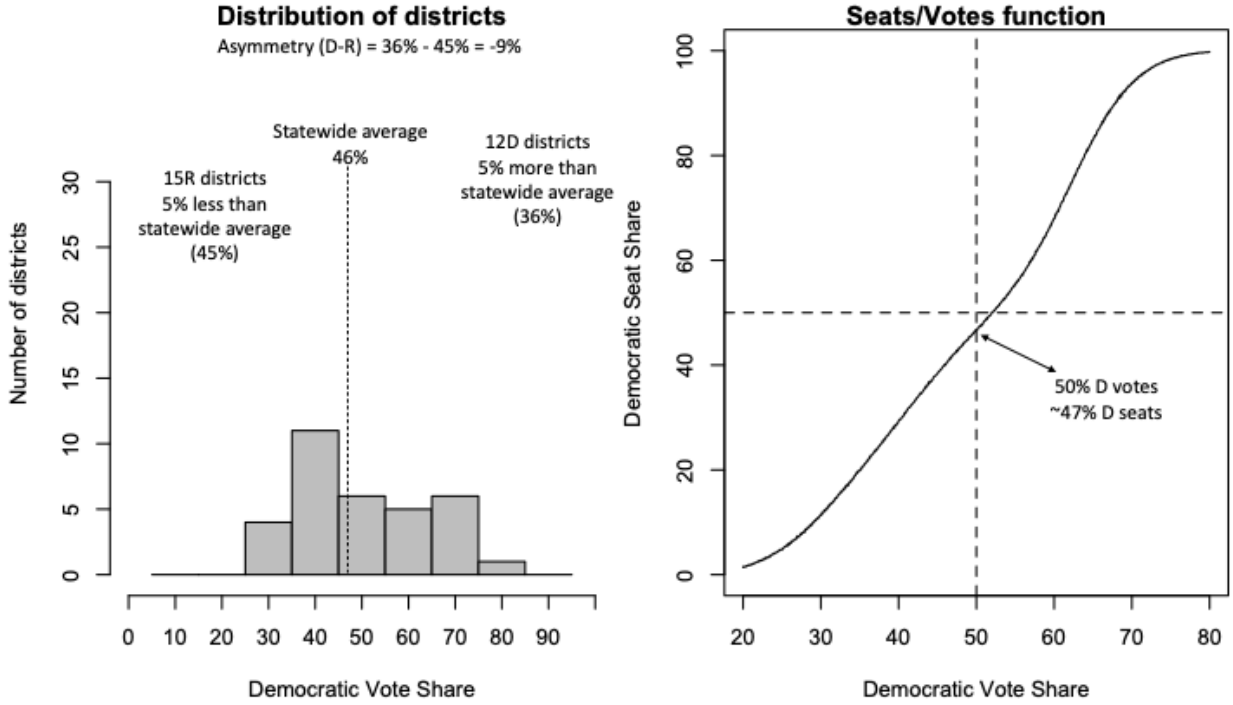


Figure 7. Histogram and Seats/Votes Function Under OCRC Senate Map

62. The foregoing analysis establishes that the Enacted Plan is biased in favor of Republicans.

B. District Boundary Analysis

1. District Boundary Overview

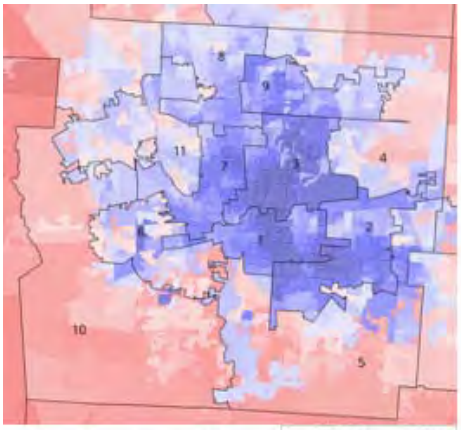
63. In order to identify the sources of asymmetry in partisan support in these maps, I compare the level of partisan support across adjacent districts and similar counties to look for evidence of partisan "packing" or "cracking" of voters. I find that in the most populous, heavily Democratic counties, adjacent districts in the Enacted Plan are drawn to maximize the number of seats that Republicans win. In mid-size and smaller counties, district design provides a decisive advantage to Republican voters. Similarly, House districts are aggregated into Senate districts in a manner that dilutes the voting power of Democratic voters. I conclude that the Enacted Plan

unnecessarily packs Democratic voters into uncompetitive districts in order to create more reliably winnable Republican districts, in a durable, seat-maximizing Republican gerrymander. More than six House districts and more than two Senate districts would need to be redrawn in order to remedy this gerrymander.

2. Precinct and District Border Analysis in the House Map

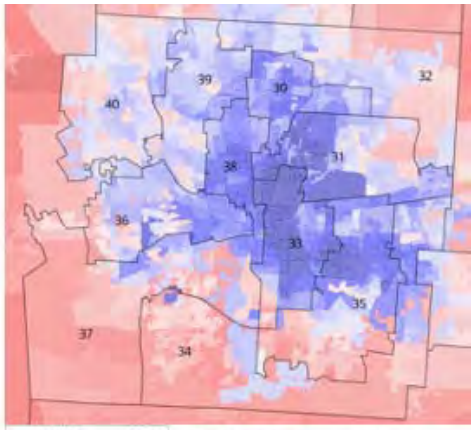
64. The selection of counties for splitting and joining together territories into districts can contribute to partisan bias. There is evidence that these discretionary choices in the Enacted Plan have been used for packing and cracking throughout the state. Using the composite 2016-2020 data, several examples illustrate these properties of the Enacted Plan through geographic and comparative analysis.

65. Figure 8a displays maps and district Democratic vote shares for the 12 districts carved out of Franklin County for the Enacted Plan and the OCRC plan. Democratic support is concentrated in central Columbus, where both maps locate four heavily Democratic districts. However, the Enacted Plan's Columbus districts (1, 2, 3, and 7) are a minimum 75 percent Democratic, while the OCRC districts do a better job of including suburban areas that help to balance the partisan vote concentration. The Enacted Plan's packing of Columbus districts yields two Republican seats by keeping district 10 out of Columbus and allocating the remainder of Franklin County's population to district 12 (upper left quadrant) and joining it with Union County.



Enacted Franklin County House Districts

District	Mean
3	85.7%
1	80.6%
2	77.3%
7	75.3%
9	68.2%
8	63.3%
11	55.8%
5	54.7%
6	54.5%
4	54.2%
10	45.3%
12	39.2%



District	Mean
33	84.3%
38	77.7%
30	72.0%
35	71.0%
31	69.2%
36	60.8%
39	59.9%
32	55.0%
37	54.5%
40	53.4%
34	52.6%
41	31.9%

OCRC Franklin County House Districts

Figure 8a. Districts 3, 1, 2 and 7 Pack Democratic Voters

66. In Figure 8b, the visible concentration of Democratic voters in a few districts creates an opportunity for Republicans to pick up an extra seat in Franklin County. This contributes to the asymmetry of the plan by carving out an additional Republican seat in a Democratic stronghold. While the Enacted Plan may appear more proportional *within* the county, the plan's asymmetry (and disproportionality) results from a lack of Democratic seats being carved out of the smaller counties where Republicans dominate.

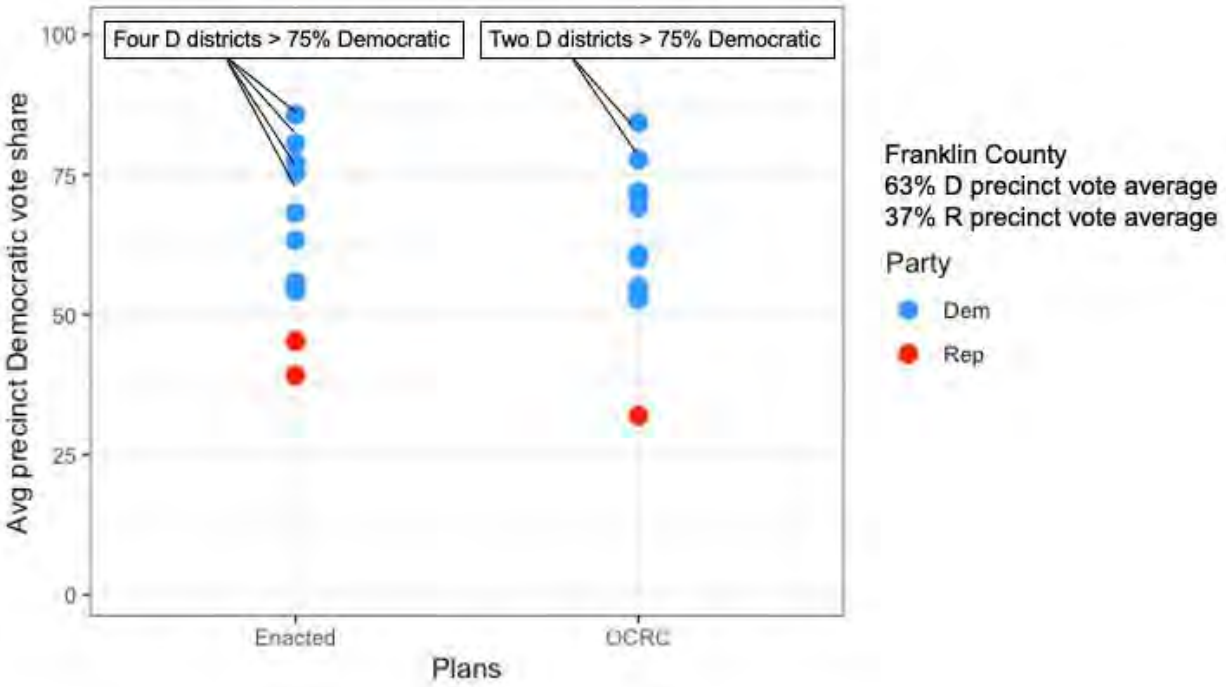
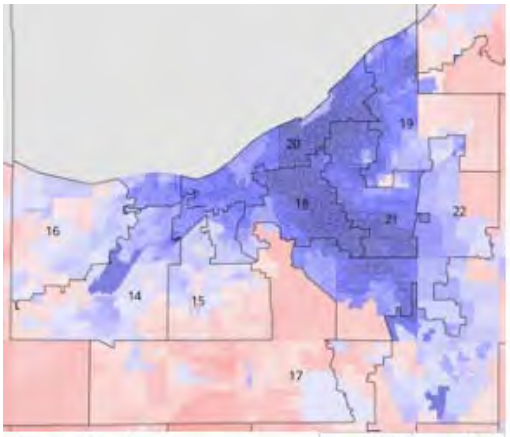


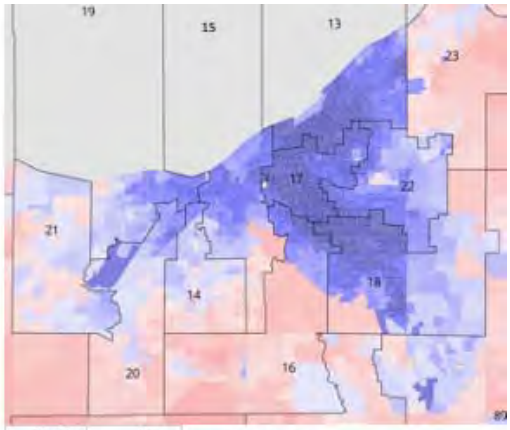
Figure 8b. Packing Democratic Voters Generates Additional Republican Seat in Franklin County

67. There is a similar pattern in the even more Democratic Cuyahoga County. See Figure 9a. Once again, while both plans carve heavily Democratic districts out of central Cleveland, the Enacted Plan's Cleveland and adjacent districts, specifically 18, 20, and 21, are packed with more Democratic voters, and that difference, however subtle, creates an opportunity to draw two highly competitive seats, 15 and 23, that lean Republican.



Enacted Cuyahoga County House Districts

District	Mean
18	91.1%
20	88.3%
21	88.1%
22	73.4%
19	72.7%
13	71.1%
14	57.2%
16	53.2%
23	49.8%
15	49.7%
17	42.8%



District	Mean
17	92.5%
13	87.9%
18	79.9%
22	74.3%
15	69.3%
19	66.5%
16	56.2%
20	54.2%
21	52.4%
14	51.8%
23	44.5%

OCRC Cuyahoga County House Districts

Figure 9a. Districts 18, 20, 21 Pack Democratic Voters

68. While it would require some relaxation of compactness requirements, and possibly a change in the Commission's county splitting rules, to create competitive districts in Cleveland, packing voters in the manner that the enacted House map does is not necessary to create a fair statewide districting plan. In these most populous counties, we repeatedly find a pattern with the Enacted Plan placing urban voters, and primarily voters of color, into slightly more concentrated districts. See Figure 9b. The cumulative impact of these tactics across counties is to generate a substantial seat advantage in the General Assembly in favor of Republicans.

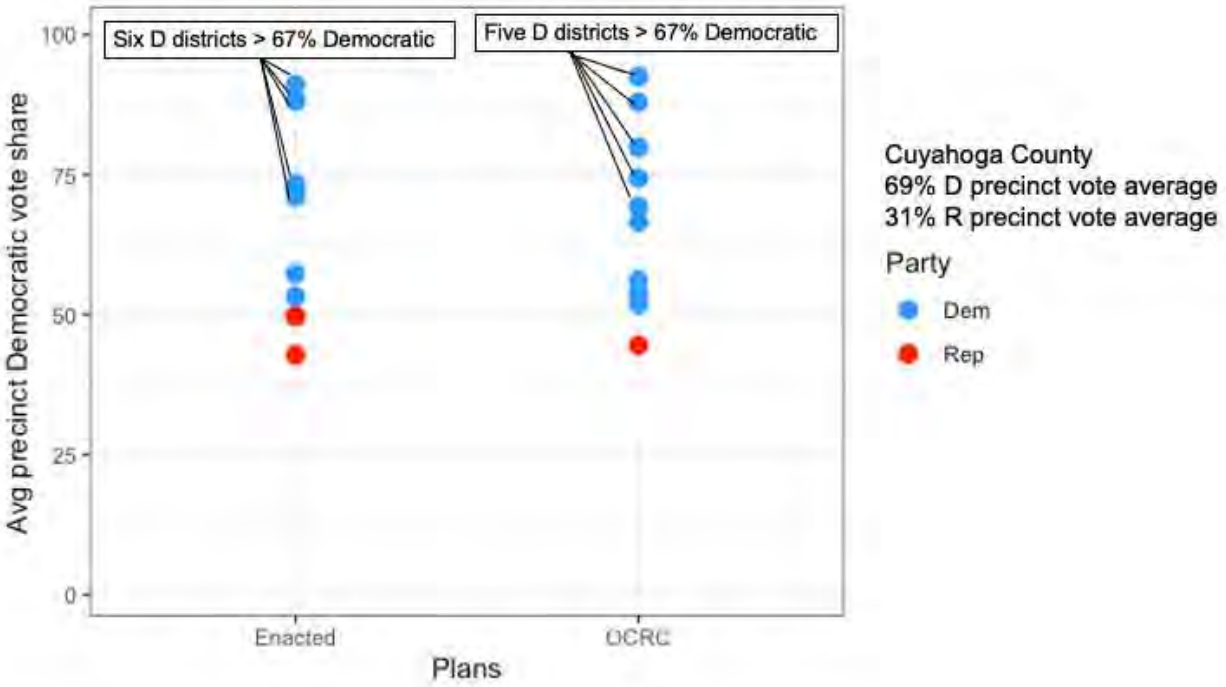
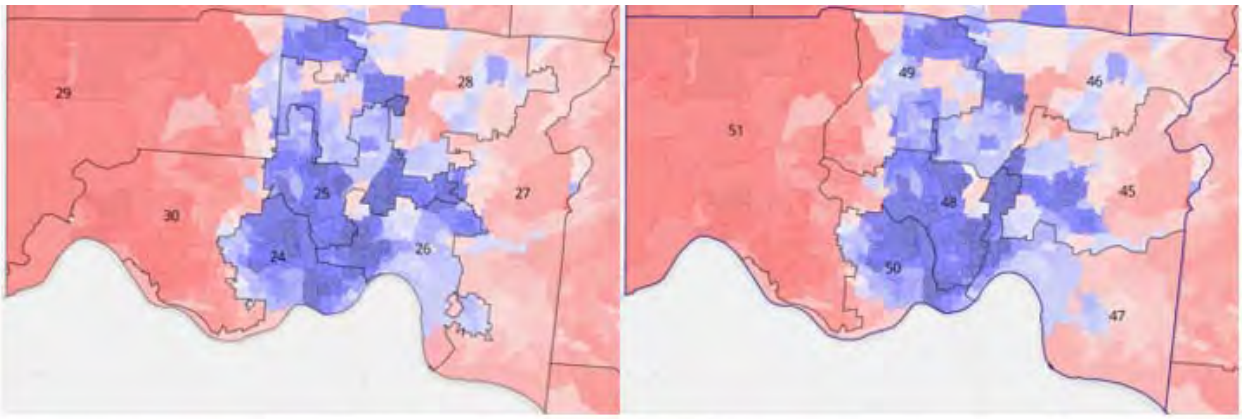


Figure 9b. Packing Democratic Voters Generates Additional Republican Seat in Cuyahoga County

69. Figure 10a illustrates the maps and district vote shares for the Enacted and OCRC House maps for districts with populations in Hamilton County. In the enacted House map, districts 24, 25, and 26 contain large shares of Cincinnati voters. These districts are uncompetitive, packing Democrats in a manner that creates three reliable Republican seats on the eastern and western borders of the county. One of those, district 29, carves out the highly Democratic city of Forest Park (top center), submerging it with the rural western half of the county. The OCRC map has four districts that are close to the county average Democratic vote share of 56 percent, compared to only one such district, 28, in the enacted House map.

70. Figure 10b shows the disparity more clearly. The enacted House map concentrates Cincinnati voters into three packed, Democratic supermajorities, which have an expected Democratic vote share of more than 67 percent. This frees up more suburban voters that the Commission used to create two more competitive, but reliably Republican districts. Specifically, the comparison to the OCRC map shows how central and southern Cincinnati voters are packed into districts 24 and 25 in a manner that dilutes the weight of their votes relative to alternatives. While it is also true that the only Republican district in the OCRC plan is uncompetitive, it does accurately reflect the politics of the rural western half of the county, and overall, more OCRC districts are closer to the county average.



Enacted Hamilton County House Districts

District	Mean
25	80.8%
24	74.6%
26	67.5%
28	53.5%
29	46.7%
27	44.0%
30	28.4%

OCRC Hamilton County House Districts

District	Mean
48	77.3%
50	65.8%
49	59.1%
47	56.7%
45	56.3%
46	53.5%
51	24.2%

Figure 10a. Districts 25, 24, and 26 Pack Democratic Voters

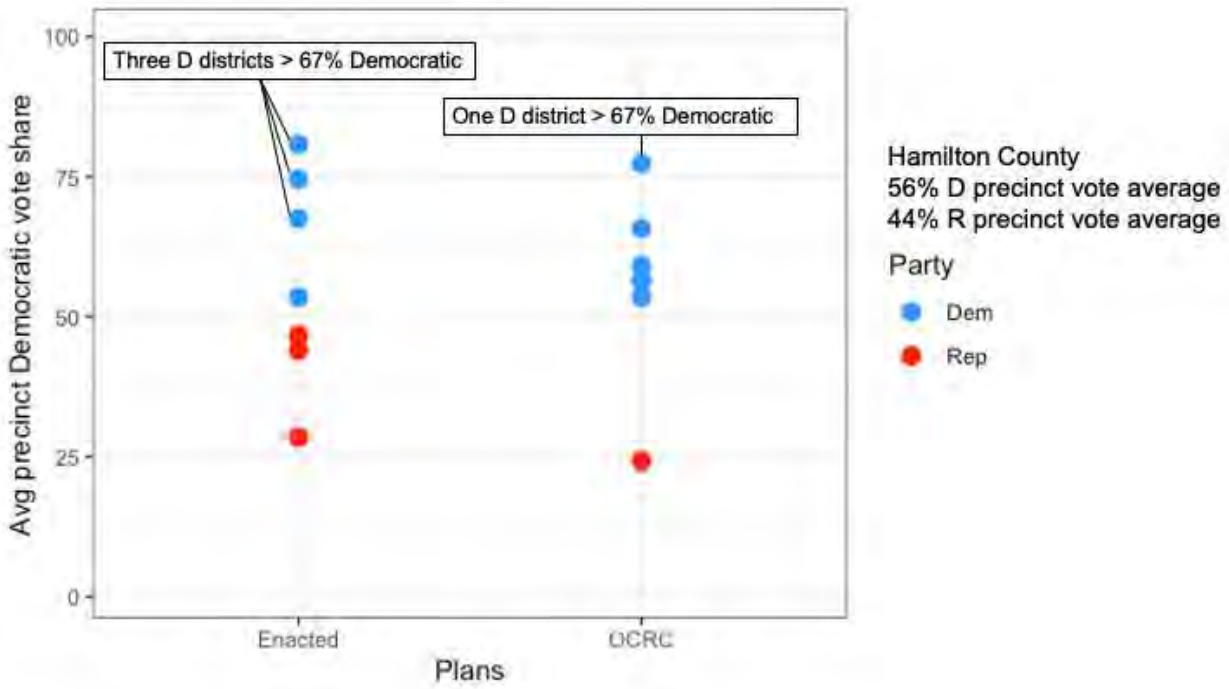
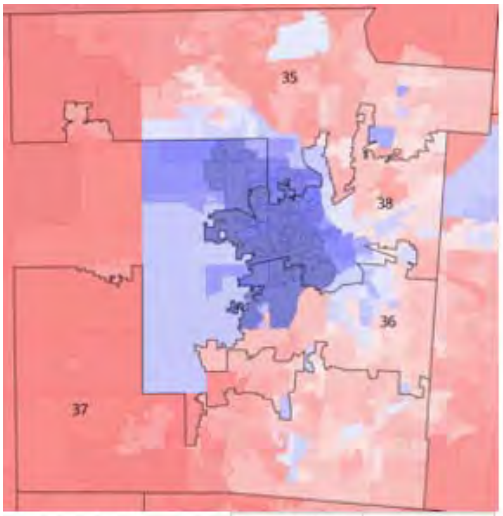


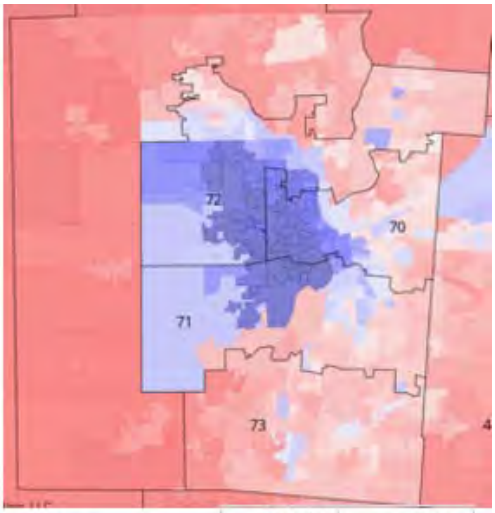
Figure 10b. Packing Democratic Voters Generates Two Additional Republican Seats in Hamilton County

71. Once again, there is a similar pattern in the five districts carved out of Montgomery County, shown in Figure 11a. District 38 in the enacted House map concentrates much of the population of central Dayton into a 71 percent Democratic "sink," while district 39 takes up the western suburbs of Montgomery County and combines them with adjacent Preble County to create a 66 percent Republican district.



Enacted Montgomery County House Districts

District	Mean
38	71.7%
36	50.7%
35	45.0%
37	37.5%
39	34.1%



OCRC Montgomery County House Districts

District	Mean
70	63.7%
72	59.6%
71	53.4%
73	39.0%
69	26.8%

Figure 11a. District 38 in Dayton Packed with Democratic Voters

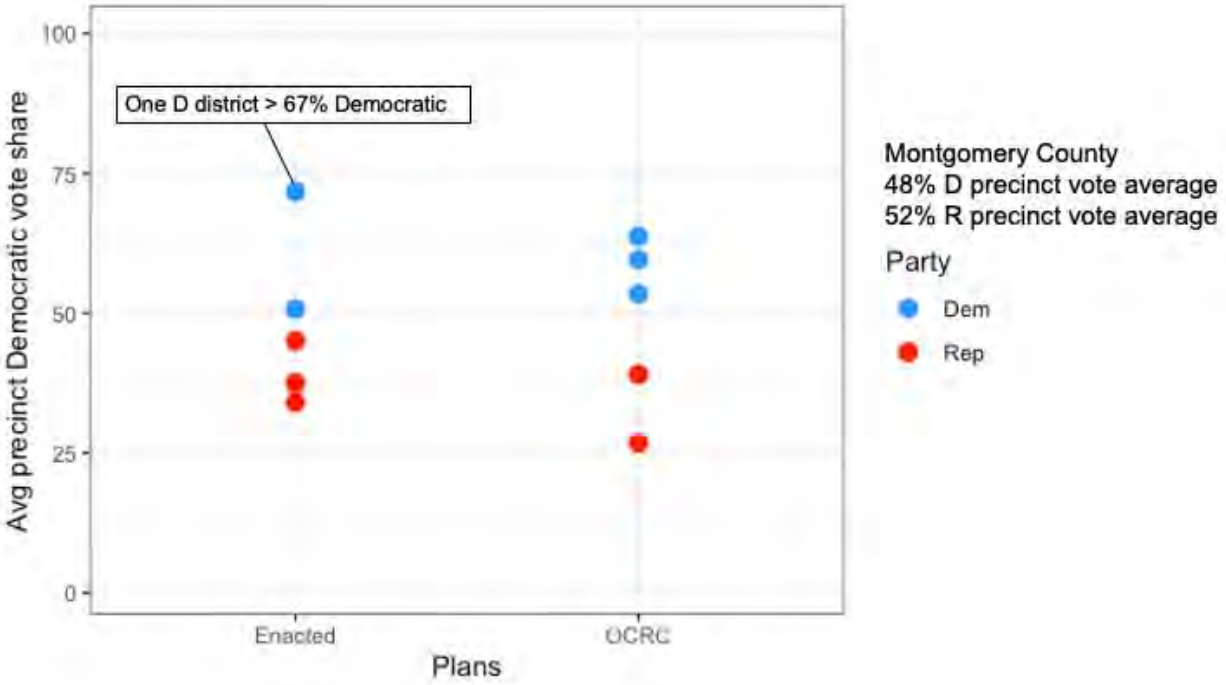
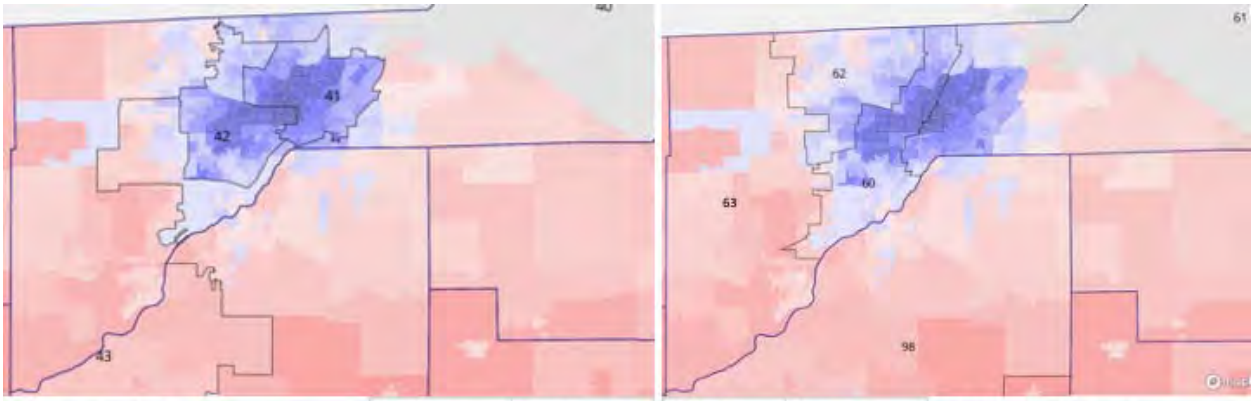


Figure 11b. Packing Democratic Voters Generates Additional Republican Seat in Montgomery County

Figure 12a shows the geographic pattern of districts in Lucas County. Once again, there is evidence that the Enacted Plan uses a "sink," district 41, to pack Toledo voters into a 77 percent Democratic district. This enabled the Commission to create a competitive district 40 that wraps around Toledo in a meandering patter and takes in different communities around the county, and District 43 which combines Toledo's suburban Democratic voters with rural voters in Hancock County more than 60 miles away.



Enacted Lucas County House Districts

District	Mean
41	77.4%
42	67.4%
40	51.9%
43	41.4%

District	Mean
60	69.7%
61	68.8%
62	55.0%
63	34.3%

OCRC Lucas County House Districts

Figure 12a. District 41 Packs Democratic Voters

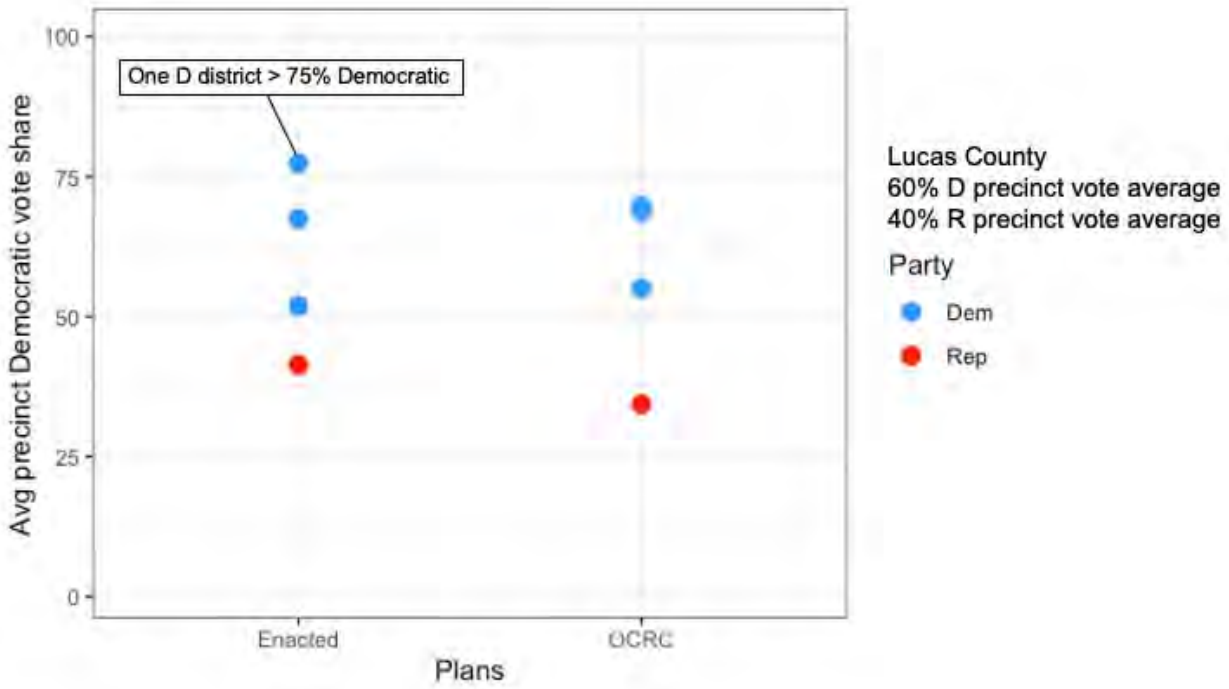


Figure 12b. Packed Democratic Voters Creates Competitive District in Lucas County

72. Generalizing, the few additional seats drawn in large, heavily Democratic counties, combined with a disproportionate number of pro-Republican districts drawn out of mid-size counties, generates most of the bias in the enacted House map. Tables 8a and 8b show the Republican vote and seat shares for the lower, middle, and upper 33 districts by the county populations from which they are drawn. These tables reflect not only the considerable urban-rural partisan divide in the state, but also the impact of choices regarding what populations are selected to construct districts.

73. Republicans earn 38 percent of votes from districts in the most populous counties and receive 27 percent of seats, a difference of 11 percent. See Table 8a. However, in districts from the least populated counties, the seat-to-vote difference is nearly three times as large, 29 percent in favor of Republicans. And in the more competitive middle third of districts,

Republicans win 71 percent of seats with 54 percent of the vote, a 17 percent difference favoring their party.

TABLE 8A

District Vote/Seat Shares by County (population)

Republicans win a disproportionate share of seats in the middle and lower third of districts, far outweighing their relative disadvantage in more populous counties.

	LOWER THIRD	MIDDLE THIRD	UPPER THIRD
Republican vote share	68%	54%	38%
Republican seat share	97%	71%	27%
Difference	29%	17%	−11%

Table 8a. Disproportionality of Seats Won by County Size in Enacted Map

74. In the OCRC House map, differences between vote and seat shares are more balanced between counties. Specifically, Republicans win fewer seats (15 percent) in the largest counties with approximately the same vote share (39 percent) as the enacted House map, which helps to balance out their winning all of the seats in the lower third of counties. There is relatively little difference (3 percent) between the vote and seat shares that parties win in the districts drawn from mid-size counties under the OCRC plan. See Table 8b. This demonstrates once again that the choice of district boundaries was a partisan one in the Enacted Plan.

TABLE 8B

District Vote/Seat Shares by County (population)

The OCRC plan exhibits more balance in the selection of district boundaries within and between counties.

	LOWER THIRD	MIDDLE THIRD	UPPER THIRD
Republican vote share	66%	55%	39%
Republican seat share	100%	58%	15%
Difference	34%	3%	−24%

Table 8b. More Proportionality of Seats Won by County Size

75. District boundaries in the enacted House map carve up partisan precincts and counties in a precise manner, indicating that the Commission relied on the partisan makeup of the districts when drawing district boundaries and attempted to draw districts to favor one political party over the other. My analysis indicates that the Commission succeeded.

3. Precinct and District Border Analysis in the Senate Map

76. My analysis of the enacted Senate map reveals that House districts were aggregated (three House districts to one Senate district) in a manner that largely preserves the bias generated in the enacted House map. As Figure 13a shows, the most Democratic House seats are largely incorporated into the most Democratic Senate seats. This reflects a decision to pack Democratic voters into districts that dilute the strength of their votes relative to Republican voters. For example, Senate district 15 packs together House districts 1-3, creating an opportunity to put together a reliably Republican Senate district 16. In Figure 13a, the average Senate Democratic vote share points is marked with the label "Sen." Under the enacted Senate

map, the competitiveness of Democratic Senate seats quickly dissipates, observed as the change in the slope of the points after the 50 percent line is reached.

77. The enacted Senate map submerges seven Democratic House seats into Republican Senate seats, compared to two Republican district seats into Democratic Senate seats. This is another way of generating or maintaining asymmetry, as a larger proportion of Democratic voters are being put into Senate districts where they are a minority relative to Republican voters. Figure 13b, which graphs the OCRC House-to Senate seats, shows that it is possible to make more balanced decisions regarding the allocation of House seats into Senate districts. The OCRC map has a more symmetric balance of competitive Republican and Democratic Senate seats. Whereas the enacted Senate map submerges seven Democratic House seats into six Republican Senate seats, but only two Republican House seats into two Democratic Senate seats, the OCRC plan submerges six and four seats, respectively. Further, with three Senate districts containing 75 percent or more Democratic voters, compared to one under the OCRC plan, the comparison of the two plans demonstrates that the Enacted Plan concentrates more Democrats into uncompetitive districts than is necessary, diluting their voting strength relative to Ohio voters who support Republican candidates.

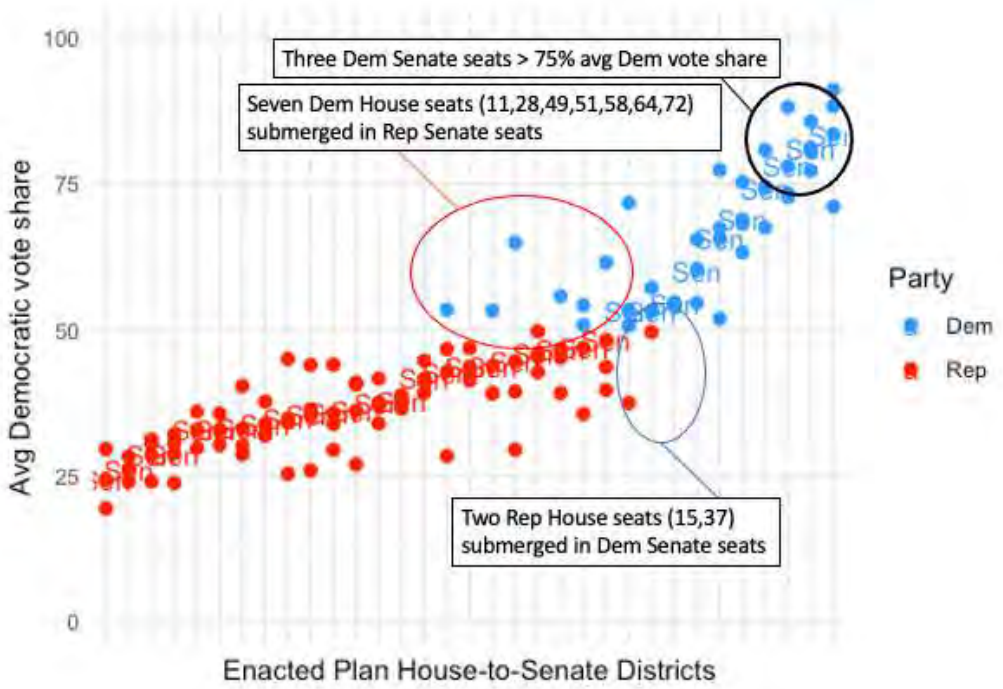


Figure 13a. Enacted Senate Map Maintains House Map Bias by Submerging Democratic House Districts into Republican Senate Seats

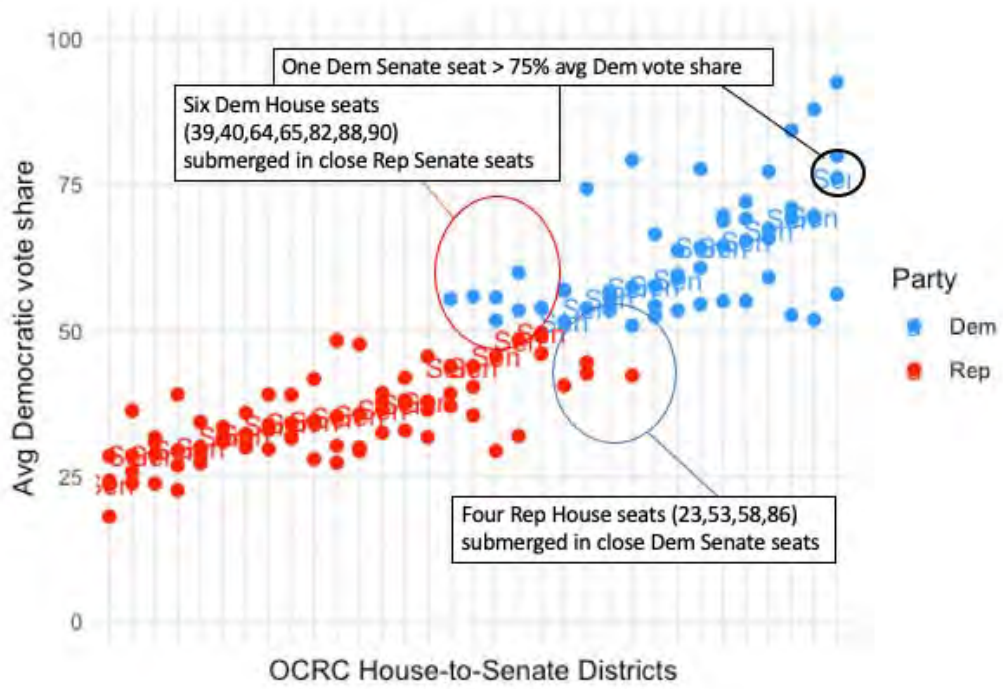


Figure 13b. OCRC Senate Map Balances Submerging Republican and Democratic House Districts into Senate Seats

C. Amendment Analysis

78. I examined the original plan submitted to the Commission by Ray DiRossi that the Commission introduced and found the following changes made to the Enacted Plan between the plan's introduction and passage. The overall impact of these amendments appears to have been to give up a few Democratic seats in order to reinforce the capacity for Republicans to retain a supermajority advantage by bolstering their support in House districts 17, 39, 65, and 94.

79. In the amendments, four House districts shifted from reliably Republican (districts 32, 64) or competitive Republican (districts 36, 72) to reliable or competitive Democratic districts. In turn, four fairly competitive Republican House districts (districts 17, 39, 65, and 94) were made more reliably Republican. Heavily Democratic districts 18 and 22 were made even less competitive (91 and 73 percent, respectively). Two heavily Republican districts, districts 81 and 82, were rearranged to be even more heavily Republican (76 and 75 percent, respectively), and two heavily Democratic districts (14 and 38) became somewhat less so (69 and 57 percent, respectively).

D. Compactness Analysis

80. I also looked to whether the map's bias could be explained by the Commission's attempt to draw compact districts. Under Section 6(C), the Commission is required to attempt to draw districts that are compact, or not irregularly shaped. However, the enacted plan is no more compact than the comparison plans.

81. There is no scientific consensus over how to measure "irregularity" in district shapes. It is a complex, multidimensional phenomena rather than a coherent scientific or legal concept. The distinction between compact and uncompact districts is thus more like the

distinction between art and pornography, in that you "know it when you see it."[29] The utility of analyzing compactness in districting decisions is that comparative analysis can reveal whether mapmakers sacrificed compactness in order to achieve other goals, or vice versa.

82. In the case of the Enacted Plan, whether one uses common compactness metrics such as Reock (the area of the district divided by the area of the smallest circle encompassing the district), Polsby-Popper (a function that divides the area of a district by its perimeter), convex hull (the area of a district divided by the convex hull of the district boundaries), or an index based on a combination of measures, the Enacted Plan districts are no more compact than the comparison plans. For example, using both conventional measures and composite indices, the Enacted House districts are less compact on average (Reock = .38, Polsby-Popper = .30, Kaufman et.al. = 29) compared to the OCRC districts (.39, .54, 56, respectively).

83. Because the Enacted Plan is no more compact than the comparison plans, I conclude that the bias observed in the Enacted Plan is not a result of the Commission trying to achieve greater district compactness. Indeed, it is possible to draw a General Assembly plan that is both more fair and at least equally compact.

E. Conclusions About the Partisan Bias Inherent in the Enacted Plan

84. Both the House and Senate maps are biased in favor of Republican voters, as demonstrated by the significant asymmetries in partisan support across districts in both enacted maps. My analysis shows that the 15-seat asymmetrical advantage that Republican voters enjoy over Democrats as a result of this plan would allow a minority of Republican voters to elect a

[29] Aaron Kaufman, Gary King, and Mayya Komisarchik. 2021. "How to Measure Legislative District Compactness If You Only Know it When You See It." American Journal of Political Science, 65, 3, Pp. 533-550. Publisher's Version Copy at https://j.mp/2Fs3ESc. The characterization of pornography comes from Justice Potter Stewart, *Jacobellis v. Ohio*, 378 U.S. 184, 197 (1964).

majority of seats in the General Assembly. Similarly, it would enable a narrow majority of Republican voters to elect a supermajority of seats in the General Assembly. By the same token, the Enacted Plan greatly disadvantages and burdens citizens who vote for Democratic candidates, as they cannot obtain the same level of political power as Republicans, even with the same number of votes. In short, the Commission's plan treats Ohio citizens differently based on their political party preference or political associations and does not give their votes equal weight or representation, thereby violating the core principles of political equality and procedural justice.

Michael S. Latner

Michael S. Latner

Exhibit A

to Affidavit of Michael S. Latner

Michael Steven Latner
mlatner@calpoly.edu, @mlatner, mikelatner.com

Appointments

Union of Concerned Scientists
- 2019- Senior Fellow
- 2018-2019 Kendall Science Fellow

California Polytechnic State University, San Luis Obispo
- 2019-Professor of Political Science
- 2014-2018 Associate Professor of Political Science
- 2008-2014 Assistant Professor of Political Science
- 2007-2008 Lecturer in Political Science

University of Southern California
- 2006-2007 Teaching Fellow

University of California, Irvine
- 2005-2007 Lecturer

Field Research Corporation
- 1996-2000 Project Manager, Senior Survey Supervisor

Education

Ph.D., Political Science, University of California at Irvine, 2008
M.A., Political Science, University of California at Irvine, 2004
B.A., Political Science, California State University Chico, 1995
A.A., Butte Community College, Oroville, CA, 1993

Books

Gerrymandering the States: Partisanship, Race, and the Transformation of American Federalism with Anthony J. McGann, Charles Anthony Smith, and Alex Keena., Cambridge University Press, 2021. https://www.cambridge.org/core/books/gerrymandering-the-states/27FBE0280F339E739758A29DF7CD74A2#fndtn-information

Gerrymandering in America: The House of Representatives, The Supreme Court, and the Future of Popular Sovereignty with Anthony J. McGann, Charles Anthony Smith, and Alex Keena., Cambridge University Press, 2016.
https://www.cambridge.org/core/books/gerrymandering-in-america/C2A9A40879A353AC7484B49834CB54E4

Peer-Reviewed Publications

"Common Forms of Gerrymandering in the United States" *Decisions*, (32) with Alex Keena,Anthony J. McGann, and Charles Anthony Smith. (2019)
https://journals.kozminski.edu.pl/pub/5797

Our Unhealthy Democracy: How Voting Restrictions Harm Public Health—and What We Can Do about It, policy paper published by Union of Concerned Scientists, Center for Science and Democracy, October 2019, https://www.ucsusa.org/resources/our-unhealthy-democracy

"Diagnosing Electoral Integrity" chapter in *Electoral Integrity in America: Securing Democracy,* Pippa Norris, Sarah Cameron and Thomas Wynter (eds.), Oxford University Press, 2018.
https://www.electoralintegrityproject.com/electoral-integrity-in-america/

Building a Healthier Democracy: The Link Between Voting Rights and Environmental Justice, Union of Concerned Scientists research report, September 2018 https://www.ucsusa.org/sites/default/files/attach/2018/09/building-a-healthier-democracy-report.pdf

"Measuring Legislative Behavior: An Exploration of Digitaldemocracy.org" with Alexander M., Dekhtyar, Foaad Khosmood, Nicole Angelini, and Andrew Voorhees, *California Journal of Politics and Policy,* vol 9, issue 3, 2017. https://doi.org/10.5070/P2cjpp9336921

"Darwinian Democracy? How evolutionary theory informs constitutional design" chapter in *Handbook of Biology and Politics,* Steven Peterson and Albert Somit (eds.), Edward Elgar Publishing, 2017. https://www.elgaronline.com/view/9781783476268.00037.xml

"A Discernable and Manageable Standard for Partisan Gerrymandering" with Anthony J. McGann, Charles Anthony Smith, and Alex Keena. December, 2015., *Election Law Journal: Rules, Politics, and Policy*. 14(4): 295-311. https://doi.org/10.1089/elj.2015.0312

"The Calculus of Consensus Democracy: Rethinking *Patterns of Democracy* without veto players" with Anthony J. McGann, *Comparative Political Studies,* 2013, Vol 46, pp. 823-850, http://dx.doi.org/10.1177/0010414012463883

"Mapping the Consequences of Electoral Reform" with Kyle Roach, in *California Journal of Politics and Policy,* 2011, vol 3, issue 1. https://escholarship.org/uc/item/9mv9b480

"Geographical Representation Under Proportional Representation: The Cases of Israel andThe Netherlands," with Anthony McGann, *Electoral Studies,* 2005, vol 24, issue 4. https://www.sciencedirect.com/science/article/pii/S0261379405000247

Recent Technical/Research Consultation Papers

The 2020 Randolph W. Thrower Symposium, Emory School of Law, Panel III: Violations and Enforcement: Identifying and Rectifying Campaign and Election Violations: https://law.emory.edu/academics/journals/emory-law-journal-symposium.html

Securing Fair Elections: Challenges to Voting in Georgia and the United States (2019), co-author, Scholars Strategy Network, https://scholars.org/sites/scholars/files/12.10.19_Securing_Fair_Elections_Report_FINAL.pdf

"Possible Results of Proportional-voting Systems for Seattle Port Commission Elections" with Jack Santucci, June 30th 2018, prepared for More Equitable Democracy

City of Pismo Beach Digital Engagement Strategy, 2015, prepared for the City of Pismo Beach

"Building a Healthier Democracy" presentation at National Advisory Board meeting, Union of Concerned Scientists, New York, New York, September 2018

Guest, Data-Driven Strategies to Promote Youth Turnout, Massachusetts Institute of

Technology, August 28-29, 2018

Census Counts 2020 Taskforce https://censuscounts.org

Presenter, Redistricting and Election Law Panel, American Political Science Association annual meeting, Boston, Massachusetts,
August 2018

"Feminist Messaging in the 2018 Congressional Elections" presented at the Cal Poly Alumni retreat, Lair of the Golden Bear, June 2018

Presenter and Discussant, Midwestern Political Science Association annual meeting, Chicago, Illinois, April 2018

Presenter and Discussant, Voting in 2018 and Beyond: Ensuring Access and Accountability of the Ballot in America, Hastings Constitutional Law Quarterly 2018 Symposium

"Diagnosing Electoral Integrity" Electoral Integrity Project pre-APSA workshop, San Francisco, California, August 2017

Presenter, American Political Science Association annual meeting, San Francisco, California, August 2017

"Will the Revolution be Digitized?" presented at the Cal Poly Alumni retreat, Lair of the Golden Bear, June 2017

Discussant and Chair, Western Political Science Association annual meeting, San Diego, California, April 2017

Chair, Discussant, and Presenter, American Political Science Association annual meeting, San Francisco, California, August 2015

Fellowships, Awards, and Professional Recognition
Kendall Science Fellow (Voting Rights), Union of Concerned Scientists, 2018-2019
Faculty Scholar, Institute for Advanced Technology and Public Policy, 2015-present
Research Scholarship and Creative Activity Grant for California Redistricting Project, 2016
Common Cause Redistricting Research Competition, 3rd Place, 2015
Gold Medal, California Mid-State Fair Home Brewing Competition, Milk Stout, 2014
Wilma Rule Award, Californians for Electoral Reform, 2013
CA State Faculty Support Grant, 2009-10

(pre-doctoral)
2003 U.C. Regents Pre-Dissertation Fellowship
2003 Summer research award, School of Social Sciences
2001 Summer research fellowship for ICPSR, University of Michigan
2000-01 William Podlich Fellow, Center for the Study of Democracy, U.C. Irvine
1995 Charles McCall Award, California State University Social Science Research Council

Election Consulting/Management
Susan Funk for Atascadero City Council 2018
Jimmy Paulding for SLO County Supervisor 2018
Aaron Gomez for San Luis Obispo City Council 2016
Dawn Ortiz-Legg for State Assembly 2016
Eric Michielssen for SLO County Supervisor 2016
Len Colamarino for Atascadero City Council 2014
Jim Patterson for SLO County Supervisor 2012
Brian Sturtevant for Atascadero City Council 2010
John Graham for Congress, 2004
John McCain for President, 2000

Recent Non-peer reviewed professional publications/news articles/blogs
A compilation of my media publications can be found at mikelatner.com

Current Teaching Rotation
POLS 590 MPP Graduate Writing Seminar (Fall section)
POLS 568 Democracy, Design and Public Policy
POLS 560 Quantitative Methods
POLS 445 Voting Rights and Representation
POLS 375 California Politics
POLS 317 Campaigns and Elections
POLS 316 Political Participation
POLS 112 American and California Government

Other Courses Taught
POLS 470 Evolutionary Perspectives in Political Science
Metropolitan Inequality (USC)
California Politics (UCI)
The American Political System (UCI)

University service
Quantitative Reasoning assessment committee, 2016-
Academic Senate Instruction Committee, 2014-2017

CLA Assessment Committee 2018
CLA Commencement, College Marshall, 2013-2016, 2018

POLS Phi Beta Kappa Supervisor, 2018
POLS Curriculum Committee, 2011-2016
POLS MPP Committee, 2007-
POLS Assessment Committee, 2008, 2009, 2011-2016, 2018
POLS Alumni Advisory Board, 2007-

Political Science Club, 2009
POLS Paper Awards Committee, 2009, 2011, 2012
POLS Guest Speaker Committee 2007-2009

ACKNOWLEDGMENT

A notary public or other officer completing this certificate verifies only the identity of the individual who signed the document to which this certificate is attached, and not the truthfulness, accuracy, or validity of that document.

State of Texas
County of Bexar)

On 10/22/2021 before me, Jose Aaron Gutierrez Banda

appeared Michael S Latner, who proved to me on the basis of satisfactory evidence to be the person(s) whose name(s) is/are subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their authorized capacity(ies), and that by his/her/their signature(s) on the instrument the person(s), or the entity upon behalf of which the person(s) acted, executed the instrument.

I certify under PENALTY OF PERJURY under the laws of the State of Texas that the foregoing paragraph is true and correct.

WITNESS my hand and official seal.

Signature Jose Aaron Gutierrez Banda **(Seal)**

NOTARY PUBLIC STATE OF TEXAS

Jose Aaron Gutierrez Banda

ID NUMBER
13290519-6
COMMISSION EXPIRES
February 2, 2025

Notarized online using audio-video communication

CERTIFICATE OF SERVICE

I, Danielle L. Stewart, hereby certify that on October 22, 2021, I caused a true and correct copy of the following documents to be served by email upon the counsel listed below:

1. Affidavit of Danielle Stewart (affidavits of Relators/witnesses and expert affidavit of Michael S. Latner)

2. Evidence of OOC Relators, Affidavits of Relators/Witnesses and Expert Affidavit of Michael S. Latner

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Supreme Court of Ohio Clerk of Court - Filed October 22, 2021 - Case No. 2021-1198

IN THE SUPREME COURT OF OHIO

BRIA BENNETT, *et al.*, *Relators*, *v.* OHIO REDISTRICTING COMMISSION, *et al.*, *Respondents*.	Case No. 2021-1198

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IN THE SUPREME COURT OF OHIO

Bria Bennett, *et al.*, **Relators,** **v.** **Ohio Redistricting Commission, *et al.*,** **Respondents.**	**Case No. 2021-1198** Original Action Filed Pursuant to Ohio Constitution, Article XI, Section 9(A) *[Apportionment Case Pursuant to S. Ct. Prac. R. 14.03]*

EXPERT AFFIDAVIT OF DR. JONATHAN RODDEN

I, Jonathan Rodden, having been duly sworn and cautioned according to law, hereby state that I am over the age of eighteen years and am competent to testify to the facts set forth below based on my personal knowledge and having personally examined all records referenced in this affidavit, and further state as follows:

I. INTRODUCTION AND SUMMARY

1. For the purpose of this report, I have been asked to examine whether and how the redistricting plan for the Ohio State House of Representatives and Ohio Senate, adopted by the Ohio Redistricting Commission on September 16, 2021, and attached as Exhibit A ("2021 Commission Plan"), addresses the standard set forth in Article XI, Section 6(B), namely, that "[t]he statewide proportion of districts whose voters, based on statewide state and federal partisan general election results during the last ten years, favor each political party shall correspond closely to the statewide preferences of the voters of Ohio."

2. I demonstrate that this "partisan proportionality" standard was clearly not met by the map adopted by the Ohio Redistricting Commission.

3. Furthermore, I have been asked to examine whether the partisan composition of the Commission's maps may have been a result of the Commission's need to satisfy other requirements of the Ohio Constitution: specifically, the requirements to avoid county and municipal splits, laid out in Article XI, Sections 3 and 4, and to attempt to draw compact districts, as set forth in Article XI, Section 6(C).

4. In order to answer this question, I do two things. First, I examine several additional maps that were available to the Commission, and to the public, prior to September 15. Second, I create my own alternative redistricting maps for the Ohio House and Senate, abiding by the rules set forth in the Ohio Constitution. I demonstrate that my alternative redistricting maps, like each of the alternative plans available to the Commission, were able to abide by the "partisan proportionality" requirement more closely while also abiding by the strict rules of

the Ohio Constitution regarding county and municipality splits, and while creating districts with similar or better compactness scores than those drawn by the Commission.

5. I was also asked to conduct a careful examination of the key geographic regions where the likely partisan outcomes associated with the 2021 Commission Plan were notably different from those of the alternative maps. In most instances, the alternative plans are more respectful of traditional redistricting criteria than the 2021 Commission Plan. Moreover, in some metro areas, the Commission's plan clearly achieves a lower anticipated Democratic seat share than the alternative plans by breaking up urban and suburban Democratic communities, including Black communities, and embedding them in districts where exurban and rural whites make up majorities. Moreover, some of the Commission's specific splits of urban counties are especially well-crafted to reduce the overall Democratic seat share in a region. And relative to the alternative plans, the Commission's plan often packs Democratic voters into overwhelmingly Democratic urban districts, which allows the Commission to carve out additional suburban and exurban districts with comfortable Republican majorities.

II. QUALIFICATIONS

6. I am currently a tenured Professor of Political Science at Stanford University and the founder and director of the Stanford Spatial Social Science Lab—a center for research and teaching with a focus on the analysis of geo-spatial data in the social sciences. I am engaged in a variety of research projects involving large, fine-grained geo-spatial data sets including ballots and election results at the level of polling places, individual records of registered voters, census data, and survey responses. I am also a senior fellow at the Stanford Institute for Economic Policy Research and the Hoover Institution. Prior to my employment at Stanford, I was the Ford Professor of Political Science at the Massachusetts Institute of Technology. I received my Ph.D. from Yale University and my B.A. from the University of Michigan, Ann Arbor, both in political science. A copy of my current C.V. is included as Exhibit G.

7. In my current academic work, I conduct research on the relationship between the patterns of political representation, geographic location of demographic and partisan groups, and the drawing of electoral districts. I have published papers using statistical methods to assess political geography, balloting, and representation in a variety of academic journals including *Statistics and Public Policy, Proceedings of the National Academy of Science*, *American Economic Review Papers and Proceedings*, the *Journal of Economic Perspectives*, the *Virginia Law Review*, the *American Journal of Political Science*, the *British Journal of Political Science*, the *Annual Review of Political Science*, and the *Journal of Politics.* One of these papers was selected by the American Political Science Association as the winner of the Michael Wallerstein Award for the best paper on political economy published in the last year, and another received an award from the American Political Science Association section on social networks. In 2021, I received a John Simon Guggenheim Memorial Foundation Fellowship, and received the Martha Derthick Award of the American Political Science Association for "the best book published at least ten years ago that has made a lasting contribution to the study of federalism and intergovernmental relations."

8. I have recently written a series of papers, along with my co-authors, using automated redistricting algorithms to assess partisan gerrymandering. This work has been published in the *Quarterly Journal of Political Science*, *Election Law Journal*, and *Political Analysis*, and it has been featured in more popular publications like the *Wall Street Journal*, the *New York Times*, and *Boston Review*. I have recently completed a book, published by *Basic Books* in June of 2019, on the relationship between political districts, the residential geography of social groups, and their political representation in the United States and other countries that use winner-take-all electoral districts. The book was reviewed in *The New York Times*, *The New York Review of Books*, *Wall Street Journal*, *The Economist*, and *The Atlantic*, among others.

9. I have expertise in the use of large data sets and geographic information systems (GIS), and I conduct research and teaching in the area of applied statistics related to elections. My PhD students frequently take academic and private sector jobs as statisticians and data scientists. I frequently work with geo-coded voter files and other large administrative data sets, including in recent papers published in the *Annals of Internal Medicine* and *The New England Journal of Medicine.* I have developed a national data set of geo-coded precinct-level election results that has been used extensively in policy-oriented research related to redistricting and representation.

10. I have been accepted and testified as an expert witness in several election law and redistricting cases: *Romo v. Detzner,* No. 2012-CA-000412 (Fla. Cir. Ct. 2012); *Mo. State Conference of the NAACP* v. *Ferguson-Florissant Sch. Dist.,* No. 4:2014-CV-02077 (E.D. Mo. 2014); *Lee v. Va. State Bd. of Elections,* No. 3:15-CV-00357 (E.D. Va. 2015); *Democratic Nat'l Committee et al. v. Hobbs et al.*, No. 16-1065-PHX-DLR (D. Ariz. 2016); *Bethune-Hill v. Virginia State Board of Elections*, No. 3:14-cv-00852-REP-AWA-BMK (E.D. Va. 2014); and *Jacobson et al. v. Lee*, No. 4:18-cv-00262 (N.D. Fla. 2018). I also worked with a coalition of academics to file Amicus Briefs in the Supreme Court in *Gill v. Whitford*, No. 16-1161, and *Rucho v. Common Cause*, No. 18-422. Much of the testimony in these cases had to do with geography, electoral districts, voting, ballots, and election administration. I recently worked as a consultant for the Maryland Redistricting Commission. I am being compensated at the rate of $550/hour for my work in this case. My compensation is not dependent upon my conclusions in any way.

III. DATA SOURCES

11. I have collected statewide election data for 2012 to 2020 from the Ohio Secretary of State. I also accessed precinct-level election results from the Ohio Secretary of State for statewide elections from 2016 to 2020 that were matched to 2020 Ohio vote tabulation districts by a team at Harvard University called the Algorithm-Assisted Redistricting Methodology Project.[1] Additionally, I accessed the proposed and adopted Ohio redistricting plans uploaded to the web page of the Ohio Redistricting Commission, true copies of which are attached as Exhibits A, C, D, and E.[2] For the analysis conducted in this report, I use three software packages: Stata, Maptitude for Redistricting, and ArcGIS Pro. In creating my maps,

[1] https://alarm-redist.github.io/posts/2021-08-10-census-2020/
[2] https://redistricting.ohio.gov/maps

I used the same U.S. Census redistricting data used by the Ohio Redistricting Commission, as archived in the "Ohio University Common and Unified Redistricting Database."[3]

IV. MEASURING PARTISAN PROPORTIONALITY

12. The Ohio Constitution instructs the Commission to use "statewide state and federal partisan general election results during the last ten years" to ascertain the "statewide preferences of the voters of Ohio" and attempt to draw a map in which the "statewide proportion of districts whose voters favor each party shall correspond closely" to those "statewide preferences."

13. As further discussed below, the only reasonable way to implement this notion of "statewide preferences," as ascertained from past elections to anticipated future seat shares, is via the proportion of votes received by the candidates for the two parties. That is to say, if a party won 50 percent of the average statewide vote in the relevant elections, a proposed map should favor that party—aggregating the results of those same elections—in somewhere very close to 50 percent of the seats.

14. The first task, then, is to establish this target from the last decade of statewide partisan election results. Figure 1 provides a visualization of Ohio statewide general election results from 2012 to 2020. Ohio is a hotly contested state with a tradition of split-ticket voting and significant swings from one year to another. The Democratic candidate won the presidential contest in 2012, but the Republican candidate won in 2016 and 2020. Ohio's U.S. Senate delegation is typically split between the parties, and other statewide elections are often very competitive, although 2014 was an exception, as was the 2016 U.S. Senate race.

15. Figure 1 reveals that while Ohio statewide elections have been mostly quite close over the last decade, Republican candidates have held a narrow advantage. To quantify this, Table 1 provides the raw data. Including all of the statewide general elections from 2012 to 2020, the Democratic share of the two-party vote (ignoring small parties and write-in candidates) was around 46 percent.

[3] https://www.redistricting.ohio.gov/resources

Figure 1: Statewide General Election Outcomes, Ohio, 2012-2020

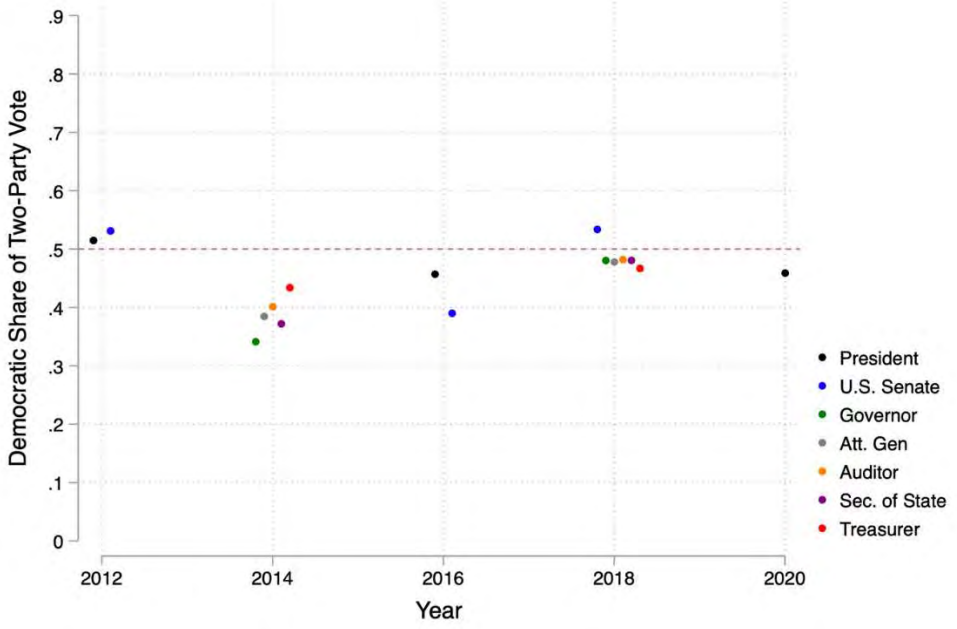

Table 1: Statewide General Election Outcomes, Ohio, 2012-2020

	Democratic Votes	Republican Votes	Other	Two-party Democratic Vote Share
2012 President	2,827,709	2,661,439	91,791	51.5%
2012 U.S. Senate	2,762,766	2,435,744	250,618	53.1%
2014 Governor	1,009,359	1,944,848	101,706	34.2%
2014 Att. Gen.	1,178,426	1,882,048		38.5%
2014 Auditor	1,149,305	1,711,927	143,363	40.2%
2014 Sec. of State	1,074,475	1,811,020	141,292	37.2%
2014 Treasurer	1,323,325	1,724,060		43.4%

2016 President	2,394,164	2,841,005	261,318	45.7%
2016 Senate	1,996,908	3,118,567	258,689	39.0%
2018 Senate	2,358,508	2,057,559	1,017	53.4%
2018 Governor	2,070,046	2,235,825	129,949	48.1%
2018 Att. Gen.	2,086,715	2,276,414		47.8%
2018 Auditor	2,008,295	2,156,663	175,962	48.2%
2018 Sec. of State	2,052,098	2,214,273	103,585	48.1%
2018 Treasurer	2,024,194	2,308,425		46.7%
2020 President	2,679,165	3,154,834	88,203	45.9%
Sum, all elections	30,995,458	36,534,651	1,747,493	**45.9%**
Sum, 2016-2020	19,670,093	22,363,565	1,018,723	**46.8%**

16. Determining the proportion of districts that favor each party, based on consideration of the relevant elections identified in Article XI, Section 6, requires an aggregation of the precinct-level results of these past elections to the boundaries of a map's proposed districts. However, precinct-level election results linked with geo-spatial boundaries were not available for the 2012 and 2014 elections, as the Commission itself acknowledged in its Article XI, Section 8(C)(2) Statement, attached as Exhibit F. Thus, Table 1 also sets forth that the two-party Democratic vote share in the 2016, 2018, and 2020 general elections was around 47 percent.

17. Accordingly, using the full statewide election results from 2012 to 2020, the statewide preferences of Ohio voters must be translated into state legislative maps in which 45.9 percent of seats favor Democrats and 54.1 percent of seats favor Republicans. Since there are 99 seats in the Ohio House of Representatives, a statewide vote share of 45.9 percent would be associated with 45.44 Democratic seats, which rounds down to 45 seats. Similarly, a 45.9 percent vote share would be associated with about 15.15 Democratic seats in the 33-member Ohio Senate, which rounds down to 15 seats.

18. I have aggregated the precinct-level results of each election from 2016 to 2020 included in Table 1 to the level of the districts in the 2021 Commission Plan. For each district, I calculate the average Democratic share of the votes received by the candidates of the two major parties across each of these elections. I then ascertain the number of districts in which this quantity is greater than 50 percent. Using this technique, I determine that the 2021 Commission Plan

produced 37 majority-Democratic House seats and 62 majority-Republican House seats, as shown in Table 2 below. In the Senate, the 2021 Commission Plan produced 10 majority-Democratic Senate seats and 23 majority-Republican seats. This is a gap of 8 House seats and 5 Senate seats between the Democratic-leaning seats produced by the 2021 Commission Plan and the seat share that would be proportionate to the statewide Democratic vote share.

19. Notably, the partisanship of the Commission's maps is not very different from that of the current maps, adopted in 2011 and attached as Exhibit B. The current breakdown of the General Assembly under the 2011 maps is as follows: 35 Democrats and 64 Republicans in the House; 8 Democrats and 25 Republicans in the Senate.

20. In addition to this examination of seats above and below the 50 percent cut-point, it is also useful to examine how many of the Democratic- and Republican-leaning seats are razor-thin majorities, and how many are more comfortable majorities. I count the number of seats where the average Democratic share of the vote for the two major parties was less than 48 percent—let us call these expected Republican seats. And I count the number of seats where the average Democratic share of the vote for the two major parties was greater than 52 percent—let us call these expected Democratic seats. Finally, I count the number of seats that we might call "toss-ups," where the average Democratic vote share was between 48 percent and 52 percent.

21. As set forth in Table 2 below, in the 2021 Commission Plan, all of the majority-Republican House seats are greater than 52 percent Republican. Of the 37 majority-Democratic seats, only 32 are greater than 52 percent Democratic. All 5 of the toss-up seats are slim Democratic majorities. As set forth in Table 3, in the Commission's Senate plan, there are 21 expected Republican seats, 9 expected Democratic seats, and 3 toss-ups, of which 1 is a slim Democratic majority and 2 are slim Republican majorities. As explained further below, by generating a large number of seats with comfortable Republican majorities, the Commission has generated plans that would provide the Republican Party with a majority of seats even in the event of a comfortable Democratic statewide victory.

22. In its Article XI, Section 8(C)(2) Statement, the Commission explained its ostensible attempt to comply with the "partisan proportionality" requirement in the Ohio Constitution. In this statement, the Ohio Redistricting Commission offers an unsound implementation of the constitutional requirement, suggesting that in addition to the vote share, an equally reasonable way to measure "statewide preferences" is by calculating the share of all elections in the last decade in which each party received more votes than the other party. This is a flawed way of characterizing voter preferences in general, but especially when the purpose is to evaluate seat shares. With this interpretation, a party that always wins 50.01 percent of the vote in general elections would be viewed as having 100 percent of the "statewide preference," entitling it to draw a map that gave itself all the seats, a patently absurd outcome.

23. Consider, for example, a situation in which the United States adopted Ohio's constitutional amendment for U.S. House of Representatives districts. The only nationwide elections are presidential elections, for which Democratic candidates have won a majority of the popular vote in each election since 2004, although many of these elections were extremely close. By the Commission's logic, voters preferred Democratic candidates 100 percent of the time, and

would therefore be entitled to 100 percent of the seats in Congress. Similarly, the Commission's measurement would suggest that Minnesota voters prefer 100 percent of their elected officials to be Democrats, simply because Democrats have won 100 percent of the statewide partisan races in the past decade—even though those elections were relatively close, and control of the state legislature in Minnesota has been closely divided throughout that period. The same would be true in California, even though more than 6 million people in that state voted for former President Donald Trump in the 2020 presidential election. This is simply not a tenable methodology for determining voter preferences.

24. In the vast academic literature on voter preferences and seats, I have never encountered the notion that the seat share should correspond to the share of past elections in which a party "won," or received a plurality of votes. Perhaps the foundational work in this literature is a paper published in 1950 by Kendall and Stuart,[4] exploring the vote share in each election as a measure of voter preferences and examining the transformation of those votes to seats in the British Parliament. Then, Gudgin and Taylor published a book in 1979 that explored the geography of voter preferences, as ultimately expressed through vote shares in specific elections, and the transformation of those votes to seats.[5] Next, a variety of books and articles by Ronald Johnston and collaborators, and more recently, Gary King and collaborators, further developed these insights about preferences, votes, and seats.[6] A recent analytical review of the resulting literature is provided in a 2020 article by Katz, King, and Rosenblatt.[7]

25. In this entire literature, the basic starting point is to conceptualize vote shares in specific elections as indicators of voter preferences. These works explore how the geography of preferences, combined with the specific electoral districting plan, combine to translate votes into seats in the legislature. All of this literature shares a basic normative notion that 50 percent of the votes should translate into 50 percent of the seats, and that in a two-party system, there should be symmetry in the way a redistricting plan treats the two parties.

26. Partisan symmetry means that if the two parties' vote shares were reversed, their seat shares would be similarly reversed. For instance, imagine a redistricting plan in which Party A, if it received 52 percent of the votes, could anticipate 55 percent of the seats, due the fact that it was victorious in several of the most competitive seats. Partisan symmetry means that an electoral wave in favor of Party B, such that Party B now received 52 percent of the votes, would also provide Party B with a similar 55 percent seat share. However, if Party A can manipulate the redistricting process to produce partisan asymmetry, it might produce an unusually large number of seats with comfortable, but not overwhelming, majorities for Party

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[4] M. Kendall and A. Stuart, 1950, "The Law of Cubic Proportion in Election Results," *British Journal of Sociology* 1,3:183,96.

[5] Gudgin G, PJ Taylor PJ. 1979*, Seats, Votes, and the Spatial Organisation of Elections*. London: Pion.

[6] See PJ Taylor Ronald Johnston, 1979*, Geography of Elections*. London: Croom Helm; and Robert Browning and Gary King, 1987, "Seats, Votes, and Gerrymandering: Estimating Representation and Bias in State Legislative Redistricting." *Law and Policy* 9,3:305-322.

[7] J. Katz, G. King, and E. Rosenblatt, 2020, "Theoretical Foundations and Empirical Evaluations of Partisan Fairness in District-Based Democracies," *American Political Science Review* 114,1: 164-178.

A, thus building a levy to withstand a wave in favor of Party B. In the asymmetric scenario, then, 52 percent of the vote for Party B would be insufficient to provide it with a legislative majority.

27. This literature on partisan proportionality and, relatedly, partisan symmetry, does sometimes examine multiple elections in order to examine the impact of different vote shares and different geographies of support over time on the transformation of votes to seats, but the starting point remains that vote share is the means to determine partisan preference. At no point in this literature do scholars conceptualize the notion of partisan proportionality or symmetry as pertaining to the relationship between the seat share and the number of overall pluralities achieved over a period of time.

28. In short, the notion of proportionality employed by academics is no different from that employed by pundits, politicians, and the mass public: it pertains to the relationship between the vote share and the seat share. Surely this is also the notion invoked by the Ohio Constitution.

29. Thus, the Commission was tasked with attempting to draw a map in which around 54 percent of the seats are anticipated to produce Republican majorities. Instead, they have drawn a House map where Republicans can expect comfortable majorities in 63 percent of the seats. And they have drawn a Senate map in which Republicans can expect majorities in a stunning 70 percent of seats.

30. Neither the academic literature nor common usage in political discourse could suggest that this result "closely corresponds" to the "statewide preferences" of voters. In fact, the lack of correspondence between votes and seats is even more profound than suggested by the simple statewide averages discussed thus far. As mentioned above, an important focus of the academic literature on votes and seats is the notion of "symmetry." In a two-party system, what would happen to the seat shares if the vote shares of the two parties reversed?

31. Fortunately, recent Ohio electoral history gives us an opportunity to examine just that scenario. In 2018, the Republican candidate for Treasurer, Robert Sprague, won 53.3 percent of the two-party vote. If we aggregate the precinct-level votes in the 2018 Treasurer election to match the 2021 Commission's Ohio House of Representatives districts, Mr. Sprague would win majorities in 64 percent of the districts. That is to say, based on the 2018 votes for Treasurer, the Republican seat share is more than 10 percentage points higher than the Republican vote share.

32. On the same day, November 6, 2018, on the same ballot, the Democratic candidate for U.S. Senate, Sherrod Brown, received slightly more votes than Mr. Sprague, ending up with 53.4 percent of the two-party vote. Yet if we aggregate these U.S. Senate votes up to match the 2021 Commission's House districts, Senator Brown would receive majorities in only 49.5 percent of the seats. With relatively similar statewide victories of just over 53 percent, these two candidates' vote shares translate to dramatically different outcomes in terms of seats in the 2021 Commission House map. The Republican candidate's 53.3 percent win translates to a supermajority of seats, while the Democratic candidate's slightly *higher* 53.4 percent win translates to a *minority* of seats.

33. This example reveals the troubling extent to which the 2021 Commission Plan falls short of any notion of correspondence between voters' preferences and legislative seats. Because so many of the Republican majorities in districts drawn by the Commission are comfortable, even if the Democrats win a comfortable majority of votes—on the order of 53.4 percent—they still cannot expect to serve in the legislative majority.

V. COMPARING THE COMMISSION'S MAPS TO ALTERNATIVE MAPS

34. It is clearly the case that the 2021 Commission did not adopt maps in which the party seat share closely corresponds with the vote share in relevant statewide elections under any reasonable interpretation of the Ohio Constitution's partisan fairness requirement. But one might imagine that the partisan composition of the Commission's maps was a function of constraints imposed by other constitutional requirements related to traditional redistricting principles that the Commission understood to be more important. Perhaps the Commission *attempted* to abide by Article XI, Section 6(B), but the job was simply too difficult.

35. In fact, the next line after the "partisan proportionality" clause dictates that the Commission "shall attempt" to draw compact districts. One might wonder whether the Commission found it difficult to achieve partisan proportionality because of a tension between that goal and the additional goal of drawing compact districts. Moreover, the Constitution requires that the Commission use entire counties, municipal corporations, and townships as the building blocks of districts to the extent possible. Counties with population greater than that which is sufficient for a single district must spill over into only a single additional district. The Commission must also endeavor not to split counties more than once, and not to split more than one municipality per district. Conceivably, efforts to abide by requirements like these could make it difficult for a map-drawer to achieve partisan proportionality despite a concerted effort to do so.

36. A simple and effective way to examine such assumptions is to analyze other maps that were made available to the Commission before it finalized its own maps. Did those maps come closer to achieving partisan proportionality while abiding by the same rules and achieving similar benchmarks with respect to the traditional redistricting principles emphasized in the Constitution? If so, one cannot accept the claim that the Commission was forced by restrictive rules into drawing maps with a large advantage for one party.

37. Specifically, I examined a map introduced by Senator Sykes on September 2, attached as Exhibit C, and another map introduced by Senator Sykes on September 15, attached as Exhibit H. An additional map was proposed by a group called the "Ohio Citizens Redistricting Commission" and is attached as Exhibit E. Based on my review and to the best of my knowledge, with the possible exception of the Sykes September 2 map, discussed further below, these maps are materially compliant with the line-drawing rules explained above, as set forth in Article XI, Sections 3 and 4 of the Ohio Constitution.

38. In addition to examining maps produced by others, I have produced my own redistricting plan for the Ohio House and Senate. By drawing my own maps, I was able to gain a full appreciation for the challenges and trade-offs associated with the Ohio Constitution's

redistricting rules, and can explain how I resolved them, and with what implications for partisanship and respect for traditional redistricting criteria.

39. My approach was to begin by creating a complete plan for the House of Representatives and then assemble groups of three House districts in order to produce a Senate plan. However, this approach ran into a roadblock since most reasonable configurations of House districts cannot produce a valid Senate plan. Article XI, Section 4(B)(2) of the Ohio Constitution states that "Counties having less than one senate ratio of representation, but at least one house of representatives ratio of representation, shall be part of only one senate district." In Northeast Ohio, it is extremely difficult to comply with Section 4(B)(2) in conjunction with the immediately preceding 4(B)(1), which states that "a county having at least one whole senate ratio of representation shall have as many senate districts wholly within the boundaries of the county as it has whole senate ratios of representation. Any fraction of the population in excess of a whole ratio shall be a part of only one adjoining senate district."

40. This is complex in Northeast Ohio because both Cuyahoga and Summit Counties have well beyond the population of a single extra house district that must find a home in an adjoining district, and many surrounding House districts are unavailable as partners because of the prohibition on splits of medium-sized counties and the position of all relevant counties in the corner of the state. A rather unsatisfactory way to solve this problem is to severely under-represent the people of Northeast Ohio, over-populating virtually every district in this part of the state as close as possible to the 5 percent constraint, and under-populating many districts throughout the rest of the state. I came to the conclusion that this is the only way to configure districts in the House of Representatives in a way that allows for Senate districts that *strictly* comply with Article XI, Section 4 in Northeast Ohio. I thus configured House districts in Northeast Ohio with a sole focus on finding an arrangement that would yield valid Senate districts.

41. This same basic approach, with dramatic over-population of Cuyahoga and other Northeast Ohio districts, was also taken in the 2021 Commission Plan, the Citizens' Commission Plan, and the Sykes 9/15 Plan. It is not entirely clear, however, that the Ohio Constitution *requires* this unusual type of harm to the voters of Northeast Ohio, since Article XI, Section 4(B)(3) instructs the commission to "commit the fewest possible violations" in the event that "it is not possible to draw representative districts that comply with all of the requirements of this article." The Sykes map of September 2, 2021 does not strictly comply with Article XI, Section 4, because it splits Trumbull County (between districts 1 and 18), even though it is in the population range of counties for which splits should usually be avoided. The Sykes 9/2 map is, thus, a useful reference point as a map that takes a slightly different approach to interpreting Article XI, Section 4: one that purchases fair representation for Northeast Ohio at the rather minute cost of a single county split. In contrast, the Sykes 9/15 plan removes the offending county split and reconfigures both the House and Senate maps to under-represent Northeast Ohio.

42. After resolving the dilemma of Northeast Ohio, my approach was to follow the rules laid out by the Ohio Constitution, beginning with House districts, and, within the strict constraints regarding municipal and county splits, also attempt to maximize compactness and minimize county splits. These goals are sometimes in conflict. In some regions of Ohio, the population

sizes and geographic arrangement of counties mean that in order to keep counties together, one must tolerate some non-compact districts. In general, since the Constitution calls for the use of entire counties as building blocks for districts whenever possible, my approach was to prioritize the minimization of county splits when drawing (and refining) first my House and then my Senate plan, while also trying to make decisions that facilitated a relatively compact set of districts for any given region.

43. After achieving these things, I considered an additional factor in metro areas. I attempted to avoid drawing districts that excessively packed members of one of the parties in a way that would undermine their representation. Moreover, when drawing district lines, I attempted to avoid splitting groups of geographically proximate co-partisans in a way that would prevent them from forming a majority.

44. I did not deviate from the application of traditional redistricting principles in order to help or harm one of the political parties. For instance, in Toledo, it is possible to further "unpack" urban Democrats and produce an additional majority-Democratic district, but this would have created a rather non-compact district that would have also intentionally split geographically proximate Republican communities. Elsewhere, in a couple of places it is possible within the rules of the Ohio Constitution to string together far-flung Democratic industrial and college towns. I avoided drawing districts in this manner. Rather, within the confines of the constitutional rules and the application of traditional redistricting criteria, I simply made a conscious effort to avoid drawing districts that would have the effect of clearly packing or cracking geographically proximate co-partisans.

45. I paid no attention to racial data when drawing my maps. However, after completing my redistricting plans, I checked for compliance with the Voting Rights Act as follows. First, I used precinct-level data on race and partisanship, using the same statewide general election races detailed in Table 1 above and, using ecological inference, ascertained whether racially polarized voting was present within each of Ohio's major metropolitan counties. Next, in counties where racially polarized voting was present, I made sure that, under my alternative Senate and House plans, candidates of choice for Black voters in statewide elections had indeed been victorious in the relevant districts in my redistricting plan. In each metro area with a large Black community and clear evidence of racially polarized voting—specifically Akron, Cincinnati, Dayton, and Toledo—this was clearly the case. I thus did not make any changes to my alternative plans to ensure compliance with the Voting Rights Act.

46. For my maps, attached as Exhibit I, for each of the alternative maps presented to the Commission, and for the Commission's proposed maps (attached as Exhibit D), I have produced compactness scores for the districts to assess the maps' compliance with Article XI, Section 6(C). I have included Reock, Polsby-Popper, and Convex Hull compactness measures, each of which takes a somewhat different approach to the notion of district compactness.

47. Although the Ohio Constitution does not specify the optimal number of county splits, I have also calculated the number of county splits generated by each plan. I define a county split in the same way as the Ohio Constitution. For example, Franklin County is not considered to be split in a House of Representatives plan if 11 districts are formed that fit completely within

the county, and no fragment of any district spills over the county boundary. Moreover, a county that is kept intact but joined together with other "split" counties is not considered a split county. A county is only considered to be split if some part—but not all—of its territory is joined with territory from another county in the formation of a district.

Table 2: Summary Information, Ohio House of Representative Plans Submitted to Ohio Redistricting Commission

	Commission 9/15	Commission 9/9	Sykes 9/2	Sykes 9/15	Citizens 9/10	Rodden
Average compactness scores						
(Higher scores = more compact)						
Reock	0.40	0.40	0.40	0.39	0.40	0.41
Polsby-Popper	0.30	0.30	0.31	0.29	0.34	0.36
Area/Convex Hull	0.74	0.73	0.74	0.72	0.76	0.79
Number of split counties	33	33	30	33	43	32
# of seats with average two-party Democratic vote share >.5	37	32	44	42	43	43
Expressed as percentage of seats	37.4%	32.3%	44.4%	42.4%	43.4%	43.4%
# of seats with average two-party Republican vote share >.5	62	67	55	57	56	56
Expressed as percentage of seats	62.6%	67.7%	55.6%	57.6%	56.6%	56.6%
Distance from proportional seat allocation (seats)	8	13	1	3	2	2
Expressed as percentage of seats	8.1%	13.1%	1.0%	3.0%	2.0%	2.0%

# of seats with average two-party Democratic vote share >.52	32	31	41	38	42	40
Expressed as a percentage of seats	32.3%	31.3%	41.4%	38.4%	42.4%	40.4%
# of seats with average two-party Democratic vote share <.48	62	63	54	54	54	56
Expressed as percentage of seats	62.6%	63.6%	54.5%	54.5%	54.5%	56.6%
# of seats with average two-party Democratic vote share between .48 and .52	5	5	4	6	3	3
Expressed as percentage of seats	5.1%	5.1%	4.0%	6.1%	3.0%	3.0%

48. In Table 2, I provide compactness scores and information on county splits for each of the Ohio House of Representatives plans I analyzed. Next, using the same technique described above, I include the number of majority-Democratic districts, majority-Republican districts, expected Democratic districts, expected Republican districts, and toss-up districts that would be produced by each plan.

49. First, in terms of compactness, Senator Sykes' initial plan was slightly more compact than the Commission's final September 15 plan, but his revised plan, after reconfiguring Northeast Ohio, was slightly less compact. The plan produced by the Citizens' Commission was on average more compact according to both the Polsby-Popper and Convex Hull scores. The House map I produced was more compact by every measure than those produced by the Commission, Senator Sykes, and the Citizens' Commission.

50. The Commission's House of Representatives Plan splits 33 counties. The Citizens' Commission splits a greater number of counties (43) than does the Ohio Redistricting Commission's, while Senator Sykes' original plan splits fewer counties (only 30), and his revised plan is similar to the Commission's on this dimension. Likewise, my alternative plan splits 32 counties.

51. Next, let us examine the partisan outcomes associated with these alternative plans. The relevant information is also contained in Table 2. The initial plan submitted by Senator Sykes came very close to achieving partisan proportionality. It produced 44 majority-Democratic seats and 55 majority-Republican seats—a difference from proportionality of only 1 seat. My alternative plan, as well as the plan produced by the Citizens' Commission, produced 43 Democratic seats and 56 Republican seats—a difference from proportionality of only 2 seats. Senator Sykes's revised plan produced 42 majority-Democratic seats—a difference from proportionality of 3 seats. Again, in contrast to my alternative plan and these other plans, which came very close to achieving partisan proportionality, the Ohio Redistricting Commission's final plan deviated 8 seats from true proportionality.

52. In short, the plans introduced by Senator Sykes and the Citizens' Redistricting Commission are relatively similar to the Commission's Plan in their deference to traditional redistricting criteria emphasized in the Ohio Constitution—and my alternative plan is more compact on average—but each of these plans also comes much closer to achieving the required partisan proportionality. This indicates that the failure of the 2021 Commission Plan to achieve partisan proportionality and its overall favorability to Republicans were intentional choices, rather than natural outgrowths of other constraints.

53. Next, let us undertake a similar comparison of the Ohio Redistricting Commission's Senate maps with these alternative maps. The key information is contained in Table 3. Once again, the plans presented by Senator Sykes demonstrated a similar level of average compactness to the Commission's plan on each of the three metrics I considered. And again, my alternative plan, along with the plan produced by the Citizens' Commission, were clearly more compact than the Commission plan. Relative to the Commission's Senate map, my alternative map split 2 additional counties, the Sykes maps split 3 additional counties, and the Citizens' map split 5 additional counties.

54. The Commission's Senate map produced only 10 majority-Democratic seats, and 23 majority-Republican seats. In contrast, both the original Sykes Senate map and the Citizens' Commission Senate map produced 14 Democratic seats and 19 Republican seats. The revised Sykes map produced 13 Democratic seats and 20 Republican seats. My alternative map produced 15 Democratic seats and 18 Republican seats. Recall that the target set forth by the Constitution was 15 Democratic seats, meaning that 2 of these plans came within a single seat of the target, and 1 achieved proportionality. Again, as with the House of Representatives, these alternative maps demonstrate that, for the Senate as well, it is possible to abide both by the Ohio Constitution's traditional redistricting requirements as well as its partisan proportionality requirement. The fact that the Commission's map so strongly favors the Republican Party is the result of discretionary choices made by the Commission and reflects that the Commission did not attempt to achieve partisan proportionality.

Table 3: Summary Information, Ohio Senate Plans Submitted to Ohio Redistricting Commission

	Commission 9/15	Commission 9/9	Sykes 9/2	Sykes 9/15	Citizens 9/10	Rodden
Average compactness scores						
(Higher scores = more compact)						
Reock	0.39	0.39	0.39	0.38	0.43	0.44
Polsby-Popper	0.31	0.31	0.31	0.31	0.37	0.37
Area/Convex Hull	0.73	0.72	0.73	0.74	0.78	0.78
Number of split counties	13	13	16	16	18	15

# of seats with average two-party Democratic vote share >.5	10	9	14	13	14	15
Expressed as percentage of seats	30.3%	27.3%	42.4%	42.4%	42.4%	45.5%
# of seats with average two-party Republican vote share >.5	23	24	19	20	19	18
Expressed as percentage of seats	69.7%	72.7%	57.6%	60.6%	57.6%	54.5%
Distance from proportional seat allocation (seats)	5	6	1	2	1	0
Expressed as percentage of seats	15.2%	18.2%	3.0%	6.1%	3.0%	0
# of seats with average two-party Democratic vote share >.52	9	8	13	12	12	12
Expressed as a percentage of seats	9.1%	8.1%	13.1%	12.1%	12.1%	12.1%
# of seats with average two-party Democratic vote share <.48	21	21	18	19	18	18
Expressed as percentage of seats	63.6%	63.6%	54.5%	57.6%	54.5%	54.5%
# of seats with average two-party Democratic vote share between .48 and .52	3	4	2	2	3	3
Expressed as percentage of seats	3.0%	4.0%	2.0%	2.0%	3.0%	3.0%

VI. WHY DID THE OHIO REDISTRICTING COMMISSION FALL SO FAR SHORT OF PROPORTIONALITY?

55. It is clear that the 2021 Commission Plan produces outcomes that are at odds with the partisan fairness required by the Ohio Constitution, while alternative plans achieve near-proportional outcomes. Next, it is useful to gain a better understanding of how this happened by examining the specific choices that led to such striking differences in the partisanship of the Commission's maps relative to the alternative maps. This section examines the differences between the maps in more detail, focusing first on aggregate data, and then drilling down into the individual regions where different outcomes are notable.

The Geographic Distribution of Partisanship Across Districts

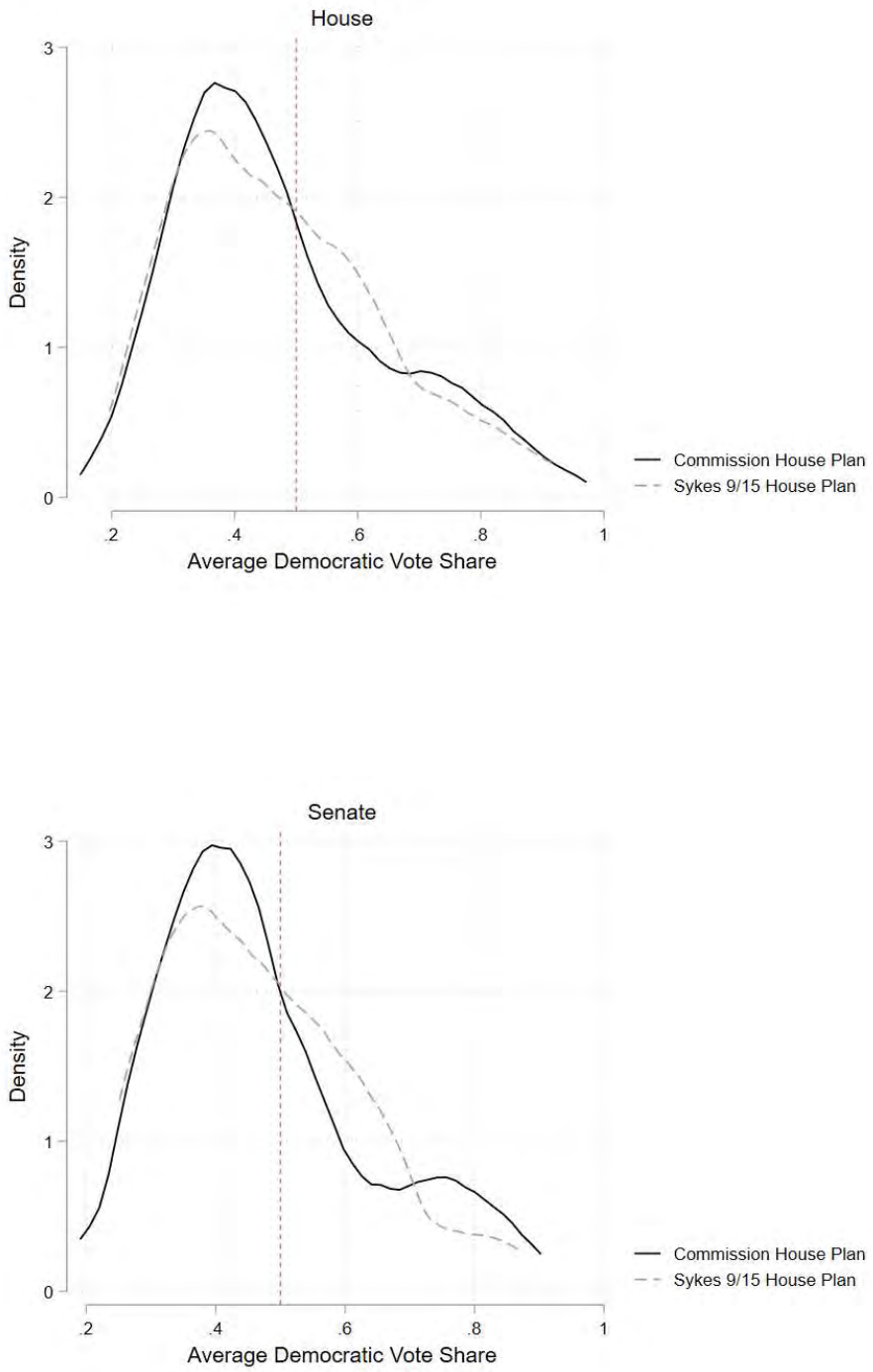
56. In order to gain a better appreciation for the way in which the maps drawn by the Commission differ from the more proportional alternative maps presented by Senator Sykes and the Citizens' Commission, and in this report, it is useful to look at how the different maps diverged in addressing the geographic distribution of partisanship across districts.

57. To do this, I present a kernel density—which is simply a smoothed histogram—that displays the distribution of the Democratic vote share across districts for each proposed redistricting plan. Figure 2 does this first for the House plans (in the top panel), and then for Senate plans (in the bottom panel). The bold line captures the distribution of Democratic vote share across the districts in the Commission's maps, and the dashed gray line captures the same thing for the Sykes 9/15 maps. The distributions for the Sykes 9/2 maps as well as the Citizens' Commission maps, as well as my own maps, look very similar to the gray dashed lines, so, for ease of exposition, I do not include them.

58. The basic shape of the kernel density in Figure 2 is one that I have written about elsewhere.[8] Democratic voters tend to be highly concentrated in the urban core of large cities, while Republican voters are concentrated in sprawling rural areas, and suburban areas are heterogeneous and competitive. Inner-ring suburban areas usually lean toward Democrats, and as one moves to the outer-ring suburbs, the Republican vote share increases. In recent years, Democratic majorities have been spilling further out into the suburbs, and in cities like Columbus, now reach to the distant outer suburbs and even some exurbs.

[8] See Jonathan Rodden, 2010 "The Geographic Distribution of Political Preferences," *Annual Review of Political Science* 13:297-340; Jonathan Rodden, 2019, *Why Cities Lose: The Deep Roots of the Urban-Rural Political Divide.* New York: Basic Books.

Figure 2: Distribution of Average Democratic Vote Shares Across Proposed Districts



59. The concentration of some Democratic voters in some very urban areas means that it is often impossible to avoid drawing electoral districts that are extremely Democratic. As a result, both the Commission's map and the alternative maps produce distributions with a long right tail. All of the districts in the right tail of the distributions in Figure 2 are in very urban areas.

60. It should also be noted that in Ohio, many rural areas are also now extremely Republican, and it can be difficult to avoid drawing rural districts that are not overwhelmingly Republican. This phenomenon is only occasionally tempered by the presence of an isolated college town like Oxford or Yellow Springs, which might, for example, turn an otherwise 80 percent Republican area into a 70 percent Republican area. While the left tail of the distribution is not quite as long as the right tail, it also includes a large number of landslide Republican districts.

61. The *overall shape* of the distribution—driven by Ohio's political geography—is similar for both the Commission's plan and the alternative plans. That is to say, both have long right tails composed of urban, Democratic districts, and both produce similar numbers of rural, highly Republican districts, as demonstrated by the fact that, on the left side of the graph, the dashed line and solid line are right on top of one another.

62. It is clear that Ohio's political geography necessitates some solidly Democratic and solidly Republican districts, but map-drawers have considerable flexibility in the middle of the distribution, and with the extent of packing of Democrats in cities. In Figure 2, we can see that the shape of the distribution of partisanship across districts in the Commission's plan is distinctive in the districts that are neither solidly Republican nor solidly Democratic. This is apparent as we move to the right on the graph and enter the territory of comfortable, but not landslide, Republican victories. The Commission's maps produce a far larger number of such districts. And then, once we cross the 50 percent threshold, there is a dramatic reversal. The Commission's maps produce far *fewer* districts with Democratic majorities. Finally, the maps are also different when we move further to the right, where the black line is above the gray dashed line, indicating that the Commission's maps produce a larger number of landslide Democratic districts—what is known in the literature as "packing."

63. How did the Commission and these alternative groups of map-drawers produce maps with such starkly different partisan outcomes, given that they were working within the constraints of the same political geography and the same rather restrictive rules? To find the answer, we must examine Ohio's cities and their surroundings. The differences between the black and gray lines in Figure 2 is driven by choices made in and around cities. In particular, the Commission's maps produced notably fewer majority-Democratic districts in the regions around Akron, Cincinnati, Cleveland, Columbus, and Dayton.

Franklin County Area

64. Consider Franklin County and its surroundings. Figure 3 displays this region, with yellow lines corresponding to the districts drawn in the 2021 Commission House map. Colors go from light blue to dark blue as the precinct-level 2020 presidential Democratic vote share increases. From Figure 3, one can see how the Commission's district boundaries correspond to partisanship.

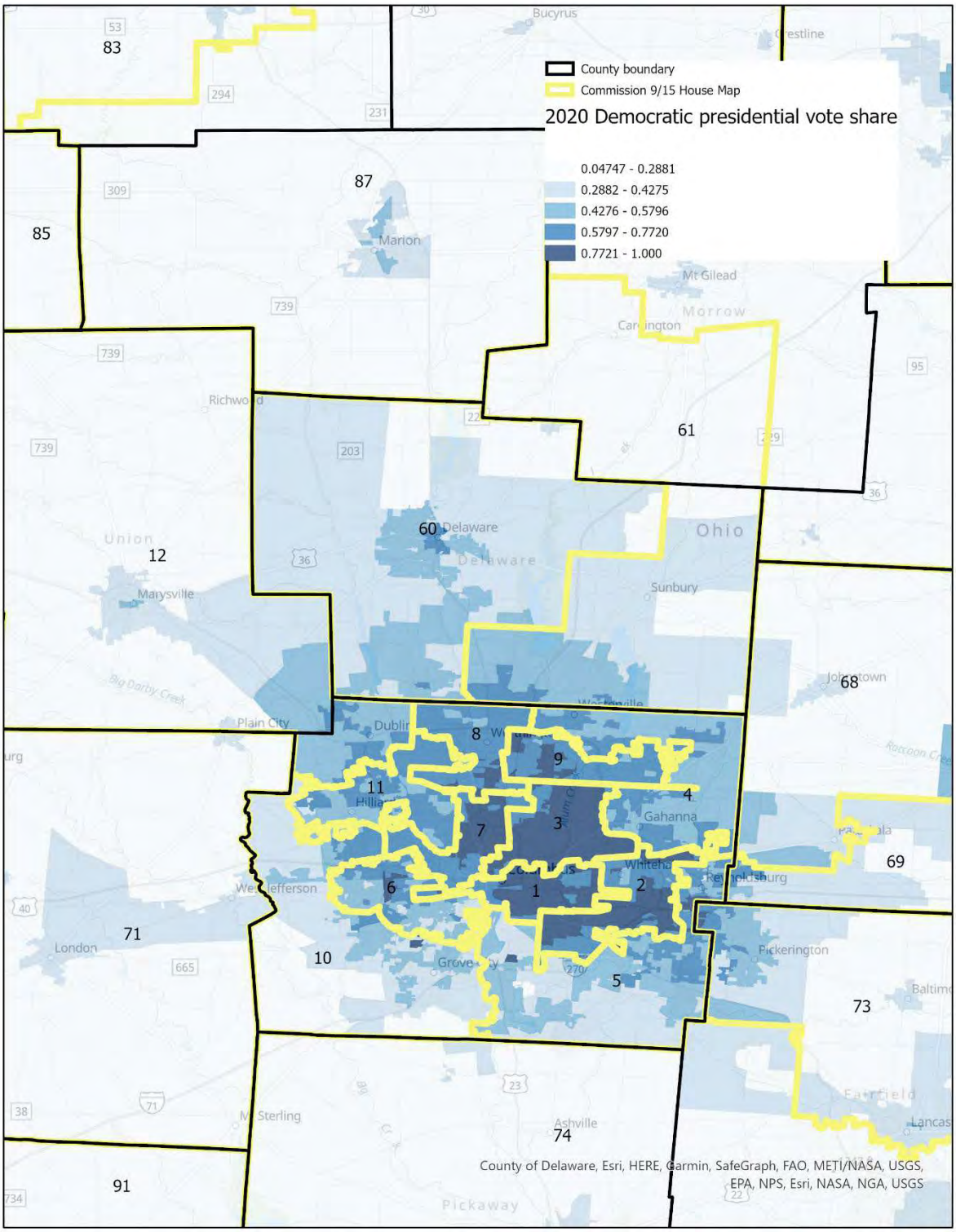
65. Several things are noteworthy about the Commission's map. First, as Franklin County has become more Democratic over time, and as Democratic dominance has spilled over from the urban core to suburban areas, there is now only one possible area for the construction of a comfortable majority-Republican district—in the southwest corner. District 10 in the

Commission's map pulls together all of the most Republican exurban parts of Franklin County in order to carve out such a district. This district runs almost the entire length of Franklin County, from the southern border almost to the northern border, stopping just short of the more Democratic-leaning suburban areas in the northwest corner of the county.

66. Second, in the northwest corner of the county, Dublin—especially the part in Franklin County closest to Ohio State University—is an educated suburban community that has been drifting toward the Democratic Party in recent years. It is one of the most Democratic border-adjacent communities in Franklin County. However, instead of connecting it with surrounding Democratic-leaning communities, the Commission map splits Franklin County in the northwest corner to extract Dublin from the rest of Franklin County, combining Dublin with relatively rural Union County. In doing so, the Commission map thus extracts a growing Democratic community and embeds it in a district with numerically greater rural Republicans. Given its population of 1,323,807, Franklin County could easily accommodate 11 districts without a split. Instead, the Commission chose to create 9 under-populated districts and extract a relatively large chunk of Democratic voters from the county, preventing those voters from contributing to an additional Democratic district.

67. Finally, there is a group of growing, increasingly Democratic-leaning Columbus suburbs hugging the southern border of Delaware County, and a corridor of Democratic-leaning precincts connecting to the relatively Democratic town of Delaware. If we use decade averages, these suburbs appear to be Republican leaning. However, they have moved sharply toward the Democratic Party in recent years, and in the 2020 Presidential Election, a majority of voters in these suburbs voted for the Democratic candidate. Using the most recent election results, these areas would easily correspond to a compact majority-Democratic district. Instead, the Commission's districts split those increasingly Democratic voters in half with a north-south dividing line, thus preventing a majority-Democratic district from emerging in that area, instead producing 2 very comfortable Republican districts. This is a classic example of what is known in the literature on gerrymandering as "cracking."

Figure 3: Franklin County and Surroundings; Partisanship and the Commission's House Boundaries



68. It is useful to contrast the Commission's plan with the alternative plans that exhibited greater statewide proportionality. Beginning with the Commission's plan, followed by my own alternative plan (referred to as the "my plan" or the "Rodden plan"), the Sykes 9/15 plan, and the Citizens' Commission plan, Figure 4 simply displays the districts with Democratic majorities in blue and Republican majorities in red, using averages over all statewide elections from 2012 to 2020. Similar maps will be presented below for other regions, where highly competitive districts, with average Democratic vote share between 48 percent and 52 percent will be displayed with separate colors, but none of the districts displayed in Figure 4 are in that range.

69. In Franklin County and the surrounding area, the Commission's plan produces 10 majority-Democratic House districts. In Figure 4, we can see that the Rodden plan, along with the Citizens' Commission plan, produces 11 majority-Democratic districts, while the Sykes plan produces 12.

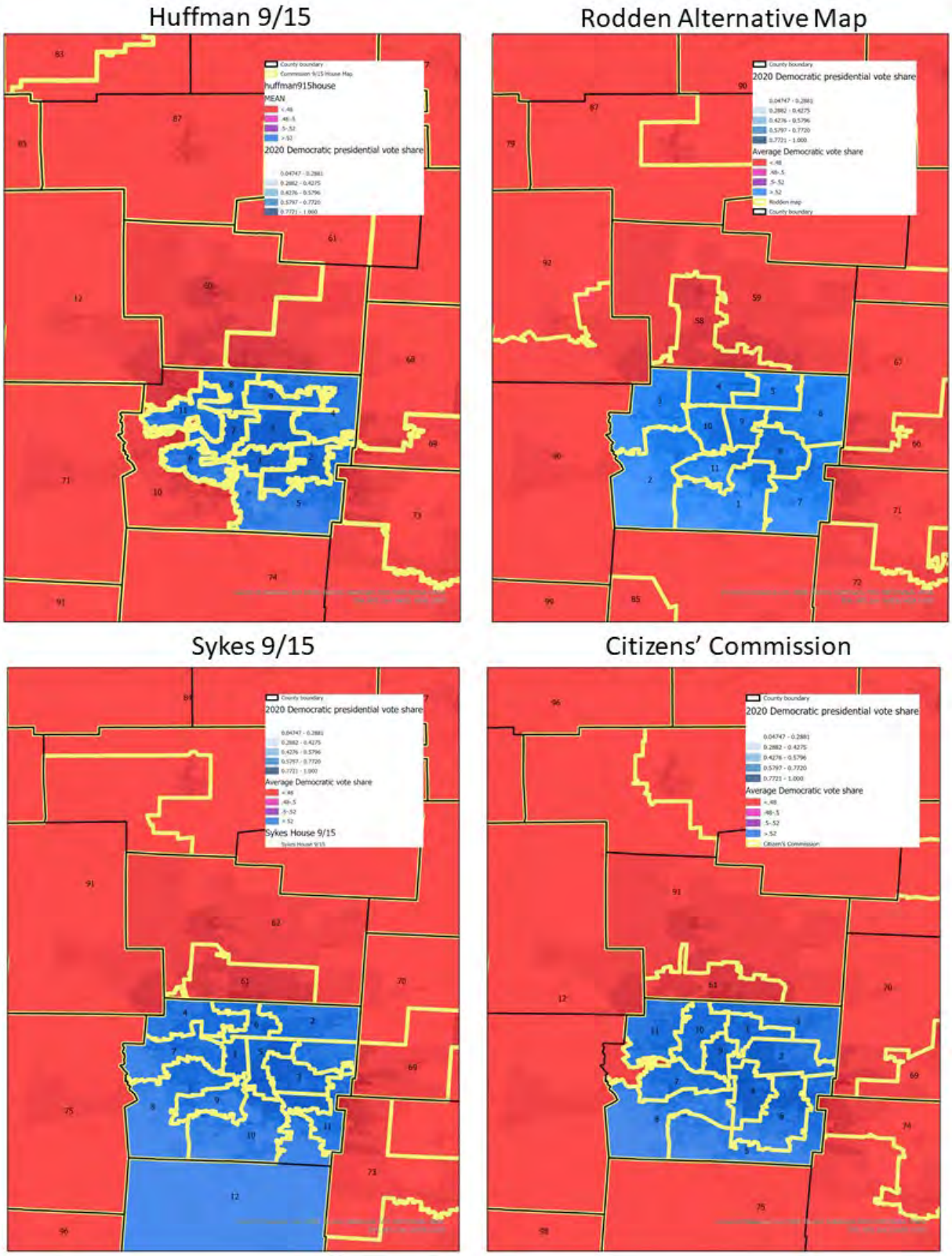
70. Let us now examine the choices made in the alternative maps that produced additional Democratic-leaning Franklin-County districts. First, those drawing alternative maps simply avoided making a special effort to carve out a Republican district in the southwest. For instance, my plan included a relatively compact district in the southwest corner of the county, but I made no effort to keep Democratic-leaning Columbus districts out in order to craft a Republican-leaning district.

71. Second, since they did not attempt to carve out a Republican district, the alternative plans engaged in less packing of Democrats into highly non-competitive districts. While the Commission's plan produced 4 Franklin-County districts where the Democratic vote share was above 75 percent, each of the alternative plans each produced only 2 such districts.

72. Third, the alternative plans took different approaches to splitting the county. As described above, my approach was to keep counties whole whenever possible. Since it was possible to avoid splitting Franklin County, I did not introduce a split. Like the Commission's plan, the Sykes plan did include a split, and it generated a district that combined some Franklin County precincts that favor Democrats with some rural Republican precincts in a surrounding county (Pickaway). But Pickaway is a smaller county than Union, such that while the Commission's split produced a comfortable Republican district in the northwest, the Sykes plan's split produced a competitive but Democratic-leaning district in the south. The Citizens' Commission did not produce systematically underpopulated districts in Franklin County and, as a result, required a much smaller split fragment of Franklin County.

73. Fourth, note that each of the alternative plans produced a compact district in southern Delaware County by keeping the growing Columbus suburbs together rather than splitting them in half. These districts are colored red in Figure 4, which is based on average vote shares over the last decade. However, if one focuses on the 2020 presidential election, these districts are majority-Democratic. Joseph Biden received around 51 percent of the vote in district 61 in both configurations.

Figure 4: Franklin County and Surroundings; Party Majorities Associated with House Boundaries of Four Redistricting Plans



74. Finally, it is worth noting that the districts in my plan are more compact than those created by the Commission. If we leave aside Delaware County and focus only on the districts of Franklin County, the average compactness of my districts, according to the Polsby-Popper score, was .39, while the score for the Commission's plan was .19. The score for the Sykes plan was .25, and that for the Citizens' plan was .30. The average Reock score for my plan was .47, while the score for the Commission's plan was .37. The scores for the Sykes and Citizens' plans were .40 and .37 respectively.

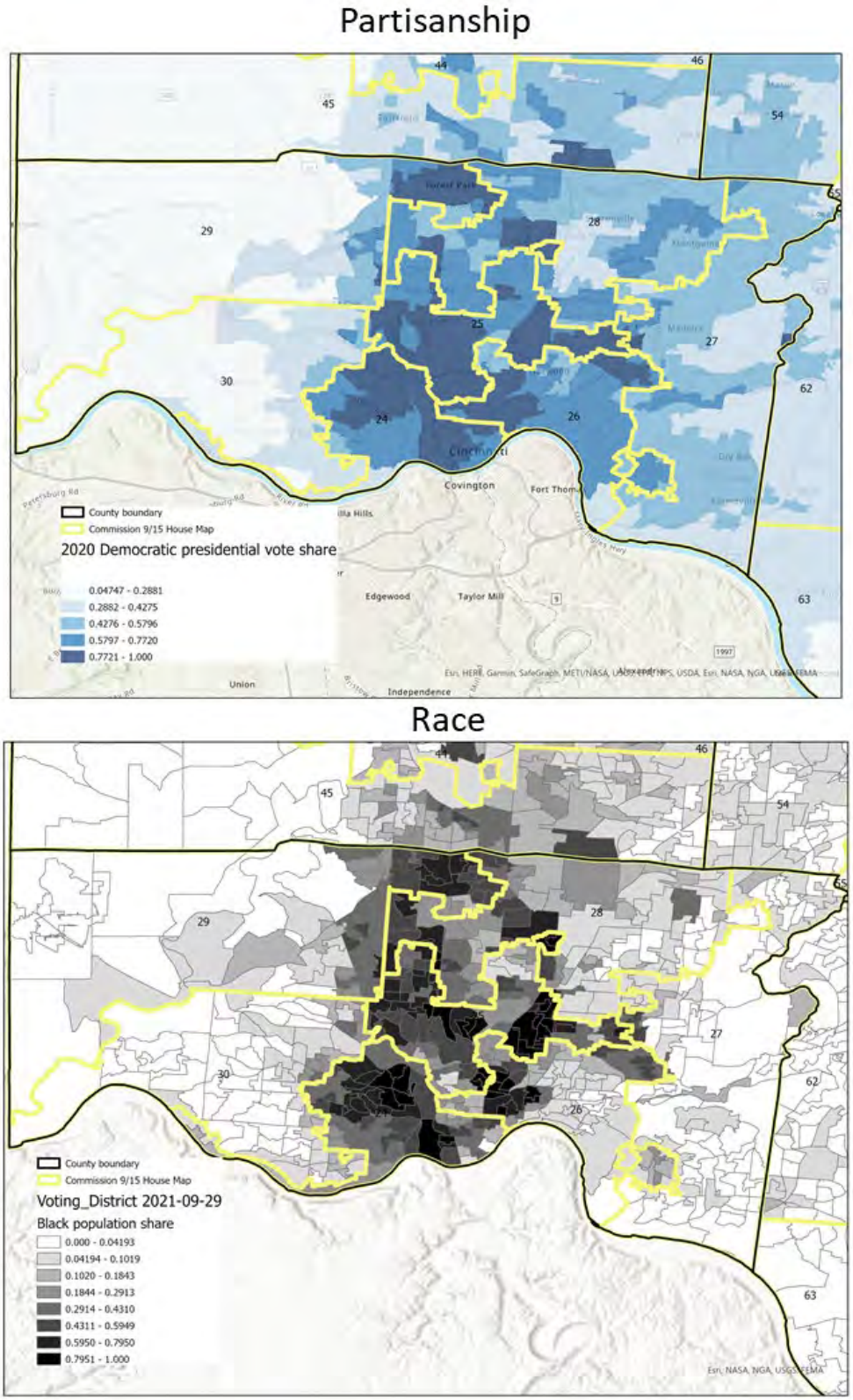
Hamilton County Area

75. Next, let us examine the Cincinnati area. Again, it is useful to get the lay of the land by viewing a precinct-level map of partisanship, superimposing the Commission's districts. It is also useful to understand the arrangement of race, which is highly correlated with voting behavior in metro Cincinnati. Figure 5 demonstrates that there is a north-south swath of Black voters in the middle of Hamilton County. These communities vote in large numbers for Democratic candidates. However, there are also Democratic-leaning suburban communities on the east side of Cincinnati that are not predominantly Black.

76. On the west side of Hamilton County, a majority-white, Republican-leaning district will emerge in the outer-ring suburbs and exurbs of Cincinnati in almost any configuration. However, the Commission has crafted a *second* majority-Republican district by keeping both districts as small as possible (within the 5 percent population deviation constraint) and reaching into Forest Park City—a majority-Black and overwhelmingly Democratic area, and surrounding precincts, in order to assemble sufficient population to produce an additional majority-Republican district. As discussed further below, this maneuver led to the creation of a relatively non-compact set of Hamilton County districts.

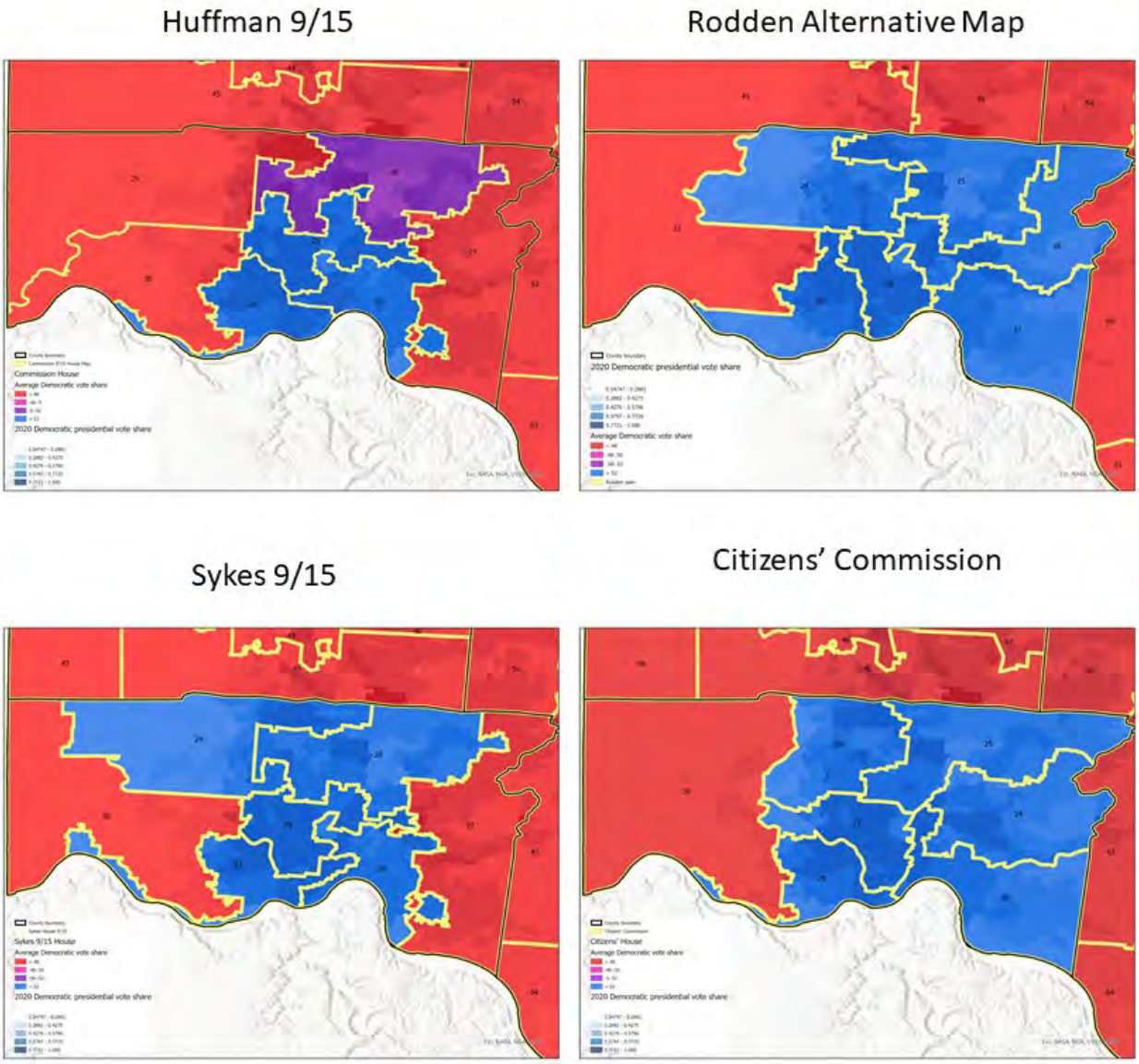
77. Moreover, by carefully avoiding Democratic neighborhoods, the Commission's plan also extracted a Republican-leaning district in Cincinnati's eastern suburbs (District 27). In addition, in the northern suburbs, District 28 in the Commission's plan, while Democratic leaning, is within reach for Republican candidates, with an average Democratic vote share of around 52 percent.

Figure 5: Hamilton County and Surroundings; Partisanship, Race, and the Commission's House Boundaries



78. Next, let us examine the alternative plans. Like the Commission's map, each of the alternative maps avoided splitting Hamilton County, which wholly contains 7 districts in each map. The Commission's map produced 3 Republican districts and 4 Democratic districts, 1 of which was relatively competitive. My plan, along with the Citizens' plan, produced a 6-1 breakdown, and the Sykes plan produced a 5-2 breakdown, both in favor of the Democrats.

Figure 6: Hamilton County and Surroundings; Party Majorities Associated with House Boundaries of Four Redistricting Plans



79. What accounts for these differences? Above all, these alternative plans made no efforts to craft a second Republican district in the suburbs by cracking Black neighborhoods in the northern part of the county, leaving them with only a single exurban Republican-leaning district. Second, by adopting an east-west rather than north-south orientation for the boundaries on the east side of the county, my plan, along with the Citizens' plan, did not craft an eastern Republican-leaning district.

80. Finally, as with Franklin County, the plans that exhibited greater statewide partisan proportionality were also the most compact in Hamilton County. My plan and the Citizens' Commission plan, both with 6-1 Democratic margins, were the most compact plans in Hamilton County. The average Polsby-Popper score for the Citizens' plan was .31, and for my plan it was .26. The Commission's plan and the Sykes plan each had scores of .17. The story is similar for the Reock score. The average for my plan was .43, and for the Citizens' plan it was .41, while for the two more Republican-leaning plans (the Commission's plan and the Sykes plan), the scores were .32 and .34 respectively.

Montgomery County Area

81. Next, let us move a few miles to the north and examine the Dayton area. In the Commission's House plan, only 1 of 5 Montgomery-based seats (number 38) has a clear Democratic majority, while an additional seat (number 36) was essentially a tie, with an average Democratic vote share of 50.03 percent. The other 3 seats had comfortable Republican majorities.

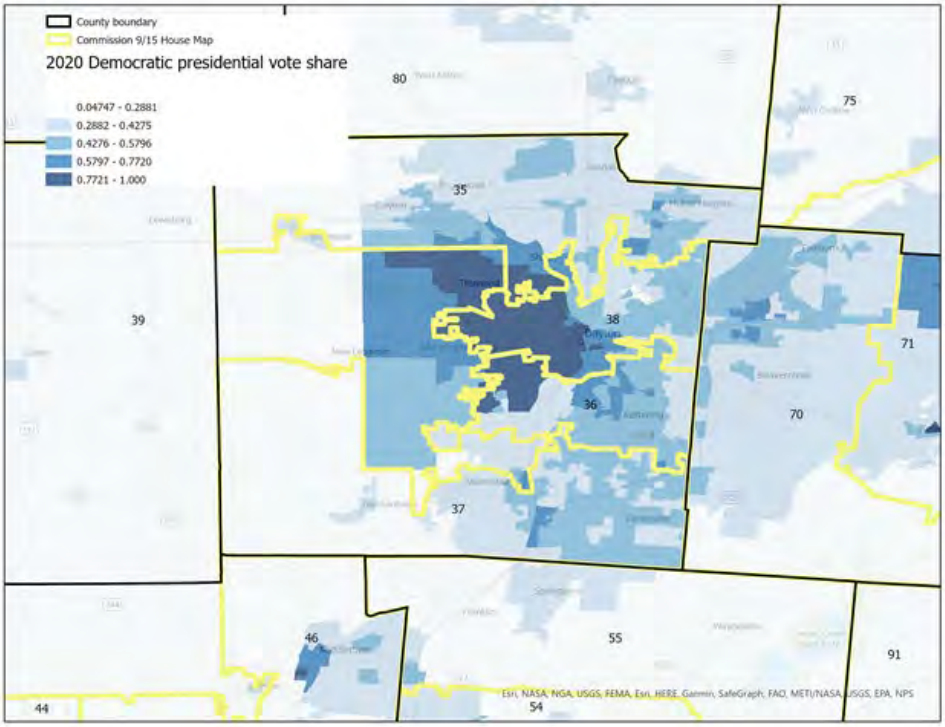
82. In my plan, there were 3 majority-Democratic seats, although 1 of them was a marginal seat, with an average Democratic vote share of 51.5 percent. Likewise, both the Sykes and Citizens' Commission plans produced 3 majority-Democratic seats. In order to see how the Commission's plan produced such a surprisingly pro-Republican outcome, let us once again examine how the Commission's districts interact with the partisan and racial geography of the county.

83. In Figure 7, the Commission's House district boundaries are superimposed on maps of partisanship and race in the Montgomery County area. The Commission's plan takes the relatively compact Black community of metropolitan Dayton, which votes overwhelmingly for Democratic candidates, and scatters it across 4 separate districts. The district with the largest Black community—number 38—is a majority-Democratic district. In fact, it is a super-majority Democratic district, where on average, Democrats win 69 percent of the vote. However, all of the other fragments of Dayton's Black community are combined with sufficient numbers of surrounding white, suburban populations in the 4 other Montgomery districts to generate 1 true toss-up (District 36) and 3 districts with comfortable Republican majorities.

84. A key part of this approach was to extract the Black community of Trotwood and other areas on the west side of Dayton and combine them with far-flung, rural Preble County to the west. Considerable care and craft seem to have gone into this effort to break up Black areas of metropolitan Dayton in a way that prevents the emergence of majority-Democratic districts.

Figure 7: Montgomery County and Surroundings; Partisanship, Race, and the Commission's House Boundaries

Partisanship



Race

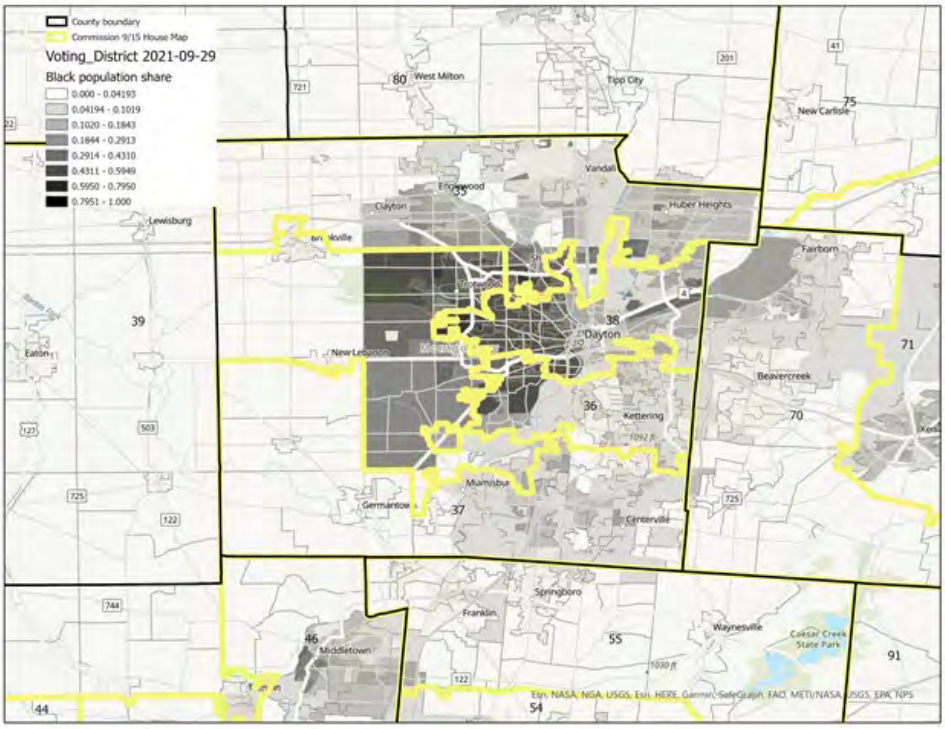
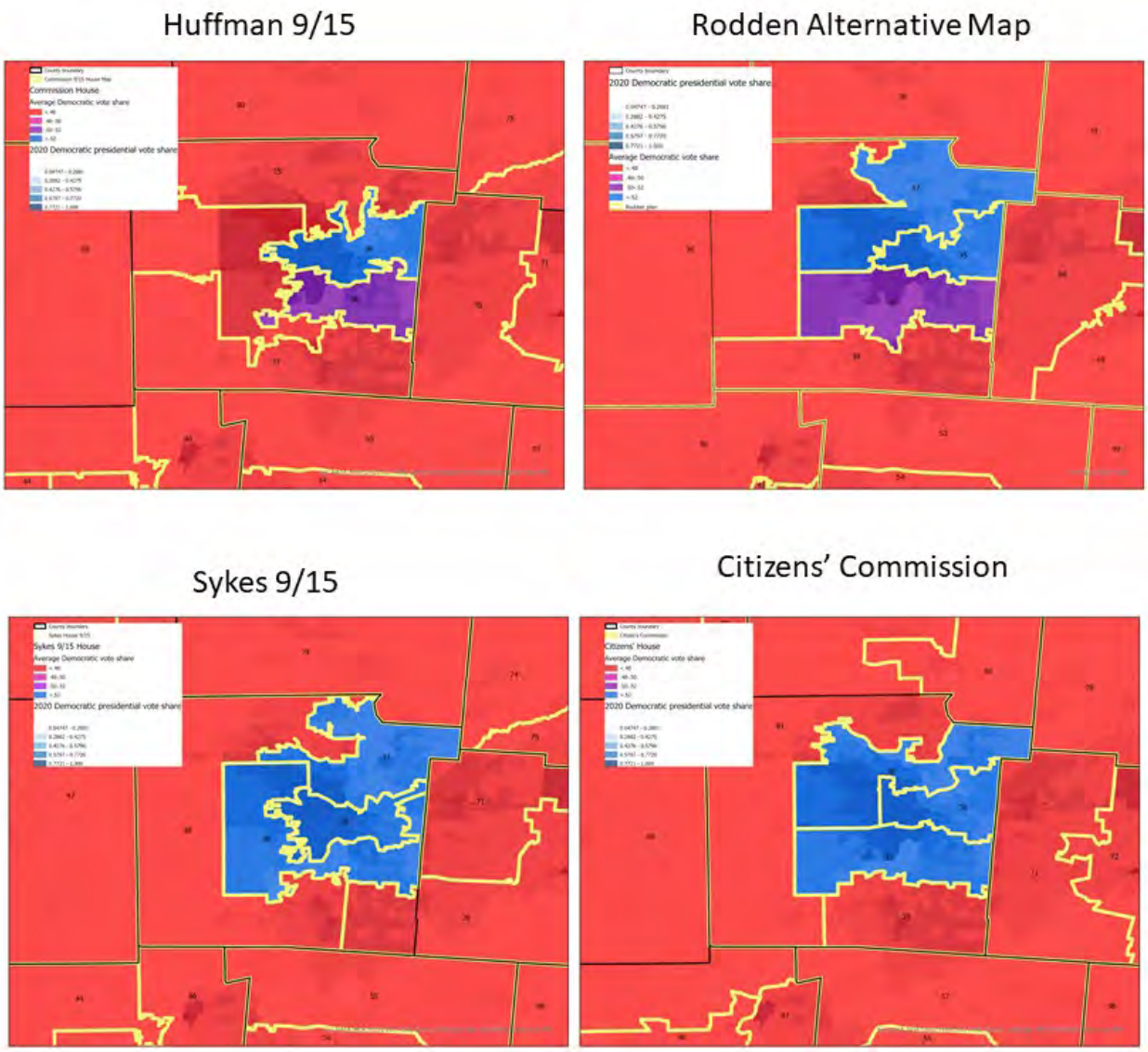


Figure 8: Montgomery County and Surroundings; Party Majorities Associated with House Boundaries of Four Redistricting Plans



85. Again, in order to appreciate the partisan impact of the Commission's approach to scattering the Dayton Black community across multiple districts, it is useful to examine the alternative maps. Following the same format as above, Figure 8 provides maps that facilitate comparison of the Commission's plan with the alternative plans.

86. Simply by keeping Dayton-area communities together, my map produced a relatively compact, very Democratic central Dayton district, as well as a Democratic-leaning northern suburban district, and a competitive but Democratic-leaning suburban district to the south. My plan also includes a Republican-leaning exurban district to the South, and a western exurban district that, like the Commission's district, combines with Preble County. A notable difference, however, is that my plan does not extract western Dayton-area Black communities in order to place them in a predominantly rural district. The configuration is different, but the same overall structure is present in the Citizens' plan. The Sykes plan has some similarities, but it is less compact, and combines parts of the Southern and western suburbs.

87. Once again, my plan and the plan produced by the Citizens' Commission, were substantially more compact according to the Polsby-Popper score, with average scores of .27 and .29 respectively for the Montgomery districts. The average score of the Commission's plan was .15, and the Sykes plan was .13. The four plans were less distinctive, however, according to the Reock score—all were bunched together with scores ranging from .37 to .39.

Northeast Ohio

88. Next, let us examine Northeast Ohio. As described above, all of the mapmakers faced difficult constraints associated with the strict rules for the construction of Senate districts, and these rules had implications for House districts as well. Each of the redistricting plans considered here ended up with the same basic solution: they drew consistently under-populated districts in Cuyahoga County, and indeed throughout the northeastern part of the state, and included a district that combines parts of several counties. Also, in each plan, it was necessary to create a district that kept Canton, Ohio whole.

89. In spite of these constraints, the Commission's plan ended up with a very different partisan outcome than the alternative plans. If we consider Northeast Ohio to be the area contained in Figure 9, the Commission's House plan includes 14 districts with average Democratic vote shares above 52 percent, and an additional 4 districts with very slim Democratic majorities, for a total of 18 majority-Democratic districts. As mentioned above, the Commission's House plan does not include any bare-majority Republican districts, in Northeast Ohio or anywhere else. Under the Commission's plan, 18 is perhaps the upper limit of districts that might be competitive for Democratic candidates.

90. In my plan, there are 17 districts with an average Democratic vote share above 52 percent, and 2 additional districts with Democratic vote shares between 50 and 52 percent, so that overall, there are 19 Democratic-leaning districts. The Sykes plan includes 17 districts with average Democratic majorities greater than 52 percent, 2 districts with slim Democratic-majorities, and 2 districts with slim Republican majorities, for a total of 19 Democratic-leaning districts, and 21 districts that could be at least competitive for Democratic candidates. The House plan produced by the Citizens' Commission produced 19 districts with average Democratic vote shares greater than 52 percent, and 2 additional districts with slim Republican majorities, again producing 21 districts that could be competitive for Democratic candidates.

91. To understand the sources of these differences, let us proceed through the region, guided by the image of the Commission's district boundaries superimposed on precinct-level election results (Figure 9), and images capturing the partisan outcomes produced by the Commission's maps and the alternative maps (Figure 10).

Figure 9: Northeast Ohio; Partisanship and the Commission's House Boundaries

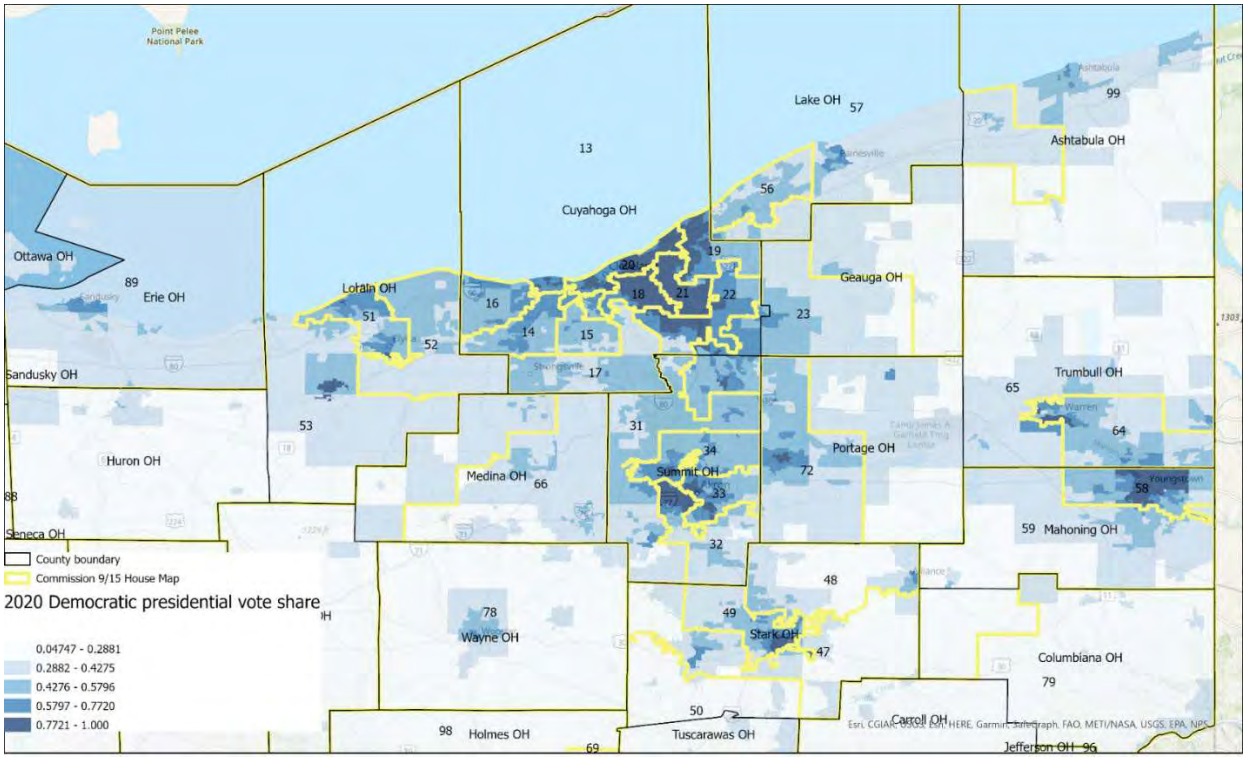
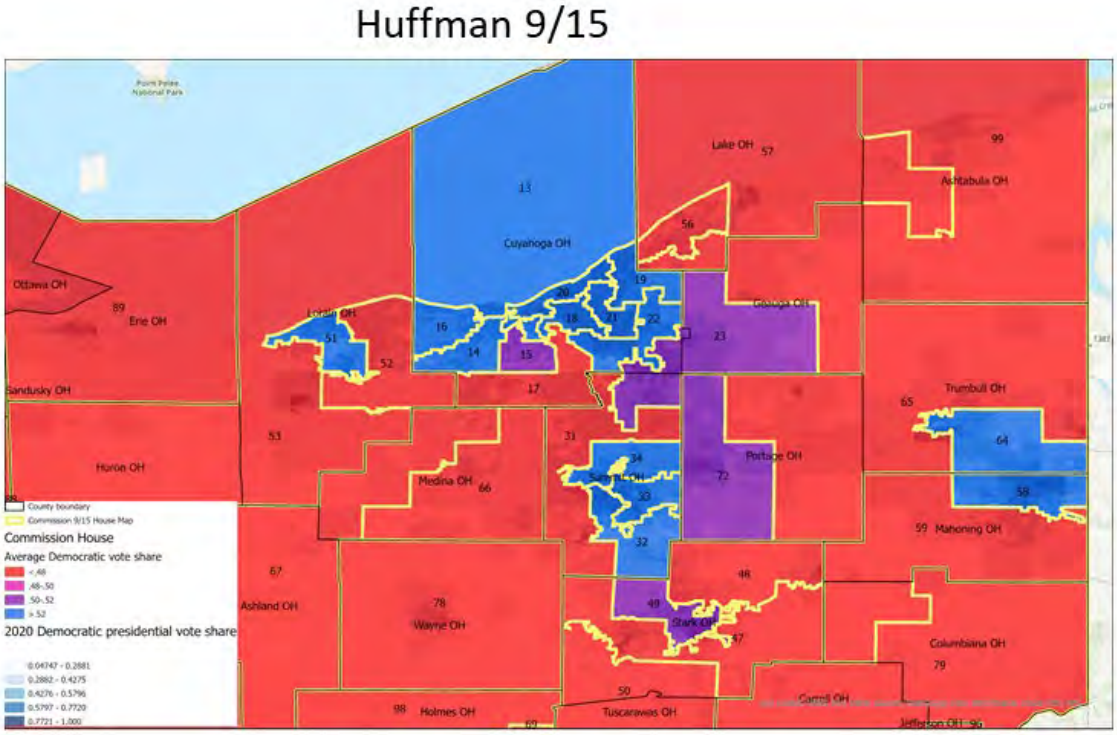


Figure 10a: Northeast Ohio; Party Majorities Associated with House Boundaries of the Commission's Plan and the Rodden Alternative Plan



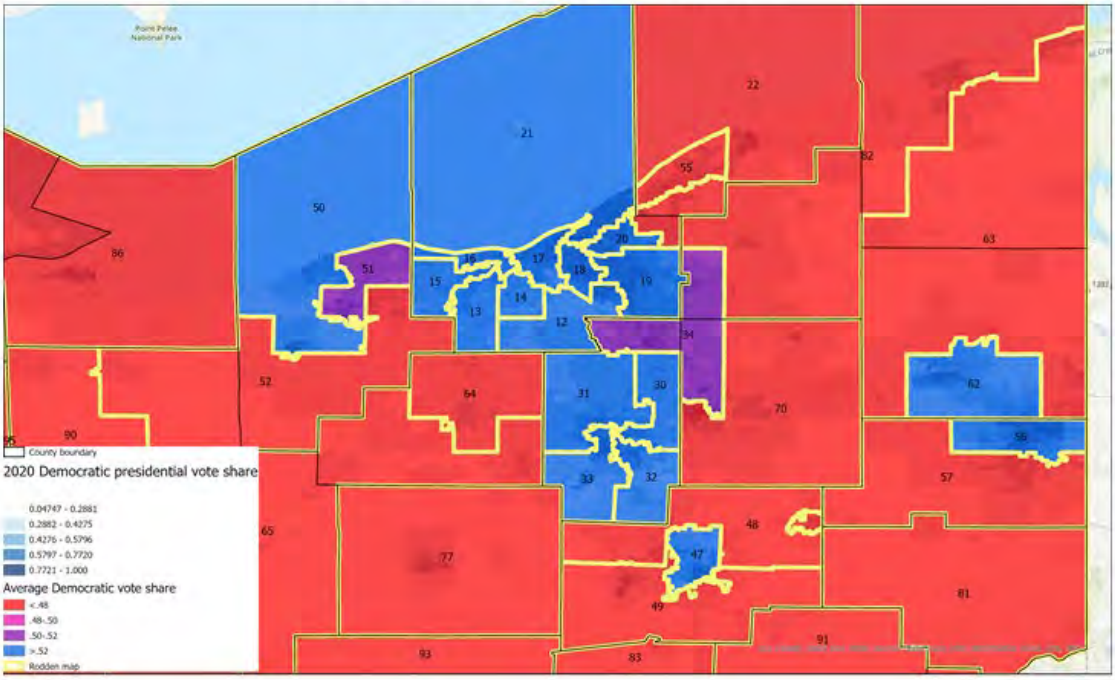
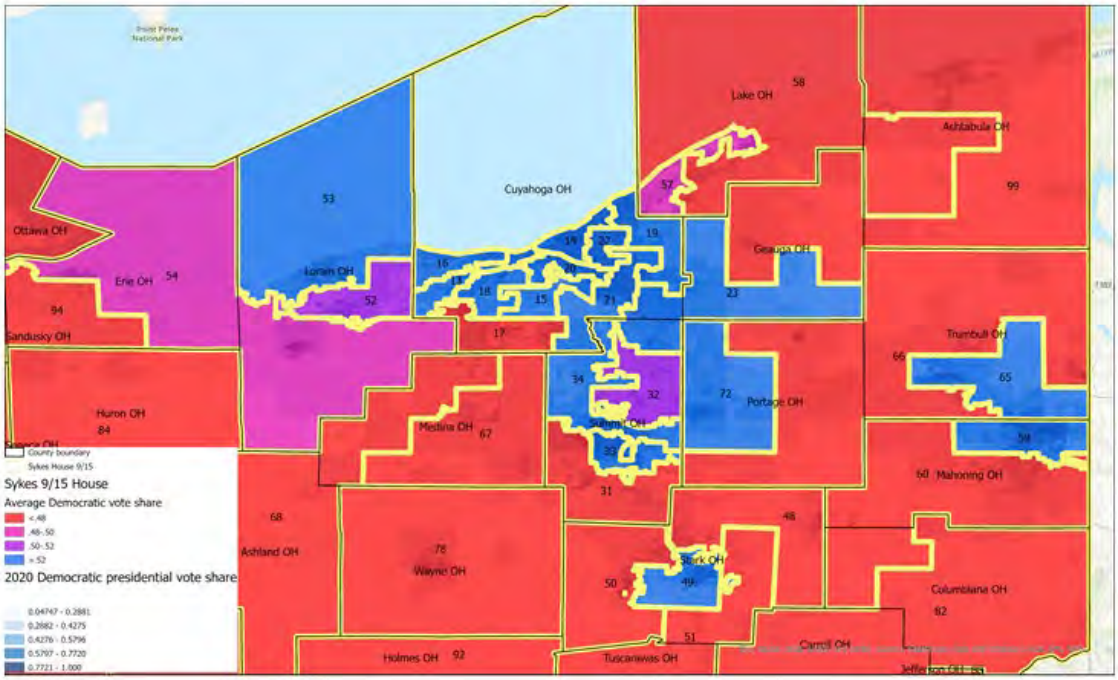
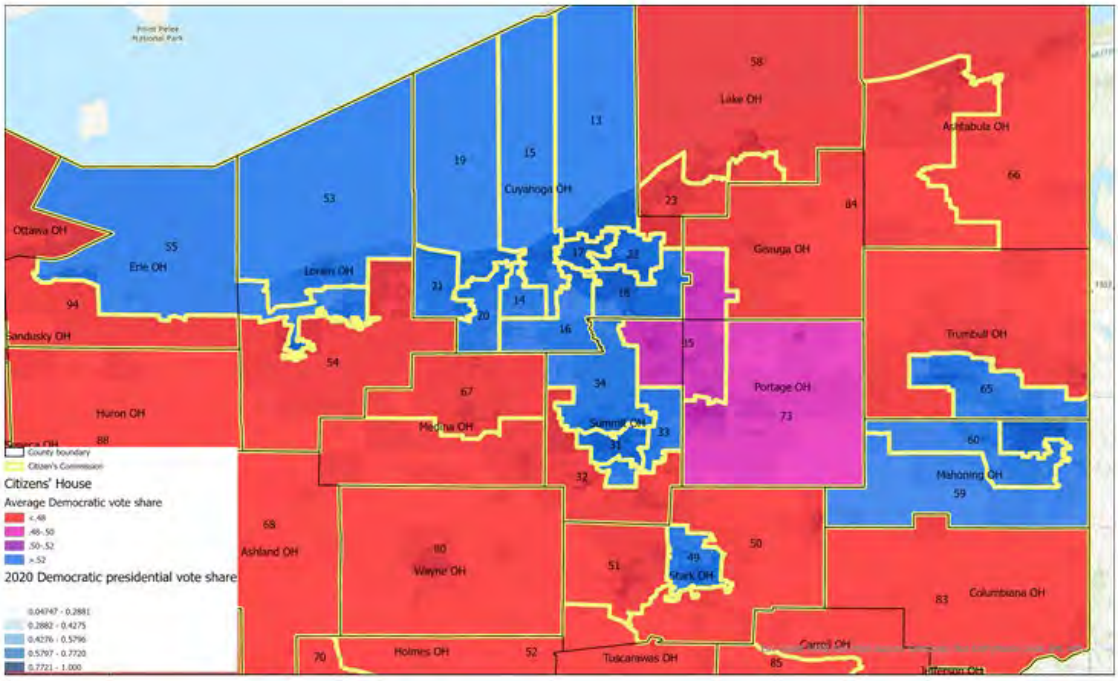


Figure 10b: Northeast Ohio; Party Majorities Associated with House Boundaries of the Sykes 9/15 and Citizens' Commission Plans

Sykes 9/15



Citizens' Commission



92. I begin with the county of Lorain. There are long-standing Democratic strongholds in each of the old industrial towns along the lake between the Sandusky Bay and Cleveland, including Lorain and Elyria, both of which are in Lorain County. Slightly to the southwest of Elyria is the small Democratic stronghold of Oberlin. Combined with their Republican suburban and rural surroundings, these towns make Erie and Lorain extremely competitive. Democrat Richard Cordray won Lorain County in the 2018 gubernatorial election by 6,578 votes, and all other statewide Democrats also won Lorain County that year, but Donald Trump won Lorain County by 3,853 votes in the 2020 presidential election. In Erie County, while Trump won by over 4,000 votes in 2020, Republican Governor DeWine received only 83 more votes than Cordray.

93. In this region, the Commission's plan produced only a single, very Democratic seat, with an average Democratic vote share of 63 percent, surrounded by comfortably Republican seats. This was achieved by combining the cities of Lorain and Elyria into a single district, numbered 51. When drawing districts in Lorain County, I avoided this packing strategy. Rather, I drew separate Lorain (50) and Elyria (51) districts. The Sykes map also created separate Lorain (53) and Elyria-based (52) districts. In both my map and the Sykes map, the Lorain-based district ends up comfortably Democratic, while the Elyria seat is Democratic-leaning but quite competitive. The Sykes approach also creates a competitive Republican-leaning district that includes Sandusky and Oberlin. In general, the Sykes plan makes this section of the Lake Erie coastline quite competitive relative to the Commission's plan. The Citizens' Commission plan produces 2 comfortably Democratic seats, by creating a Lorain-centric district, numbered 53, as well as an elongated coastal district that pulls together Elyria, Oberlin, and Sandusky.

94. Next, in Cuyahoga County, the Commission's plan carved out a comfortable Republican district along the southern border of the county, numbered 17, as well as a competitive Parma-based district, numbered 15. Looking at Figure 9, one can see that district 17 was drawn so as to pull together Republican-leaning communities in the outer suburbs. Using all of the elections since 2016, District 15 has an average Democratic vote share of 51.7 percent, but it should be noted that Donald Trump won majorities in this district in both 2016 and 2020. In addition, the district that combines Cuyahoga, Geauga, and Summit counties is essentially a toss-up, with an average Democratic vote share of 50.1 percent. In short, this plan creates 3 districts that are either comfortable or quite competitive for Republican candidates.

95. As described above, my approach to Cuyahoga County was to pay no attention to partisanship, but rather, to focus on generating a House plan that would enable a valid Senate plan. This required careful efforts to avoid splitting municipalities, while creating districts that were as close as possible to the 5 percent population deviation threshold. Those efforts did not yield a majority-Republican district in southern Cuyahoga County. The same was true of the Citizens' plan, but the Sykes 9/15 plan did produce one such district.

96. As in other metro areas examined above, an important part of the reason for the difference between the Commission's plan and the alternative plans in Cuyahoga County is that the Commission produces 6 districts with Democratic majorities higher than 70 percent, while each of the alternative plans produces only 4 such highly packed districts.

97. Next, let us turn to Summit County. The Commission's plan produces 3 comfortable Democratic districts and 1 comfortable Republican district. My plan divided most of the county into 4 relatively compact quadrants, which generated 4 Democratic-leaning districts. The Sykes plan and Citizens' Commission plans also produced 3 majority-Democratic districts and 1 majority-Republican district, but 1 of the majority-Democratic districts in the Sykes plan—number 32—is extremely competitive, with an average Democratic vote share of only 50.7 percent.

98. Next, each redistricting plan had a different approach to the city of Canton. In the Commission's plan, the Canton district, number 49, is quite competitive for Republican candidates, with an average Democratic vote share of 51 percent. In my plan, and in both the Sykes and Citizens' Commission plans, a more compact Canton-based district (numbered 47 in the Rodden plan and 49 in the others), produced more comfortable Democratic majorities (53.9 percent in the Rodden plan, 54.5 in the Sykes plan, and 54.1 percent in the Citizens' plan).

99. Finally, Mahoning County is evenly divided, with 1 majority-Democratic districts and 1 majority-Republican district in the Commission's plan, in the Rodden plan, and in the Sykes plan. The population of Mahoning County makes it possible to draw 2 House districts that fall completely within Mahoning County. My plan, as well as the Citizens' Commission plan, were able to achieve this. Note that the configuration adopted by the Citizens' Commission plan led to the creation of 2 majority-Democratic districts rather than only 1.

100. As with the other metro areas examined above, in Northeast Ohio, my alternative plan, as well as the plans introduced by Senator Sykes and the Citizens' Commission produced a larger number of majority-Democratic districts than did the Commission's plan—thus pushing the overall plan in the direction of statewide partisan proportionality. This was not achieved by abandoning the application of traditional redistricting principles. By avoiding a split of Mahoning County, my plan and the Citizens' Commission plan contained 1 fewer county split in Northeast Ohio than did the Commission's plan. There is no evidence that the specific county splits and mergers selected in the Sykes or Citizens' Commission plans did greater violence to specific communities of interest than did the Commission's plan. As in the other parts of Ohio explored above, my alternative map was more compact on average than the Commission's map. The average Polsby-Popper score for my map, as well as the Citizens' map, in the districts of Northeast Ohio was .35. The score for the Commission's plan was .30, and that for the Sykes plan was .27. The average Reock scores were closer together. The average score for my plan was .41, the Citizens' Commission and the Ohio Redistricting Commission were both .39, and Sykes plan was .37.

Summary of Case Studies

101. This tour around Ohio's metropolitan areas helps explain how the Commission managed to produce so many Republican-majority districts relative to the statewide vote share. For the most part, they followed the strategy of packing and cracking the supporters of their opponents. In each metropolitan area discussed above, the Commission generated a set of extremely Democratic districts in urban core areas, leaving fewer Democrats to contribute to potential Democratic majorities in other districts. As demonstrated by the alternative maps,

it was always possible to abide by traditional redistricting principles and draw compact districts that did not produce nearly as many extremely Democratic districts. Packing occurred not just in dense neighborhoods in large cities. Another example of packing is in Lorain County, where two Democratic cities were stuffed into the same district.

102. Second, when possible, the Commission's maps attempted to prevent geographically proximate groups of Democrats from joining together to form a district. In the Cincinnati and Dayton metro areas, for instance, this involved splitting proximate suburban Black communities and scattering them across majority-Republican districts that were largely exurban and even rural. As demonstrated by the alternative plans, these choices were not driven by constitutional rules, traditional redistricting principles, or geographic constraints. Rather, they were driven by discretionary choices.

103. Third, while keeping proximate groups of Democrats apart, when possible, the Commission's plans always attempted to string together groups of proximate Republicans to carve out majority-Republican districts within urban counties. Often, this involved a configuration based on long, narrow strips hugging the county boundary in sparsely populated exurban areas. Examples include District 10 in southwest Franklin County, District 27 in eastern Hamilton County, District 39 outside of Dayton, and District 17 in southern Cuyahoga County. District 31 in Summit County follows the Republican-leaning exurbs almost all the way around Akron.

104. Additionally, the Commission was careful in its use of county splits near cities. In Franklin County, for example, the Commission created a series of under-populated but extremely Democratic districts, freeing up voters to combine with a neighboring rural, Republican county, thus minimizing the Democratic seats produced in the Columbus area.

105. These case studies demonstrated that it is not always necessary to draw bizarre-shaped districts in order to pursue the cracking and packing maneuvers that produce surprisingly pro-Republican outcomes. However, it is telling that in each metro area my maps were, on average, more compact than those produced by the Commission according to the Polsby-Popper measure, and in most cases, according to the Reock measure as well. The same was true of the maps produced by the Citizens' Commission. Recall from Tables 2 and 3 above that when considered as a whole, my maps and those produced by the Citizens' Commission were more compact by every measure than those produced by the Ohio Redistricting Commission.

106. Overall, the contrast between the Commission's map and the alternative maps allows us to rule out the claim that the surprisingly large number of anticipated Republican seats associated with the Commission's plan were somehow driven by the confluence of Ohio's political geography, the requirements of the Ohio Constitution, and a focus on traditional redistricting principles. Indeed, we have seen that three very different alternative plans came very close to overall partisan proportionality, while abiding by the rules of the Ohio Constitution and often hewing more closely to traditional redistricting principles.

VII. CONCLUSION

107. Under no reasonable statistical method or definition do the Ohio State House of Representatives and Senate maps adopted by the Ohio Redistricting Commission achieve partisan proportionality.

108. The Commission's plan favors Republicans for reasons other than compliance with traditional redistricting principles and the Ohio Constitution's other requirements, as demonstrated by maps that I have prepared myself, as well as alternative maps presented to the Commission. These alternative maps achieve far greater partisan proportionality and are relatively similar, indeed in many cases better, according to traditional redistricting principles.

Jonathan Andrew Rodden

Jonathan Rodden

STATE OF FLORIDA COUNTY OF Duval

Sworn to before me this 22nd day of October 2021. by Jonathan Andrew Rodden

Provided Identification: Passport

Richard T Schnell

Notary Public Richard T Schnell

Notarized online using audio-video communication

RICHARD T SCHNELL
Notary Public - State of Florida
Commission # HH 29895
Expires on August 9, 2024

My commission expires 08/09/2024

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CERTIFICATE OF SERVICE

I, Derek Clinger, hereby certify that a copy of Evidence of Bennett Relators (Expert Affidavit of Dr. Jonathan Rodden) was served via email this 22nd day of October, 2021, upon the counsel listed below:

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AFFIDAVIT OF DR. JONATHAN RODDEN – APPENDIX OF EXHIBITS

Index of Documents

ITEM	DESCRIPTION	BATES RANGE
A	2021 Commission Plan	RODDEN_0001 – 0003
B	2011 Adopted Plan	RODDEN_0004 – 0006
C	September 2, 2021 Ohio Senate Democratic Update	RODDEN_0007 – 0009
D	September 9, 2021 Ohio Senate President	RODDEN_0010 – 0012
E	Ohio Citizens' Redistricting Commission Plan	RODDEN_0013 – 0015
F	Article XI, Sec 8(C)(2) Statement	RODDEN_0016 – 0018
G	Curriculum Vitae of Dr. Jonathan Rodden	RODDEN_0019 – 0027
H	September 15, 2021 House& Senate Dem Caucus	RODDEN_0028 – 0030
I	Rodden Alternative Plan	RODDEN_0031 – 0033

Exhibit A

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Exhibit B

Frank LaRose
Ohio Secretary of State

Ohio House Districts 2012-2022

(As Adopted 2012)

For the most up-to-date and detailed information on each district, please contact the local county board of elections.

Last Revised 02/2018

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Frank LaRose
Ohio Secretary of State

Ohio Senate Districts 2012-2022

(As Adopted 2012)

For the most up-to-date and detailed information on each district, please contact the local county board of elections.

Last Revised 02/2018

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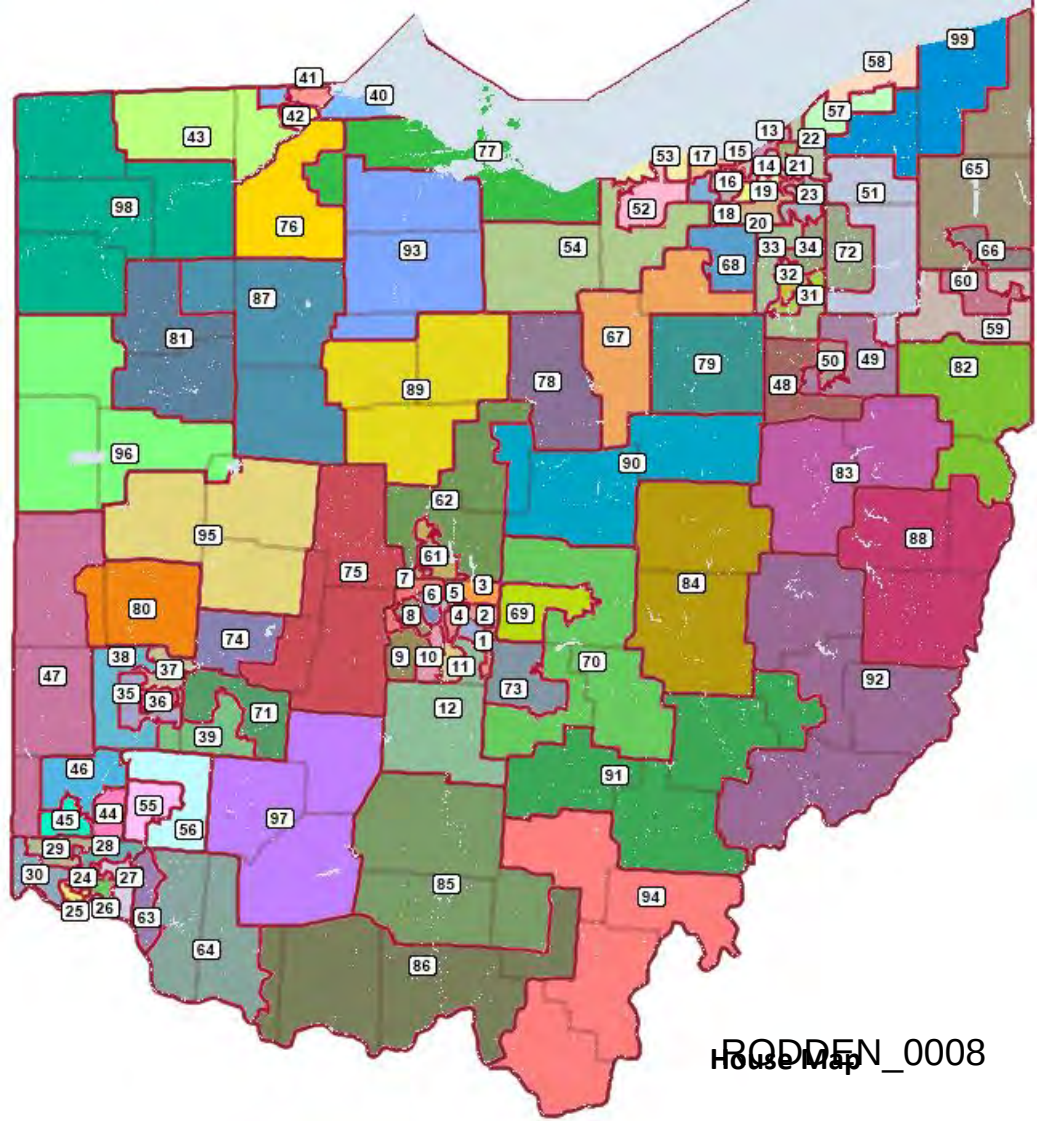
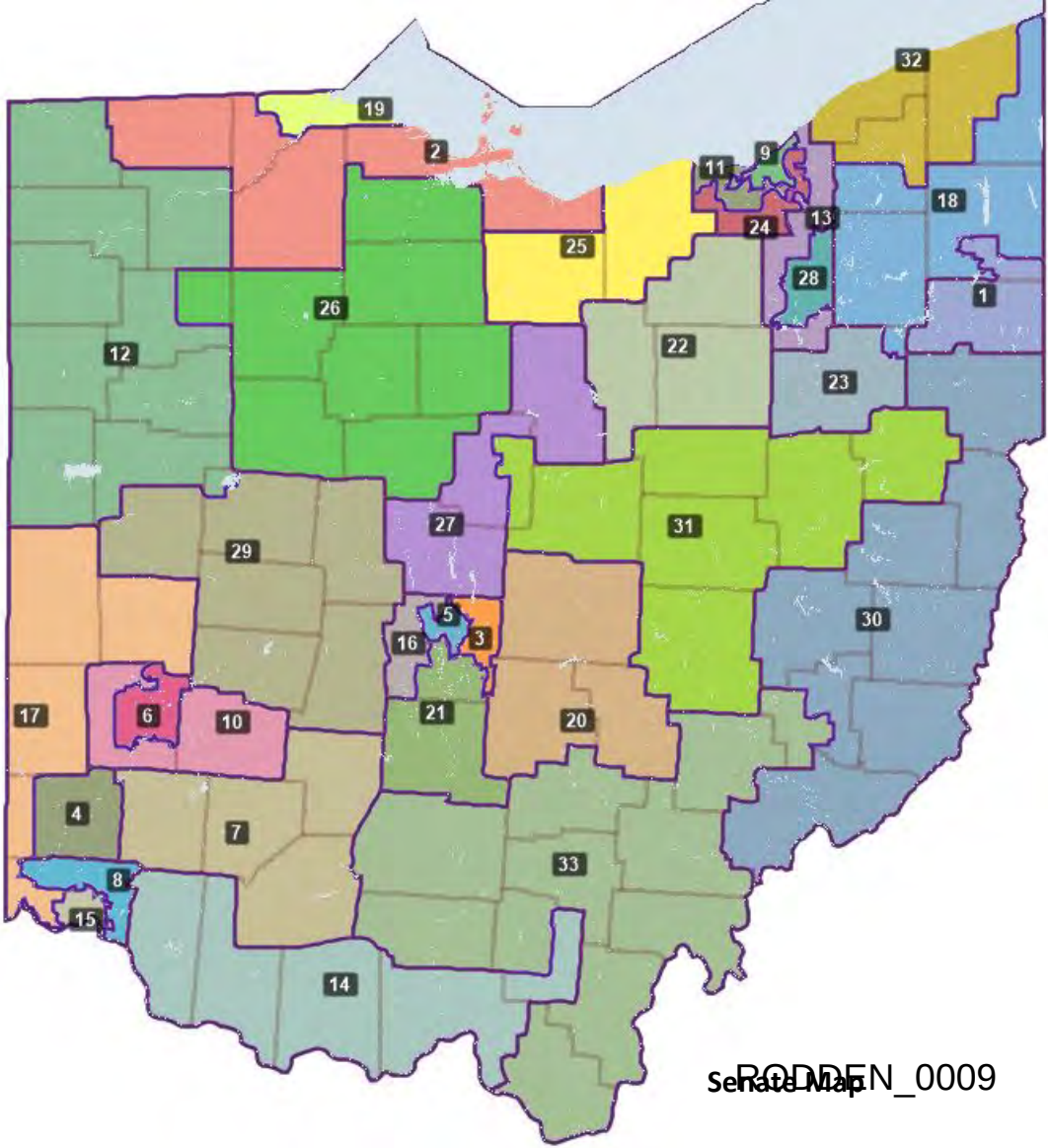
Exhibit C


House Map



Senate Map

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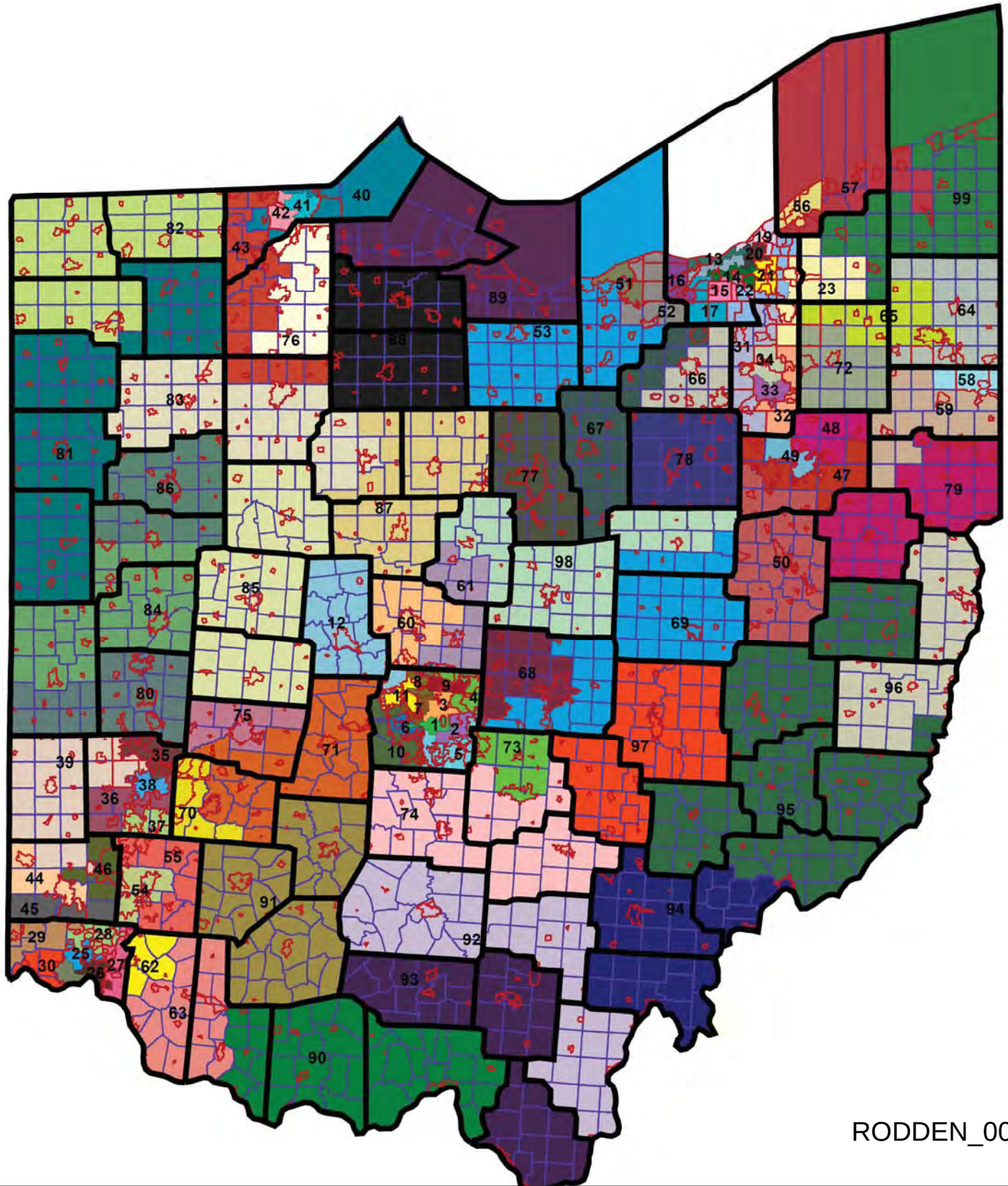
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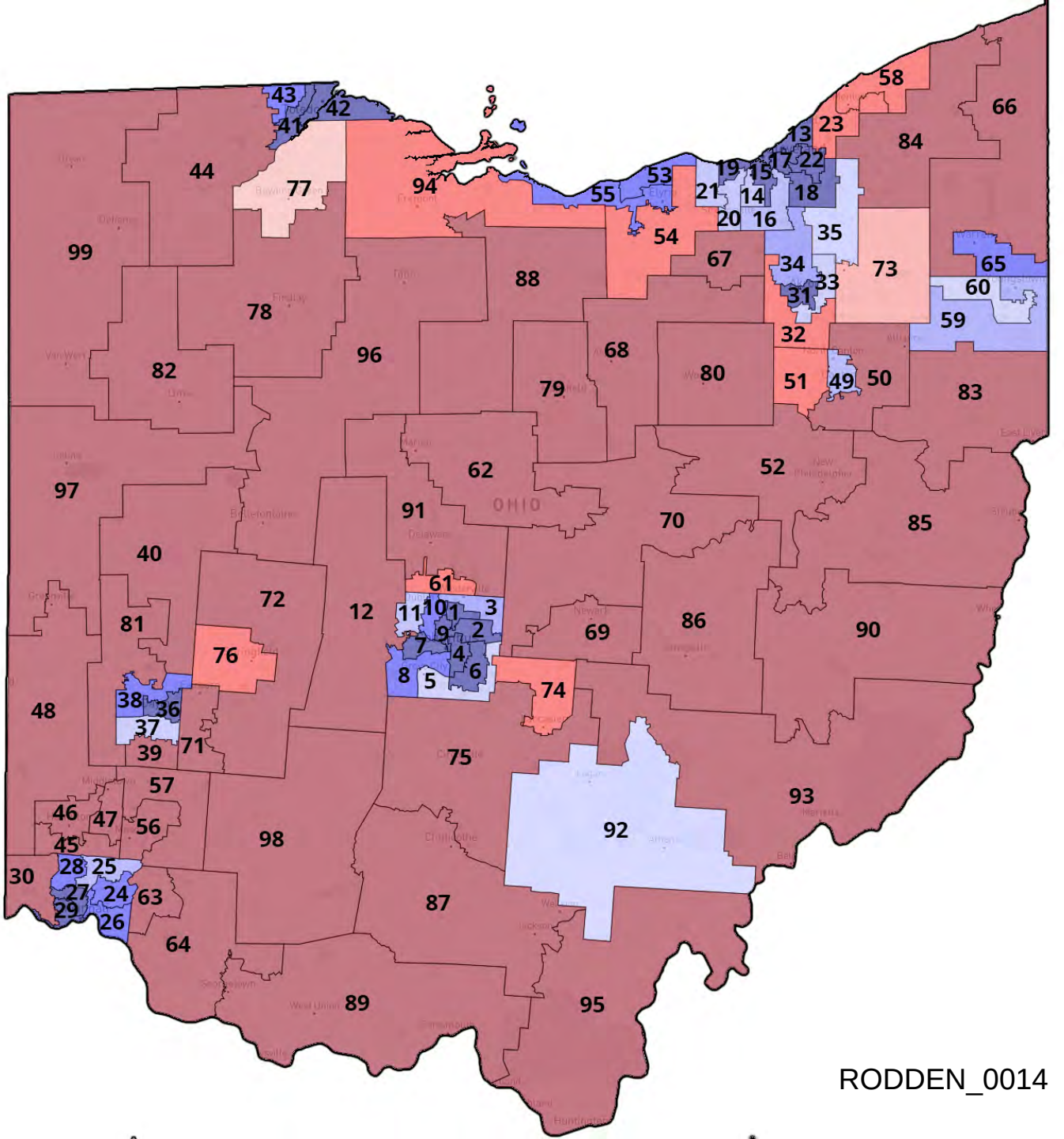
Exhibit E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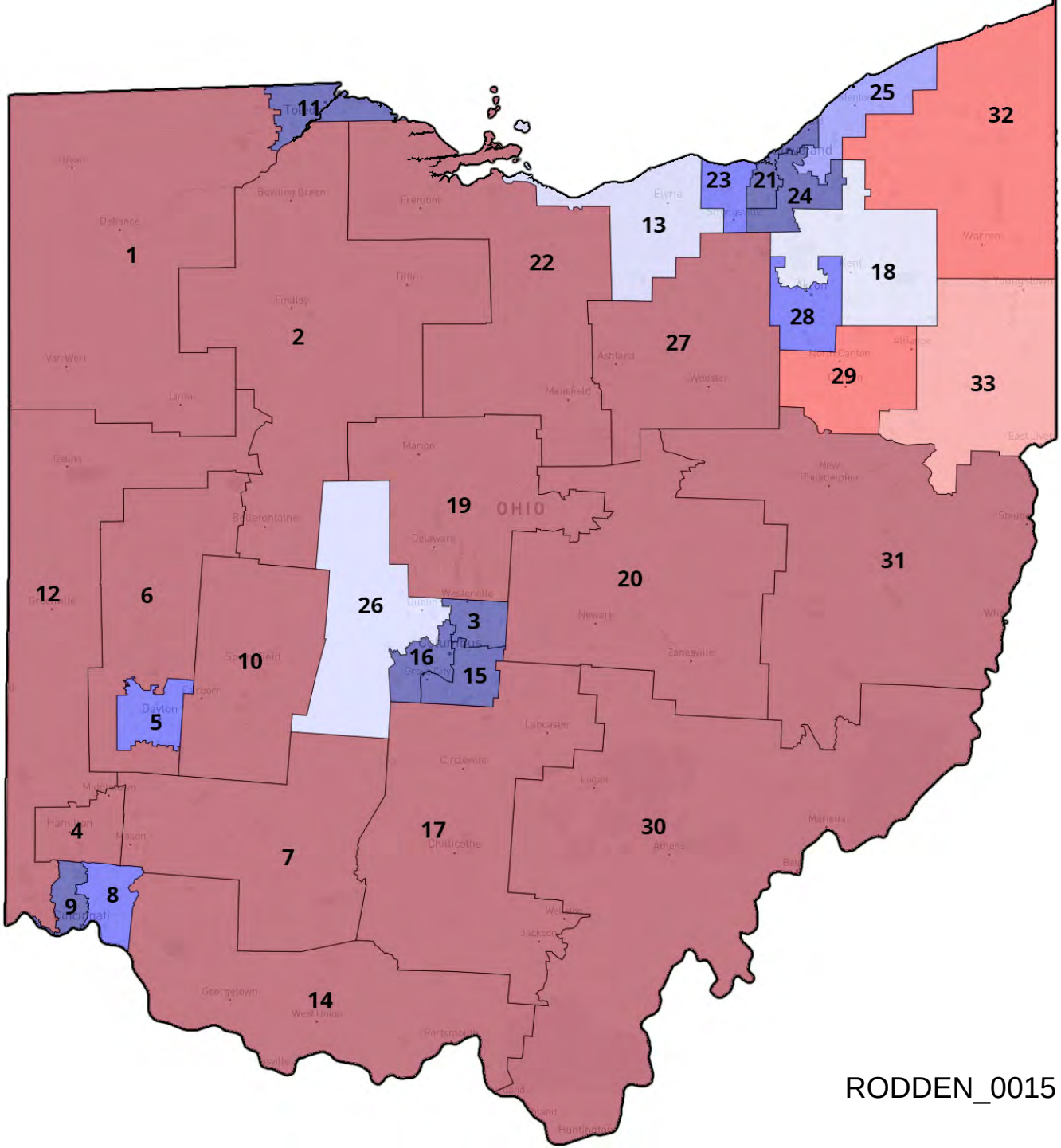
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Mason
Wilmington
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Exhibit F

Article XI, Section 8(C)(2) Statement

Pursuant to Article XI, Section 8(C)(2) of the Ohio Constitution, the Ohio Redistricting Commission issues the following statement:

The Commission determined that the statewide preferences of the voters of Ohio predominately favor Republican candidates.

The Commission considered statewide state and federal partisan general election results during the last ten years. There were sixteen such contests. When considering the results of each of those elections, the Commission determined that Republican candidates won thirteen out of sixteen of those elections resulting in a statewide proportion of voters favoring statewide Republican candidates of 81% and a statewide proportion of voters favoring statewide Democratic candidates of 19%. When considering the number of votes cast in each of those elections for Republican and Democratic candidates, the statewide proportion of voters favoring statewide Republican candidates is 54% and the statewide proportion of voters favoring statewide Democratic candidates is 46%. Thus, the statewide proportion of voters favoring statewide Republican candidates is between 54% and 81% and the statewide proportion of voters favoring statewide Democratic candidates is between 19% and 46%. The Commission obtained publicly available geographic data for statewide partisan elections in 2016, 2018, and 2020. Publicly available geographic data for those elections was not available for elections in 2012 and 2014. Using this data, the Commission adopted the final general assembly district plan, which contains 85 districts (64.4%) favoring Republican candidates and 47 districts (35.6%) favoring Democratic candidates out of a total of 132 districts. Accordingly, the statewide proportion of districts whose voters favor each political party corresponds closely to the statewide preferences of the voters of Ohio.

The final general assembly district plan adopted by the Commission complies with all of the mandatory requirements of Article XI, Sections 2, 3, 4, 5, and 7 of the Ohio Constitution. The Commission's attempt to meet the aspirational standards of Article XI, Section 6 of the Ohio Constitution did not result in any violation of the mandatory requirements of Article XI, Sections 2, 3 ,4, 5, and 7 of the Ohio Constitution.

Exhibit G

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Senior Fellow, Stanford Institute for Economic Policy Research, 2020–present.

Senior Fellow, Hoover Institution, Stanford University, 2012–present.

Director, Spatial Social Science Lab, Stanford University, 2012–present.

W. Glenn Campbell and Rita Ricardo-Campbell National Fellow, Hoover Institution, Stanford University, 2010–2012.

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Fellow, Center for Advanced Study in the Behavioral Sciences, Palo Alto, CA, 2006–2007.

Ford Career Development Associate Professor of Political Science, MIT, 2003–2006.

Visiting Scholar, Center for Basic Research in the Social Sciences, Harvard University, 2004.

Assistant Professor of Political Science, MIT, 1999–2003.

Instructor, Department of Political Science and School of Management, Yale University, 1997–1999.

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Publications

Books

Why Cities Lose: The Deep Roots of the Urban-Rural Divide. Basic Books, 2019.

Decentralized Governance and Accountability: Academic Research and the Future of Donor Programming. Co-edited with Erik Wibbels, Cambridge University Press, 2019.

Hamilton's Paradox: The Promise and Peril of Fiscal Federalism, Cambridge University Press, 2006. Winner, Gregory Luebbert Award for Best Book in Comparative Politics, 2007; Martha Derthick Award for lasting contribution to the study of federalism, 2021.

Fiscal Decentralization and the Challenge of Hard Budget Constraints, MIT Press, 2003. Co-edited with Gunnar Eskeland and Jennie Litvack.

Peer Reviewed Journal Articles

Who Registers? Village Networks, Household Dynamics, and Voter Registration in Rural Uganda, 2021, *Comparative Political Studies* forthcoming (with Romain Ferrali, Guy Grossman, and Melina Platas).

Partisan Dislocation: A Precinct-Level Measure of Representation and Gerrymandering, 2021, *Political Analysis* forthcoming (with Daryl DeFord Nick Eubank).

Who is my Neighbor? The Spatial Efficiency of Partisanship, 2020, *Statistics and Public Policy* 7(1):87-100 (with Nick Eubank).

Handgun Ownership and Suicide in California, 2020, *New England Journal of Medicine* 382:2220-2229 (with David M. Studdert, Yifan Zhang, Sonja A. Swanson, Lea Prince, Erin E. Holsinger, Matthew J. Spittal, Garen J. Wintemute, and Matthew Miller).

Viral Voting: Social Networks and Political Participation, 2020, *Quarterly Journal of Political Science* (with Nick Eubank, Guy Grossman, and Melina Platas).

It Takes a Village: Peer Effects and Externalities in Technology Adoption, 2020, *American Journal of Political Science* (with Romain Ferrali, Guy Grossman, and Melina Platas). Winner, 2020 Best Conference Paper Award, American Political Science Association Network Section.

Assembly of the LongSHOT Cohort: Public Record Linkage on a Grand Scale, 2019, *Injury Prevention* (with Yifan Zhang, Erin Holsinger, Lea Prince, Sonja Swanson, Matthew Miller, Garen Wintemute, and David Studdert).

Crowdsourcing Accountability: ICT for Service Delivery, 2018, *World Development* 112: 74-87 (with Guy Grossman and Melina Platas).

Geography, Uncertainty, and Polarization, 2018, *Political Science Research and Methods* doi:10.1017/psrm.2018.12 (with Nolan McCarty, Boris Shor, Chris Tausanovitch, and Chris Warshaw).

Handgun Acquisitions in California after Two Mass Shootings, 2017, *Annals of Internal Medicine* 166(10):698-706. (with David Studdert, Yifan Zhang, Rob Hyndman, and Garen Wintemute).

Cutting Through the Thicket: Redistricting Simulations and the Detection of Partisan Gerrymanders, 2015, *Election Law Journal* 14,4:1-15 (with Jowei Chen).

The Achilles Heel of Plurality Systems: Geography and Representation in Multi-Party Democracies, 2015, *American Journal of Political Science* 59,4: 789-805 (with Ernesto Calvo). Winner, Michael Wallerstein Award for best paper in political economy, American Political Science Association.

RODDEN_0021

Why has U.S. Policy Uncertainty Risen Since 1960?, 2014, *American Economic Review: Papers and Proceedings* May 2014 (with Nicholas Bloom, Brandice Canes-Wrone, Scott Baker, and Steven Davis).

Unintentional Gerrymandering: Political Geography and Electoral Bias in Legislatures, 2013, *Quarterly Journal of Political Science* 8: 239-269 (with Jowei Chen).

How Should We Measure District-Level Public Opinion on Individual Issues?, 2012, *Journal of Politics* 74, 1: 203-219 (with Chris Warshaw).

Representation and Redistribution in Federations, 2011, *Proceedings of the National Academy of Sciences* 108, 21:8601-8604 (with Tiberiu Dragu).

Dual Accountability and the Nationalization of Party Competition: Evidence from Four Federatons, 2011, *Party Politics* 17, 5: 629-653 (with Erik Wibbels).

The Geographic Distribution of Political Preferences, 2010, *Annual Review of Political Science* 13: 297–340.

Fiscal Decentralization and the Business Cycle: An Empirical Study of Seven Federations, 2009, *Economics and Politics* 22,1: 37–67 (with Erik Wibbels).

Getting into the Game: Legislative Bargaining, Distributive Politics, and EU Enlargement, 2009, *Public Finance and Management* 9, 4 (with Deniz Aksoy).

The Strength of Issues: Using Multiple Measures to Gauge Preference Stability, Ideological Constraint, and Issue Voting, 2008. *American Political Science Review* 102, 2: 215–232 (with Stephen Ansolabehere and James Snyder).

Does Religion Distract the Poor? Income and Issue Voting Around the World, 2008, *Comparative Political Studies* 41, 4: 437–476 (with Ana Lorena De La O).

Purple America, 2006, *Journal of Economic Perspectives* 20,2 (Spring): 97–118 (with Stephen Ansolabehere and James Snyder).

Economic Geography and Economic Voting: Evidence from the U.S. States, 2006, *British Journal of Political Science* 36, 3: 527–47 (with Michael Ebeid).

Distributive Politics in a Federation: Electoral Strategies, Legislative Bargaining, and Government Coalitions, 2004, *Dados* 47, 3 (with Marta Arretche, in Portuguese).

Comparative Federalism and Decentralization: On Meaning and Measurement, 2004, *Comparative Politics* 36, 4: 481-500. (Portuguese version, 2005, in *Revista de Sociologia e Politica* 25).

Reviving Leviathan: Fiscal Federalism and the Growth of Government, 2003, *International Organization* 57 (Fall), 695–729.

Beyond the Fiction of Federalism: Macroeconomic Management in Multi-tiered Systems, 2003, *World Politics* 54, 4 (July): 494–531 (with Erik Wibbels).

The Dilemma of Fiscal Federalism: Grants and Fiscal Performance around the World, 2002, *American Journal of Political Science* 46(3): 670–687.

Strength in Numbers: Representation and Redistribution in the European Union, 2002, *European Union Politics* 3, 2: 151–175.

Does Federalism Preserve Markets? *Virginia Law Review* 83, 7 (with Susan Rose-Ackerman). Spanish version, 1999, in *Quorum* 68.

RODDEN_0022

Working Papers

Elections, Political Polarization, and Economic Uncertainty, NBER Working Paper 27961 (with Scott Baker, Aniket Baksy, Nicholas Bloom, and Steven Davis).

Federalism and Inter-regional Redistribution, Working Paper 2009/3, Institut d'Economia de Barcelona.

Representation and Regional Redistribution in Federations, Working Paper 2010/16, Institut d'Economia de Barcelona (with Tiberiu Dragu).

Chapters in Books

Political Geography and Representation: A Case Study of Districting in Pennsylvania (with Thomas Weighill), in *Political Geometry*, edited by Moon Duchin and Olivia Walch, forthcoming 2021, Springer.

Keeping Your Enemies Close: Electoral Rules and Partisan Polarization, in *The New Politics of Insecurity*, edited by Frances Rosenbluth and Margaret Weir, forthcoming 2021, Cambridge University Press.

Decentralized Rule and Revenue, 2019, in Jonathan Rodden and Erik Wibbels, eds., *Decentralized Governance and Accountability*, Cambridge University Press.

Geography and Gridlock in the United States, 2014, in Nathaniel Persily, ed. *Solutions to Political Polarization in America*, Cambridge University Press.

Can Market Discipline Survive in the U.S. Federation?, 2013, in Daniel Nadler and Paul Peterson, eds, *The Global Debt Crisis: Haunting U.S. and European Federalism*, Brookings Press.

Market Discipline and U.S. Federalism, 2012, in Peter Conti-Brown and David A. Skeel, Jr., eds, *When States Go Broke: The Origins, Context, and Solutions for the American States in Fiscal Crisis*, Cambridge University Press.

Federalism and Inter-Regional Redistribution, 2010, in Nuria Bosch, Marta Espasa, and Albert Sole Olle, eds., *The Political Economy of Inter-Regional Fiscal Flows*, Edward Elgar.

Back to the Future: Endogenous Institutions and Comparative Politics, 2009, in Mark Lichbach and Alan Zuckerman, eds., *Comparative Politics: Rationality, Culture, and Structure* (Second Edition), Cambridge University Press.

The Political Economy of Federalism, 2006, in Barry Weingast and Donald Wittman, eds., *Oxford Handbook of Political Economy*, Oxford University Press.

Fiscal Discipline in Federations: Germany and the EMU, 2006, in Peter Wierts, Servaas Deroose, Elena Flores and Alessandro Turrini, eds., *Fiscal Policy Surveillance in Europe*, Palgrave MacMillan.

The Political Economy of Pro-cyclical Decentralised Finance (with Erik Wibbels), 2006, in Peter Wierts, Servaas Deroose, Elena Flores and Alessandro Turrini, eds., *Fiscal Policy Surveillance in Europe*, Palgrave MacMillan.

Globalization and Fiscal Decentralization, (with Geoffrey Garrett), 2003, in Miles Kahler and David Lake, eds., *Governance in a Global Economy: Political Authority in Transition*, Princeton University Press: 87-109. (Updated version, 2007, in David Cameron, Gustav Ranis, and Annalisa Zinn, eds., *Globalization and Self-Determination: Is the Nation-State under Siege?* Routledge.)

Introduction and Overview (Chapter 1), 2003, in Rodden et al., *Fiscal Decentralization and the Challenge of Hard Budget Constraints* (see above).

RODDEN_0023

Soft Budget Constraints and German Federalism (Chapter 5), 2003, in Rodden, et al, *Fiscal Decentralization and the Challenge of Hard Budget Constraints* (see above).

Federalism and Bailouts in Brazil (Chapter 7), 2003, in Rodden, et al., *Fiscal Decentralization and the Challenge of Hard Budget Constraints* (see above).

Lessons and Conclusions (Chapter 13), 2003, in Rodden, et al., *Fiscal Decentralization and the Challenge of Hard Budget Constraints* (see above).

Online Interactive Visualization

Stanford Election Atlas, 2012 (collaboration with Stephen Ansolabehere at Harvard and Jim Herries at ESRI)

Other Publications

Supporting Advanced Manufacturing in Alabama, Report to the Alabama Innovation Commission, Hoover Institution, 2021.

How America's Urban-Rural Divide has Shaped the Pandemic, 2020, *Foreign Affairs*, April 20, 2020.

An Evolutionary Path for the European Monetary Fund? A Comparative Perspective, 2017, Briefing paper for the Economic and Financial Affairs Committee of the European Parliament.

Representation and Regional Redistribution in Federations: A Research Report, 2009, in *World Report on Fiscal Federalism*, Institut d'Economia de Barcelona.

On the Migration of Fiscal Sovereignty, 2004, *PS: Political Science and Politics* July, 2004: 427–431.

Decentralization and the Challenge of Hard Budget Constraints, *PREM Note* 41, Poverty Reduction and Economic Management Unit, World Bank, Washington, D.C. (July).

Decentralization and Hard Budget Constraints, *APSA-CP* (Newsletter of the Organized Section in Comparative Politics, American Political Science Association) 11:1 (with Jennie Litvack).

Book Review of *The Government of Money* by Peter Johnson, *Comparative Political Studies 32,7: 897-900.*

Fellowships, Honors, and Grants

John Simon Guggenheim Memorial Foundation Fellowship, 2021.

Martha Derthick Award of the American Political Science Association for "the best book published at least ten years ago that has made a lasting contribution to the study of federalism and intergovernmental relations," 2021.

National Institutes of Health, funding for "Relationship between lawful handgun ownership and risk of homicide victimization in the home," 2021.

National Collaborative on Gun Violence Research, funding for "Cohort Study Of Firearm-Related Mortality Among Cohabitants Of Handgun Owners." 2020.

Fund for a Safer Future, Longitudinal Study of Handgun Ownership and Transfer (LongSHOT), GA004696, 2017-2018.

Stanford Institute for Innovation in Developing Economies, Innovation and Entrepreneurship research grant, 2015.

RODDEN_0024

Michael Wallerstein Award for best paper in political economy, American Political Science Association, 2016.

Common Cause Gerrymandering Standard Writing Competition, 2015.

General support grant from the Hewlett Foundation for Spatial Social Science Lab, 2014.

Fellow, Institute for Research in the Social Sciences, Stanford University, 2012.

Sloan Foundation, grant for assembly of geo-referenced precinct-level electoral data set (with Stephen Ansolabehere and James Snyder), 2009-2011.

Hoagland Award Fund for Innovations in Undergraduate Teaching, Stanford University, 2009.

W. Glenn Campbell and Rita Ricardo-Campbell National Fellow, Hoover Institution, Stanford University, beginning Fall 2010.

Research Grant on Fiscal Federalism, Institut d'Economia de Barcelona, 2009.

Fellow, Institute for Research in the Social Sciences, Stanford University, 2008.

United Postal Service Foundation grant for study of the spatial distribution of income in cities, 2008.

Gregory Luebbert Award for Best Book in Comparative Politics, 2007.

Fellow, Center for Advanced Study in the Behavioral Sciences, 2006-2007.

National Science Foundation grant for assembly of cross-national provincial-level dataset on elections, public finance, and government composition, 2003-2004 (with Erik Wibbels).

MIT Dean's Fund and School of Humanities, Arts, and Social Sciences Research Funds.

Funding from DAAD (German Academic Exchange Service), MIT, and Harvard EU Center to organize the conference, "European Fiscal Federalism in Comparative Perspective," held at Harvard University, November 4, 2000.

Canadian Studies Fellowship (Canadian Federal Government), 1996-1997.

Prize Teaching Fellowship, Yale University, 1998-1999.

Fulbright Grant, University of Leipzig, Germany, 1993-1994.

Michigan Association of Governing Boards Award, one of two top graduating students at the University of Michigan, 1993.

W. J. Bryan Prize, top graduating senior in political science department at the University of Michigan, 1993.

Other Professional Activities

Selection committee, best paper award, American Journal of Political Science.

International Advisory Committee, Center for Metropolitan Studies, Sao Paulo, Brazil, 2006–2010.

Selection committee, Mancur Olson Prize awarded by the American Political Science Association Political Economy Section for the best dissertation in the field of political economy.

Selection committee, Gregory Luebbert Best Book Award.

Selection committee, William Anderson Prize, awarded by the American Political Science Association for the best dissertation in the field of federalism and intergovernmental relations.

RODDEN_0025

Courses

Undergraduate

Politics, Economics, and Democracy

Introduction to Comparative Politics

Introduction to Political Science

Political Science Scope and Methods

Institutional Economics

Spatial Approaches to Social Science

Graduate

Political Economy

Political Economy of Institutions

Federalism and Fiscal Decentralization

Politics and Geography

Consulting

2017. Economic and Financial Affairs Committee of the European Parliament.

2016. Briefing paper for the World Bank on fiscal federalism in Brazil.

2013-2018: Principal Investigator, SMS for Better Governance (a collaborative project involving USAID, Social Impact, and UNICEF in Arua, Uganda).

2019: Written expert testimony in *McLemore, Holmes, Robinson, and Woullard v. Hosemann*, United States District Court, Mississippi.

2019: Expert witness in *Nancy Corola Jacobson v. Detzner*, United States District Court, Florida.

2018: Written expert testimony in *League of Women Voters of Florida v. Detzner* No. 4:18-cv-002510, United States District Court, Florida.

2018: Written expert testimony in *College Democrats of the University of Michigan, et al. v. Johnson, et al.*, United States District Court for the Eastern District of Michigan.

2017: Expert witness in *Bethune-Hill v. Virginia Board of Elections*, No. 3:14-CV-00852, United States District Court for the Eastern District of Virginia.

2017: Expert witness in *Arizona Democratic Party, et al. v. Reagan, et al.*, No. 2:16-CV-01065, United States District Court for Arizona.

2016: Expert witness in *Lee v. Virginia Board of Elections*, 3:15-cv-357, United States District Court for the Eastern District of Virginia, Richmond Division.

2016: Expert witness in *Missouri NAACP v. Ferguson-Florissant School District*, United States District Court for the Eastern District of Missouri, Eastern Division.

2014-2015: Written expert testimony in *League of Women Voters of Florida et al. v. Detzner, et al.*, 2012-CA-002842 in Florida Circuit Court, Leon County (Florida Senate redistricting case).

2013-2014: Expert witness in *Romo v Detzner*, 2012-CA-000412 in Florida Curcuit Court, Leon County (Florida Congressional redistricting case).

2011-2014: Consultation with investment groups and hedge funds on European debt crisis.

2011-2014: Lead Outcome Expert, Democracy and Governance, USAID and Social Impact.

2010: USAID, Review of USAID analysis of decentralization in Africa.

2006–2009: World Bank, Independent Evaluations Group. Undertook evaluations of World Bank decentralization and safety net programs.

2008–2011: International Monetary Fund Institute. Designed and taught course on fiscal federalism.

1998–2003: World Bank, Poverty Reduction and Economic Management Unit. Consultant for *World Development Report*, lecturer for training courses, participant in working group for assembly of decentralization data, director of multi-country study of fiscal discipline in decentralized countries, collaborator on review of subnational adjustment lending.

Last updated: September 23, 2021

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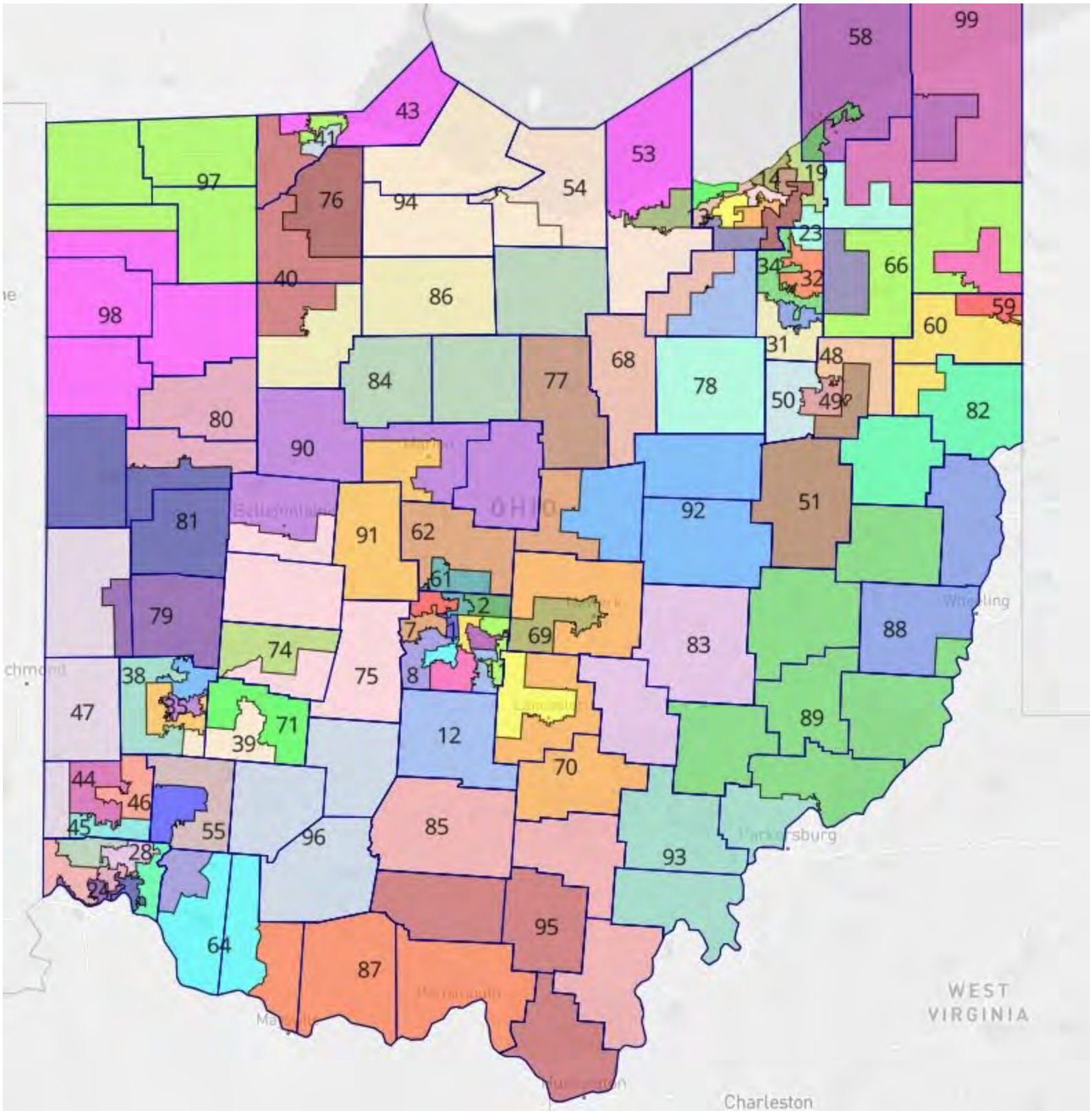
Exhibit H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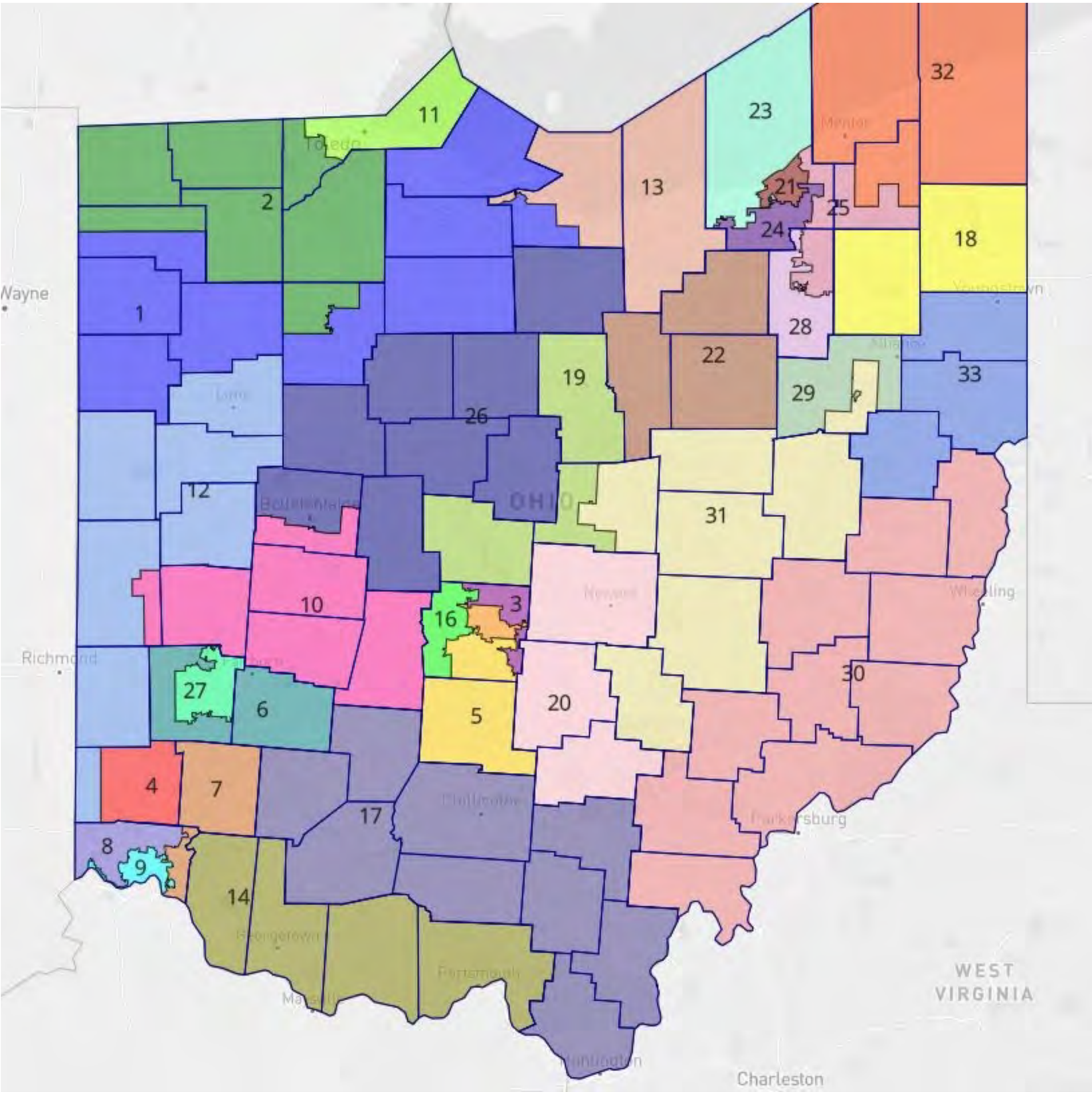
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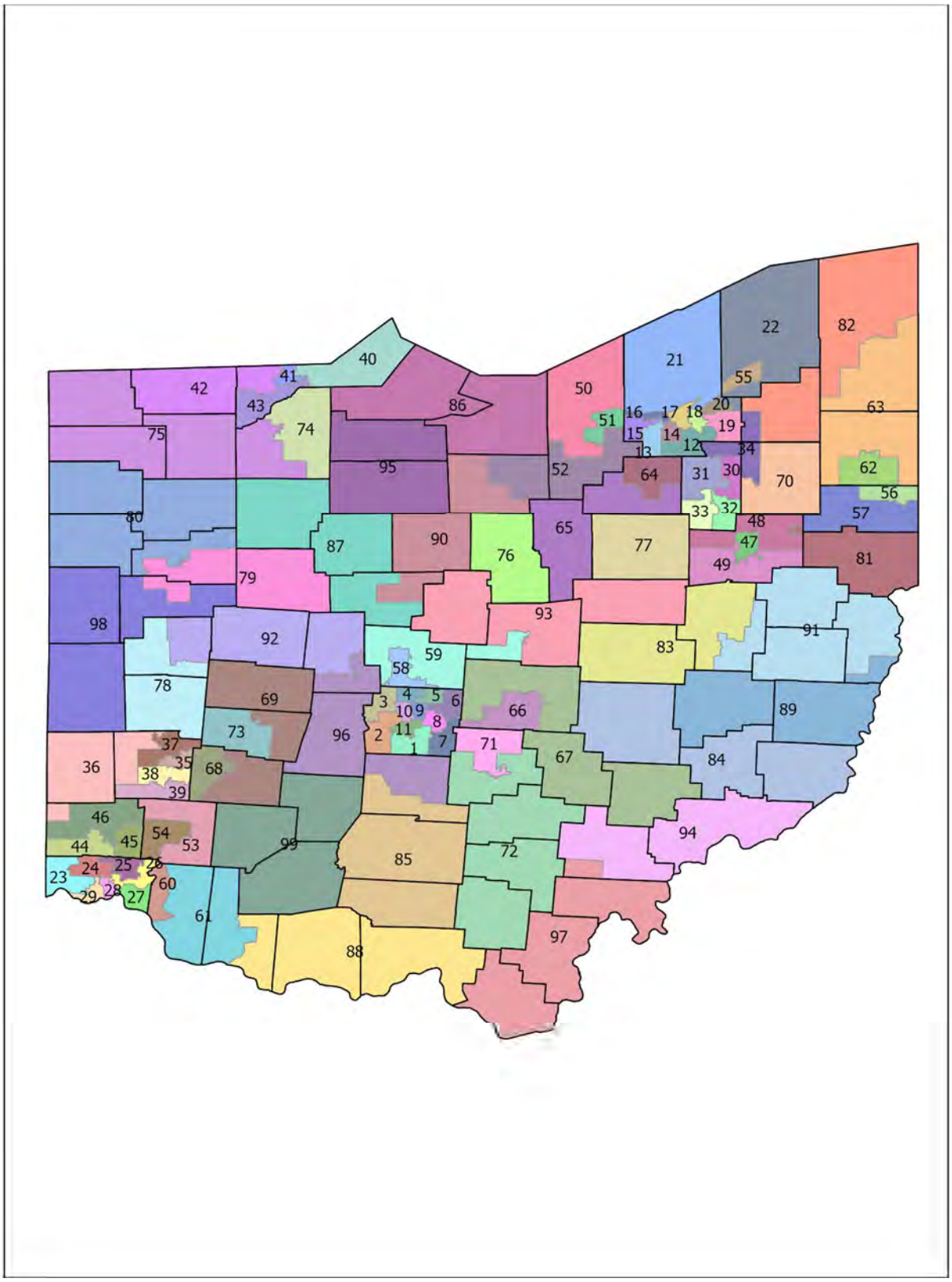
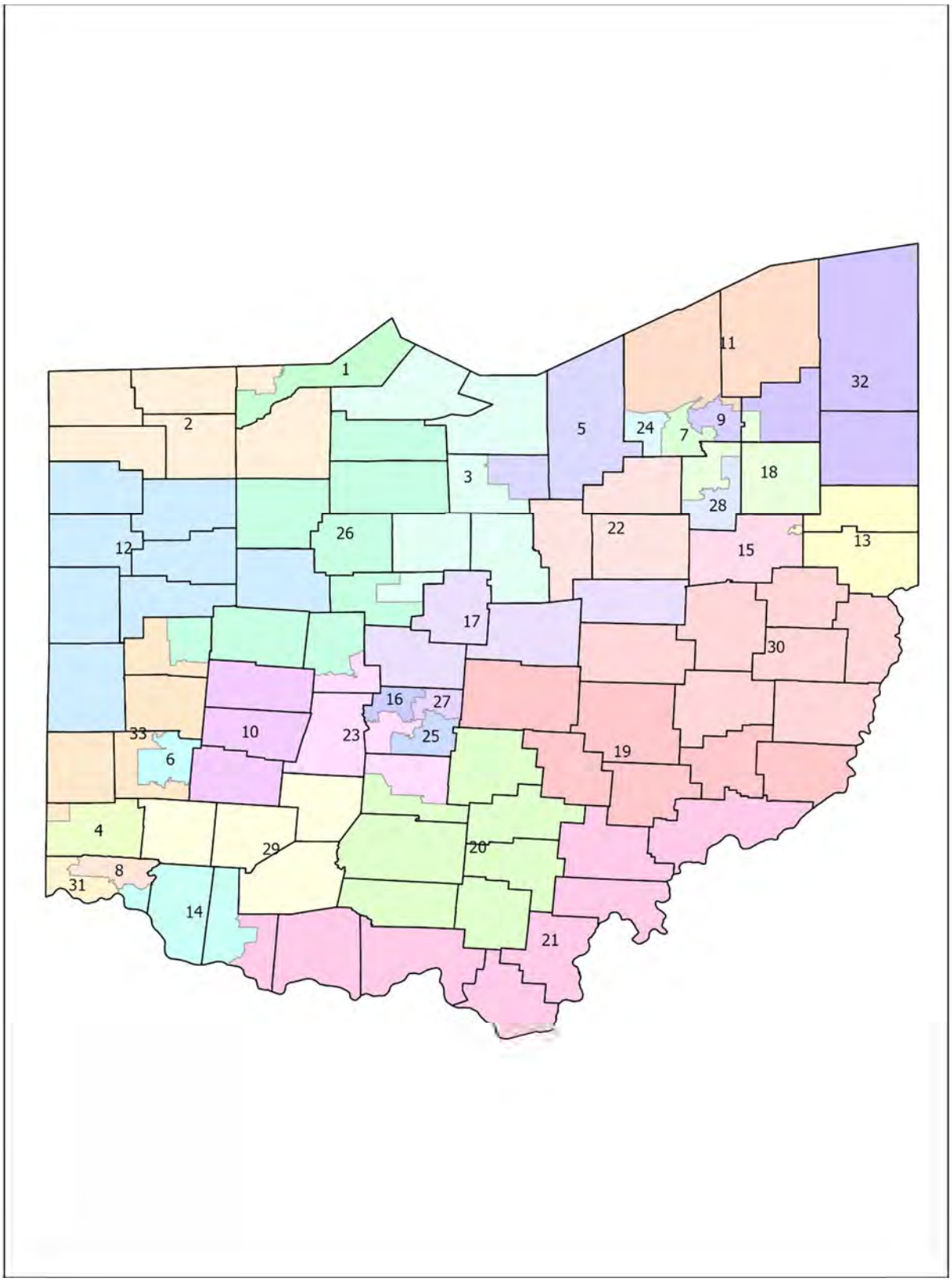
Exhibit I

Rodden Alternative House Plan



Rodden Alternative Senate Plan



CERTIFICATE OF SERVICE

I, Freda J. Levenson, hereby certify that on October 22, 2021, I caused a true and correct copy of the following documents to be served by email upon the counsel listed below:

1. **Affidavit of Freda J. Levenson**
2. **Affidavit and Expert Report of Michael S. Latner and Exhibits**
3. **Expert Affidavit of Dr. Jonathan Rodden and Exhibits**

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Counsel for Respondent Ohio Redistricting Commission

/s/ Freda J. Levenson