IN THE SUPREME COURT OF OHIO

LEAGUE OF WOMEN VOTERS OF OHIO, *et al.* ***Relators*,** ***v.*** **OHIO REDISTRICTING COMMISSION, *et al.*,** ***Respondents*.**	**Case No. 2021-1449** **Original Action Filed Pursuant to Ohio Const., art. XIX, Sec. 3(A)**

SUPPLEMENT TO RELATORS' MERITS BRIEF - VOLUME 1 OF 2

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SUPPLEMENT TO RELATORS' MERITS BRIEF

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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. 2021-1449

Original Action Filed Pursuant to Ohio Const., Art. XIX, Sec. 1(C)(3)

AFFIDAVIT OF KOSUKE IMAI

Franklin County
/ss
State of Ohio

Now comes affiant Kosuke Imai, having been first duly cautioned and sworn, deposes and states as follows:

1. I am over the age of 18 and fully competent to make this declaration. I have personal knowledge of the statements and facts contained herein.
2. For the purposes of this litigation, I have been asked by counsel for Relators to analyze relevant data and provide my expert opinions.
3. To that end, I have personally prepared the report attached to this affidavit as Exhibit A, and swear to its authenticity and to the faithfulness of the opinions expressed, and, to the best of my knowledge, the accuracy of the factual statements made therein.

FURTHER AFFIANT SAYETH NAUGHT

Executed on 12/09/2021, 2021.

Kosuke Imai
Signed on 2021/12/09 08:01:53 -8:00

Kosuke Imai

Sworn and subscribed before me this 12/09/2021 day of _____, 2021

Signed on 2021/12/09 08:01:53 -8:00

Notary Public

Theresa M Sabo
Commission # 2016-RE-619622
Electronic Notary Public
State of Ohio
My Comm Exp. Nov 28, 2026

Notary Stamp 2021/12/09 09:01:53 PST C9A5EA4809AA

Notarial act performed by audio-visual communication

EXHIBIT A

IN THE SUPREME COURT OF OHIO

League of Women Voters of Ohio, *et al.* *Relators*, v. Ohio Redistricting Commission, *et al.* *Respondents*.	Original Action Filed Pursuant to Ohio Const., Art. XIX, Sec. 3(A)

EXPERT REPORT
Kosuke Imai, Ph.D.
December 9, 2021

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EXPERT REPORT

I. INTRODUCTION AND SCOPE OF WORK

1. My name is Kosuke Imai, Ph.D., and I am a Professor in the Department of Government and the Department of Statistics at Harvard University. I specialize in the development of statistical methods for and their applications to social science research. I am also affiliated with Harvard's Institute for Quantitative Social Science.

2. I have been asked by counsel representing the relators in this case to analyze relevant data and provide my expert opinions related to whether Ohio's enacted congressional districting plan (SB 258, which I will refer to as the "enacted plan" in this report) meets the criteria in Article XIX, Section 1(C)(3)(a) of Ohio's Constitution. More specifically, I have been asked to statistically analyze the enacted plan's compliance with Article XIX, Section 1(C)(3)(a)'s requirement that "[t]he general assembly shall not pass a plan that unduly favors or disfavors a political party or its incumbents" by comparing it against other alternative plans that are as or more compliant with other relevant requirements of Article XIX.

II. SUMMARY OF OPINIONS

3. I simulated 5,000 hypothetical plans that are at least as compliant with Article XIX as the enacted plan. The comparison of these simulated plans with the enacted plan yields the following findings:

- The enacted plan unduly favors the Republican Party by giving the Republicans a much greater expected number of seats than in any of my 5,000 simulated plans. Even using the General Assembly's assumptions regarding the appropriate election set and calculation of expected number of seats, the Republican candidates are expected to win 2.8 more seats under the enacted plan than under the average simulated plan.

- The expected number of Republican seats under the enacted plan is a clear statistical outlier. Indeed, any plan that provides for more than 9 expected Republican seats is an outlier. Moreover, the probability of generating the enacted plan's extreme partisan outcome under the non-partisan simulation procedure I used is essentially zero.

- The enacted plan exhibits a significant partisan bias in favor of the Republican Party. Even using the General Assembly's assumptions regarding the appropriate election set and calculation of expected number of seats, the magnitude of bias is much greater under the enacted plan than in any of my 5,000 simulated plans and is a clear statistical outlier, according to several standard metrics used in the academic literature.

- In Hamilton County, the enacted plan cracks Democratic voters to create safe Republican seats, while in Franklin and Cuyahoga counties the enacted plan packs Democratic voters to create additional Republican-leaning districts.

III. QUALIFICATIONS, EXPERIENCE, AND COMPENSATION

4. I am trained as a political scientist (Ph.D. in 2003, Harvard) and a statistician (MA in 2002, Harvard). I have published more than 60 articles in peer reviewed journals, including premier political science journals (e.g., *American Journal of Political Science*, *American Political Science Review*, *Political Science*), statistics journals (e.g., *Biometrika*, *Journal of the American Statistical Association*, *Journal of the Royal Statistical Society*), and general science journals (e.g., *Lancet*, *Nature Human Behavior*, *Science Advances*). My work has been widely cited across a diverse set of disciplines. For each of the past four years, Clarivate Analytics, which tracks citation counts in academic journals, has named me as a highly cited researcher in the cross-field category for producing "multiple highly cited papers that rank in the top 1% by citations for field and year in Web of Science."

5. I started my academic career at Princeton University, where I played a leading role in building interdisciplinary data science communities and programs on campus. I was the founding director of Princeton's Program in Statistics and Machine Learning from 2013 to 2017. In 2018, I moved to Harvard, where I am Professor jointly appointed in the Department of Government and the Department of Statistics, the first such appointment in the history of the university. Outside of universities, between 2017 and 2019, I served as the president of the Society for Political Methodology, a primary academic organization of more than one thousand researchers worldwide who conduct methodological research in political science. My introductory statistics textbook for

social scientists, *Quantitative Social Science: An Introduction* (Princeton University Press, 2017), has been widely adopted at major research universities in the United States and beyond.

6. Computational social science is one of my major research areas. As part of this research agenda, I have developed simulation algorithms for evaluating legislative redistricting since the beginning of this emerging literature. At Harvard, I lead the Algorithm-Assisted Redistricting Methodology (ALARM; https://alarm-redist.github.io/) Project, which studies how algorithms can be used to improve legislative redistricting practice and evaluation.

7. Back in 2014, along with Jonathan Mattingly's team at Duke, my collaborators and I were the first to use Monte Carlo algorithms to generate an ensemble of redistricting plans. Since then, my team has written several methodological articles on redistricting simulation algorithms (Fifield, Higgins, et al. 2020; Fifield, Imai, et al. 2020; McCartan and Imai 2020; Kenny et al. 2021).

8. I have also developed an open-source software package titled `redist` that allows researchers and policy makers to implement the cutting-edge simulation methods developed by us and others (Kenny et al. 2020). This software package can be installed for free on any personal computer with Windows, Mac, or Linux operating system. According to a website that tracks the download statistics of R packages, our software package has been downloaded about 30,000 times since 2016 with an increasing download rate.[1]

9. In addition to redistricting simulation methods, I have also developed the methodology for ecological inference referenced in voting rights cases (Imai, Lu, and Strauss 2008; Imai and Khanna 2016). For example, my methodology for predicting individual's race using voter files and census data was extensively used in a recent decision by the Second Circuit Court of Appeals regarding a redistricting case (Docket No. 20-1668; Clerveaux *et al* v. East Ramapo Central School District).

10. A copy of my curriculum vitae is attached as Exhibit A.

11. I am being compensated at a rate of $450 per hour. My compensation does not

1. https://ipub.com/dev-corner/apps/r-package-downloads/ (accessed on December 6, 2021)

depend in any way on the outcome of the case or on the opinions and testimony that I provide.

IV. METHODOLOGY

12. I conducted simulation analyses to evaluate the enacted plan's compliance with Section 1(C)(3)(a) of Article XIX. Redistricting simulation algorithms generate a representative sample of all possible plans under a specified set of criteria. This allows one to evaluate the properties of a proposed plan by comparing them against those of the simulated plans. If the proposed plan unusually favors one party over another *when compared to* the ensemble of simulated plans, this serves as empirical evidence that the proposed plan is a partisan gerrymander. Furthermore, statistical theory allows us to quantify the degree to which the proposed plan is extreme relative to the ensemble of simulated plans in terms of partisan outcomes.

13. A primary advantage of the simulation-based approach, over the traditional methods, is its ability to account for the political and geographic features that are specific to each state, including spatial distribution of voters and configuration of administrative boundaries. Simulation methods can also incorporate each state's redistricting rules. These state-specific features limit the types of redistricting plans that can be drawn, making comparison across states difficult. The simulation-based approach therefore allows us to compare the enacted plan to a representative set of alternate districting plans subject to Ohio's administrative boundaries, political realities, and constitutional requirements. Appendix A provides a brief introduction to redistricting simulation.

A. Simulation Analysis

14. I have ensured that all my simulated plans are equally or more compliant with Section 2(B) of Article XIX than the enacted plan. My simulation procedure achieves this, in part, by being compliant with the U.S. Constitution and federal law protecting racial minority voting rights, generating contiguous and compact districts, limiting the number of county splits, and respecting the other splitting criteria specified in Section 2(B). I also avoid splitting the counties the enacted plan does not split. Appendix B provides detailed information about this process. For all simulations, I ensure districts fall within a 0.5% deviation from population parity. Although this deviation is greater than the population deviation used in the enacted plan, it only accounts for less

than 4,000 people and hence has no impact on the conclusions of my analysis.

15. Here, I provide a brief overview of the procedure while leaving the details to Appendix B. My simulation proceeds in two steps. First, at the instruction of counsel for the relators, I ensured that every simulated plan has one district in Cuyahoga County with the proportion of black voting age population (BVAP) falling above 42% in order to be compliant with the U.S. Constitution and federal law protecting racial minority voting rights. To do this, I sampled a contiguous and compact district that has an appropriate population size and BVAP proportion within Cuyahoga County. This district always contains the entire city of Cleveland because Section 2(B)(4)(b) prohibits splitting it. Once such a district is generated, I then separately run the simulation algorithm on the rest of the state and generate the remaining 14 districts while making sure that the resulting districts satisfy the requirements specified in Section 2(B). I repeat this procedure 5,000 times to obtain the desired number of simulated plans.

B. Metrics Used to Measure Bias

16. Using the redistricting simulation methodology, I evaluate compliance with Section 1(C)(3)(a) of Article XIX in the set of simulated plans generated by the algorithm as well as the enacted plan. To determine whether the enacted plan unduly favors a particular political party, I compare the expected number of Republican and Democratic seats under the enacted plan against the corresponding number under the simulated plans.

17. I understand that the General Assembly assessed the partisan leanings of the enacted plan using the set of six statewide federal elections from 2012 to 2020 (see Appendix E.1 for the list of these elections). I do not endorse the assumption that using this limited data set can accurately predict the expected number of Republican and Democratic seats under the enacted plan.[2] I nonetheless use this same set of election results data in my analysis so that the differences in conclusions between my analysis and the General Assembly's assessment cannot be attributed to the way in which the partisan leanings of districts are evaluated. Given that these elections

2. I have reviewed the Affidavit of Dr. Christopher Warshaw dated November 30, 2021, which concludes that this set of elections artificially enhances the perception of Democratic Party strength under the enacted plan. I agree with his conclusion in this regard.

enhance the perception of Democratic relative strength, using this assumption effectively gives the enacted plan the benefit of the doubt.

18. I also adopt the General Assembly's approach to computing the expected number of Republican seats under a given redistricting plan. Specifically, I first compute the total number of Republican votes for each district and then sum it across the six statewide federal elections. Dividing this by the total number of two-party votes that are similarly aggregated across these elections yields the Republican two-party vote share for each district. This aggregation method may not be ideal because it gives greater weights to general elections, which tend to have higher turnout than midterm elections. In spite of this potential problem, I follow the General Assembly's approach so that the findings of my analysis can be directly compared to the General Assembly's assessment. I have confirmed that the resulting vote share for each district under the enacted plan is essentially identical to the corresponding district-level vote share presented in the November 16, 2021 statement from Senator Rob McColley. Finally, based on these vote shares, I determine likely winners of all districts based on the vote totals for each statewide election. This gives the total number of expected Republican and Democratic seats for a given plan under the General Assembly's approach.

19. In addition to the expected number of seats, I apply a variety of metrics that are commonly used in the academic literature. These metrics are extensively discussed in Dr. Christopher Warshaw's affidavit, dated November 30, 2021, and the references therein. I have reviewed Dr. Warshaw's articulation of these metrics and they are consistent with my understanding, and appear to be applicable to the facts of this case. Specifically, to measure compliance with Section 1(C)(3)(a), I use the following partisan bias metrics whose definitions are discussed in Dr. Warshaw's affidavit and the references therein.

- Efficiency gap
- Mean-median gap
- Symmetry in the vote-seat curve across parties
- Declination

C. The Determination of Whether the Enacted Plan is a Statistical Outlier Can Provide a Useful Measure of its Partisan Bias

20. Another important benefit of using the redistricting simulation methodology is that it can determine whether or not the enacted plan is a statistical outlier relative to the simulated plans generated under a specified set of criteria. If the enacted plan is a statistical outlier, then the observed difference in partisan outcome between the enacted plan and the simulated plans represents a systematic partisan bias.

21. To determine whether the enacted plan is a statistical outlier, I first estimate the probability of generating a simulated plan that favors a political party at least as much as the enacted plan does. This can be done by simply computing the proportion of the simulated plans that favors a political party equally or more than the enacted plan. If this estimated probability is very small (e.g., less than 0.001), then the enacted plan is a statistical outlier because it is highly unlikely to come from the non-partisan distribution that is used to generate the simulated plans. If the data based on the simulated plans follow the normal distribution, which is a bell-shaped symmetric distribution without skew, then this probability of 0.001, for example, implies that the enacted plan is more than three standard deviations away from the average simulated plans.[3]

22. I also compute the difference in partisan outcome between the enacted plan and the average simulated plan. This allows me to measure the magnitude of partisan bias while accounting for its random variability across the simulated plans. I apply the most commonly used definition of an outlier (Tukey 1977). According to this definition, an outlier represents a data point that is beyond a distance of 1.5 interquartile range (IQR) below the first quartile or above the third quartile. If the data based on the simulated plans were normally distributed, the enacted plan is regarded as an outlier if it is at least 2.70 standard deviations away from the average simulated plan.

D. Description of Redistricting Simulation Software

3. Note that a standard deviation represents the average distance between a data point and the mean.

23. In my analysis, I use the open-source software package for redistricting analysis `redist` (Kenny et al. 2020), which implements a variety of redistricting simulation algorithms as well as other evaluation methods. My collaborators and I have written the code for this software package, so that other researchers and the general public can implement these state-of-the-art methods on their own. I supplement this package with code written primarily to account for the redistricting rules and criteria that are specific to Ohio. All of my analyses are conducted on a laptop. Indeed, all of my analysis code can be run on any personal computer once the required software packages, which are also freely available and open-source, are installed.

V. EVALUATION OF THE ENACTED PLAN USING THE GENERAL ASSEMBLY'S APPROACH

24. Using the redistricting simulation methodology, I evaluate the enacted plan's compliance with Section 1(C)(3)(a). Appendix E.1 provides the detailed information about data sources. I simulated 5,000 alternative Congressional redistricting plans, using the simulation procedure described in Section IV. As explained in Appendix B, every simulated plan is at least as compliant with Sections 2(B) as the enacted plan. For example, Appendices C and D show that the simulated plans are more compact and have fewer county splits than the enacted plan.

25. I can easily generate additional compliant plans by running the algorithm longer, but for the purpose of my analysis, 5,000 simulated plans will yield statistically precise conclusions. In other words, generating more than 5,000 plans, while possible, will not materially affect the conclusions of my analysis.

26. To evaluate the enacted plan's compliance with Section 1(C)(3)(a), I first compare the expected number of Republican seats under the enacted plan with that under each of my 5,000 simulated plans. Figure 1 shows that under the enacted plan, the Republican Party is expected to win 11 seats.[4] In contrast, under about 80% of the simulated plans, the expected number of Republican seats is only 8, while the Republican Party is expected to win 9 seats under the remaining

4. This prediction of 11 expected seats is based on using the set of six statewide federal elections from 2012 to 2020 that the General Assembly used. Again, I do not endorse the assumption that using this limited data set can accurately predict the expected number of Republican seats.

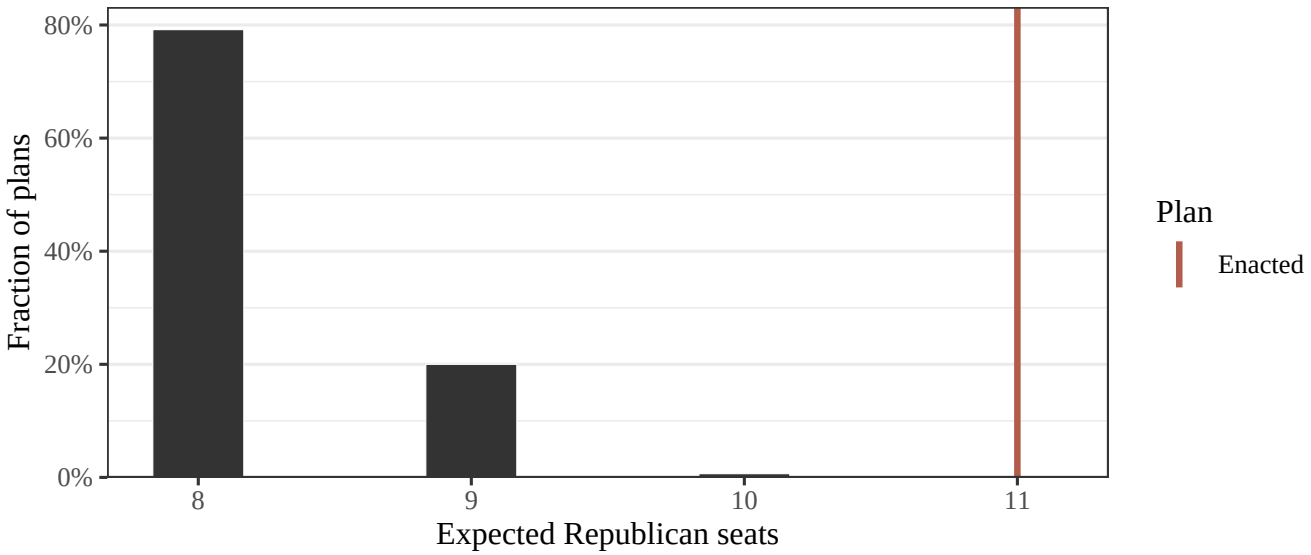

Figure 1: Expected number of Republican seats calculated for the 5,000 simulated plans computed by averaging across the six statewide federal elections from 2012 to 2020. Overlaid is the value for the enacted plan (red).

20% of the simulated plans. In other words, the enacted plan is expected to yield an additional 2.8 Republican seats when compared to the average simulated plan. Indeed, none of my 5,000 simulated plans gives as many Republican seats as the enacted plan. This result implies that the probability of generating the enacted plan's extreme partisan outcome under the non-partisan simulation procedure I used is essentially zero. Thus, any redistricting plan that gives more than 9 seats to the Republican Party, including the enacted plan, is a clear statistical outlier.

27. Under most of the simulated plans, the Republican Party is expected to win 8 seats, which is equivalent to 53% of the Ohio's 15 Congressional seats. This seat proportion is almost identical to the statewide vote share of the Republican Party, which is approximately 52% calculated using the General Assembly's approach and 54% based on the statement made by the Ohio Redistricting Commission in compliance with Section 8(C)(2) of Article XI of the Ohio Constitution. In contrast, under the enacted plan, the expected seat share of the Republican Party is 73%, which is roughly 20 percentage points greater than its expected vote share. As discussed above, this seat share result is a clear statistical outlier. Accordingly, this shows that the enacted plan unduly favors the Republican Party.

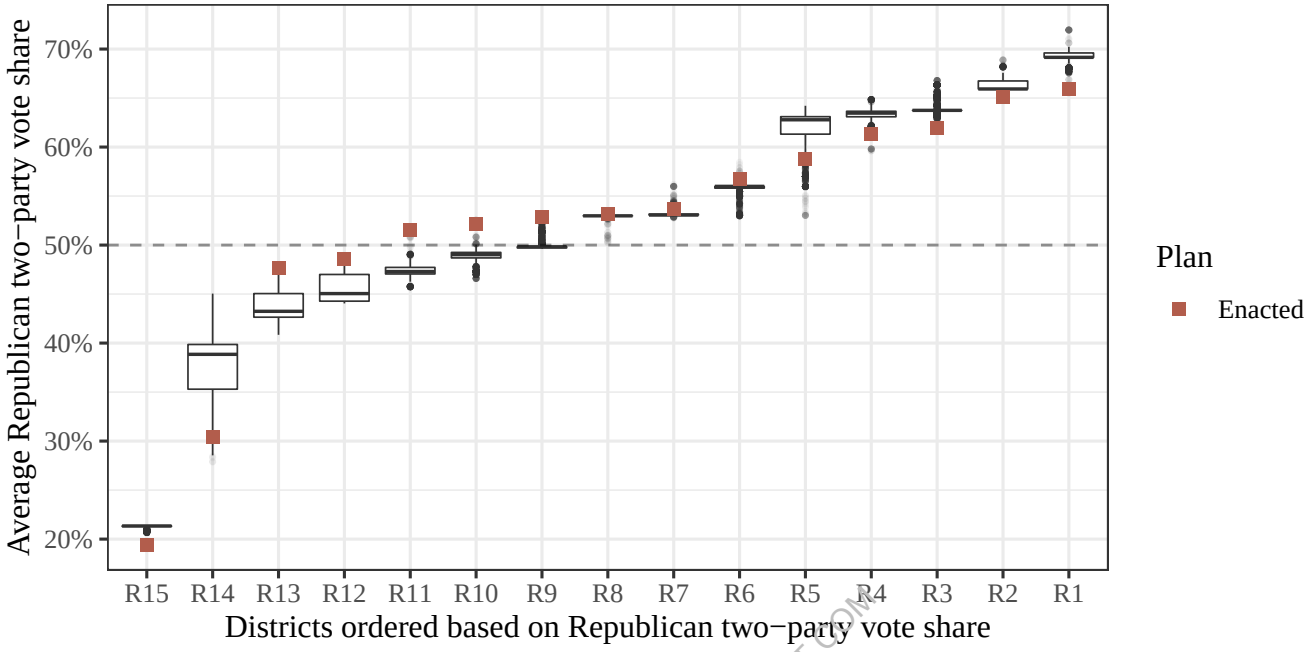

Figure 2: Expected Republican vote share for districts using the six statewide federal elections from 2012 to 2020. For any given plan, the districts are ordered based on their expected Republican vote share. Boxplots represent the distribution of the expected Republican vote share across the simulated plans, whereas the red square correponds to the expected Republican vote share under the enacted plan.

28. Figure 2 further demonstrates the partisan bias of the enacted plan. In this plot, for any given plan (both enacted and simulated), I ordered the districts based on the magnitude of their expected Republican vote share. This means that under any given plan, district R1 yields the highest expected vote share while district R15 is expected to give the least support to the Republican candidate (to be clear, the R1 through R15 district identifiers do not correspond to the Congressional district numbers in the enacted plan). If the expected Republican vote share of each ordered district under the enacted plan (red square) diverges from the corresponding distribution of the simulated plans (boxplot), it constitutes evidence of possible partisan bias. Note that in a boxplot, the "box" contains 50% of the data points (those from 25 percentile to 75 percentile to be exact) with the horizontal line indicating the median value whereas the vertical lines coming out of the box, called "whiskers", indicate the range, which contains most data. Any data points that are beyond these whiskers are considered as outliers according to the second part of the definition

discussed in Section IV.C (paragraph 23).

29. The figure shows clear evidence of the enacted plan's partisan bias. This partisan bias, for the reasons discussed below, further shows that the enacted plan unduly favors the Republican Party. For all of my 5,000 simulated plans, districts R10 and R11 (the 10th and 11th most Republican-leaning districts, respectively) lean toward the Democratic party with the expected median Republican vote share equal to 49.0% and 47.3%, respectively. Indeed, for district R11, none of 5,000 simulated plans are expected to yield as many Republican votes as the enacted plan. Yet under the enacted plan, both of these districts have the expected Republican vote shares above 50%. According to the definition discussed in Section IV.C, these two points associated with the enacted plan are clear statistical outliers, with district R10 and R11 5.2 and 5.8 standard deviations away from the median, respectively.

30. I also find that under the enacted plan, districts R12 and R13 lean much less strongly towards the Democratic party than under all of the simulated plans. Lastly, the enacted plan packs Democratic voters in districts R14 and R15, which are two most Democratic-leaning districts. This is indicated by the fact that these districts have much lower levels of expected Republican vote shares under the enacted plan than under the simulated plans. In contrast, the enacted plan avoids packing Republican voters in the five most Republican districts (districts R1 to R5). Indeed, these districts have much lower levels of expected Republican vote shares under the enacted plan than under the simulated plans. Aside from districts R2 and R5, these points are also statistical outliers. Districts R1 to R5 are 6.8, 1.4, 2.4, 3.7 and 2.0 standard deviations away from the median, respectively.

31. I next use the four partisan bias metrics discussed in Section IV.B to examine the enacted plan's compliance with Section 1(C)(3)(a). I adjusted the sign of each metric so that positive values indicate Republican bias, and values nearer to zero indicate less partisan bias. To summarize the results, as shown in Figure 3, when compared to these simulated plans (black histogram), the enacted plan (red vertical line) is a clear outlier favoring the Republican Party. Indeed, the enacted map is more biased than any of 5,000 simulated plans for all four partisan bias

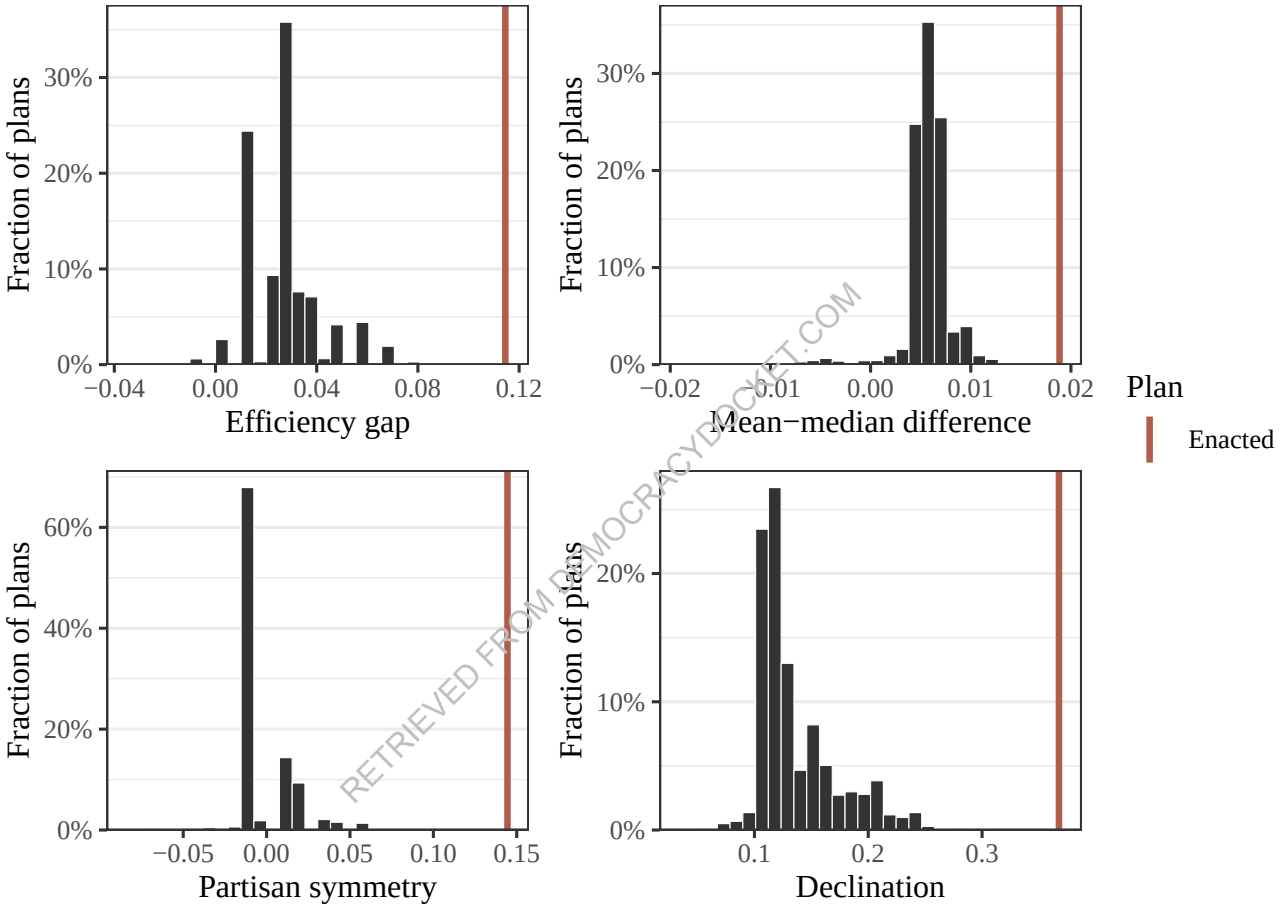

Figure 3: Four partisan bias measures calculated for the 5,000 simulated Congressional redistricting plans computed by averaging across the six federal elections from 2012 to 2020. Overlaid is the value for the enacted plan (red). For each measure, larger values (towards the right) correspond to more Republican-favoring plans.

metrics I considered.

32. The efficiency gap, which captures both cracking and packing, is 15.0% for the enacted map, whereas the average efficiency gap for the simulated plans is only 5.7%. This implies that the enacted plan wastes around 219,000 more Democratic votes on average than the simulated plans, and around 219,000 fewer Republican votes. As shown in the top-left plot of Figure 3, the enacted map is 7.5 standard deviations away from the average simulated plan, and is thus a clear statistical outlier in terms of the efficiency gap metric.

33. The mean-median gap is a measure of asymmetry in the distribution of votes across districts. The existence of packed districts may lead to a large mean-median gap. The top-right plot of the figure shows that the mean-median gap is 0.018 under the enacted plan while the simulated plans score 0.007 on average. Indeed, the enacted plan is 5.7 standard deviations away from the average simulated plan, and is thus a clear statistical outlier in terms of the mean-median gap metric.

34. Partisan symmetry is based on the idea that each party should receive half of the seats if they each receive 50% of votes. The bottom-left plot of Figure 3 shows that the enacted plan scores 14.1% on this metric while the simulated plans score 1.8%, on average. This suggests that under the enacted plan, the Republican Party would gain roughly 2.1 more seats than the Democrats, for a hypothetical tied election. In contrast, the simulated plans would give only 0.3 more seats to the Republican Party than the Democrats in the same situation. The enacted plan is 7.4 standard deviations away from the average simulated plan, and is thus a clear statistical outlier in terms of the partisan symmetry metric.

35. Lastly, the declination metric represents another measure of asymmetry in the vote distribution. As shown in the bottom-right plot of the figure, the enacted plan also scores worse on this metric than any of the 5,000 simulated plans. Specifically, the enacted plan scores 0.42 whereas the simulated plans earn 0.21 on average. The enacted plan is 9.3 standard deviations away from the average simulated plan, and is thus a clear statistical outlier in terms of the declination metric.

36. Thus, all of the partisan bias metrics show that the enacted plan is a clear statistical

outlier, favoring the Republican Party, when compared to the simulated plans. Indeed, the enacted plan has a worse partisan bias than any of my 5,000 simulated plans.

VI. LOCAL ANALYSIS OF SELECTED COUNTIES

37. Partisan bias in the enacted plan is apparent not just in statewide summary statistics, as shown above, but also at the local level. To illustrate this, I performed a detailed analysis of the Congressional districts in Hamilton, Franklin, and Cuyahoga counties. My analysis of these cities shows that the enacted plan packs a disproportionately large number of Democratic voters into some districts while cracking Democratic voters in other districts to create Republican-leaning seats.

38. My analysis of each county proceeds as follows. For each precinct, I first compute the expected two-party vote share of the district to which the precinct is assigned under the enacted plan. I then perform the same calculation under each simulated plan and average these expected vote shares across all of the simulated plans. Comparison of these two numbers reveals whether the enacted plan assigns a precinct to a district whose political leaning is different from what would be expected under the simulated plans. As in Section V, the results shown below are based on the General Assembly's approach that uses the statewide federal elections from 2012-2020.

A. Hamilton County

39. I begin by illustrating the above calculation through an example. Precinct 061031BEZ of Cincinnati lies within District 1 of the enacted map, which has an expected Republican two-party vote share of 51.53%. However, the same precinct belongs to different districts in most of the simulated maps, each with their own Republican vote share. The average Republican vote share for the districts to which this precinct is assigned across all of the simulated plans is 44.85%, which is 6.68 percentage points lower than under the enacted plan. So, based on the representative set of simulated plans that have less partisan bias, precinct 061031BEZ is assigned to a more Republican-leaning district under the enacted plan than under the average simulation plan.

40. The left map of Figure 4 presents the expected vote shares of districts under the

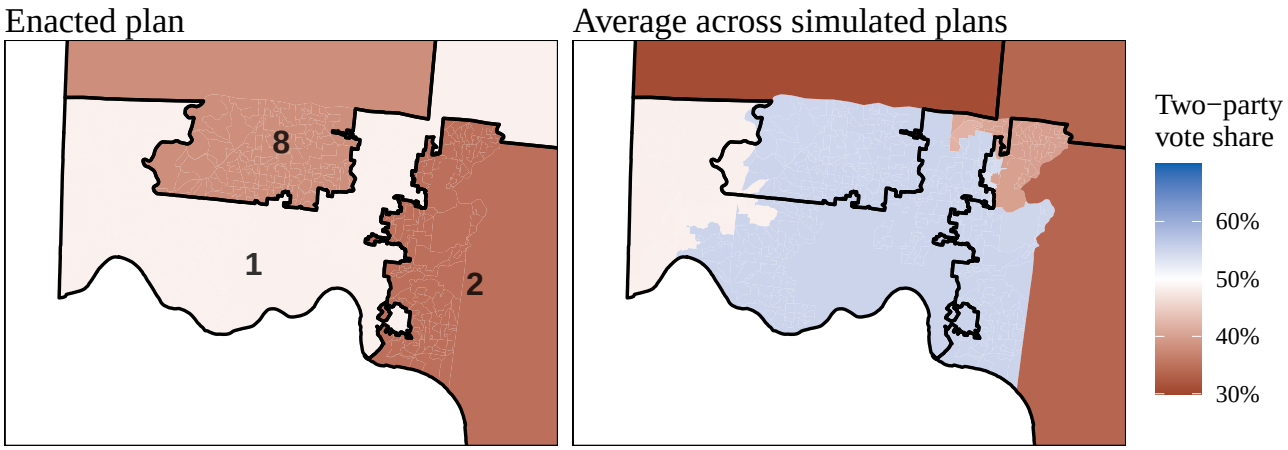

Figure 4: Congressional districts in Hamilton County. The left map presents the expected two-party vote shares of districts under the enacted plan, while the right map shows, for each precinct, the average expected two-party vote share of districts to which the precinct is assigned across the simulated plans. The enacted district boundaries are shown with thick black lines. While under the simulated plans, Cincinnati and its environs are expected to belong to a Democratic-leaning district, the enacted plan cracks Democratic voters, leading to solely Republican districts.

enacted plan, while the right map shows, for each precinct, the average expected two-party vote share of districts to which the precinct is assigned across the simulated plans. Under the enacted plan, Democratic areas are cracked to yield three Republican-leaning districts, despite a significant concentration of Democratic voters in and around Cincinnati. This is especially apparent with the two unusual protrusions of Districts 2 and 8 into Hamilton County, which split the county twice. The simulated plans, in comparison, are expected to only split Hamilton County once. As the right figure indicates, the area covered by these protrusions would normally be expected to belong to a Democratic district, but as a result of being lumped with adjacent districts in the enacted plan, instead belongs to safely Republican districts.

41. As a result of these manipulations and additional splits of Hamilton County, the enacted plan has no Democratic seats under the average statewide federal contest, whereas the simulated plans are expected to yield a Democratic seat. So in Hamilton County alone, cracking of Democratic voters nets Republicans an entire seat.

B. Franklin County

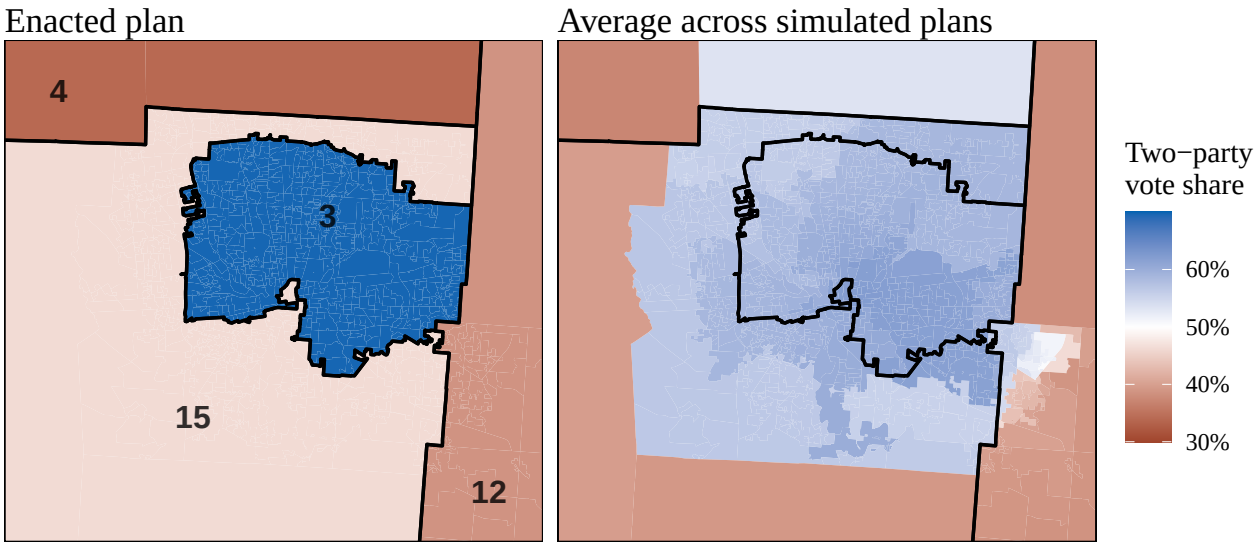

Figure 5: Congressional districts in Franklin County. The left map presents the expected two-party vote shares of districts under the enacted plan, while the right map shows, for each precinct, the average expected two-party vote share of districts to which the precinct is assigned across the simulated plans. The enacted district boundaries are shown with thick black lines. While under the simulated plans, all of Franklin County are expected to belong to a Democratic district, the enacted plan packs Democratic voters, leaving much of the city of Columbus in a Republican district stretching most of the way to Cincinnati.

42. Analogous to Figure 4, Figure 5 compares the enacted plan with the simulated plans in Franklin County. Unlike in Hamilton County, the enacted plan packs Democratic voters into a single, heavily Democratic, District 3, leaving Districts 4, 12, and 15 to be safely Republican. Much of the area inside Franklin County belongs to a safe Republican district under the enacted plan. In contrast, under the simulated plans, the entire area of Franklin County is expected to belong to a Democratic-leaning district, as is Delaware County and part of Fairfield County.

43. By confining Democratic voters to a single district containing part of Columbus, the enacted plan deprives Democratic voters in the rest of the county of a reasonable opportunity to elect a Democratic candidate. In doing so, the enacted plan yields around one additional seat for Republicans, on average, when compared to the simulated plans.

C. Cuyahoga County

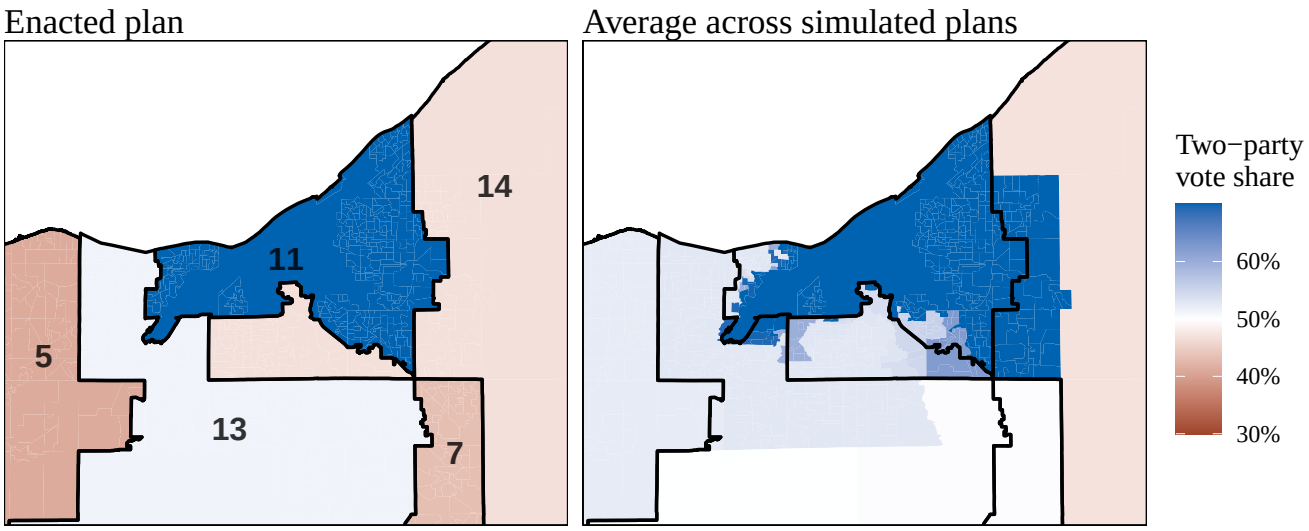

Figure 6: Congressional districts in Cuyahoga County. The left map presents the expected two-party vote shares of districts under the enacted plan, while the right map shows, for each precinct, the average expected two-party vote share of districts to which the precinct is assigned across the simulated plans. The enacted district boundaries are shown with thick black lines. While under the simulated plans, the suburbs of Cleveland are expected to belong to either Democratic districts or highly competitive districts, the enacted plan packs urban Democratic voters, leaving the remainder of Cuyahoga County and nearby areas in Republican districts.

44. Figure 6 is constructed just like Figures 4 and 5. Districts in Cuyahoga County are more constrained than in Franklin County, based on the need to avoid splitting the city of Cleveland, as well as Voting Rights Act considerations. Even so, the enacted plan differs in key ways from the average simulated plan. First, it overly packs Democratic voters in District 11, as indicated by Figure 2 where District 11 corresponds to the least Republican-leaning district (R15). More importantly, Districts 5, 7, 13, and 14 in the enacted plan are drawn to crack the remaining Democratic voters outside of Cleveland and in the cities of Lorain and Akron. The result of this is to create three Republican-leaning districts and only one competitive district. In contrast, under the simulated plans, all of the areas south and west of Cleveland are generally expected to belong to competitive or Democratic-leaning districts.

VII. APPENDIX

A. Introduction to Redistricting Simulation

1. In recent years, redistricting simulation algorithms have played an increasingly important role in court cases involving redistricting plans. Simulation evidence has been presented to courts in many states, including Michigan, North Carolina, Ohio, and Pennsylvania.[5]

2. Over the past several years, researchers have made major scientific advances to improve the theoretical properties and empirical performance of redistricting simulation algorithms. All of the state-of-the-art redistricting simulation algorithms belong to the family of Monte Carlo methods. They are based on random generation of spanning trees, which are mathematical objects in graph theory (DeFord, Duchin, and Solomon 2021). The use of these random spanning trees allows these state-of-the-art algorithms to efficiently sample a representative set of plans (Autry et al. 2020; Carter et al. 2019; McCartan and Imai 2020; Kenny et al. 2021). Algorithms developed earlier, which do not use random spanning trees and instead rely on incremental changes to district boundaries, are often not able to do so.

3. These algorithms are designed to sample plans from a specific probability distribution, which means that every legal redistricting plan has certain odds of being generated. The algorithms put as few restrictions as possible on these odds, except to ensure that, on average, the generated plans meet certain criteria. For example, the probabilities are set so that the generated plans reach a certain level of geographic compactness, on average. Other criteria, based on the state in question, may be fed into the algorithm by the researcher. In other words, this target distribution is based on the weakest assumption about the data under the specified constraints.

4. In addition, the algorithms ensure that all of the sampled plans (a) are geographically contiguous, and (b) have a population which deviates by no more than a specified amount

5. Declaration of Dr. Jonathan C. Mattingly, Common Cause v. Lewis (2019); Testimony of Dr. Jowei Chen, Common Cause v. Lewis (2019); Testimony of Dr. Pegden, Common Cause v. Lewis (2019); Expert Report of Jonathan Mattingly on the North Carolina State Legislature, Rucho v. Common Cause (2019); Expert Report of Jowei Chen, Rucho v. Common Cause (2019); Amicus Brief of Mathematicians, Law Professors, and Students in Support of Appellees and Affirmance, Rucho v. Common Cause (2019); Brief of Amici Curaiae Professors Wesley Pegden, Jonathan Rodden, and Samuel S.-H. Wang in Support of Appellees, Rucho v. Common Cause (2019); Intervenor's Memo, Ohio A. Philip Randolph Inst. et al. v. Larry Householder (2019); Expert Report of Jowei Chen, League of Women Voters of Michigan v. Benson (2019).

from a target population.

5. There are two types of general Monte Carlo algorithms which generate redistricting plans with these guarantees and other properties: sequential Monte Carlo (SMC; Doucet, Freitas, and Gordon 2001) and Markov chain Monte Carlo (MCMC; Gilks, Richardson, and Spiegelhalter 1996) algorithms.

6. The SMC algorithm (McCartan and Imai 2020; Kenny et al. 2021) samples many redistricting plans in parallel, starting from a blank map. First, the algorithm draws a random spanning tree and removes an edge from it, creating a "split" in the map, which forms a new district. This process is repeated until the algorithm generates enough plans with just one district drawn. The algorithm calculates a weight for each plan in a specific way so that the algorithm yields a representative sample from the target probability distribution. Next, the algorithm selects one of the drawn plans at random. Plans with greater weights are more likely to be selected. The algorithm then draws another district using the same splitting procedure and calculates a new weight for each updated plan that comports with the target probability distribution. The whole process of random selection and drawing is repeated again and again, each time drawing one additional district on each plan. Once all districts are drawn, the algorithm yields a sample of maps representative of the target probability distribution.

7. The MCMC algorithms (Autry et al. 2020; Carter et al. 2019) also form districts by drawing a random spanning tree and splitting it. Unlike the SMC algorithm, however, these algorithms do not draw redistricting plans from scratch. Instead, the MCMC algorithms start with an existing plan and modify it, merging a random pair of districts and then splitting them a new way.

8. Diagnostic measures exist for both these algorithms which allow users to make sure the algorithms are functioning correctly and accurately. The original papers for these algorithms referenced above provide more detail on the algorithm specifics, empirical validation of their performance, and the appropriateness of the chosen target distribution.

B. Implementation Details

9. In my analysis, I use the SMC algorithm for several reasons. First, unlike the MCMC algorithms, the SMC algorithm generates nearly independent samples, leading to a diverse set of redistricting plans that satisfy the specified constraints. Second, the SMC algorithm avoids splitting political subdivision boundaries where possible, an important consideration in the case of Ohio. Third, Sections 2(B)(2) and 2(B)(3) require districts to be compact and contiguous, respectively. The SMC algorithm automatically satisfy both of these requirements. Appendix C shows that most of simulated plans generate more compact districts than the enacted plan according to the Polsby-Popper measure, which is a common metric of compactness used in the academic literature.

10. My simulation proceeds in two steps. First, I sample a district in Cuyahoga County using a Voting Rights Act (VRA) constraint to be compliant with Section 2(B)(1). At the instruction of counsel for the relators, I sample one district within Cuyahoga County such that its BVAP proportion falls above 42%. This is done by using the constraint of the form $\sqrt{\max(x_b - B(x_b), 0)}$, where x_b is the share of a district's VAP that is Black, and $B(x_b)$ returns the target BVAP percentages closest to x_b from the set $\{0.02, 0.08, 0.42\}$. This is a common way to formulate the VRA constraint (Herschlag et al. 2020). Note that I also instructed the algorithm to never split the City of Cleveland, in accordance with Section 2(B)(4)(b), and not to split Cuyahoga County three times or more, in accordance with Sections 2(B)(4)(a) and 2(B)(5).

11. Once a district is sampled within Cuyahoga, I generate the remaining 14 districts within the rest of the state without the VRA constraint. In this second step, I incorporate several split constraints. According to Section 2(B)(4)(b), municipalities with population between 100,000 people and the Congressional ratio of represetation, that reside in a county with population greater than the Congressional ratio of representation, should not be split. In addition to the City of Cleveland, this provision also applies to the City of Cincinnati. I instruct the SMC algorithm to never split either of these municipalities.

12. Section 2(B)(5) requires that of Ohio's 88 counties, at least 65 counties should not

be split; no more than 18 counties can be split no more than once; no more than 5 counties can be split no more than twice. I made sure that all of my simulated plans satisfy this requirement by not splitting the counties the enacted plan does not split and imposing a constraint that discourages the algorithm from splitting a county. This is accomplished in two pieces. First, the SMC algorithm, by design, can be instructed to attempt to follow county boundaries where possible by drawing spanning trees within counties and then between them; I use this feature. Additionally, I penalize a district which splits a county twice with a score of 3, and I penalize a district which splits a county three or more times with a score of 100. A penalty of 100 is so severe that any such district is effectively discarded. These parameter values are chosen such that the diversity of the simulated plans is reasonable while minimizing the number of county splits.

13. As shown in Appendix D, all of my simulation plans have fewer county splits than the enacted plan. In addition, while the enacted plan splits Hamilton and Cuyahoga counties twice, only 8 of my 5,000 simulated plans split two counties twice. 35.9% of the simulated plans split only Franklin County twice whereas the remaining simulated plans split no counties twice.

14. Section 2(B)(4)(a) applies to single municipality or township that exceeds the Congressional ratio of representation. The only municipality or township that satisfies this criteria is the City of Columbus. The provision states that the map drawers "shall attempt to include a significant portion of that municipal corporation or township in a single district and may include in that district other municipal corporations or townships that are located in that county and whose residents have similar interests as the residents of the municipal corporation or township that contains a population that exceeds the congressional ratio of representation." To satisfy this requirement, I impose a penalty of 0.5 for each additional district that encompasses any part of the city. This has the effect of ensuring that the city is not split into many different districts. Again, this parameter value is chosen such that the diversity of the simulated plans is reasonable while appropriately discouraging Columbus splits. Like the enacted plan, all of my simulated plans split Columbus into two districts but in different ways.

15. According to Section 2(B)(6), for counties that are split by a congressional district,

the part of the district that falls within county lines must be geographically contiguous within the county. This requirement is mathematically guaranteed by the properties of the SMC algorithm; by drawing spanning trees hierarchically, within and then across counties, it is impossible to split off a district which has two discontiguous pieces inside one county.

16. Section 2(B)(7) requires that two congressional districts can share at most the territory of a single county, excepting counties with population greater than 400,000, where another county can be shared. Like Section 2(B)(6), this requirement is guaranteed by the SMC algorithm: each new district will split at most one county, whereas a 2(B)(7) violation would require two districts to each split the same two counties.

17. Section 2(B)(8) states, "The authority drawing the districts shall attempt to include at least one whole county in each congressional district." This provision does not apply when a district is contained entirely within a county or when in conflict with federal law. This requirement is guaranteed by the enacted plans' choice of counties to split: with the exception of Cuyahoga and Franklin counties, which are each large enough to have a district contained entirely within them, every other split county is surrounded by counties which are not split. Since I do not permit the algorithm to split these surrounding counties, every other district is either contained within a single county or includes the entirety of one of these surrounding counties.

C. Compactness of the Simulated Plans

18. I now show that the simulated plans are more compliant with Section 2(B)(2), which requires districts to be compact, than the enacted plan. I use the Polsby–Popper (Polsby and Popper 1991) and edge-removal (DeFord, Duchin, and Solomon 2021; McCartan and Imai 2020) scores, two commonly-used quantitative measures of district compactness. For the edge-removal compactness, I present the fraction of edge kept so that like the Polsby–Popper score, a greater value implies a higher level of compactness. Figure 7 shows that a vast majority of the simulated plans are more compact than the enacted plan according to the Polsby–Popper score. If I instead use the edge-removal compactness score, all of the simulated plans have superior compactness when compared to the enacted plan. The result clearly implies that it is possible to be compliant

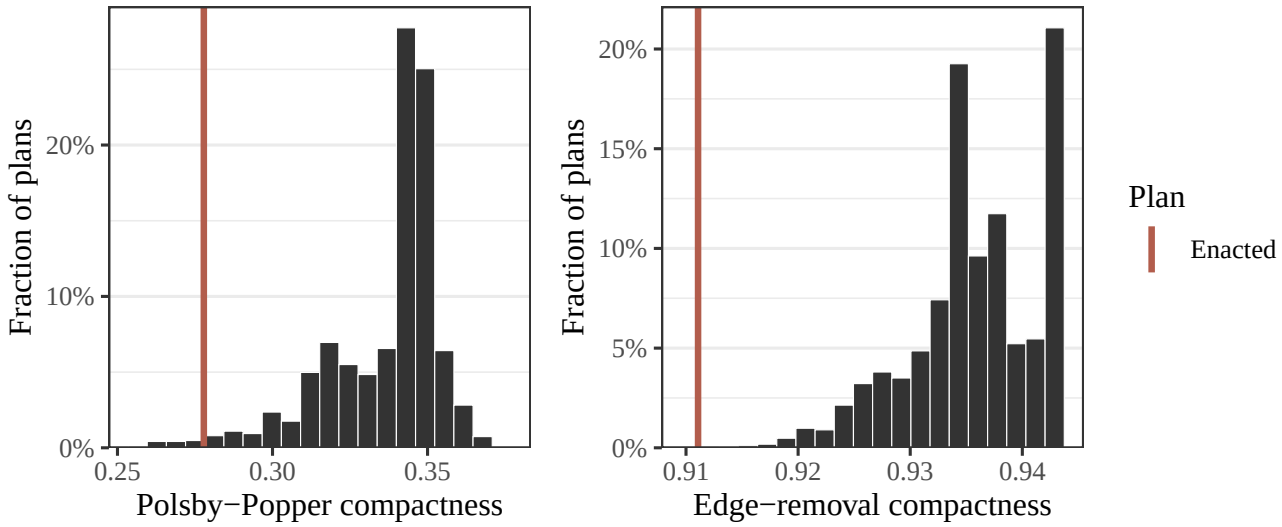

Figure 7: Polsby–Popper and edge–removal compactness scores for the simulated redistricting plans. Overlaid are scores for the enacted plan (red). For both measures, larger values indicate more compact districts.

with Section 1(C)(3)(a) without sacrificing the compliance with Section 2(B)(2).

D. County Splits of the Simulated Plans

19. Similar to compactness, it is possible to be compliant with Section 1(C)(3)(a) without splitting counties more than the enacted plan. The left plot of Figure 8 shows that the number of counties split once is much less under any of the simulated plans than under the enacted plan. The same finding applies to the number of counties that are split twice. As a result, the total number of counties split under the enacted plan is much greater than that under any of the simulated plans.

E. References and Materials Considered

E.1. Data Sources

Data Aquisition

- I analyze a total of 13 statewide elections: US President (2012, 2016, 2020), US Senate (2012, 2016, 2018), Secretary of State (2014, 2018), Governor (2014, 2018), Attorney General (2018), Treasurer (2018), Auditor (2018)

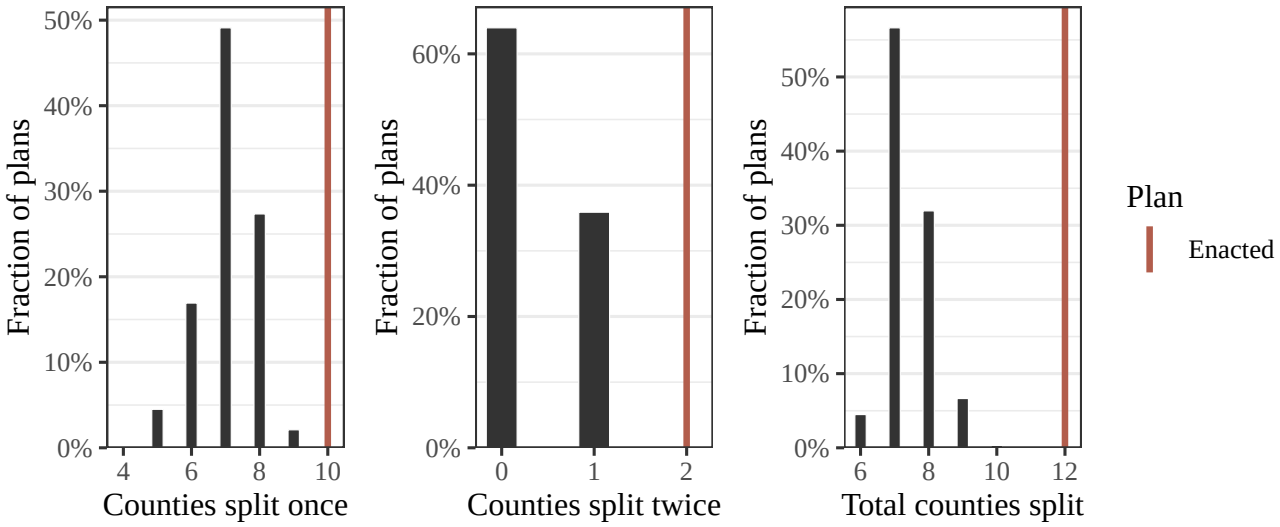

Figure 8: The number of county splits for the simulated redistricting plans. Overlaid are the scores for the enacted plan (red). The left plot shows the number of counties that are split once under each plan, whereas the middle plot presents the number of counties that are split twice under each plan. The right plot shows the number of counties that are split either once or twice. No county is split more than twice under both the enacted plan and any of the simulated plans.

- The six statewide federal elections I use to implement the General Assembly's approach: US President (2012, 2016, 2020), US Senate (2012, 2016, 2018)

- The 2016, 2018, and 2020 precinct-level shapefiles were acquired from the Voting and Election Science Team at the University of Florida and Wichita State University. This data is publicly available on the Harvard Dataverse, an online repository of social science data. Those shapefiles were joined to precinct-level election returns from the Ohio Secretary of State's office, which had been processed and cleaned by OpenElections.

- The 2012 and 2014 election returns pro-rated to the 2010 VTD level were acquired from Bill Cooper. Counsel has informed that Bill Cooper provided the following description of the data: The 2012 results are disaggregated to the block level (based on block centroids) from the statewide 2012 precinct file. The 2014 results are based on a geocoding of about 3.15 million voters who cast ballots in Nov. 2014. These addresses were matched to census blocks and the blocks were aggregated to the precinct level. These virtual precincts were

next matched to the 2014 election results and then disaggregated back to the block level, with block-level matches. When aggregated to the congressional level, the differences are measured in the tenths of a percent for House contests. As a final step, these datasets were aggregated from the block-level to the 2010 VTD level. Finally, it is important to note that there is a 2% to 3% undercount statewide for all votes cast in the 2014 election.

- Given the missing votes for the 2014 contests in Lorain County, the VTD-level totals in that county were approximated using the official precinct 2014 returns. First, after identifying the township, city, or village of each 2014 precinct, the official precinct-level returns were aggregated up to that level. Those municipality-level returns were then disaggregated for each candidate down to the VTDs in each municipality, proportionally to the vote counts for the candidate running for the same office and party in the 2018 midterm cycle.

- The 2020 Census Block shapefiles, total population by race and ethnicity, and voting age population by race and ethnicity were obtained directly from the Census FTP portal.

- The 2020 Census place block assignment files (for city and village boundaries and VTD block assignment files) were obtained from the Census website.

- The 2020 Census county subdivision shapefiles (for Ohio township boundaries) were obtained from the Census website.

- The enacted plan data were gathered from the text of SB258, and cleaned into a block equivalency file.

- Geolocated congressional incumbent names and addresses, which were gathered by Carl Klarner, were acquired through Redistricting Data Hub. For new incumbents who came into office following the 2021 general election (Shontel Brown, Mike Carey), their addresses and geolocated locations were given to me by counsel for the plaintiffs.

Data Processing

- The datasets that were on the 2020 census block level (total population, voting age population, Census place assignment, VTD assignment, enacted plan) were joined to the 2020 Census block shapefile.

- The datasets that were not on the level of the census block (2016, 2018, and 2020 election returns – precinct; 2012 and 2014 election returns – 2010 VTD) were disaggregated down to the 2020 census block level. Then, the resulting data were joined to the 2020 Census block shapefile.

- For the 2020 Census county subdivision shapefile, each 2020 Census block was assigned to its corresponding county subdivision assignment by overlaying the county subdivision shapefile onto the 2020 Census blocks.

- Given that some of Ohio's voting districts are geographically discontiguous, the separate discontiguous pieces of each voting district were identified.

Data Aggregation

- The full block-level dataset was aggregated up to the level of the 2020 voting districts, taking into account (a) discontiguous voting districts and (b) splits of voting districts by the enacted plan.

- The final municipality ID was constructed on the aggregated dataset. Where a VTD belonged to a village or a city, the municipality ID took the value of that village or city. Otherwise, it took the value of the county subdivision of the VTD. Then, discontiguous municipalities or townships were identified, and assigned to unique identifiers. The final municipality ID concatenates the original municipality ID, the identifier for each discontiguous piece, and a county identifier, so that it identifies a unique contiguous piece of a municipality within a given county.

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EXHIBIT A

Curriculum Vitae

Kosuke Imai

Curriculum Vitae

November 2021

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Education

Ph.D. in Political Science, Harvard University (1999–2003)

A.M. in Statistics, Harvard University (2000–2002)

B.A. in Liberal Arts, The University of Tokyo (1994–1998)

Positions

Professor, Department of Government and Department of Statistics, Harvard University (2018 – present)

Professor, Department of Politics and Center for Statistics and Machine Learning, Princeton University (2013 – 2018)

Founding Director, Program in Statistics and Machine Learning (2013 – 2017)

Professor of Visiting Status, Graduate Schools of Law and Politics, The University of Tokyo (2016 – present)

Associate Professor, Department of Politics, Princeton University (2012 – 2013)

Assistant Professor, Department of Politics, Princeton University (2004 – 2012)

Visiting Researcher, Faculty of Economics, The University of Tokyo (August, 2006)

Instructor, Department of Politics, Princeton University (2003 – 2004)

Honors and Awards

1. Invited to read "Experimental Evaluation of Computer-Assisted Human Decision-Making: Application to Pretrial Risk Assessment Instrument." before the Royal Statistical Society Research Section, London (2021).

2. *Excellence in Mentoring Award*, awarded by the Society for Political Methodology (2021).

3. *Statistical Software Award* for developing statistical software that makes a significant research contribution, for "fastLink: Fast Probabilistic Record Linkage," awarded by the Society for Political Methodology (2021).

4. *Highly Cited Researcher* (cross-field category) for "production of multiple highly cited papers that rank in the top 1% by citations for field and year in Web of Science," awarded by Clarivate Analytics (2018, 2019, 2020).

5. *President*, The Society for Political Methodology (2017–2019). *Vice President and President-elect* (2015–2017).

6. *Elected Fellow*, The Society for Political Methodology (2017).

7. *The Nils Petter Gleditsch Article of the Year Award* (2017), awarded by *Journal of Peace Research*.

8. *Statistical Software Award* for developing statistical software that makes a significant research contribution, for "mediation: R Package for Causal Mediation Analysis," awarded by the Society for Political Methodology (2015).

9. *Outstanding Reviewer Award* for Journal of Educational and Behavioral Statistics, given by the American Educational Research Association (2014).

10. *The Stanley Kelley, Jr. Teaching Award*, given by the Department of Politics, Princeton University (2013).

11. *Pi Sigma Alpha Award* for the best paper presented at the 2012 Midwest Political Science Association annual meeting, for "Explaining Support for Combatants during Wartime: A Survey Experiment in Afghanistan," awarded by the Midwest Political Science Association (2013).

12. Invited to read "Experimental Designs for Identifying Causal Mechanisms" before the Royal Statistical Society Research Section, London (2012).

13. Inaugural recipient of the *Emerging Scholar Award* for a young scholar making exceptional contributions to political methodology who is within ten years of their terminal degree, awarded by the Society for Political Methodology (2011).

14. *Political Analysis Editors' Choice Award* for an article providing an especially significant contribution to political methodology, for "Estimation of Heterogeneous Treatment Effects from Randomized Experiments, with Application to the Optimal Planning of the Get-out-the-vote Campaign," awarded by the Society for Political Methodology and Oxford University Press (2011).

15. *Tom Ten Have Memorial Award* for the best poster presented at the 2011 Atlantic Causal Inference Conference, for "Identifying Treatment Effect Heterogeneity through Optimal Classification and Variable Selection," awarded by the Departments of Biostatistics and Statistics, University of Michigan (2011).

16. Nominated for the *Graduate Mentoring Award*, The McGraw Center for Teaching and Learning, Princeton University (2010, 2011).

17. *New Hot Paper*, for the most-cited paper in the field of Economics & Business in the last two months among papers published in the last year, for "Misunderstandings among Experimentalists and Observationalists about Causal Inference," named by Thomson Reuters' ScienceWatch (2009).

18. *Warren Miller Prize* for the best article published in *Political Analysis*, for "Matching as Nonparametric Preprocessing for Reducing Model Dependence in Parametric Causal Inference," awarded by the Society for Political Methodology and Oxford University Press (2008).

19. *Fast Breaking Paper* for the article with the largest percentage increase in citations among those in the top 1% of total citations across the social sciences in the last two years, for "Matching as Nonparametric Preprocessing for Reducing Model Dependence in Parametric Causal Inference," named by Thomson Reuters' ScienceWatch (2008).

20. *Pharmacoepidemiology and Drug Safety Outstanding Reviewer Recognition* (2008).

21. *Miyake Award* for the best political science article published in 2005, for "Do Get-Out-The-Vote Calls Reduce Turnout? The Importance of Statistical Methods for Field Experiments," awarded by the Japanese Political Science Association (2006).

22. *Toppan Prize* for the best dissertation in political science, for *Essays on Political Methodology*, awarded by Harvard University (2004). Also, nominated for American Political Science Association E.E. Schattschneider Award for the best doctoral dissertation in the field of American government and politics.

Publications in English

Book

Imai, Kosuke. (2017). *Quantitative Social Science: An Introduction*. Princeton University Press. Translated into Japanese (2018), Chinese (2020), and Korean (2021).

Stata version (2021) with Lori D. Bougher.

Tidyverse version (forthcoming) with Nora Webb Williams

Refereed Journal Articles

1. Fan, Jianqing, Kosuke Imai, Inbeom Lee, Han Liu, Yang Ning, and Xiaolin Yang. "Optimal Covariate Balancing Conditions in Propensity Score Estimation." *Journal of Business & Economic Statistics*, Forthcoming.

2. Imai, Kosuke, Zhichao Jiang, D. James Greiner, Ryan Halen, and Sooahn Shin. "Experimental Evaluation of Computer-Assisted Human Decision-Making: Application to Pretrial Risk Assessment Instrument." (with discussion) *Journal of the Royal Statistical Society, Series A (Statistics in Society)*, Forthcoming. To be read before the Royal Statistical Society.

3. Imai, Kosuke, In Song Kim, and Erik Wang. "Matching Methods for Causal Inference with Time-Series Cross-Sectional Data." *American Journal of Political Science*, Forthcoming.

4. Imai, Kosuke and Michael Lingzhi Li. "Experimental Evaluation of Individualized Treatment Rules." *Journal of the American Statistical Association*, Forthcoming.

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Invited Contributions

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13. Imai, Kosuke, Gary King, and Clayton Nall. (2009). "Rejoinder: Matched Pairs and the Future of Cluster-Randomized Experiments." *Statistical Science*, Vol. 24, No. 1 (February), pp. 65–72.

14. Imai, Kosuke. (2003). "Review of Jeff Gill's *Bayesian Methods: A Social and Behavioral Sciences Approach*," *The Political Methodologist*, Vol. 11 No. 1, 9–10.

Refereed Conference Proceedings

1. Svyatkovskiy, Alexey, Kosuke Imai, Mary Kroeger, and Yuki Shiraito. (2016). "Large-scale text processing pipeline with Apache Spark," *IEEE International Conference on Big Data*, Washington, DC, pp. 3928-3935.

Other Publications and Manuscripts

1. Goldstein, Daniel, Kosuke Imai, Anja S. Göritz, and Peter M. Gollwitzer. (2008). "Nudging Turnout: Mere Measurement and Implementation Planning of Intentions to Vote."

2. Ho, Daniel E. and Kosuke Imai. (2004). " The Impact of Partisan Electoral Regulation: Ballot Effects from the California Alphabet Lottery, 1978–2002." Princeton Law & Public Affairs Paper No. 04-001; Harvard Public Law Working Paper No. 89.

3. Imai, Kosuke. (2003). "Essays on Political Methodology," *Ph.D. Thesis.* Department of Government, Harvard University.

4. Imai, Kosuke, and Jeremy M. Weinstein. (2000). "Measuring the Economic Impact of Civil War," Working Paper Series No. 51, Center for International Development, Harvard University.

Selected Manuscripts

1. McCartan, Cory, Jacob Brown, and Kosuke Imai. "Measuring and Modeling Neighborhoods."

2. Ben-Michael, Eli, D. James Greiner, Kosuke Imai, and Zhichao Jiang. "Safe Policy Learning through Extrapolation: Application to Pre-trial Risk Assessment."

3. Tarr, Alexander and Kosuke Imai. "Estimating Average Treatment Effects with Support Vector Machines."

4. McCartan, Cory and Kosuke Imai. "Sequential Monte Carlo for Sampling Balanced and Compact Redistricting Plans."

5. Imai, Kosuke and Zhichao Jiang. "Principal Fairness for Human and Algorithmic Decision-Making."

6. Papadogeorgou, Georgia, Kosuke Imai, Jason Lyall, and Fan Li. "Causal Inference with Spatio-temporal Data: Estimating the Effects of Airstrikes on Insurgent Violence in Iraq."

7. Eshima, Shusei, Kosuke Imai, and Tomoya Sasaki. "Keyword Assisted Topic Models."

8. Tarr, Alexander, June Hwang, and Kosuke Imai. "Automated Coding of Political Campaign Advertisement Videos: An Empirical Validation Study."

9. Olivella, Santiago, Tyler Pratt, and Kosuke Imai. "Dynamic Stochastic Blockmodel Regression for Social Networks: Application to International Conflicts."

10. Chan, K.C.G, K. Imai, S.C.P. Yam, Z. Zhang. "Efficient Nonparametric Estimation of Causal Mediation Effects."

11. Barber, Michael and Kosuke Imai. "Estimating Neighborhood Effects on Turnout from Geocoded Voter Registration Records."

12. Hirano, Shigeo, Kosuke Imai, Yuki Shiraito, and Masaki Taniguchi. "Policy Positions in Mixed Member Electoral Systems: Evidence from Japan."

Publications in Japanese

1. Imai, Kosuke. (2007). "Keiryō Seijigaku niokeru Ingateki Suiron (Causal Inference in Quantitative Political Science)." *Leviathan*, Vol. 40, Spring, pp. 224–233.

2. Horiuchi, Yusaku, Kosuke Imai, and Naoko Taniguchi. (2005). "Seisaku Jyōhō to Tōhyō Sanka: Field Jikken ni yoru Kensyō (Policy Information and Voter Participation: A Field Experiment)." *Nenpō Seijigaku (The Annals of the Japanese Political Science Association)*, 2005–I, pp. 161–180.

3. Taniguchi, Naoko, Yusaku Horiuchi, and Kosuke Imai. (2004). "Seitō Saito no Etsuran ha Tohyō Kōdō ni Eikyō Suruka? (Does Visiting Political Party Websites Influence Voting Behavior?)" *Nikkei Research Report*, Vol. IV, pp. 16–19.

Statistical Software

1. Eshima, Shusei, Kosuke Imai, and Tomoya Sasaki. "Keyword Assisted Topic Models." The Comprehensive R Archive Network and GitHub. 2020.

2. Li, Michael Lingzhi and Kosuke Imai. "evalITR: Evaluating Individualized Treatment Rules." available through The Comprehensive R Archive Network and GitHub. 2020.

3. Egami, Naoki, Brandon de la Cuesta, and Kosuke Imai. "factorEx: Design and Analysis for Factorial Experiments." available through The Comprehensive R Archive Network and GitHub. 2019.

4. Kim, In Song, Erik Wang, Adam Rauh, and Kosuke Imai. "PanelMatch: Matching Methods for Causal Inference with Time-Series Cross-Section Data." available through GitHub. 2018.

5. Olivella, Santiago, Adeline Lo, Tyler Pratt, and Kosuke Imai. "NetMix: Mixed-membership Regression Stochastic Blockmodel for Networks." available through CRAN and Github. 2019.

6. Enamorado, Ted, Benjamin Fifield, and Kosuke Imai. "fastLink: Fast Probabilistic Record Linkage." available through The Comprehensive R Archive Network and GitHub. Winner of the Statistical Software Award. 2017.

7. Khanna, Kabir, and Kosuke Imai. "wru: Who Are You? Bayesian Predictions of Racial Category Using Surname and Geolocation." available through The Comprehensive R Archive Network and GitHub. 2015.

8. Fifield, Benjamin, Christopher T. Kenny, Cory McCartan, and Kosuke Imai. "redist: Markov Chain Monte Carlo Methods for Redistricting Simulation." available through The Comprehensive R Archive Network and GitHub. 2015.

9. Imai, Kosuke, James Lo, and Jonathan Olmsted. "emIRT: EM Algorithms for Estimating Item Response Theory Models." available through The Comprehensive R Archive Network. 2015.

10. Blair, Graeme, Yang-Yang Zhou, and Kosuke Imai. "rr: Statistical Methods for the Randomized Response Technique." available through The Comprehensive R Archive Network and GitHub. 2015.

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12. Egami, Naoki, Marc Ratkovic, and Kosuke Imai. "FindIt: R Package for Finding Heterogeneous Treatment Effects." available through The Comprehensive R Archive Network and GitHub. 2012.

13. Kim, In Song, and Kosuke Imai. "wfe: Weighted Linear Fixed Effects Regression Models for Causal Inference." available through The Comprehensive R Archive Network. 2011.

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15. Blair, Graeme, and Kosuke Imai. "list: Statistical Methods for the Item Count Technique and List Experiments." available through The Comprehensive R Archive Network and GitHub. 2011.

16. Tingley, Dustin, Teppei Yamamoto, Kentaro Hirose, Luke Keele, and Kosuke Imai. "mediation: R Package for Causal Mediation Analysis." available through The Comprehensive R Archive Network and GitHub. 2009. Winner of the Statistical Software Award. Reviewed in *Journal of Educational and Behavioral Statistics*.

17. Imai, Kosuke. "experiment: R Package for Designing and Analyzing Randomized Experiments." available through The Comprehensive R Archive Network. 2007.

18. Ho, Daniel E., Kosuke Imai, Gary King, and Elizabeth Stuart. "MatchIt: Nonparametric Preprocessing for Parametric Causal Inference." available through The Comprehensive R Archive Network and GitHub. 2005.

19. Imai, Kosuke, Ying Lu, and Aaron Strauss. "eco: Ecological Inference in 2×2 Tables." available through The Comprehensive R Archive Network and GitHub. 2004.

20. Imai, Kosuke, and David A. van Dyk. "MNP: R Package for Fitting the Multinomial Probit Model." available through The Comprehensive R Archive Network and GitHub. 2004.

21. Imai, Kosuke, Gary King, and Olivia Lau. "Zelig: Everyone's Statistical Software." available through The Comprehensive R Archive Network. 2004.

External Research Grants

Principal Investigator

1. National Science Foundation (2021–2024). "Collaborative Research: Causal Inference with Spatio-Temporal Data on Human Dynamics in Conflict Settings." (Algorithm for Threat Detection Program; DMS-2124463). Principal Investigator (with Georgia Papadogeorgou and Jason Lyall) $485,340.

2. National Science Foundation (2021–2023). "Evaluating the Impacts of Machine Learning Algorithms on Human Decisions." (Methodology, Measurement, and Statistics Program; SES-2051196). Principal Investigator (with D. James Greiner and Zhichao Jiang) $330,000.

3. Cisco Systems, Inc. (2020–2022). "Evaluating the Impacts of Algorithmic Recommendations on the Fairness of Human Decisions." (Ethics in AI; CG# 2370386) Principal Investigator (with D. James Greiner and Zhichao Jiang) $110,085.

4. The Alfred P. Sloan Foundation (2020–2022). "Causal Inference with Complex Treatment Regimes: Design, Identification, Estimation, and Heterogeneity." (Economics Program;

2020–13946) Co-Principal Investigator (with Francesca Dominici and Jose Zubizarreta) $996,299

5. Facebook Research Grant (2018). $25,000.

6. National Science Foundation (2016–2021). "Collaborative Conference Proposal: Support for Conferences and Mentoring of Women and Underrepresented Groups in Political Methodology." (Methodology, Measurement and Statistics and Political Science Programs; SES–1628102) Principal Investigator (with Jeffrey Lewis) $312,322. Supplement (SES–1831370) $60,000.

7. The United States Agency for International Development (2015–2017). "Unemployment and Insurgent Violence in Afghanistan: Evidence from the Community Development Program." (AID–OAA–A–12–00096) Principal Investigator (with Jason Lyall) $188,037

8. The United States Institute of Peace (2015–2016). "Assessing the Links between Economic Interventions and Stability: An impact evaluation of vocational and skills training in Kandahar, Afghanistan," Principal Investigator (with David Haines, Jon Kurtz, and Jason Lyall) $144,494.

9. Amazon Web Services in Education Research Grant (2014). Principal Investigator (with Graeme Blair and Carlos Velasco Rivera) $3,000.

10. Development Bank of Latin America (CAF) (2013). "The Origins of Citizen Support for Narcos: An Empirical Investigation," Principal Investigator (with Graeme Blair, Fabiana Machado, and Carlos Velasco Rivera). $15,000.

11. The International Growth Centre (2011–2013). "Poverty, Militancy, and Citizen Demands in Natural Resource-Rich Regions: Randomized Evaluation of the Oil Profits Dividend Plan for the Niger Delta" (RA–2010–12–013). Principal Investigator (with Graeme Blair). $117,116.

12. National Science Foundation, (2009–2012). "Statistical Analysis of Causal Mechanisms: Identification, Inference, and Sensitivity Analysis," (Methodology, Measurement, and Statistics Program and Political Science Program; SES–0918968). Principal Investigator. $97,574.

13. National Science Foundation, (2009–2011). "Collaborative Research: The Measurement and Identification of Media Priming Effects in Political Science," (Methodology, Measurement, and Statistics Program and Political Science Program; SES–0849715). Principal Investigator (with Nicholas Valentino). $317,126.

14. National Science Foundation, (2008–2009). "New Statistical Methods for Randomized Experiments in Political Science and Public Policy," (Political Science Program; SES–0752050). Principal Investigator. $52,565.

15. National Science Foundation, (2006–2009). "Collaborative Research: Generalized Propensity Score Methods," (Methodology, Measurement and Statistics Program; SES–0550873). Principal Investigator (with Donald B. Rubin and David A. van Dyk). $460,000.

16. The Telecommunications Advancement Foundation, (2004). "Analyzing the Effects of Party Webpages on Political Opinions and Voting Behavior," Principal Investigator (with Naoko Taniguchi and Yusaku Horiuchi). $12,000.

Adviser and Statistical Consultant

1. National Science Foundation (2016–2017). "Doctoral Dissertation Research: Crossing Africa's Arbitrary Borders: How Refugees Shape National Boundaries by Challenging Them." (Political Science Program, SES–1560636). Principal Investigator and Adviser for Co-PI Yang-Yang Zhou's Dissertation Research. $18,900.

2. Institute of Education Sciences (2012–2014). "Academic and Behavioral Consequences of Visible Security Measures in Schools" (R305A120181). Statistical Consultant (Emily Tanner-Smith, Principal Investigator). $351,228.

3. National Science Foundation (2013–2014). "Doctoral Dissertation Research: Open Trade for Sale: Lobbying by Productive Exporting Firm" (Political Science Program, SES–1264090). Principal Investigator and Adviser for Co-PI In Song Kim's Dissertation Research. $22,540.

4. National Science Foundation (2012–2013). "Doctoral Dissertation Research: The Politics of Location in Resource Rent Distribution and the Projection of Power in Africa" (Political Science Program, SES–1260754). Principal Investigator and Adviser for Co-PI Graeme Blair's Dissertation Research. $17,640.

Invited Short Courses and Outreach Lectures

1. Short Course on Causal Inference and Statistics – Department of Political Science, Rice University, 2009; Institute of Political Science, Academia Sinica, 2014.

2. Short Course on Causal Inference and Identification, The Empirical Implications of Theoretical Models (EITM) Summer Institute – Harris School of Public Policy, University of Chicago, 2011; Department of Politics, Princeton University, 2012.

3. Short Course on Causal Mediation Analysis – Summer Graduate Seminar, Institute of Statistical Mathematics, Tokyo Japan, 2010; Society for Research on Educational Effectiveness Conference, Washington DC, Fall 2011, Spring 2012, Spring 2015; Inter-American Development Bank, 2012; Center for Education Research, University of Wisconsin, Madison, 2012; Bobst Center for Peace and Justice, Princeton University, 2014; Graduate School of Education, University of Pennsylvania, 2014; EITM Summer Institute, Duke University, 2014; Center for Lifespan Psychology, Max Planck Institute for Human Development, 2015; School of Communication Research, University of Amsterdam, 2015; Uppsala University, 2016

4. Short Course on Covariate Balancing Propensity Score – Society for Research on Educational Effectiveness Conference, Washington DC, Spring 2013; Uppsala University, 2016

5. Short Course on Matching Methods for Causal Inference – Institute of Behavioral Science, University of Colorado, Boulder, 2009; Department of Political Science, Duke University, 2013.

6. Lecture on Statistics and Social Sciences – New Jersey Japanese School, 2011, 2016; Kaisei Academy, 2012, 2014; Princeton University Wilson College, 2012; University of Tokyo, 2014

Selected Presentations

1. Distinguished speaker, Harvard College Summer Program for Undergraduates in Data Science, 2021.
2. Keynote speaker, Kansas-Western Missouri Chapter of the American Statistical Association, 2021.
3. Invited plenary panelist, Association for Computing Machinery Conference on Fairness, Accountability, and Transparency (ACM FAccT) 2021.
4. Keynote speaker, Taiwan Political Science Association, 2020.
5. Keynote speaker, Boston Japanese Researchers Forum, Massachusetts Institute of Technology, 2020.
6. Keynote speaker, Causal Mediation Analysis Training Workshop, Mailman School of Public Health, Columbia University, 2020.
7. Keynote speaker, Special Workshop on Evidence-based Policy Making. World Economic Forum, Centre for the Fourth Industrial Revolution, Japan, 2020.
8. Distinguished speaker, Institute for Data, Systems, and Society. Massachusetts Institute of Technology, 2019.
9. Keynote speaker, The Harvard Experimental Political Science Graduate Student Conference, Harvard University, 2019.
10. Invited speaker, Beyond Curve Fitting: Causation, Counterfactuals, and Imagination-based AI. Association for the Advancement of Artificial Intelligence, Spring Symposium, Stanford University, 2019.
11. Inaugural speaker, Causal Inference Seminar, Departments of Biostatistics and Statistics, Boston University, 2019.
12. Keynote speaker, The Second Latin American Political Methodology Meeting, Universidad de los Andes (Department of Political Science), 2018.
13. Keynote speaker, The First Latin American Political Methodology Meeting, Pontifical Catholic University of Chile (Department of Political Science), 2017.
14. Keynote speaker, Workshop on Uncovering Causal Mechanisms, University of Munich (Department of Economics), 2016.
15. Keynote speaker, The National Quality Registry Research Conference, Stockholm, 2016.
16. Keynote speaker, The UK-Causal Inference Meeting, University of Bristol (School of Mathematics), 2015.
17. Keynote speaker, The UP-STAT Conference, the Upstate Chapters of the American Statistical Association, 2015.
18. Keynote speaker, The Winter Conference in Statistics, Swedish Statistical Society and Umeå University (Department of Mathematics and Mathematical Statistics), 2015.

19. Inaugural invited speaker, The International Methods Colloquium, Rice University, 2015.
20. Invited speaker, The International Meeting on Experimental and Behavioral Social Sciences, University of Oxford (Nuffield College), 2014.
21. Keynote speaker, The Annual Conference of Australian Society for Quantitative Political Science, University of Sydney, 2013.
22. Keynote speaker, The Graduate Student Conference on Experiments in Interactive Decision Making, Princeton University. 2008.

Conferences Organized

1. The Asian Political Methodology Meetings (January 2014, 2015, 2016, 2017, 2018; co-organizer)
2. The Experimental Research Workshop (September 2012; co-organizer)
3. The 12th World Meeting of the International Society for Bayesian Analysis (June 2012; a member of the organizing committee)
4. Conference on Causal Inference and the Study of Conflict and State Building (May 2012; organizer)
5. The 28th Annual Society for Political Methodology Summer Meeting (July 2011; host)
6. Conference on New Methodologies and their Applications in Comparative Politics and International Relations (February 2011; co-organizer)

Teaching

Courses Taught at Harvard

1. Stat 286/Gov 2003 Causal Inference (formally Stat 186/Gov 2002): introduction to causal inference
2. Gov 2003 Topics in Quantitative Methodology: causal inference, applied Bayesian statistics, machine learning

Courses Taught at Princeton

1. POL 245 Visualizing Data: exploratory data analysis, graphical statistics, data visualization
2. POL 345 Quantitative Analysis and Politics: a first course in quantitative social science
3. POL 451 Statistical Methods in Political Science: basic probability and statistical theory, their applications in the social sciences
4. POL 502 Mathematics for Political Science: real analysis, linear algebra, calculus
5. POL 571 Quantitative Analysis I: probability theory, statistical theory, linear models
6. POL 572 Quantitative Analysis II: intermediate applied statistics

7. POL 573 Quantitative Analysis III: advanced applied statistics
8. POL 574 Quantitative Analysis IV: advanced applied statistics with various topics including Bayesian statistics and causal inference
9. Reading Courses: basic mathematical probability and statistics, applied bayesian statistics, spatial statistics

Advising

Current Students

1. Soubhik Barari (Government)
2. Adam Breuer (Computer Science and Government). To be Assistant Professor, Department of Government and Department of Computer Science, Dartmouth College
3. Jacob Brown (Government)
4. Ambarish Chattopadhyay (Statistics)
5. Shusei Eshima (Government)
6. Georgina Evans (Government)
7. Dae Woong Ham (Statistics)
8. Christopher T. Kenny (Government)
9. Michael Lingzhe Li (MIT, Operations Research Center)
10. Jialu Li (Government)
11. Cory McCartan (Statistics)
12. Sayumi Miyano (Princeton, Politics)
13. Sun Young Park (Government)
14. Casey Petroff (Political Economy and Government)
15. Averell Schmidt (Kennedy School)
16. Sooahn Shin (Government)
17. Tyler Simko (Government)
18. Soichiro Yamauchi (Government)
19. Yi Zhang (Statistics)

Current Postdocs

1. Eli Ben-Michael
2. Evan Rosenman

Former Students

1. Alexander Tarr (Ph.D. in 2021, Department of Electrical and Computer Engineering, Princeton University; Dissertation Committee Chair)

2. Connor Jerzak (Ph.D. in 2021, Department of Government, Harvard University). Postdoctoral Fellow, Linkoping University. To be Assistant Professor, Department of Government, University of Texas, Austin

3. Shiro Kuriwaki (Ph.D. in 2021, Department of Government, Harvard University). Postdoctoral Fellow, Stanford University. To be Assistant Professor, Department of Political Science, Yale University

4. Erik Wang (Ph.D. in 2020, Department of Politics, Princeton University). Assistant Professor, Department of Political and Social Change, Australian National University

5. Diana Stanescu (Ph.D. in 2020, Department of Politics, Princeton University). Postdoctoral Fellow, Stanford University

6. Nicole Pashley (Ph.D. in 2020, Department of Statistics, Harvard University). Assistant Professor, Department of Statistics, Rutgers University

7. Asya Magazinnik (Ph.D. in 2020, Department of Politics, Princeton University). Assistant Professor, Department of Political Science, Massachusetts Institute of Technology

8. Max Goplerud (Ph.D. in 2020, Department of Government, Harvard University). Assistant Professor, Department of Political Science, University of Pittsburgh

9. Naoki Egami (Ph.D. in 2020, Department of Politics, Princeton University; Dissertation Committee Chair). Assistant Professor, Department of Political Science, Columbia University

10. Brandon de la Cuesta (Ph.D. in 2019, Department of Politics, Princeton University). Postdoctoral Fellow, Center on Global Poverty and Development, Stanford University

11. Yang-Yang Zhou (Ph.D. in 2019, Department of Politics, Princeton University). Assistant Professor, Department of Political Science, University of British Columbia

12. Winston Chou (Ph.D. in 2019, Department of Politics, Princeton University). Senior Data Scientist at Apple

13. Ted Enamorado (Ph.D. in 2019, Department of Politics, Princeton University; Dissertation Committee Chair). Assistant Professor, Department of Political Science, Washington University in St. Louis

14. Benjamin Fifield (Ph.D. in 2018, Department of Politics, Princeton University; Dissertation Committee Chair). Data Scientist, American Civil Liberties Union

15. Tyler Pratt. (Ph.D. in 2018, Department of Politics, Princeton University). Assistant Professor, Department of Political Science, Yale University

16. Romain Ferrali (Ph.D. in 2018, Department of Politics, Princeton University). Assistant Professor, Aix-Marseille School of Economics

17. Julia Morse (Ph.D. in 2017, Woodrow Wilson School, Princeton University). Assistant Professor, Department of Political Science, University of California, Santa Barbara

18. Yuki Shiraito (Ph.D. in 2017, Department of Politics, Princeton University; Dissertation Committee Chair). Assistant Professor, Department of Political Science, University of Michigan

19. Carlos Velasco Rivera (Ph.D. in 2016, Department of Politics, Princeton University). Research Scientist, Facebook

20. Gabriel Lopez Moctezuma (Ph.D. in 2016, Department of Politics, Princeton University). Assistant Professor, Division of the Humanities and Social Sciences, California Institute of Technology

21. Graeme Blair (Ph.D. in 2016, Department of Politics, Princeton University). Assistant Professor, University of California, Los Angeles

22. Jaquilyn R. Waddell Boie (Ph.D. in 2015, Department of Politics, Princeton University). Private consultant

23. Scott Abramson (Ph.D. in 2014, Department of Politics, Princeton University). Associate Professor, Department of Political Science, University of Rochester

24. Michael Barber (Ph.D. in 2014, Department of Politics, Princeton University). Associate Professor, Department of Political Science, Brigham Young University

25. In Song Kim (Ph.D. in 2014, Department of Politics, Princeton University). Associate Professor, Department of Political Science, Massachusetts Institute of Technology

26. Alex Ruder (Ph.D. in 2014, Department of Politics, Princeton University). Senior Community Economic Development Advisor, Federal Reserve Bank of Atlanta

27. Meredith Wilf (Ph.D. in 2014, Department of Politics, Princeton University). Senior Director, Capital Rx

28. Will Bullock. (Ph.D. candidate, Department of Politics, Princeton University). Senior Researcher, Facebook

29. Teppei Yamamoto (Ph.D. in 2011, Department of Politics, Princeton University; Dissertation Committee Chair). Associate Professor, Department of Political Science, Massachusetts Institute of Technology

30. Dustin Tingley (Ph.D. in 2010, Department of Politics, Princeton University). Professor, Department of Government, Harvard University

31. Aaron Strauss (Ph.D. in 2009, Department of Politics, Princeton University). Former Executive Director, Analyst Institute

32. Samir Soneji (Ph.D. in 2008, Office of Population Research, Princeton University; Dissertation Committee Chair). Associate Professor, Department of Health Behavior at the Gillings School of Global Public Health, University of North Carolina, Chapel Hill

33. Ying Lu (Ph.D. in 2005, Woodrow Wilson School, Princeton University; Dissertation Committee Chair). Associate Professor, Steinhardt School of Culture, Education, and Human Development, New York University

Former Predocs and Postdocs

1. Zhichao Jiang (Postdoctoral Fellow, 2016–2019). Assistant Professor, Department of Biostatistics and Epidemiology, School of Public Health and Health Sciences, University of Massachusetts, Amherst

2. Adeline Lo (Postdoctoral Fellow, 2016–2019). Assistant Professor, Department of Political Science, University of Wisconsin, Madison

3. Yunkyu Sohn (Postdoctoral Fellow, 2016–2018). Assistant Professor, School of Political Science and Economics, Waseda University

4. Xiaolin Yang (Postdoctoral Fellow, 2015–2017). Research Scientist, Amazon

5. Santiago Olivella (Postdoctoral Fellow, 2015–2016). Associate Professor, Department of Political Science, University of North Carolina

6. Drew Dimmery (Predoctoral Fellow, 2015–2016). Research Scientist, Facebook

7. James Lo (Postdoctoral Fellow, 2014–2016). Assistant Professor, Department of Political Science, University of Southern California

8. Steven Liao (Predoctoral Fellow, 2014–2015). Assistant Professor, Department of Political Science, University of California, Riverside

9. Michael Higgins (Postdoctoral Fellow, 2013–2015). Associate Professor, Department of Statistics, Kansas State University

10. Kentaro Hirose (Postdoctoral Fellow, 2012–2015). Assistant Professor, Waseda Institute for Advanced Studies

11. Chad Hazlett (Predoctoral Fellow, 2013–2014). Associate Professor, Departments of Political Science and Statistics, University of California, Los Angeles

12. Florian Hollenbach (Predoctoral Fellow, 2013–2014). Associate Professor, Department of International Economics, Government and Business at the Copenhagen Business School

13. Marc Ratkovic (Predoctoral and Postdoctoral Fellow, 2010–2012). Assistant Professor, Department of Politics, Princeton University

Editorial and Referee Service

Co-editor for *Journal of Causal Inference* (2014 – present)

Associate editor for *American Journal of Political Science* (2014 – 2019), *Journal of Business & Economic Statistics* (2015 – 2024), *Journal of Causal Inference* (2011 – 2014), *Journal of Experimental Political Science* (2013 – 2017), *Observational Studies* (2014 – present), *Political Analysis* (2014 – 2017).

Editorial board member for *Asian Journal of Comparative Politics* (2014 – present), *Journal of Educational and Behavioral Statistics* (2011 – present), *Journal of Politics* (2007 – 2008, 2019–2020), *Journal of Research on Educational Effectiveness* (2014 – 2016), *Political Analysis* (2010 – 2013), *Political Science Research and Methods* (2019 – present).

Guest editor for *Political Analysis* virtual issue on causal inference (2011).

Referee for *ACM Computing Surveys*, *American Economic Journal: Applied Economics*, *American Economic Review: Insights*, *American Journal of Epidemiology*, *American Journal of Evaluation*, *American Journal of Political Science*, *American Political Science Review*, *American Politics Research*, *American Sociological Review*, *Annals of Applied Statistics*, *Annals of Statistics*, *Annals of the Institute of Statistical Mathematics*, *Biometrics*, *Biometrika*, *Biostatistics*, *BMC Medical Research Methodology*, *British Journal of Mathematical and Statistical Psychology*, *British Journal of Political Science*, *Canadian Journal of Statistics*, *Chapman & Hall/CRC Press*, *Child Development*, *Communications for Statistical Applications and Methods*, *Computational Statistics and Data Analysis*, *Electoral Studies*, *Econometrica*, *Econometrics*, *Empirical Economics*, *Environmental Management*, *Epidemiology*, *European Union Politics*, *IEEE Transactions on Information Theory*, *International Journal of Biostatistics*, *International Journal of Epidemiology*, *International Journal of Public Opinion Research*, *International Migration Review*, John Wiley & Sons, *Journal of Applied Econometrics*, *Journal of Applied Statistics*, *Journal of Biopharmaceutical Statistics*, *Journal of Business and Economic Statistics*, *Journal of Causal Inference*, *Journal of Computational and Graphical Statistics*, *Journal of Conflict Resolution*, *Journal of Consulting and Clinical Psychology*, *Journal of Econometrics*, *Journal of Educational and Behavioral Statistics*, *Journal of Empirical Legal Studies*, *Journal of Multivariate Analysis*, *Journal of Official Statistics*, *Journal of Peace Research*, *Journal of Politics*, *Journal of Research on Educational Effectiveness*,*Journal of Statistical Planning and Inference*, *Journal of Statistical Software*, *Journal of Survey Statistics and Methodology*, *Journal of the American Statistical Association (Case Studies and Applications; Theory and Methods)*, *Journal of the Japanese and International Economies*, *Journal of the Japan Statistical Society*, *Journal of the Royal Statistical Society (Series A; Series B; Series C)*, *Law & Social Inquiry*, *Legislative Studies Quarterly*, *Management Science*, Multivariate Behavioral Research, National Science Foundation (Economics; Methodology, Measurement, and Statistics; Political Science), Natural Sciences and Engineering Research Council of Canada, *Nature Machine Intelligence*, *NeuroImage*, *Osteoporosis International*, *Oxford Bulletin of Economics and Statistics*, *Pharmaceutical Statistics*, *Pharmacoepidemiology and Drug Safety*, *PLOS One*, *Policy and Internet*, *Political Analysis*, *Political Behavior*, *Political Communication*, *Political Research Quarterly*, *Political Science Research and Methods*, *Population Health Metrics*, *Population Studies*, *Prevention Science*, *Proceedings of the National Academy of Sciences*, Princeton University Press, *Psychological Methods*, *Psychometrika*, *Public Opinion Quarterly*, *Quarterly Journal of Economics*, *Quarterly Journal of Political Science*, *Review of Economics and Statistics*, Routledge, Sage Publications, *Scandinavian Journal of Statistics*, *Science*, Sloan Foundation, Springer, *Sociological Methodology*, *Sociological Methods & Research*, *Statistical Methodology*, *Statistical Methods and Applications*, *Statistical Methods in Medical Research*, *Statistical Science*, *Statistica Sinica*, *Statistics & Probability Letters*, *Statistics in Medicine*, *Systems Biology*, U.S.-Israel Binational Science Foundation, *Value in Health*, *World Politics*.

University and Departmental Committees

Harvard University

Department of Government

Member, Curriculum and Educational Policy Committee (2020–2021)

Member, Second-year Progress Committee (2019–2020)

Member, Graduate Placement Committee (2019–2020)

Member, Graduate Admissions Committee (2018–2019)

Member, Graduate Poster Session Committee (2018–2019)

Department of Statistics

Chair, Senior Faculty Search Committee (2021–2022)

Member, Junior Faculty Search Committee (2018–2019)

Member, Second-year Progress Committee (2018–2019, 2020–2021)

Princeton University

University

Executive Committee Member, Program in Statistics and Machine Learning (2013–2018)

Executive Committee Member, Committee for Statistical Studies (2011-2018)

Member, Organizing Committee, Retreat on Data and Information Science at Princeton (2016)

Member, Council of the Princeton University Community (2015)

Member, Search Committee for the Dean of College (2015)

Member, Committee on the Library and Computing (2013–2016)

Member, Committee on the Fund for Experimental Social Science (2013–2018)

Member, Personally Identifiable Research Data Group (2012–2018)

Member, Research Computing Advisory Group (2013–2018)

Member, Task Force on Statistics and Machine Learning (2014–2015)

Department of Politics

Chair, Department Committee on Research and Computing (2012–2018)

Chair, Formal and Quantitative Methods Junior Search Committee (2012–2013, 2014–2015, 2016–2017)

Chair, Reappointment Committee (2015–2016)

Member, Diversity Initiative Committee (2014–2015)

Member, American Politics Junior Search Committee (2012–2014)

Member, Department Chair's Advisory Committee (2010–2013, 2015–2016)

Member, Department Priority Committee (2012–2013, 2014–2015, 2016–2017)

Member, Formal and Quantitative Methods Curriculum Committee (2005–2006)

Member, Formal and Quantitative Methods Junior Search Committee (2009–2010, 2015–2016)

Member, Formal and Quantitative Methods Postdoc Search Committee (2009–2018)

Member, Graduate Admissions Committee (2012–2013)

Member, Reappointment Committee (2014–2016)

Member, Space Committee (2014–2016)

Member, Undergraduate Curriculum Committee (2014–2015)

Member, Undergraduate Exam Committee (2007–2008)

Member, Undergraduate Thesis Prize Committee (2005–2006, 2008–2011)

Center for Statistics and Machine Learning

Executive Committee Member (2016–2018)

Member, Search Committee (2015–2017)

Services to the Profession

National Academies of Sciences, Engineering, and Medicine

Committee on National Statistics, Division of Behavioral and Social Sciences and Education, Panel on the Review and Evaluation of the 2014 Survey of Income and Program Participation Content and Design (2014–2017)

National Science Foundation

Proposal Review Panel (2020)

The Society for Political Methodology

President (2017–2019)

Vice President and President Elect (2015–2017)

Annual Meeting Committee, Chair (2011)

Career Award Committee (2015–2017)

Program Committee for Annual Meeting (2012), Chair (2011)

Graduate Student Selection Committee for the Annual Meeting (2005), Chair (2011)

Miller Prize Selection Committee (2010–2011)

Statistical Software Award Committee (2009–2010)

Emerging Scholar Award Committee (2013)

American Statistical Association

Journal of Educational and Behavioral Statistics Management Committee (2016 – present)

Others

External Expert, Department of Methodology, London School of Economics and Political Science (2017)

Memberships

American Political Science Association; American Statistical Association; Midwest Political Science Association; The Society for Political Methodology.

IN THE SUPREME COURT OF OHIO

LEAGUE OF WOMEN VOTERS OF OHIO, et al.,	
Relators	**Case No.**
v.	**Original Action Pursuant to Ohio Const., Art. XIX**
GOVERNOR MIKE DEWINE, et al.,	
Respondents.	

AFFIDAVIT OF CHRISTOPHER WARSHAW

Franklin County
/ss
State of Ohio

Now comes affiant Christopher Warshaw, having been first duly cautioned and sworn, deposes and states as follows:

1. I am over the age of 18 and fully competent to make this declaration. I have personal knowledge of the statements and facts contained herein.
2. For the purposes of this litigation, I have been asked by counsel for Relators to analyze relevant data and provide my expert opinions.
3. To that end, I have personally prepared the report attached to this affidavit as Exhibit A, and swear to its authenticity and to the faithfulness of the opinions expressed and, to the best of my knowledge, the accuracy of the factual statements made therein.

FURTHER AFFIANT SAYETH NAUGHT.

Executed on 11/30/2021, 2021.

Christopher Warshaw
Signed on 2021/11/30 08:13:08 -8:00

Christopher Warshaw

Sworn and subscribed before me this 11/30/2021 day of _____, 2021.

Theresa M Sabo
Signed on 2021/11/30 08:13:08 -8:00

Notary Public

Theresa M Sabo
Commission # 2016-RE-619622
Electronic Notary Public
State of Ohio
My Comm Exp. Nov 28, 2026

Notary Stamp 2021/11/30 09:13:08 PST 0C271766C922

Notarial act performed by audio-visual communication

RPTS_0010

EXHIBIT A

An Evaluation of the Partisan Bias in Ohio's Enacted Congressional Districting Plan

Christopher Warshaw*

November 30, 2021

*Associate Professor, Department of Political Science, George Washington University. warshaw@gwu.edu. Note that the analyses and views in this report are my own, and do not represent the views of George Washington University.

Contents

1 Introduction

My name is Christopher Warshaw. I am an Associate Professor of Political Science at George Washington University. Previously, I was an Associate Professor at the Massachusetts Institute of Technology from July 2016 - July 2017, and an Assistant Professor at MIT from July 2012 - July 2016.

I have been asked by counsel representing the relators in this case to analyze relevant data and provide my expert opinions about whether Ohio's enacted congressional districting plan meets the requirement in Article XIX.01, Section 3(A) of Ohio's Constitution that "If the general assembly passes a congressional district plan under division (C)(1) of this section by a simple majority of the members of each house of the general assembly, and not by the vote described in division (C)(2) of this section", then "The general assembly shall not pass a plan that unduly favors or disfavors a political party or its incumbents."

2 Qualifications, Publications and Compensation

My Ph.D. is in Political Science, from Stanford University, where my graduate training included courses in political science and statistics. I also have a J.D. from Stanford Law School. My academic research focuses on public opinion, representation, elections, and polarization in American Politics. I have written over 20 peer reviewed papers on these topics. Moreover, I have written multiple papers that focus on elections and two articles that focus specifically on partisan gerrymandering. I also have a forthcoming book that includes an extensive analysis on the causes and consequences of partisan gerrymandering in state governments.

My curriculum vitae is attached to this report. All publications that I have authored and published appear in my curriculum vitae. My work is published or forthcoming in peer-reviewed journals such as: the *American Political Science Review*, the *American Journal of Political Science*, the *Journal of Politics*, *Political Analysis*, *Political Science Research and Methods*, the *British Journal of Political Science*, the *Annual Review of Political Science*, *Political Behavior*, *Legislative Studies Quarterly*, *Science Advances*, the *Election Law Journal*, *Nature Energy*, *Public Choice*, and edited volumes from Cambridge University Press and Oxford University Press. My book entitled *Dynamic Democracy in the American States* is forthcoming from the University of Chicago Press. My non-academic writing has been published in the *New York Times* and the *Washington Post*. My work has also been discussed in the *Economist* and many other prominent media

outlets.

My opinions in this case are based on the knowledge I have amassed over my education, training and experience, including a detailed review of the relevant academic literature. They also follow from statistical analysis of the following data:

- In order to calculate partisan bias in congressional elections on the enacted plan in Ohio, I examined:
  - GIS Files with the 2012-2020 Ohio Congressional plan and the enacted 2022-24 plan): I obtained the 2012-2020 plan from the state website and the enacted plan from Counsel in this case.
  - Precinct-level data on recent statewide Ohio elections: I use precinct-level data on Ohio's statewide elections between 2016-20 from the Voting and Election Science Team (University of Florida, Wichita State University). I obtained these data from the Harvard Dataverse.[1] As far as I know, there are no publicly available datasets with precinct-level returns from 2012-14 that are linked to precinct boundaries (e.g., shapefiles). For these elections, I obtained data via the ACLU that Bill Cooper, the relators' expert in League of Women Voters v. Ohio Redistricting Commission, No. 2021-1193, put together.[2]
  - Precinct-level data on recent statewide Ohio elections: I use a GIS file with precinct-level data on the results of the 2020 congressional elections in Ohio that I obtained from Counsel in this case.
  - The Plan Score website: PlanScore is a project of the nonpartisan Campaign Legal Center (CLC) that enables people to score proposed maps for their partisan, demographic, racial, and geometric features. I am on the social science advisory team for PlanScore.

1. See `https://dataverse.harvard.edu/dataverse/electionscience`.

2. Cooper provided the following description of the data via Counsel: The 2012 results are disaggregated to the block level (based on block centroids) from the statewide 2012 precinct file. The 2014 results are based on a geocoding of about 3.15 million voters who cast ballots in Nov. 2014. These addresses were matched to census blocks and the blocks were aggregated to the precinct level. These "virtual" precincts were next matched to the 2014 election results and then disaggregated back to the block level, with block-level matches. When aggregated to the congressional level, the differences are measured in the tenths of a percent for House contests. As a final step, these datasets were aggregated from the block-level to the 2010 VTD level. Finally, it is important to note that there is a 2% to 3% undercount statewide for all votes cast in the 2014 election. Given the missing votes for the 2014 contests in Lorain County, the VTD-level totals in that county were approximated using the official precinct 2014 returns. First, after identifying the township, city, or village of each 2014 precinct, the official precinct-level returns were aggregated up to that level. Those municipality-level returns were then disaggregated for each candidate down to the VTDs in each municipality, proportionally to the vote counts for the candidate running for the same office and party in the 2018 midterm cycle.

- In order to compare the maps in Ohio to other congressional elections across the nation over the past five decades, I examined:
  - A large data set on candidacies and results in Congressional elections: I obtained results from 1972-2018 collected by the Constituency-Level Elections Archive (CLEA) (Kollman et al. 2017). The results from 1972-1990 are based on data collected and maintained by the Inter-university Consortium for Political and Social Research (ICPSR) and adjusted by CLEA. The data from 1992-2018 are based on data collected by CLEA from the Office of the Clerk at the House of the Representatives. I supplemented this dataset with recent election results collected by the MIT Election and Data Science Lab (MIT Election and Data Science Lab 2017) and Dave Leip's Atlas of U.S. Presidential Elections.
  - Data on presidential election returns and incumbency status in Congressional elections. I used data on elections in congressional districts from 1972-2020 collected by Professor Gary Jacobson (University of California, San Diego). This dataset has been used in many Political Science studies and has canonical status in the political science profession (Jacobson 2015).
  - Information on who controlled each redistricting plan in Congressional elections (e.g., Democrats, Republicans, or a Commission) from 1972-2012 assembled by the Brennan Center (Brennan Center 2017).
  - I imputed vote shares and turnout in uncontested districts and then calculated the partisan bias metrics described on pp. 6-14 of this report using the methodology described in Stephanopoulos and Warshaw (2020).

I have previously provided expert reports in five redistricting-related cases:

- Between 2017 and 2019, I provided reports for *League of Women Voters of Pennsylvania v. Commonwealth of Pennsylvania*, No. 159 MM 2017, *League of Women Voters of Michigan* v. *Johnson*, 17-14148 (E.D. Mich), and *APRI et al.* v. *Smith et al.*, No. 18-cv-357 (S.D. Ohio). My testimony was found to be credible in each of these cases and was extensively cited by the judges in their decisions.

- In the current redistricting cycle, I have provided reports in *League of Women Voters* v. *Ohio Redistricting Commission*, No. 2021-1193 and *League of Women Voters* vs. *Kent County Apportionment Commission*.

In addition, I have provided expert testimony and reports in several cases related to the U.S. Census: *State of New York et al.* v. *United States Department of Commerce*, 18-cv-2921 (S.D.N.Y.), *New York* v. *Trump*; *Common Cause* v. *Trump*, 20-cv-2023 (D.D.C.), and *La Union Del Pueblo Entero (LUPE)* v. *Trump*, 19-2710 (D. Md.).

I am being compensated at a rate of $325 per hour. The opinions in this report are my own, and do not represent the views of George Washington University.

3 Summary

Ohio's Congressional redistricting plan was proposed by Republican leaders and passed on party lines, with nearly all Republicans voting in favor and all Democrats opposed.[3] This report examines whether this plan meets the criteria in the Ohio Constitution. Article XIX.01, Section 3(A) of Ohio's Constitution requires that "If the general assembly passes a congressional district plan under division (C)(1) of this section by a simple majority of the members of each house of the general assembly, and not by the vote described in division (C)(2) of this section", then "The general assembly shall not pass a plan that unduly favors or disfavors a political party or its incumbents."

Ohio's Constitutional criteria, which require that congressional districting plans not unduly favor or disfavor a political party, are related to a long-line of Political Science literature on partisan gerrymandering and democratic representation. The relationship between the distribution of partisan support in the electorate and the partisan composition of the government—what Powell (2004) calls "vote–seat representation"—is a critical link in the longer representational chain between citizens' preferences and governments' policies. If the relationship between votes and seats systematically advantages one party over another, then some citizens will enjoy more influence—more "voice"—over elections and political outcomes than others (Caughey, Tausanovitch, and Warshaw 2017).

I use three complementary methodologies to project future election results in order to evaluate whether Ohio's newly enacted Congressional map meets the requirements of Article XIX.01, Section 3(A) in its Constitution. First, I analyze the results of the 2020 Congressional election on the newly enacted map. Second, I use a composite of previous statewide election results between 2012-2020 to analyze the new map.[4] Third, I

3. See Jeremy Pelzer, Cleveland Plain Dealer, November 18, 2021, https://www.cleveland.com/news/2021/11/ohio-legislature-passes-congressional-redistricting-plan-giving-republicans-a-likely-13-2-advantage.html.

4. These include the following elections: 2012 Presidential, 2012 Senate, 2014 gubernatorial, 2014 Secretary of State, 2016 Presidential, 2016 Senate, 2018 Senate, 2018 gubernatorial, 2018 attorney's general, 2018 Secretary of State, 2018 Auditor, 2018 Treasurer, and 2020 Presidential. Geographic data on the other three statewide elections in 2014 is not available. But this probably doesn't affect my results

complement this approach using the open source PlanScore.org website, which is a project of the Campaign Legal Center.[5] PlanScore uses a statistical model to estimate district-level vote shares for a new map based on the relationship between presidential election results and legislative results between 2012-2020.[6] Based on these three approaches, I characterize the bias in Ohio's plans based on a large set of established metrics of partisan fairness. I also place the bias in Ohio's plans into historical perspective. I also analyze whether the map unduly favors incumbents from one party.

All of these analyses indicate an extreme level of pro-Republican bias in Ohio's enacted Congressional plan. There are 10 strongly Republican districts, 2 strongly Democratic districts, and 3 potentially competitive districts, each of which leans toward Republicans. In the average election, Republicans are likely to get about 55% of the statewide vote and about 80% of the seats in Ohio's congressional delegation. Thus, the plan clearly unduly favors the Republican party.

In the actual 2020 congressional election, Democrats received 43% of the two-party vote (and Republicans 57%), but Democrats only won 25% (4) of the seats (and Republicans won 75%). This was already one of the most extreme partisan gerrymanders of a congressional map in modern history (See *APRI et al.* v. *Smith et al.*, No. 18-cv-357 (S.D. Ohio)). Based on the congressional election results, the new plan is even more extreme than the last one. On the new map, Democrats would only win 13% (2) of the seats using the precinct-level results of the 2020 congressional election.

The new plan also displays an extreme level of partisan bias when I evaluate it based on the results of recent statewide elections. In the 2020 presidential election, Democrat Joe Biden received about 46% of the two-party vote.[7] However, he would have only won 27% (4) of the Congressional districts. In the 2018 gubernatorial election, Democrat Richard Cordray did a little bit better. He received about 48% of the two-party vote. Yet again, however, he would have only won 27% of the districts under the enacted plan. In the 2016 presidential election, Democrat Hillary Clinton received about 46% of the two-party vote. But she would have only won 13% of the seats. In the 2012 presidential election, Democratic President Barack Obama received about 52% of the two-party vote. But he would have still won only 40% of the seats.

Based on all the available statewide elections in Ohio between 2012-2020, I find that

much since these elections were similar to the average of the 2014 gubernatorial and Secretary of State elections.

5. I am on the social science advisory board of Plan Score, but do not have any role in PlanScore's evaluation of individual maps.

6. See `https://planscore.campaignlegal.org/models/data/2021C/` for more details.

7. Following standard convention, throughout my analysis I focus on two-party vote shares.

the enacted Congressional plan leads to a much higher Republican share of the seats than their share of the statewide vote. Indeed, across all statewide elections during this period, the Democrats' statewide two-party vote share averaged about 45% of the vote, but they are only likely to win about 26% of the seats.[8]

I reach the same conclusion using the predictive model on the PlanScore website. It indicates that the enacted plan favors Republican candidates in 97% of scenarios. Even though Republicans only get about 56% of the statewide vote in recent elections (and Democrats get 44%), PlanScore analysis indicates that Republicans are expected to win 79% of the seats in Ohio's Congressional delegation (and Democrats would win 21% of the seats).[9] Based on generally accepted Political Science metrics (the Efficiency Gap and the Declination), PlanScore indicates that Ohio's enacted plan would have historically extreme levels of pro-Republican bias. In fact, the pro-Republican bias in Ohio's Congressional plan is larger than 98% of previous plans in the United States from 1972-2020.

Overall, this analysis indicates that the enacted plan unduly favors the Republican party. This conclusion is based on a wide variety of approaches to project future election results and to estimate the partisan bias of the plan. Regardless of the approach I use, it is clear that the enacted map has an extreme level of bias in favor of the Republican party.

The enacted plan also favors incumbents from the Republican Party. It puts two of the four Democratic incumbents from the previous plan into largely new districts that will now have a majority of Republican voters. It does not put any Republican incumbent into a district with a majority of Democratic voters. This bias against Democratic incumbents is especially clear in the case of Representative Marcy Kaptur. In 2020, she comfortably won reelection with 63% of the two-party vote. The new plan slices her old district into five districts. On the new map, she would have only won about 46% in the 2020 House election, and thus would likely lose in 2022.

4 Background on Partisan Gerrymandering

The goal of partisan gerrymandering is to create legislative districts that are as "efficient" as possible in translating a party's vote share into seat share (McGhee 2014, 2017; Caughey, Tausanovitch, and Warshaw 2017). In practice, this entails drawing districts in which the supporters of the advantaged party constitute either a slim majority (e.g., 55%

8. I weight the composite scores to give each election cycle equal weight in the index. The seat-level projections are based on the 13 statewide elections where I have precinct-level data.

9. This is a probabilistic estimate based on 1000 simulations of possible elections using a model of the elections between 2012-2020.

of the two-party vote) or a small minority (e.g., 20%). The former is achieved by "cracking" local opposing-party majorities across multiple districts and the latter by "packing" them into a few overwhelming strongholds. In a "cracked" district, the disadvantaged party narrowly loses, while in a "packed" district, the disadvantaged party wins overwhelmingly (Buzas and Warrington 2021). The resulting *asymmetry* or *advantage* in the efficiency of the vote–seat relationships of the two parties lies at the core of normative critiques of partisan gerrymandering. Asymmetries in the translation of votes to seats "offer a party a means of increasing its margin of control over policy without winning more votes from the public" (McGhee 2014).

In addition to creating a plan that skews the vote-seat curve toward their party, the advantaged party also often seeks to build a map that is *insulated* against changes in the public's preferences. This type of unresponsive map enables the advantaged party to continue to win the majority of seats even in the face of large gains in the disadvantaged party's statewide vote share. It ensures that the gerrymander is durable over multiple election cycles.

There are a number of approaches that have been proposed to measure partisan advantage in a districting plan. These approaches focus on asymmetries in the efficiency of the vote–seat relationships of the two parties. In recent years, at least 10 different approaches have been proposed (McGhee 2017). While no measure is perfect, much of the recent literature has focused on a handful of related approaches that I describe below.

4.1 Efficiency Gap

Both cracked and packed districts "waste" more votes of the disadvantaged party than of the advantaged one (McGhee 2014; Stephanopoulos and McGhee 2015).[10] This suggests that gerrymandering can be measured based on asymmetries in the number of wasted votes for each party. The *efficiency gap* (EG) focuses squarely on the number of each party's wasted votes in each election. It is defined as "the difference between the parties' respective wasted votes, divided by the total number of votes cast in the election" (Stephanopoulos and McGhee 2015, 831; see also McGhee 2014, 2017).[11] All of the losing

10. The authors of the efficiency gap use the term "waste" or "wasted" to describe votes for the losing party and votes for the winning party in excess of what is needed to win an election. Since the term is used by the efficiency gap authors, I use it here when discussing the efficiency gap.

11. The efficiency gap calculations here focus on wasted votes in *congressional elections* since these results directly capture voters' preferences in these elections. However, we might also calculate the efficiency gap using district-level results from presidential elections or other statewide races. These have the "advantage of being (mostly) unaffected by district-level candidate characteristics" (Stephanopoulos and McGhee 2015, 868). This feature is particularly useful for simulating efficiency gaps from randomly generated districting plans since candidate characteristics are clearly influenced by the final districting

party's votes are wasted if they lose the election. When a party wins an election, the wasted votes are those above the 50%+1 needed to win.

If we adopt the convention that positive values of the efficiency gap imply a Democratic advantage in the districting process and negative ones imply a Republican advantage, the efficiency gap can be written mathematically as:

$$EG = \frac{W_R}{n} - \frac{W_D}{n} \tag{1}$$

where W_R are wasted votes for Republicans, W_D are wasted votes for Democrats, and n is the total number of votes in each state.

Table 1 provides a simple example about how to calculate the efficiency gap with three districts where the same number of people vote in each district. In this example, Democrats win a majority of the statewide vote, but they only win 1/3 seats. In the first district, they win the district with 75/100 votes. This means that they only wasted the 24 votes that were unnecessary to win a majority of the vote in this district. But they lose the other two districts and thus waste all 40 of their votes in those districts. In all, they waste 104 votes. Republicans, on the other hand, waste all 25 of their votes in the first district. But they only waste the 9 votes unnecessary to win a majority in the two districts they win. In all, they only waste 43 votes. This implies a pro-Republican efficiency gap of $\frac{43}{300}$ - $\frac{104}{300}$= -20%.

Table 1: Illustrative Example of Efficiency Gap

District	Democratic Votes	Republican Votes
1	75	25
2	40	60
3	40	60
Total	155 (52%)	145 (48%)
Wasted	104	43

In order to account for unequal population or turnout across districts, the efficiency gap formula in equation 1 can be rewritten as:

$$EG = S_D^{margin} - 2 * V_D^{margin} \tag{2}$$

plan. Presidential elections or other statewide races are less closely tied, however, to voters' preferences in legislative races given the district lines that actually exist. In practice, though, both legislative races and other statewide races produce similar efficiency gap results for modern elections where voters are well sorted by party and ideology. Indeed, the data indicate that the correlation between efficiency gap estimates based on congressional elections and presidential elections is approximately 0.8 for elections held after 2000 and about 0.9 for elections held after the 2011 redistricting cycle.

where S_D^{margin} is the Democratic Party's seat margin (the seat share minus 0.5) and V_D^{margin} is is the Democratic Party's vote margin. V_D^{margin} is calculated by aggregating the raw votes for Democratic candidates across all districts, dividing by the total raw vote cast across all districts, and subtracting 0.5 (McGhee 2017, 11-12). In the example above, this equation also provides an efficiency gap of -20% in favor of Republicans. But it could lead to a slightly different estimate of the efficiency gap if districts are malapportioned or there is unequal turnout across districts.[12]

In the case of Ohio's enacted Congressional map, equation 2 implies there would have been a pro-Republican efficiency gap of approximately 23% using the votes from the 2020 election re-aggregated onto the enacted plan. This is a larger pro-Republican Efficiency Gap than 99% of previous congressional plans with more than 6 seats over the past 50 years.

The efficiency gap mathematically captures the packing and cracking that are at the heart of partisan gerrymanders (Buzas and Warrington 2021). It measures the extra seats one party wins over and above what would be expected if neither party were advantaged in the translation of votes to seats (i.e., if they had the same number of wasted votes). A key advantage of the efficiency gap over other measures of partisan bias is that it can be calculated directly from observed election returns even when the parties' statewide vote shares are not equal.

4.2 Declination

Another measure of asymmetries in redistricting plans is called *declination* (Warrington 2018b, 2018a). The declination metric treats asymmetry in the vote distribution as indicative of partisan bias in a districting plan (Warrington 2018a). If all the districts in a plan are lined up from the least Democratic to the most Democratic, the mid-point of the line formed by one party's seats should be about as far from the 50 percent threshold for victory on average as the other party's (McGhee 2018).

Declination suggests that when there is no gerrymandering, the angles of the lines (θ_D and θ_R) between the mean across all districts and the point on the 50% line between the mass of points representing each party will be roughly equal. When they deviate from each other, the smaller angle (θ_R in the case of Ohio) will generally identify the favored party. To capture this idea, declination takes the difference between those two angles (θ_D

12. In general, the two formulations of the efficiency gap formula yield very similar results. Because Democrats tend to win lower-turnout districts, however, the turnout adjusted version of the efficiency gap in equation 2 tends to produce results that suggest about a 2% smaller disadvantage for Democrats than the version in Equation 1 (see McGhee 2018).

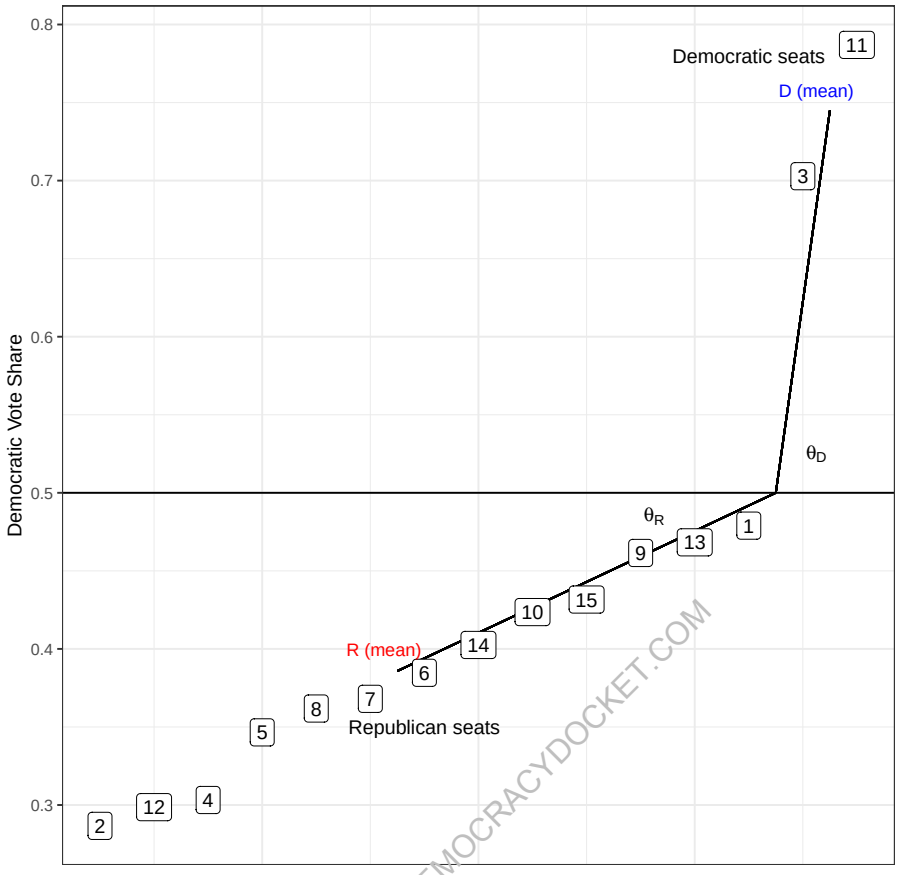

Figure 1: Plot illustrating declination based on votes in 2020 Congressional election re-aggregated to new plan

and θ_R) and divides by $\pi/2$ to convert the result from radians to fractions of 90 degrees.[13] This produces a number between -1 and 1. As calculated here, positive values favor Democrats and negative values favor Republicans. Warrington (2018b) suggests a further adjustment to account for differences in the number of seats across legislative chambers. I use this adjusted declination estimate in the analysis that follows.[14]

In the case of Ohio's 2020 congressional elections, the declination metric indicates that the plan has a pro-Republican bias of .90. This is a larger absolute level of bias than 97% of previous congressional elections in states with more than 6 seats, and more pro-Republican than 97% of previous plans.

13. This equation is: $\delta = 2^* (\theta_R - \theta_D) / \pi$.
14. This adjustment uses this equation: $\hat{\delta} = \delta * \ln(\text{seats}) / 2$

4.3 Mean-median Gap

Another metric that some scholars have proposed to measure partisan bias in a districting plan is the *mean-median gap*: the difference between a party's vote share in the median district and their average vote share across all districts. If the party wins more votes in the median district than in the average district, they have an advantage in the translation of votes to seats (Krasno et al. 2018; Best et al. 2017; Wang 2016). In statistics, comparing a dataset's mean and median is a common statistical analysis used to assess skews in the data and detect asymmetries (Brennan Center 2017).

The mean-median difference is very easy to apply (Wang 2016). It is possible, however, for packing and cracking to occur without any change in the mean-median difference (Buzas and Warrington 2021). That is, a party could gain seats in the legislature without the mean-median gap changing (McGhee 2017).[15] It is also sensitive to the outcome in the median district (Warrington 2018b). In addition, the mean-median difference lacks a straightforward interpretation in terms of the number of seats that a party gains through gerrymandering. Finally, the assumptions of the mean-median gap are less tenable in less electorally competitive states.

District	Democratic Vote Share
2	0.29
12	0.30
4	0.30
5	0.35
8	0.36
7	0.37
6	0.38
14	0.40
10	0.42
15	0.43
9	0.46
13	0.47
1	0.48
3	0.70
11	0.79
Mean	43.4%
Median	40.3%

Table 2: Results in 2020 Ohio Congressional Elections Re-Aggregated onto Enacted Map

15. As McGhee (2017), notes, "If the median equals the win/loss threshold–i.e., a vote share of 0.5–then when a seat changes hands, the median will also change and the median- mean difference will reflect that change. But if the median is anything other than 0.5, seats can change hands without any change in the median and so without any change in the median-mean difference." See also Buzas and Warrington (2021) who make a similar point using simulated packing and cracking.

Table 2 illustrates the mean-median approach using the results in the 2020 Ohio congressional elections re-aggregated to the districts in the enacted map. In the actual 2020 congressional elections, Democrats won 4 seats. But on the enacted plan, Democrats would only have won 2 seats. Moreover, Table 2 shows that many Democratic voters were packed into just 2 districts where the Democratic candidates won by overwhelming margins. The remaining Democratic voters were cracked across the other districts. This table shows the disproportionate percentage of the statewide vote that Democrats would have needed to win a majority of Ohio's congressional seats in 2020. Across all districts, Democrats won an average of 43.4% of the vote. But they only won 40.3% in the median district. This translated into a pro-Republican mean-median difference of 3.1%.

4.4 Symmetry in the Vote-Seat Curve Across Parties

Basic fairness suggests that in a two-party system each party should receive the same share of seats for identical shares of votes. The *symmetry* idea is easiest to understand at an aggregate vote share of 0.5—a party that receives half the vote ought to receive half the seats—but a similar logic can apply across the "seats- votes curve" that traces out how seat shares change as vote shares rise and fall. For example, if a party receives a vote share of 0.57 and a seat share of 0.64, the opposing party should also expect to receive a seat share of 0.64 if it were to receive a vote share of 0.57. An unbiased system means that for V share of the votes a party should receive S share of the seats, and this should be true for all parties and vote percentages (Niemi and Deegan 1978; Gelman and King 1994a; McGhee 2014; Katz, King, and Rosenblatt 2020).

Gelman and King (1994a, 536) propose two ways to measure partisan bias in the symmetry of the vote-seat curve. First, it can be measured using counter-factual election results in a range of statewide vote shares between .45 and .55. Across this range of vote shares, each party should receive the same number of seats. Symmetry captures any departures from the standard that each party should receive the same seat share across this range of plausible vote shares. For example, if partisan bias is -0.05, this means that the Democrats receive 5% fewer seats in the legislature than they should under the symmetry standard (and the Republicans receive 5% more seats than they should).

To illustrate the symmetry metric, Table 3 calculates what each party's share of the seats would have been in Ohio's 2020 Congressional elections (re-aggregated onto the enacted map) across a range of statewide vote shares from 45%-55%. It shows that Democrats only received a third or less of the seats in most of the scenarios where they received less than 50% of the votes. This might not have been problematic under the

symmetry standard if Republicans also only received a third of the seats when they received less than 50% of the votes. However, Table 3 shows that Republicans still would have received half of the seats even when they won a minority of the votes. Across this range of statewide vote shares from 45%-55%, Democrats receive an average of 39% of the seats (and Republicans win 61%). This implies a partisan bias of 11% using the symmetry metric. That is, Republicans won 11 percentage points more of the seats than they would have won if the seat-vote curve was symmetric between the two parties.

Dem. Vote Share	Dem. Seat Share	Rep. Vote Share	Rep. Seat Share
45%	13%	55%	87%
46%	20%	54%	80%
47%	33%	53%	67%
48%	33%	52%	67%
49%	33%	51%	67%
50%	40%	50%	60%
51%	47%	49%	53%
52%	47%	48%	53%
53%	53%	47%	47%
54%	53%	46%	47%
55%	60%	45%	40%
Mean Seat Share	39%		61%
Bias	-11%		11%

Table 3: Symmetry Calculations for 2020's Congressional Elections Re-Aggregated onto Enacted Map

The symmetry metric is closely related to the efficiency gap. In the special case where each party receives half of the statewide vote, the symmetry and the efficiency gap metrics are mathematically identical (Stephanopoulos and McGhee 2015, 856). More generally, the symmetry and efficiency gap yield very similar substantive results when each party's statewide vote share is close to 50% (as is the case in Ohio). When elections are uncompetitive, however, and one party wins a large percentage of the statewide vote, the efficiency gap and these symmetry metrics are less correlated with one another (857).

A weakness of the symmetry approach is that it requires the analyst to calculate counterfactual elections. This approach has both conceptual and empirical limitations. At a conceptual level, it is not clear that it aligns perfectly with the usual definition of a gerrymander. Indeed, "when observers assert that a district plan is a gerrymander, they usually mean that it systematically benefits a party (and harms its opponent) in actual elections. They do not mean that a plan would advantage a party in the hypothetical event

of a tied election, or if the parties' vote shares flipped" (Stephanopoulos and McGhee 2015, 857). At an empirical level, in order to generate symmetry metrics, we need to simulate counter-factual elections by shifting the actual vote share in each district a uniform amount (McGhee 2014).[16] In general, this uniform swing assumption seems reasonable based on past election results (though is probably less reasonable in less competitive states). Moreover, it has been widely used in past studies of redistricting. But there is no way to conclusively validate the uniform swing assumption for any particular election.

An important strength, however, of the symmetry approach is that it is based on the shape of the seats-votes curve and not any particular point on it. As a result, it is relatively immune to shifts in party performance (McGhee 2014). For instance, the bias toward Republicans in Ohio's symmetry metric was very similar in 2012-2020. Moreover, the symmetry approach has been very widely used in previous studies of gerrymandering and redistricting (Gelman and King 1994a; McGhee 2014). Overall, the symmetry approach is useful for assessing partisan advantage in the districting process.

4.5 Comparison of Partisan Bias Measures

All of the measures of partisan advantage discussed in the previous sections are closely related both theoretically and empirically (McGhee 2017; Stephanopoulos and McGhee 2018). Broadly speaking, all of the metrics consider how votes between the two parties are distributed across districts (Warrington 2018a). For example, the efficiency gap is mathematically equivalent to partisan bias in tied statewide elections (Stephanopoulos and McGhee 2018). Also, the median-mean difference is similar to the symmetry metric, since any perfectly symmetric seats-votes curve will also have the same mean and median (McGhee 2017).

Second, each of the concepts are closely related empirically, particularly in states with competitive elections. Figure 2 shows the correlation between each measure. The various measures have high correlations with one another.[17] Moreover, most of the variation in the metrics can be summarized on a single latent dimension (Stephanopoulos and McGhee 2018; Stephanopoulos and Warshaw 2020). So, overall, while there may be occasional

16. In principle, the uniform swing election could be relaxed, and swings could be estimated on a district-by-district basis. But this is rarely done in practice since it would require a much more complicated statistical model, and probably would not improve estimates of symmetry very much.

17. While each measure is highly correlated with one another, the efficiency gap and declination measures are particularly closed related and the symmetry and mean-median measures are very closely related. This could be because the efficiency gap and the declination consider the seats actually won by each party, while the symmetry metric and the mean-median difference do not (Stephanopoulos and McGhee 2018, 1557). In addition, the efficiency gap and the declination appear to best capture the packing and cracking that characterize partisan gerrymandering (Buzas and Warrington 2021).

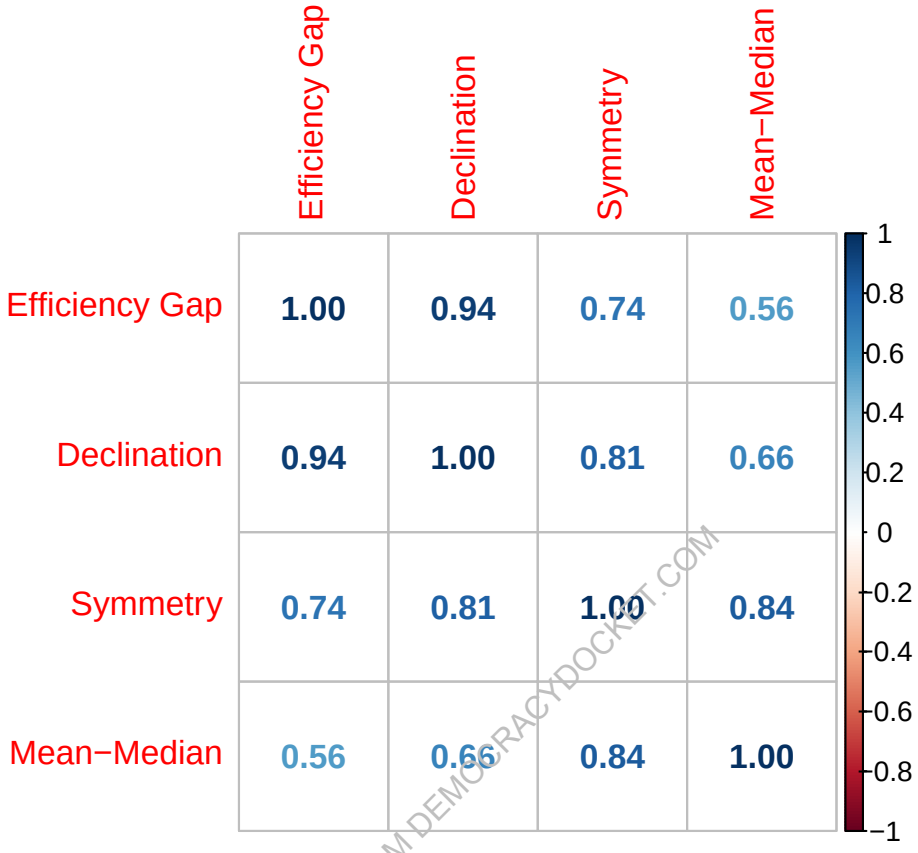

Figure 2: Correlation between measures of partisan bias in states.

cases where the metrics disagree about the amount of bias in a particular plan, the various metrics usually yield similar results for the degree of partisan bias in a districting plan (Nagle 2015). Where none of the metrics is an outlier and they all point in the same direction, we can draw a particularly robust conclusion.

While all the metrics are useful for summarizing partisan bias in a districting plan, Buzas and Warrington (2021) shows that the efficiency gap and the declination capture the packing and cracking that characterize partisan gerrymandering extremely well. In contrast, "partisan bias and mean-median difference are unable to consistently record simulated packing and cracking... As a result, we recommend that neither partisan bias nor the mean-median difference be used for the "outlier" or "ensemble" method, where it is crucial that more extreme values of the measure indicate more extreme levels of partisan gerrymandering." Moreover, McGhee (2017, 9) shows that the assumptions of the

symmetry and mean-median measures become progressively less plausible as the statewide vote shares in a plan move away from 50% (McGhee 2017, 9). In my analysis below, I generally show all four metrics. But I particularly focus on the efficiency gap and declination since these best capture packing and cracking, and these metrics are best suited for a state such as Ohio where there is typically about a 45-55 split of the two-party vote in statewide elections.

4.6 Responsiveness and Competitive Elections

Another benchmark for a districting plan is the percentage of districts likely to have competitive elections under that plan and the responsiveness of the plan to changes in voters' preferences (Cox and Katz 1999). There are a number of normative reasons to care about the number of competitive districts in a plan. First, this affects the responsiveness of a map as the two parties' statewide vote shares rise and fall. A plan with more competitive elections is likely to be more responsive to changes in voters' preferences than a plan with fewer competitive elections (McGhee 2014). An unresponsive map ensures that the bias in a districting plan toward the advantaged party is insulated against changes in voters' preferences, and thus is durable across multiple election cycles. Second, uncompetitive districts tend to protect incumbents from electoral sanctions (Tufte 1973; Gelman and King 1994a). This could harm political representation by making legislators less responsive and accountable to their constituents' preferences.

To illustrate the concept of responsiveness, Figure 3 shows the vote-seat curve in Ohio generated by applying uniform swings to the 2020 election results.[18] Specifically, I apply a uniform swing in the actual election results until I achieve an average Democratic vote share of 40%. Then I steadily increase the average Democratic vote share until it reaches 60%. Figure 3 indicates that Republicans win two thirds or more of the seats across all of the range of actual election swings over the past decade.

There are a couple of approaches we might use to evaluate whether individual districts on a plan are likely to have competitive elections. We could measure whether a district was competitive in an election based on whether the winning party received less than 55% of the two-party vote (Fraga and Hersh 2018; Jacobson and Carson 2015, 91).[19] While this definition is sometimes used in the literature, though, it is not clear that a sharp threshold at 55% is the best measure of competitiveness.

Another possible definition of competitiveness might be whether a district is likely

18. The layout of this chart is adapted from charts in Royden, Li, and Rudensky (2018).

19. Fraga and Hersh (2018) justify this definition based on the fact that the Cook Political Report's "median 'leaning' race ended up with a vote margin of 10 percentage points (a 55%–45% race)."

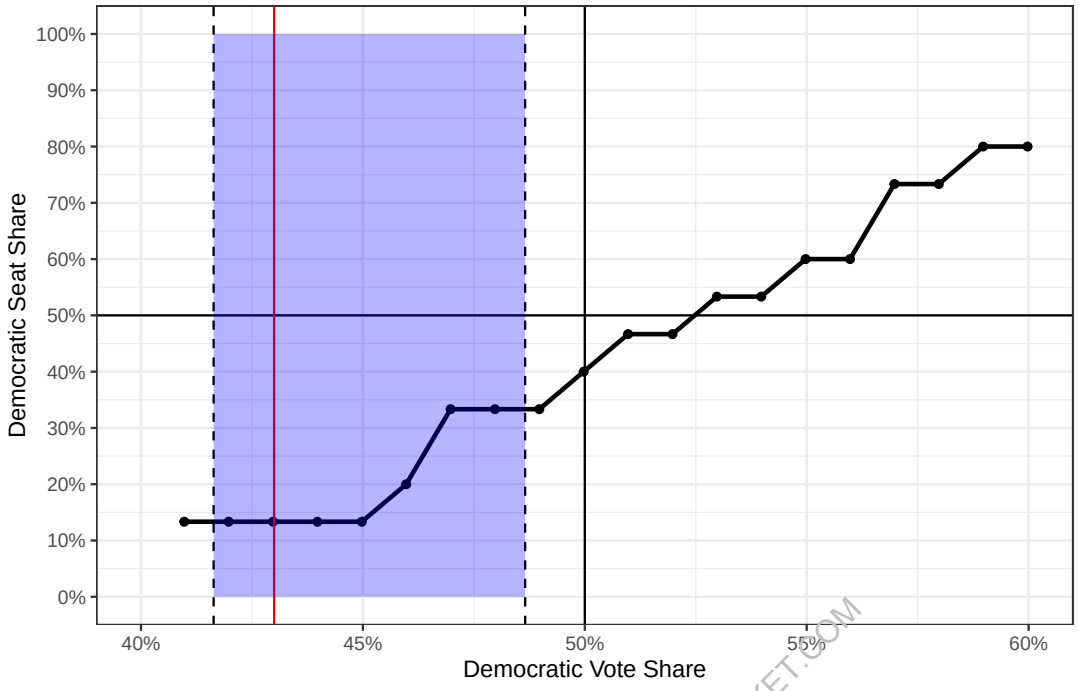

Figure 3: Vote-seat curve in Ohio using uniform swings in 2020 election results re-aggregated using enacted plan. The shaded area shows the range between the minimum and maximum Democratic statewide vote share in congressional elections from 2012-2020. The red line shows the actual Democratic statewide vote share in the 2020 House elections.

to switch parties at least once per decade (Henderson, Hamel, and Goldzimer 2018). This definition is more empirically robust because it is not dependent on any particular electoral threshold for competitiveness. Indeed, in a state with swing voters where the two parties' statewide shares vary substantially over the course of the decade, a district where the winning party normally wins 56% of the vote could be competitive. In another state with few swing voters and very inelastic election results, a district where the winning party normally wins 53% of the vote might not even be competitive.

4.7 Partisan Control of the Redistricting Process and Gerrymandering

While many factors could influence the degree of partisan advantage in the districting process,[20] there is a wide body of evidence from previous studies that control of the redistricting process has a large effect on partisan advantage in subsequent elections carried

20. Partisan advantage in the districting process can differ across states for reasons unrelated to the drawing of district lines, such as variation in how groups are distributed across geography (Chen and Rodden 2013). It can also be affected by goals other than maximizing partisan seat share, such as representation of racial minorities (e.g., Brace, Grofman, and Handley 1987).

out under a given plan. Cox and Katz (2002) show that Democratic control of the redistricting process in many states during the 1960s led to a lasting partisan advantage for Democrats in House elections. More generally, Gelman and King (1994b) find that the party in control of redistricting shifts outcomes in its favor, and that "the effect is substantial and fades only very gradually over the following 10 years" (543). This result has been confirmed in numerous recent articles. McGhee (2014) finds that "parties seek to use redistricting to shift bias in their favor and that they are successful in these efforts" (74).[21] Finally, Stephanopoulos (2018) shows that partisan control of the districting process has a substantial effect on the efficiency gap.[22] This past literature indicates that districting plans passed by one political party with unified control of government, as in Ohio, often unduly favor that party.

5 Partisan Bias in Ohio's Enacted Congressional Map

In this section, I will provide a comprehensive evaluation of the partisan fairness of Ohio's enacted congressional districting plan (see Figure 4 for a map of the enacted plan). In order to evaluate the enacted plan, we need to predict future election results on this map. Unfortunately, there is no way to know, with certainty, the results of future elections. Thus, I use three complementary methodologies to predict future congressional elections in Ohio and generate the various metrics I discussed earlier.

Figure 4: Map of Enacted Congressional Districts from PlanScore.org

21. McGhee (2014) finds that partisan control affects the districting process using both the Gelman and King (1994b) measure of partisan symmetry and the efficiency gap as outcome variables.

22. He shows that states with unified Republican control have about 5 percentage points more pro-Republican efficiency gaps than states with split control, and states with unified Democratic control have about 3 percentage points more pro-Democratic efficiency gaps than states with split control.

5.1 2020 Congressional election results

First, I use the 2020 precinct-level congressional results on both the 2012-20 map and re-aggregated to the enacted map to estimate the various metrics. This approach implicitly assumes that future elections will look like the 2020 election. These endogenous election are likely to be an excellent predictor of future voting patterns in congressional elections. Based on these results, Republicans would win 57% of the votes, but 87% of the seats on the enacted plan. In other words, Republicans would win thirty percentage points more seats than votes.

Metric	Value	More Biased than this % Historical Plans	More Pro-Republican than this % Historical Plans
2012-2020 Plan			
Republican Seat Share	75%		
Efficiency Gap	-11%	78%	91%
Declination	-.51	85%	91%
Mean-Median Diff	-4%	57%	78%
Symmetry Bias	-12%	78%	87%
Average		75%	87%
Enacted Plan			
Republican Seat Share	87%		
Efficiency Gap	-23%	98%	99%
Declination	-.90	97%	97%
Mean-Median Diff	-3%	42%	72%
Symmetry Bias	-10%	69%	83%
Average		77%	88%

Table 4: Partisan bias metrics for Congressional plan based on 2020 Congressional election results re-aggregated onto enacted map

The average efficiency gap of the enacted plan based on the precinct-level 2020 House results is -23% (see Table 4). This is more extreme than 98% of previous plans and more pro-Republican than over 99% of previous plans. The enacted plan is more pro-Republican than 97% of prior plans in the country using the declination metric. The other metrics also show that Ohio's enacted plan has a large pro-Republican bias. When we average across all four metrics, the plan is more extreme than 77% of previous plans and more pro-Republican than 88% of previous plans.

5.2 Composite of previous statewide elections

Next, I use a composite of previous statewide election results between 2012-2020 re-aggregated to the enacted map.[23] For each year, I estimate each party's vote share, seat share, and the average of the partisan bias metrics across races. I then average them together to produce a composite result. This approach implicitly assumes that future voting patterns will look like the average of these recent statewide elections.

		2012-2020 Composite	
Metric	Value	> Biased than this % Plans	> Pro-Rep. than this % Plans
2012-2020 Plan			
Republican Seat Share	75%		
Efficiency Gap	-15%	90%	96%
Declination	-.54	88%	93%
Mean-Median	-4%	47%	74%
Symmetry Bias	-19%	94%	95%
Average		80%	89%
Enacted Plan			
Republican Seat Share	74%		
Efficiency Gap	-14%	87%	95%
Declination	-.54	88%	92%
Mean-Median	-2%	28%	65%
Symmetry Bias	-13%	81%	88%
Average		70%	85%

Table 5: Composite bias metrics for enacted Congressional plan based on statewide elections

When I average across these statewide elections from 2012-2020, Democrats win 45% of the votes and 26% of the seats (see Table 5). The average efficiency gap of the enacted plan based on these previous election results is -14%. This is more extreme than 87% of previous plans and more pro-Republican than 95% of previous plans. The enacted plan is also more pro-Republican than 92% of previous plans using the declination metric. The mean-median and symmetry also show that Ohio's enacted plan has a substantial pro-Republican bias. When I average across all four metrics, the plan is more extreme than 70% of previous plans and more pro-Republican than 85% of previous plans.[24]

23. These include the following elections: 2012 Presidential, 2012 Senate, 2014 gubernatorial, 2014 Secretary of State, 2016 Presidential, 2016 Senate, 2018 Senate, 2018 gubernatorial, 2018 attorney's general, 2018 Secretary of State, 2018 Auditor, 2018 Treasurer, and 2020 Presidential. Geographic data on the other three statewide elections in 2014 is not available. But this probably doesn't affect my results much since these elections were similar to the average of the 2014 gubernatorial and Secretary of State elections. I weight the elections so that each year is given equal weight in the composite.

24. In the Appendix, I show that I reach very similar results using a variety of other combinations of past elections to construct the composite index.

5.3 PlanScore

Third, I evaluate the enacted plan using a predictive model from the PlanScore.org website. PlanScore uses a statistical model of the relationship between districts' latent partisanship and election outcomes. This enables it to estimate district-level vote shares for a new map and the corresponding partisan gerrymandering metrics.[25] It then calculates various partisan bias metrics. In this case, PlanScore provides estimates of the efficiency gap and declination.[26]

PlanScore also indicates that the enacted Congressional plan has a substantial pro-Republican bias (Table 6). According to PlanScore, the enacted plan has a pro-Republican efficiency gap of 16%. The enacted plan favors Republicans in 99% of the scenarios estimated by PlanScore.[27] Moreover, it is more extreme than 96% of previous plans and more pro-Republican than 98% of previous plans.

Metric	Value	Favors Rep's in this % of Scenarios	More Biased than this % Historical Plans	More Pro-Republican than this % Historical Plans
2012-2020 Plan				
Republican Seat Share	74%			
Efficiency Gap	-12%	96%	90%	97%
Declination	-.42	95%	87%	93%
Average		96%	89%	95%
Enacted Plan				
Republican Seat Share	79%			
Efficiency Gap	-16%	99%	97%	97%
Declination	-.58	99%	95%	98%
Average		99%	96%	98%

Table 6: PlanScore partisan bias metrics for enacted Congressional plan

5.4 Competitiveness of Districts

In their summary of the enacted plan, the Ohio state legislature asserted that "the plan contains six Republican-leaning districts, two Democratic-leaning districts, and seven competitive districts. The number of competitive districts in the plan significantly exceeds the number of competitive districts contained in Ohio's current plan."[28] In this section, I

25. See `https://planscore.campaignlegal.org/models/data/2021C/` for more details.

26. The partisan symmetry and mean-median difference scores are only shown when the parties' statewide vote shares fall between 45% and 55% because outside this range the metrics' assumptions are less plausible (McGhee 2017, 9). In the PlanScore model, the Democrats' two-party vote share is just below 45%.

27. See `https://planscore.campaignlegal.org/plan.html?20211127T135358.249351808Z`

28. See `https://www.legislature.ohio.gov/download?key=17868&format=pdf`. It is important to note the analysis underlying this assertion only includes federal statewide elections, which is an odd set

analyze the accuracy of this statement.

I use a variety of approaches to estimate the number of competitive districts in both the 2012-20 congressional plan and the enacted plan (see Table 7). None of these approaches, however, indicate there are seven competitive districts in the enacted plan. Instead, they indicate there are approximately three competitive districts. Moreover, none of these approaches indicate that the number of competitive districts significantly exceeds the number of competitive districts contained in Ohio's 2012-20 plan. On average, my analysis indicates that the enacted plan has just one more competitive district than the 2012-2020 plan. As a result, I find that the state legislature's claims regarding the competitive districts on the enacted plan are inaccurate.

Data:	2020 House Results		Composite (2012-20)	PlanScore			**Mean**
Metric:	45-55	Historical Swing	45-55	45-55	20%+ Prob. of Each Party Win.	50%+ Prob. Flip in Dec.	
Plan	(1)	(2)	(3)	(4)	(5)	(6)	(7)
2012-20 Plan	2	1	1	3	2	5	2
Enacted Plan	3	3	3	4	2	4	3

Table 7: Number of competitive districts using various data sources and metrics.

First, I use the actual 2020 House results to examine the number of competitive districts. In column 1 of Table 7, I begin by tallying the number of districts where each party's two-party vote share was between 45 and 55%. This approach indicates there are 2 competitive districts on the 2012-20 plan and 3 competitive districts on the enacted plan. As I discussed earlier, however, it is not clear that a sharp threshold at 55% is the best measure of competitiveness.

Based on the approach in Henderson, Hamel, and Goldzimer (2018, Appendix, p. 2), we can also define competitiveness based on whether a district is likely to switch parties at least once per decade based on the maximal swing in the two-party vote. In column 2 of Table 7, I use this approach to tally the number of districts that each party would win at least once over the course of the decade based on the historical range of statewide election results between 2012-2020. Specifically, I conduct a uniform swing to simulate what would happen if the 2020 congressional election were held in the best year for Democrats (2012).[29] I then examine the number of districts that would have been

of elections to focus on. First, this composite does not include the Republican wave year in 2014, but it does include the Democratic wave year in 2018. It also includes two elections from 2012, which implicitly heavily weights this election in the index.

29. It is worth noting, however, that 2012 appears to have been a high-water mark for Democrats in Ohio, and their electoral performance has not come close to this level in subsequent elections.

won at least once by each party. This approach indicates there was 1 competitive district on the 2012-20 plan and 3 competitive districts on the enacted plan.

Next, I use a composite of the 2012-2020 statewide election results to estimate the number of competitive districts. Once again, in column 3 of Table 7, I tally the number of districts where each party's two-party vote share was between 45 and 55%. This approach indicates there was 1 competitive district on the 2012-20 plan and 3 competitive districts on the enacted plan.

Lastly, I use PlanScore to estimate the potential competitiveness of individual districts on the enacted plan. In column 4 of Table 7, I show the number of districts where PlanScore estimates that each party's two-party vote share is expected to be between 45 and 55%. This approach indicates there were 3 competitive districts on the 2012-20 plan and 4 competitive districts on the enacted plan.

It is also possible to use PlanScore to evaluate whether a district is likely to switch parties at least once per decade (Henderson, Hamel, and Goldzimer 2018). PlanScore conducts 1,000 simulations of possible electoral scenarios based on the results of the 2012-2020 congressional and state legislative elections in every state. Using these simulations, PlanScore provides an estimate of the probability that each party will win each seat as well as whether they are likely to have at least a 50% chance of winning each seat once over the course of the decade. In column 5 of Table 7, I estimate the number of districts where each party has at least a 20% chance of winning according to PlanScore. This approach indicates there were 2 competitive districts on the 2012-20 plan and 2 competitive districts on the enacted plan. In column 6 of Table 7, I conduct a similar analysis where I tally the number of districts that each party would have at least a 50% chance of winning at least once over the course of the decade. This approach indicates there are 5 competitive districts on the 2012-20 plan and 4 competitive districts on the enacted plan.

Finally, column 7 of Table 7 averages across all of these approaches. It indicates there are about 2 competitive districts on the 2012-2020 plan and 3 competitive seats on the enacted plan. Thus, there is neither support for the notion that there are seven competitive districts nor that the the enacted plan yields significantly more competitive districts than the 2012-20 plan.

Moreover, it is important to note that the fact that there are about three potentially competitive districts on the enacted plan does not mean that each party has a 50-50 chance at winning these districts. In fact, Republicans are favored in each of these districts and heavily favored in several of them. We can see this using each of the predictive approaches I've used in this report that are summarized in Table 8. The table shows that none of the competitive districts (shown in grey) lean toward Democrats. Indeed, the Republican

District	Projected Democratic Vote Share				Probability Dem. Wins (PlanScore)
	House 2020	Composite (2012-2020)	PlanScore	Average Dem. Share	
1	0.48	0.46	0.48	0.47	36%
2	0.29	0.33	0.30	0.30	1%
3	0.70	0.66	0.70	0.69	99%
4	0.30	0.31	0.31	0.31	1%
5	0.35	0.38	0.35	0.36	1%
6	0.38	0.44	0.36	0.40	1%
7	0.37	0.40	0.38	0.39	1%
8	0.36	0.36	0.36	0.36	1%
9	0.46	0.49	0.45	0.47	16%
10	0.42	0.45	0.46	0.44	18%
11	0.79	0.77	0.76	0.77	99%
12	0.30	0.36	0.32	0.33	1%
13	0.47	0.48	0.48	0.47	31%
14	0.40	0.44	0.42	0.42	4%
15	0.43	0.43	0.44	0.44	13%

Table 8: Democratic Vote Share Projections for Each District on Enacted Plan using a Variety of Methods. Competitive districts in grey.

candidate is likely to win District 1 by 5%, District 9 by 7%, and District 13 by 5%.[30] So Republicans are likely to win all, or nearly all, of these districts in the average election (see right-most column in Table 8). This is especially true if Republicans also have an incumbency advantage in most of these districts (see Jacobson 2021, for more on the incumbency advantage in 2020). Overall, 13 of the 15 districts on the enacted plan lean toward Republicans.

6 Incumbency

Article XIX.01, Section 3(A) of Ohio's Constitution requires that "The general assembly shall not pass a plan that unduly favors or disfavors a political party or its incumbents" (emphasis added). In previous sections of this report, I have shown that the enacted plan unduly favors the Republican Party. In this section, I will examine whether it favors incumbents from the Republican Party. I find that it does.

In order to examine whether the new plan favors incumbents from the Republican Party, I first examine the percentage of the Democratic and Republican voters in each

30. Note that the margins here are based on the unrounded vote shares in each district. Also, according to PlanScore, Republicans have at least a 64% chance of winning each of these districts.

2020 Districts	2022 District	% Overlap	Dem. Vote Share Old District	Dem. Vote Share New District
1	1	0.81	0.46	0.48
2	2	0.68	0.39	0.29
3	3	0.71	0.71	0.70
4	4	0.53	0.30	0.30
5	9	0.56	0.32	0.46
6	6	0.61	0.26	0.38
7	7	0.41	0.30	0.37
8	8	0.80	0.31	0.36
9	9	0.44	0.63	0.46
10	10	0.97	0.42	0.42
11	11	0.79	0.80	0.79
12	4	0.41	0.43	0.30
13	6	0.54	0.54	0.38
14	14	0.73	0.40	0.40
15	15	0.43	0.37	0.43
16	13	0.48	0.37	0.47

Table 9: Evaluation of how incumbent in each of the old districts would perform on the enacted plan based on re-aggregating the 2020 House results to new districts. Districts won by Democrats in 2020 in blue.

of the 16 districts used in the 2020 congressional election that will be in each of the 15 districts on the enacted plan. This enables me to determine the new district that most overlaps with each of the old districts. I then compare the incumbent's vote share in each district of the old plan to their expected vote share in the new plan by re-aggregating the 2020 House elections to the new district that most overlaps with the old districts.

Table 9 shows the results. It shows that the enacted plan favors incumbents from the Republican Party. It puts the Democratic incumbents in districts 9 and 13 into largely new districts that will now have a majority of Republican voters. Democratic incumbent Tim Ryan in district 13 is retiring and running for Senate, so maybe we should put less weight on this district. But it is very clear that the plan is drawn to harm Representative Marcy Kaptur.

Representative Kaptur's old district 9 went along the Lake Erie coastline from Toledo to the Cleveland suburbs. In 2020, she comfortably won reelection with 63% of the two-party vote on the 2020 map. Her new district, however, goes from the Indiana border to a bit west of Lorain. It no longer includes any of the Democratic-leaning Cleveland suburbs. Overall, the new district 9 only includes 44% of the voters from Kaptur's old district 9. On the new map, she would have only won about 46% in the 2020 House election, and

thus would likely lose in 2022.

7 Conclusion

Overall, there is a substantial Republican bias in the translation of votes to seats in the enacted congressional plan in Ohio. Based on a variety of metrics, the pro-Republican bias in Ohio's congressional districting plan is very large relative to other states over the past 50 years. Moreover, the new map does not contain significantly more competitive districts than the 2012-2020 plan. The plan unduly favors congressional candidates from the Republican Party.

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Supplementary Appendix

A Alternative Composite Indices

Metric	Value	More Biased than this % Historical Plans	More Pro-Republican than this % Historical Plans
2012-2020 Plan			
Efficiency Gap	-13%	86%	94%
Declination	-.47	83%	89%
Mean-Median Diff	-3%	45%	73%
Symmetry	-19%	93%	94%
Average		77%	88%
Enacted Plan			
Efficiency Gap	-10%	75%	89%
Declination	-.38	78%	85%
Mean-Median Diff	-2%	24%	63%
Symmetry	-14%	84%	90%
Average		65%	82%

Table A1: Composite partisan bias metrics for Congressional plan based on federal statewide elections from 2012-2020

Metric	Value	More Biased than this % Historical Plans	More Pro-Republican than this % Historical Plans
2012-2020 Plan			
Efficiency Gap	-10%	74%	89%
Declination	-.41	79%	86%
Mean-Median Diff	-3%	39%	71%
Symmetry	-17%	91%	93%
Average		77%	88%
Enacted Plan			
Efficiency Gap	-11%	79%	91%
Declination	-.44	81%	88%
Mean-Median Diff	-1%	19%	61%
Symmetry	-13%	82%	88%
Average		70%	85%

Table A2: Composite partisan bias metrics for Congressional plan based on all federal elections from 2016-2020

Metric	Value	More Biased than this % Historical Plans	More Pro-Republican than this % Historical Plans
2012-2020 Plan			
Efficiency Gap	-16%	90%	96%
Declination	-.56	89%	93%
Mean-Median Diff	-3%	39%	71%
Symmetry Bias	-17%	91%	93%
Average		77%	88%
Enacted Plan			
Efficiency Gap	-18%	93%	97%
Declination	-.59	92%	95%
Mean-Median Diff	-2%	24%	63%
Symmetry Bias	-10%	69%	83%
Average		70%	85%

Table A3: Composite partisan bias metrics for Congressional plan based on all 2016-2020 statewide elections

IN THE SUPREME COURT OF OHIO

Regina Adams, *et al.* **Relators,** **v.** **Governor Mike DeWine, *et al.*** **Respondents.**	**Case No. _____** Original Action Filed Pursuant to Ohio Constitution, Article XIX, Section 3(A)

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 delegation to the United States House of Representatives, adopted by the Ohio General Assembly on November 18, 2021 and signed into law by Governor Mike DeWine two days later, and attached as Exhibit A ("2021 Congressional Plan" or the "Enacted Plan"), conforms to the requirement set forth in Article XIX, Section 1(C)(3)(a), namely, that the plan does not "unduly favor[] or disfavor[] a political party or its incumbents." I have also been asked to examine the extent to which the General Assembly's redistricting plan splits governmental units, and to assess the plan's adherence to other traditional redistricting criteria, including compactness.

2. I demonstrate that given the statewide support for the two parties, the 2021 Congressional Plan provides an extreme advantage to the Republican Party. With around 53.2 percent of the statewide vote in the last three general elections, the Republican Party can expect to win around 80 percent of the seats under the Enacted Plan. This is an increase over the map that was in effect from 2012 to 2020, under which Republican candidates were able to consistently win 75 percent of the seats.

3. I also examined the extent to which the General Assembly's plan disproportionately favors or disfavors the *incumbents* for one of the two parties. Under the previous plan, there were 12 Republican incumbents, one of which has already announced his retirement. All of the remaining districts with Republican incumbents continue to have Republican majorities—most of them quite comfortable. Of the four Democratic incumbents, only two continue to reside in majority-Democratic districts. The other two districts with Democratic incumbents have been dramatically reconfigured, both now with Republican majorities.

4. These outcomes were not forced upon the General Assembly by Ohio's political geography, or by the requirements of the Ohio Constitution. On the contrary, I demonstrate that it is possible to abide by the Constitution and achieve partisan fairness, while drawing districts that are more compact, introduce fewer splits in metropolitan counties and a similar number of county splits overall, introduce similar or even fewer splits to municipal subdivisions and do a better job keeping communities together.

II. QUALIFICATIONS

5. 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 F.

6. 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."

7. 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.

8. 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.

9. 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

10. 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 several proposed Ohio congressional plans uploaded to the web page of the Ohio Redistricting Commission as well as the websites for the Ohio House and Senate, true copies of which are attached as Exhibits B, C, and D.[2] Since the General Assembly has not as of this writing made block assignment files or electronic files of its redistricting plan available to the public, I relied upon a block assignment file extracted from a public web archive that creates block assignment files from map images.[3] I also consulted the same U.S. Census redistricting data used by the General Assembly, as archived in the "Ohio University Common and Unified Redistricting Database."[4] For comparative analysis, I collected data on U.S. Senate, U.S. House, and presidential elections from state election authorities of a number of states, as detailed below. I also consulted precinct-level presidential results, again from state election authorities, aggregated to the level of U.S.

[1] https://alarm-redist.github.io/posts/2021-08-10-census-2020/.
[2] https://redistricting.ohio.gov/maps.
[3] https://davesredistricting.org.
[4] https://www.redistricting.ohio.gov/resources.

congressional districts.[5] I also used geographic boundary files of communities of Columbus, Ohio from the City of Columbus GIS department.[6] For the analysis conducted in this report, I use three software packages: Stata, Maptitude for Redistricting, and ArcGIS Pro.

IV. THE PARTISANSHIP OF THE 2021 CONGRESSIONAL PLAN

11. I have been asked to determine whether the 2021 Congressional Plan favors one of the two parties and, if so, to what extent. I proceed by first characterizing statewide partisanship in Ohio, and then examining the most likely partisan outcomes associated with the Enacted Plan.

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

12. 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.

13. 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

[5]https://docs.google.com/spreadsheets/d/17yr9mcAtuUdNjI9NEPYKxXsEldzzQ2ZaDwEAbnPRyS4/edit?pref=2&pli=1#gid=1641247082.
[6] https://opendata.columbus.gov/datasets/c4b483507f374e62bd705450e116e017/explore

Democratic share of the two-party vote (setting aside small parties and write-in candidates) was around 46 percent. If we focus on more recent elections, from 2016 to the present, the Democratic vote share is closer to 47 percent.

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%**

14. Next, in order to gain an initial understanding of which party's candidate is likely to win each seat under the 2021 Congressional Plan, I use precinct-level data from recent elections, and aggregate the results within the district boundaries enacted by the legislature. I have been able to obtain geo-coded precinct-level results for elections from 2016 to 2020. I calculate the Democratic and Republican shares of the two-party vote in each of the following races: 2016 President, 2016 U.S. Senate, 2018 U.S. Senate, 2018 Governor, 2018 Auditor, 2018 Secretary of State, 2018 Treasurer, and 2020 President. I then simply add up the votes cast for Democrats and Republicans in these races across all the precincts contained in each of the individual districts under the Enacted Plan, and divide by the total votes cast for the two parties in the respective district. The results of this exercise are displayed on the left side of Table 2.

Table 2: Shares of the Vote Obtained by the Two Major Parties from 2016 to 2020 in the Districts of the 2021 Congressional Plan and in the Districts of the Previous Plan

Newly Enacted Map			Map in Place from 2012 to 2020		
District	Democratic vote share	Republican vote share	District	Democratic vote share	Republican vote share
1	0.484	0.516	1	0.460	0.540
2	0.333	0.667	2	0.426	0.574
3	0.703	0.297	3	0.703	0.297
4	0.327	0.673	4	0.340	0.660
5	0.392	0.608	5	0.383	0.617
6	0.437	0.563	6	0.328	0.672
7	0.421	0.579	7	0.371	0.629
8	0.375	0.625	8	0.327	0.673
9	0.497	0.503	9	0.620	0.380
10	0.467	0.533	10	0.461	0.539
11	0.802	0.198	11	0.811	0.189
12	0.369	0.631	12	0.449	0.551
13	0.508	0.492	13	0.556	0.444
14	0.459	0.541	14	0.456	0.544
15	0.461	0.539	15	0.437	0.563
			16	0.431	0.569

15. As indicated in gray, when considering the specific data referenced above, there are only three districts with Democratic majorities in the Enacted Plan. Two of those districts have very comfortable Democratic majorities, and one has a very slight Democratic lean (District 13). There is one additional district (District 9) that leans just ever so slightly Republican.

16. This represents a considerable change in favor of Republicans from the status quo under the previous map, attached as Exhibit E. Table 2 also provides the results of the same exercise for the map that was in place from 2012 to 2020. That plan included four districts with relatively comfortable Democratic majorities. It is rather remarkable that the General

Assembly was able to devise a plan that made the Democratic Party *worse* off, given that, as demonstrated below, the previous plan was one of the most favorable to the Republican Party in the United States in recent history.

17. The district-level aggregated statewide election results displayed on the right-hand side of Table 2 are extremely reliable predictors of actual congressional election results. There were five general elections for Ohio's 16 seats from 2012 to 2020, for a total of 80 congressional races. In *every single* race, the candidate of the party with the higher vote share on the right-hand side of Table 2 was victorious.

18. If the same pattern continues, and the statewide aggregates continue to perfectly predict congressional outcomes, the Democrats can anticipate winning only 3 of 15 seats throughout the decade. Recall from Table 1 that Democrats' statewide vote share was around 47 percent from 2016 to 2020, but their anticipated seat share under the Enacted Plan is only 20 percent. Correspondingly, with around 53 percent of the statewide vote, the Republican Party can expect 80 percent of the seats.[7]

19. Districts 9 and 13 have statewide vote shares that are very close to 50 percent (within one percentage point). District 9 is a highly reconfigured district in which a Democratic incumbent will now be competing in very different territory with a slight Republican majority. District 13 is an open seat with a slim Democratic majority. Even if one considers both Districts 9 and 13 in the Enacted Plan to be tossups, and assigns a 50 percent probability of victory to Democratic candidates in each, the same conclusion holds: Republican candidates can expect to win around 12 of 15 seats.

20. Based on the statewide vote shares in Table 2, without any consideration of incumbency, one might get the mistaken impression that there are additional "competitive" seats in the Enacted Plan. Above all, one might imagine that District 1, with its roughly 52 percent Republican vote share, is a competitive seat. However, note that in the previous cycle the district had a slightly higher 54 percent Republican vote share in statewide races. The incumbent, Steve Chabot, very consistently outperformed his party's district vote share in statewide races, winning easily with, on average, around 58 percent of the vote. In other words, Representative Chabot enjoyed an incumbency advantage of around four percentage points. Much of the district remains unchanged, including parts of Cincinnati, its western suburbs, and Warren County, so there is no reason to anticipate that this advantage will suddenly disappear.

21. The remaining seats are even less competitive. For instance, the Republican vote share in statewide races in District 10 is around 53 percent, down slightly from 54 percent in the previous redistricting cycle. However, the Republican incumbent, Mike Turner, won each general election from 2012 to 2020 with an average two-party vote share above 62 percent. Once again, as with District 1, the incumbent enjoyed a sizable incumbency advantage, and again, there is no reason to anticipate that it will suddenly disappear. One simply cannot characterize District 10 in the Enacted Plan as competitive. The same can be said about

[7] Note that I refer to statewide results from 2016 to 2020 since those are the years for which I have precinct-level breakdowns that allow me to calculate district-level tallies.

Districts 14 and 15—districts with Republican incumbents where the Republican vote share hovers around 54 percent.

V. PUTTING THE 2021 CONGRESSIONAL PLAN IN PERSPECTIVE

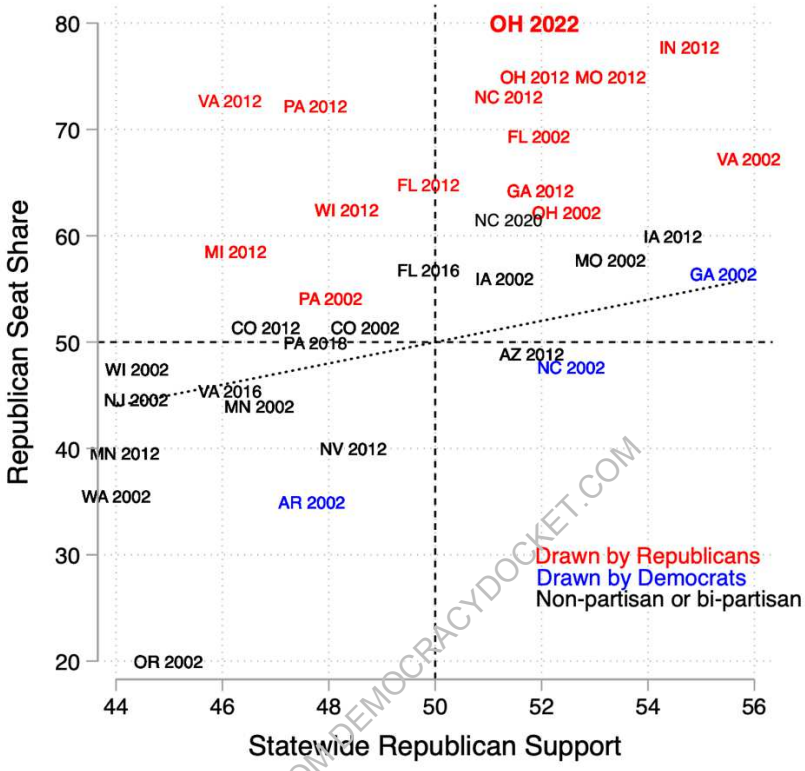
22. In any two-party democracy, it is not normal for a party with an average of 53.2 percent of the vote to receive 80 percent of the seats. In fact, even in the United States, which has maintained the idiosyncratic practice of allowing incumbent partisan majorities to draw their own districts without constraint, this is a highly unusual result. To see this, let us focus on a set of states that are comparable to Ohio in that they have seen relatively competitive statewide races in recent decades and are large enough to have four or more congressional districts. To measure statewide partisanship in a way that facilitates cross-state comparison, I have assembled data on presidential and U.S. Senate elections. For each redistricting cycle, I calculate the average Republican share of the two-party vote in Senate and presidential elections.[8] Next, for each redistricting cycle, I calculate the share of all congressional seats won by Republican candidates.

23. In Figure 2, the data markers indicate the state and the year that the relevant redistricting plan went into effect. States with districts drawn by legislatures under unified Republican control are indicated in red. States with districts drawn by independent commissions, courts, or divided legislatures are indicated in black. And states where districts were drawn under unified Democratic control are indicated in blue.[9] The dotted line indicates proportionality—where, for instance, 50 percent of the vote translates into 50 percent of the seats, 52 percent of the vote translates into 52 percent of the seats, and so on. In Figure 2, in order to focus on states most similar to Ohio and facilitate legibility, I zoom in on a group of the most evenly divided states, where statewide partisanship is between 44 and 56 percent. I also include a graph that includes all the states in the appendix.

[8] In a few states, I also have access to data on statewide executive offices, e.g., Governor, Attorney General, Railroad Commissioner, Treasurer, and the like. However, the mix of elected offices varies from one state to another, and comparable data are unavailable in some states. I elect to use statewide races for *national* elections only (president and U.S. Senate) in order to facilitate cross-state comparison.

[9] Information about control of the redistricting process was obtained from https://redistricting.lls.edu/.

Figure 2: Vote Shares in Statewide Elections and Seat Shares in Congressional Elections, Evenly Divided States With Four or More Districts, 2000 and 2020 Redistricting Cycles



24. For the most part, districts drawn by courts, divided legislatures, and independent commissions come closer to proportionality than those drawn by legislators. This can be seen most clearly *within* states where the districts were redrawn during a redistricting cycle due to litigation—including Virginia, Pennsylvania, North Carolina, and Florida. In these states, Republican-drawn maps led to Republican seat shares far beyond the party's statewide support, and plans drawn by courts came much closer to proportionality. While Democrats have controlled the redistricting process in very Democratic states like Maryland, Illinois, and Massachusetts (see the appendix), they have rarely done so in the relatively competitive states featured in Figure 2. But the Republican Party has been able to draw the districts over the last two redistricting cycles in a large number of relatively competitive states, including Florida, Michigan, Virginia, Pennsylvania, Wisconsin, North Carolina, Georgia, Missouri, Indiana, and Ohio. As can be seen in Figure 2, throughout the range of statewide vote shares—from Democratic-leaning states like Pennsylvania to Republican-leaning states like Indiana—Republican candidates have been able to win surprisingly large seat shares in the states where districts were drawn by unified Republican legislatures. This group includes notoriously gerrymandered states, including North Carolina, Pennsylvania, and Florida, where state courts eventually invalidated maps that favored Republicans in ways that violated state constitutions.

25. Even among this group of highly partisan maps, Ohio stands out. The data marker titled "Ohio 2012" corresponds to the observed seat share of Republican candidates throughout the 2010 redistricting cycle (12 of 16 seats in each election, or 75 percent). And the data marker titled "Ohio 2022" is the anticipated seat share, calculated as described above at 80 percent, for the 2021 Congressional Plan.

26. As can be visualized in Figure 2, with one exception, the absolute vertical distance from the dotted line of proportionality to the "Ohio 2022" data marker is larger than for all other relatively competitive states with four or more districts over the last two redistricting cycles.[10]

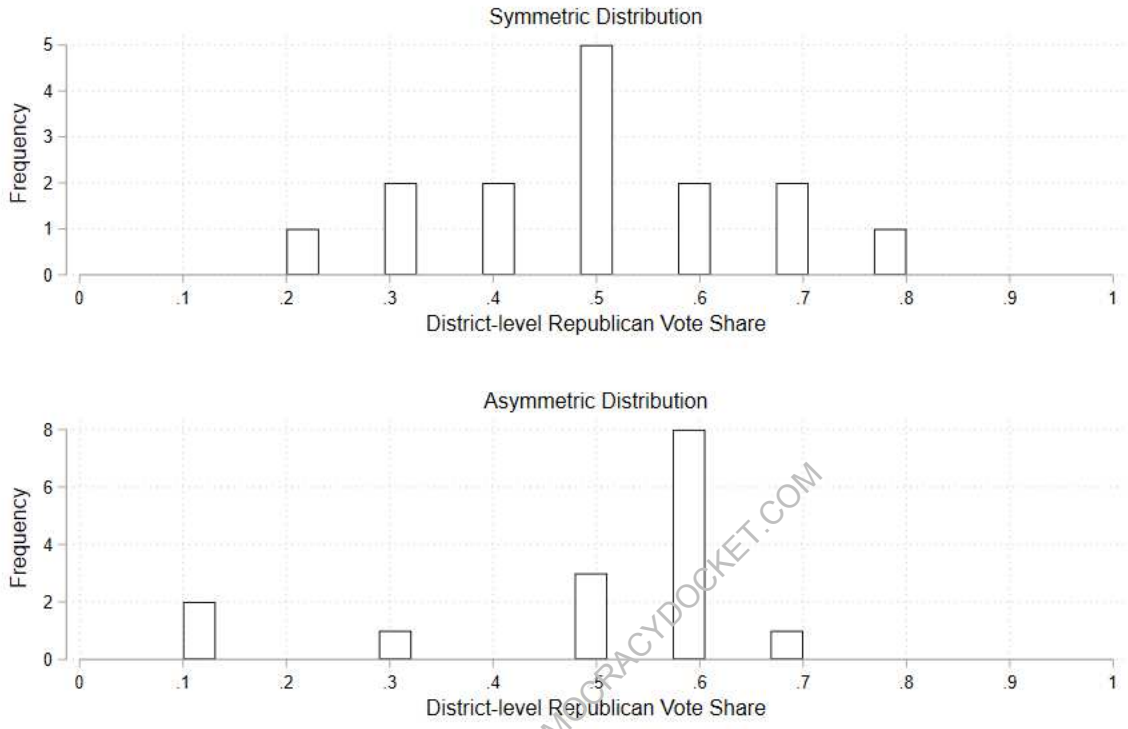
27. When attempting to assess the impact of a redistricting plan on the relative advantage or disadvantage it provides to the parties, it is important to go beyond simply calculating the difference between a party's statewide support and its seat share. For many realistic scenarios in which partisans are distributed across districts without political manipulation of the district boundaries, we can anticipate that the party with more votes will usually win more than a proportional share of seats. To see why this is true, imagine a simple example of a state with 15 districts, where there are 10 voters in each district, and party registration is distributed as displayed in the columns labeled "Example 1" in Table 3 below.

Table 3: Examples of Symmetric and Asymmetric Distributions of Votes Across Districts in a Hypothetical State

	Example 1: Symmetric Distribution		Example 2: Asymmetric Distribution	
District	Democrats	Republicans	Democrats	Republicans
1	2	8	3	7
2	3	7	4	6
3	3	7	4	6
4	4	6	4	6
5	4	6	4	6
6	5	5	4	6
7	5	5	4	6
8	5	5	4	6
9	5	5	4	6
10	5	5	5	5
11	6	4	5	5
12	6	4	5	5
13	7	3	7	3
14	7	3	9	1
15	8	2	9	1

[10] The exception is Oregon between 2002 and 2010, where the Democratic candidates won the four coastal districts and the Republican candidate won the single interior district in spite of a statewide Republican vote share of around 45 percent.

Figure 3: Distribution of Vote Shares Across Districts in Two Redistricting Plans in Hypothetical State

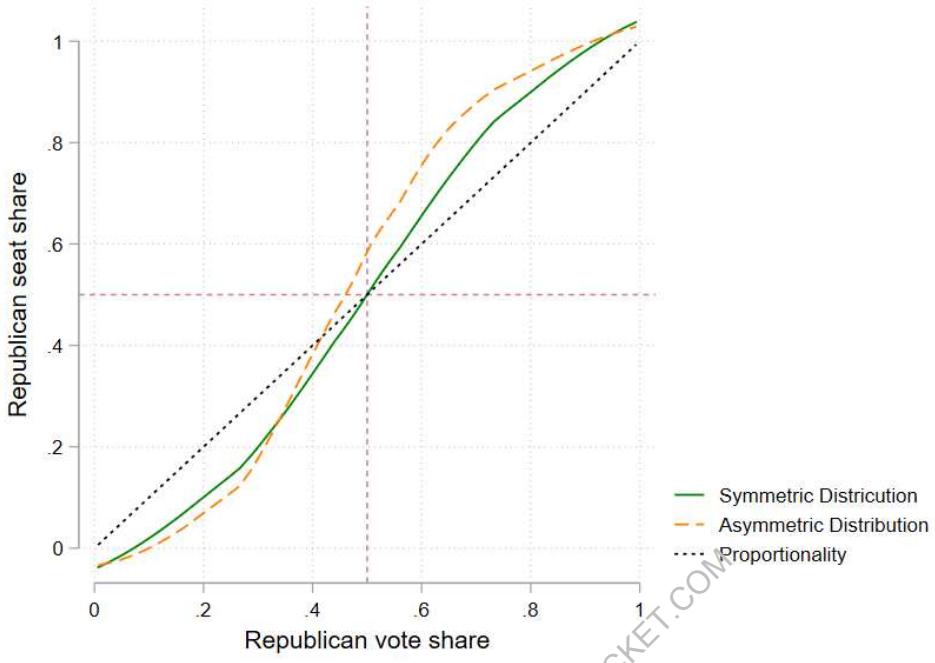


28. In this example, there are 75 Democrats and 75 Republicans. Under normal circumstances, each party can expect to win 5 districts, but 5 districts are toss-ups containing even numbers of Democrats and Republicans.

29. The top panel of Figure 3 uses a histogram—a simple visual display of the data from Table 3—to display the distribution of expected vote shares of the parties across districts in this hypothetical state, with its symmetric distribution of partisanship.

30. Let us assume that the partisanship of some of the individuals in this state is malleable, such that a successful campaign, a good debate performance by a candidate, or a strong economy leads some of the registered Democrats to vote for Republicans. Let us randomly choose one Democrat in the state and turn her into a Republican. Let us perform this random vote-flipping exercise 10,000 times, take the average, and see how this very small change in voting behavior—just one party-switcher out of 150—can be expected to affect the parties' seat shares. Let us do that with two of the Democrats, three, and so on, all the way until the overall Republican vote share approaches 100 percent. We can perform the same operation in the other direction, systematically turning random Republicans into Democrats.

Figure 4: Hypothetical symmetric vote-seat curve



31. How do these alternative scenarios affect the seat share? The result of these simulated scenarios is displayed with the green line in Figure 4. The horizontal axis is the Republican vote share, and the vertical axis is the corresponding seat share. The green line provides a plot of what happens to the seat share as the Republican vote share increases and decreases from 50 percent.

32. The green line in Figure 4 is a standard vote-seat curve associated with a symmetric distribution of partisanship across districts. It is a foundational observation in the literature on majoritarian elections that when the distribution of partisanship across districts approximates the normal distribution, with its bell-shaped appearance, the transformation of votes to seats will look something like the green line in Figure 4. With 50 percent of the vote, a party can expect 50 percent of the seats. However, note what happens when the Republican Party is able to obtain 55 percent of the votes—it receives around 60 percent of the seats. This phenomenon is known as the "winner's bonus." This happens because there are several districts where the underlying partisanship of the electorate is evenly divided, such that with 55 percent of the overall statewide vote, the Republican Party can win several of these pivotal districts, thus providing it with a disproportionate share of the seats.

33. When we observe a situation in which a party wins 55 percent of the vote but something like 59 or 60 percent of the seats, we cannot necessarily conclude, without further analysis, that the district boundaries have been drawn to help or harm a political party. The "winner's bonus" is a basic feature of majoritarian electoral systems. An important feature of the green line in Figure 4, however, is that it treats each party exactly the same. That is, the Democrats can expect the exact same "winner's bonus" as the Republicans when they are able to win over more votes. This partisan symmetry is a lower standard to meet than one that requires

proportional outcomes, because it merely ensures that any "winner's bonus" could be applied to either party relatively evenly, and that thus, both parties have similar incentives to be responsive to voters.

34. Next, let us consider the same state, with the same even split in party registration, but with a different set of district boundaries, drawn strategically by the Republican Party. In this example, provided numerically on the right-hand side of Table 3 (labeled as "Example 2"), and visually with a histogram in the lower panel of Figure 3, Democrats are "packed" into three extremely Democratic districts, and districts have been drawn so as to avoid Democratic majorities to the extent possible elsewhere. There are fewer truly competitive districts, and there is a much larger number of districts that are comfortably, but not overwhelmingly, Republican. With this type of arrangement, with 50 percent of the vote, the Republicans can expect to win well over half the seats.

35. I apply the same simulation procedure as described above and display the resulting relationship between seats and votes with the orange dashed line in Figure 4. We can see that in this example, the Republican Party enjoys a substantial advantage in the transformation of votes to seats over Democrats. It can lose a majority of votes statewide but still win legislative majorities, and it receives a very large seat premium when it achieves even a slight victory in statewide votes. In this second example, the treatment of the two parties is far from symmetric.

36. Political scientists and geographers have attempted to measure this type of asymmetric distribution of partisans across districts—and the resulting asymmetry in the transformation of votes to seats. What has now become the most common approach is rooted in the work of British political geographers. In his 2000 Annual Political Geography Lecture, Ron Johnston described "wasted votes" as votes obtained in constituencies that a party loses, while "surplus votes" are additional votes obtained by a party in constituencies it wins beyond the number needed for victory.[11] In the example above, for instance, 6 is the number of votes required for victory in each district. Thus, if a party received 9 votes, 3 of them would be considered "surplus." In that same district of 10 voters, the losing party received 1 "wasted" vote. Johnston calculated wasted and surplus votes for the Labour and the Conservative parties in post-war British elections, as well as the share of "effective" votes received by each party: that is, votes that were neither "wasted" nor "surplus." The latter is a measure of the relative efficiency of support for the parties, and the gap between them is an indicator of the extent to which support for the Conservatives has been more efficient than support for Labour (or vice-versa).

37. More recently, Nicholas Stephanopoulos and Eric McGhee have adapted this concept to the context of redistricting and gerrymandering in the United States.[12] The terminology is slightly different. For Stephanopoulos and McGhee, the term "wasted votes" captures not just the votes obtained in a constituency the party lost, but also the surplus votes obtained in

[11] Ron Johnston. 2002. "Manipulating Maps and Winning Elections: Measuring the Impact of Malapportionment and Gerrymandering." *Political Geography* 21: pages 1-31.
[12] See Nicholas Stephanopoulos and Eric McGhee. 2015. "Partisan Gerrymandering and the Efficiency Gap." *University of Chicago Law Review* 82,831.

districts the party won: what Johnston called "ineffective votes." For Stephanopoulos and McGhee, "wasted votes" are all the votes received by a party in districts that it loses, combined with all the surplus votes beyond the winning threshold in districts it wins. They calculate the total wasted votes for each party in each district, tally them over all districts, and divide by the total number of votes cast. They refer to this construct as the "efficiency gap." To see how this works, let us return to our examples.

Table 4: Efficiency Gap Calculations in Hypothetical Examples

	Example 1: Symmetric Distribution				Example 2: Asymmetric Distribution			
District	Dem	Rep	Dem Wasted Votes	Rep Wasted Votes	Dem	Rep	Dem Wasted Votes	Rep Wasted Votes
1	2	8	2	2	3	7	3	1
2	3	7	3	1	4	6	4	0
3	3	7	3	1	4	6	4	0
4	4	6	4	0	4	6	4	0
5	4	6	4	0	4	6	4	0
6	5	5	0	0	4	6	4	0
7	5	5	0	0	4	6	4	0
8	5	5	0	0	4	6	4	0
9	5	5	0	0	4	6	4	0
10	5	5	0	0	5	5	0	0
11	6	4	0	4	5	5	0	0
12	6	4	0	4	5	5	0	0
13	7	3	1	3	7	3	1	0
14	7	3	1	3	9	1	3	1
15	8	2	2	2	9	1	3	1
Total	75	75	20	20	75	75	42	3

38. Table 4 includes columns to capture wasted votes for the Republicans and Democrats in both hypothetical examples. In the first example, the Republicans win the first district in a landslide, 8-2. They waste two votes (since they only needed 6 to win), and the Democrats waste two votes in their losing effort. At the bottom of the table, I sum the wasted votes for each party. The Democrats and Republicans each waste the same number of votes, 20. Thus, the efficiency gap is zero.

39. Next, consider the second example. The Republicans have a very efficient distribution of support such that they received six votes in several districts, while the Democrats wasted votes in a handful of districts that they won by large majorities. In this example, the Republicans waste only three votes while the Democrats waste 42. Thus, there is an efficiency gap of 39, which amounts to 26 percent of all votes cast.

40. Let us now apply this approach to the 2021 Congressional Plan in Ohio. First, I have summed up all the votes received by Democratic and Republican candidates in each of the statewide races from 2016 to 2020 listed above, and use these sums to calculate the efficiency gap. Aggregating precinct-level data from these races to the level of districts in the Enacted Plan, we see the efficiency gap associated with the Enacted Plan is quite large—24 percent—indicating that Republicans' votes are distributed across districts with far greater efficiency than those of Democrats. In fact, the distribution of partisanship created by the General Assembly's plan is quite similar to that in the second hypothetical example of Table 3.

41. In order to put this in perspective, it is useful to engage in some simple cross-state comparisons. As a metric, the efficiency gap is known to be less reliable in non-competitive states, as well as states with few congressional districts. Thus, I calculate the efficiency gap for the districts used in the last redistricting cycle, focusing on states with more than four congressional districts among the relatively competitive states featured in Figure 2 above. One drawback of the efficiency gap is that the measure is not always stable for a set of districts when one switches from using data from one election to another, depending on the individual quirks of incumbents and challengers, and patterns of split-ticket voting. In order to compare apples with apples and mitigate candidate-specific effects, I use data from the 2016 and 2020 presidential elections, aggregated to the level of congressional districts.

42. Using data from the 2016 presidential election, the efficiency gap associated with the Enacted Plan is almost identical to what I calculated using all of the Ohio statewide elections from 2016 to 2020: 24 percent. I also calculated the efficiency gap using the 2016 presidential election for the other large, competitive states discussed above. The efficiency gap associated with the Enacted Plan is larger than those observed in Colorado, Florida, Missouri, Arizona, Virginia, Indiana, Minnesota, Michigan, Georgia, and Wisconsin, surpassed only by Pennsylvania's notorious (and ultimately invalidated) map, where the efficiency gap calculated using 2016 presidential data was 38 percent.

43. Using data from the 2020 presidential election, the efficiency gap associated with the Enacted Plan is around 16 percent. This is slightly lower than the 24 percent figure associated with all statewide races, largely because relative to a typical statewide race in Ohio, the Republican candidate, Donald Trump, won by larger margins in rural areas, hence producing more wasted votes for Republicans, and Democratic candidate Joseph Biden won by slightly smaller margins in urban core areas, leading to slightly fewer wasted votes for Democrats. A similar phenomenon occurred in other states, however, and 16 percent is larger than the efficiency gap calculated using 2020 data for any of the other states mentioned above, this time with the exception of Wisconsin, where the efficiency gap was 27 percent.[13]

44. In addition to the efficiency gap, another approach to measuring partisan asymmetry is to calculate so-called electoral bias.[14] This approach flows directly from the vote-seat curves in

[13] Note that I do not have 2020 presidential data aggregated to the level of the court-invalidated Pennsylvania districts that were no longer in use in 2020.

[14] See Edward Tufte. 1973. "The Relationship Between Seats and Votes in Two-Party Systems," *American Political Science Review* 67: pages 540-554; Bernard Grofman. 1983. "Measures of Bias

Figure 4 above. Recall that because of the "winner's bonus" and the typical shape of vote-seat curves, if we observe that a party gets a seat share that is higher than its vote share, it could very well be the case that the other party would receive a similar bonus if it had received a similar vote share. We would like to know if, with a similar share of the vote, the parties can expect similar seat shares. If not, it indicates the presence of electoral bias favoring one party over the other.

45. From the observed distribution of district-level election results, one can simulate the relationship between votes and seats under other hypothetical vote shares than the one observed. Above all, it is useful to examine the hypothetical of a tied election: With 50 percent of the vote, can each party expect 50 percent of the seats? Or can one party expect a larger seat share due to its superior efficiency of support across districts? In the examples above, there is no electoral bias in the symmetric case, but in the asymmetric example, the (pro-Republican) electoral bias is 10 percent. This can be seen in Figure 4 above: a 50 percent vote share on the horizontal axis corresponds to a 60 percent seat share on the vertical axis.

46. I calculate the electoral bias based on all Ohio statewide elections from 2016 to 2020. This approach indicates that in a tied election, the Republican Party could nevertheless expect to win 10 of 15 seats, or around 66.7 percent, under the Enacted Plan. The measure of electoral bias, then, is 16.7 percent.

47. In recent years there has been a lively debate about whether courts should adopt a specific measure as a "talismanic" indicator of impermissible gerrymandering. The approach of this affidavit is neither to contribute to this debate nor endorse a specific measure. For the most part, critics of the various measures often dwell on the prospect that they will produce false negatives. That is, they might fail to recognize a gerrymander when one is in fact present.[15]

48. As can be appreciated from the discussion above, these metrics are not always stable when we switch from the analysis of one type of election to another. Statewide results and the spatial distribution of support can vary across elections in ways that push pivotal districts above the 50 percent threshold in some races but not others—especially when we are simulating hypothetical tied elections in order to calculate electoral bias. Perhaps the most vexing problem with these indicators is that, when we are attempting to assess the likely seat share associated with future elections in the next redistricting cycle from a single statewide election—for instance a presidential election—we ignore the power of incumbency. As described above, Ohio's Republican congressional incumbents typically outperform

and Proportionality in Seats-Votes Relationships," *Political Methodology* 9: pages 295-327; Gary King and R. Browning .1987. "Democratic Representation and Partisan Bias in Congressional Elections," *American Political Science Review* 81: pages 1251-1273; Andrew Gelman and Gary King. 1994. "A Unified Method of Evaluation Electoral Systems and Redistricting Plans," *American Journal of Political Science* 38, pages 514-544; and Simon Jackman. 1994. "Measuring Electoral Bias: Australia 1949-1993," *British Journal of Political Science* 24: pages 319-357.

[15] See, for instance, Jonathan Krasno, Daniel Magleby, Michael, D. McDonald, Shawn Donahue, and Robin Best. 2018. "Can Gerrymanders be Measured? An Examination of Wisconsin's State Assembly," *American Politics Research* 47,5: 1162-1201, arguing that the efficiency gap often produces false negatives.

statewide candidates by several percentage points. Thus, there is reason for deep skepticism about the notion that a statewide swing of 3 percentage points, for instance, would yield a Democratic victory in District 1 as drawn by the General Assembly, or that a statewide swing of four percentage points would yield a Democratic victory in District 15.

49. In any case, whether we pursue 1) a simple comparison of the anticipated seat share with the statewide vote share, 2) a measure of the efficiency of support across districts, or 3) electoral bias, it is clear that the Enacted Plan's districts provide a very substantial benefit to the Republican Party. That is, under any of these measures, and with regard to any of the individual elections or aggregated election results considered above, the 2021 Congressional Plan significantly advantages the Republican Party.

VI. HOW DOES THE 2021 CONGRESSIONAL PLAN TREAT INCUMBENTS?

50. In addition to analyzing the extent to which the Enacted Plan favors or disfavors a party in the aggregate, I have also been asked to examine the extent to which it disproportionately favors or disfavors the *incumbents* for one of the two parties. Under the previous plan, there were 12 Republican incumbents. One of these, Anthony Gonzalez, has announced his retirement. All of the remaining districts with Republican incumbents continue to have Republican majorities—most of them quite comfortable.

51. The only district with a Republican incumbent worthy of further discussion is District 1. The district had previously been drawn to bisect Cincinnati, which had the effect of preventing the emergence of a majority-Democratic district in a heavily Democratic urban area by creating two districts in which parts of Cincinnati were subsumed into Republican exurban and rural areas. The Ohio Constitution now requires that Cincinnati be wholly contained within a single district, which, to my understanding, given their residential addresses, required that two Republican incumbents end up in the same district (although there is no in-district residency requirement for candidates for the U.S. House in Ohio). However, one of the supposedly paired incumbents, Representative Brad Wenstrup, has announced that he intends to seek re-election in District 2, thereby eliminating the possibility of a double-bunking of incumbents in District 1.[16]

52. The legislature has redrawn District 1 to include many of the suburban and rural areas that had previously been in District 1, where Steve Chabot is a long-serving incumbent. By carving out the Democratic suburban areas north of Cincinnati and combining the city with extremely Republican rural areas, the legislature has managed to unify Cincinnati while only slightly increasing the district's Democratic vote share, thus likely keeping it safe for the Republican incumbent, who, as mentioned above, has benefited from a large incumbency advantage.

53. In all the other districts with Republican incumbents, safe margins have been maintained so that incumbents are likely to survive even a significant statewide swing toward the

[16] https://highlandcountypress.com/Content/In-The-News/In-The-News/Article/Rep-Wenstrup-announces-intent-to-seek-re-election-in-2nd-District/2/20/74059.

Democratic Party.

54. In contrast, of the four Democratic incumbents, only two continue to reside in majority-Democratic districts. The other two reside in dramatically reconfigured districts. Marcy Kaptur represented a relatively urban and comfortably Democratic District 9 (drawn in 2011 to pair Marcy Kaptur with another Democratic incumbent). This district has been redrawn to separate Ohio's northern industrial cities, thus subsuming Toledo in a much more rural district that now has a Republican majority. Tim Ryan, who has announced that he is running for the U.S. Senate, was the incumbent in District 13, which has been completely reconfigured as a predominantly rural, safe Republican district in the Enacted Plan.

VII. HOW DOES THE 2021 CONGRESSIONAL PLAN ACHIEVE THESE RESULTS?

55. Without a doubt, the Enacted Plan favors the Republican Party and its many incumbents, while disfavoring the Democratic Party and its handful of incumbents. One might suspect, however, that this outcome was driven not by the choices of the map-drawers, but by the Ohio Constitution—with its requirements about keeping counties, cities, and townships whole—combined with Ohio's political geography. I have written extensively about the difficulties for parties of the left in majoritarian democracies like the United States in an era when population density is becoming highly correlated with higher proportions of votes for more progressive candidates.[17] Democrats are highly concentrated in cities and, increasingly, their suburbs. When cities are very large relative to the size of districts, this tends to create some districts in which Democrats win very large majorities. This can make their geographic distribution of support relatively less efficient if Republican majorities in rural areas are not correspondingly large. Thinking visually in terms of cross-district histograms, like those in Figure 3 above, the presence of overwhelmingly Democratic cities can pull out the left tail of the distribution, thus wasting some Democratic votes. Anyone drawing congressional districts—including a non-partisan computer algorithm or even a Democratic activist—is likely to draw a very Democratic district in Cleveland or Columbus. It is also the case that such a map-drawer cannot avoid creating some extremely Republican districts in rural areas.

56. However, the larger implication for the transformation of votes to seats depends crucially on what is happening in the middle of the distribution of districts. This is precisely where those drawing the districts have maximum discretion. With a very Democratic city like Cincinnati that is *not* especially large relative to the size of congressional districts, it is possible to avoid the emergence of a Democratic district altogether by cutting off its most Democratic suburbs—splitting communities of interest along the way—and combining it with far-flung rural areas. If smaller Democratic cities are close to one another, as in northwestern Ohio, or as in the Canton/Akron/Youngstown area, boundaries can be drawn to make sure they do not combine to form any district with an urban, and hence Democratic, majority. And when cities are sufficiently large that they must be subdivided, and can thus provide *two* Democratic majorities, as in Columbus, it is possible to conduct this subdivision in a way that prevents the emergence of a second Democratic district by packing as many Democratic votes into a

[17] Jonathan Rodden, 2019, *Why Cities Lose: The Deep Roots of the Urban-Rural Political Divide*. New York: Basic Books.

single district as possible. The legislature has pursued each of these strategies to prevent the emergence of majority-Democratic districts in Ohio.

57. In my academic research, I have shown that residential geography can make life easier for those drawing districts with the intent of favoring Republicans. With maneuvers like those described in the preceding paragraph, a Republican map-drawer can produce a substantial advantage for Republican candidates without drawing highly non-compact or odd-shaped districts. My research has also pointed out that a mere concentration of Democrats in cities is insufficient to produce advantages for Republican candidates. It is clearly the case that in states where Republicans have controlled the redistricting process, districts have favored Republicans far more than anything that can be explained by residential geography alone. Recall the striking difference between the black and red data markers in Figure 2 above, indicating that with similar levels of partisanship, districts drawn by Republican legislators have had far larger Republican seat shares than those drawn by courts, commissions, and divided legislatures. In fact, in my academic writings, I have used Ohio in the 2010 redistricting cycle as a leading example of this phenomenon.[18]

58. In order to verify that the extreme pro-Republican bias described above was not forced upon the legislature by the Ohio Constitution or residential geography of Ohio, it is useful to conduct a simple exercise: we can examine the congressional maps submitted by Democrats and other groups in the state legislature. The purpose of this exercise is not to recommend these maps for adoption. Rather, these maps are useful because they were available to the legislature prior to adopting their map and, if they comply with the Constitution, demonstrate similar or superior compactness, pursue fewer unnecessary county splits, and are less prone to splitting obvious communities of interest, we can conclude that the extreme pro-Republican slant of the Enacted Plan was not driven by residential geography or constitutional requirements, but by discretionary choices.

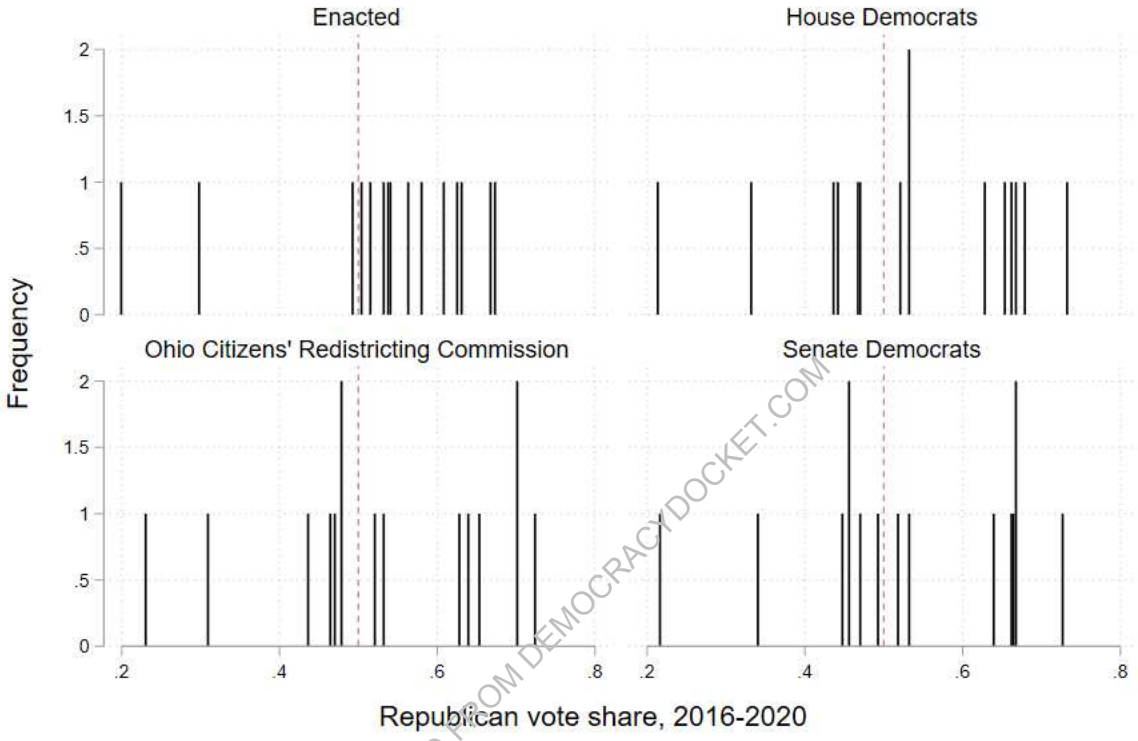
59. Figure 5 provides histograms of the composite vote share of statewide Republican candidates from 2016 to 2020—the same measure used extensively above—aggregated to boundaries of proposed congressional districts. The top left panel represents the enacted districts. The panels on the right represent districts proposed by the House (top) and Senate (bottom) Democrats, attached as Exhibits C and B, respectively. In the lower left-hand corner, I include a districting plan submitted by a group called the Ohio Citizens Redistricting Committee (OCRC), attached as Exhibit D.

60. Note that all the graphs share something in common. Each includes two extremely Democratic districts on the left-hand side of the graph. In each case, one is in Cleveland and one in Columbus. However, as described above, the Enacted Plan only includes a single additional district that is (barely) on the Democratic side of 50 percent, for a total of three. In the other comparison maps, there are seven districts with Democratic majorities in statewide races, six in the case of the House Democrats' plan. Thus, the Senate Democrats' plan and the OCRC plan, where 46.7 percent of the districts have Democratic majorities in statewide races, correspond almost exactly with the statewide aggregate vote share (see Table

[18] See, for example, *Why Cities Lose*, op cit., Figure 6.2 on page 171 and the surrounding discussion, as well as Figure 6.8 on page 184 and the accompanying discussion in the text.

1 above), while the House plan falls short by one seat. In other words, if these maps were included in Figure 3 above, they would be on, or slightly below, the dotted line of proportionality, much like the court-drawn maps in Figure 3.

Figure 5: Histograms of Enacted and Alternative Maps



61. The Enacted Plan is also unique in that it avoids creating extremely Republican rural districts on the right side of the histogram. The vast majority of districts have comfortable but not staggering Republican majorities. In all, it is a textbook case of a map that creates an extremely efficient distribution of support for one party and an inefficient distribution for the other. As mentioned above, the efficiency gap (using composite statewide election results between 2016-2020) is 24 percent. The other maps are far more even-handed. For the House Democrats' plan, it is 3.5 percent (still favoring Republicans). For the Senate Democrats' plan and the OCRC plan, the distribution of support is slightly more efficient for the Democrats, with gaps that are swung in the other direction of 3.7 percent and 3.6 percent respectively.

62. What accounts for these large differences in the efficiency of support for the two parties in the different maps? Above all, the answer lies in the treatment of urban areas.

63. First, consider the Enacted Plan's treatment of Hamilton County. Any treatment of Hamilton County that attempts to minimize splits and keep Cincinnati-area communities together would produce a majority-Democratic district. Any such district would keep northern suburbs with large Black populations, like North College Hill and Mount Healthy, together with similar neighborhoods across the Cincinnati boundary. Each of the alternative maps

keeps Hamilton County mostly whole, and keeps the Black community together, in a relatively compact district contained entirely within the county.

Figure 6: Partisanship and the Enacted Plan's Districts, Hamilton County and Surroundings

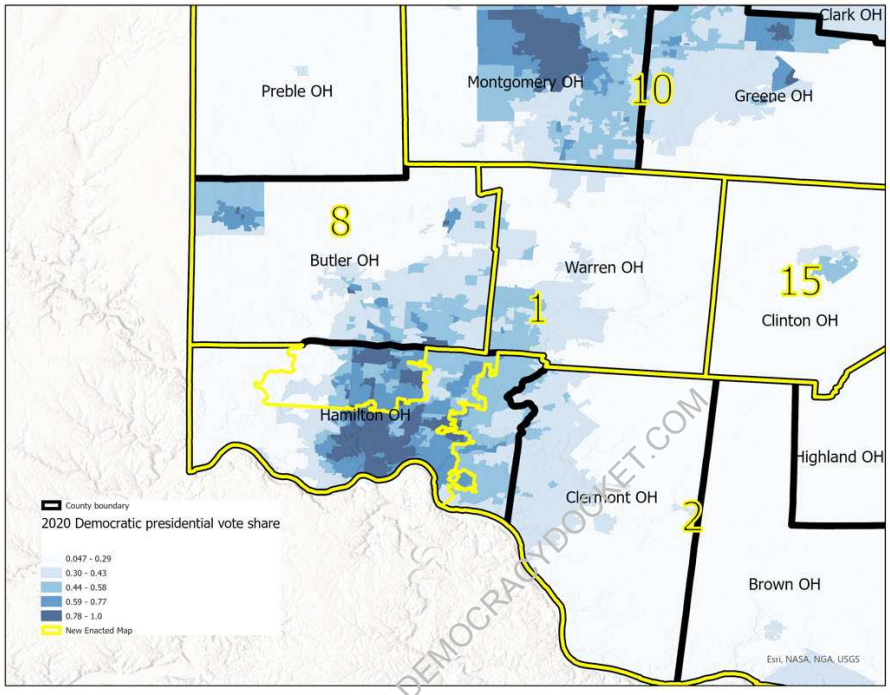
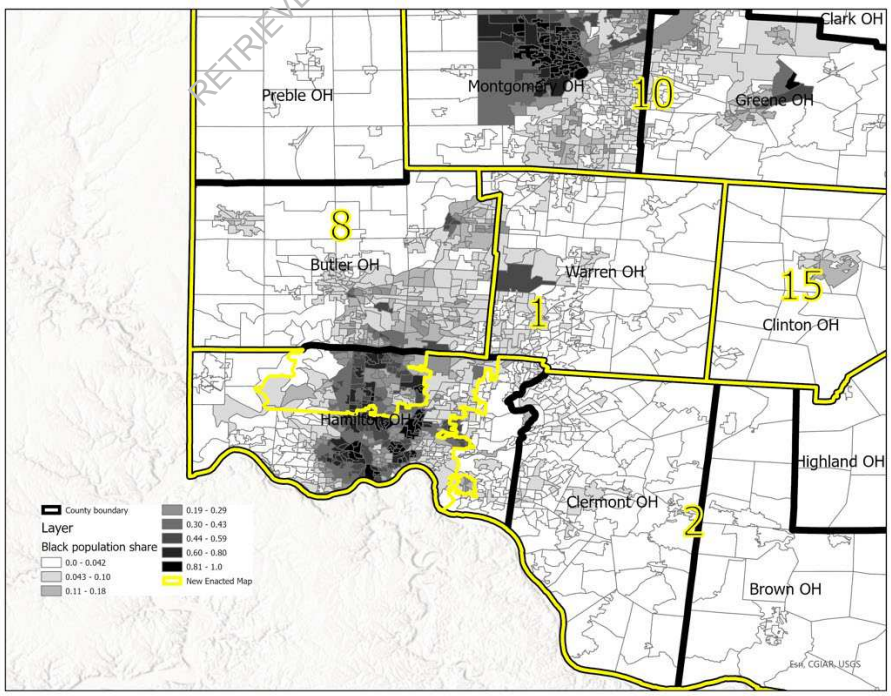


Figure 7: Race and the Enacted Plan's Districts, Hamilton County and Surroundings



64. However, the Enacted Plan traverses the Hamilton County boundary in *three* different places in order to overwhelm Cincinnati's Democratic population with a sufficient number of exurban and rural Republicans. The entire urban, Black population of Northern Hamilton County is carved out from its urban surroundings and combined with a rural Republican district, District 8, whose northern boundary is 85 miles away. Second, instead of being combined with its immediate inner-ring suburbs, Cincinnati is combined with rural Warren County via a very narrow corridor in District 1. Finally, Cincinnati's eastern suburbs are extracted and combined with District 2, which is extremely rural and Republican.

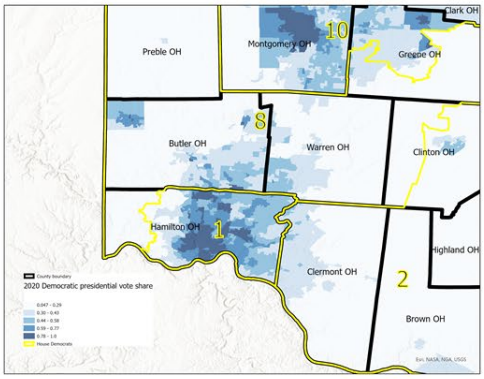
65. This can be visualized in Figure 6, which overlays the Enacted Plan on a map of partisanship, from precinct-level results of the 2020 presidential election. Figure 7 then overlays the district boundaries on a map that shows the area's racial composition. It highlights the extent to which the Enacted Plan splits Hamilton County's Black population.

66. Under any method of counting splits, the Enacted Plan's approach involves at least two splits of Hamilton County—a line running north-south on the east side of the county and another one that carves out the northern suburbs. These maneuvers are clearly not necessary for any reason other than partisan advantage. Each of the alternative plans keeps metro Cincinnati together in a compact district remaining within the county, avoids splitting the Black community, and splits the county only once.

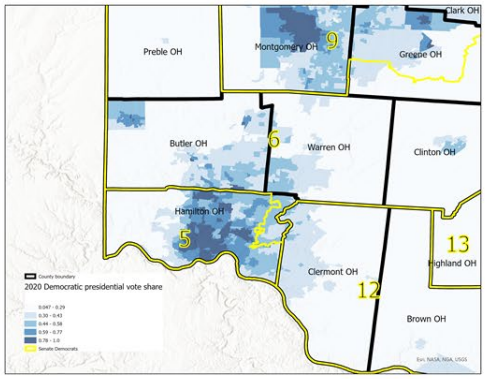
67. The arrangement of these plans can be seen in Figure 8. Clearly, it is quite straightforward to draw a district that is compact, minimizes splits, and keeps the Black community together. Notably, these arrangements all produce a majority-Democratic district (56.5 percent for the House Democrats' plan, 55.4 percent for the Senate Democrats' plan, and 56.4 percent for the OCRC plan).

Figure 8: Partisanship and Districts of Alternative Plans, Hamilton County and Surroundings

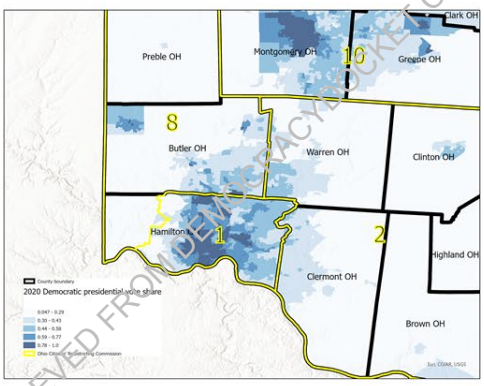
House Democrats



Senate Democrats

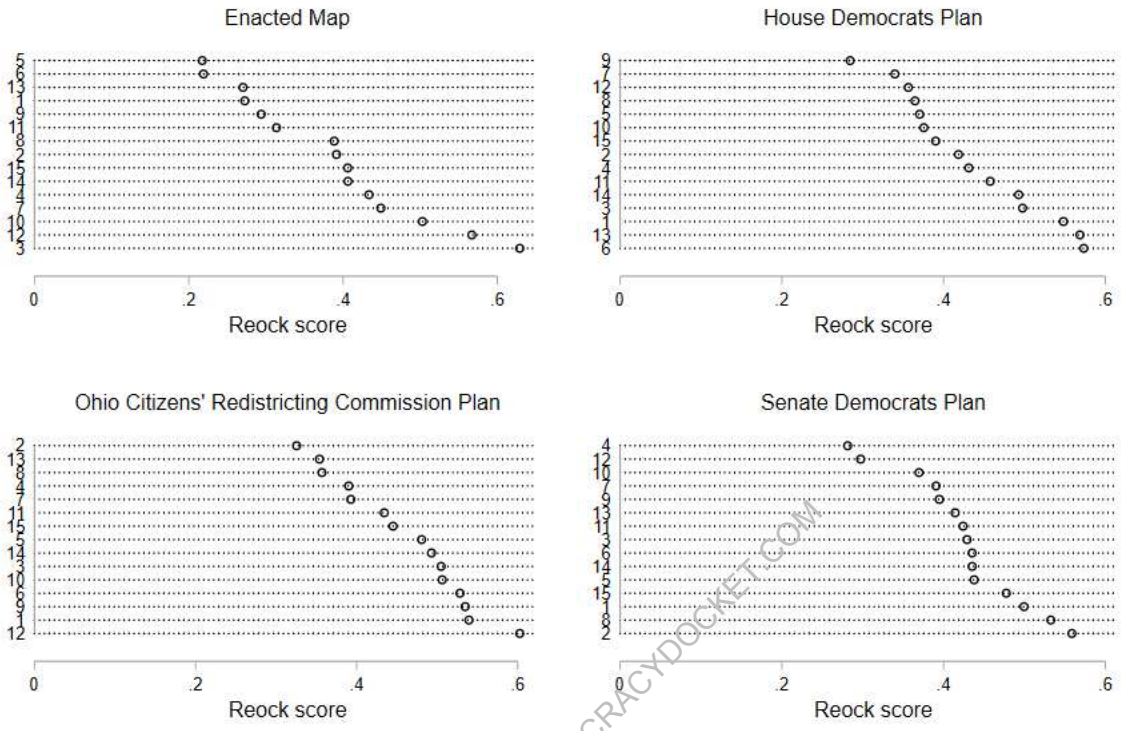


Ohio Citizens' Redistricting Commission



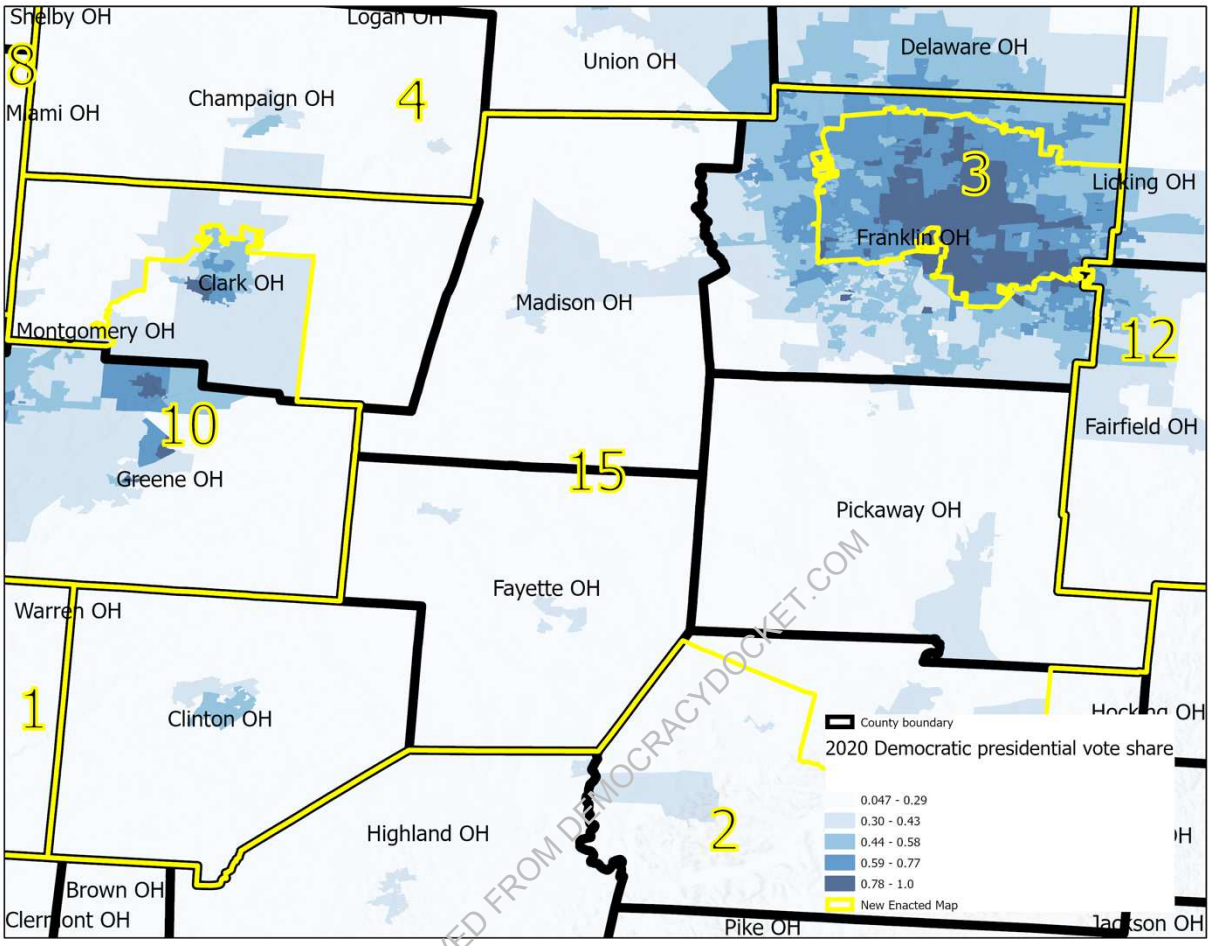
68. These alternative plans are also more compact than the Enacted Plan, both in the areas in and around Hamilton County and (as discussed below) plan-wide. Higher Reock score values indicate greater compactness. The Reock score for the General Assembly's District 1 was .27. The Reock score for District 1 in the OCRC plan is .54, and the score for the comparable district (5) in the Senate Democrats' plan is .44. Summary information about Reock scores for all the districts in each of these plans is provided in Figure 9 below.

Figure 9: Reock Scores for Enacted and Alternative Plans



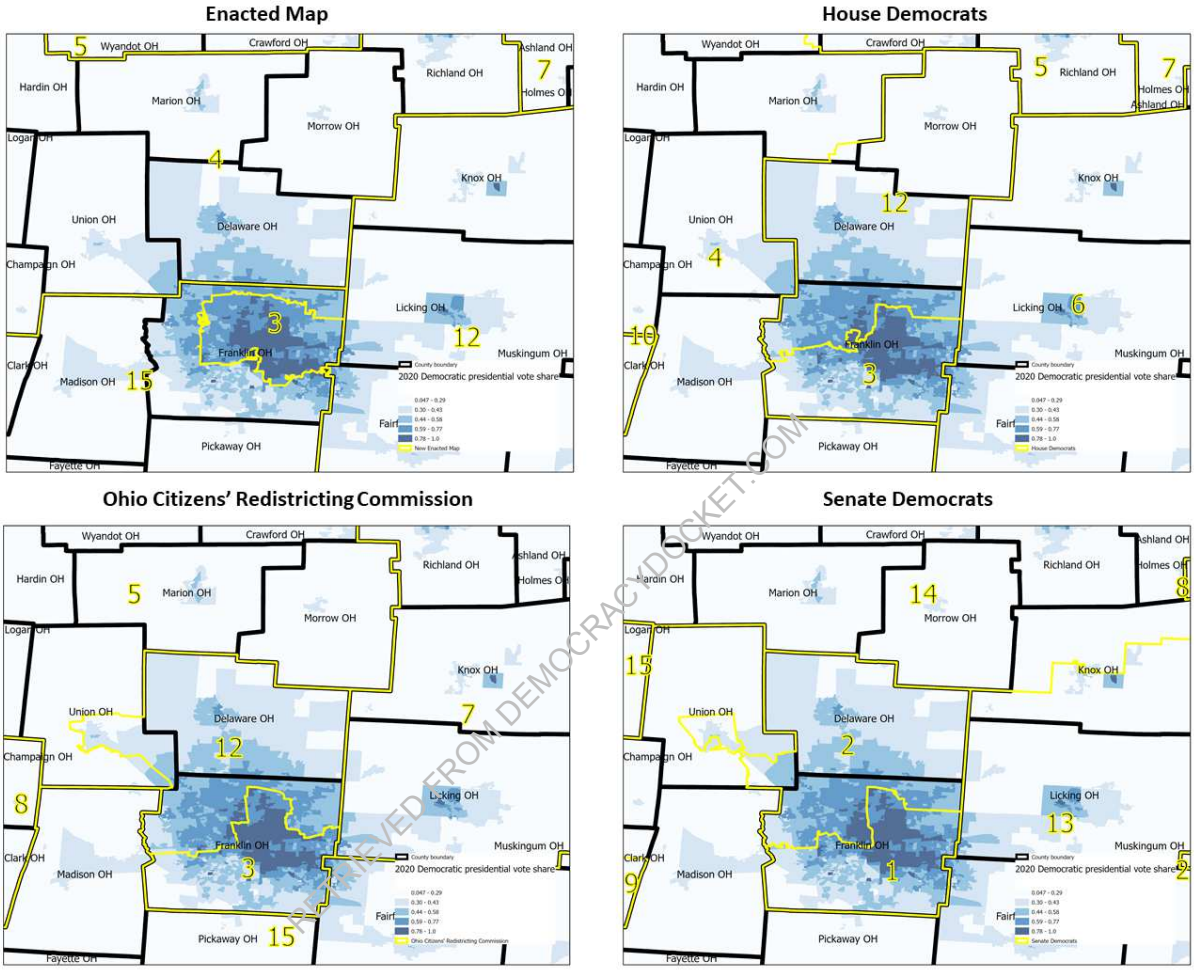
69. Next, consider the Columbus area in Franklin County. The city of Columbus is larger than a unit of congressional representation, so it must be split. In Cincinnati, it was possible to maneuver to avoid the creation of a Democratic district that would have otherwise emerged. But in Columbus, the number of Democratic voters was simply too large to pursue that strategy. The Enacted Plan in Franklin County packs Democrats into one very Democratic Columbus district (District 3). It then reaches around the city to extract its outer reaches and suburbs, connecting them with far-flung rural communities to the southwest—an arrangement that prevents the emergence of a second Democratic district by removing Democratic Columbus-area neighborhoods from their context and submerging them in rural Republican areas (see Figure 10).

Figure 10: Partisanship and Enacted Districts, Columbus and Surroundings



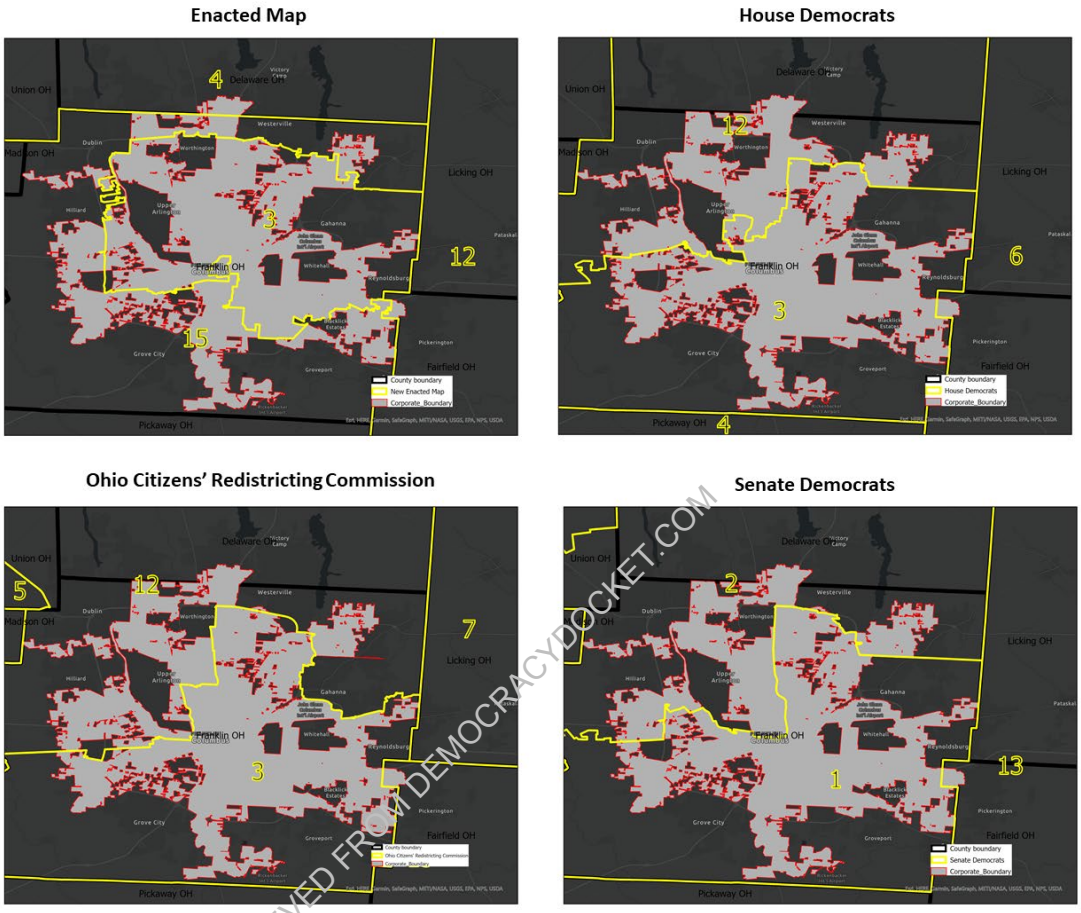
70. In contrast, the alternative plans split Columbus with a line that runs from west to east (see Figure 11). This arrangement creates a compact southern Columbus district that includes much of the city and its southern suburbs, and a relatively compact northern Columbus district that is able to include all of the northern reaches of the city and its suburbs. In northern Franklin County, the cities of Westerville, Columbus, and Dublin all cross over into Delaware County, and these alternative plans keep them together. In fact, Dublin also extends into Union County, and the Senate Democrats' plan and the OCRC Plan extend into Union County and keep Dublin whole. Given the fact that Columbus and its suburbs spill into counties to the north, if one is attempting to keep communities together, the northern border—not the western border—is the obvious place to extend the second Franklin County/Columbus district.

Figure 11: Partisanship and Enacted and Alternative Districts, Columbus and Surroundings



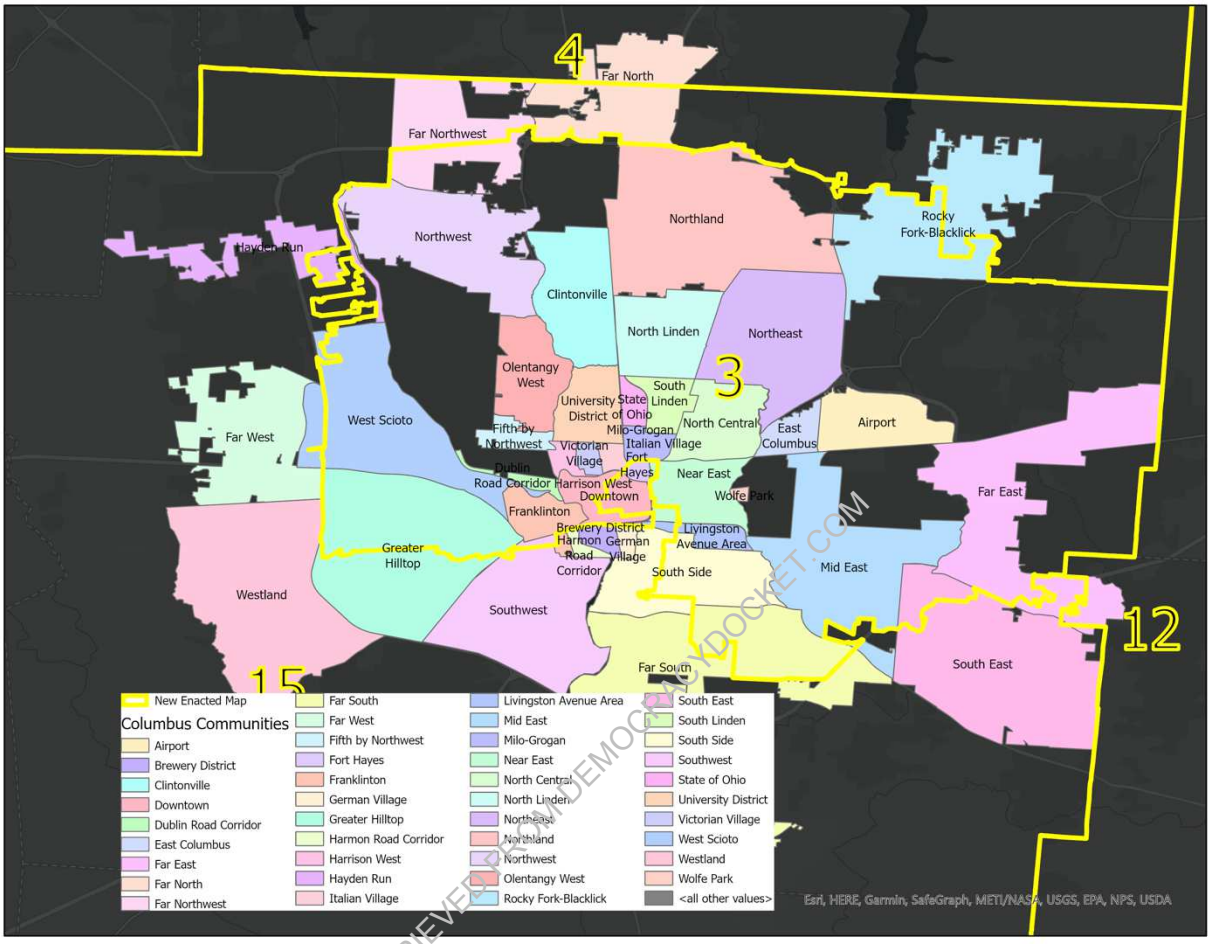
71. The Enacted Plan produces several non-contiguous chunks of Columbus that are removed from the city and placed in largely rural District 15. Figure 12 features the Columbus Corporate Boundary and its interaction with the Enacted Plan as well as the alternative plans. In the Enacted Plan, there are five chunks of non-contiguous territory that are carved away from Columbus and placed in District 15 (two in the north, one in the west, one in the southwest, and one in the southeast). In contrast, each of the alternative plans places two non-contiguous chunks of Columbus in its northern Columbus-oriented district, and the House Democrats' plan also includes a third tiny non-contiguous sliver of Columbus that abuts Upper Arlington and Grandview Heights.

Figure 12: The Boundary of the City of Columbus and Boundaries of the Enacted Plan and Alternative Plans



72. Perhaps a better way to contrast the way these redistricting plans treat Columbus is to examine its communities. The city of Columbus produces maps of areas recognized by the city as distinct communities. Figure 13 provides a map of Columbus communities and the boundaries of the Enacted Plan. Due to its circumnavigation of the city, the Enacted Plan splits 15 of Columbus' communities (16 if we include the Far North, which extends into Delaware County). For instance, the northern part of the Rocky Fork-Blacklick area is extracted and placed in a rural district that curls around the city and extends 100 miles to the southwest. On the south side of Columbus, the Hilltop neighborhood is cleaved down the middle. Residents on the north side of Sullivant Avenue are in an urban district with a large Democratic majority, while residents on the south side of the street are in a rural district that extends to the southwest part of the state. Along the eastern boundary of Franklin County in the southeast part of Columbus, several neighborhoods with large minority populations are split between the Columbus-based District 3 and the rural District 15.

Figure 13: The Boundary of the Communities of the City of Columbus and Boundaries of the Enacted Plan

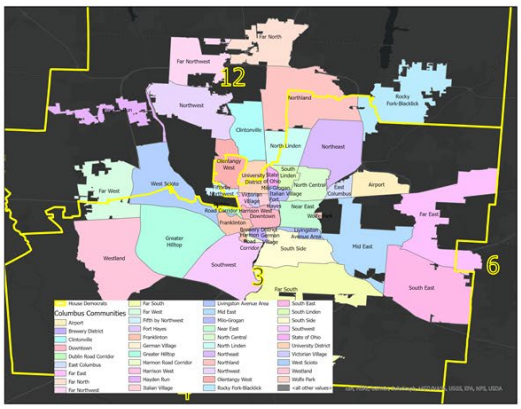


73. The approaches taken to dividing Columbus in the alternative plans produce fewer subdivisions of Columbus communities. The House Democrats' plan splits eight communities, while the Senate Democrats' plan splits five, and the OCRC plan splits 10 (see Figure 14).[19]

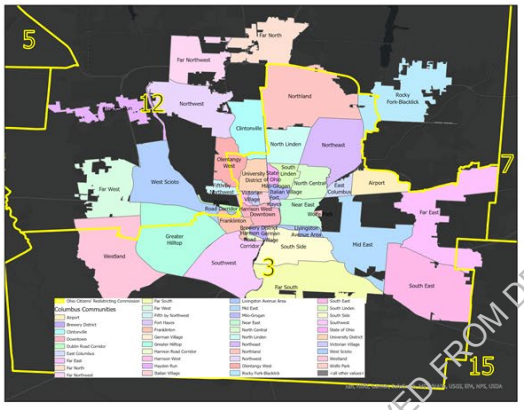
[19] In the Senate Democrats' and OCRC plans, one of these splits, to the community of Northland, involves a single small precinct that is separated from the rest of the community by Highway 270.

Figure 14: The Boundary of the Communities of the City of Columbus and Boundaries of the Alternative Plans

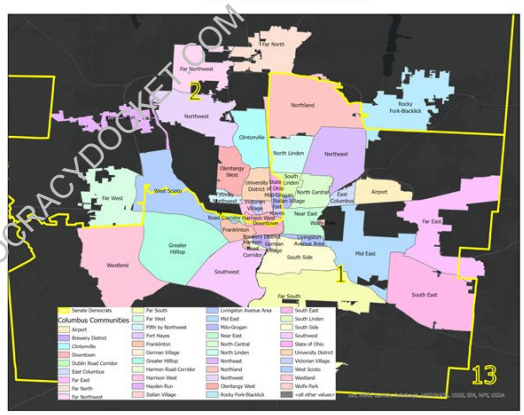
House Democrats



Ohio Citizens' Redistricting Commission



Senate Democrats



74. Next, consider Summit County and the Akron area. As with Cincinnati, the Enacted Plan cuts off Akron's eastern suburbs from the city. In this case, the maneuver introduces a long, narrow north-south corridor that is, in one spot, less than one mile wide, connecting a number of relatively urban, Democratic-leaning precincts, removing them from their geographic context, and combining them with rural areas well to the southwest. For example, Twinsburg, a small city nestled between Cleveland and Akron near the northern border of Summit County, is in a district with neither of them. Rather, it is part of a rural district well to the south, whose southwest border is over 70 miles away, where Ashland, Knox, and Richland counties come together. And rather than combining Akron with its own suburbs, the Enacted Plan combines it with rural Medina County and the most Republican outer exurbs of Cleveland (see Figures 15 and 16).

Figure 15: Partisanship and the Boundaries of the Enacted Plan, Northeast Ohio

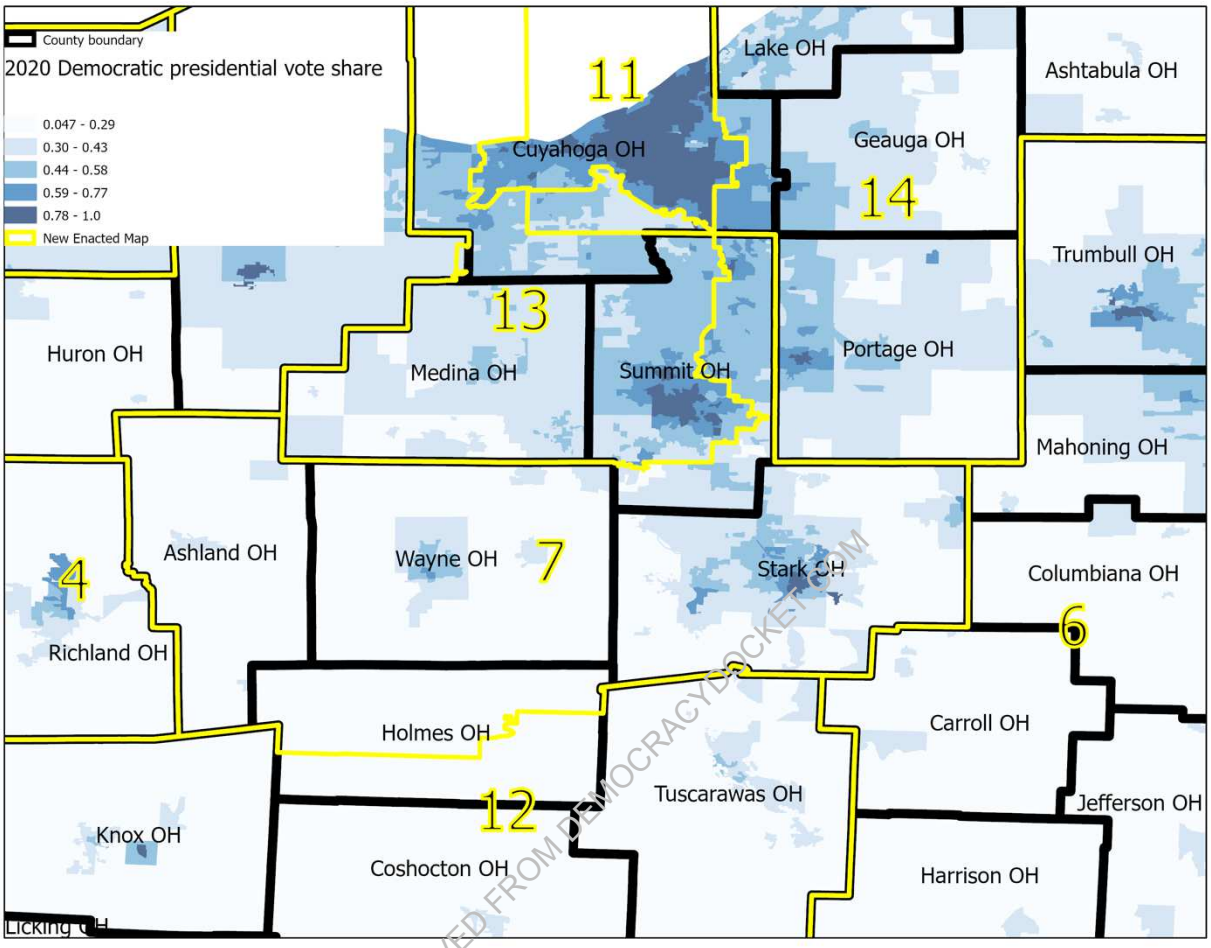
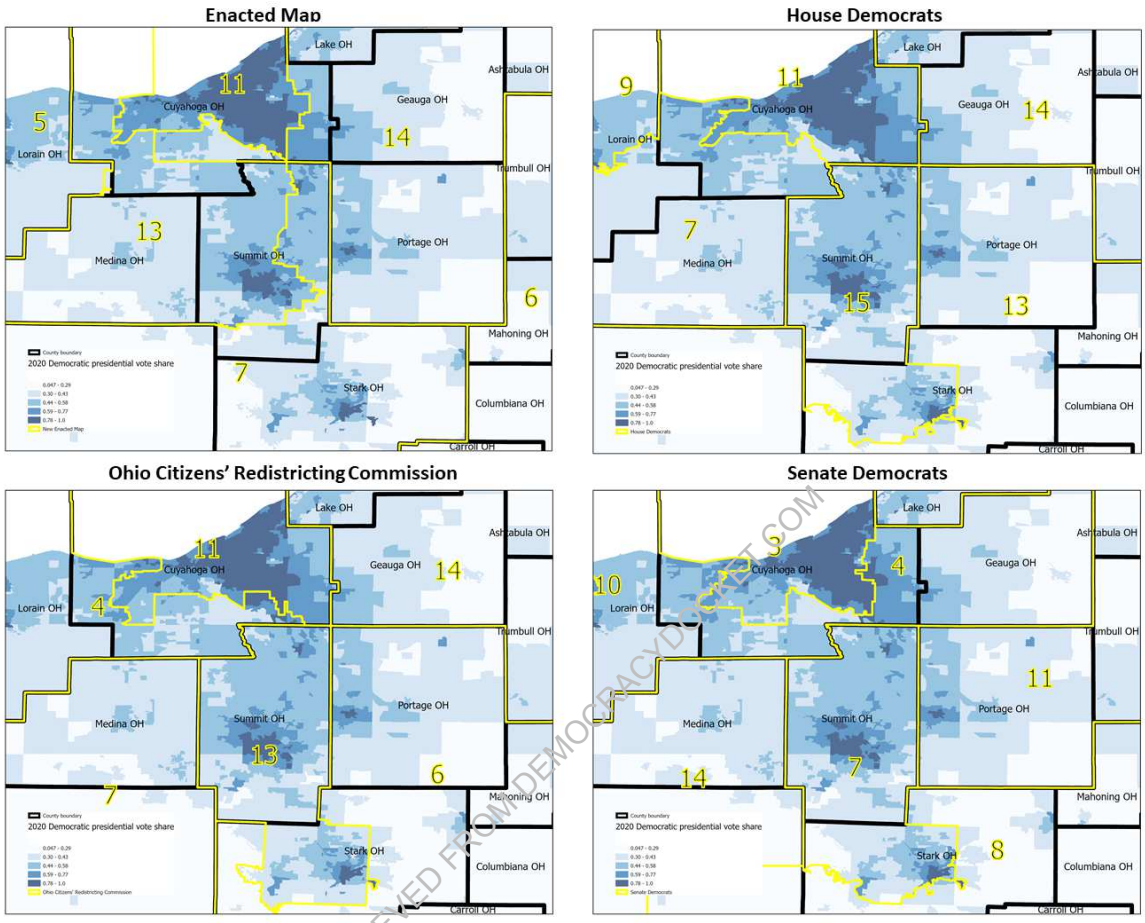


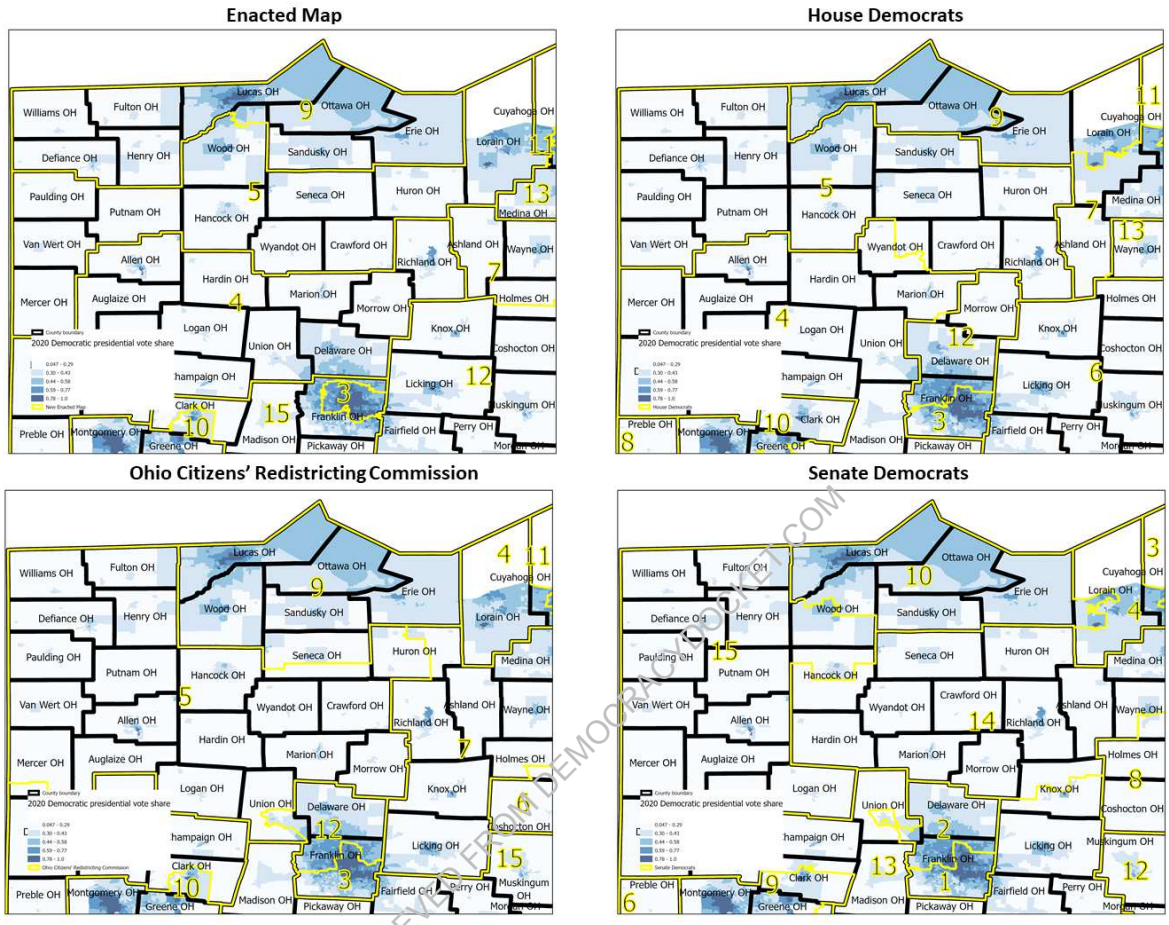
Figure 16: Partisanship and the Boundaries of the Enacted and Alternative Plans, Northeast Ohio



75. Next, consider Cuyahoga County and Cleveland. Here, the Enacted Plan produces multiple splits of Cuyahoga County—placing fragments in three different districts, and an arrangement featuring a narrow corridor that is, in one spot, the width of one census block, with no road connecting the fragments. In this area, four districts—7, 11, 13, and 14—converge upon an area spanning less than a square mile. The Cleveland-based District 11 nearly splits District 14 in half (i.e., making it noncontiguous), but for the grace of the one census block mentioned above.

76. Finally, consider Northwest Ohio. The Enacted plan and the three alternative plans are depicted in Figure 17. Each of the plans includes Toledo and draws a relatively narrow district that runs from West to East along the Michigan border and Lake Erie. However, the General Assembly's plan stops short of Lorain County and its Democratic cities, extending instead all the way to the Western border with an arrangement that, reminiscent of the Cincinnati strategy described above, combines Toledo with very rural areas. In this arrangement, the Democratic cities of Lorain County are removed from their geographic context and subsumed within a narrow rural district 5 that reaches all the way to the Indiana border.

Figure 17: Partisanship and the Boundaries of the Enacted and Alternative Plans, Northwest Ohio



77. In contrast, the plans created by the House Democrats and Senate Democrats simply extend the district slightly to the East—leaving out the Western rural counties—keeping the string of proximate industrial towns along Lake Erie together. The Senate Democrats' plan and the OCRC plan also extend into Wood County to keep Toledo's Southern suburbs together with the city. In contrast with the General Assembly's plan, each of these plans creates a Democratic-leaning district. According to the Reock score, the Senate Democrats and OCRC version of District 9 is more compact than the General Assembly's version.

78. In sum, the 2021 Congressional Plan includes consequential extra county splits vis-à-vis the alternative plans in Hamilton, Summit, and Cuyahoga Counties. It includes two counties—Hamilton and Cuyahoga—that are split between three districts, whereas the alternative plans never do this. If we simply add up county splits, there are 12 split counties in the Enacted Plan, but since two of them are split multiple times, the total number of splits is 14. The Senate and House Democrats' plans split 14 individual counties, while the OCRC plan splits 13 individual counties.

79. While prioritizing counties first, the Ohio Constitution also instructs those drawing the districts as a secondary priority to attempt to avoid splits of townships and as a third priority,

to avoid splits of municipal corporations. The Enacted Plan, along with those submitted by the Senate and House Democrats, achieved absolute population equality across districts. In order to do so, it was necessary to split a number of townships and/or cities. The General Assembly, along with the Senate and House Democrats, clearly placed considerable effort into minimizing these splits. OCRC did not attempt to achieve absolute population equality, and while its plan achieved fewer county splits than the other plans, it was less successful in avoiding township splits.

80. Of the four plans considered here, the plan submitted by the Senate Democrats performs the best when it comes to avoiding township splits. By my accounting, which is explained in Appendix B, this plan did not split any townships, while producing 15 city splits. The Enacted Plan created a total of 17 splits, 8 of which involved townships. The House Democrats' plan creates 19 splits, 13 of which involved townships. The OCRC plan produced 27 splits, all of which were townships except for the city of Columbus.

81. In addition to providing guidance about county splits, the Ohio Constitution also calls for compact districts. As already indicated in the discussion above, the Enacted Plan produces a set of districts that are less compact than those of the alternative plans. Average compactness scores across all districts, including the Reock, Polsby-Popper, and Convex Hull scores, are set forth in Table 5. With each of these scores, a higher number indicates a higher level of compactness. On each indicator, the Enacted Plan is less compact than the alternative plans.

Table 5: Average Compactness Scores

	Reock	Polsby-Popper	Convex Hull
Enacted Plan	0.38	0.28	0.73
House Democrats	0.43	0.33	0.78
Senate Democrats	0.43	0.29	0.76
OCRC	0.46	0.37	0.79

82. As described above, and as explained further elsewhere,[20] highly non-compact districts are sometimes an obvious manifestation of efforts by partisan map-drawers to favor a political party. Among the clearest examples are the notorious maps of Pennsylvania and North Carolina from the last redistricting cycle. In these cases, given the underlying political geography, such maps were necessary in order to generate the maximum possible number of Republican seats. However, it is a myth that such odd-shaped districts are the *sine qua non* of gerrymandering. Depending on the underlying political geography, it is sometimes possible to draw maps that are extremely favorable to a political party— maps that pack and crack one's opponents, divide communities, and maximize a party's seat share—without drawing long tendrils and comical shapes in every region. Likewise, sometimes relatively

[20] Rodden, *Why Cities Lose*, op cit.

non-compact districts are forced upon district-drawers by natural geography and the specific rules governing the redistricting process in a state.

83. For this reason, one should approach average, plan-wide compactness scores like those in Table 5 with caution—especially for cross-state comparisons. However, the discussion above demonstrates that the extreme favorability of the General Assembly's maps to the Republican Party and its incumbents required specific choices in certain urban areas, many of which clearly required non-compact districts, and a comparison with alternative maps clarifies that these choices were not forced by political geography or constitutional rules. The same is true about the General Assembly's decisions to unnecessarily split several urban counties and the communities within them.

VIII. CONCLUSION

84. The 2021 Congressional Plan is highly favorable to the Republican Party and its incumbents, and it disfavors the Democratic Party and its incumbents. This is true not because of the requirements of the Ohio Constitution or the political geography of Ohio, but because of discretionary choices made by those drawing the districts, which had the effect of "packing" Democrats into districts that they win by large majorities and "cracking" Democratic communities that would otherwise have produced majority-Democratic districts. In drawing districts to achieve partisan gain, the General Assembly sacrificed compactness, introduced unnecessary splits to urban counties, and divided a number of urban and suburban communities, including minority communities, throughout the state.

85. I have read the Complaint filed in this action and affirm that the factual allegations contained in paragraphs 2, 4, 13, 14, 61, 98-100, 116-24, and 126-30 are true.

Jonathan Rodden

Sworn to before me this 22nd day of November 2021.

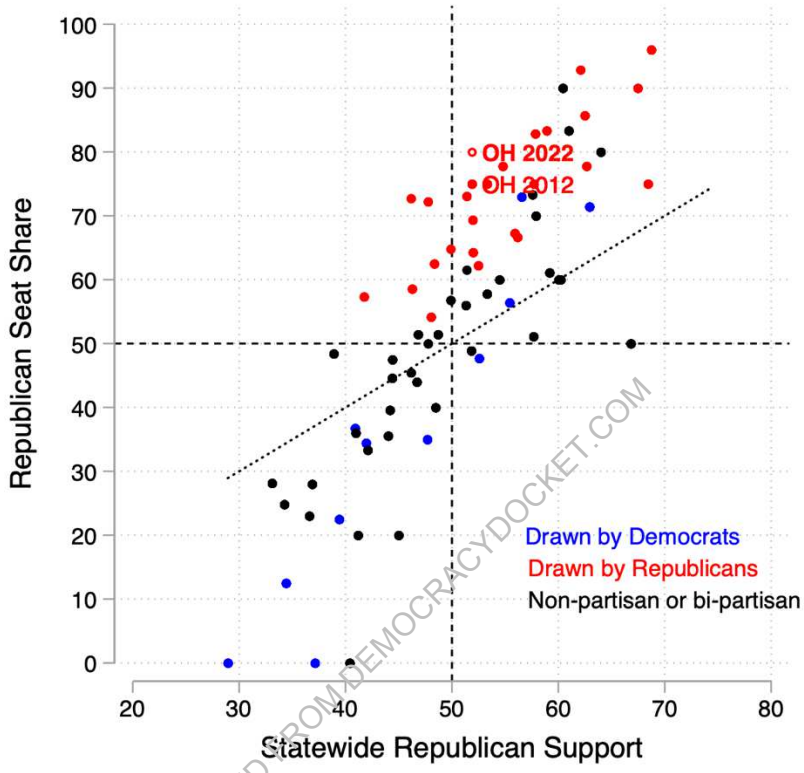
(See Attached Notarize.com Certificate for Notarization)

Notary Public

My commission expires 06/03/2025

Appendix A

Figure A1: Vote Shares in Statewide Elections and Seat Shares in Congressional Elections, 2000 and 2020 Redistricting Cycles, All States with 4 or More Seats



Appendix B: Splits of Municipal Subdivisions

I have attempted to assemble information on all the splits of townships and municipal corporations in the Enacted Plan and the three alternative plans. A complication is that cities and villages sometimes spill slightly over the boundary of a township, such that a district-drawer must choose between splitting the municipal corporation or the township. In such instances, I do not count a township that was clearly split in order to keep a municipal corporation whole, and likewise, I do not count splits of small fragments of cities that were clearly made in order to keep a township whole. I document these decisions in italics below. Furthermore, I attempt to avoid double-counting. If a single split of a municipal corporation also appears to split a township in which it is embedded, I only count a single split. As I discuss in the text, each of the plans introduces multiple splits of the City of Columbus, and I count each of these as a distinct split.

Enacted Plan

Sycamore Township and Kenwood CDP, Hamilton County
(This also splits Rossmoyne CDP, which is also in Sycamore Township, so count once).
Glendale Village, Hamilton County
Union Township, Ross County
City of Columbus, Franklin County (5 splits total, see main text)
Norwich Township is split, but this can potentially be explained by an effort to follow the Hilliard City line. Do not count
Green Township, Shelby County
Perrysburg Township, Wood County
Columbia Township, Lorain County
Belpre Township, Washington County
Berlin Township, Holmes County
Cuyahoga Falls City, Summit County
Stony Ridge CDP, but presumably this was done to keep Lake Township whole, so do not count.
Mad River Township and Green Meadows CDP (only count once), Clark County
Rocky River City, Cuyahoga County
Oakwood Village, Cuyahoga County

Total splits: 17, 8 of which are townships.

Senate Democratic Plan

Columbus City (two splits, see main text)
Marysville City, Union County
Berea City, Cuyahoga County
Madeira City, Hamilton County
Beavercreek City, Greene County
Massillon City, Stark County
Cambridge City, Guernsey County

Campbell City, Mahoning County
Wooster City, Wayne County
Springfield City, Clark County
Pike Township split to keep New Carlisle City together, so do not count
Amherst City, Elyria County
Amherst Township split to keep South Adams Village together, so do not count
Bowling Green City, Wood County
Mount Vernon City, Knox County
Findlay City, Hancock County
Total splits: 15, all cities.

House Democratic Plan

Mack CDP, also splits Green Township, Hamilton County; only count once as Township split
Union Township, Clinton County
Liberty Township, Clinton County
Buckskin Township, Ross County
Concord Township, Ross County
Dunham Township, Washington
Columbus City (3 splits, see text, see main text), Franklin County
Prairie Township is nominally split, but to keep Lake Darby CDP whole, so do not count
Waldo Township, Marion County
Antrim Township, Wyandot County
Pitt and Salem Townships nominally split in Wyandot County, but to keep the City of Upper Sandusky together, so do not count.
Walnut Creek Township, Holmes County
Dunham Township, Washington County
Lake Township, Ashland County
Seven Hills City, Cuyahoga County
North Ridgeville City, Lorain County
Beavercreek City, Greene County
Canton Township, Stark County
Poland Township, Mahoning County

Total splits: 19 total splits, 13 are townships

Ohio Citizens Redistricting Commission Plan

Colerain Township, Hamilton County
Racoon Township, Gallia County
Prairie Township, Franklin County
Columbus City, Franklin County (2 splits)
Blendon Township, Franklin County
Jefferson Township, Franklin County

Hartland Township, Huron
Fitchville Township, Huron
Greenwich Township, Huron
Dover Township, Union County
Paris Township, Union County
Jerome Township, Union County
Granville Township, Mercer County
Recovery Township, Mercer County
Big Spring Township, Seneca County
Richland Township, Guernsey County
Killbuck Township, Holmes County
Tuscarawas Township, Stark County
Lake Township, Stark County
Boardman Township, Mahoning County
Poland Township, Mahoning County
Coitsville Township, Mahoning County
Moorefield Township, Clark County
German Township, Clark County
Bethel Township, Clark County
Mad River Township, Clark County

Total splits: 27, all townships except Columbus

JURAT

State/Commonwealth of TEXAS)
)
☐ City ☑ County of Comal)

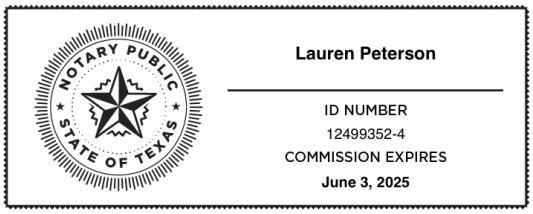
On 11/22/2021 (Date), before me, Lauren Peterson (Notary Name),
the foregoing instrument was subscribed and sworn (or affirmed) before me by:

Jonathan Rodden.
Name of Affiant(s)

❑ Personally known to me **-- OR --**

❑ Proved to me on the basis of the oath of N/A (*Name of Credible Witness*) **-- OR --**

☑ Proved to me on the basis of satisfactory evidence: driver_license (*Type of ID Presented*)



WITNESS my hand and official seal.

Notary Public Signature: Lauren Peterson

Notary Name: Lauren Peterson
Notary Commission Number: 12499352-4
Notary Commission Expires: 06/03/2025
Notarized online using audio-video communication

DESCRIPTION OF ATTACHED DOCUMENT

Title or Type of Document: Ohio Congressional Redistricting- Expert Affidavit

Document Date: 11/22/2021

Number of Pages (including notarial certificate): 39

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Notarize

Exhibit A

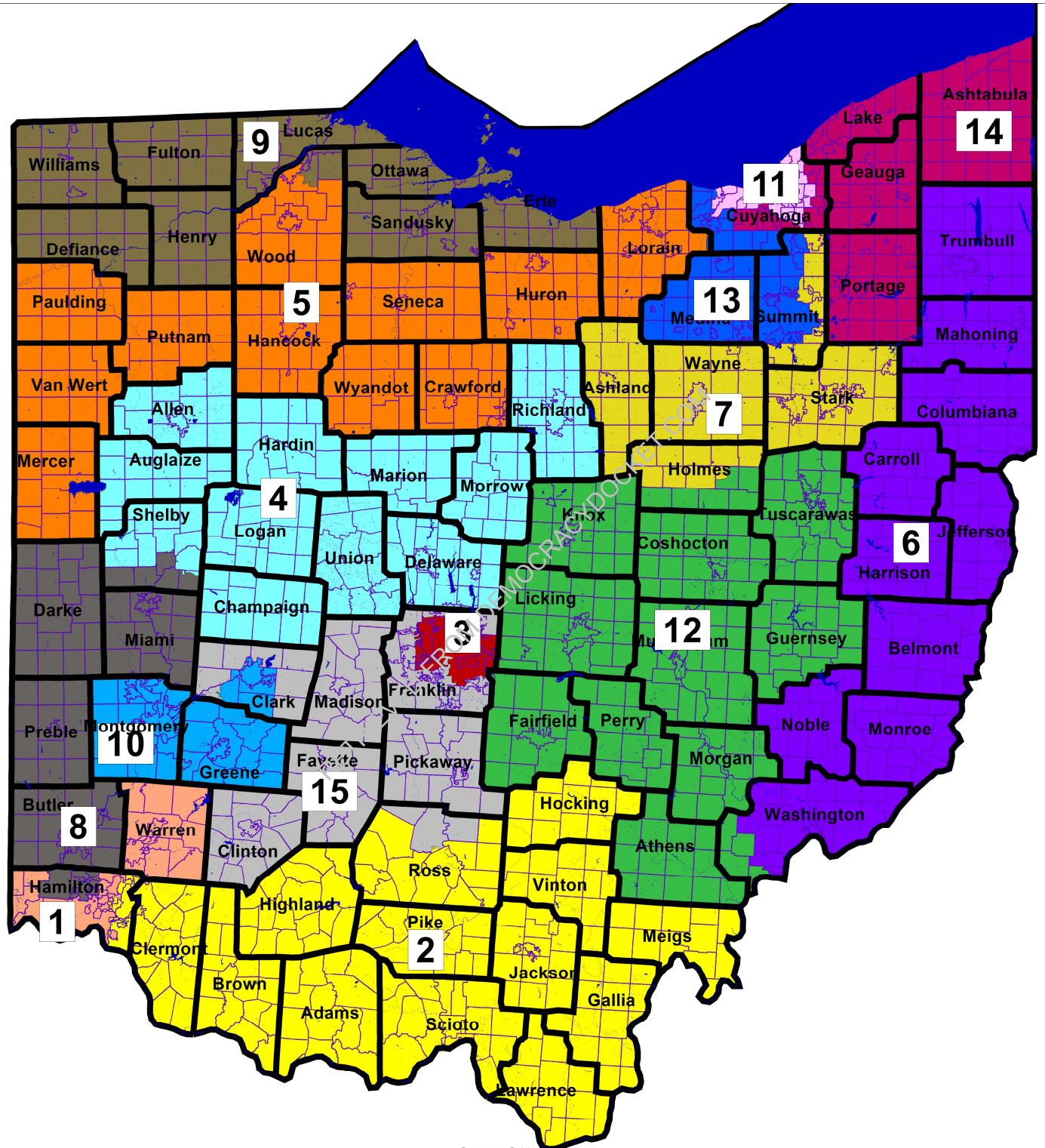

Exhibit B

Proposed Sub SB 237 Map

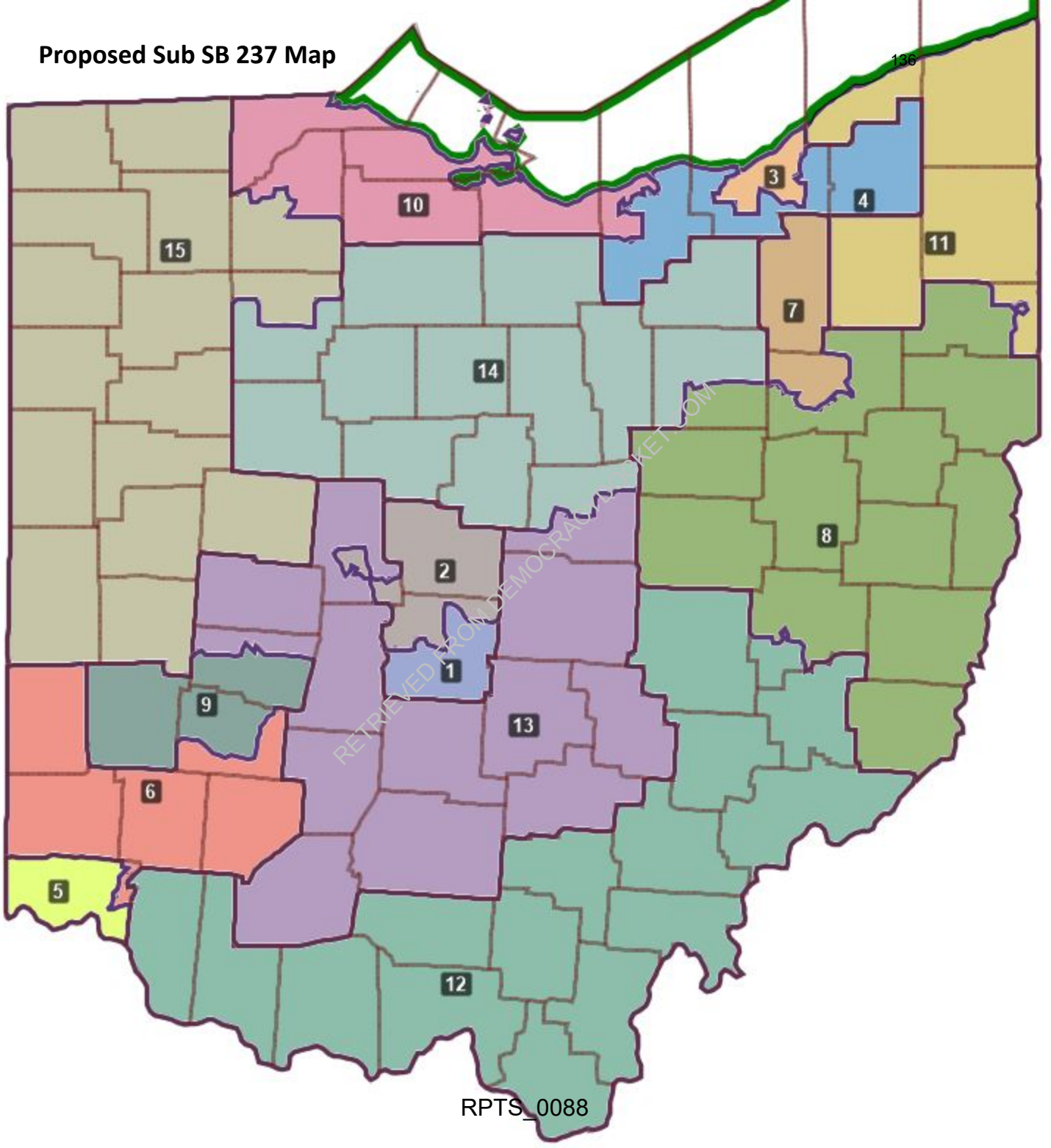

Exhibit C

Brown/Galonski Congressional District Proposal

Exhibit D

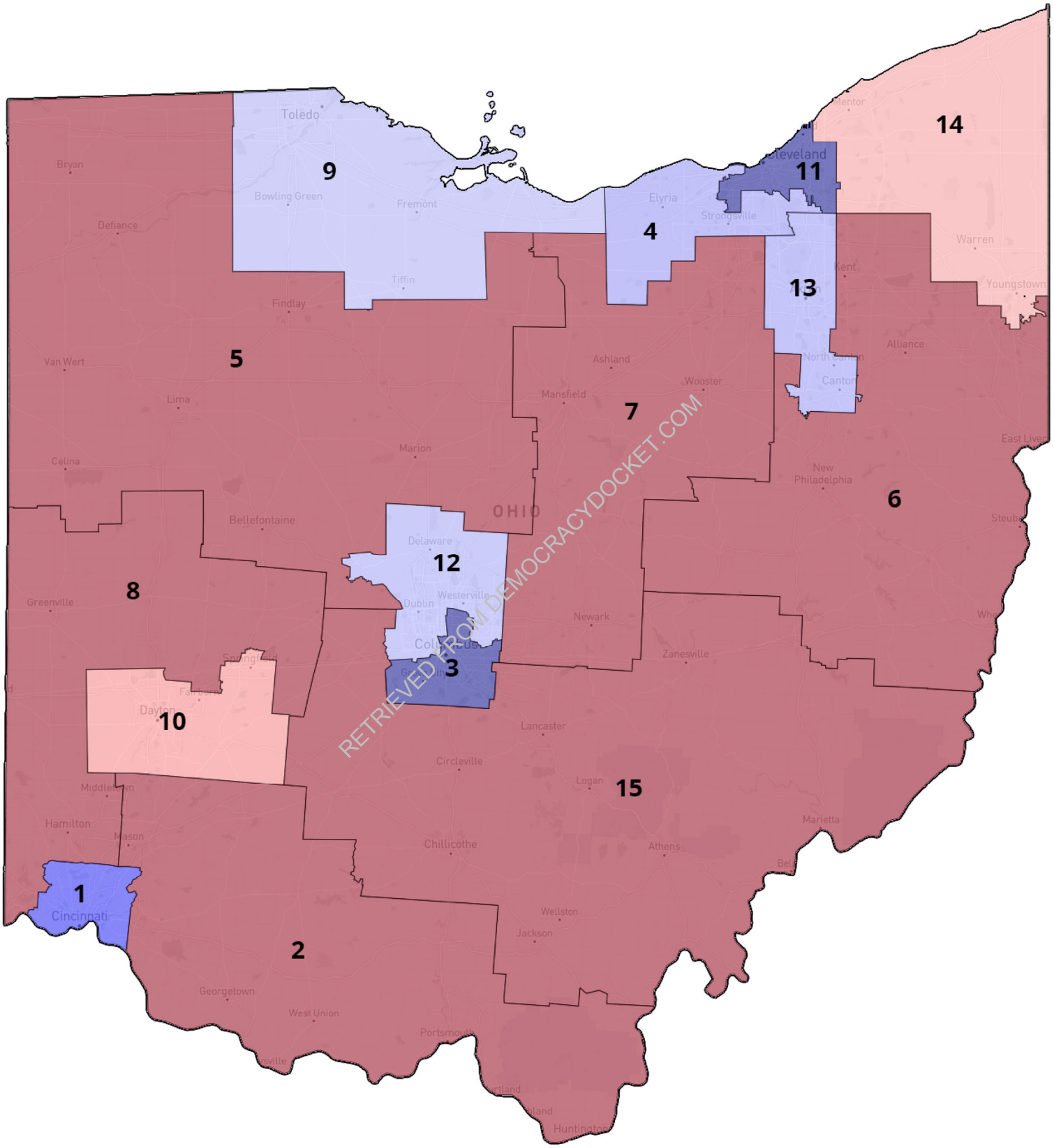

Exhibit E

Frank LaRose
Ohio Secretary of State

U.S. Congressional Districts 2012-2022 in Ohio

(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

Exhibit F

Jonathan Rodden

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Personal

Born on August 18. 1971, St. Louis, MO.

United States Citizen.

Education

Ph.D. Political Science, Yale University, 2000.

Fulbright Scholar, University of Leipzig, Germany, 1993–1994.

B.A., Political Science, University of Michigan, 1993.

Academic Positions

Professor, Department of Political Science, Stanford University, 2012–present.

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.

Associate Professor, Department of Political Science, Stanford University, 2007–2012.

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.

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).

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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.

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.

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).

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.

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.

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

IN THE SUPREME COURT OF OHIO

Regina C. Adams, *et al.*, ***Relators*,** ***v.*** **Governor Mike DeWine, *et al.*,** ***Respondents*.**	**Case No. 2021-1428** **Original Action Filed Pursuant to Ohio Const., Art. XIX, Sec. 3(A)**

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(Expert Affidavit of Dr. Jonathan Rodden & Exhibits)

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IN THE SUPREME COURT OF OHIO

Regina Adams, *et al.* **Relators,** **v.** **Governor Mike DeWine, *et al.*** **Respondents.**	**Case No. 2021-1428** Original Action Filed Pursuant to Ohio Constitution, Article XIX, Section 3(A)

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 delegation to the United States House of Representatives, adopted by the Ohio General Assembly on November 18, 2021 and signed into law by Governor Mike DeWine two days later, and attached as Exhibit A ("2021 Congressional Plan" or the "Enacted Plan"), conforms to the requirement set forth in Article XIX, Section 1(C)(3)(a), namely, that the plan does not "unduly favor[] or disfavor[] a political party or its incumbents." I have also been asked to examine the extent to which the General Assembly's redistricting plan splits governmental units, and to assess the plan's adherence to other traditional redistricting criteria, including compactness. Finally, I have been asked to examine characterizations of the Enacted Plan made by Senate Majority Whip and primary sponsor of the Enacted Plan Senator Rob McColley.

2. I demonstrate that given the statewide support for the two parties, the 2021 Congressional Plan provides an extreme advantage to the Republican Party. With around 53.2 percent of the statewide vote in the last three general elections, the Republican Party can expect to win around 80 percent of the seats under the new plan. This is an increase over the map that was in effect from 2012 to 2020, under which Republican candidates were able to consistently win 75 percent of the seats. I also demonstrate that this level of partisan advantage is extremely unusual when compared with other states.

3. Comparing past statewide results with congressional results and considering the role of incumbency, I conclude that only two or three of the 15 districts in the Enacted Plan are likely to be competitive.

4. I also examined the extent to which the General Assembly's plan disproportionately favors or disfavors the *incumbents* for one of the two parties. Under the previous plan, there were 12 Republican incumbents, one of whom has already announced his retirement. All the remaining districts with Republican incumbents continue to have Republican majorities—most of them quite comfortable. Of the four Democratic incumbents, only two continue to reside in districts where Democratic candidates receive majorities in statewide elections. The other two districts with Democratic incumbents have been dramatically reconfigured to the significant advantage of Republicans: in one district, Republican candidates win by large majorities in statewide races (although the Democratic incumbent in that district has announced he is running for U.S. Senate); in the other, they typically hold a narrow edge.

5. These outcomes were not forced upon the General Assembly by Ohio's political geography, or by the requirements of the Ohio Constitution. On the contrary, I demonstrate that it is possible to abide by the Constitution and achieve partisan fairness, while drawing districts that are more compact, introduce fewer splits in metropolitan counties and a similar number of county splits overall, introduce similar or even fewer splits to municipal subdivisions, and do a better job keeping communities together. I demonstrate that in contrast to plans that achieve greater partisan balance, the Enacted Plan achieves its extreme partisan advantage in large part by splitting geographically proximate communities of co-partisans (i.e., people who vote the same way)—extracting them from their geographic context and placing them in districts dominated by voters from very different types of communities.

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 F.

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 several proposed Ohio congressional plans uploaded to the web page of the Ohio Redistricting Commission as well as the websites for the Ohio House and Senate, true copies of which are attached as Exhibits B, C, and D.[2] I also consulted geographic boundary files of the Enacted Plan that were provided to me by Counsel. I also consulted the same U.S. Census redistricting data used by the General Assembly, as archived in the "Ohio University Common and Unified Redistricting Database."[3] For comparative analysis, I collected data on U.S. Senate, U.S. House, and presidential elections from state election authorities of a number of states, as detailed below. I also consulted precinct-level presidential results, again from state election authorities, aggregated to the level of U.S. congressional districts.[4] I also used geographic boundary files of communities of Columbus, Ohio from the City of Columbus GIS department.[5] For the analysis conducted in this report, I use three software packages: Stata, Maptitude for Redistricting, and ArcGIS Pro.

12. Through counsel, I also had access to several Maptitude files produced in this case by Ray DiRossi, Finance and Budget Director for the Ohio Senate Majority and, to my understanding, the primary mapmaker for the Enacted Plan. These included .shp files for both the Enacted Plan as well as the plan introduced by Senator McColley on November 3, 2021, produced at Bates DiRossi_000003 and 000005, respectively. Using these files, I was able to reproduce the plans along with any data DiRossi had access to in Maptitude through a very simple process. First, I would open Maptitude and select Ohio from a drop-down menu in the "Plan Manager" section of Maptitude, which allowed me to view a map of Ohio in the program. Next, I would click on "Layers" under the "Map" dropdown, then click "add layer" and choose "County." This allowed me to view Ohio's county borders on the map display in Maptitude. Next, I would open the .shp file produced by DiRossi in Maptitude (I did this once for each .shp file produced by DiRossi to produce a separate map for each file). Next, I would navigate back to the "Layers" dropdown and select a box with the name of the plan produced and click "add layer." This enabled me to see the district lines of the plan produced. So, for example, by uploading the plan entitled "Enacted Plan SB 258 Final SHP," I was able to view the district lines for the Enacted Plan in Maptitude. Uploading this file also allowed me to view the data DiRossi had access to while drawing each of the two plans in Maptitude. To do this, I would navigate to the display manager and right click on the row with the name of the plan produced (in the case of the Enacted Plan, once again "Enacted Plan SB 258 Final SHP"). I would then click "New Dataview" from the right-click drop down menu. As soon as I did that, many columns populated at the top of my Maptitude screen in the "dataview," a table in the Maptitude window that displays information about a draft map including (in this case) target population, district number, total population within a district, a district's performance under certain partisan indices, as well as other pieces of data. This dataview presents the data DiRossi had uploaded into Maptitude while drawing maps. The screenshots of the results of this process were submitted to the court via USB and identified as Exhibit 5 to the affidavit submitted to this Court by Derek Clinger on December 10, 2021. I was also

[1] https://alarm-redist.github.io/posts/2021-08-10-census-2020/.
[2] https://redistricting.ohio.gov/maps.
[3] https://www.redistricting.ohio.gov/resources.
[4]https://docs.google.com/spreadsheets/d/17yr9mcAtuUdNjI9NEPYKxXsEldzzQ2ZaDwEAbnPRyS4/edit?pref=2&pli=1#gid=1641247082.
[5] https://opendata.columbus.gov/datasets/c4b483507f374e62bd705450e116e017/explore.

able to export the data from this window into Microsoft Excel by going to File, export, and then table. This automatically generated an excel spreadsheet with all of the information contained in the dataview just described. I have attached excel spreadsheets extracted from two .shp files (including the file for the Enacted Plan) produced by DiRossi as Exhibits 7 and 8 to the Clinger Affidavit, also submitted via USB. I also performed the same process for the Maptitude files produced by Blake Springhetti, DiRossi's counterpart in the Ohio House, in that case in .BIN and .cdf format at Bates Springhetti_001042 and 001043. I have attached the results of that process as Exhibits 6 and 9 to the Clinger affidavit, both submitted via USB to the Court. Also, as specified in the Clinger affidavit, several of these files were used as exhibits at the depositions of DiRossi and Springhetti.

IV. THE PARTISANSHIP OF THE 2021 CONGRESSIONAL PLAN

13. I have been asked to determine whether the 2021 Congressional Plan favors one of the two major political parties in Ohio and, if so, to what extent. I proceed by first characterizing statewide partisanship in Ohio, and then examining the most likely partisan outcomes associated with the Enacted Plan.

14. 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 the statewide general elections from 2012 to 2020, the Democratic share of the two-party vote (setting aside small parties and write-in candidates) was around 46 percent. If we focus on more recent elections, from 2016 to the present, the Democratic vote share is closer to 47 percent.

16. Next, in order to make inferences about what is likely to happen under the newly enacted districts, the best strategy is to begin by aggregating data from these recent elections, beginning with precinct-level results and calculating the number of votes received by the various candidates within the boundaries of the new districts. I have been able to obtain geo-coded precinct-level results for elections from 2016 to 2020. I calculate the Democratic and Republican shares of the two-party vote in each of the following races: 2016 President, 2016 U.S. Senate, 2018 U.S. Senate, 2018 Governor, 2018 Auditor, 2018 Secretary of State, 2018 Treasurer, 2018 Attorney General, and 2020 President. I then simply add up the votes cast for Democrats and Republicans in these races across all the precincts contained in each of the individual districts under the Enacted Plan, and divide by the total votes cast for the two parties in the respective district. The results of this exercise are displayed on the left side of Table 2.

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

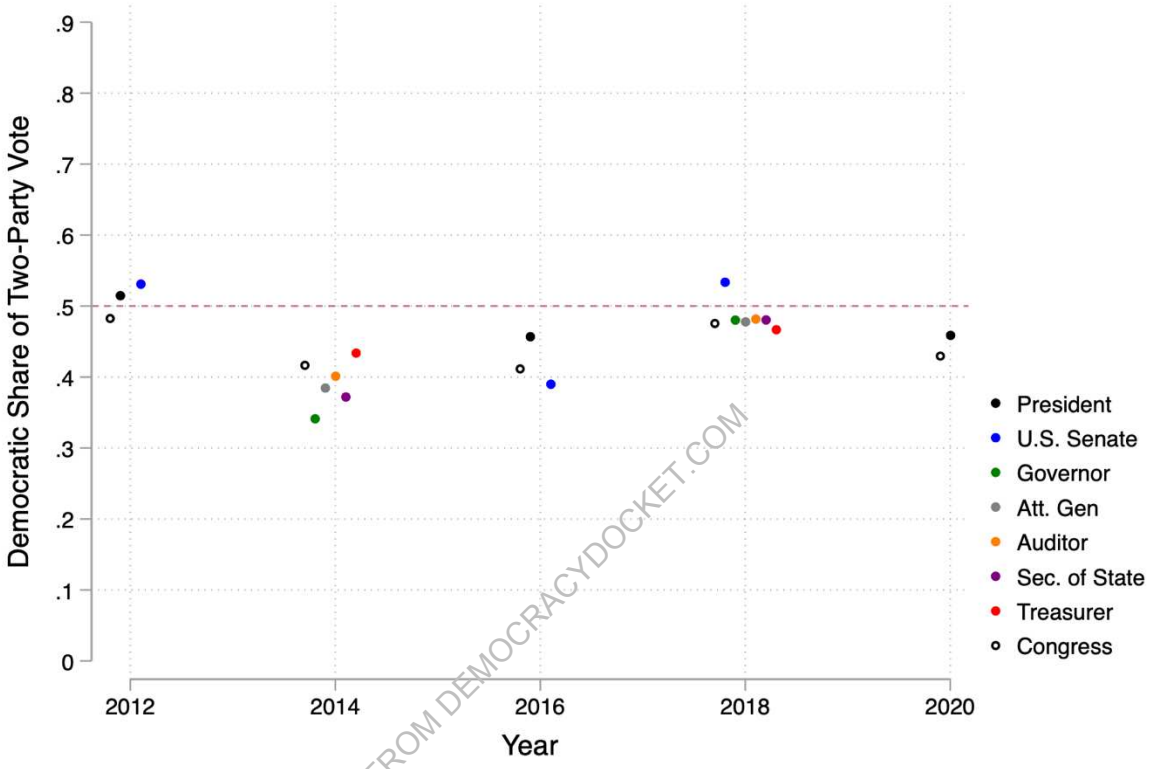


Table 1: Statewide General Election Outcomes, Ohio, 2012-2020

	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%**

Table 2: Shares of the Vote Obtained by the Two Major Parties from 2016 to 2020 in the Districts of the 2021 Congressional Plan and in the Districts of the Previous Plan

Newly Enacted Map			Map in Place from 2012 to 2020		
District	Democratic vote share	Republican vote share	District	Democratic vote share	Republican vote share
1	0.484	0.516	1	0.460	0.540
2	0.333	0.667	2	0.426	0.574
3	0.703	0.297	3	0.703	0.297
4	0.327	0.673	4	0.340	0.660
5	0.392	0.608	5	0.383	0.617
6	0.437	0.563	6	0.328	0.672
7	0.421	0.579	7	0.371	0.629
8	0.375	0.625	8	0.327	0.673
9	0.497	0.503	9	0.620	0.380
10	0.467	0.533	10	0.461	0.539
11	0.802	0.198	11	0.811	0.189
12	0.369	0.631	12	0.449	0.551
13	0.508	0.492	13	0.556	0.444
14	0.459	0.541	14	0.456	0.544
15	0.461	0.539	15	0.437	0.563
			16	0.431	0.569

17. As indicated in gray, when considering the specific data referenced above, there are only three districts with Democratic majorities in the Enacted Plan. Two of those districts have very comfortable Democratic majorities, and one has a very slight Democratic lean (District 13). There is one additional district (District 9) that leans just ever so slightly Republican.

18. This represents a considerable change in favor of Republicans from the status quo under the previous map, attached as Exhibit E. Table 2 also provides the results of the same exercise for the map that was in place from 2012 to 2020. That plan included four districts with relatively comfortable Democratic majorities. It is rather remarkable that the General Assembly was able to devise a plan that made the Democratic Party *worse* off, given that, as demonstrated below, the previous plan was one of the most favorable to the Republican Party in the United States in recent history.

19. There were five general elections for each of Ohio's 16 congressional districts from 2012 to 2020, for a total of 80 congressional races. In *every single* race, the candidate of the party with the higher vote share on the right-hand side of Table 2 was victorious.

20. If the same pattern continues, and the statewide aggregates continue to predict congressional outcomes, the Democrats can anticipate winning only 3 of 15 seats for the next four years (after which point a new map must be enacted under Ohio law). Recall from Table 1 that Democrats' statewide vote share was around 47 percent from 2016 to 2020, but their

anticipated seat share under the Enacted Plan is only 20 percent. Correspondingly, with around 53 percent of the statewide vote, the Republican Party can expect 80 percent of the seats.[6]

21. Districts 9 and 13 have statewide vote shares that are very close to 50 percent (within one percentage point). District 9 is a highly reconfigured district in which a Democratic incumbent will now be competing in very different territory with a slight Republican majority. Most of the new voters added to this district typically vote for Republicans. District 13 is an open seat with a slim Democratic majority. Even if one considers both Districts 9 and 13 in the Enacted Plan to be tossups and assigns a 50 percent probability of victory to Democratic candidates in each, the same conclusion holds: Republican candidates can expect to win around 12 of 15 seats.

22. In written remarks in support of the Enacted Plan, Ohio Senate Majority Whip Rob McColley stated that the Enacted Plan created 7 competitive districts.[7] To reach this figure, Senator McColley uses a rather peculiar alternative partisan index, and along with it, an alternative analysis of district competitiveness. Senator McColley presented an index based only on presidential and U.S. Senate elections. In order to understand how his index was constructed, it is useful to return to Figure 1 above. Senator McColley's index is composed of only six elections, represented by the 3 black (presidential) and 3 blue (U.S. Senate) dots in Figure 1. This means one third of the index is composed of elections in which U.S. Senator Sherrod Brown was the Democratic nominee. And one third of the index comes from 2012 alone—an election that took place a full decade before the new districts will come into effect.

23. According to Senator McColley's index, the statewide Democratic vote share in Ohio is 48 percent. Recall from Table 1 that when *all* statewide elections are used during the same period examined by Senator McColley (2012-2020), Ohio's statewide Democratic vote share is just under 46 percent. Using all statewide elections from 2016 to 2020—the years for which I was able to obtain geo-coded precinct-level data—the statewide Democratic vote share is a little under 47 percent.

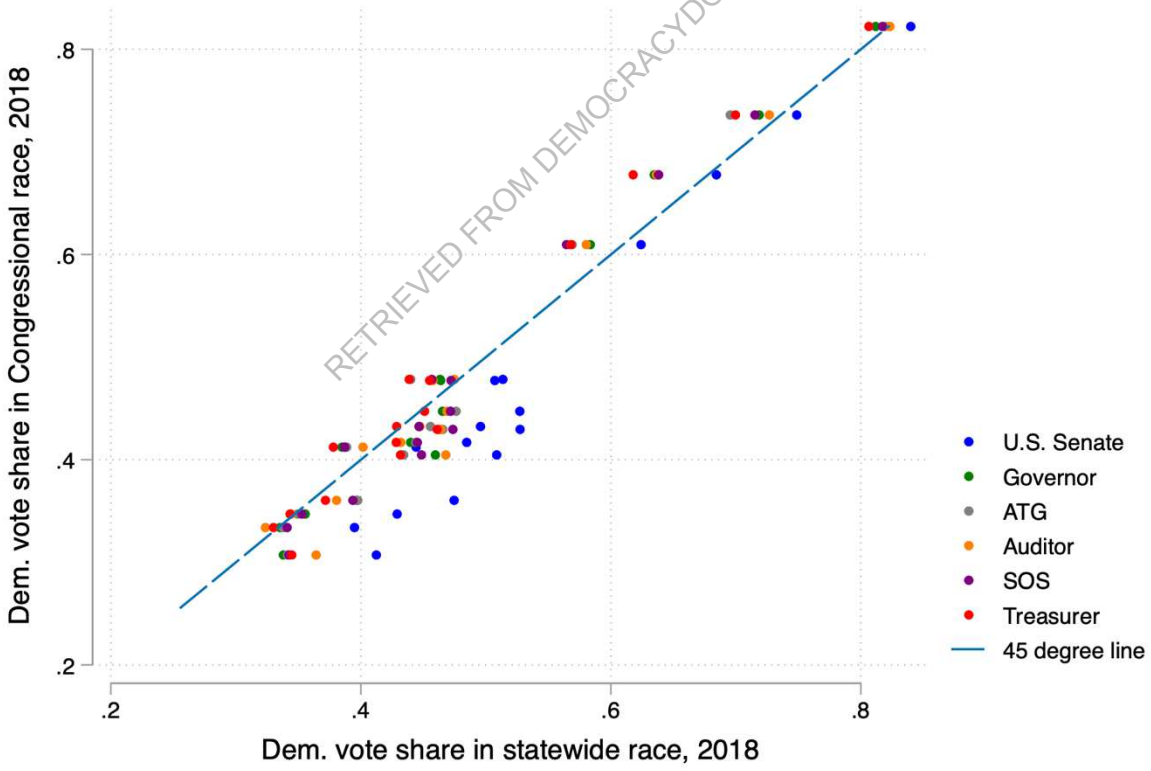
24. Figure 1 also includes aggregate Democratic vote shares for Ohio's 16 congressional races in each of these elections, indicated with hollow dots with black boundaries.[8] It is important to note that these hollow dots fall well below the black and blue solid dots in every case but one (2016 U.S. Senate). We can see, then, that Senator McColley has chosen not only the most Democratic-skewed possible set of statewide elections, but also a set of elections that is systematically more Democratic-leaning than the *congressional* races that he is ostensibly trying to predict. It is also clear from Figure 1 that if one is trying to come up with a set of

[6] Note that I refer to statewide results from 2016 to 2020 since those are the years for which I have precinct-level breakdowns that allow me to calculate district-level tallies.
[7] See The Ohio Senate, Local Government and Elections Committee, https://www.ohiosenate.gov/committees/local-government-and-elections/document-archive (testimony of Senator Rob McColley on November 16, 2021).
[8] Note that there were three uncontested races during this period: districts 8 and 11 in 2012, and district 7 in 2014. I imputed the results of these races by taking the average vote shares experienced in these districts during all of the other years when they *were* contested.

races that predict congressional outcomes (the hollow dots), the most predictive races are those that McColley throws out: the statewide races for Governor (green), Attorney General (gray), Auditor (orange), Secretary of State (purple), and Treasurer (red). Note that the hollow dots—the congressional races—move up and down over time with the partisan waves that drive these statewide races. Thus, it is quite misleading to exclude so much of the valuable data—especially from recent years.

25. Moving beyond aggregate data, if we make comparisons across districts within specific elections, it is also notable that Senator McColley has excluded the races that hew most closely with each district's congressional results. He relies instead on an index of partisanship that draws disproportionately on high-turnout presidential races and Senate elections won by Senator Sherrod Brown. To demonstrate the latter problem, Figure 2 presents a scatter plot of district-level results of the 2018 election. On the horizontal axis is the Democratic vote share in statewide races, aggregated to the boundaries of the districts in place in 2018. On the vertical axis is the corresponding vote share of the Democratic candidate in the congressional race in each district in 2018. The dashed line is the 45-degree line.

Figure 2: Statewide Results Aggregated Within Boundaries of 2018 Districts and 2018 District-Level Congressional Results



26. Data markers directly on the 45-degree line are those where the results of the state-wide race are exactly the same as those in the congressional race. In other words, observations on the 45-degree line are districts where there is minimal split-ticket voting, so that the statewide

race perfectly predicts the congressional race. Note that in the four Democratic districts on the right side of the graph, the blue dots—where the horizontal axis represents Senator Sherrod Brown's vote share—are arranged almost exactly on the 45-degree line. However, in all 12 of the Republican-leaning districts, the blue dots are far below the 45-degree line, and far below all the other colored dots, which correspond to the vote shares of Democratic candidates in the other statewide races. In other words, Senator Sherrod Brown has drawn a substantial amount of support from voters who otherwise supported Republican candidates for all other offices. This means that by using Senator Sherrod Brown's vote share and ignoring the other data at his disposal in 2018, Senator McColley has chosen the one race in 2018 that is most out of sync with almost all congressional races in the state, and as a result, badly over-estimates the Democratic congressional vote share. He thereby inaccurately characterizes a number of rather reliable Republican voters as Democrats, and as a result, inaccurately characterizes comfortably Republican districts as "competitive."

Table 3: McColley Partisan Index in Comparative Perspective

District	Republican vote share, all statewide races, 2016-2020	Republican vote share, federal elections only, 2012-2020 (McColley's index)	Difference
1	0.516	0.515	0.001
2	0.667	0.651	0.016
3	0.297	0.304	-0.007
4	0.673	0.66	0.013
5	0.608	0.588	0.020
6	0.563	0.529	0.034
7	0.579	0.567	0.012
8	0.625	0.62	0.005
9	0.503	0.477	0.026
10	0.533	0.522	0.011
11	0.198	0.194	0.004
12	0.631	0.613	0.018
13	0.492	0.486	0.006
14	0.541	0.532	0.009
15	0.539	0.537	0.002

27. It is already clear from Figures 1 and 2 that Senator McColley's index is systematically more Democratic than an index that relies on a more representative set of races, but Table 3

quantifies the difference for each district. In the left-hand column, I reproduce the partisan index (from Table 2) that is based on all statewide races held from 2016 to 2020. In the next column, I reproduce Senator McColley's more limited index, and in the third column, I report the difference. In all districts but one, the McColley index makes districts appear to be more Democratic than the more expansive index. On average across districts, the difference is around 1.1 percentage points, but Senator McColley's index is especially misleading in District 6, where it over-estimates the Democratic vote share by 3.4 percentage points, and in District 9, where the over-estimate is 2.6 percentage points, and where McColley's index classifies the district as Democratic-leaning. Of particular note, McColley's chosen benchmark for competitiveness (46-54 percent) would treat District 6 as competitive under his index, but not under an index that takes account of all statewide races.

28. More generally, it is not clear why districts where average statewide vote shares fall in the rather wide range between 46 and 54 percent should be viewed as "competitive," since as described further below, Ohio congressional races in such districts have not been especially competitive in the past, and over the last decade, the party with the higher partisan index has always been victorious—almost always by a comfortable margin.

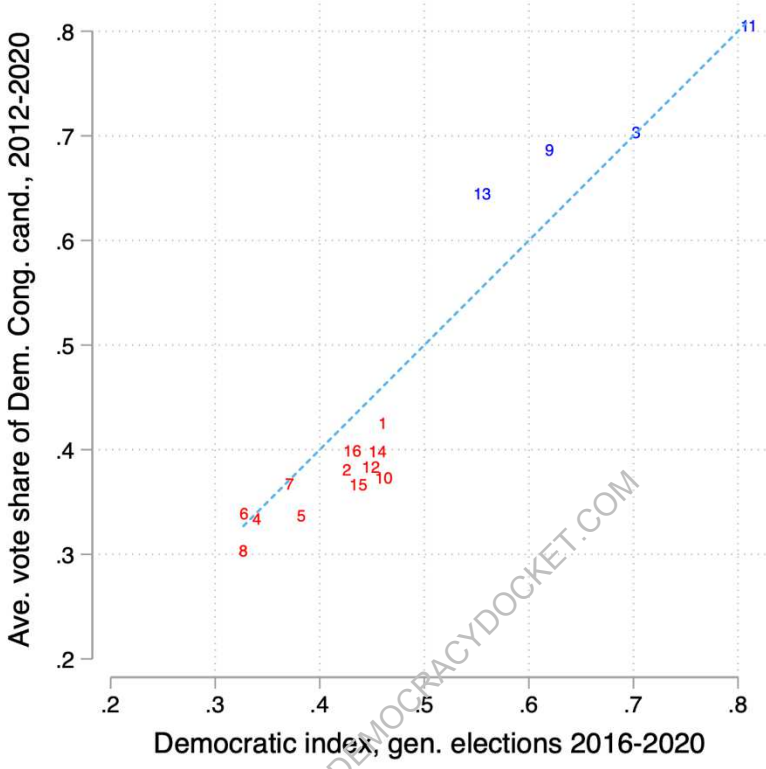
29. Even if we avoid Senator McColley's reliance on a biased sample of statewide races and use a more meaningful partisan index, we should not be so naïve as to assume that statewide races are straightforward predictors of congressional races. Even a better index that uses all the relevant statewide data from recent years will still substantially over-estimate the likely Democratic vote share in almost all the Republican-leaning districts. This is because of the role of incumbency advantage in congressional races. A large empirical literature in American politics establishes that, for a variety of reasons, incumbents typically enjoy a substantial advantage over challengers, especially in legislative elections.[9]

30. To demonstrate this problem, Figure 3 plots, on the horizontal axis, the data from the right-hand side of Table 2 above—the average Democratic vote share in all statewide races from 2016 to 2020—within each of the 16 Ohio congressional districts in use over the last decade. On the vertical axis, it plots the average vote share of the Democratic candidate in congressional races in the same district.[10] Again, the 45-degree line indicates a perfect correspondence between statewide races and congressional races. Blue data markers are districts with Democratic incumbents, and red data markers are districts with Republican incumbents.

[9] See, for instance, Stephen Ansolabehere and James M. Snyder, 2004, "The Incumbency Advantage in U.S. Elections: An Analysis of State and Federal Elections, 1942-2000," *Election Law Journal* 1,3: 315-338.

[10] As above, I impute the results of the uncontested races (districts 8 and 11 in 2012, and district 7 in 2014) by taking the average vote shares experienced in these districts during all of the other years when they *were* contested.

Figure 3: Democratic Partisan Index Based on Statewide Races and Average Vote Share of Democratic Candidates in Congressional Races, 2012-2020

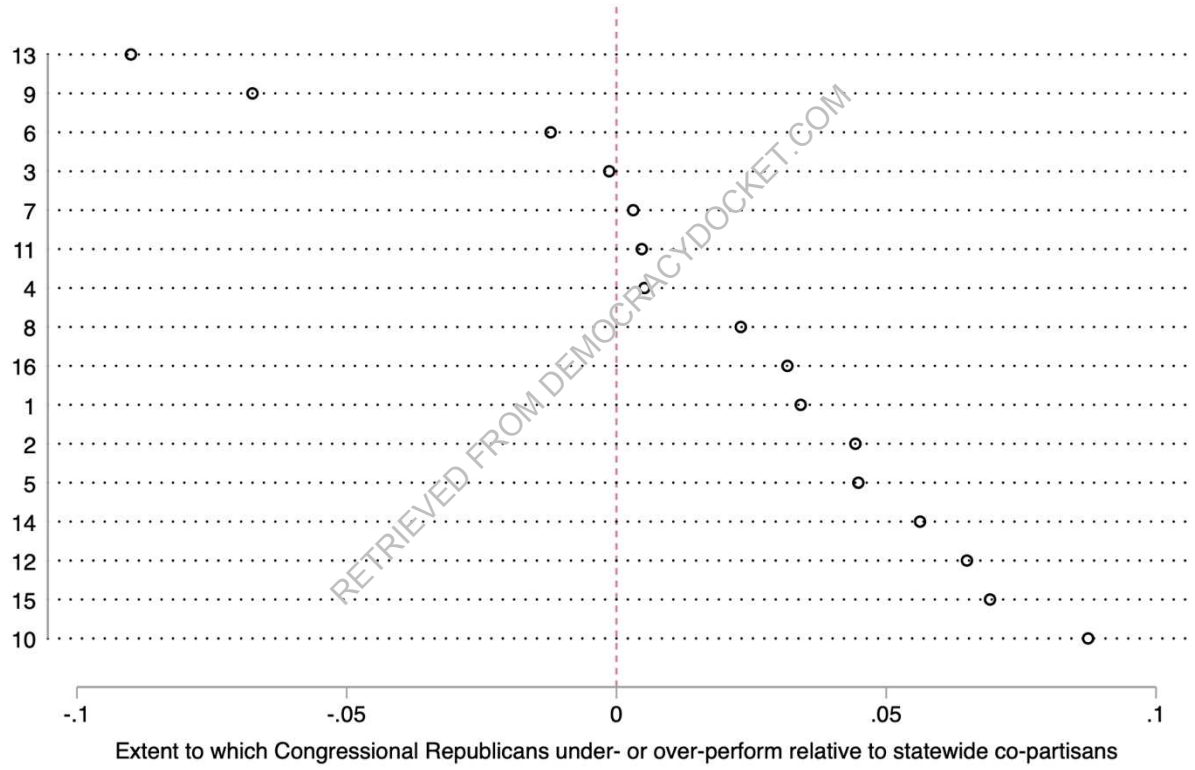


31. We can see that in races in the most overwhelmingly Democratic-leaning and Republican-leaning districts, on the far right and far left of the graph, the correspondence between statewide races and congressional races is quite strong. In the two overwhelmingly Democratic urban districts (3 and 11), for instance, congressional candidates do not significantly outperform their co-partisans in statewide races. The same is true in some of the most Republican districts (e.g., 4, 6, and 7). However, in the districts that are less imbalanced in terms of partisanship, the correspondence between statewide races and congressional races is far weaker, and in a very specific way: incumbents in congressional races outperform their statewide co-partisans. Visually, in Figure 3, we can see that the blue markers for Districts 9 and 13 are well above the 45-degree line, and the red markers for Republican incumbents in districts 1, 2, 5, 10, 12, 14, 15, and 16 are well below the line. The political science literature explores a variety of reasons for this advantage, including name recognition, an advantage in fundraising that translates into disproportionately large campaign war chests that facilitate effective campaigns and scare off challengers, the ability to use the perks of office to provide favors for local groups, and the ability to claim credit for public expenditures that take place in the district. It may also be the case that given the collective nature of legislatures vis-à-vis executive positions, it is easier for legislators to escape blame when things go wrong, either for the nation, the state, or their party. This is

related to a paradox attributed to Richard Fenno: Americans claim to hate Congress, but often express support for the member of Congress from their own district.[11]

32. To convey a better sense of what this means, Figure 4 simply plots the vertical distance between the data markers in Figure 3 and the 45-degree line—that is to say, the extent to which incumbent legislators outperformed their statewide co-partisans from 2012 to 2020. Positive numbers indicate that Republicans running in congressional races do better than their statewide co-partisans. Negative numbers indicate that they do worse.

Figure 4: Extent to which Congressional Republicans Under- or Over-Performed Relative to their Statewide Co-Partisans



33. Three of the first four observations at the top (except District 6) are districts with *Democratic* incumbents, where these incumbents perform better, on average throughout the decade, than their statewide co-partisans. The remaining observations (except District 11) are the districts where Republican incumbents were running throughout the decade, and in every case, they out-perform their statewide co-partisans—often by a considerable margin.

34. Figures 3 and 4 indicate the folly of imagining that a district with a 52 percent statewide Republican vote share throughout the last decade, like District 1 in the new Enacted Plan, is

[11] Richard Fenno, *Home Style: House Members in their Disricts,* 1978, Longman.

a highly competitive district where a moderate statewide swing toward the Democrats might yield a toss-up election in which a Democratic candidate can hope for victory. As we can see in Figure 4, Representative Chabot typically receives an incumbency advantage of around four percentage points. Over the past decade, he received around 58 percent of the votes cast for the two major parties in District 1, even though his statewide co-partisans had received, on average, around 54 percent of the votes in his district.

35. In the Enacted Plan, much of Mr. Chabot's district remains unchanged, including parts of Cincinnati, its western suburbs, and Warren County. I have identified the census blocks that were common to both the old and new districts, summed up their current population, and divided by the population size of the new districts (786,630). This exercise reveals that around 81 percent of Mr. Chabot's current district is composed of people who were in the previous manifestation of District 1. As a result, there is no reason to anticipate that his incumbency advantage will suddenly disappear. If we consider incumbency, a more realistic projection of Mr. Chabot's likely vote share in the future, then, might approach 56 percent.

36. It would be even more misleading to characterize District 10 as competitive. For instance, the Republican vote share in statewide races (from 2016 to 2020) in District 10 is around 53 percent, down slightly from 54 percent in the previous redistricting cycle. However, the Republican incumbent, Mike Turner, won each general election from 2012 to 2020 with an average two-party vote share above 62 percent (see Figure 3). Once again, as with District 1, the incumbent enjoyed a massive incumbency advantage—around 8.7 percentage points. And District 10 is the only district in which the incumbent retained *more* of their old district than District 1: 89.7 percent of the population of District 10 in the new Enacted Plan was in Representative Turner's previous District 10. So again, there is no reason to anticipate that this advantage will suddenly disappear. Putting these facts together, one simply cannot characterize District 10 in the Enacted Plan as competitive.

37. Likewise, Districts 14 and 15 cannot be classified as competitive. As shown in Table 2, both are districts with Republican incumbents where the statewide 2016-2020 Republican vote share hovered around 54 percent. However, as we can see in Figure 4, both incumbents substantially outperformed their party's statewide vote share, by 5.6 percentage points in District 14, and 6.9 percentage points in District 15. District 14 retained 69 percent of the voters from its earlier manifestation, and District 15 retained 42 percent. Again, once we consider incumbency, as with District 10, even if we accept Senator McColley's rather unusual characterization of districts with an anticipated Republican vote share of 54 percent as "competitive," we cannot characterize Districts 14 and 15 as competitive.

38. In sum, it is quite difficult to oust a congressional incumbent in Ohio. Recall from Table 1 that the average Democratic vote share in statewide races from 2012 to 2020 was 45.9 percent. However, recall from Figure 1 that there were substantial year-to-year deviations in statewide results. If we take yearly averages, we see that the biggest pro-Democratic deviations were in 2012, where the average Democratic vote share in statewide offices was 52.3 percent, and in the "blue wave" of 2018, when it was 48.7 percent. There were also large pro-Republican deviations in 2014 (average Democratic vote share of 38.7 percent) and 2016 (42.4 percent). In spite of the presence of several districts that Senator McColley would designate as competitive—with a statewide Republican vote share between 46 and 54

percent—even shifts of 6 and 7 percentage points in statewide vote shares from the decade average did not dislodge a single incumbent.

39. With this fuller understanding of incumbency in hand, we can see that the only districts that appear to be competitive in the Enacted Plan are Districts 9 and 13—both district numbers that corresponded to what were comfortable Democratic districts in the old plan. In District 9, the district leans Republican in statewide races, but in the past, Representative Kaptur has outperformed her statewide co-partisans by over 6 percentage points (Figure 4). However, in contrast to Districts 1 and 10, where Republican incumbents in more competitive districts retained more than 80 percent of their old district population, only around 40 percent of the population of the new version of Representative Kaptur's district was part of her previous configuration of District 9, and the new population in her district is quite Republican. As a result, she may not be able to rely on a similar level of incumbency advantage as Representatives Chabot and Turner.

40. Finally, it is noteworthy in this regard that the Enacted Plan would be in place for only four years; meaning that it can be redrawn in short order if any incumbents retire. The short duration of the Enacted Plan thus allows the mapdrawers to more aggressively rely on incumbency advantages than may be prudent for a map that will remain in effect for a 10-year period.

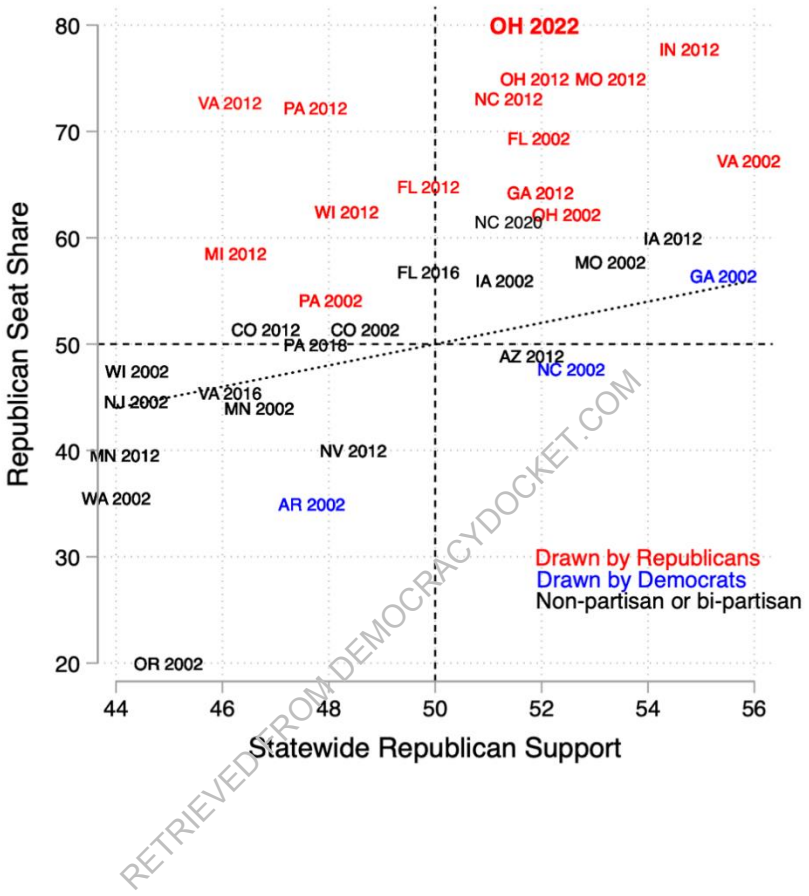
41. In sum, a reliable assessment of the likely partisan results associated with the Enacted Plan—considering all available statewide election results and accounting for the role of incumbency—indicates that the Enacted Plan creates 11 safe Republican districts, 2 safe Democratic districts, and 2 districts that are likely to be quite competitive. If we give each party a 50 percent probability of victory in each of the two competitive districts, we are left with the conclusion that the Democrats can expect to win only 3 of 15 seats under this plan, which corresponds to a 20 percent seat share.

V. PUTTING THE 2021 CONGRESSIONAL PLAN IN PERSPECTIVE

42. In any two-party democracy, it is not normal for a party with an average of 53.2 percent of the vote to receive 80 percent of the seats. In fact, even in the United States, which has maintained the idiosyncratic practice of allowing incumbent partisan majorities to draw their own districts without constraint, this is a highly unusual result. To see this, let us focus on a set of states that are comparable to Ohio in that they have seen relatively competitive statewide races in recent decades and are large enough to have four or more congressional districts. To measure statewide partisanship in a way that facilitates cross-state comparison, I have assembled data on presidential and U.S. Senate elections. For each redistricting cycle, I calculate the average Republican share of the two-party vote in Senate and presidential elections.[12] Next, for each redistricting cycle, I calculate the share of all congressional seats won by Republican candidates.

[12] In a few states, I also have access to data on statewide executive offices, e.g., Governor, Attorney General, Railroad Commissioner, Treasurer, and the like. However, the mix of elected offices

Figure 5: Vote Shares in Statewide Elections and Seat Shares in Congressional Elections, Evenly Divided States with Four or More Districts, 2000 through 2020 Redistricting Cycles



43. In Figure 5, the data markers indicate the state and the year that the relevant redistricting plan went into effect. States with districts drawn by legislatures under unified Republican control are indicated in red. States with districts drawn by independent commissions, courts, or divided legislatures are indicated in black. And states where districts were drawn under unified Democratic control are indicated in blue.[13] The dotted line indicates proportionality—where, for instance, 50 percent of the vote translates into 50 percent of the seats, 52 percent of the vote translates into 52 percent of the seats, and so on. In Figure 5, in order to focus on states most similar to Ohio and facilitate legibility, I zoom in on a group of

varies from one state to another, and comparable data are unavailable in some states. I elect to use statewide races for *national* elections only (president and U.S. Senate) in order to facilitate cross-state comparison.

[13] Information about control of the redistricting process was obtained from https://redistricting.lls.edu/.

the most evenly divided states. I also include in the appendix a graph that presents the exact same information, but zooms out to include all the states with four or more districts—including those, like Massachusetts and Oklahoma—that are dominated by one party or the other, and where the dominant party ends up winning all, or nearly all, of the seats.

44. For the most part, districts drawn by courts, divided legislatures, and independent commissions come closer to proportionality than those drawn by legislatures with unified party control of state government. This can be seen most clearly *within* states where the districts were redrawn during a redistricting cycle due to litigation—including Virginia, Pennsylvania, North Carolina, and Florida. In these states, Republican-drawn maps led to Republican seat shares far beyond the party's statewide support, and plans drawn by courts came much closer to proportionality. While Democrats have controlled the redistricting process in very Democratic states like Maryland, Illinois, and Massachusetts (see the appendix), they have rarely done so in the relatively competitive states featured in Figure 5. But the Republican Party has been able to draw the districts over the last two redistricting cycles in a large number of relatively competitive states, including Florida, Michigan, Virginia, Pennsylvania, Wisconsin, North Carolina, Georgia, Missouri, Indiana, and Ohio. As can be seen in Figure 5, throughout the range of statewide vote shares—from Democratic-leaning states like Pennsylvania to Republican-leaning states like Indiana—Republican candidates have been able to win surprisingly large seat shares in the states where districts were drawn by unified Republican legislatures. This group includes notoriously gerrymandered states, including North Carolina, Pennsylvania, and Florida, where state courts eventually invalidated maps that favored Republicans in ways that violated state constitutions.

45. Even among this group of highly partisan maps, Ohio stands out. The data marker titled "Ohio 2012" corresponds to the observed seat share of Republican candidates throughout the 2010 redistricting cycle (12 of 16 seats in each election, or 75 percent). And the bold data marker titled "Ohio 2022" is the anticipated seat share, calculated as described above at 80 percent, for the 2021 Congressional Plan. It should be stressed that this data point is different in kind from the others. All of the other data markers in Figure 5 are *observed* congressional seat shares from the past. The "Ohio 2022" data marker is a *predicted* seat share based, as described above, on past statewide elections.

46. As can be visualized in Figure 5, with one exception, the absolute vertical distance from the dotted line of proportionality to the "Ohio 2022" data marker is larger than for all other relatively competitive states with four or more districts over the last two redistricting cycles.[14]

47. When attempting to assess the impact of a redistricting plan on the relative advantage or disadvantage it provides to the parties, it is important to go beyond simply calculating the difference between a party's statewide support and its seat share. For many realistic scenarios in which partisans are distributed across districts without political manipulation of the district

[14] The exception is Oregon between 2002 and 2010, where the Democratic candidates won the four coastal districts and the Republican candidate won the single interior district in spite of a statewide Republican vote share of around 45 percent.

boundaries, we can anticipate that the party with more votes will usually win more than a proportional share of seats. To see why this is true, imagine a simple example of a state with 15 districts, where there are 10 voters in each district, and party registration is distributed as displayed in the columns labeled "Example 1" in Table 4 below.

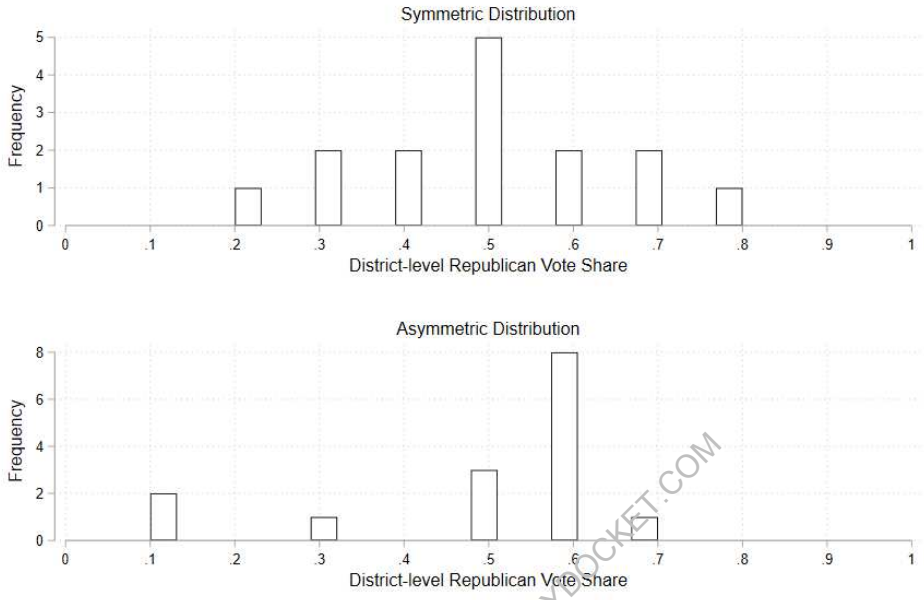
Table 4: Examples of Symmetric and Asymmetric Distributions of Votes Across Districts in a Hypothetical State

	Example 1: Symmetric Distribution		Example 2: Asymmetric Distribution	
District	Democrats	Republicans	Democrats	Republicans
1	2	8	3	7
2	3	7	4	6
3	3	7	4	6
4	4	6	4	6
5	4	6	4	6
6	5	5	4	6
7	5	5	4	6
8	5	5	4	6
9	5	5	4	6
10	5	5	5	5
11	6	4	5	5
12	6	4	5	5
13	7	3	7	3
14	7	3	9	1
15	8	2	9	1

48. In this example, there are 75 Democrats and 75 Republicans. Under normal circumstances, each party can expect to win 5 districts, but 5 districts are toss-ups containing even numbers of Democrats and Republicans.

49. The top panel of Figure 6 below uses a histogram—a simple visual display of the data from Table 4—to display the distribution of expected vote shares of the parties across districts in this hypothetical state, with its symmetric distribution of partisanship.

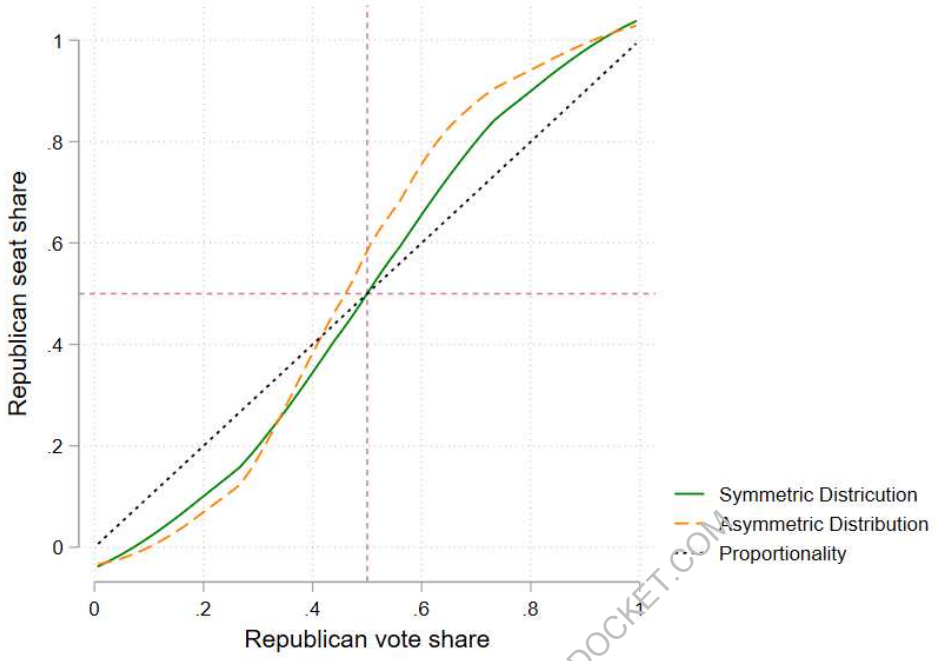
Figure 6: Distribution of Vote Shares Across Districts in Two Redistricting Plans in Hypothetical State



50. Let us assume that the partisanship of some of the individuals in this state is malleable, such that a successful campaign, a good debate performance by a candidate, or a strong economy leads some of the registered Democrats to vote for Republicans. Let us randomly choose one Democrat in the state and turn her into a Republican. Let us perform this random vote-flipping exercise 10,000 times, take the average, and see how this very small change in voting behavior—just one party-switcher out of 150—can be expected to affect the parties' seat shares. Let us do that with two of the Democrats, three, and so on, all the way until the overall Republican vote share approaches 100 percent. We can perform the same operation in the other direction, systematically turning random Republicans into Democrats.

51. How do these alternative scenarios affect the seat share? The result of these simulated scenarios is displayed with the green line in Figure 7. The horizontal axis is the Republican vote share, and the vertical axis is the corresponding seat share. The green line provides a plot of what happens to the seat share as the Republican vote share increases and decreases from 50 percent.

Figure 7: Hypothetical symmetric vote-seat curve



52. The green line in Figure 7 is a standard vote-seat curve associated with a symmetric distribution of partisanship across districts. It is a foundational observation in the literature on majoritarian elections that when the distribution of partisanship across districts approximates the normal distribution, with its bell-shaped appearance, the transformation of votes to seats will look something like the green line in Figure 7. With 50 percent of the vote, a party can expect 50 percent of the seats. However, note what happens when the Republican Party is able to obtain 55 percent of the votes—it receives around 60 percent of the seats. This phenomenon is known as the "winner's bonus." This happens because there are several districts where the underlying partisanship of the electorate is evenly divided, such that with 55 percent of the overall statewide vote, the Republican Party can win several of these pivotal districts, thus providing it with a disproportionate share of the seats.

53. When we observe a situation in which a party wins 55 percent of the vote but something like 59 or 60 percent of the seats, we cannot necessarily conclude, without further analysis, that the district boundaries have been drawn to help or harm a political party. The "winner's bonus" is a basic feature of majoritarian electoral systems. An important feature of the green line in Figure 7, however, is that it treats each party exactly the same. That is, the Democrats can expect the exact same "winner's bonus" as the Republicans when they are able to win over more votes. This partisan symmetry is a lower standard to meet than one that requires proportional outcomes, because it merely ensures that any "winner's bonus" could be applied to either party relatively evenly, and that thus, both parties have similar incentives to be responsive to voters.

54. Next, let us consider the same state, with the same even split in party registration, but with a different set of district boundaries, drawn strategically to favor the Republican Party. In this example, provided numerically on the right-hand side of Table 4 (labeled as "Example 2"), and visually with a histogram in the lower panel of Figure 6, Democrats are "packed" into three extremely Democratic districts, and districts have been drawn so as to avoid Democratic majorities to the extent possible elsewhere. There are fewer truly competitive districts, and there is a much larger number of districts that are comfortably, but not overwhelmingly, Republican. With this type of arrangement, with 50 percent of the vote, the Republicans can expect to win well over half the seats.

55. I apply the same simulation procedure as described above and display the resulting relationship between seats and votes with the orange dashed line in Figure 7. We can see that in this example, the Republican Party enjoys a substantial advantage in the transformation of votes to seats over Democrats. It can lose a majority of votes statewide but still win legislative majorities, and it receives a very large seat premium when it achieves even a slight victory in statewide votes. In this second example, the treatment of the two parties is far from symmetric.

56. Political scientists and geographers have attempted to measure this type of asymmetric distribution of partisans across districts—and the resulting asymmetry in the transformation of votes to seats. What has now become the most common approach is rooted in the work of British political geographers. In his 2000 Annual Political Geography Lecture, Ron Johnston described "wasted votes" as votes obtained in constituencies that a party loses, while "surplus votes" are additional votes obtained by a party in constituencies it wins beyond the number needed for victory.[15] In the example above, for instance, 6 is the number of votes required for victory in each district. Thus, if a party received 9 votes, 3 of them would be considered "surplus." In that same district of 10 voters, the losing party received 1 "wasted" vote. Johnston calculated wasted and surplus votes for the Labour and the Conservative parties in post-war British elections, as well as the share of "effective" votes received by each party: that is, votes that were neither "wasted" nor "surplus." The latter is a measure of the relative efficiency of support for the parties, and the gap between them is an indicator of the extent to which support for the Conservatives has been more efficient than support for Labour (or vice-versa).

57. More recently, Nicholas Stephanopoulos and Eric McGhee have adapted this concept to the context of redistricting and gerrymandering in the United States.[16] The terminology is slightly different. For Stephanopoulos and McGhee, the term "wasted votes" captures not just the votes obtained in a constituency the party lost, but also the surplus votes obtained in districts the party won: what Johnston called "ineffective votes." For Stephanopoulos and McGhee, "wasted votes" are all the votes received by a party in districts that it loses, combined with all the surplus votes beyond the winning threshold in districts it wins. They calculate the total wasted votes for each party in each district, tally them over all districts,

[15] Ron Johnston. 2002. "Manipulating Maps and Winning Elections: Measuring the Impact of Malapportionment and Gerrymandering." *Political Geography* 21: pages 1-31.

[16] See Nicholas Stephanopoulos and Eric McGhee, 2015, "Partisan Gerrymandering and the Efficiency Gap." *University of Chicago Law Review* 82,831.

and divide by the total number of votes cast. They refer to this construct as the "efficiency gap." To see how this works, let us return to our examples.

58. Table 5 includes columns to capture wasted votes for the Republicans and Democrats in both hypothetical examples. In the first example, the Republicans win the first district in a landslide, 8-2. They waste two votes (since they only needed 6 to win), and the Democrats waste two votes in their losing effort. At the bottom of the table, I sum the wasted votes for each party. The Democrats and Republicans each waste the same number of votes, 20. Thus, the efficiency gap is zero.

59. Next, consider the second example. The Republicans have a very efficient distribution of support such that they received six votes in several districts, while the Democrats wasted votes in a handful of districts that they won by large majorities. In this example, the Republicans waste only three votes while the Democrats waste 42. Thus, there is an efficiency gap of 39, which amounts to 26 percent of all votes cast.

Table 5: Efficiency Gap Calculations in Hypothetical Examples

	Example 1: Symmetric Distribution				Example 2: Asymmetric Distribution			
District	Dem	Rep	Dem Wasted Votes	Rep Wasted Votes	Dem	Rep	Dem Wasted Votes	Rep Wasted Votes
1	2	8	2	2	3	7	3	1
2	3	7	3	1	4	6	4	0
3	3	7	3	1	4	6	4	0
4	4	6	4	0	4	6	4	0
5	4	6	4	0	4	6	4	0
6	5	5	0	0	4	6	4	0
7	5	5	0	0	4	6	4	0
8	5	5	0	0	4	6	4	0
9	5	5	0	0	4	6	4	0
10	5	5	0	0	5	5	0	0
11	6	4	0	4	5	5	0	0
12	6	4	0	4	5	5	0	0
13	7	3	1	3	7	3	1	0
14	7	3	1	3	9	1	3	1
15	8	2	2	2	9	1	3	1
Total	75	75	20	20	75	75	42	3

60. Let us now apply this approach to the 2021 Congressional Plan in Ohio. First, I have summed up all the votes received by Democratic and Republican candidates in each of the statewide races from 2016 to 2020 listed above, and use these sums to calculate the efficiency gap. Aggregating precinct-level data from these races to the level of districts in the Enacted Plan, we see the efficiency gap associated with the Enacted Plan is quite large—24 percent—indicating that Republicans' votes are distributed across districts with far greater efficiency than those of Democrats. In fact, the distribution of partisanship created by the General Assembly's plan is quite similar to that in the second hypothetical example of Table 4.

61. In order to put this in perspective, it is useful to engage in some simple cross-state comparisons. As a metric, the efficiency gap is known to be less reliable in non-competitive states, as well as states with few congressional districts. Thus, I calculate the efficiency gap for the districts used in the last redistricting cycle, focusing on states with more than four congressional districts among the relatively competitive states featured in Figure 5 above. One drawback of the efficiency gap is that the measure is not always stable for a set of districts when one switches from using data from one election to another, depending on the individual quirks of incumbents and challengers, and patterns of split-ticket voting. In order to compare apples with apples and mitigate candidate-specific effects, I use data from the 2016 and 2020 presidential elections, aggregated to the level of congressional districts.

62. Using data from the 2016 presidential election, the efficiency gap associated with the Enacted Plan is almost identical to what I calculated using all of the Ohio statewide elections from 2016 to 2020: 24 percent. I also calculated the efficiency gap using the 2016 presidential election for the other large, competitive states discussed above. The efficiency gap associated with the Enacted Plan is larger than those observed in Colorado, Florida, Missouri, Arizona, Virginia, Indiana, Minnesota, Michigan, Georgia, and Wisconsin, surpassed only by Pennsylvania's notorious (and ultimately invalidated) map, where the efficiency gap calculated using 2016 presidential data was 38 percent.

63. Using data from the 2020 presidential election, the efficiency gap associated with the Enacted Plan is around 16 percent. This is slightly lower than the 24 percent figure associated with all statewide races, largely because relative to a typical statewide race in Ohio, the Republican candidate, Donald Trump, won by larger margins in rural areas, hence producing more wasted votes for Republicans, and Democratic candidate Joseph Biden won by slightly smaller margins in urban core areas, leading to slightly fewer wasted votes for Democrats. A similar phenomenon occurred in other states, however, and 16 percent is larger than the efficiency gap calculated using 2020 data for any of the other states mentioned above, this time with the exception of Wisconsin, where the efficiency gap was 27 percent.[17]

64. In addition to the efficiency gap, another approach to measuring partisan asymmetry is to calculate so-called electoral bias.[18] This approach flows directly from the vote-seat curves in

[17] Note that I do not have 2020 presidential data aggregated to the level of the court-invalidated Pennsylvania districts that were no longer in use in 2020.

[18] See Edward Tufte. 1973. "The Relationship Between Seats and Votes in Two-Party Systems," *American Political Science Review* 67: pages 540-554; Bernard Grofman. 1983. "Measures of Bias

Figure 7 above. Recall that because of the "winner's bonus" and the typical shape of vote-seat curves, if we observe that a party gets a seat share that is higher than its vote share, it could very well be the case that the other party would receive a similar bonus if it had received a similar vote share. We would like to know if, with a similar share of the vote, the parties can expect similar seat shares. If not, it indicates the presence of electoral bias favoring one party over the other.

65. From the observed distribution of district-level election results, one can simulate the relationship between votes and seats under other hypothetical vote shares than the one observed. Above all, it is useful to examine the hypothetical of a tied election: With 50 percent of the vote, can each party expect 50 percent of the seats? Or can one party expect a larger seat share due to its superior efficiency of support across districts? In the examples above, there is no electoral bias in the symmetric case, but in the asymmetric example, the (pro-Republican) electoral bias is 10 percent. This can be seen in Figure 7 above: a 50 percent vote share on the horizontal axis corresponds to a 60 percent seat share on the vertical axis.

66. I calculate the electoral bias based on all Ohio statewide elections from 2016 to 2020. This approach indicates that in a tied election, the Republican Party could nevertheless expect to win 10 of 15 seats, or around 66.7 percent, under the Enacted Plan. The measure of electoral bias, then, is 16.7 percent.

67. In recent years there has been a lively debate about whether courts should adopt a specific measure as a "talismanic" indicator of impermissible gerrymandering. The approach of this report is neither to contribute to this debate nor endorse a specific measure. For the most part, critics of the various measures often dwell on the prospect that they will produce false negatives. That is, they might fail to recognize a gerrymander when one is in fact present.[19]

68. As can be appreciated from the discussion above, these metrics are not always stable when we switch from the analysis of one type of election to another. Statewide results and the spatial distribution of support can vary across elections in ways that push pivotal districts above the 50 percent threshold in some races but not others—especially when we are simulating hypothetical tied elections in order to calculate electoral bias. Perhaps the most vexing problem with these indicators is that, when we are attempting to assess the likely seat share associated with future elections in the next redistricting cycle from a single statewide election—for instance a presidential election—we ignore the power of incumbency. As described above, Ohio's Republican congressional incumbents typically outperform

and Proportionality in Seats-Votes Relationships," *Political Methodology* 9: pages 295-327; Gary King and R. Browning, 1987. "Democratic Representation and Partisan Bias in Congressional Elections," *American Political Science Review* 81: pages 1251-1273; Andrew Gelman and Gary King. 1994. "A Unified Method of Evaluation Electoral Systems and Redistricting Plans," *American Journal of Political Science* 38, pages 514-544; and Simon Jackman. 1994. "Measuring Electoral Bias: Australia 1949-1993," *British Journal of Political Science* 24: pages 319-357.

[19] See, for instance, Jonathan Krasno, Daniel Magleby, Michael, D. McDonald, Shawn Donahue, and Robin Best. 2018. "Can Gerrymanders be Measured? An Examination of Wisconsin's State Assembly," *American Politics Research* 47,5: 1162-1201, arguing that the efficiency gap often produces false negatives.

statewide candidates by several percentage points. Thus, there is reason for deep skepticism about the notion that a statewide swing of 3 percentage points, for instance, would yield a Democratic victory in District 1 as drawn by the General Assembly, or that a statewide swing of four percentage points would yield a Democratic victory in District 15.

69. In any case, whether we analyze the map using 1) a simple comparison of the anticipated seat share with the statewide vote share, 2) a measure of the efficiency of support across districts, or 3) electoral bias, it is clear that the Enacted Plan's districts provide a very substantial benefit to the Republican Party. That is, under any of these measures, and with regard to any of the individual elections or aggregated election results considered above, the 2021 Congressional Plan significantly advantages the Republican Party.

VI. HOW DOES THE 2021 CONGRESSIONAL PLAN TREAT INCUMBENTS?

70. In addition to analyzing the extent to which the Enacted Plan favors or disfavors a party in the aggregate, I have also been asked to examine the extent to which it disproportionately favors or disfavors the *incumbents* for one of the two parties. Under the previous plan, there were 12 Republican incumbents. One of these, Anthony Gonzalez, has announced his retirement. All of the remaining districts with Republican incumbents continue to have Republican majorities—most of them quite comfortable.

71. The only district with a Republican incumbent worthy of further discussion is District 1. The district had previously been drawn to bisect Cincinnati, which had the effect of preventing the emergence of a majority-Democratic district in a heavily Democratic urban area by creating two districts in which parts of Cincinnati were subsumed into Republican exurban and rural areas. The Ohio Constitution now requires that Cincinnati be wholly contained within a single district, which, to my understanding, given their residential addresses, required that two Republican incumbents end up in the same district (although there is no in-district residency requirement for candidates for the U.S. House in Ohio). However, one of the ostensibly paired incumbents, Representative Brad Wenstrup, has announced that he intends to seek re-election in District 2, thereby eliminating the possibility of a double-bunking of incumbents in District 1.[20]

72. In the Enacted Plan, District 1 includes many of the suburban and rural areas that existed in the previous District 1, where Steve Chabot is a long-serving incumbent. By carving out the Democratic suburban areas north of Cincinnati and combining the city with extremely Republican rural areas, the legislature has managed to unify Cincinnati while only slightly increasing the district's Democratic vote share, thus likely keeping it safe for the Republican incumbent, who, as mentioned above, has benefited from a large incumbency advantage, and will compete in a new district where over 80 percent of the population was in his old district.

[20] https://highlandcountypress.com/Content/In-The-News/In-The-News/Article/Rep-Wenstrup-announces-intent-to-seek-re-election-in-2nd-District/2/20/74059.

73. In all the other districts with Republican incumbents, as documented above, safe margins have been maintained so that incumbents are likely to survive even a significant statewide swing toward the Democratic Party.

74. In contrast, of the four Democratic incumbents, only two continue to reside in majority-Democratic districts. The other two reside in dramatically reconfigured districts. Marcy Kaptur represented a relatively urban and comfortably Democratic District 9 (drawn in 2011 to pair Kaptur with another Democratic incumbent). This district has been redrawn to separate Ohio's northern industrial cities, thus subsuming Toledo in a much more rural district that now has a Republican majority. As described above, less than 40 percent of the new version of District 9 was in her previous district. Tim Ryan, who has announced that he is running for the U.S. Senate, was the incumbent in the Youngstown-based District 13, which has been completely reconfigured, with Ryan now placed in the predominantly rural, safe Republican 6th District in the Enacted Plan.

VII. HOW DOES THE 2021 CONGRESSIONAL PLAN ACHIEVE THESE RESULTS?

75. Without a doubt, the Enacted Plan favors the Republican Party and its many incumbents, while disfavoring the Democratic Party and its handful of incumbents. One might suspect, however, that this outcome was driven not by the choices of the map-drawers, but by the Ohio Constitution—with its requirements about keeping counties, cities, and townships whole—combined with Ohio's political geography. I have written extensively about the difficulties for parties of the left in majoritarian democracies like the United States in an era when population density is becoming highly correlated with votes for more progressive candidates.[21] Democrats are highly concentrated in cities and, increasingly, their suburbs. When cities are very large relative to the size of districts, this tends to create some districts in which Democrats win very large majorities. This can make their geographic distribution of support relatively less efficient if Republican majorities in rural areas are not correspondingly large. Thinking visually in terms of cross-district histograms, like those in Figure 6 above, the presence of overwhelmingly Democratic cities can pull out the left tail of the distribution, thus wasting some Democratic votes. Anyone drawing congressional districts—including a non-partisan computer algorithm or even a Democratic activist—is likely to draw a very Democratic district in Cleveland or Columbus. It is also the case that such a map-drawer cannot avoid creating some extremely Republican districts in rural areas.

76. However, the larger implication of this type of political geography for the transformation of votes to seats depends crucially on what is happening in the middle of the distribution of districts. This is precisely where those drawing the districts have maximum discretion. With a very Democratic city like Cincinnati that is *not* especially large relative to the size of congressional districts, it is possible to avoid the emergence of a Democratic district altogether by cutting off its most Democratic suburbs—splitting communities of interest along the way—and combining it with far-flung rural areas. If smaller Democratic cities are close to one another, as in northwestern Ohio, or as in the Canton/Akron/Youngstown area,

[21] Jonathan Rodden, 2019, *Why Cities Lose: The Deep Roots of the Urban-Rural Political Divide*. New York: Basic Books.

boundaries can be drawn to make sure they do not combine to form any district with an urban, and hence Democratic, majority. And when cities are sufficiently large that they must be subdivided, and can thus provide *two* Democratic majorities, as in Columbus, it is possible to conduct this subdivision in a way that prevents the emergence of a second Democratic district by packing as many Democratic votes into a single district as possible and subsuming the remaining Democrats in very Republican rural areas. The legislature has pursued each of these strategies to prevent the emergence of majority-Democratic districts in Ohio.

77. In my academic research, I have shown that residential geography can make life easier for those drawing districts with the intent of favoring Republicans. With maneuvers like those described in the preceding paragraph, a Republican map-drawer can produce a substantial advantage for Republican candidates without drawing highly non-compact or odd-shaped districts. My research has also pointed out that a mere concentration of Democrats in cities is insufficient to produce advantages for Republican candidates. It is clearly the case that in states where Republicans have controlled the redistricting process, districts have favored Republican candidates far more than what might be explained by residential geography alone. Recall the striking difference between the black and red data markers in Figure 5 above, indicating that with similar levels of partisanship, districts drawn by Republican legislatures have had far larger Republican seat shares than those drawn by courts, commissions, and divided legislatures. In fact, in my academic writings, I have used Ohio in the 2010 redistricting cycle as a leading example of this phenomenon.[22]

78. In order to verify that the extreme pro-Republican bias described above was not forced upon the legislature by the Ohio Constitution or the residential geography of Ohio, it is useful to conduct a simple exercise: we can examine the congressional maps submitted by Democrats and other groups to the state legislature. The purpose of this exercise is not to recommend these maps for adoption. Rather, these maps are useful because they were available to the legislature prior to adopting the Enacted Plan and, if they comply with the Constitution,[23] demonstrate similar or superior compactness, pursue fewer unnecessary county splits, and are less prone to splitting obvious communities of interest, we can conclude that the extreme pro-Republican slant of the Enacted Plan was not driven by residential geography or constitutional requirements, but by discretionary choices.

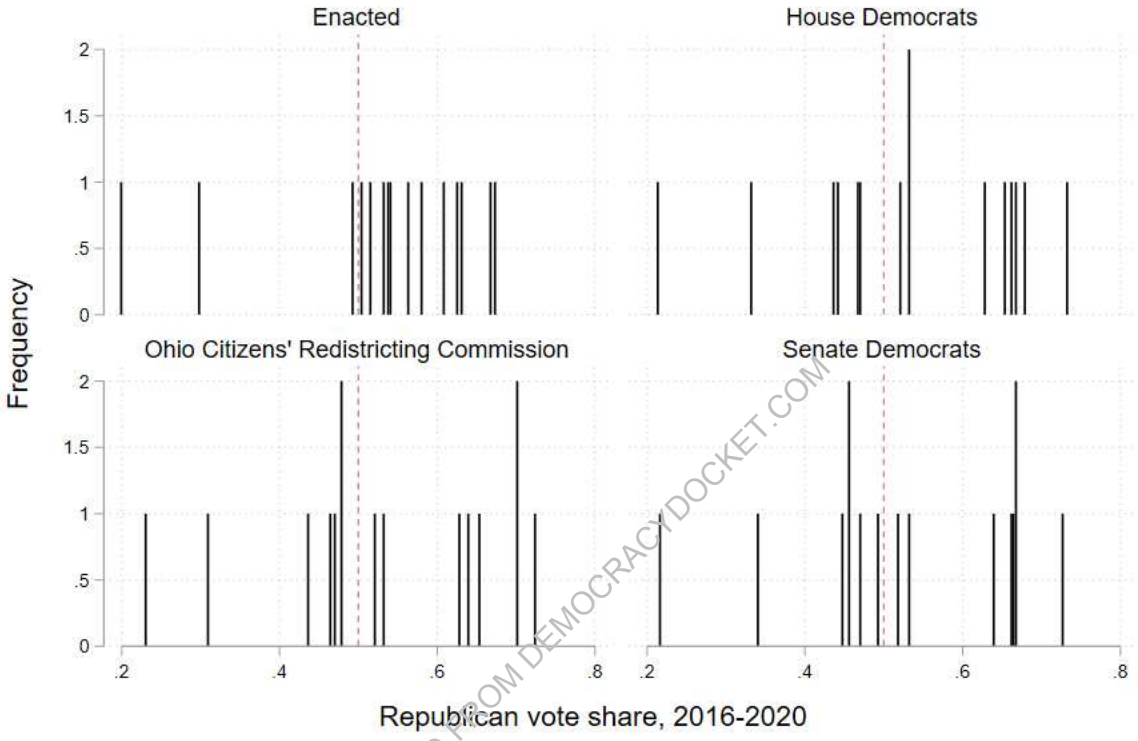
79. Figure 8 provides discrete histograms of the composite vote share of statewide Republican candidates from 2016 to 2020—the same measure used extensively above—aggregated to boundaries of proposed congressional districts. The top left panel represents the Enacted Plan. The panels on the right represent districts proposed by the House (top) and Senate (bottom) Democrats, attached as Exhibits C and B, respectively. In the lower left-hand

[22] See, for example, *Why Cities Lose*, op cit., Figure 6.2 on page 171 and the surrounding discussion, as well as Figure 6.8 on page 184 and the accompanying discussion in the text.

[23] I have carefully examined these plans, and according to my review, the only clear constitional compliance issue arises with the Senate Democrats' plan, where a single house on the border of Massillon City was mistakenly placed in District 8 rather than District 7, creating a very minor non-contiguity. See the appendix for an image of the misplaced fragment. Needless to say, this mistake does not undermine the usefulness of the map for comparative analysis.

corner, I include a districting plan submitted by a group called the Ohio Citizens Redistricting Committee (OCRC), attached as Exhibit D.

Figure 8: Histograms of Enacted and Alternative Maps



80. Note that all the histograms share something in common: each includes two extremely Democratic districts on the left-hand side of the graph. In each case, one is in Cleveland and one in Columbus. However, as described above, the Enacted Plan only includes a single additional district that is (barely) on the Democratic side of 50 percent, for a total of three. In the other comparison maps, there are seven districts with Democratic majorities in statewide races, six in the case of the House Democrats' plan. Thus, the Senate Democrats' plan and the OCRC plan, where 46.7 percent of the districts have Democratic majorities in statewide races, correspond almost exactly with the statewide aggregate vote share (see Table 1 above), while the House Democrats' plan falls short by one seat. In other words, if these maps were included in Figure 5 above, they would be on, or slightly below, the dotted line of proportionality, much like the court-drawn maps in Figure 5.

81. The Enacted Plan is also unique in that it avoids creating extremely Republican rural districts on the right side of the histogram. The vast majority of districts have comfortable but not staggering Republican majorities. As discussed above, Senator McColley has portrayed the presence of several solidly but not overwhelmingly Republican districts, all with longstanding Republican incumbents, as a virtue of the map, in that it introduces "competition." However, in a state where only 53 to 54 percent of the votes go to

Republicans, it is simply not possible to create 12 of 15 districts in which Republican candidates win with over 54 percent of the vote. In all, the cross-district distribution of support in the Enacted Plan is a textbook example not of a plan with highly competitive districts that may swing from one election to the next, but, rather, of a distribution that is extremely efficient for one party and inefficient for the other. As mentioned above, the efficiency gap (using composite statewide election results between 2016-2020) is 24 percent. The other maps are far more even-handed. For the House Democrats' plan, it is 3.5 percent (still favoring Republicans). For the Senate Democrats' plan and the OCRC plan, the distribution of support is slightly more efficient for the Democrats, with gaps that are swung in the other direction of 3.7 percent and 3.6 percent, respectively.

Table 6: Comparison of Enacted Plan with Alternative Plans	Seats in which statewide Democratic vote share exceeds 50 percent	Efficiency gap
Enacted	3	24%
Senate Democrats	7	-3.7%
House Democrats	6	3.5%
OCRC	7	-3.6%

Note: Efficiency gap is calculated so that a positive number indicates pro-Republican efficiency gap.

82. What accounts for these large differences in the efficiency of support for the two parties in the different maps? Above all, the remainder of this report demonstrates that the answer lies in the treatment of urban areas.

Cincinnati

83. First, consider the Enacted Plan's treatment of Hamilton County. Any treatment of Hamilton County that attempts to minimize splits and keep Cincinnati-area communities together would produce a majority-Democratic district. Any such district would keep northern suburbs with large Black populations together with similar neighborhoods across the Cincinnati boundary. Each of the alternative maps keeps Hamilton County mostly whole and keeps the Black community together in a relatively compact district contained entirely within the county.

84. However, the Enacted Plan traverses the Hamilton County boundary in *three* different places in order to overwhelm Cincinnati's Democratic population with a sufficient number of exurban and rural Republicans. The entire urban, Black population of Northern Hamilton County is carved out from its surroundings and combined with a rural Republican district, number 8, whose northern boundary is 85 miles away. Second, instead of being combined with its immediate inner-ring suburbs, for instance, linking neighborhoods like College Hill and North College Hill (see Figure 11), Cincinnati proper is combined with rural Warren

County via a very narrow corridor in District 1. Finally, Cincinnati's relatively Democratic eastern suburbs are also extracted from the city and combined with District 2, which is extremely rural and Republican.

Figure 9: Partisanship and the Enacted Plan's Districts, Hamilton County and Surroundings

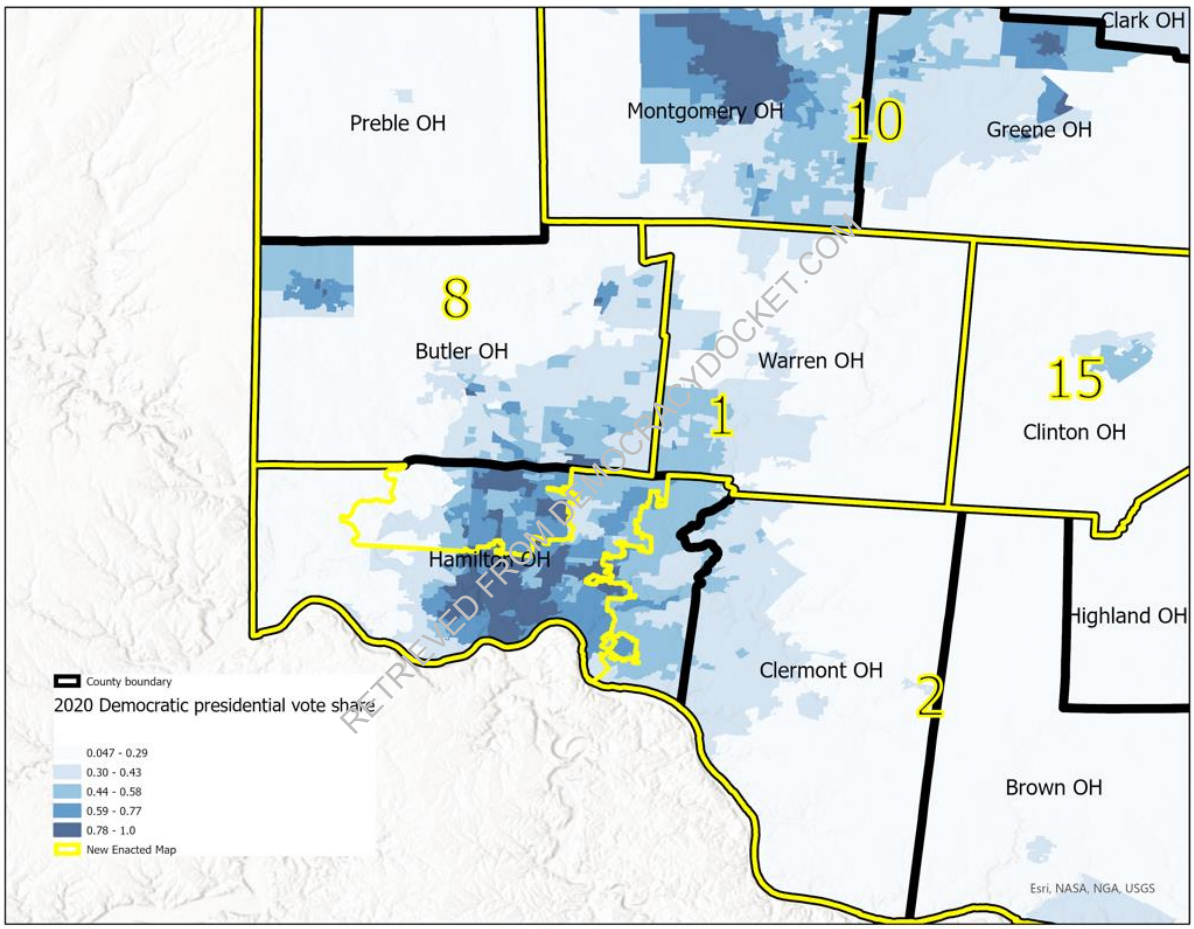


Figure 10: Race and the Enacted Plan's Districts, Hamilton County and Surroundings

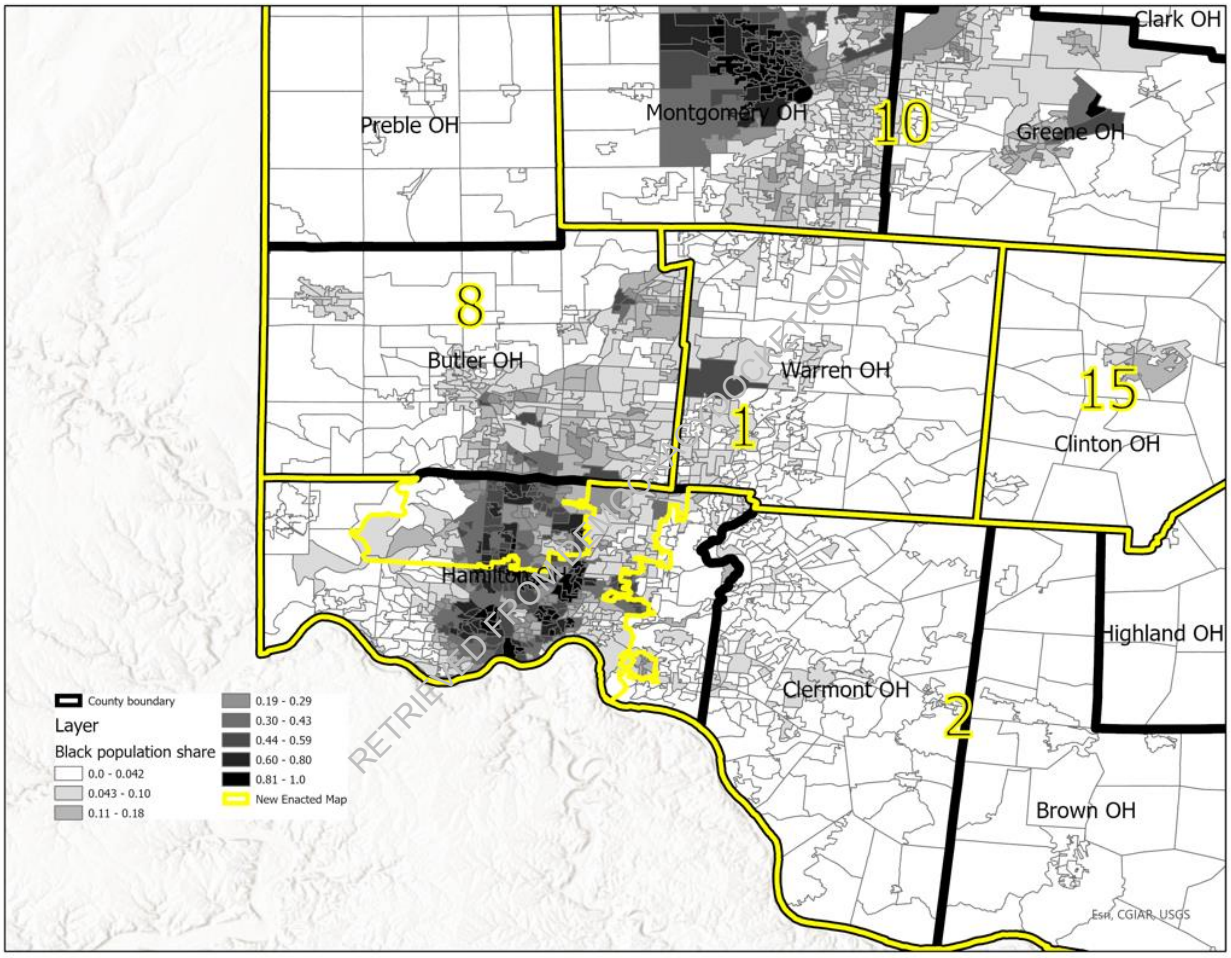
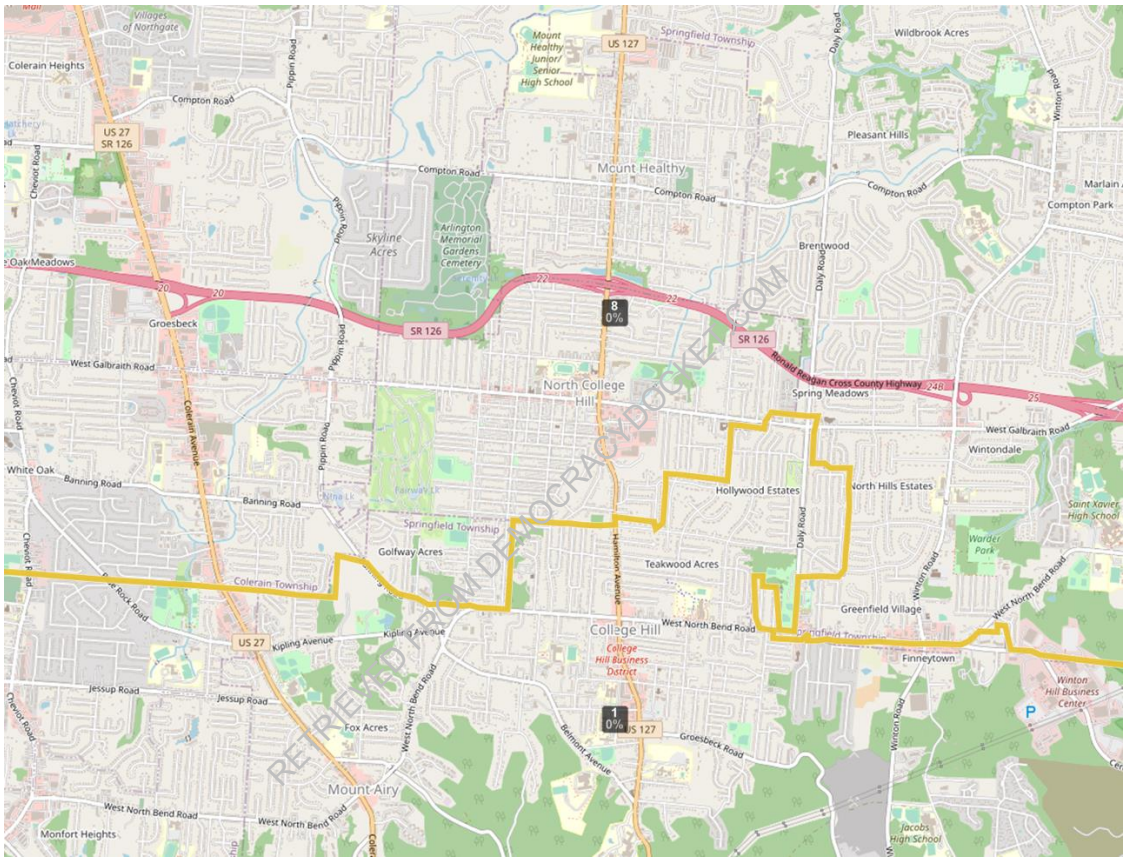


Figure 11: Cincinnati, College Hill Area



85. This can be visualized in Figure 9, which overlays the Enacted Plan on a map of partisanship, from precinct-level results of the 2020 presidential election. Figure 10 then overlays the district boundaries on a map that shows the area's racial composition. It highlights the extent to which the Enacted Plan splits Hamilton County's Black population—cutting the Black community essentially in half and cutting through neighborhoods.

86. Under any method of counting splits, the Enacted Plan's approach involves at least two splits of Hamilton County—a line running north-south on the east side of the county and another one that carves out the northern suburbs. These maneuvers are clearly not necessary for any reason other than partisan advantage. Each of the alternative plans keeps metro Cincinnati together in a compact district remaining within the county, avoids splitting the Black community, and splits the county only once.

87. The arrangement of these alternative plans can be seen in Figure 12. Clearly, it is quite straightforward to draw a district that is compact, minimizes splits, and keeps the Black community together. Notably, these arrangements all produce a majority-Democratic district (56.5 percent for the House Democrats' plan, 55.4 percent for the Senate Democrats' plan, and 56.4 percent for the OCRC plan).

88. These alternative plans are also more compact than the Enacted Plan, both in the areas in and around Hamilton County and (as discussed below) plan-wide. Higher Reock score values indicate greater compactness. The Reock score for the General Assembly's District 1 was .27. The Reock score for District 1 in the OCRC plan is .54, and the score for the comparable district (5) in the Senate Democrats' plan is .44. Summary information about Reock scores for all the districts in each of these plans is provided in Figure 13 below.

Figure 12: Partisanship and Districts of Alternative Plans, Hamilton County and Surroundings

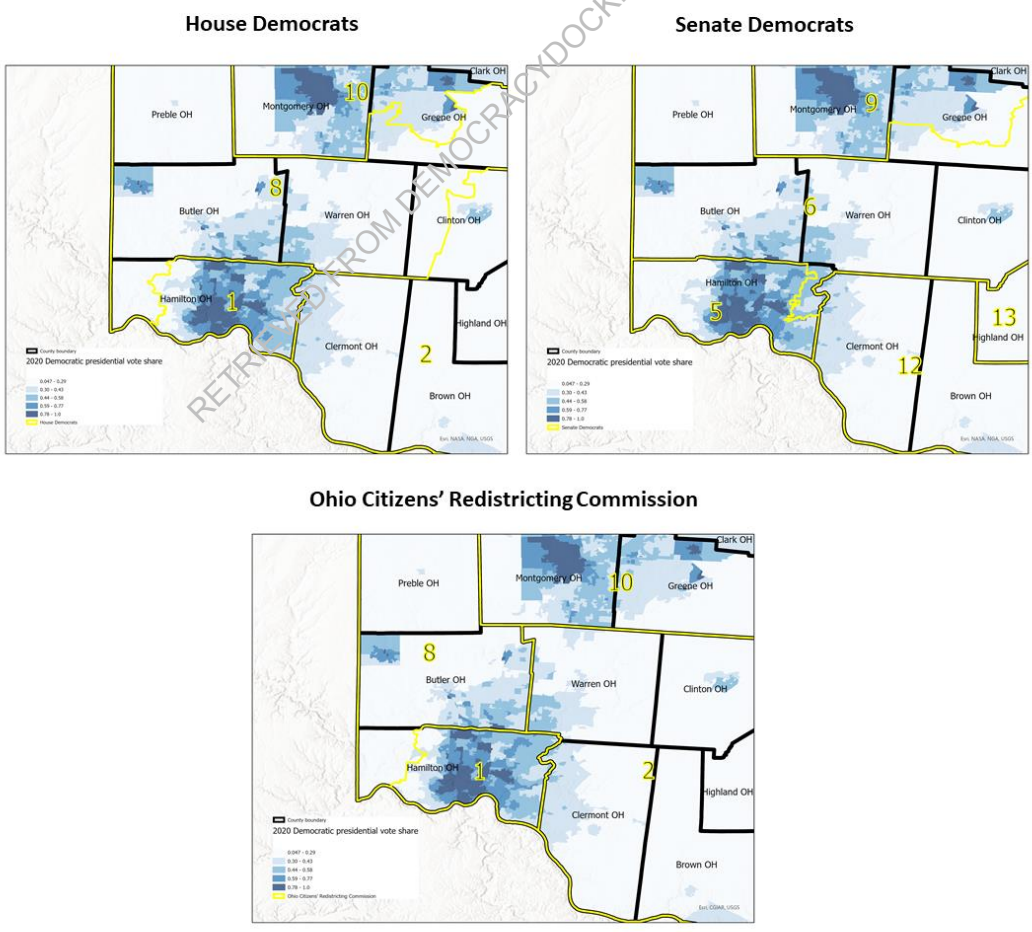
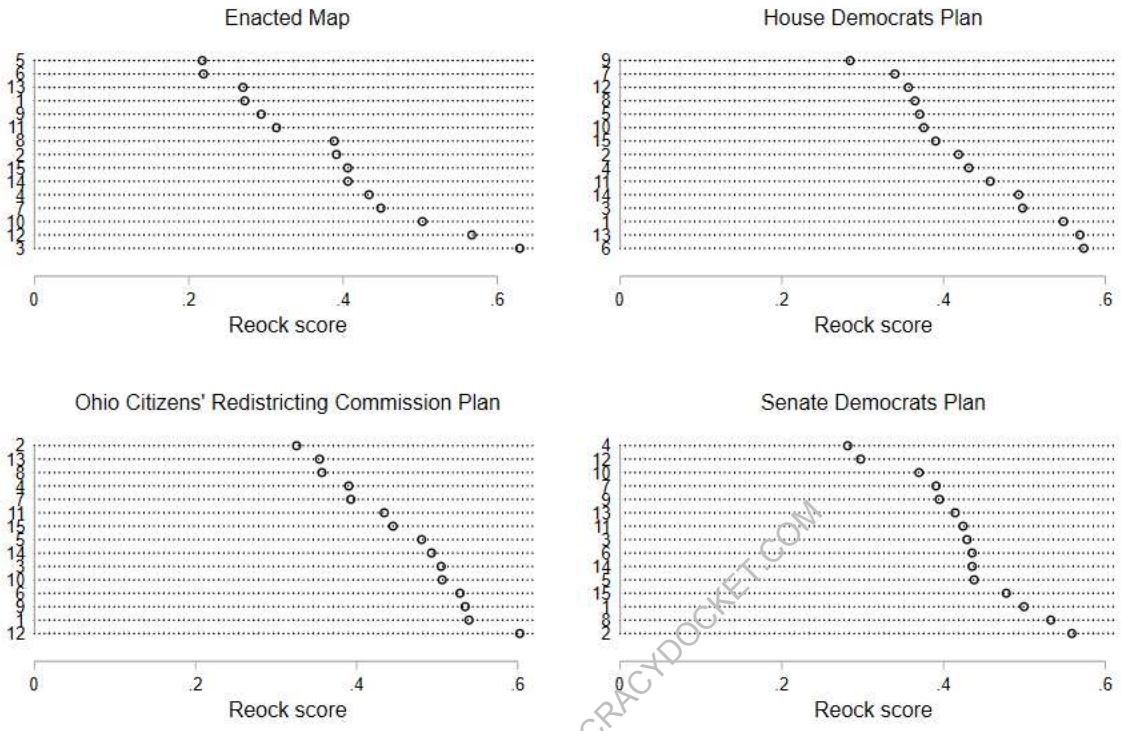


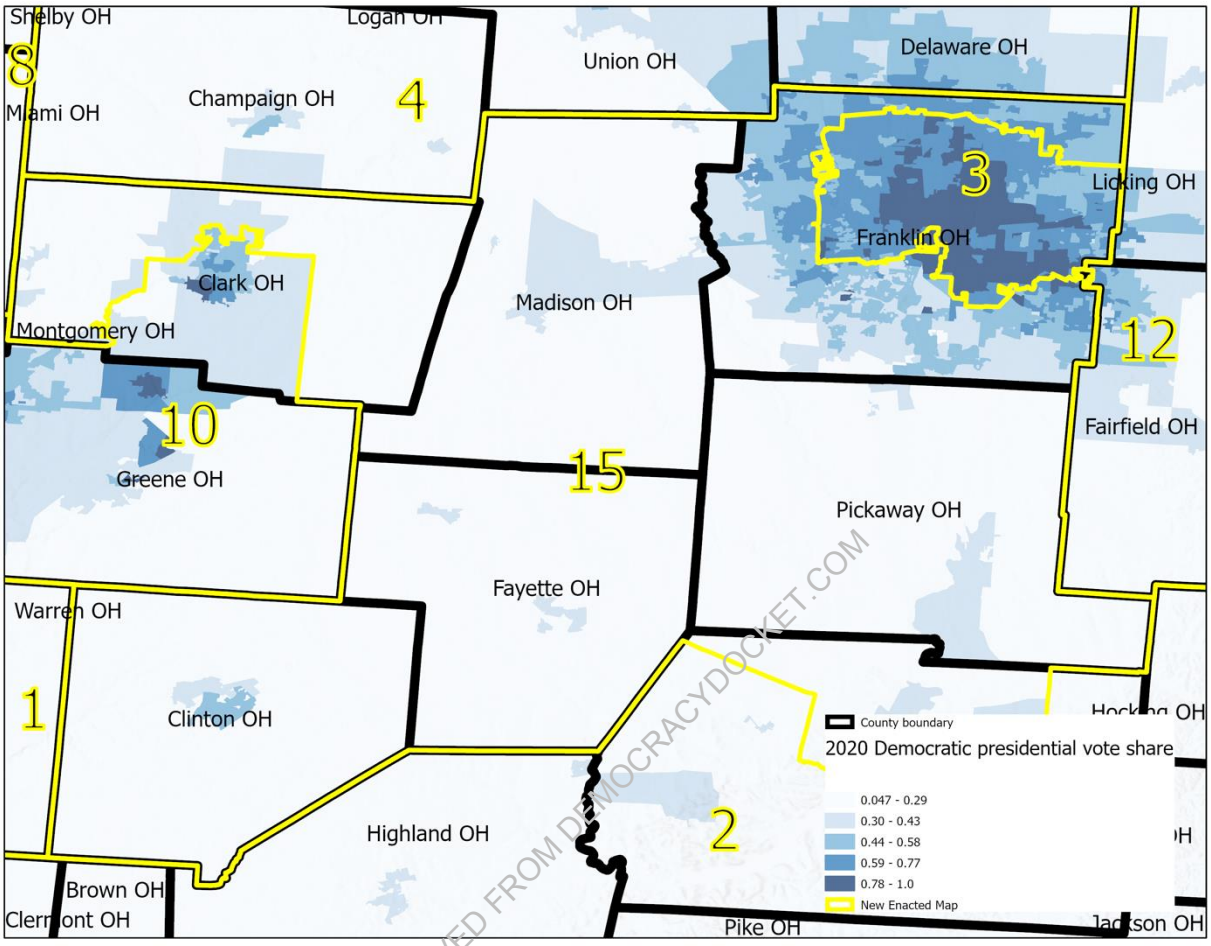
Figure 13: Reock Scores for Districts in Enacted and Alternative Plans



Columbus

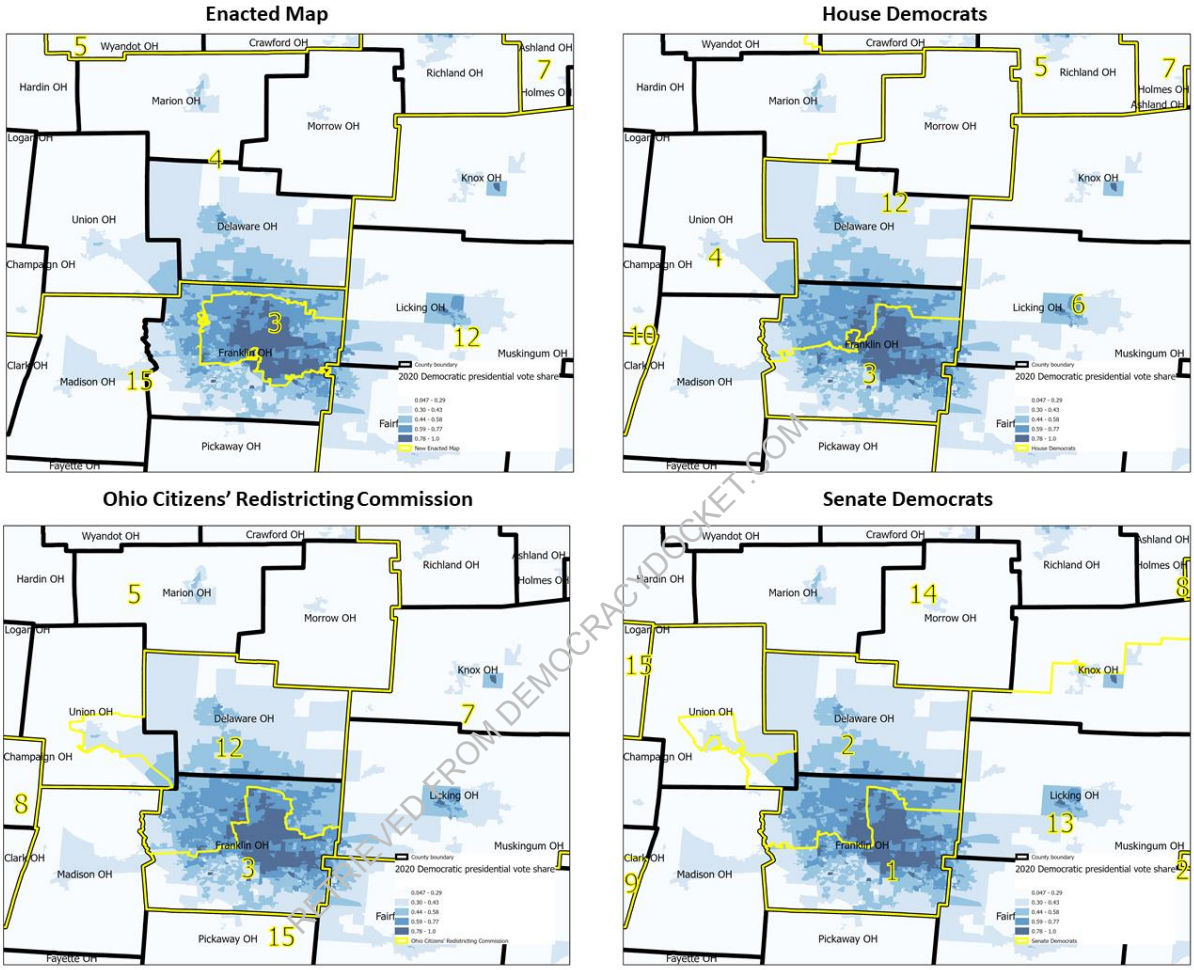
89. Next, consider the Columbus area in Franklin County. The city of Columbus is larger than a unit of congressional representation, so it must be split. In Cincinnati, it was possible to maneuver to avoid the creation of a Democratic district that would have otherwise emerged. But in Columbus, the number of Democratic voters was simply too large to pursue that strategy. Instead, the Enacted Plan in Franklin County packs Democrats into one very Democratic Columbus district (District 3). It then reaches around the city to extract its outer reaches and suburbs, connecting them with far-flung rural communities to the southwest—an arrangement that prevents the emergence of a second Democratic district by removing Democratic Columbus-area neighborhoods from their context and submerging them in rural Republican areas (see Figure 14).

Figure 14: Partisanship and Enacted Districts, Columbus and Surroundings



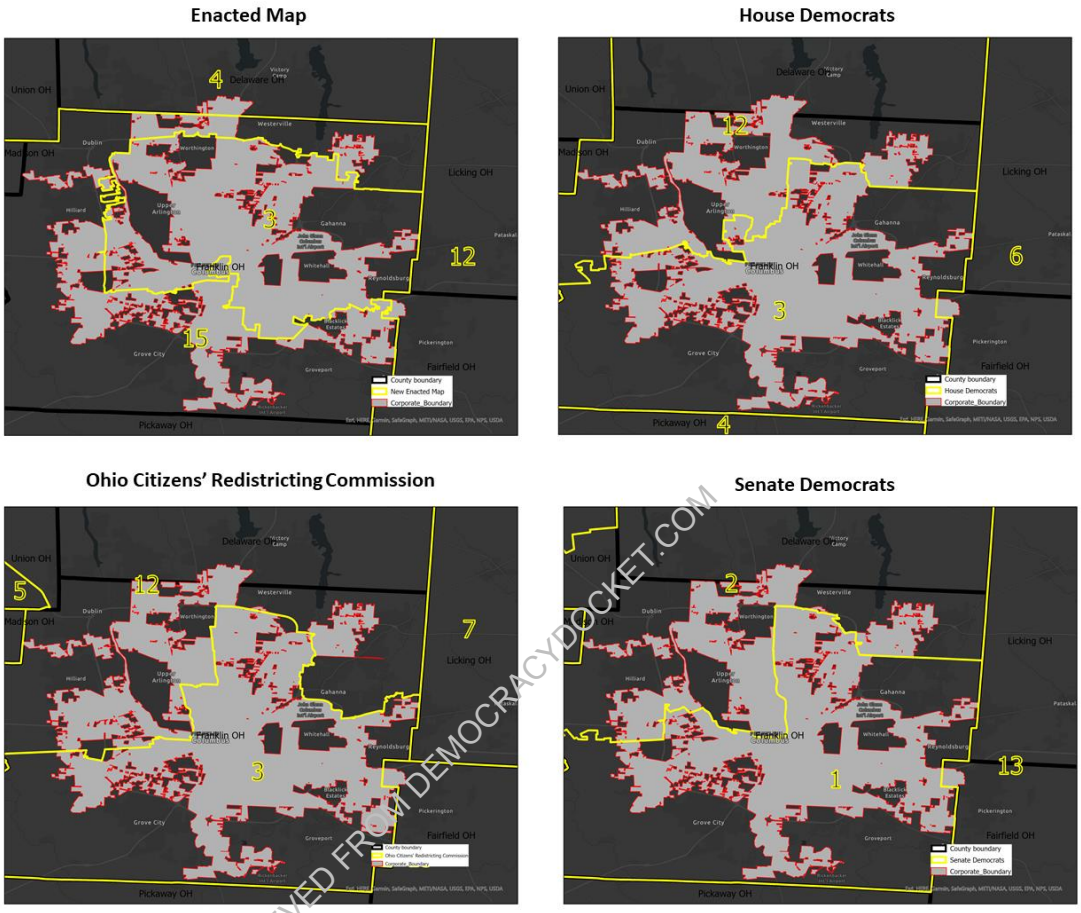
90. In contrast, the alternative plans split Columbus with a line that runs from west to east (see Figure 15). This arrangement creates a compact southern Columbus district that includes much of the city and its southern suburbs, and a relatively compact northern Columbus district that includes all the northern reaches of the city and its suburbs. In northern Franklin County, the cities of Westerville, Columbus, and Dublin all cross over into Delaware County, and these alternative plans keep them together. In fact, Dublin also extends into Union County, and the Senate Democrats' plan and the OCRC Plan extend into Union County and keep Dublin whole. Given the fact that Columbus and its suburbs spill into counties to the north, if one is attempting to keep communities together, the northern border—not the western border—is the obvious place to extend the second Franklin County/Columbus district.

Figure 15: Partisanship and Enacted and Alternative Districts, Columbus and Surroundings



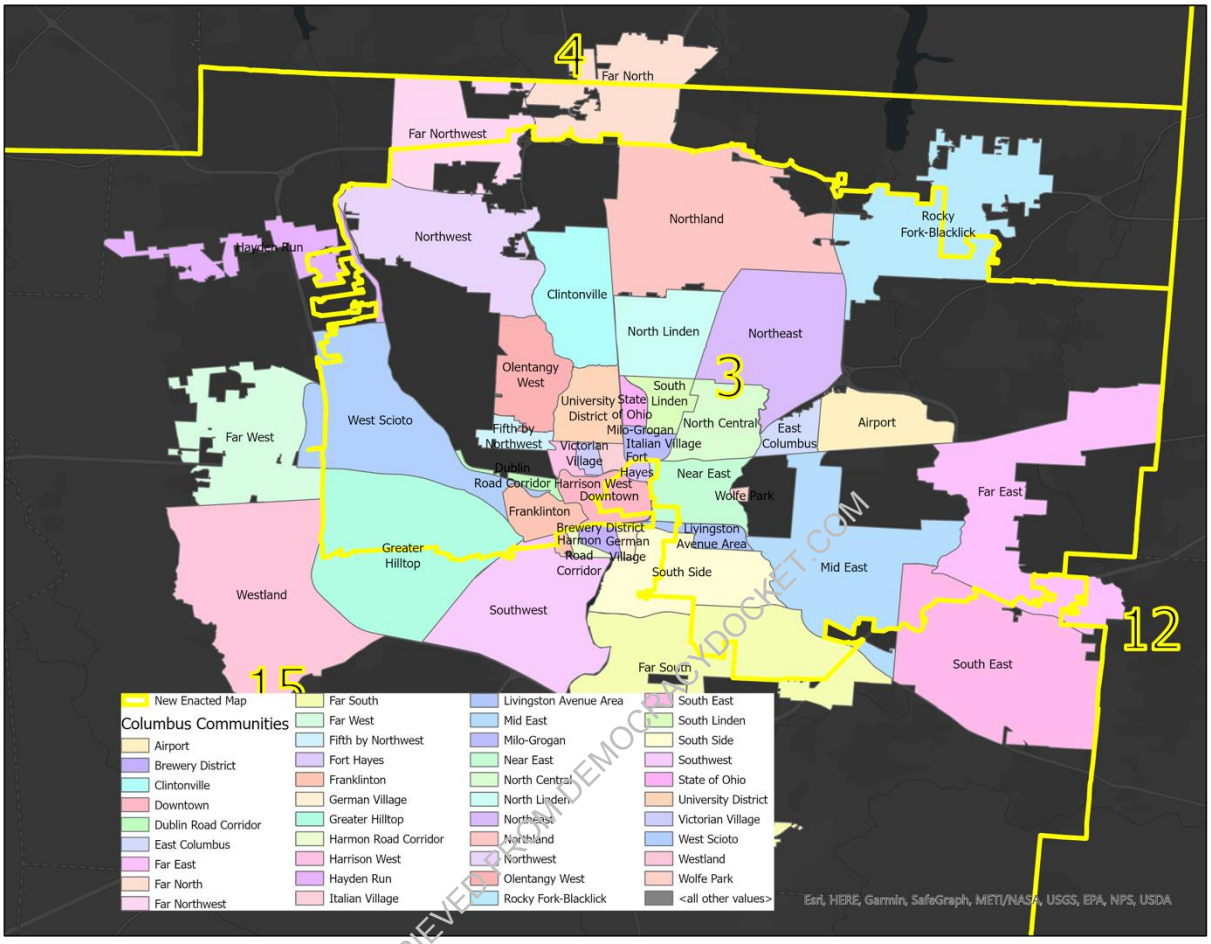
91. The Enacted Plan produces several non-contiguous chunks of Columbus that are removed from the city and placed in largely rural District 15. Figure 16 features the Columbus Corporate Boundary and its interaction with the Enacted Plan as well as the alternative plans. In the Enacted Plan, there are five chunks of non-contiguous territory that are carved away from Columbus and placed in District 15 (two in the north, one in the west, one in the southwest, and one in the southeast). In contrast, each of the alternative plans places two non-contiguous chunks of Columbus in its northern Columbus-oriented district, and the House Democrats' plan also includes a third tiny non-contiguous sliver of Columbus that abuts Upper Arlington and Grandview Heights.

Figure 16: The Boundary of the City of Columbus and Boundaries of the Enacted Plan and Alternative Plans



92. Perhaps a better way to contrast the way these redistricting plans treat Columbus is to examine its communities. The city of Columbus produces maps of areas recognized by the city as distinct communities. Figure 17 provides a map of Columbus communities and the boundaries of the Enacted Plan. Due to its circumnavigation of the city, the Enacted Plan splits 15 of Columbus' communities (16 if we include the Far North, which extends into Delaware County). For instance, the northern part of the Rocky Fork-Blacklick area is extracted and placed in a rural district that curls around the city and extends 100 miles to the southwest. On the south side of Columbus, the Hilltop neighborhood is cleaved down the middle. Residents on the north side of Sullivant Avenue are in an urban district with a large Democratic majority, while residents on the south side of the street are in a rural district that extends to the southwest part of the state. Along the eastern boundary of Franklin County in the southeast part of Columbus, several neighborhoods with large minority populations are split between the Columbus-based District 3 and the rural District 15.

Figure 17: The Boundary of the Communities of the City of Columbus and Boundaries of the Enacted Plan

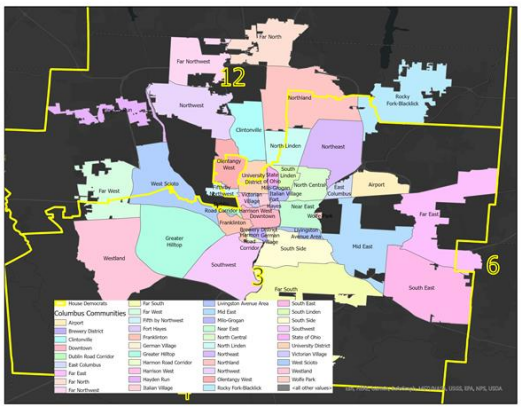


93. The approaches taken to dividing Columbus in the alternative plans produce fewer subdivisions of Columbus communities. The House Democrats' plan splits eight communities, while the Senate Democrats' plan splits five, and the OCRC plan splits 10 (see Figure 18).[24]

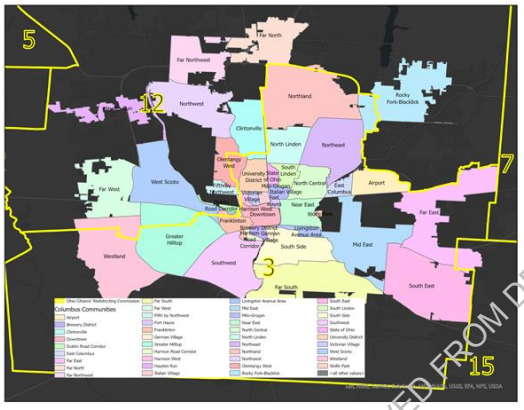
[24] In the Senate Democrats' and OCRC plans, one of these splits, to the community of Northland, involves a single small precinct that is separated from the rest of the community by Highway 270.

Figure 18: The Boundary of the Communities of the City of Columbus and Boundaries of the Alternative Plans

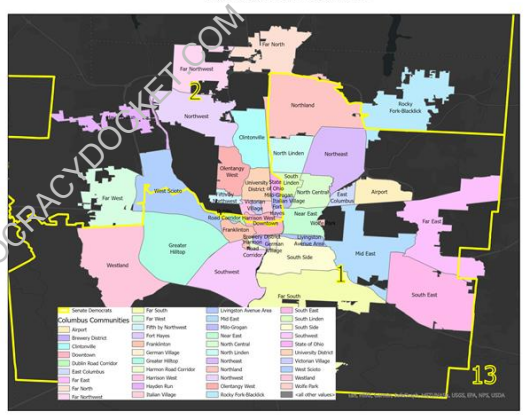
House Democrats



Ohio Citizens' Redistricting Commission



Senate Democrats



Northeast Ohio

94. Next, consider Summit County and the Akron area. As with Cincinnati, the Enacted Plan cuts off Akron's eastern suburbs from the city. In this case, the maneuver introduces a long, narrow north-south corridor that is, in one spot, less than one mile wide, connecting a number of relatively urban, Democratic-leaning precincts, removing them from their geographic context, and combining them with rural areas well to the southwest. For example, Twinsburg, a small city nestled between Cleveland and Akron near the northern border of Summit County, is in a district with neither of them. Rather, it is part of a rural district well to the south, whose southwest border is over 70 miles away, where Ashland, Knox, and Richland counties come together. And rather than combining Akron with its own suburbs, the Enacted Plan combines it with rural Medina County and the most Republican outer exurbs of Cleveland (see Figures 19 and 20).

Figure 19: Partisanship and the Boundaries of the Enacted Plan, Northeast Ohio

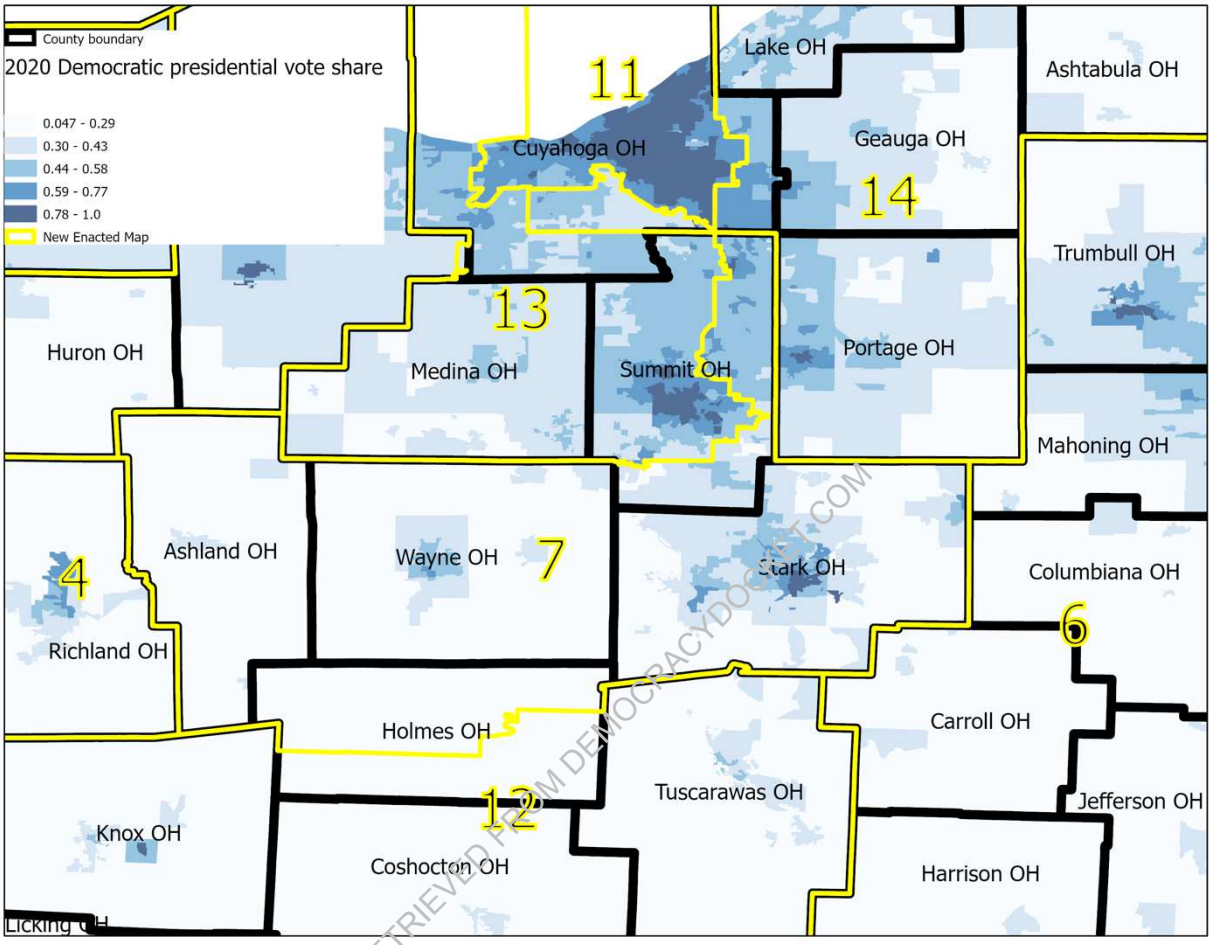


Figure 20: Partisanship and the Boundaries of the Enacted and Alternative Plans, Northeast Ohio

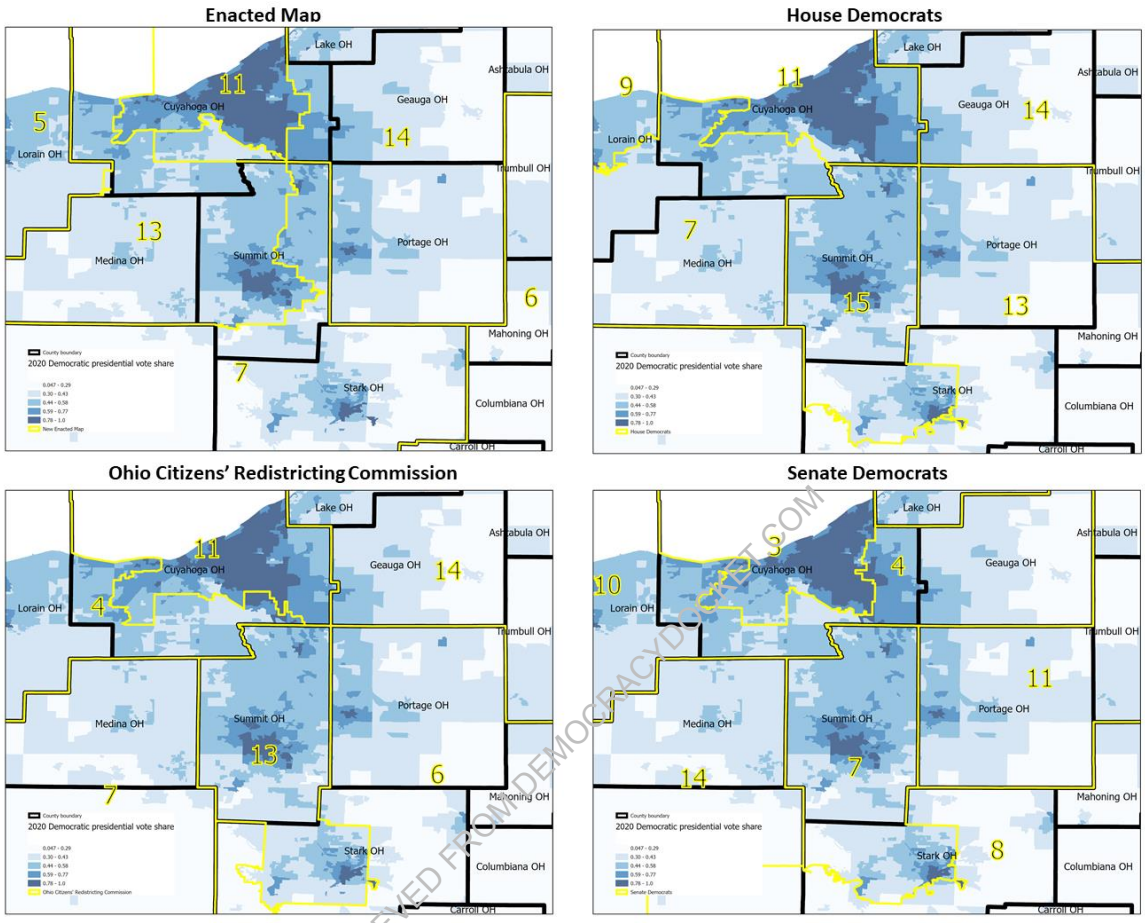
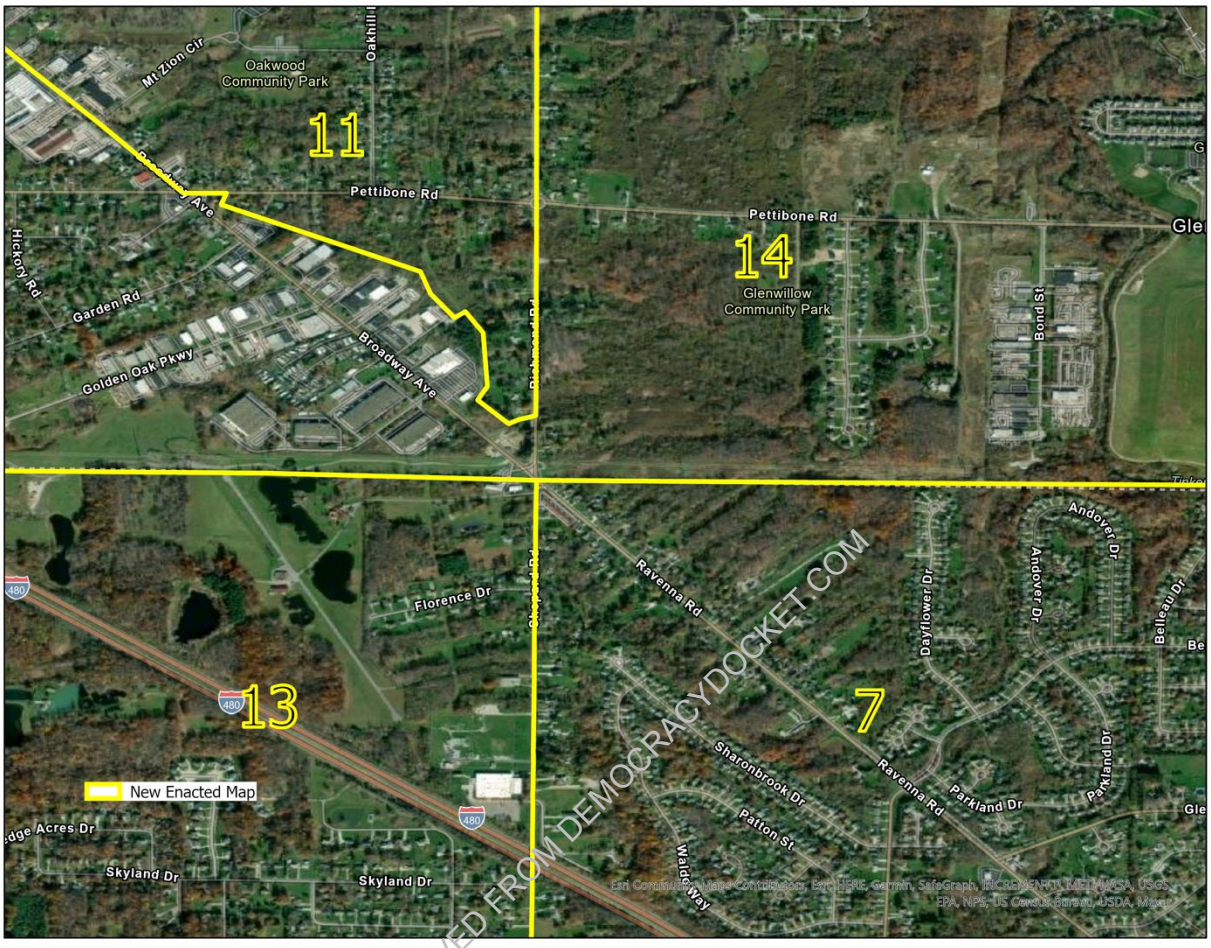


Figure 21: The Cuyahoga Corridor



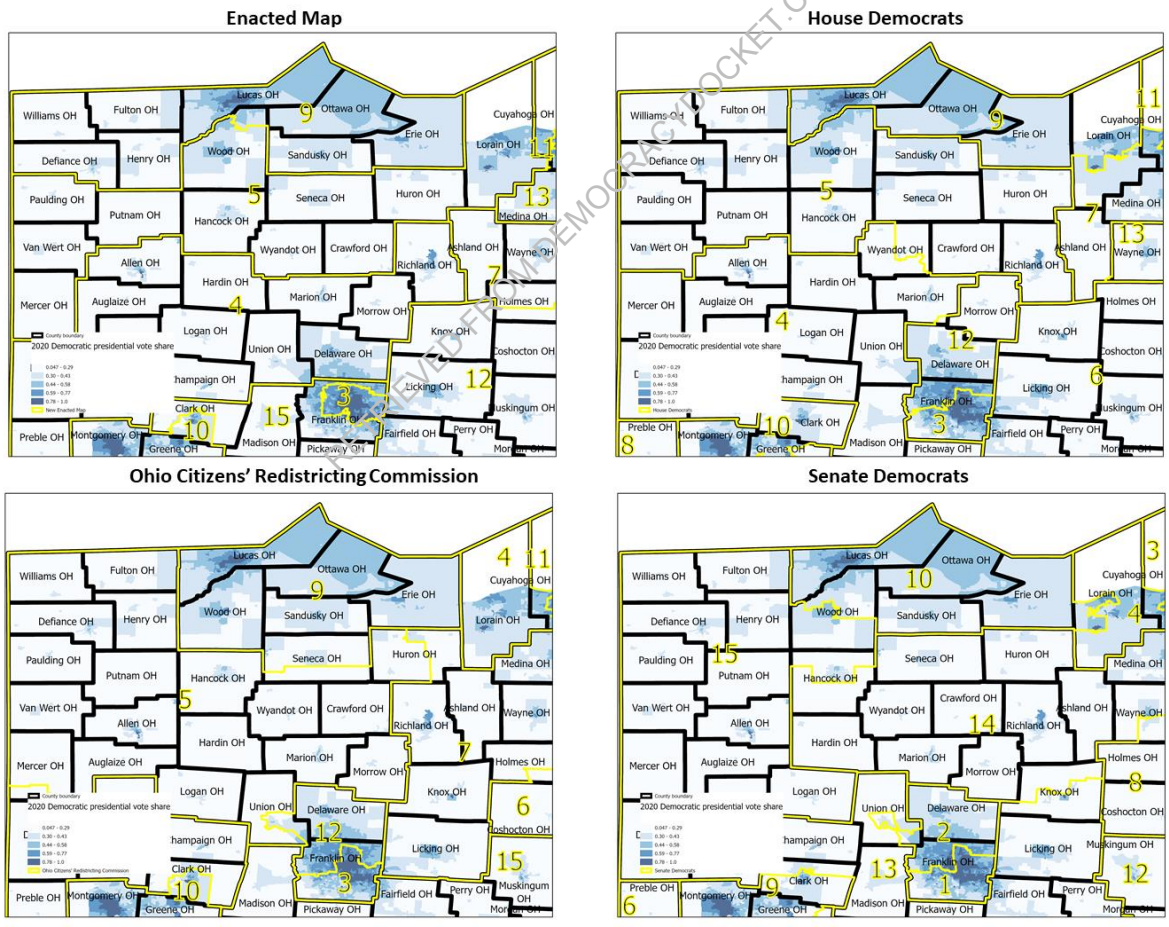
95. Next, consider Cuyahoga County and Cleveland. Here, the Enacted Plan produces multiple splits of Cuyahoga County—placing fragments in three different districts, and an arrangement featuring a narrow corridor (seen in Figure 21) that is, in one spot, the width of one census block, with no road connecting the fragments. In this area, four districts—7, 11, 13, and 14—converge upon an area spanning less than a square mile. The Cleveland-based District 11 nearly splits District 14 in half (i.e., making it noncontiguous), but for the grace of the one census block mentioned above.

96. District 13 in the Enacted Plan appears to have been crafted as part of an effort to make sure there is only one very Democratic district in Northeast Ohio, such that what would otherwise be a comfortable Democratic Akron-based district is instead a toss-up. In addition to separating Akron from its Democratic suburbs, the map avoids a connection to Canton. Moreover, Democratic neighborhoods nestled between Cleveland and Lorain are prevented from joining with either of their surrounding Democratic strongholds and are instead combined with Medina County to the South.

Northwest Ohio

97. Finally, consider Northwest Ohio. The Enacted plan and the three alternative plans are depicted in Figure 22. Each of the plans includes Toledo and draws a relatively narrow district that runs from West to East along the Michigan border and Lake Erie. However, the General Assembly's plan stops short of Lorain County and its Democratic cities, extending instead all the way west to the Indiana border with an arrangement that, reminiscent of the Cincinnati strategy described above, combines Toledo with very rural areas. In this arrangement, the Democratic cities of Lorain County are removed from their geographic context and subsumed within a narrow rural District 5 that reaches all the way to Mercer County, along the Indiana border, which is 180 miles away, more than a 3-hour drive from downtown Lorain.

Figure 22: Partisanship and the Boundaries of the Enacted and Alternative Plans, Northwest Ohio



98. In contrast, the plans created by the House Democrats and Senate Democrats simply extend the district slightly to the East—leaving out the Western rural counties—keeping the string of proximate industrial towns along Lake Erie together. The Senate Democrats' plan and the OCRC plan also extend into Wood County to keep Toledo's Southern suburbs together with the city. In contrast with the General Assembly's plan, each of these plans creates a Democratic-leaning district. According to the Reock score, the Senate Democrats and OCRC version of District 9 is more compact than the General Assembly's version.

County and Municipal Splits

99. In sum, the 2021 Congressional Plan includes consequential extra county splits vis-à-vis the alternative plans in Hamilton, Summit, and Cuyahoga Counties. It includes two counties—Hamilton and Cuyahoga—that are split between three districts, whereas the alternative plans never do this. If we simply add up county splits, there are 12 split counties in the Enacted Plan, but since two of them are split multiple times, the total number of splits is 14. The Senate and House Democrats' plans split 14 individual counties, while the OCRC plan splits 13 individual counties.

100. While prioritizing counties first, the Ohio Constitution also instructs those drawing the districts as a secondary priority to attempt to avoid splits of townships and as a third priority, to avoid splits of municipal corporations. The Enacted Plan, along with those submitted by the Senate and House Democrats, achieved absolute population equality across districts. In order to do so, it was necessary to split a number of townships and/or cities. The General Assembly, along with the Senate and House Democrats, clearly placed considerable effort into minimizing these splits. OCRC did not attempt to achieve absolute population equality, and while its plan achieved fewer county splits than the other plans, it was less successful in avoiding township splits.

101. Of the four plans considered here, the plan submitted by the Senate Democrats performs the best when it comes to avoiding township splits. By my accounting, which is explained in Appendix B, this plan did not split one township, while producing 15 city splits.[25] The Enacted Plan created a total of 17 splits, 8 of which involved townships. The House Democrats' plan creates 19 splits, 13 of which involved townships. The OCRC plan produced 27 splits, all of which were townships except for the city of Columbus.

Compactness

102. In addition to providing guidance about county splits, the Ohio Constitution also calls for compact districts. As already indicated in the discussion above, the Enacted Plan produces a set of districts that are less compact than those of the alternative plans. Average compactness scores across all districts, including the Reock, Polsby-Popper, and Convex Hull scores, are set forth in Table 7. With each of these scores, a higher number indicates a higher level of compactness. On each indicator, the Enacted Plan is less compact than the alternative plans.

[25] Note that in an earlier affidavit I submitted in this case, I missed one instance of a split township—Prairie Township—in Franklin County.

Table 7: Average Compactness Scores

	Reock	Polsby-Popper	Convex Hull
Enacted Plan	0.38	0.28	0.73
House Democrats	0.43	0.33	0.78
Senate Democrats	0.43	0.29	0.76
OCRC	0.46	0.37	0.79

103. As described above, and as explained further elsewhere,[26] highly non-compact districts are sometimes an obvious manifestation of efforts by partisan map-drawers to favor a political party. Among the clearest examples are the notorious maps of Pennsylvania and North Carolina from the last redistricting cycle. In these cases, given the underlying political geography, such maps were necessary in order to generate the maximum possible number of Republican seats. However, it is a myth that such odd-shaped districts are the *sine qua non* of gerrymandering. Depending on the underlying political geography, it is sometimes possible to draw maps that are extremely favorable to a political party— maps that pack and crack one's opponents, divide communities, and maximize a party's seat share—without drawing long tendrils and comical shapes in every region. Likewise, sometimes relatively non-compact districts are forced upon district-drawers by natural geography and the specific rules governing the redistricting process in a state.

104. For this reason, one should approach average, plan-wide compactness scores like those in Table 7 with caution—especially for cross-state comparisons. However, the discussion above demonstrates that the extreme favorability of the Enacted Plan to the Republican Party and its incumbents required specific choices in certain urban areas, many of which clearly required non-compact districts, and a comparison with alternative maps clarifies that these choices were not forced by political geography or constitutional rules. The same is true about the General Assembly's decisions to unnecessarily split several urban counties and the communities within them.

Splits of Partisan Communities

105. It is clear from the maps and analysis above that in the vicinity of Ohio's major cities, the Enacted Plan achieves an unusually large advantage in the efficiency of its support across districts by inserting district boundaries that split geographically proximate groups of Democrats in order to prevent them from forming districts with Democratic majorities, while trying to place as many Republicans as possible in majority-Republican districts. In order to

[26] Rodden, *Why Cities Lose*, op cit.

visualize this type of intentional "cracking" of co-partisans, along with co-authors, I have developed a simple measure that we call "partisan dislocation."[27]

106. We begin with geo-spatial precinct-level geographic boundaries of each precinct, associated with outcomes of past elections—in this case, all the statewide races from 2016 to 2020. We create a series of points within each precinct, where each point is represents a voter, and each representative voter is classified as either a Democrat or Republican, with these classifications made in proportion to the precinct-level vote shares of the parties. For each point, based on the size of an Ohio congressional district, we also find the representative voter's 786,630 nearest neighbors, and then calculate the partisanship of that voter's bespoke "neighborhood." This is akin to asking, for each representative voter: if a congressional district was built with this voter at the absolute center, what would be the vote share of Democrats and Republicans in that district? For a resident of the urban core of Cleveland, Cincinnati, or Columbus, it would be very Democratic. For a resident of a rural county who is far away from a city, it would be quite Republican. For many suburban residents, this bespoke district would be more heterogeneous, but would lean more Democratic as we move closer to the city, and more Republican in the outer exurbs.

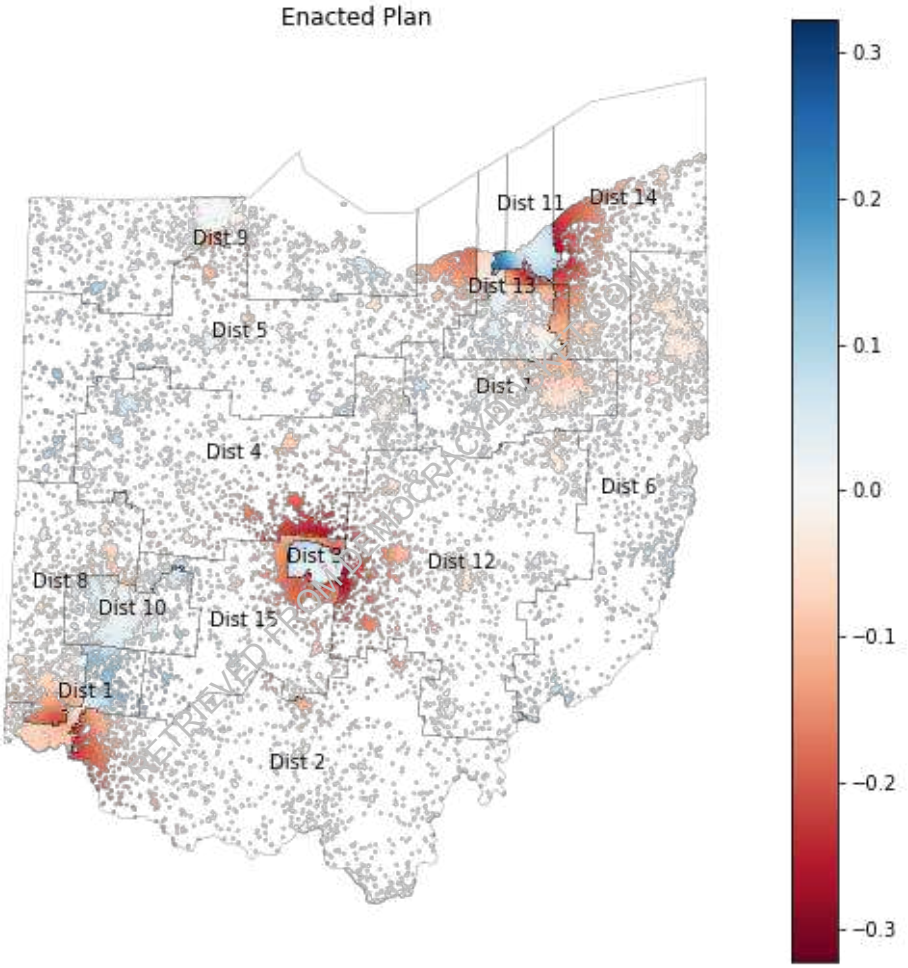
107. An interesting question, then, is whether in an enacted redistricting plan, people end up in districts where the partisanship is roughly similar to that of their geographic neighborhood, or if they end up in districts where the partisanship is quite different. To examine this, for each representative voter, we simply calculate the difference between the partisanship of the district in which they have been placed, and the partisanship of their geographic neighborhood. We refer to this difference as "partisan dislocation." We have discovered that in maps where districts have been drawn to provide an advantage for a political party, we can see telltale patterns of "dislocated" voters clustered near district boundaries. Specifically, when map-drawers are attempting to create an advantage for their in-party, they will produce large numbers of "dislocated" members of the out-party, often near district boundaries—that is to say, large clusters of voters whose nearest neighbors, at the relevant geographic scale for drawing districts, strongly support the opposite party, but have nevertheless been placed in districts where the in-party is a majority.

108. This type of analysis is illuminating in Ohio. In Figure 23, I present a map of the districts in the Enacted Plan, with dots for representative voters, where the dots are colored according to the level of partisan dislocation. A dark red color indicates that the partisanship of the enacted district is much more *Republican* than the representative voter's 786,630 nearest neighbors. A dark blue color indicates that the district is much more *Democratic* than the

[27] Daryl DeFord, Nicholas Eubank, and Jonathan Rodden, 2021, "Partisan Dislocation: A Precinct-Level Measure of Representation and Gerrymandering." *Political Analysis*. Online early view available here: https://doi.org/10.1017/pan.2021.13. Nicolas Eubank provided assistance with the generation of the Ohio partisan dislocation map presented below.

representative voter's neighborhood. Figure 23 brings to life the extent to which the districts of the Enacted Plan cut up geographic communities of co-partisans.

Figure 23: Partisan Dislocation Associated with the Enacted Congressional Redistricting Plan in Ohio



Note: Dots are representative voters. Darker shades of red indicate the extent to which the voter's district in the Enacted Plan is more Republican than their nearest 786,630 neighbors. Darker shares of blue indicate the extent to which the voter's district is more Democratic than their nearest neighbors.

109. The area around Cincinnati is especially interesting. As discussed above, the Enacted Plan carves out an extremely Democratic section of Northern Hamilton County with a large Black population and places it in the rural-dominated 8th District. And the Democratic-leaning

Eastern suburbs of Cincinnati have been cleaved from the city and placed in the rural-dominated 2nd district. In Figure 23, we can see that levels of partisan dislocation are relatively high for these voters; they have been extracted from their geographic setting and placed in a district where the partisanship is completely different from that of their surrounding neighborhood. Democratic, relatively densely populated neighborhoods have been placed in extremely non-competitive rural districts where they have virtually no chance to elect their preferred candidates.

110. The story in Columbus is similar. As described above, the Democratic suburbs that fall within Franklin County have been pulled from their geographic context and placed in relatively rural District 15, which means that residents of Columbus suburbs are in a district whose partisanship is quite different from that of their neighborhood. The same is true of the suburban communities to the North of Columbus in Delaware County, which have been placed in an even more rural and Republican District 4.

111. Likewise, Figure 23 illuminates the impact of the Enacted districts in Northeast Ohio, where there is a large concentration of Democratic neighborhoods that have been placed in majority-Republican districts. District 14 extracts large numbers of Democrats in suburban areas from Cuyahoga County that are in a largely Democratic geographic context, and places them in the 14th District, where voting behavior is far more Republican. Also, Figure 23 clarifies how the long, narrow appendage of District 7, which extracts Akron's suburbs, removes them from their Democrat-leaning partisan context and places them in a highly Republican district. Likewise, we can see that the partisanship of the enacted 5th district is far more Republican than the partisan neighborhood in the Democratic cities of Lorain County.

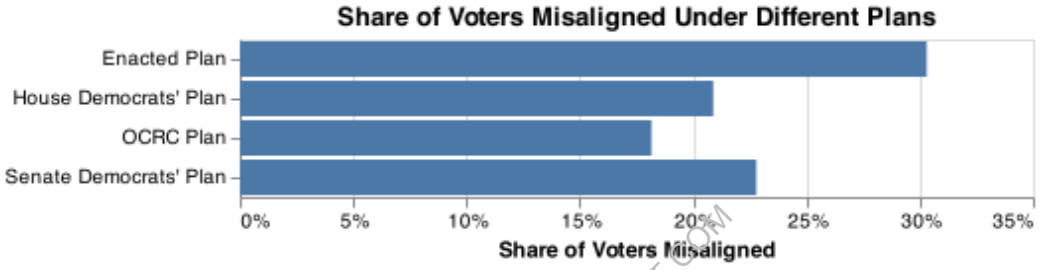
112. Each of these areas shows up as relatively dark red dots in Figure 23. Note, however, that there are very few places on the map where the dots are dark blue; that is, where the partisanship of the Enacted Plan is much more Democratic than the geographic neighborhood. The only exception is part of the Western suburbs of Cleveland within Cuyahoga County, where relatively evenly divided (but still Democratic leaning) neighborhoods are contained in a district that is mostly composed of extremely Democratic parts of Cleveland.

113. There are light blue dots throughout the map. Some of these are in the two very Democratic urban districts, where the partisanship of the district is slightly more Democratic than that of the geographic neighborhood. And Warren County, which was connected via a narrow corridor to Cincinnati, is in a district that is somewhat more Democratic than its neighborhood. The other areas with light-blue dots correspond to places where very Republican rural areas are placed in districts that include college towns, suburbs, or small cities that make the district as a whole more Democratic than the region in question. However, in every case like this, the district remains comfortably Republican.

114. In sum, we can see that the Enacted Plan tended to extract Democratic neighborhoods in and around cities from their partisan geographic context and place them in districts that were far more Republican, while keeping Republican exurban and rural neighborhoods in safely Republican districts.

115. This pattern of partisan dislocation was not forced upon the General Assembly by Ohio's political geography, or by the requirements of the Ohio Constitution. Again, this is made clear through analysis of the alternative plans described above. I have conducted the same dislocation analysis for these alternative maps. Let us consider a simpler, binary rather than continuous notion of dislocation, such that a representative voter is said to be living in a "misaligned" neighborhood if the partisan majority among their 786,630 nearest neighbors is not the same as that in the district to which they were assigned. In the Enacted Plan, over 30 percent of all Ohio residents are living in such misaligned neighborhoods (see Figure 24).

Figure 24:



116. As shown in Figure 24, far fewer voters reside in such misaligned neighborhoods in the alternative plans: around 22.5 percent in the Senate Democrats' Plan, 21 percent in the House Democrats' Plan, and only 18 percent in the OCRC Plan. Of course, not everyone can be in an electoral district where the partisan majority matches their bespoke neighborhood. This is especially true when those drawing the districts must minimize county splits, and thus cannot easily keep groups of co-partisans together, as is the case where a city's Democratic suburbs spill into surrounding counties. It is therefore not surprising that some voters would also live in "misaligned" neighborhoods in the alternative plans. However, the large difference in the percentage of misaligned voters between the Enacted Plan and the alternative plans makes it abundantly clear that the far more efficient Republican support distribution in the Enacted plan relative to the alternative plans was achieved by carving up clusters of geographically proximate Democratic communities and removing them from their neighborhood context. The choices outlined above in the alternative plans—such as splitting Hamilton and Cuyahoga Counties only once, drawing two Columbus-oriented districts rather than one, and keeping Summit County together—achieved greater Democratic representation by keeping such communities of co-partisans in the same district.

VIII. CONCLUSION

117. The 2021 Congressional Plan is highly favorable to the Republican Party and its incumbents, and it disfavors the Democratic Party and its incumbents. This is true not because of the requirements of the Ohio Constitution or the political geography of Ohio, but because of discretionary choices made by those drawing the districts, which had the effect of "packing" Democrats into districts where they win by large majorities and "cracking" Democratic communities that would otherwise have produced majority-Democratic districts. In drawing districts to achieve partisan gain, the legislature sacrificed compactness, introduced

unnecessary splits to urban counties, and divided a number of urban and suburban communities, including minority communities, throughout the state.

Jonathan Rodden

Jonathan Rodden

Sworn to before me this 10th day of December 2021.

Notary Public

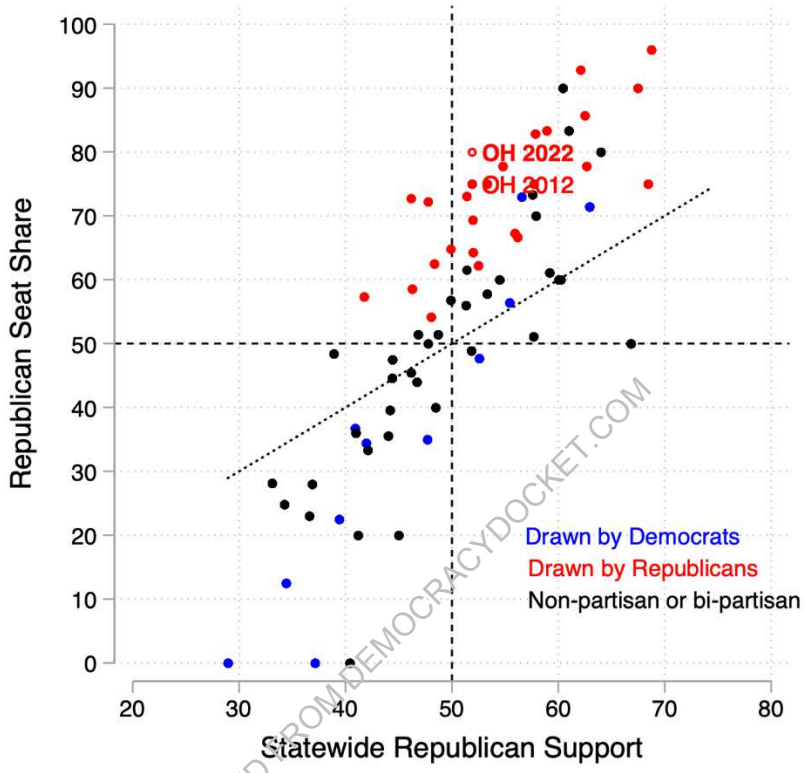
LESTER SAURI
Notary Public - State of Florida
Commission # HH 6340
Expires on June 3, 2024

My commission expires 06/03/2024

Notarized online using audio-video communication

Appendix A

Figure A1: Vote Shares in Statewide Elections and Seat Shares in Congressional Elections, 2000 and 2020 Redistricting Cycles, All States with 4 or More Seats



Appendix B: Splits of Municipal Subdivisions

I have attempted to assemble information on all the splits of townships and municipal corporations in the Enacted Plan and the three alternative plans. A complication is that cities and villages sometimes spill slightly over the boundary of a township, such that a district-drawer must choose between splitting the municipal corporation or the township. In such instances, I do not count a township that was clearly split in order to keep a municipal corporation whole, and likewise, I do not count splits of small fragments of cities that were clearly made in order to keep a township whole. I document these decisions in italics below. Furthermore, I attempt to avoid double-counting. If a single split of a municipal corporation also appears to split a township in which it is embedded, I only count a single split. As I discuss in the text, each of the plans introduces multiple splits of the City of Columbus, and I count each of these as a distinct split.

Enacted Plan

Sycamore Township and Kenwood CDP, Hamilton County
(This also splits Rossmoyne CDP, which is also in Sycamore Township, so count once).
Glendale Village, Hamilton County
Union Township, Ross County
City of Columbus, Franklin County (5 splits total, see main text)
Norwich Township is split, but this can potentially be explained by an effort to follow the Hilliard City line. Do not count
Green Township, Shelby County
Perrysburg Township, Wood County
Columbia Township, Lorain County
Belpre Township, Washington County
Berlin Township, Holmes County
Cuyahoga Falls City, Summit County
Stony Ridge CDP, but presumably this was done to keep Lake Township whole, so do not count.
Mad River Township and Green Meadows CDP (only count once), Clark County
Rocky River City, Cuyahoga County
Oakwood Village, Cuyahoga County

Total splits: 17, 8 of which are townships.

Senate Democratic Plan

Columbus City (two splits, see main text)
Prairie Township, Franklin County
Marysville City, Union County
Millcreek Township does not count as a split, as it was split in order to prevent the introduction of an additional split to Marysville City.
Berea City, Cuyahoga County
Madeira City, Hamilton County

Beavercreek City, Greene County
Massillon City, Stark County
Cambridge City, Guernsey County
Campbell City, Mahoning County
Wooster City, Wayne County
Springfield City, Clark County
Pike Township split to keep New Carlisle City together, so do not count
Amherst City, Lorain County
Amherst Township split to keep South Adams Village together, so do not count
Bowling Green City, Wood County
Mount Vernon City, Knox County
Findlay City, Hancock County

Total splits: 16, 1 township and 15 cities.

House Democratic Plan

Mack CDP, Hamilton County
This is a single split that also simultaneously can be viewed as a bisecting the boundary between Green and Miami Townships, Hamilton County; only count once.
Union Township, Clinton County
Liberty Township, Clinton County
Buckskin Township, Ross County
Concord Township, Ross County
According to the Ohio Constitution, the small fragment of Greenfield Village on the Ross County side of the county boundary should not be considered a split.
Dunham Township, Washington
Columbus City (3 splits, see text, see main text), Franklin County
Prairie Township is nominally split, but to keep Lake Darby CDP whole, so do not count
Waldo Township, Marion County
Antrim Township, Wyandot County
Pitt and Salem Townships nominally split in Wyandot County, but to keep the City of Upper Sandusky together, so do not count.
Walnut Creek Township, Holmes County
Dunham Township, Washington County
Fairfield Township, Washington County
Lake Township, Ashland County
Seven Hills City, Cuyahoga County
North Ridgeville City, Lorain County
Beavercreek City, Greene County
Do not double-count Beavercreek Township.
Canton Township, Stark County
Poland Township, Mahoning County

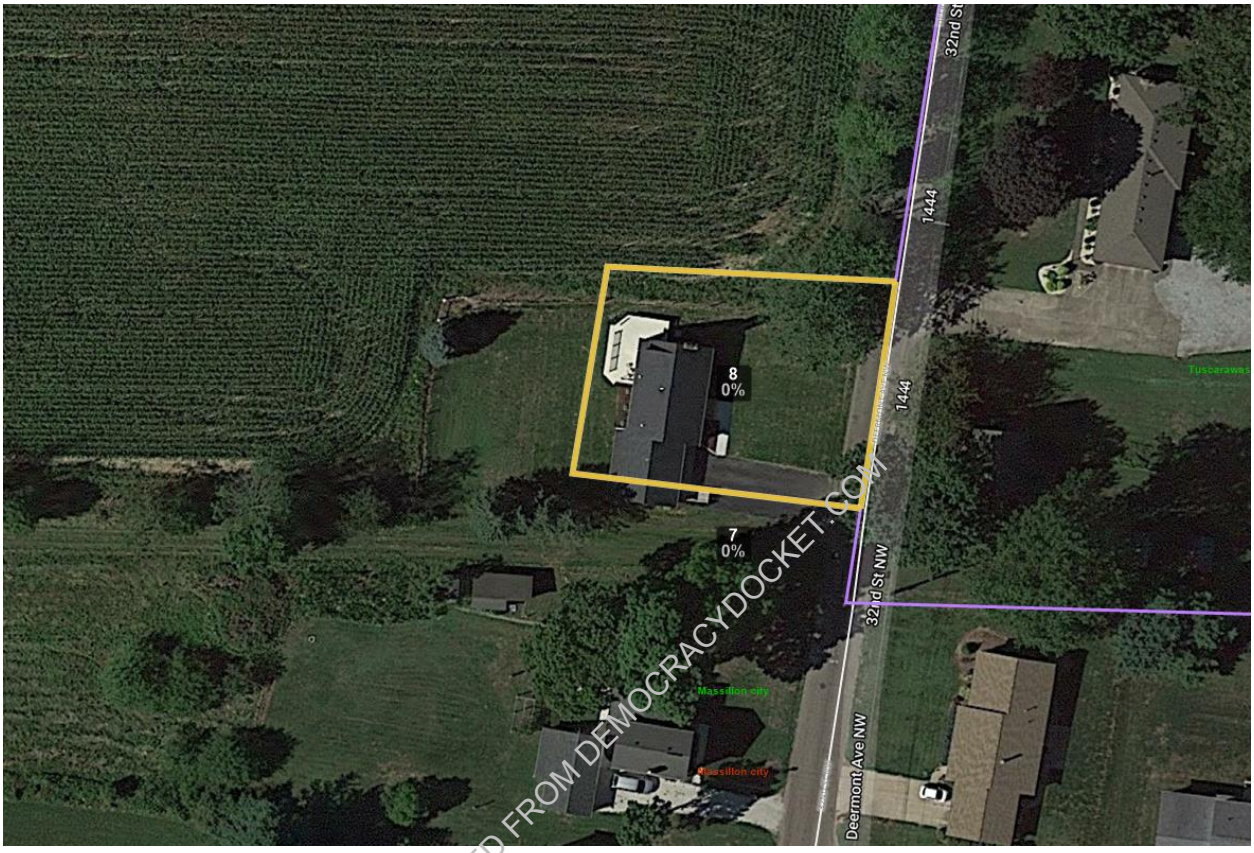
Total splits: 20 total splits, 14 are townships

Ohio Citizens Redistricting Commission

Colerain Township, Hamilton County
Racoon Township, Gallia County
Prairie Township, Franklin County
Columbus City, Franklin County (2 splits)
Blendon Township, Franklin County
Jefferson Township, Franklin County
Hartland Township, Huron
Fitchville Township, Huron
Greenwich Township, Huron
Dover Township, Union County
Paris Township, Union County
Jerome Township, Union County
Granville Township, Mercer County
Recovery Township, Mercer County
Big Spring Township, Seneca County
Richland Township, Guernsey County
Killbuck Township, Holmes County
Tuscarawas Township, Stark County
Lake Township, Stark County
Boardman Township, Mahoning County
Poland Township, Mahoning County
Coitsville Township, Mahoning County
Moorefield Township, Clark County
German Township, Clark County
Bethel Township, Clark County
Mad River Township, Clark County

Total splits: 27, all townships except Columbus

Appendix C: Image of Mistake in Senate Democrats' Redistricting Plan



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CERTIFICATE OF SERVICE

I hereby certify that the foregoing was sent via email this 10th day of December, 2021 to the following:

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Derek S. Clinger (0092075)

AFFIDAVIT OF DR. JONATHAN RODDEN – APPENDIX OF EXHIBITS

Index of Documents

ITEM	DESCRIPTION	BATES RANGE
A	2021 Congressional Plan	RODDEN_0001-02
B	Proposed Senate Democratic Caucus Plan	RODDEN_0003-04
C	Proposed House Democratic Caucus Plan	RODDEN_0005-06
D	Proposed Ohio Citizens Redistricting Committee Plan	RODDEN_0007-08
E	2011 Congressional Plan	RODDEN_0009-10
F	Curriculum Vitae of Dr. Jonathan Rodden	RODDEN_0011-19

Exhibit A

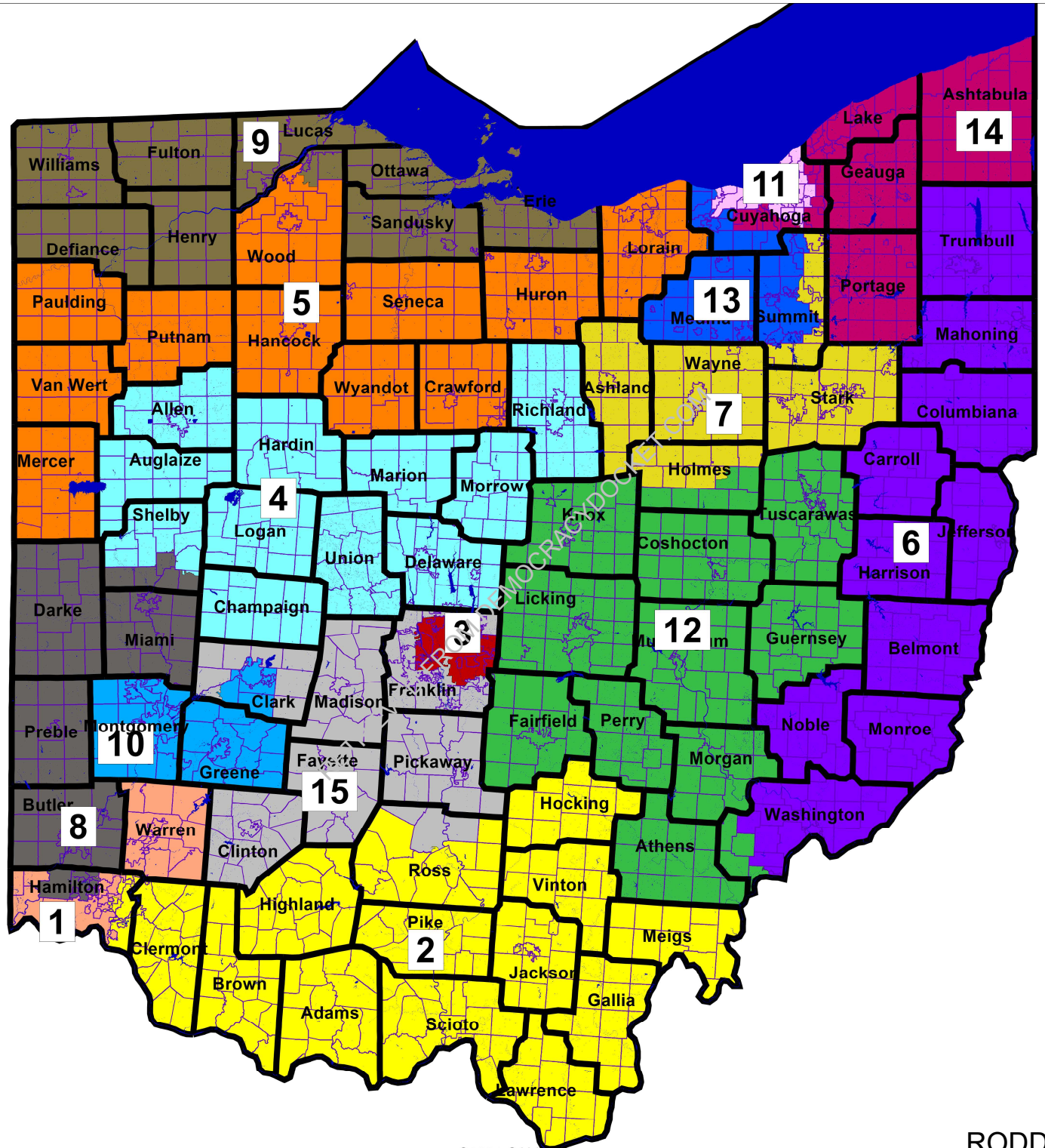

Exhibit B

Proposed Sub SB 237 Map

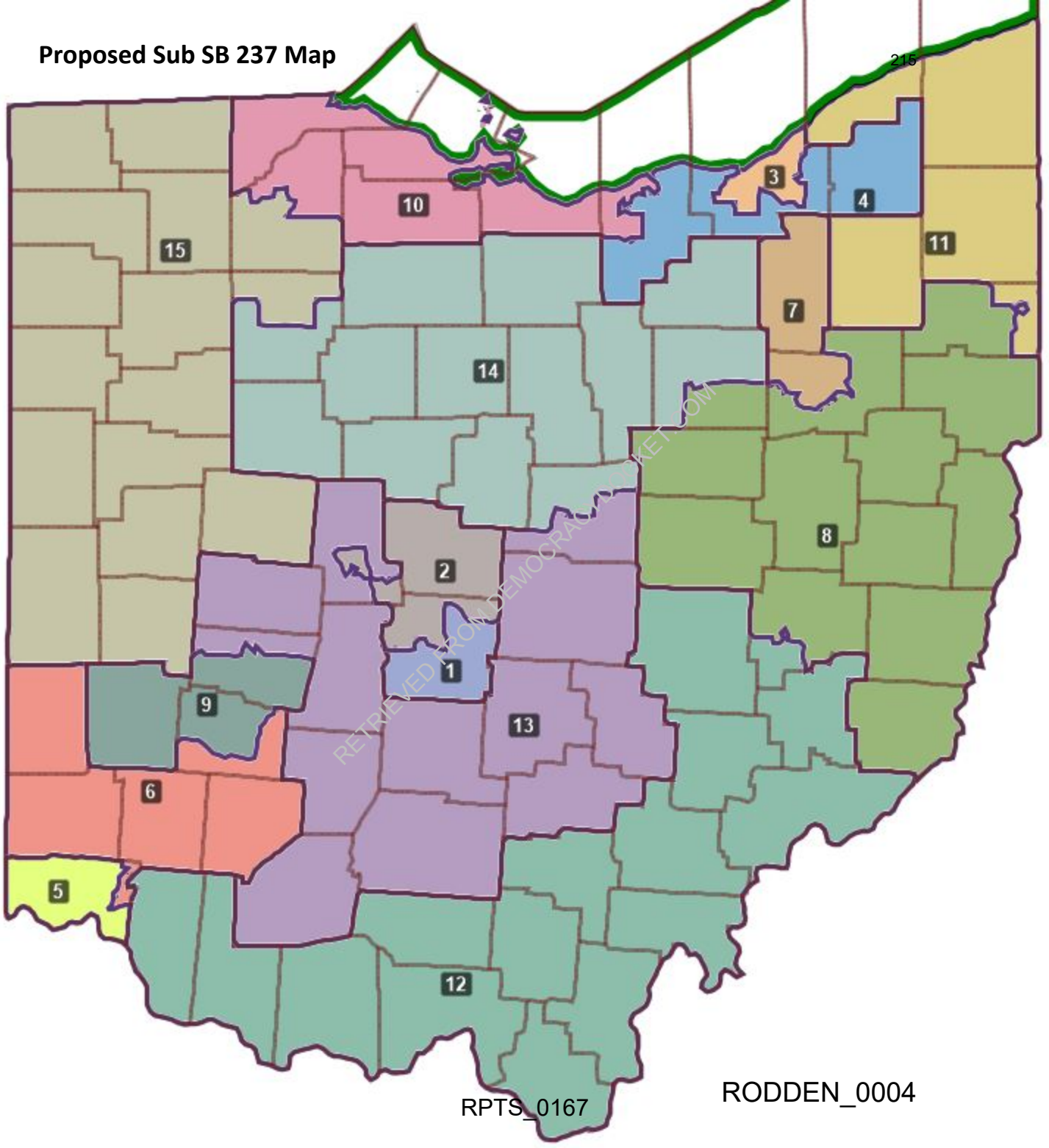

Exhibit C

Brown/Galonski Congressional District Proposal

Exhibit D

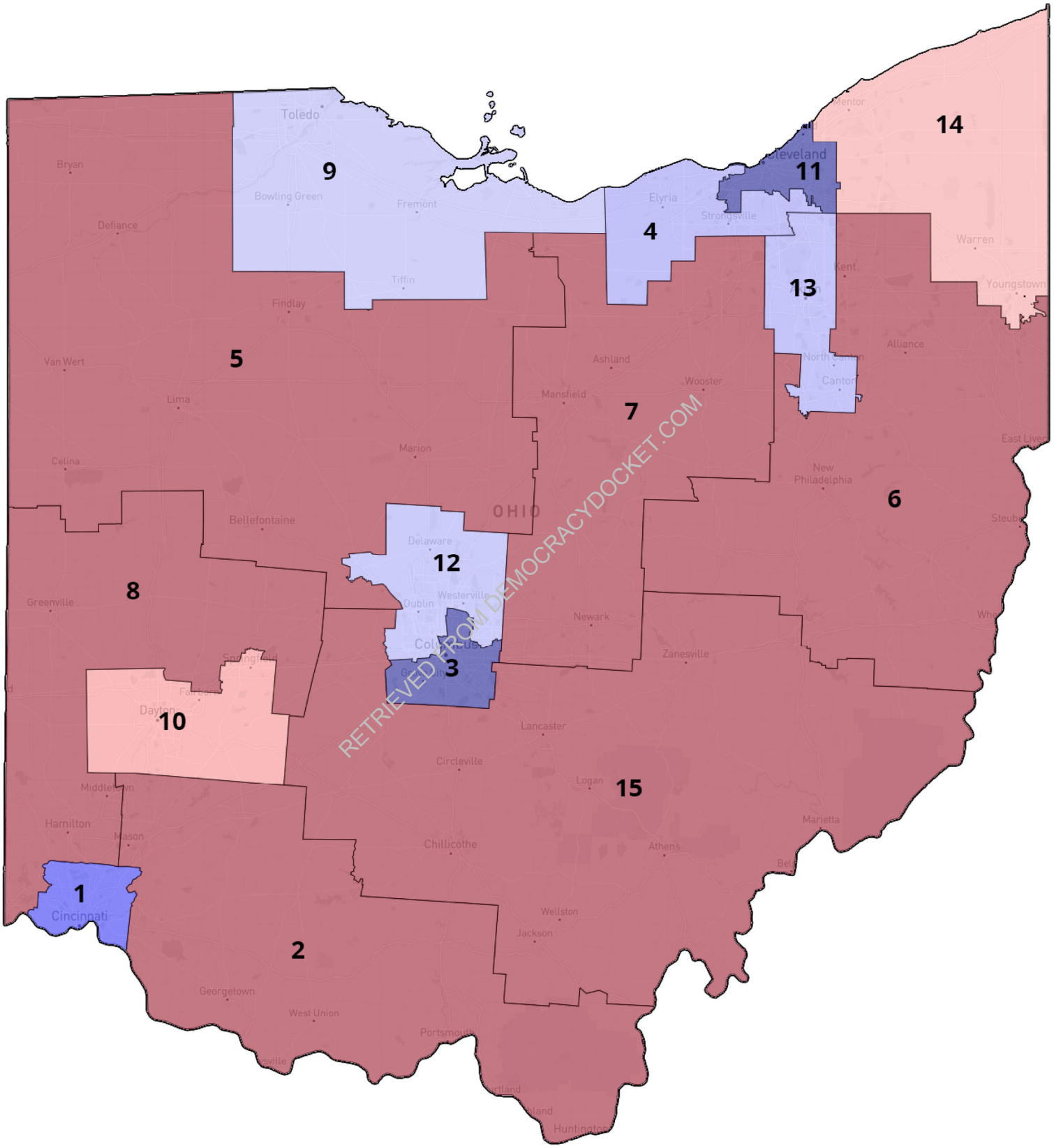

Exhibit E

Frank LaRose
Ohio Secretary of State

U.S. Congressional Districts 2012-2022 in Ohio

(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

RODDEN_0010

RPTS_0173

Exhibit F

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Personal

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Education

Ph.D. Political Science, Yale University, 2000.

Fulbright Scholar, University of Leipzig, Germany, 1993–1994.

B.A., Political Science, University of Michigan, 1993.

Academic Positions

Professor, Department of Political Science, Stanford University, 2012–present.

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.

Associate Professor, Department of Political Science, Stanford University, 2007–2012.

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.

Publications

Books

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

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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).

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.

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.

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

IN THE SUPREME COURT OF OHIO

League of Women Voters of Ohio, et al., ***Relators,*** **v.** **Governor Michael DeWine, et al.** ***Respondents.***	Case No. 2021-1449 Original Action Filed Pursuant to Ohio Const., art. XIX Apportionment Case

AFFIDAVIT OF CONGRESSWOMAN MARCY KAPTUR

STATE OF OHIO)
) SS:
COUNTY OF LUCAS)

Now comes affiant Marcy Kaptur, having been first duly cautioned and sworn, deposes and states as follows:

1. I am over the age of 18 and fully competent to offer the testimony contained herein. I make these statements based on my personal knowledge.
2. I am a member of the United States House of Representatives, representing Ohio's 9th congressional district. I was first elected to Congress in November of 1982, and was sworn in on January 3, 1982. I have represented the 9th congressional district continuously since then.
3. I am a member of the Democratic Party.
4. As it is drawn under the current congressional map, which was enacted in 2011 (the "2011 Map"), Ohio's 9th congressional district is a long, slender district that stretches from Toledo to Cleveland. It includes portions of Cuyahoga, Erie, Lorain, Lucas, and Ottawa counties. It's been infamously described as the "Snake on the Lake."

5. Under the 2011 Map, the neighboring 5th congressional district lies primarily to the west and southwest of the 9th congressional district. The 5th district is roughly square-shaped, and encompasses the northwestern corner of Ohio.

6. I had no input into the 2011 Map. When I first saw it, I was immediately concerned about how the 9th congressional district was drawn. Among other things, it divides up communities and counties, so that the district encompasses only small portions of several counties, from Cuyahoga County to Lucas County. The district is very long and slender, and not compact.

7. I found it astonishing and very troubling that the district was drawn in that manner. It is important to draw compact congressional districts that preserve communities. It is much harder to build communities when their congressional representation is divided.

8. I also had no input into the Ohio congressional district map that Governor DeWine signed into law on November 20, 2021 (the "2021 Map"), but I reviewed it after it became publicly available.

9. Unfortunately, many of the aspects of the 2011 Map that concerned me are not remedied in the 2021 Map, but are actually exacerbated.

10. For example, the 5th congressional district under the 2021 Map would be even longer and more spread out than the "Snake on the Lake," the 9th district under the 2011 Map. It is not compact. It includes Lorain County, which is just west of Cleveland in the northeast quadrant of Ohio, and stretches all the way to the western border of the state, where it curves south and covers Paulding, Van Wert, and Mercer Counties, all of which are along the Indiana border.

11. The 2021 Map also separates the cities of Toledo and Lorain, placing the former in the 9th district, and the latter in the 5th district.

12. I am well familiar with Lorain and the community around it, as it currently lies within the district that I represent. I have approximately ten years of experience representing that community. It shares more in common with the Toledo community than with more rural areas like Paulding, Van Wert, and Mercer Counties. For example, Lorain and Toledo both lie along the lakefront, which in my experience means that they share common political interests, especially relating to environmental concerns. They also share similar demographic characteristics, including significant minority populations.

13. The people of Lorain and Toledo would not be well served by being combined into an even longer, more spread-out district than they are currently in, or being combined together with distant rural areas near Indiana. Unfortunately, that is exactly what the 2021 Map does.

14. While removing Lorain from the 9th district, the 2021 Map also removes Williams, Fulton, Defiance, and Henry Counties from the 5th district and places them in the 9th district. This exchange serves only to make the 5th district less compact, and to dilute the voting power of both the Lorain and Toledo communities.

FURTHER AFFIANT SAYETH NAUGHT.

Executed on December 6, 2021.

Congresswoman Marcy Kaptur

Congresswoman Marcy Kaptur

Sworn and subscribed before me this 6th day of December, 2021.

Notary Public

My commission expires _____

NOTARIAL SEAL
STATE OF OHIO

MARGARET J. RYAN
NOTARY PUBLIC - OHIO
MY COMMISSION EXPIRES 11-14-2022

Issue 1

TITLE

Proposed Constitutional Amendment

Proposed by Joint Resolution of the General Assembly

To amend the version of Section 1 of Article XI that is scheduled to take effect January 1, 2021, and to enact Sections 1, 2, and 3 of Article XIX of the Constitution of the State of Ohio to establish a process for congressional redistricting.

A majority yes vote is necessary for the amendment to pass.

The proposed amendment would:

- End the partisan process for drawing congressional districts, and replace it with a process with the goals of promoting bipartisanship, keeping local communities together, and having district boundaries that are more compact.
- Ensure a transparent process by requiring public hearings and allowing public submission of proposed plans.
- Require the General Assembly or the Ohio Redistricting Commission to adopt new congressional districts by a bipartisan vote for the plan to be effective for the full 10-year period.
- Require that if a plan is adopted by the General Assembly without significant bipartisan support, it cannot be effective for the entire 10-year period and must comply with explicit anti-gerrymandering requirements.

If passed, the amendment will become effective immediately.

	YES	**SHALL THE AMENDMENT BE APPROVED?**
	NO	

CERTIFICATION

Acting in my capacity as the secretary of the Ohio Ballot Board, I hereby certify to the Secretary of the State of Ohio that the foregoing text is the ballot language prescribed by the Ohio Ballot Board, acting pursuant to Article XVI, Section 1 of the Ohio Constitution and section 3505.062 of the Revised Code of Ohio of the Revised Code of Ohio, for this constitutional amendment proposed by the General Assembly for submission to the Ohio electorate at the election to be held on May 8, 2018.

In testimony whereof, I have subscribed my name in Columbus, Ohio, this 20th day of February, 2018.

Carrie Kunc

Secretary, Ohio Ballot Board

Vote **YES** on Issue 1

A FAIR, BIPARTISAN, and TRANSPARENT PROCESS

VOTE YES on **Issue 1**. A **YES** vote will create a **fair, bipartisan, and transparent** process when drawing congressional districts that will **make politicians more accountable** to the voters. Issue 1 is supported by an overwhelming bipartisan majority of legislators as well as nonpartisan advocates.

Currently, it is too easy for one political party to gerrymander safe seats in Congress by dividing local communities and drawing a map without bipartisan support. Voting **YES on Issue 1** will limit gerrymandering by requiring that congressional districts be drawn with **bipartisan approval or utilizing strict anti-gerrymandering criteria.** It will also **keep communities together** by limiting splits of counties, townships and cities and promote geographically compact districts.

Fair

Voting YES on Issue 1 will establish fair standards for drawing congressional districts through its requirement of **bipartisan approval**, or **use of strict anti-gerrymandering criteria**.

Voting YES on Issue 1 will help keep our communities together by limiting the number of splits of counties, cities, and townships.

Bipartisan

Voting YES on Issue 1 will require significant bipartisan support to adopt new congressional districts for 10 years.

Transparent

Voting YES on Issue 1 will require multiple public meetings before adopting a proposed plan for congressional districts.

Voting YES on Issue 1 will guarantee public participation by allowing members of the public to submit a plan for congressional districts.

Voting YES on Issue 1 will preserve citizens' right to referendum and the veto power of the Governor when the General Assembly passes a plan for congressional districts.

Make your vote count, **vote YES on ISSUE 1**

Prepared by Senators Matt Huffman and Vernon Sykes
and Representatives Kirk Schuring and Jack Cera

Statewide Issue

JON HUSTED
Ohio Secretary of State

I, Jon Husted, certify that printed below are the full text, ballot language, explanation and arguments that were certified to me by the Ohio Ballot Board, or filed with the Secretary of State as prescribed by law, for the constitutional amendment proposed by the Ohio General Assembly pursuant to Article XVI, Section 1 of the Ohio Constitution.

IN TESTIMONY WHEREFORE, I have subscribed my name in Columbus, Ohio, this fifteenth day of April, 2018.

In addition to certifying the following State Issue for the Primary Election occurring May 8, 2018, R.C. 3505.062(G) and Ohio Constitution Article II, Section 1g require the Secretary of State to contract for the publication of this information once a week for three (3) consecutive weeks preceding the election in at least one (1) newspaper of general circulation in each county in the state where a newspaper is published.

Jon Husted
OHIO SECRETARY OF STATE

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Ballot Language

Issue 1

Creates a bipartisan, public process for drawing congressional districts

Proposed Constitutional Amendment

Proposed by Joint Resolution of the General Assembly

To amend the version of Section 1 of Article XI that is scheduled to take effect January 1, 2021, and to enact Sections 1, 2, and 3 of Article XIX of the Constitution of the State of Ohio to establish a process for congressional redistricting.

A majority yes vote is necessary for the amendment to pass.

The proposed amendment would:

- End the partisan process for drawing congressional districts, and replace it with a process with the goals of promoting bipartisanship, keeping local communities together, and having district boundaries that are more compact.
- Ensure a transparent process by requiring public hearings and allowing public submission of proposed plans.
- Require the General Assembly or the Ohio Redistricting Commission to adopt new congressional districts by a bipartisan vote for the plan to be effective for the full 10-year period.
- Require that if a plan is adopted by the General Assembly without significant bipartisan support, it cannot be effective for the entire 10-year period and must comply with explicit anti-gerrymandering requirements.

If passed, the amendment will become effective immediately.

Shall the amendment be approved?

- ○ **YES**
- ○ **NO**

Explanation for Issue 1

The proposed amendment would end the current partisan process for drawing congressional districts by a simple majority vote of the General Assembly. This amendment requires a map be adopted with significant bipartisan support, with the goals of keeping local communities together and having district boundaries that are more compact. If bipartisan support cannot be obtained, strict anti-gerrymandering criteria would apply when adopting a congressional map.

Proposed Constitutional Amendment

Argument FOR Issue 1

Vote **YES** on Issue 1

A FAIR, BIPARTISAN, and TRANSPARENT PROCESS

VOTE YES on **Issue 1**. A **YES** vote will create a **fair, bipartisan, and transparent** process when drawing congressional districts that will **make politicians more accountable** to the voters. Issue 1 is supported by an overwhelming bipartisan majority of legislators as well as nonpartisan advocates.

Currently, it is too easy for one political party to gerrymander safe seats in Congress by dividing local communities and drawing a map without bipartisan support. Voting **YES on Issue 1** will limit gerrymandering by requiring that congressional districts be drawn with **bipartisan approval or utilizing strict anti-gerrymandering criteria**. It will also **keep communities together** by limiting splits of counties, townships and cities and promote geographically compact districts.

Fair

Voting YES on Issue 1 will establish fair standards for drawing congressional districts through its requirement of **bipartisan approval**, or **use of strict anti-gerrymandering criteria**.

Voting YES on Issue 1 will help keep our communities together by limiting the number of splits of counties, cities, and townships.

Bipartisan

Voting YES on Issue 1 will require significant bipartisan support to adopt new congressional districts for 10 years.

Transparent

Voting YES on Issue 1 will require multiple public meetings before adopting a proposed plan for congressional districts.

Voting YES on Issue 1 will guarantee public participation by allowing members of the public to submit a plan for congressional districts.

Voting YES on Issue 1 will preserve citizens' right to referendum and the veto power of the Governor when the General Assembly passes a plan for congressional districts.

Make your vote count, **vote YES on ISSUE 1**

Prepared by Senators Matt Huffman and Vernon Sykes and Representatives Kirk Schuring and Jack Cera

Argument AGAINST Issue 1

The current process for drawing new congressional districts is adequate and has served Ohio well for many years. Although the current system allows for one-party control, the voters can hold their state legislators responsible and vote against them if they believe those legislators are too partisan.

Even when this process is controlled by a single party, it is still representative of the people's will since any map is passed by statewide officials, who were themselves elected by popular vote. Historically, one party's control doesn't last forever.

The current process can be trusted to maintain fair district lines; a "no" vote maintains the status quo.

Prepared by the Ohio Ballot Board as required by Ohio Revised Code Section 3505.063(A).

Full Text of Amendment

(132nd General Assembly)

(Substitute Senate Joint Resolution Number 5)

A JOINT RESOLUTION

Proposing to amend the version of Section 1 of Article XI that is scheduled to take effect January 1, 2021, and to enact Sections 1, 2, and 3 of Article XIX of the Constitution of the State of Ohio to establish a process for congressional redistricting.

Be it resolved by the General Assembly of the State of Ohio, three-fifths of the members elected to each house concurring herein, that there shall be submitted to the electors of the state, in the manner prescribed by law at a special election to be held on May 8, 2018, a proposal to amend the version of Section 1 of Article XI that is scheduled to take effect January 1, 2021, and to enact Sections 1, 2, and 3 of Article XIX of the Constitution of the State of Ohio to read as follows:

ARTICLE XI

Section 1. (A) The Ohio redistricting commission shall be responsible for the redistricting of this state for the general assembly. The commission shall consist of the following seven members:

(1) The governor;

(2) The auditor of state;

(3) The secretary of state;

(4) One person appointed by the speaker of the house of representatives;

(5) One person appointed by the legislative leader of the largest political party in the house of representatives of which the speaker of the house of representatives is not a member;

(6) One person appointed by the president of the senate; and

(7) One person appointed by the legislative leader of the largest political party in the senate of which the president of the senate is not a member.

No appointed member of the commission shall be a current member of congress.

The legislative leaders in the senate and the house of representatives of each of the two largest political parties represented in the general assembly, acting jointly by political party, shall appoint a member of the commission to serve as a co-chairperson of the commission.

(B)(1) Unless otherwise specified in this article or in Article XIX of this constitution, a simple majority of the commission members shall be required for any action by the commission.

(2)(a) Except as otherwise provided in division (B)(2)(b) of this section, a majority vote of the members of the commission, including at least one member of the commission who is a member of each of the two largest political parties represented in the general assembly, shall be required to do any of the following:

Proposed Constitutional Amendment

Full Text of Amendment - Cont.

(i) Adopt rules of the commission;
(ii) Hire staff for the commission;
(iii) Expend funds.

(b) If the commission is unable to agree, by the vote required under division (B)(2)(a) of this section, on the manner in which funds should be expended, each co-chairperson of the commission shall have the authority to expend one-half of the funds that have been appropriated to the commission.

(3) The affirmative vote of four members of the commission, including at least two members of the commission who represent each of the two largest political parties represented in the general assembly shall be required to adopt any general assembly district plan. For the ~~purpose~~ purposes of this division and of Section 1 of Article XIX of this constitution, a member of the commission shall be considered to represent a political party if the member was appointed to the commission by a member of that political party or if, in the case of the governor, the auditor of state, or the secretary of state, the member is a member of that political party.

(C) At the first meeting of the commission, which the governor shall convene only in a year ending in the numeral one, except as provided in Sections 8 and 9 of this article and in Sections 1 and 3 of Article XIX of this constitution, the commission shall set a schedule for the adoption of procedural rules for the operation of the commission.

The commission shall release to the public a proposed general assembly district plan for the boundaries for each of the ninety-nine house of representatives districts and the thirty-three senate districts. The commission shall draft the proposed plan in the manner prescribed in this article. Before adopting, but after introducing, a proposed plan, the commission shall conduct a minimum of three public hearings across the state to present the proposed plan and shall seek public input regarding the proposed plan. All meetings of the commission shall be open to the public. Meetings shall be broadcast by electronic means of transmission using a medium readily accessible by the general public.

The commission shall adopt a final general assembly district plan not later than the first day of September of a year ending in the numeral one. After the commission adopts a final plan, the commission shall promptly file the plan with the secretary of state. Upon filing with the secretary of state, the plan shall become effective.

Four weeks after the adoption of a general assembly district plan or a congressional district plan, whichever is later, the commission shall be automatically dissolved.

(D) The general assembly shall be responsible for making the appropriations it determines necessary in order for the commission to perform its duties under this article and Article XIX of this constitution.

ARTICLE XIX

Section 1. (A) Except as otherwise provided in this section, the general assembly shall be responsible for the redistricting of this state for congress based on the prescribed number of congressional districts apportioned to the state pursuant to Section 2 of Article I of the Constitution of the United States.

Not later than the last day of September of a year ending in the numeral one, the general assembly shall pass a congressional district plan in the form of a bill by the affirmative vote of three-fifths of the members of each house of the general assembly, including the affirmative vote of at least one-half of the members of each of the two largest political parties represented in that house. A congressional district plan that is passed under this division and becomes law shall remain effective until the next year ending in the numeral one, except as provided in Section 3 of this article.

(B) If a congressional district plan is not passed not later than the last day of September of a year ending in the numeral one and filed with the secretary of state in accordance with Section 16 of Article II of this constitution, then the Ohio redistricting commission described in Article XI of this constitution shall adopt a congressional district plan not later than the last day of October of that year by the affirmative vote of four members of the commission, including at least two members of the commission who represent each of the two largest political parties represented in the general assembly. The plan shall take effect upon filing with the secretary of state and shall remain effective until the next year ending in the numeral one, except as provided in Section 3 of this article.

(C)(1) If the Ohio redistricting commission does not adopt a plan not later than the last day of October of a year ending in the numeral one, then the general assembly shall pass a congressional district plan in the form of a bill not later than the last day of November of that year.

(2) If the general assembly passes a congressional district plan under division (C)(1) of this section by the affirmative vote of three-fifths of the members of each house of the general assembly, including the affirmative vote of at least one-third of the members of each of the two largest political parties represented in that house, and the plan becomes law, the plan shall remain effective until the next year ending in the numeral one, except as provided in Section 3 of this article.

(3) If the general assembly passes a congressional district plan under division (C)(1) of this section by a simple majority of the members of each house of the general assembly, and not by the vote described in division (C)(2) of this section, all of the following shall apply:

(a) The general assembly shall not pass a plan that unduly favors or disfavors a political party or its incumbents.

(b) The general assembly shall not unduly split governmental units, giving preference to keeping whole, in the order named, counties, then townships and municipal corporations.

(c) Division (B)(2) of Section 2 of this article shall not apply to the plan. The general assembly shall attempt to draw districts that are compact.

(d) The general assembly shall include in the plan an explanation of the plan's compliance with divisions (C)(3)(a) to (c) of this section.

(e) If the plan becomes law, the plan shall remain effective until two general elections for the United States house of representatives have occurred under the plan, except as provided in Section 3 of this article.

(D) Not later than the last day of September of the year after the year in which a plan expires under division (C)(3)(e) of this section, the general assembly shall pass a congressional district plan in the form of a bill by the affirmative vote of three-fifths of the members of each house of the general assembly, including the affirmative vote of at least one-half of the members of each of the two largest political parties represented in that house. A congressional district plan that is passed under this division and becomes law shall remain effective until the next year ending in the numeral one, except as provided in Section 3 of this article.

A congressional district plan passed under this division shall be drawn using the federal decennial census data or other data on which the previous redistricting was based.

(E) If a congressional district plan is not passed not later than the last day of September of the year after the year in which a plan expires under division (C)(3)(e) of this section and filed with the secretary of state in accordance with Section 16 of Article II of this constitution, then the Ohio redistricting commission described in Article XI of this constitution shall be reconstituted and reconvene and shall adopt a congressional district plan not later than the last day of October of that year by the affirmative vote of four members of the commission, including at least two members of the commission who represent each of the two largest political parties represented in the general assembly. A congressional district plan adopted under this division shall take effect upon filing with the secretary of state and shall remain effective until the next year ending in the numeral one, except as provided in Section 3 of this article.

A congressional district plan adopted under this division shall be drawn using the federal decennial census data or other data on which the previous redistricting was based.

(F)(1) If the Ohio redistricting commission does not adopt a congressional district plan not later than the last day of October of the year after the year in which a plan expires under division (C)(3)(e) of this section, then the general assembly shall pass a congressional district plan in the form of a bill not later than the last day of November of that year.

A congressional district plan adopted under this division shall be drawn using the federal decennial census data or other data on which the previous redistricting was based.

(2) If the general assembly passes a congressional district plan under division (F)(1) of this section by the affirmative vote of three-fifths of the members of each house, including the affirmative vote of at least one-third of the members of each of the two largest political parties represented in that house, and the plan becomes law, it shall remain effective until the next year ending in the numeral one, except as provided in Section 3 of this article.

(3) If the general assembly passes a congressional district plan under division (F)(1) of this section by a simple majority vote of the members of each house of the general assembly, and not by the vote described in division (F)(2) of this section, all of the following shall apply:

(a) The general assembly shall not pass a plan that unduly favors or disfavors a political party or its incumbents.

(b) The general assembly shall not unduly split governmental units, giving preference to keeping whole, in the order named, counties, then townships and municipal corporations.

(c) Division (B)(2) of Section 2 of this article shall not apply to the plan. The

Proposed Constitutional Amendment

Full Text of Amendment - Cont.

general assembly shall attempt to draw districts that are compact.

(d) The general assembly shall include in the plan an explanation of the plan's compliance with divisions (F)(3)(a) to (c) of this section.

(e) If the plan becomes law, the plan shall remain effective until the next year ending in the numeral one, except as provided in Section 3 of this article.

(G) Before the general assembly passes a congressional district plan under any division of this section, a joint committee of the general assembly shall hold at least two public committee hearings concerning a proposed plan. Before the Ohio redistricting commission adopts a congressional district plan under any division of this section, the commission shall hold at least two public hearings concerning a proposed plan.

(H) The general assembly and the Ohio redistricting commission shall facilitate and allow for the submission of proposed congressional district plans by members of the public. The general assembly shall provide by law the manner in which members of the public may do so.

(I) For purposes of filing a congressional district plan with the governor or the secretary of state under this article, a congressional district plan shall include both a legal description of the boundaries of the congressional districts and all electronic data necessary to create a congressional district map for the purpose of holding congressional elections.

(J) When a congressional district plan ceases to be effective under this article, the district boundaries described in that plan shall continue in operation for the purpose of holding elections until a new congressional district plan takes effect in accordance with this article. If a vacancy occurs in a district that was created under the previous district plan, the election to fill the vacancy for the remainder of the unexpired term shall be held using the previous district plan.

Section 2. (A)(1) Each congressional district shall be entitled to a single representative in the United States house of representatives in each congress.

(2) The whole population of the state, as determined by the federal decennial census or, if the federal decennial census is unavailable, another basis as directed by the general assembly, shall be divided by the number of congressional districts apportioned to the state pursuant to Section 2 of Article I of the Constitution of the United States, and the quotient shall be the congressional ratio of representation for the next ten years.

(3) Notwithstanding the fact that boundaries of counties, municipal corporations, and townships within a district may be changed, district boundaries shall be created by using the data from the most recent federal decennial census or from the basis directed by the general assembly, as applicable.

(B) A congressional district plan shall comply with all of the following requirements:

(1) The plan shall comply with all applicable provisions of the constitutions of Ohio and the United States and of federal law, including federal laws protecting racial minority voting rights.

(2) Every congressional district shall be compact.

(3) Every congressional district shall be composed of contiguous territory, and the boundary of each district shall be a single nonintersecting continuous line.

(4) Except as otherwise required by federal law, in a county that contains a population that exceeds the congressional ratio of representation, the authority drawing the districts shall take the first of the following actions that applies to that county:

(a) If a municipal corporation or township located in that county contains a population that exceeds the congressional ratio of representation, the authority shall attempt to include a significant portion of that municipal corporation or township in a single district and may include in that district other municipal corporations or townships that are located in that county and whose residents have similar interests as the residents of the municipal corporation or township that contains a population that exceeds the congressional ratio of representation. In determining whether the population of a municipal corporation or township exceeds the congressional ratio of representation for the purpose of this division, if the territory of that municipal corporation or township completely surrounds the territory of another municipal corporation or township, the territory of the surrounded municipal corporation or township shall be considered part of the territory of the surrounding municipal corporation or township.

(b) If one municipal corporation or township in that county contains a population of not less than one hundred thousand and not more than the congressional ratio of representation, that municipal corporation or township shall not be split. If that county contains two or more such municipal corporations or townships, only the most populous of those municipal corporations or townships shall not be split.

(5) Of the eighty-eight counties in this state, sixty-five counties shall be contained entirely within a district, eighteen counties may be split not more than once, and five counties may be split not more than twice. The authority drawing the districts may determine which counties may be split.

(6) If a congressional district includes only part of the territory of a particular county, the part of that congressional district that lies in that particular county shall be contiguous within the boundaries of the county.

(7) No two congressional districts shall share portions of the territory of more than one county, except for a county whose population exceeds four hundred thousand.

(8) The authority drawing the districts shall attempt to include at least one whole county in each congressional district. This division does not apply to a congressional district that is contained entirely within one county or that cannot be drawn in that manner while complying with federal law.

(C)(1) Except as otherwise provided in division (C)(2) of this section, for purposes of this article, a county, municipal corporation, or township is considered to be split if, based on the census data used for the purpose of redistricting, any contiguous portion of its territory is not contained entirely within one district.

(2) If a municipal corporation or township has territory in more than one county, the contiguous portion of that municipal corporation or township that lies in each county shall be considered to be a separate municipal corporation or township for purposes of this section.

Section 3. (A) The supreme court of Ohio shall have exclusive, original jurisdiction in all cases arising under this article.

(B)(1) In the event that any section of this constitution relating to congressional redistricting, any congressional district plan, or any congressional district or group of congressional districts is challenged and is determined to be invalid by an unappealed final order of a court of competent jurisdiction then, notwithstanding any other provisions of this constitution, the general assembly shall pass a congressional district plan in accordance with the provisions of this constitution that are then valid, to be used until the next time for redistricting under this article in accordance with the provisions of this constitution that are then valid.

The general assembly shall pass that plan not later than the thirtieth day after the last day on which an appeal of the court order could have been filed or, if the order is not appealable, the thirtieth day after the day on which the order is issued.

A congressional district plan passed under this division shall remedy any legal defects in the previous plan identified by the court but shall include no changes to the previous plan other than those made in order to remedy those defects.

(2) If a new congressional district plan is not passed in accordance with division (B)(1) of this section and filed with the secretary of state in accordance with Section 16 of Article II of this constitution, the Ohio redistricting commission shall be reconstituted and reconvene and shall adopt a congressional district plan in accordance with the provisions of this constitution that are then valid, to be used until the next time for redistricting under this article in accordance with the provisions of this constitution that are then valid.

The commission shall adopt that plan not later than the thirtieth day after the deadline described in division (B)(1) of this section.

A congressional district plan adopted under this division shall remedy any legal defects in the previous plan identified by the court but shall include no other changes to the previous plan other than those made in order to remedy those defects.

EFFECTIVE DATE AND REPEAL

If adopted by a majority of the electors voting on this proposal, the version of Section 1 of Article XI amended by this proposal and Sections 1, 2, and 3 of Article XIX of the Constitution of the State of Ohio enacted by this proposal take effect January 1, 2021, and the existing version of Section 1 of Article XI of the Constitution of the State of Ohio that is scheduled to take effect January 1, 2021, is repealed from that effective date.

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SECTION 2. That section 3521.01 of the Revised Code is hereby repealed.

SECTION 3. Concerning the congressional district plan described in sections 3521.01 to 3521.0115 of the Revised Code, as enacted by this act, the General Assembly finds as follows:

(A) The congressional district plan does not unduly favor or disfavor a political party or its incumbents. The plan contains six Republican-leaning districts, two Democratic-leaning districts, and seven competitive districts. The number of competitive districts in the plan significantly exceeds the number of competitive districts contained in the congressional district plan described in the version of section 3521.01 of the Revised Code that was in effect immediately before the effective date of this section. Two incumbents expected to seek office again, both Republican, are paired in one

district in the plan described in sections 3521.01 to 3521.0115 of the Revised Code, as enacted by this act. No other incumbent, either Republican or Democratic, expected to seek office again, is paired with another incumbent in a congressional district in this plan.

(B) The congressional district plan does not unduly split governmental units and gives preference to keeping whole, in the order named, counties, then townships and municipal corporations. The plan splits only twelve counties and only fourteen townships and municipal corporations. The congressional district plan described in the version of section 3521.01 of the Revised Code that was in effect immediately before the effective date of this section split twenty-three counties and over thirty townships and municipal corporations.

(C) A visual inspection of the congressional district plan demonstrates that it draws districts that are compact, particularly when visually compared to the congressional district plan described in the version of section 3521.01 of the Revised Code that was in effect immediately before the effective date of this section.

SECTION 4. Both of the following apply to the primary election to be held on the first Tuesday after the first Monday in May in the year 2022:

(A) Notwithstanding section 3513.05 or 3513.041 or any other provision of the Revised Code to the contrary, to be eligible to appear as a candidate for nomination, or to receive votes as a write-in candidate, for the office of a member of the United States House of Representatives at the 2022 primary election, a person shall file the applicable declaration of candidacy, declaration of candidacy and petition, nominating petition, or declaration to be a write-in candidate not later than four p.m. on the sixtieth day before the day of that election in the manner specified under Title XXXV of the Revised Code. The Secretary of State shall adjust any applicable deadlines for petition verification, challenges to petitions, and ballot certification as the Secretary of State determines necessary to accommodate the shorter timeframe for filing for these candidates so as to ensure that ballots are prepared and made available in the times and manner required under Title XXXV of the Revised Code and federal election law.

(B) Any declaration of candidacy, declaration of candidacy and petition, nominating petition, or declaration of intent to be a write-in candidate filed by a person seeking nomination for the office of a member of the United States House of Representatives that is filed for the 2022 primary election before the effective date of this section is null and void. The Secretary of State or applicable board of elections promptly shall refund any filing fee paid by a person who filed such a declaration or petition. A person whose declaration is nullified and voided under this section who files again, after the effective date of this section, to become a candidate for nomination, or to receive votes as a write-in candidate, to the office of a member of the United States House of Representatives is not disqualified as a candidate under section 3513.052 of the Revised Code, and if the person otherwise qualifies as a candidate, shall be placed on the ballot for nomination for that office at that election.

Ohio Senate
Senate Building
1 Capitol Square
Columbus, Ohio 43215
(614) 466-8150

Rob McColley
Senate Majority Whip
1st Senate District

Thank you, Chairman Wilkin, Vice-Chair White, Ranking Member Brown and members of the Government Oversight Committee for allowing me to present testimony today for Substitute Senate Bill 258. After considering multiple maps presented by Democrat and Republican Caucuses in both the House and the Senate, and listening to the public's input on all of those maps, we offer this map that is not only constitutionally compliant, but the most competitive map offered by any caucus to date. It is also a map that splits the least counties of any map offered by any caucus, keeps Ohio's largest cities whole, installs compact districts and implements many of the requested changes we heard in testimony.

Article 19, Section 2(B)(5) of the Ohio Constitution describes the process that must be followed when splitting counties in a congressional map. In essence, a map may have up to 23 split counties with up to 18 being split once and up to five being split twice. This map splits only 12 counties with only two of those counties being split twice. The counties that are split once are Clark, Fairfield, Franklin, Holmes, Lorain, Ross, Shelby, Summit, Washington and Wood. The Counties split twice are Hamilton and Cuyahoga. Notably, for the first time since the map passed thirty years ago, Lucas County will be whole and for the first time since the map passed twenty years ago Stark County will be whole. The impact on several of Ohio's other large counties is also minimized by Franklin and Summit County having the least splits since the maps passed thirty years ago. Finally, the map complies with Article 19, Section 2(B)(8) by including an entire county in each district where possible. If passed, this map would have the least counties split in over fifty years. Additionally, this map splits two less counties than both the House and Senate Democrat proposals.

Since the introduction of SB258, we have maintained that it is important to keep Ohio's largest cities whole. With exception to Columbus, which must be split under the Constitution and cities that straddle county lines and, therefore, do not count as a split under the Constitution, 98 of Ohio's 100 largest cities are kept whole in this map (Rocky River, Cuyahoga Falls). In total, only eight townships and six municipalities are split in this proposed map, which more than adequately complies with Article 19, Section 1(C)(3)(b)'s requirement that the general assembly not unduly split governmental units.

Article 19, Section 2(B)(2) also requires that districts be compact. This requirement is not applicable to a four-year map, however, under Section 1(C)(3)(c). In such an instance, the

general assembly shall attempt, but is not required to draw compact districts. Nevertheless, the districts presented before you are compact.

Finally, the map before you is the most competitive map offered by any caucus to date and the most competitive Ohio congressional map in decades. Ohio is subject to swings in voter preferences, particularly in federal elections. Even though, with exception to 2006, Republicans have swept every election for statewide constitutional office since 1994, Ohio has voted for a both a Democrat and a Republican for President in the past four presidential elections and continues to be represented by both a Democrat and Republican in the United States Senate. Clearly, Ohioans are bifurcating between federal and state elections and issues. Therefore, because the map before you is for United States Congressional districts, it makes sense to judge competitiveness based upon statewide federal elections over the last ten years. This allows us to capture the true nature of Ohio's voting tendencies in federal elections and to insulate from outliers. When evaluating these districts in the federal statewide context and defining a competitive district as one with a 46%-54% Republican index, this map has six seats that lean Republican, seven seats that are competitive and two seats that lean Democrat. The indexes are as follows:

Congressional District #	**Population**	**Deviation**	**Federal Statewide Elections 2012-2020**
1	786,630	0	51.5
2	786,630	0	65.1
3	786,630	0	30.4
4	786,630	0	66.0
5	786,630	0	58.8
6	786,629	-1	52.9
7	786,630	0	56.7
8	786,630	0	62.0
9	786,630	0	47.7
10	786,630	0	52.2
11	786,630	0	19.4
12	786,629	-1	61.3
13	786,630	0	48.6
14	786,630	0	53.2
15	786,630	0	53.7

Article 19, Section 1(C)(3)(a) states that a map shall not unduly favor or disfavor a party or its

incumbents. There have been some that have suggested that we simply take the fifteen seats and split them eight districts to one side of the aisle and seven to the other and that somehow captures the spirit of what the voters passed in 2018. I strongly disagree with that sentiment. What captures the spirit of what the voters passed in 2018 is competitive districts that are subject to the changing political winds and changing tides of what is going on in the state of Ohio. No sporting event should ever favor or disfavor a team by some predetermined final score before either team walks on the field. A congressional map should not be judged to favor or disfavor either party that way either. Rather, it should be judged based upon how many districts are going to be determined by the various important issues and candidates in that election. This map embodies that belief by ensuring a plurality of the districts will be competitive in any given cycle. Its seven competitive districts are two more than any House or Senate Democrat proposal and five more than the map passed in 2011. Further, this map neither favors nor disfavors either party's incumbents. It accomplishes this by only combining two incumbents, who are required to be combined through the prohibition against splitting Cincinnati.

This bill also addresses the quickly approaching filing deadline for congressional candidates. The current filing deadline is February 2, 2022. Recognizing this process has been delayed due to the Census data being late; we have moved the filing deadline to March 4th to allow candidates ample time to collect the required number of signatures to file for the election.

The map before you complies with the requirements placed upon the General Assembly under the Ohio Constitution. It is the product of a deliberate effort to draw compact districts, minimize county splits, keep Ohio's largest cities whole and ensure a plurality of Ohio's congressional districts will be competitive. I am pleased to say Substitute Senate Bill 258 passed the Senate with a vote of 24-7. Thank you Chairman Wilkin, Vice-Chair White, Ranking Member Brown and members of the Government Oversight Committee for allowing me to present testimony on Substitute Senate Bill 258 and the proposed congressional district map contained therein. I would be happy to take any questions.

File Edit Map Dataview Selection Tools Redistricting Window Help

Districts

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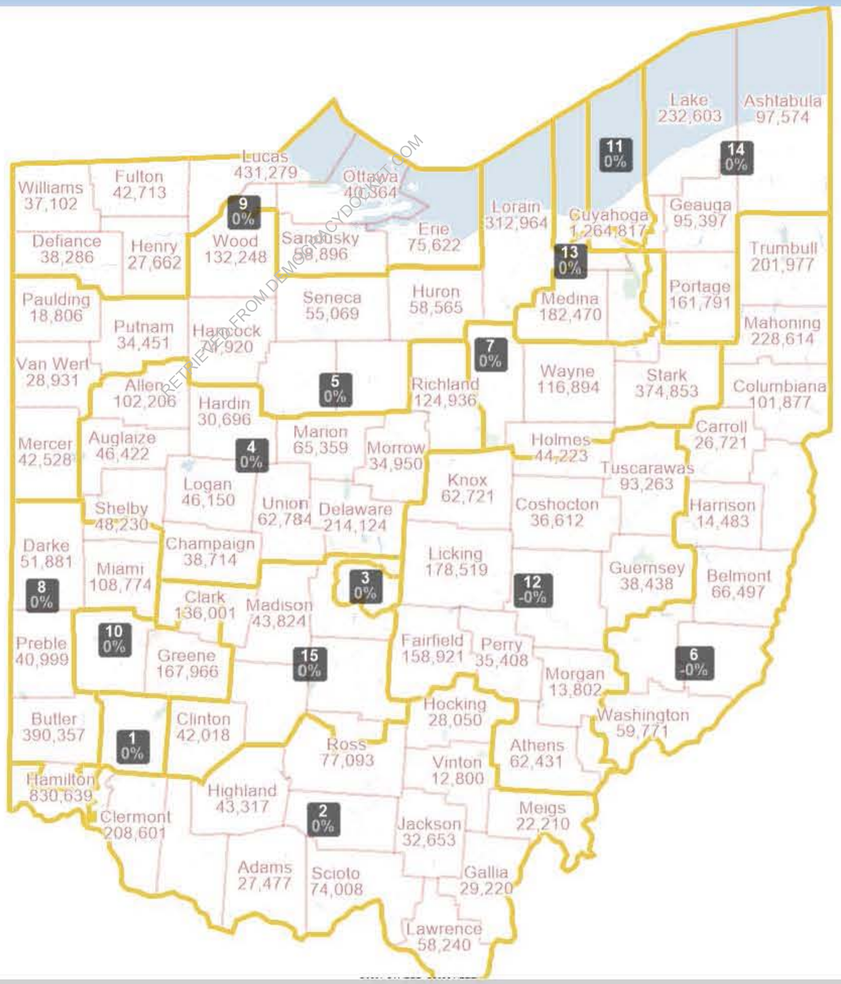
Display Manager

- TIGER/Line Segment
- Landmark Area
- US Landmark Area
- Water Area
- US Street
- Streets
- River
- Census Block
- Railroad
- Voting District
- City/Town
- County
- US Landmark
- **Districts**
- Enacted Plan SB 258 Final

Dataview18 - Enacted Plan SB 258 Final SHP

ID	ID:1	AREA	DISTRICT	MEMBERS	LOCKED	NAME	TOTPOP	G20R	G20V	G20P_DV	G20P_RV	G20P_TV	G12P_DV	G12P_RV	G12P_TV	G12S_DV	G12S_RV	G12S_TV	G14G_DV	G14G_RV	G14G_TV	G14A_DV	G14A_RV	G14A_TV	G14I_DV	G14I_RV	G14I_TV	G14T_DV	G14T
1	581	1979.67	7	1.0			786630	530142.800	403362.700	161717.200	235706.800	403363.100	174464.100	195493.000	376690.200	171123.900	175811.800	368353.700	58917.560	142019.000	207184.000	67979.380	138907.000	206886.400	70699.750	123098.700	203066.000	3567.430	11823.
2	530	4663.95	4	1.0			786630	532597.200	408059.400	132452.500	269261.000	408059.700	131939.300	222037.100	360336.300	128735.400	209022.900	354969.400	47216.410	156765.000	209464.000	55951.970	153196.300	209148.200	50830.110	146409.000	207116.400	6523.390	11673.
3	521	3953.59	9	1.0			786630	551009.500	388974.200	182464.300	199867.500	388974.700	223669.700	158801.100	389782.300	214844.900	148678.300	382040.700	79759.190	122671.400	209595.700	91134.080	118162.400	209296.500	86181.480	105282.700	203761.400	4811.870	10866.
4	564	654.29	1	1.0			786630	558812.200	405284.900	202960.200	196045.000	405285.100	178325.800	188861.000	372442.000	177980.300	172901.700	364505.900	66079.070	127164.400	200327.500	86960.270	115254.700	202214.900	72733.380	115147.800	197688.400	1554.960	8774.
5	563	2110.74	8	1.0			786630	531333.300	393454.900	149054.900	238697.300	393455.200	143717.300	216808.700	366239.500	141906.400	201841.800	359354.700	53138.670	141819.600	199810.000	66832.350	133518.700	200351.100	57142.920	130868.300	198227.800	4859.520	5059.
6	565	6408.48	2	1.0			786630	539263.900	396912.200	124503.100	266964.300	396912.300	139314.800	216014.300	361824.900	139310.000	194644.800	350822.000	55709.570	145457.400	207333.000	69161.460	138960.000	208121.500	60122.250	132954.900	204178.100	7416.190	17456.
7	491	3378.06	14	1.0			786630	539401.100	420753.700	183788.400	231445.100	420753.900	194077.700	188606.300	389148.600	187157.700	170305.500	377490.600	66798.130	147835.700	222567.500	76689.040	145932.000	222621.000	81172.040	126530.000	217562.000	5344.050	11985.
8	566	205.14	3	1.0			786630	525659.200	365287.300	263276.000	96456.080	365287.600	231433.600	108413.900	344952.900	226859.200	100050.000	338849.200	79428.830	85849.940	174301.600	92404.800	82979.050	175383.800	91315.020	75793.720	173511.400	8782.150	8852.
9	557	4748.40	6	1.0			786629	547668.400	400172.000	150885.400	244146.500	400172.500	212283.200	173816.600	393192.600	214101.200	147386.700	381235.000	87573.820	130646.300	225753.800	103559.000	122384.900	225944.000	103697.300	106835.300	221585.200	6267.040	4068.
10	573	2554.48	15	1.0			786630	512318.200	383689.500	177697.900	199916.100	383689.700	155967.600	170592.600	331945.200	152208.900	158076.100	325973.500	50430.990	120813.600	177008.800	58936.110	118622.600	177558.700	56494.790	110851.200	175066.300	1682.530	16289.
11	526	5640.67	5	1.0			786630	538893.000	397748.600	145570.900	245990.800	397749.000	167558.300	193149.400	368006.000	162635.100	180974.700	361898.200	57555.840	140091.700	203682.500	66121.320	136581.900	202703.300	65744.240	122038.100	198585.900	9222.880	11083.
12	562	995.65	10	1.0			786630	543199.800	391705.700	185644.500	199426.600	391706.000	189723.700	189983.100	385939.400	187232.300	177885.800	379457.200	70935.560	138774.500	215035.200	76730.330	138484.100	215214.400	76413.220	125482.000	211801.500	2670.210	12065.
13	574	1096.72	13	1.0			786630	553965.400	422352.000	210060.500	207066.900	422352.400	208390.000	181180.700	394997.800	208206.800	159049.500	384702.400	68192.870	136695.600	212349.100	78334.910	133836.500	212171.400	83174.320	115427.800	207205.500	8598.310	11137.
14	572	5690.83	12	1.0			786629	517916.000	384457.400	127432.000	251134.900	384457.900	153514.400	186699.400	347597.400	147233.600	175089.500	341711.100	57728.290	135028.100	199165.200	66466.300	132839.700	199306.000	62508.790	123734.600	196086.100	7516.480	9377.
15	418	693.07	11	1.0			786630	551649.300	358167.500	281658.400	72712.100	358167.800	321613.300	69586.280	394585.100	301583.500	62712.970	374674.600	109446.700	72299.310	190934.700	120684.900	71460.400	192145.400	130588.200	50636.910	187773.900	5229.100	9615.

enacted_2021.map - Block-VTD-County



Dataview17 - Pending Cha...

District	New
Population	0
Change - Population	0
Ideal Value	786,630
Deviation	-786,630
% Deviation	-100%

Redistricting Toolbox - enacted_2021

Target: New District | Source: All | Selection Layer: Enacted Plan SB 258 F | Theme: None

Tools

Map layers: County, Districts

0 10 20

Exhibit # DiRossi 01 12/07/2021 - ER

exhibitstricker.com

Map scale: 1 Inch = 28.33737 Miles (1:1,795,456) (-83.941589, 38.486265)

File Edit Map Dataview Selection Tools Redistricting Window Help

Districts

247

Display Manager

- TIGER/Line Segment
- Landmark Area
- US Landmark Area
- Water Area
- US Street
- Streets
- River
- Census Block
- Railroad
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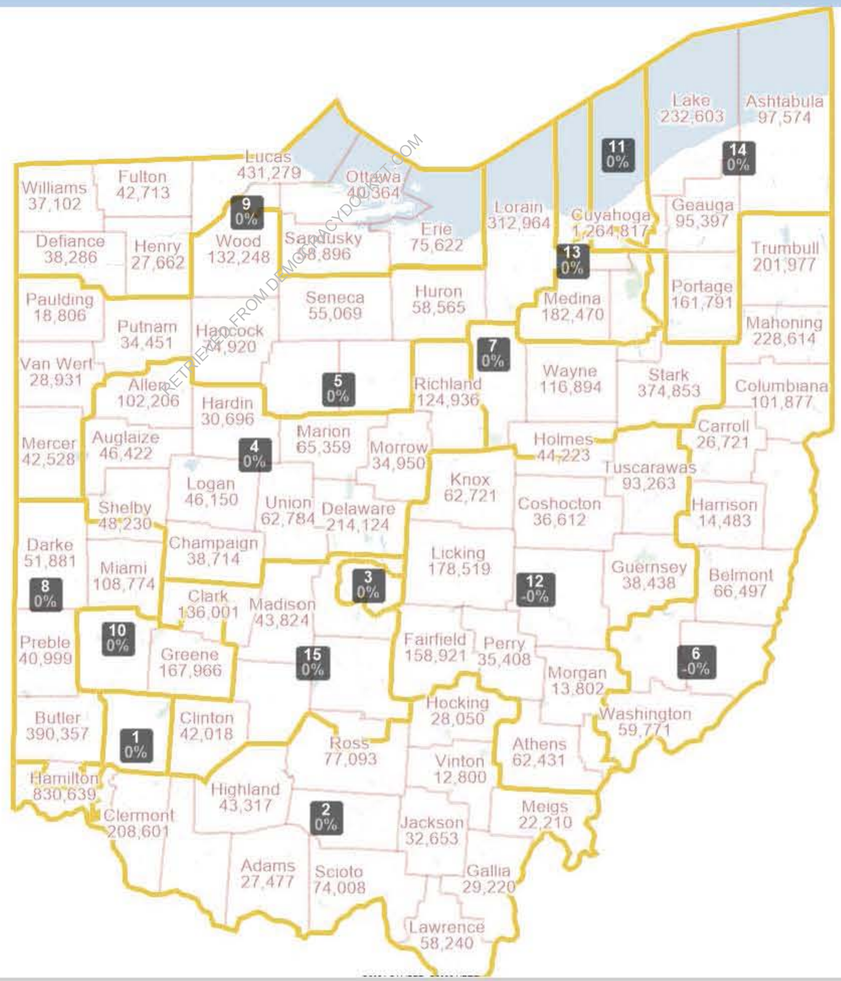
- Enacted Plan SB 258 Final

Dataview18 - Enacted Plan SB 258 Final SHP

G14T_RV	G14T_TV	G14J_DV	G14J_RV	G14J_TV	G16P_DV	G16P_RV	G16P_TV	G16S_DV	G16S_RV	G16S_TV	G18S_DV	G18S_RV	G18S_TV	G18G_DV	G18G_RV	G18G_TV	G18A_DV	G18A_RV	G18A_TV	G18I_DV	G18I_RV	G18I_TV	G18T_DV	G18T_RV	G18T_TV	G18J_DV	G18J_RV	G18J_TV	EA51_DV	EA51_RV	EA51_TV	EA52_DV	EA52_RV	EA52_TV	POPULATION	DEVIATION	F_DEVIATIO	DISTRICT_N	EA53	F_G20P_RV	F
31823.700	34612.900	31132.610	34990.100	36122.800	30772.500	38984.300	36926.500	38161.500	31972.800	30463.700	33789.800	33159.000	36948.800	36080.000	32038.600	37804.200	38473.900	33870.600	32344.600	32793.300	37548.000	32109.000	33901.600	33815.800	34523.700	33844.100	37582.100	31426.300	33773.600	36810.000	30583.600	35641.300	37349.100	32990.500	786630	0.0000	0.0000	7	57.8809	0.5844	
31673.900	37887.700	36778.620	31632.200	38410.800	37284.900	36954.300	31016.500	36363.270	34888.400	37527.500	30950.900	79908.000	30859.000	39841.960	33659.500	32383.600	37269.860	31797.600	39067.400	36162.910	30781.100	37513.000	37676.910	33772.700	38494.800	35818.930	30159.200	35978.100	33118.600	32102.900	35221.600	35539.300	32069.800	37609.100	786630	0.0000	0.0000	4	67.2917	0.6599	
30866.500	36483.300	31921.700	36644.500	38566.300	71871.000	79501.600	71979.700	36293.000	39747.700	34554.600	37334.600	30761.100	38095.800	33835.700	35907.800	30285.300	36120.100	39472.700	35592.900	35156.500	34586.400	32485.700	30661.700	35178.500	33962.200	37995.600	34059.700	32055.300	36805.900	72824.100	39630.100	35214.300	37967.400	33181.800	786630	0.0000	0.0000	9	50.3142	0.5138	
38774.300	39810.800	31013.200	30626.000	31639.200	74398.500	31653.300	72817.700	36492.100	33438.900	35428.300	34608.800	34689.700	39298.600	37957.400	34084.000	30687.700	32530.900	33833.600	36364.500	30172.500	30619.000	35296.700	39199.700	30984.900	37641.000	35644.900	39082.200	34727.200	33550.400	34435.900	37986.400	39849.200	72371.000	32220.200	786630	0.0000	0.0000	1	51.5499	0.4837	
35059.100	39193.800	35946.520	34616.900	30563.500	38996.000	32782.200	37163.000	31410.200	35164.600	31478.900	35983.100	34031.500	30014.600	38593.500	72997.200	30539.600	31022.700	73874.200	34896.900	32322.500	72692.100	37453.300	39979.400	31682.200	38682.500	38363.400	78436.300	36799.700	33466.000	38531.300	71997.300	36569.500	38275.300	34844.800	786630	0.0000	0.0000	8	62.4661	0.6067	
37456.500	35265.400	37001.300	30165.000	37166.300	38026.100	31685.900	35079.500	33350.750	33028.600	31169.300	35918.600	73717.100	39635.800	38093.540	35083.200	31659.200	39059.970	38251.300	37311.300	34488.480	79686.800	36098.000	38017.870	32049.600	37140.200	36599.130	38426.200	35025.300	36463.000	37822.600	34285.700	33931.000	32812.500	36743.600	786630	0.0000	0.0000	2	66.6999	0.6726	
31985.900	38078.300	34490.660	37078.000	31568.700	39645.800	34175.000	30718.300	39873.600	39281.000	39873.700	34835.500	35710.200	30545.700	31506.200	30007.900	31617.400	37549.800	39309.800	36859.600	36894.200	31262.800	31855.100	34608.900	34572.700	36458.800	38272.700	34180.500	32453.300	32559.900	33625.700	36185.600	36073.600	31922.600	37996.200	786630	0.0000	0.0000	14	54.1365	0.5501	
78852.600	74581.500	37094.900	37837.780	74932.600	35156.500	34300.150	35310.500	36918.200	36643.500	37747.300	36092.600	72203.200	38295.800	32811.500	30430.860	39826.200	37481.100	38643.840	36124.900	37994.000	75410.950	33312.900	38206.200	31017.000	34980.600	35258.800	37547.840	32806.600	36715.000	30841.700	77556.800	35591.800	39388.170	34980.000	786630	0.0000	0.0000	3	29.6636	0.2641	
24068.700	32269.300	31159.900	33326.700	34486.700	36138.500	38276.400	79104.000	37938.900	32792.500	30570.800	33735.900	33043.500	36779.400	31878.300	36789.400	37109.400	31958.500	30276.500	32235.100	30214.900	38456.600	39778.200	37304.400	37940.900	32183.300	31407.500	37358.100	38765.600	30707.800	37933.100	38641.000	30303.300	31160.600	31463.900	786629	-1.0000	-0.0000	6	56.2949	0.6101	
36289.700	75910.000	72467.040	34167.200	76634.300	34616.600	78349.100	39249.600	37853.400	32314.400	34552.100	38400.700	32055.600	30456.300	32843.500	32532.000	32411.800	37314.800	31625.900	78940.700	38561.900	37227.600	76052.900	37692.100	33140.200	77166.700	34930.900	30070.600	75001.500	34627.500	38423.300	33050.800	31159.200	35011.900	36171.100	786630	0.0000	0.0000	15	53.8865	0.5210	
31083.100	30461.900	75890.060	36476.500	32366.600	39048.400	35981.200	34118.900	39049.600	38439.400	36692.000	37702.100	39785.400	37487.500	33264.400	36653.300	39427.700	34694.200	37093.900	31788.100	37626.400	33093.800	32520.900	32698.900	33721.500	33803.500	39630.500	72510.100	32140.700	33773.900	39814.400	33588.400	32940.100	32594.800	35535.000	786630	0.0000	0.0000	5	60.7897	0.6185	
32065.700	34073.200	33193.140	30635.300	33828.400	36475.200	39174.100	73016.200	32944.100	39731.300	38765.600	30171.300	39817.700	39989.100	36342.000	35562.000	31141.900	39754.100	37426.200	37180.400	32737.400	30068.500	35689.800	39027.300	31415.700	37608.900	38043.400	37921.500	35964.900	34180.500	32243.400	36423.900	39145.400	72184.600	31330.000	786630	0.0000	0.0000	10	53.3209	0.5091	
21137.000	38721.300	39250.450	31897.600	31148.100	32679.600	34985.200	33513.500	38045.600	35050.700	72802.300	39824.500	36118.700	35943.200	30414.300	37623.300	36501.600	34015.600	35497.700	39513.300	34509.300	30453.700	77713.200	37736.600	36899.800	31611.400	34797.500	32691.800	37489.300	78610.400	30816.600	39427.000	33959.600	37825.600	31785.200	786630	0.0000	0.0000	13	49.2329	0.4903	
39377.200	36675.900	76825.350	30958.600	37783.900	34774.600	39001.700	30467.600	30495.900	72827.200	35648.500	33373.400	36245.900	79619.300	34040.900	38039.100	30717.000	32245.400	73223.400	75468.900	32270.900	36264.200	77621.000	33002.500	37175.100	76920.700	32533.500	72216.100	34749.600	34360.600	38226.800	32587.500	31398.300	33898.900	35297.200	786629	-1.0000	-0.0000	12	63.0713	0.6532	
39615.270	31376.000	38557.600	32211.720	30769.300	33276.700	34674.500	38107.300	39508.100	35546.020	31800.500	34962.500	36011.700	30974.200	31782.200	34091.870	32233.700	36466.400	31867.380	78333.800	35657.900	38178.830	74321.100	31634.600	30557.280	77582.500	30311.100	35819.610	76130.800	36124.300	34076.350	30200.700	39012.200	38532.890	37545.100	786630	0.0000	0.0000	11	19.7950	0.2030	

enacted_2021.map - Block-VTD-County



Dataview17 - Pending Cha...

District	New
Population	0
Change - Population	0
Ideal Value	786,630
Deviation	-786,630
% Deviation	-100%

Redistricting Toolbox - enacted_2021

Target: New District
Source: All
Selection Layer: Enacted Plan SB 258 F
Theme: None

Tools

Map layers
County
Districts
0 10 20

Map scale: 1 Inch = 28.33737 Miles (1:1,795,456) (-81.263787, 38.466104)

File Edit Map Dataview Selection Tools Redistricting Window Help

Districts

248

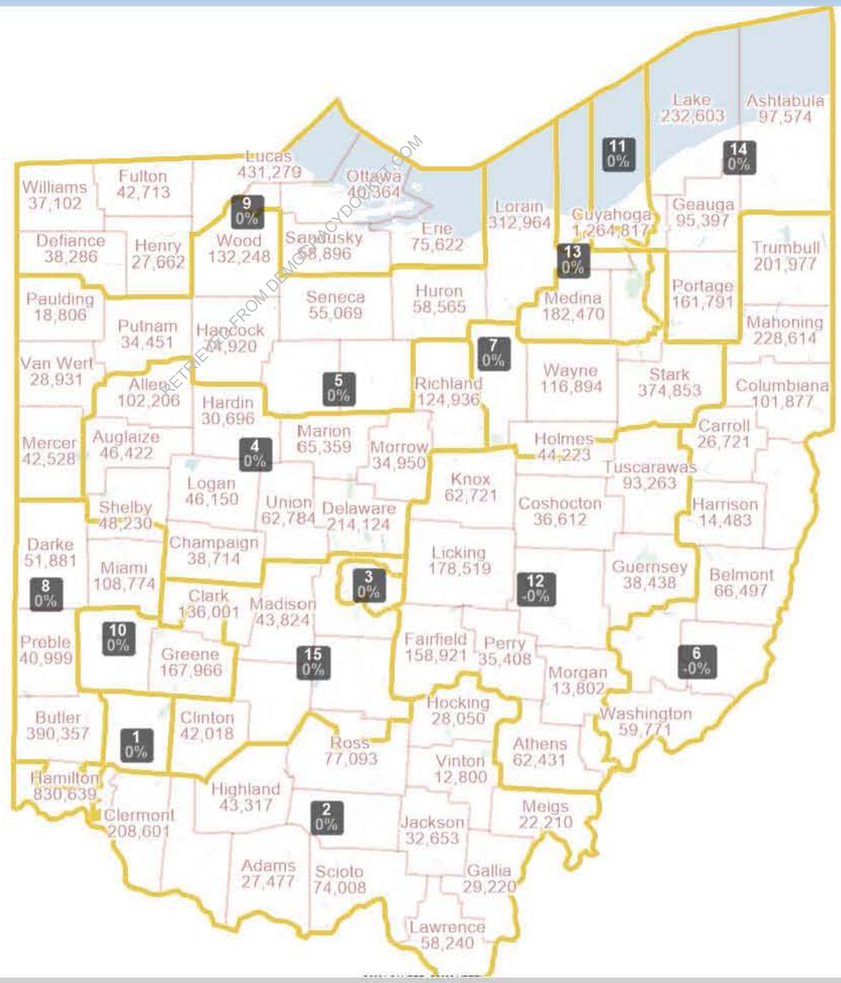
Display Manager

- TIGER/Line Segment
- Landmark Area
- US Landmark Area
- Water Area
- US Street
- Streets
- River
- Census Block
- Railroad
- Voting District
- City/Town
- County
- US Landmark
- **Districts**
- Enacted Plan SB 258 Final

Dataview18 - Enacted Plan SB 258 Final SHP

G18A_DV	G18A_RV	G18A_TV	G18I_DV	G18I_RV	G18I_TV	G18J_DV	G18J_RV	G18J_TV	G18T_DV	G18T_RV	G18T_TV	EA51_DV	EA51_RV	EA51_TV	EA52_DV	EA52_RV	EA52_TV	POPULATION	DEVIATION	F_DEVIATIO	DISTRICT_N	EA53	F_G20P_RV	F_EA51_RV	F_EA52_RV	IDEAL_VALU	F_POPULATI	F20PRES_RD	FEDEA	FEDEA_RDI	MULTIPLE_F	DISTRICT_I
8473.900	3870.600	12344.600	2793.300	7548.000	2109.000	3901.600	3815.800	4523.700	3844.100	7582.100	1426.300	3773.600	6810.000	3583.600	5641.300	7349.100	2990.500	786630	0.0000	0.0000	7	57.8809	0.5844	0.5899	0.5626	786630.0000	1.0000	59.3000	56.7000	54.8000	7|0	7|0%
7269.860	1797.600	9067.400	2162.910	0781.100	7513.000	7676.910	3772.700	8494.800	5818.930	0159.200	5978.100	3118.600	2102.900	5221.600	5539.300	2069.800	7609.100	786630	0.0000	0.0000	4	67.2917	0.6599	0.6816	0.6578	786630.0000	1.0000	67.0000	66.0000	64.0000	4|0	4|0%
6120.100	9472.700	15592.900	5156.500	4586.400	2485.700	0661.700	5178.500	3962.200	7995.600	4059.700	2055.300	6805.900	2824.100	9630.100	5214.300	7967.400	3181.800	786630	0.0000	0.0000	9	50.3142	0.5138	0.5089	0.4888	786630.0000	1.0000	52.3000	47.7000	46.1000	9|0	9|0%
2530.900	3833.600	6364.500	0172.500	0619.000	5296.700	9199.700	0984.900	7641.000	5644.900	9082.200	4727.200	3550.400	4435.900	7986.400	9849.200	2371.000	2220.200	786630	0.0000	0.0000	1	51.5499	0.4837	0.5431	0.5037	786630.0000	1.0000	49.1000	51.5000	50.1000	1|0	1|0%
1022.700	3874.200	4896.900	2322.500	2692.100	7453.300	9979.400	7682.200	8682.500	8363.400	8436.300	6799.700	3466.000	8531.300	1997.300	6569.500	8275.300	4844.800	786630	0.0000	0.0000	8	62.4661	0.6067	0.6390	0.6104	786630.0000	1.0000	61.6000	62.0000	60.3000	8|0	8|0%
9059.970	8251.300	17311.300	4488.480	9686.800	6098.000	8017.870	2049.600	7140.200	6599.130	8426.200	5025.300	6463.000	7822.600	4285.700	3931.000	2812.500	6743.600	786630	0.0000	0.0000	2	66.6999	0.6726	0.6617	0.6513	786630.0000	1.0000	68.2000	65.1000	63.3000	2|0	2|0%
7549.800	9309.800	16859.600	6894.200	1262.800	1855.100	4608.900	4572.700	6458.800	8272.700	4180.500	2453.300	2559.900	3625.700	6185.600	6073.600	1922.600	7996.200	786630	0.0000	0.0000	14	54.1365	0.5501	0.5561	0.5228	786630.0000	1.0000	55.7000	53.2000	51.6000	14|0	14|0%
7481.100	8643.840	16124.900	7994.000	5410.950	3312.900	8206.200	1017.000	4980.600	5258.800	7547.840	2806.600	6715.000	0841.700	7556.800	5591.800	9388.170	4980.000	786630	0.0000	0.0000	3	29.6636	0.2641	0.3384	0.2838	786630.0000	1.0000	26.8000	30.4000	29.6000	3|0	3|0%
1958.500	0276.500	2235.100	0214.900	8456.600	9778.200	7304.400	7940.900	2183.300	1407.500	7358.100	8765.600	0707.800	7933.100	8641.000	0303.300	1160.600	1463.900	786629	-1.0000	-0.0000	6	56.2949	0.6101	0.5390	0.5465	786630.0000	1.0000	61.8000	52.9000	51.3000	6|-1	6|-0%
7314.800	1625.900	8940.700	8561.900	7227.600	6052.900	7692.100	3140.200	7166.700	4930.900	0070.600	5001.500	4627.500	8423.300	3050.800	1159.200	5011.900	6171.100	786630	0.0000	0.0000	15	53.8865	0.5210	0.5657	0.5219	786630.0000	1.0000	52.9000	53.7000	52.2000	15|0	15|0%
4694.200	7093.900	11788.100	7626.400	3093.800	2520.900	2698.900	3721.500	3803.500	9630.500	2510.100	2140.700	3773.900	9814.400	3588.400	2940.100	2594.800	5535.000	786630	0.0000	0.0000	5	60.7897	0.6185	0.6107	0.5916	786630.0000	1.0000	62.8000	58.8000	56.9000	5|0	5|0%
9754.100	7426.200	17180.400	2737.400	0068.500	5689.800	9027.300	1415.700	7608.900	8043.400	7921.500	5964.900	4180.500	2243.400	6423.900	9145.400	2184.600	1330.000	786630	0.0000	0.0000	10	53.3209	0.5091	0.5549	0.5197	786630.0000	1.0000	51.8000	52.2000	50.8000	10|0	10|0%
4015.600	5497.700	9513.300	4509.300	0453.700	3713.200	7736.600	6899.800	1611.400	4797.500	2691.800	7489.300	8610.400	0816.600	9427.000	3959.600	7825.600	1785.200	786630	0.0000	0.0000	13	49.2329	0.4903	0.5165	0.4771	786630.0000	1.0000	49.6000	48.6000	47.2000	13|0	13|0%
2245.400	3223.400	5468.900	2270.900	6264.200	7621.000	3002.500	7175.100	6920.700	2533.500	2216.100	4749.600	4360.600	8226.800	2587.500	1398.300	3898.900	5297.200	786629	-1.0000	-0.0000	12	63.0713	0.6532	0.6261	0.6150	786630.0000	1.0000	66.3000	61.3000	59.3000	12|-1	12|-0%
6466.400	1867.380	8333.800	5657.900	8178.830	4321.100	1634.600	0557.280	7582.500	0311.100	5819.610	6130.800	6124.300	4076.350	0200.700	9012.200	8532.890	7545.100	786630	0.0000	0.0000	11	19.7950	0.2030	0.2313	0.1903	786630.0000	1.0000	20.5000	19.4000	19.0000	11|0	11|0%

enacted_2021.map - Block-VTD-County



Dataview17 - Pending Cha...

District	New
Population	0
Change - Population	0
Ideal Value	786,630
Deviation	-786,630
% Deviation	-100%

Redistricting Toolbox - enacted_2021

Target: New District
Source: All
Selection Layer: Enacted Plan SB 258 F
Theme: None

Tools

Map layers
County
Districts
0 10 20

Map scale: 1 inch = 28.33737 Miles (1:1,795,456) (-83.952173, 38.595135)

File Edit Map Dataview Selection Tools Redistricting Window Help

Districts

249

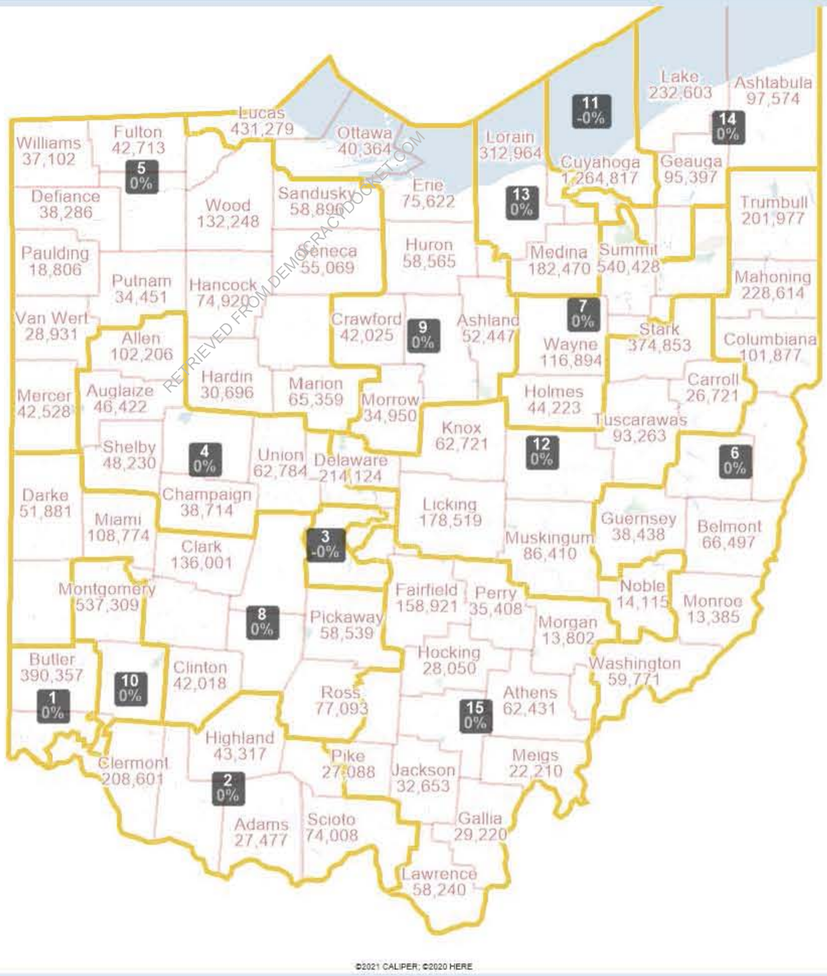
Display Manager

- TIGER/Line Segment
- Landmark Area
- US Landmark Area
- Water Area
- US Street
- Streets
- River
- Census Block
- Railroad
- Voting District
- City/Town
- County
- US Landmark
- Districts
- Enacted Plan SB 258 Introd

Dataview23 - Enacted Plan SB 258 Introduced

ID	ID:1	AREA	DISTRICT	MEMBERS	LOCKED	NAME	TOTPOP	G20R	G20V	G20P_DV	G20P_RV	G20P_TV	G12P_DV	G12P_RV	G12P_TV	G12S_DV	G12S_RV	G12S_TV	G14G_DV	G14G_RV	G14G_TV	G14A_DV	G14A_RV	G14A_TV	G14I_DV	G14I_RV	G14I_TV	G14T_DV	G14T_RV	G14T_TV	G14J_DV	G14J_RV	G14J_TV	G16P_DV	G16P_RV	G16P_TV	G16S_DV	G16S_RV
1	581	1801.84	7	1.0			786630	266.000	511.500	9282.200	617.900	512.000	1743.600	7072.400	4714.300	8157.800	9503.100	7064.400	4486.190	4280.000	518.600	2711.250	2574.300	5285.500	6090.250	7376.400	1757.800	9079.420	5047.100	3502.700	7591.160	7360.800	4952.000	9036.900	6024.800	1846.300	5465.600	7115.500
2	530	2870.16	4	1.0			786630	2955.100	6398.900	4716.400	5685.800	6399.200	3700.400	1715.700	1153.000	9093.700	1716.800	4696.300	5926.650	7602.700	446.200	6002.510	4650.700	1653.200	2084.010	8097.600	8868.200	9169.060	2218.300	9856.400	6806.170	13113.000	9919.100	7406.700	4628.800	8535.300	5585.900	2362.700
3	521	3957.59	9	1.0			786630	7890.700	5066.600	3180.600	5716.000	5066.700	6585.200	2790.800	6526.300	1375.000	1214.600	700.100	5153.610	3261.800	5002.500	5252.540	9070.000	4322.500	1767.100	7377.500	9994.600	2623.810	8741.400	1613.200	3934.400	9947.000	3881.400	6077.600	3957.000	8179.400	5961.400	6346.100
4	564	723.02	1	1.0			786630	3308.000	6907.600	3778.500	7158.400	6907.700	1759.900	2698.500	9939.200	2866.700	3641.500	2108.000	8113.220	6264.500	119.200	6795.140	4538.200	1333.300	3218.640	4249.200	8091.600	533.550	8791.600	9080.000	1059.070	10653.900	1712.900	5757.000	6330.900	8686.500	3177.000	4144.500
5	563	4530.50	8	1.0			786630	1793.100	9958.000	3031.200	9580.300	9958.500	10642.500	13742.800	9630.200	7662.800	1388.300	5667.200	9339.910	4499.100	9009.900	6719.100	3872.100	10591.200	4736.710	2230.600	7333.100	9815.460	9402.100	8977.600	10426.330	8989.200	9415.500	9229.200	13076.800	8377.300	6843.070	2798.100
6	565	3033.05	2	1.0			786630	14900.400	8143.300	10864.300	11736.500	8143.400	14040.700	8889.100	8619.800	10271.100	3028.700	7548.800	9211.840	5988.600	2397.600	8910.310	5185.700	14096.000	5674.570	3950.300	9787.400	4877.820	7181.600	11692.300	11568.360	11745.300	13313.700	13711.000	6874.500	5640.600	4092.400	2031.200
7	491	3060.24	14	1.0			786630	12522.300	13945.800	8008.100	10417.900	13945.900	13585.900	11367.100	11230.800	7643.000	12355.400	9597.500	16027.320	9742.700	13507.600	5692.760	17671.400	13364.100	10347.660	18172.800	18203.100	14308.460	14057.600	19020.800	14464.070	17821.300	12285.400	11546.000	14680.700	13396.100	10430.200	11727.900
8	640	389.65	3	1.0			786629	17833.100	13962.000	14435.700	13290.600	13962.100	10449.300	13380.500	19231.800	7207.700	11254.600	12981.300	18339.030	12602.200	8227.700	19475.140	19385.500	8860.600	17577.700	11955.200	6727.200	13004.170	16806.100	17586.200	15669.400	12443.600	18113.000	13330.600	13179.300	14043.800	18660.300	16348.100
9	557	4480.50	6	1.0			786630	17486.500	19325.000	11422.300	12748.400	19325.600	12515.400	12789.400	12207.500	14126.200	16631.500	10136.500	17418.020	10292.700	15147.300	13387.300	11944.300	15331.700	13584.800	16353.400	10953.300	16112.750	13574.200	11617.500	11224.800	12651.500	13876.300	16472.500	16905.200	17976.600	18054.600	12069.000
10	683	5136.19	15	1.0			786630	8565.700	10766.300	8713.100	16643.000	10766.600	10399.700	14766.800	11218.200	16923.600	12151.700	14604.700	13549.830	11351.600	11863.800	10943.360	11305.000	12248.400	18748.360	12359.900	19336.400	16198.700	15763.400	10265.800	19066.640	19025.820	10932.400	11394.400	17603.500	14066.300	17159.900	14060.000
11	526	6993.08	5	1.0			786630	18096.500	12918.100	9507.000	16540.400	12918.800	18230.400	12019.000	18385.100	10325.300	11442.300	11919.500	14845.440	10736.200	11650.200	15150.610	16545.000	11695.700	19387.220	14787.200	16711.400	10760.640	17904.100	19479.000	14702.380	16211.700	10914.100	15031.700	18019.700	14604.600	17146.570	11582.400
12	562	891.22	10	1.0			786630	17570.500	12328.700	16523.000	19386.400	12328.900	10508.600	17672.800	13986.300	10054.700	12525.600	16716.500	12976.990	10754.400	18741.600	13055.220	16029.000	19084.200	17914.460	18545.200	16008.800	15348.730	13528.500	17995.200	18827.170	16334.800	18162.000	19225.400	14314.700	10911.200	13052.900	16617.300
13	793	1395.57	13	1.0			786630	18830.000	11387.100	19610.900	16338.800	11387.400	10123.100	11203.400	17233.800	10269.300	19853.700	17064.100	16013.060	11221.100	15375.100	16278.790	18120.900	14399.700	11450.610	18448.000	19461.700	17036.940	13357.100	10423.000	16509.870	16858.400	13368.300	16978.800	18728.100	12846.300	11370.100	12653.600
14	572	4479.03	12	1.0			786630	19755.200	16189.200	19771.500	10335.200	16189.700	13550.000	15262.100	16661.100	17233.000	10613.000	19776.600	18235.950	19494.900	13860.600	17900.240	16011.300	13911.500	16674.760	13576.100	10558.800	10009.850	11049.700	11244.300	17714.460	14860.900	12575.400	17356.800	17013.900	11162.400	11851.700	15770.400
15	633	1032.11	11	1.0			786629	19656.200	17573.900	16321.200	17641.070	17574.200	18158.300	14673.120	15942.800	18909.300	17111.390	16056.000	18274.400	15838.970	12644.700	19672.100	14216.700	13888.800	19560.900	13611.790	19422.400	14166.700	12706.210	13047.300	17318.900	15246.920	12565.800	19606.400	19141.280	18316.000	15846.800	10240.240

introduced.map - Block-VTD-County



Dataview22 - Pending Changes (None)

District	New
Population	0
Change - Population	0
Ideal Value	786,630
Deviation	-786,630
% Deviation	-100%

Redistricting Toolbox - introduced

Target: New District
Source: All
Selection Layer: Census Block
Theme: None

Tools

Map layers
County
Districts
0 10 20
Miles

File Edit Map Dataview Selection Tools Redistricting Window Help

Districts

250

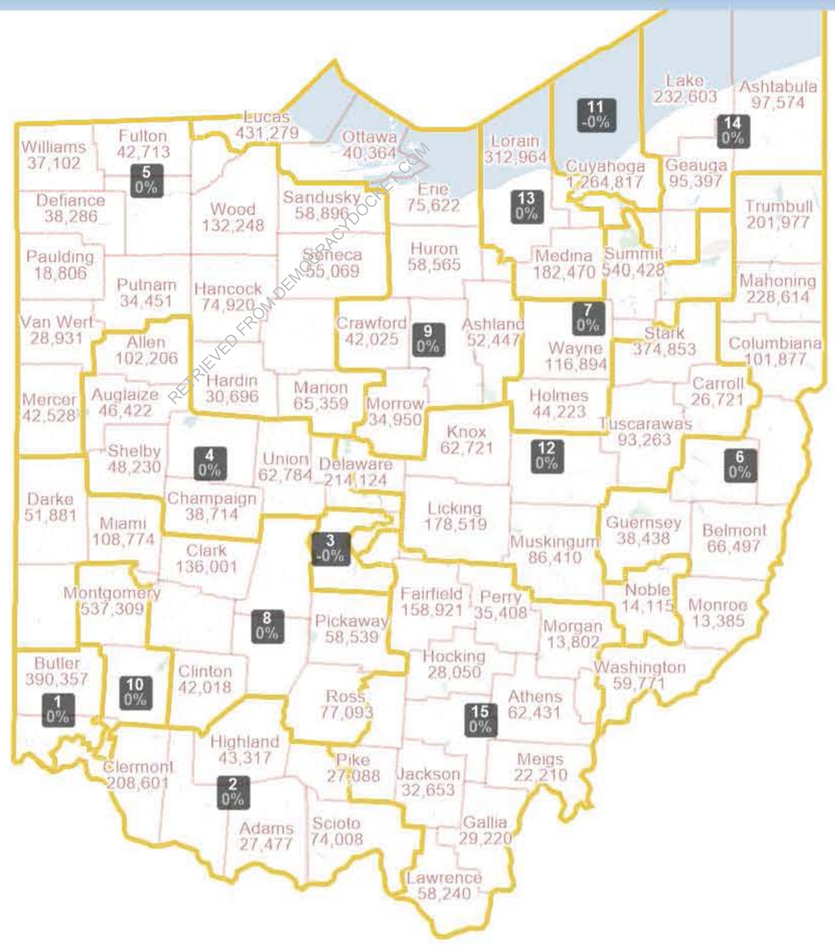
Display Manager

- TIGER/Line Segment
- Landmark Area
- US Landmark Area
- Water Area
- US Street
- Streets
- River
- Census Block
- Railroad
- Voting District
- City/Town
- County
- US Landmark
- **Districts**
- Enacted Plan SB 258 Introd

Dataview23 - Enacted Plan SB 258 Introduced

G16S_TV	G18S_DV	G18S_RV	G18S_TV	G18G_DV	G18G_RV	G18G_TV	G18A_DV	G18A_RV	G18A_TV	G18I_DV	G18I_RV	G18I_TV	G18T_DV	G18T_RV	G18T_TV	G18J_DV	G18J_RV	G18J_TV	EA51_DV	EA51_RV	EA51_TV	EA52_DV	EA52_RV	EA52_TV	POPULATION	DEVIATION	F_DEVIATIO	DISTRICT_N	EA53	F_G20P_RV	F_EA51_RV	F_EA52_RV	IDEAL_VALU	F_POPULATI	F20PRES_RD	FEDEA	FEDEA_RDI	D
2807.000	7871.700	7787.400	5659.100	2033.100	4374.600	5630.900	3265.100	6482.500	9747.600	7290.900	0397.400	9828.200	8962.700	8063.100	3526.500	8531.200	0661.500	9192.700	9707.000	5864.400	5571.500	1301.800	7622.800	8924.600	786630	0.0000	0.0000	7	52.3045	0.5325	0.5378	0.5096	786630.0000	1.0000	54.0000	51.3000	49.7000	7
2590.400	8645.100	1694.500	0339.600	0096.800	3674.300	1709.700	6746.800	1960.000	8706.800	4594.800	2122.500	7088.200	6969.600	4523.600	8080.900	4780.300	0636.100	5416.500	2619.700	6434.500	9054.300	8121.900	5150.900	3272.900	786630	0.0000	0.0000	4	53.8378	0.5189	0.5628	0.5255	786630.0000	1.0000	52.7000	53.6000	52.2000	4
1315.200	2351.400	5656.500	8007.900	2091.900	7374.000	9720.300	4176.600	0952.300	5128.900	5907.500	5131.500	2791.800	0036.100	6814.900	4350.700	8097.200	4215.000	2312.300	3745.500	7647.900	7393.500	1420.100	0082.400	1502.500	786630	0.0000	0.0000	9	52.7830	0.5485	0.5304	0.5139	786630.0000	1.0000	55.8000	50.3000	48.6000	9
1872.900	1149.200	5517.800	6667.000	4355.900	4609.900	7538.700	8500.200	3924.900	2425.200	7145.000	1469.400	2799.600	6142.400	1773.000	5077.900	2910.600	9631.000	2541.600	7963.000	9260.200	7223.200	4250.400	6411.200	0661.700	786630	0.0000	0.0000	1	59.1114	0.5583	0.6138	0.5766	786630.0000	1.0000	56.7000	59.3000	57.7000	1
5382.800	6145.000	9148.700	5293.800	2649.390	5016.500	7106.700	4462.580	8617.000	3079.500	0585.250	0878.400	2886.900	3637.260	2465.300	3353.900	3099.490	8544.400	1643.900	0117.400	8415.200	8532.600	0131.800	1258.800	1390.700	786630	0.0000	0.0000	8	67.1746	0.6682	0.6747	0.6573	786630.0000	1.0000	67.9000	65.1000	63.2000	8
1042.700	3421.800	0893.600	4315.400	8356.000	9083.400	6081.800	1935.500	0911.200	2846.800	1317.900	6020.500	0737.000	8887.700	6627.400	2587.500	6815.400	3408.600	0224.100	7064.300	5048.200	2112.600	7963.000	8805.900	6768.900	786630	0.0000	0.0000	2	51.4388	0.5070	0.5271	0.5013	786630.0000	1.0000	51.5000	50.7000	49.3000	2
2622.800	6572.200	6824.900	3397.200	2849.300	1672.000	4298.900	8505.000	0697.300	9202.400	8258.400	3010.900	4936.600	4759.000	7145.500	9228.300	9377.800	5843.700	5221.600	3319.100	5803.300	9122.500	7603.900	3244.000	0847.900	786630	0.0000	0.0000	14	54.0798	0.5435	0.5575	0.5223	786630.0000	1.0000	55.1000	53.2000	51.6000	14
9081.700	1840.100	9769.300	1609.500	7571.600	9404.400	3664.100	9925.500	9903.200	9828.700	1963.400	3619.200	6279.500	0835.200	0746.600	7840.100	6980.900	8387.500	5368.500	7174.700	3638.400	8813.100	7976.500	5786.900	3763.400	786629	-1.0000	-0.0000	3	43.5973	0.3992	0.4830	0.4194	786630.0000	1.0000	40.6000	44.5000	43.2000	3
9614.300	3600.700	1841.900	5442.700	1677.100	5876.900	5903.700	1864.800	9196.000	1060.800	0101.400	7418.500	8559.900	7198.000	6844.200	0962.000	1371.200	6193.600	7564.900	0699.200	6915.400	7614.600	0328.500	0049.200	0377.800	786630	0.0000	0.0000	6	56.1347	0.6079	0.5377	0.5450	786630.0000	1.0000	61.6000	52.7000	51.2000	6
6823.700	9041.900	2999.200	2041.100	2106.600	4401.600	3865.500	7595.700	0257.600	7853.300	2467.200	6886.700	8484.300	9647.800	2906.700	8711.000	8807.000	8416.000	7223.100	3621.800	8694.100	2316.000	1428.000	4737.800	6165.800	786630	0.0000	0.0000	15	50.1340	0.5164	0.5076	0.4894	786630.0000	1.0000	52.4000	48.9000	47.5000	15
7636.100	7194.900	4804.100	1999.000	0443.700	3582.000	4298.700	2153.400	7044.500	9198.000	3679.250	1863.400	7691.400	8759.950	1804.300	8501.900	5894.850	1409.700	7304.600	0251.500	8357.400	8608.900	8076.600	2429.000	0505.600	786630	0.0000	0.0000	5	65.8000	0.6615	0.6551	0.6427	786630.0000	1.0000	67.3000	63.2000	61.0000	5
5569.800	4427.300	8319.600	2746.900	4125.400	0413.000	3413.300	6604.600	7748.000	8352.600	8552.400	6636.800	8332.200	6012.400	7086.100	0524.600	3786.600	4713.400	8500.100	8716.100	4154.900	2871.100	5758.800	0626.400	6385.300	786630	0.0000	0.0000	10	56.3637	0.5321	0.5902	0.5503	786630.0000	1.0000	54.0000	55.8000	54.4000	10
3674.900	0225.100	6987.600	7212.800	8478.800	1730.800	8988.000	2091.400	8006.600	0098.100	1954.700	3127.700	8301.300	7647.100	6637.700	1736.800	2179.200	6152.300	8331.600	7812.300	7375.200	5187.600	4163.700	2290.800	6454.500	786630	0.0000	0.0000	13	50.1643	0.5015	0.5261	0.4833	786630.0000	1.0000	50.8000	49.7000	48.3000	13
6863.800	4595.300	5404.000	9999.300	5280.500	6158.700	0725.800	5756.000	1077.300	6833.400	2176.100	5827.600	7577.500	4601.600	6032.100	7458.100	4832.400	0380.400	5212.800	6702.700	6754.900	3457.600	3721.600	2158.800	5880.500	786630	0.0000	0.0000	12	62.5135	0.6482	0.6200	0.6083	786630.0000	1.0000	65.9000	60.3000	58.2000	12
2177.100	0602.700	9609.070	0211.700	7169.100	8127.960	1400.300	2374.100	5286.210	7660.300	1569.000	1920.040	3526.300	7252.100	4453.320	6820.600	5987.600	9468.500	5456.100	1323.100	8164.090	9487.200	4081.400	2710.120	6791.600	786629	-1.0000	-0.0000	11	21.1735	0.2171	0.2447	0.2044	786630.0000	1.0000	21.9000	20.7000	20.3000	1

introduced.map - Block-VTD-County



Dataview22 - Pending Changes (None)

District	New
Population	0
Change - Population	0
Ideal Value	786,630
Deviation	-786,630
% Deviation	-100%

Redistricting Toolbox - introduced

Target: New District | Source: All | Selection Layer: Census Block | Theme: None

Tools

Map layers
County
Districts
0 10 20
Miles

Map scale: 1 Inch = 28.69159 Miles (1:1,817,899)

File Edit Map Dataview Selection Tools Redistricting Window Help

Districts

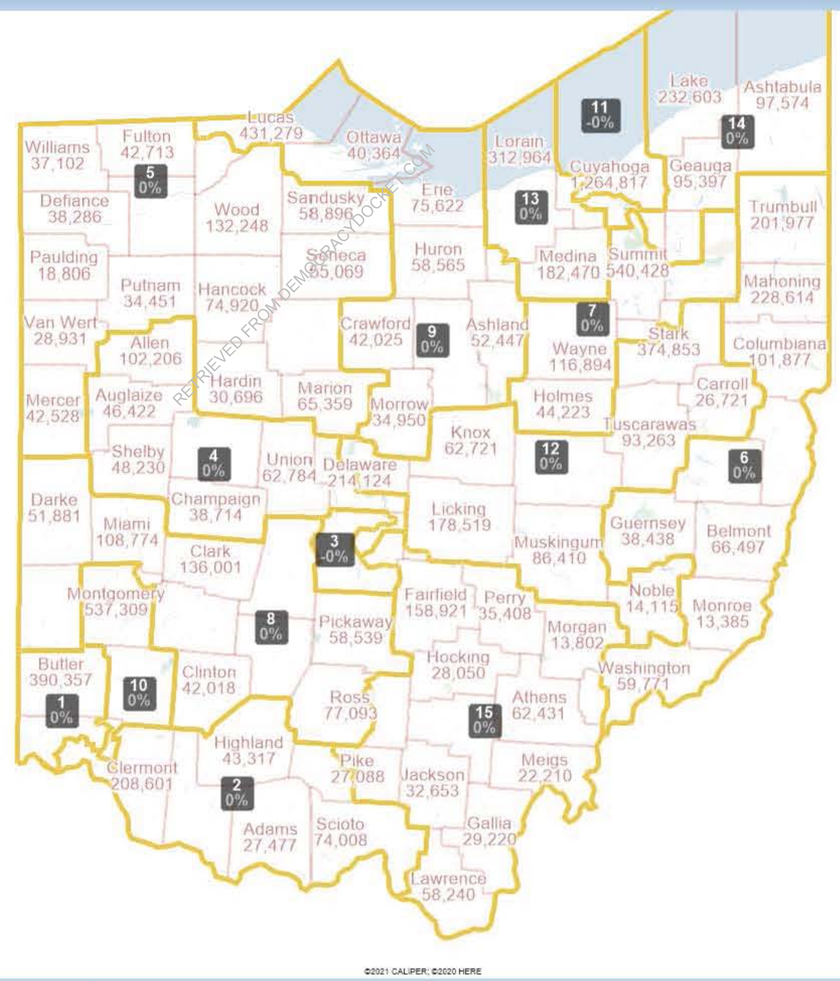
Display Manager

- TIGER/Line Segment
- Landmark Area
- US Landmark Area
- Water Area
- US Street
- Streets
- River
- Census Block
- Railroad
- Voting District
- City/Town
- County
- US Landmark
- **Districts**
- Enacted Plan SB 258 Introc

Dataview23 - Enacted Plan SB 258 Introduced

G18S_RV	G18S_TV	G18G_DV	G18G_RV	G18G_TV	G18A_DV	G18A_RV	G18A_TV	G18I_DV	G18I_RV	G18I_TV	G18T_DV	G18T_RV	G18T_TV	G18J_DV	G18J_RV	G18J_TV	EA51_DV	EA51_RV	EA51_TV	EA52_DV	EA52_RV	EA52_TV	POPULATION	DEVIATION	F_DEVIATIO	DISTRICT_N	EA53	F_G20P_RV	F_EA51_RV	F_EA52_RV	IDEAL_VALU	F_POPULATI	F20PRES_RD	FEDEA	FEDEA_RDI	DISTRICT_L
87787.400	85659.100	82033.100	84374.600	85630.900	83265.100	86482.500	89747.600	87290.900	80397.400	89828.200	88962.700	88063.100	83526.500	88531.200	80661.500	89192.700	89707.000	85864.400	85571.500	81301.800	87622.800	88924.600	786630	0.0000	0.0000	7	52.3045	0.5325	0.5378	0.5096	786630.0000	1.0000	54.0000	51.3000	49.7000	7|0%
81694.500	80339.600	80096.800	83674.300	81709.700	86746.800	81960.000	88706.800	84594.800	82122.500	87088.200	86969.600	84523.600	88080.900	84780.300	80636.100	85416.500	82619.700	86434.500	89054.300	83121.900	75150.900	83272.900	786630	0.0000	0.0000	4	53.8378	0.5189	0.5628	0.5255	786630.0000	1.0000	52.7000	53.6000	52.2000	4|0%
85656.500	88007.900	82091.900	83734.000	89720.300	84176.600	80952.300	85128.900	85907.500	85131.500	82791.800	80036.100	86814.900	84350.700	88097.200	84215.000	82312.300	83745.500	83647.900	87393.500	81420.100	80082.400	81502.500	786630	0.0000	0.0000	9	52.7830	0.5485	0.5304	0.5139	786630.0000	1.0000	55.8000	50.3000	48.6000	9|0%
85517.800	86667.000	84355.900	84609.900	87538.700	88500.200	83924.900	82425.200	87145.000	81469.400	82799.600	86142.400	71773.000	85077.900	82910.600	79631.000	82541.600	73963.000	89260.200	87223.200	84250.400	86411.200	80661.700	786630	0.0000	0.0000	1	59.1114	0.5583	0.6138	0.5766	786630.0000	1.0000	56.7000	59.3000	57.7000	1|0%
89148.700	85293.800	82649.390	85016.500	87106.700	84462.580	86617.000	83079.500	80585.250	80878.400	82886.900	83637.260	82465.300	83353.900	83099.490	88544.400	81643.900	80117.400	88415.200	88532.600	80131.800	81258.800	81390.700	786630	0.0000	0.0000	8	67.1746	0.6682	0.6747	0.6573	786630.0000	1.0000	67.9000	65.1000	63.2000	8|0%
80893.600	84315.400	88356.000	89083.400	86081.800	81935.500	80911.200	82846.800	81317.900	86020.500	80737.000	88887.700	86627.400	82587.500	86815.400	83408.600	80224.100	87064.300	75048.200	82112.600	87963.000	88805.900	86768.900	786630	0.0000	0.0000	2	51.4388	0.5070	0.5271	0.5013	786630.0000	1.0000	51.5000	50.7000	49.3000	2|0%
86824.900	83397.200	82849.300	81672.000	84298.900	88505.000	80697.300	89202.400	88258.400	83010.900	84936.600	84759.000	87145.500	89228.300	89377.800	85843.700	85221.600	83319.100	85803.300	89122.500	87603.900	83244.000	80847.900	786630	0.0000	0.0000	14	54.0798	0.5435	0.5575	0.5223	786630.0000	1.0000	55.1000	53.2000	51.6000	14|0%
89769.300	81609.500	87571.600	89404.400	83664.100	89925.500	89903.200	89828.700	81963.400	83619.200	86279.500	80835.200	80746.600	87840.100	86980.900	88387.500	85368.500	75174.700	83638.400	88813.100	87976.500	85786.900	83763.400	786629	-1.0000	-0.0000	3	43.5973	0.3992	0.4830	0.4194	786630.0000	1.0000	40.6000	44.5000	43.2000	3|-0%
81841.900	85442.700	81677.100	85876.900	85903.700	81864.800	89196.000	81060.800	80101.400	87418.500	88559.900	87198.000	86844.200	80962.000	81371.200	86193.600	87564.900	80699.200	86915.400	87614.600	80328.500	80049.200	80377.800	786630	0.0000	0.0000	6	56.1347	0.6079	0.5377	0.5450	786630.0000	1.0000	61.6000	52.7000	51.2000	6|0%
82999.200	82041.100	82106.600	84401.600	83865.500	87595.700	80257.600	87853.300	82467.200	86886.700	88484.300	89647.800	82906.700	88711.000	88807.000	88416.000	87223.100	83621.800	88694.100	82316.000	81428.000	84737.800	86165.800	786630	0.0000	0.0000	15	50.1340	0.5164	0.5076	0.4894	786630.0000	1.0000	52.4000	48.9000	47.5000	15|0%
84804.100	81999.000	80443.700	83582.000	84298.700	82153.400	87044.500	89198.000	83679.250	81863.400	87691.400	88759.950	81804.300	88501.900	85894.850	81409.700	87304.600	80251.500	88357.400	88608.900	88076.600	82429.000	80505.600	786630	0.0000	0.0000	5	65.8000	0.6615	0.6551	0.6427	786630.0000	1.0000	67.3000	63.2000	61.0000	5|0%
88319.600	82746.900	84125.400	80413.000	83413.300	86604.600	71748.000	88352.600	88552.400	86636.800	88332.200	86012.400	87086.100	80524.600	83786.600	74713.400	88500.100	88716.100	84154.900	82871.100	85758.800	80626.400	86385.300	786630	0.0000	0.0000	10	56.3637	0.5321	0.5902	0.5503	786630.0000	1.0000	54.0000	55.8000	54.4000	10|0%
86987.600	87212.800	88478.800	81730.800	88988.000	82091.400	88006.600	80098.100	81954.700	83127.700	88301.300	87647.100	86637.700	81736.800	82179.200	86152.300	88331.600	77812.300	87375.200	85187.600	84163.700	72290.800	86454.500	786630	0.0000	0.0000	13	50.1643	0.5015	0.5261	0.4833	786630.0000	1.0000	50.8000	49.7000	48.3000	13|0%
85404.000	89999.300	85280.500	86158.700	80725.800	85756.000	81077.300	86833.400	82176.100	85827.600	87577.500	84601.600	86032.100	87458.100	84832.400	80380.400	85212.800	86702.700	86754.900	83457.600	83721.600	82158.800	85880.500	786630	0.0000	0.0000	12	62.5135	0.6482	0.6200	0.6083	786630.0000	1.0000	65.9000	60.3000	58.2000	12|0%
89609.070	80211.700	87169.100	88127.960	81400.300	82374.100	85286.210	87660.300	81569.000	81920.040	83526.300	87252.100	84453.320	86820.600	85987.600	89468.500	85456.100	81323.100	88164.090	89487.200	84081.400	82710.120	86791.600	786629	-1.0000	-0.0000	11	21.1735	0.2171	0.2447	0.2044	786630.0000	1.0000	21.9000	20.7000	20.3000	11|-0%

introduced.map - Block-VTD-County



Dataview22 - Pending Changes (None)

District	New
Population	0
Change - Population	0
Ideal Value	786,630
Deviation	-786,630
% Deviation	-100%

Redistricting Toolbox - introduced

Target: New District
Source: All
Selection Layer: Census Block
Theme: None

Tools

Map layers
County
Districts
0 10 20
Miles

Map scale: 1 Inch = 28.69159 Miles (1:1,817,899)

To: McColley, Robert[Robert.McColley@ohiosenate.gov]
From: DiRossi, Ray
Sent: Mon 11/15/2021 9:05:40 PM
Subject: SB 258 Ray notes
SB 258 Substitute Bill items.docx
graphic.xlsx

See 2 attachments
Ray

- Required to have at least 65 whole counties — Map has 76
  - Map only splits 12 counties (76 whole)
  - Current map splits 23 counties (65 whole)
  - Most whole counties in at least the last 50+ years
  - Whole counties: 1971: 68, 1981: 66, 1991: 68, 2001: 67 and 2011: 65

- Counties with 4 districts – constitutionally prohibited — Map complies = 0
  - 1971: 2, 1981: 0, 1991: 1, 2001: 1 and 2011: 2

- Counties with 3 districts – allowed 5 — Map complies = 2
  - 1971: 3, 1981: 1, 1991: 0, 2001: 2 and 2011: 5

- Counties with 2 districts – allowed 18 — Map complies = 10
  - Clark, Fairfield, Franklin, Holmes, Lorain, Ross, Shelby, Summit, Washington & Wood

- Attempt to have 1 whole County per CD (exclude wholly contained) — Map achieves
  - 2011 map had 2 such (all parts) districts = CD 9 and CD 13

- One person one vote – state population of 11,799,448 — Map achieves
  - 13 CDs at 786,630 (target) and 2 CDs at 786,629 (-1)

County splits: Current versions of maps

McColley (SB 258)	12 splits	14 total splits
House Dems (HB 483)	14 splits	14 total splits
Sykes / Yuko 258 (Nov SB 237)	14 splits	14 total splits
Contest Winning map #1, 3	14 splits	14 total splits
Current map	23 splits	32 total splits

Subdivision splits: Current versions of maps

McColley (SB 258) — **14 splits: 8 TWP and 6 Municipal Corps**

1. Clark	Mad River TWP	CD 10 / CD 15
2. Cuyahoga	Rocky River (#80)	CD 11 / CD 13
3. Cuyahoga	Oakwood (#355)	CD 11 / CD 14
4. Fairfield	Columbus (#1)	CD 12 / CD 15
5. Franklin	Columbus (#1)	CD 3 / CD 15
6. Hamilton	Glendale (#444)	CD 1 / CD 8
7. Hamilton:	Sycamore TWP	CD 1 / CD 2
8. Holmes	Berlin TWP	CD 7 / CD 12
9. Lorain	Columbia TWP	CD 5 / CD 13
10. Ross	Union TWP	CD 2 / CD 15
11. Shelby	Green TWP	CD 4 / CD 8
12. Summit	Cuyahoga Falls (#15)	CD 7 / CD 13
13. Washington	Belpre TWP	CD 6 / CD 12
14. Wood	Perrysburg TWP	CD 5 / CD 9

Only 3 of top 100 most populous cities are split (Columbus, Cuyahoga Falls & Rocky River)

Sykes / Yuko 258 (Nov SB 237) **16 splits: 2 TWP and 14 Municipal Corps**

1. Clark: Springfield
2. Cuyahoga: Berea
3. Guernsey: Cambridge
4. Hamilton: Maderia
5. Hancock: Findlay
6. Franklin: Columbus
7. Franklin: Prairie TWP
8. Greene: Beavercreek
9. Knox: Mount Vernon
10. Lorain: Amherst
11. Mahoning: Campbell
12. Medina: Wooster
13. Stark: Massillon
14. Union: Marysville
15. Union: Millcreek TWP
16. Wood: Bowling Green

House Dems (HB 483) **21 splits: 16 TWP and 5 Municipal Corps**

1. Ashland: Lake TWP
2. Clinton: Liberty TWP
3. Clinton: Union TWP
4. Cuyahoga: Seven Hills
5. Franklin: Columbus
6. Franklin: Prairie TWP
7. Greene: Beavercreek
8. Greene: Beavercreek TWP
9. Hamilton: Green TWP
10. Hamilton: Miami TWP
11. Holmes: Walnut Creek TWP
12. Lorain: North Ridgeville
13. Mahoning: Poland TWP
14. Marion: Waldo TWP
15. Ross: Greenfield
16. Ross: Concord TWP
17. Ross: Buckskin TWP
18. Stark: Canton TWP
19. Washington: Fairfield TWP
20. Washington: Dunham TWP
21. Wyandot: Antrim TWP

County Split Comparison – to last decade

	2011 Enacted	2021 Proposal
Athens	Split: 2 CDs	
Clark		Split: 2 CDs
Cuyahoga	Split: 4 CDs	Split: 3 CDs
Erie	Split: 2 CDs	
Fairfield		Split: 2 CDs
Fayette	Split: 2 CDs	
Franklin	Split: 3 CDs	Split: 2 CDs
Hamilton	Split: 2 CDs	Split: 3 CDs
Holmes		Split: 2 CDs
Huron	Split: 2 CDs	
Lorain	Split: 3 CDs	Split: 2 CDs
Lucas	Split: 2 CDs	
Mahoning	Split: 2 CDs	
Marion	Split: 2 CDs	
Medina	Split: 2 CDs	
Mercer	Split: 3 CDs	
Muskingum	Split: 2 CDs	
Ottawa	Split: 2 CDs	
Portage	Split: 3 CDs	
Richland	Split: 2 CDs	
Ross	Split: 2 CDs	Split: 2 CDs
Scioto	Split: 2 CDs	
Shelby		Split: 2 CDs
Stark	Split: 3 CDs	
Summit	Split: 4 CDs	Split: 2 CDs
Trumbull	Split: 2 CDs	
Tuscarawas	Split: 2 CDs	
Washington		Split: 2 CDs
Wood		Split: 2 CDs
	23 splits	**12 splits**

2010 Split Subdivisions (35*) * = Annexation changes in geography between 2010/2020

Cuyahoga	Berea	
Cuyahoga	Cleveland	made whole in 2021
Cuyahoga	Parma	
Cuyahoga	Rocky River	
Fayette	Jasper TWP	
Fayette	Union TWP	
Franklin	Columbus	population required split
Franklin	Gahanna	
Franklin	Grandview Heights	
Franklin	Grove City	
Franklin	Groveport	
Franklin	New Albany	
Franklin	Obetz	
Franklin	Westerville	
Franklin	Worthington	
Hamilton	Cincinnati	made whole in 2021
Lorain	Grafton TWP	
Lucas	Toledo	made whole in 2021
Marion	Claridon TWP	
Medina	Brunswick TWP	
Mercer	Butler TWP	
Mercer	Jefferson TWP	
Ottawa	Berlin TWP	
Portage	Brimfield TWP	
Richland	Madison TWP	
Ross	Twin TWP	
Scioto	Rush TWP	
Stark	Canton	made whole in 2021
Stark	Canton TWP	
Stark	Lake TWP	
Stark	Perry TWP	
Stark	Plain TWP	
Summit	Akron	made whole in 2021
Summit	Cuyahoga Falls	
Summit	Springfield TWP	

FED election data over 10 years **7 Competitive CDs = +/- 4.0%**

			FED 12 to 20
1	786,630		51.5
2	786,630		65.1
3	786,630		30.4
4	786,630		66.0
5	786,630		58.8
6	786,629	-1	52.9
7	786,630		56.7
8	786,630		62.0
9	786,630		47.7
10	786,630		52.2
11	786,630		19.4
12	786,629	-1	61.3
13	786,630		48.6
14	786,630		53.2
15	786,630		53.7

Competitive CDs (+/- 4%) using FED data		Competitive CDs (+/- 4%) using all data	
7	McColley (SB 258)	5	McColley (SB 258)
5	Yuko Sykes (SB 237) Sept 29th	5	Yuko Sykes (SB 237) Sept 29th
5	Yuko Sykes (SB 237) Nov 10th	4	Yuko Sykes (SB 237) Nov 10th
5	House Dem (HB 483)	5	House Dem (HB 483)
2	Current Map	2	Current Map

Major cities history……

- Regarding 7 of the Big 8 cities: Akron, Canton, Cincinnati, Cleveland, Dayton, Toledo and Youngstown (Note: Columbus too big to be 1 CD)
- 1st time since at least 1965 that all are major cities (Columbus note) whole / none split

Testimony to add Greene county (Wright Patt) back to the 10th DONE
Testimony to not split Franklin 3 ways DONE
Testimony to not split Toledo / Lucas county DONE
Testimony to unify the Mahoning Valley (Trumbull and Mahoning) DONE

County specific history……

Lucas County

2021 Whole 2011 Split in 2 2001 Split in 2

Montgomery County

2021	Whole
2011	Whole
2001	Split in 2
1991	Split in 2
1981	Split in 2
1971	Split in 3
1968	Split in 4

Franklin County

2021	Split in 2
2011	Split in 3
2001	Split in 3

Summit County

2021	Split in 2
2011	Split in 4
2001	Split in 3

Stark County

2021 Whole 2011 Split in 3

Cuyahoga County

2021	Split in 3
2011	Split in 4
2001	Split in 4
1991	Split in 4
1981	Split in 3
1971	Split in 4
1968	Split in 4
1965	Split in 4

Population affected by a split county analysis

Population of Split counties		**Big 3**	**Other**	**Total**
McColley (SB 258)	12 splits	3,419,263	1,509,879	4,929,142
House Dems (HB 483)	14 splits	3,419,263	1,447,208	4,866,471
Sykes / Yuko 258 (Nov SB 237)	14 splits	3,419,263	1,708,403	5,127,666
Contest winning maps #1, 3	14 splits	3,419,263		
Current map	23 splits	3,419,263	3,263,906	6,683,169

Columbus Franklin county portion = 880,329
Note: 89.35% is max score
Columbus in CD 3 = 584,813 66.4%

Columbus and circumscribed area Franklin county portion = 1,019,670
Note: 77.14% is max score
Senate REP Area in CD 3 = 697,723 68.42%
House DEM Area in CD 3 = 625,181 61.30%
Senate DEM Area in CD 3 = 620,960 60.80%

Distance Measurements

2011 CD 6 is 201 miles long
2011 CD 4 is 158 miles long

Senate REP 2021 CD 6 is 159 miles long
Senate REP 2021 CD 5 is 167 miles long

Senate DEM 2021 CD 12 is 175 miles long

House DEM 2021 CD 2 is 151 miles long
House DEM 2021 CD 5 is 150 miles long

	BASELINE			FED 12 to 20
1	768,550	31,084	4.22%	53.60
2	734,793	(2,673)	-0.36%	57.20
3	809,749	72,283	9.80%	30.20
4	716,177	(21,289)	-2.89%	63.60
5	731,052	(6,414)	-0.87%	59.70
6	687,118	(50,348)	-6.83%	64.20
7	737,340	(126)	-0.02%	61.00
8	745,736	8,270	1.12%	66.00
9	704,051	(33,415)	-4.53%	36.30
10	729,405	(8,061)	-1.09%	52.90
11	692,589	(44,877)	-6.09%	18.30
12	808,944	71,478	9.69%	55.30
13	698,441	(39,025)	-5.29%	42.00
14	730,056	(7,410)	-1.00%	53.90
15	766,337	28,871	3.91%	55.70
16	739,110	1,644	0.22%	56.40

Ohio Senate
Senate Building
1 Capitol Square
Columbus, Ohio 43215
(614) 466-8150

Rob McColley
Senate Majority Whip
1st Senate District

Thank you, Chairwoman Gavarone, Vice-Chair O'Brien, Ranking Member Maharath and members of the Local Government and Elections Committee for allowing me to present testimony today for Substitute Senate Bill 258. After considering multiple maps presented by Democrat and Republican Caucuses in both the House and the Senate, and listening to the public's input on all of those maps, we offer this map that is not only constitutionally compliant, but the most competitive map offered by any caucus to date. It is also a map that splits the least counties of any map offered by any caucus, keeps Ohio's largest cities whole, installs compact districts and implements many of the requested changes we heard in testimony.

Article 19, Section 2(B)(5) of the Ohio Constitution describes the process that must be followed when splitting counties in a congressional map. In essence, a map may have up to 23 split counties with up to 18 being split once and up to five being split twice. This map splits only 12 counties with only two of those counties being split twice. The counties that are split once are Clark, Fairfield, Franklin, Holmes, Lorain, Ross, Shelby, Summit, Washington and Wood. The Counties split twice are Hamilton and Cuyahoga. Notably, for the first time since the map passed thirty years ago, Lucas County will be whole and for the first time since the map passed twenty years ago Stark County will be whole. The impact on several of Ohio's other large counties is also minimized by Franklin and Summit County having the least splits since the maps passed thirty years ago. Finally, the map complies with Article 19, Section 2(B)(8) by including an entire county in each district where possible. If passed, this map would have the least counties split in over fifty years. Additionally, this map splits two less counties than both the House and Senate Democrat proposals.

Since the introduction of SB258, we have maintained that it is important to keep Ohio's largest cities whole. With exception to Columbus, which must be split under the Constitution and cities that straddle county lines and, therefore, do not count as a split under the Constitution, 98 of Ohio's 100 largest cities are kept whole in this map (Rocky River, Cuyahoga Falls). In total, only eight townships and six municipalities are split in this proposed map, which more than adequately complies with Article 19, Section 1(C)(3)(b)'s requirement that the general assembly not unduly split governmental units.

Article 19, Section 2(B)(2) also requires that districts be compact. This requirement is not applicable to a four-year map, however, under Section 1(C)(3)(c). In such an instance, the

general assembly shall attempt, but is not required to draw compact districts. Nevertheless, the districts presented before you are compact.

Finally, the map before you is the most competitive map offered by any caucus to date and the most competitive Ohio congressional map in decades. Ohio is subject to swings in voter preferences, particularly in federal elections. Even though, with exception to 2006, Republicans have swept every election for statewide constitutional office since 1994, Ohio has voted for a both a Democrat and a Republican for President in the past four presidential elections and continues to be represented by both a Democrat and Republican in the United States Senate. Clearly, Ohioans are bifurcating between federal and state elections and issues. Therefore, because the map before you is for United States Congressional districts, it makes sense to judge competitiveness based upon statewide federal elections over the last ten years. This allows us to capture the true nature of Ohio's voting tendencies in federal elections and to insulate from outliers. When evaluating these districts in the federal statewide context and defining a competitive district as one with a 46%-54% Republican index, this map has six seats that lean Republican, seven seats that are competitive and two seats that lean Democrat. The indexes are as follows:

Congressional District #	**Population**	**Deviation**	**Federal Statewide Elections 2012-2020**
1	786,630	0	51.5
2	786,630	0	65.1
3	786,630	0	30.4
4	786,630	0	66.0
5	786,630	0	58.8
6	786,629	-1	52.9
7	786,630	0	56.7
8	786,630	0	62.0
9	786,630	0	47.7
10	786,630	0	52.2
11	786,630	0	19.4
12	786,629	-1	61.3
13	786,630	0	48.6
14	786,630	0	53.2
15	786,630	0	53.7

Article 19, Section 1(C)(3)(a) states that a map shall not unduly favor or disfavor a party or its

incumbents. No sporting event should ever favor or disfavor a team by some predetermined final score before either team walks on the field. A congressional map should not be judged to favor or disfavor either party that way either. Rather, it should be judged based upon how many districts are going to be determined by the various important issues and candidates in that election. This map embodies that belief by ensuring a plurality of the districts will be competitive in any given cycle. Its seven competitive districts are two more than any House or Senate Democrat proposal and five more than the map passed in 2011. Further, this map neither favors nor disfavors either party's incumbents. It accomplishes this by only combining two incumbents, who are required to be combined through the prohibition against splitting Cincinnati.

The map before you complies with the requirements placed upon the General Assembly under the Ohio Constitution. It is the product of a deliberate effort to draw compact districts, minimize county splits, keep Ohio's largest cities whole and ensure a plurality of Ohio's congressional districts will be competitive. Thank you Chairwoman Gavarone, Vice-Chair O'Brien, Ranking Member Maharath and members of the Local Government and Elections Committee for allowing me to present testimony on Substitute Senate Bill 258 and the proposed congressional district map contained therein. I would be happy to take any questions.

Competitive CDs (+/- 4%) using FED data		Competitive CDs (+/- 4%) using all data	
7	McColley (SB 258)	5	McColley (SB 258)
5	Yuko Sykes (SB 237) Sept 29th	5	Yuko Sykes (SB 237) Sept 29th
5	Yuko Sykes (SB 237) Nov 10th	4	Yuko Sykes (SB 237) Nov 10th
5	House Dem (HB 483)	5	House Dem (HB 483)
2	Current Map	2	Current Map

Competitive CDs (+/- 3.75%) using FED data		Competitive CDs (+/- 3.75%) using all data	
7	McColley (SB 258)	4	McColley (SB 258)
5	Yuko Sykes (SB 237) Sept 29th	4	Yuko Sykes (SB 237) Sept 29th
5	Yuko Sykes (SB 237) Nov 10th	4	Yuko Sykes (SB 237) Nov 10th
5	House Dem (HB 483)	5	House Dem (HB 483)
0	Current Map	2	Current Map

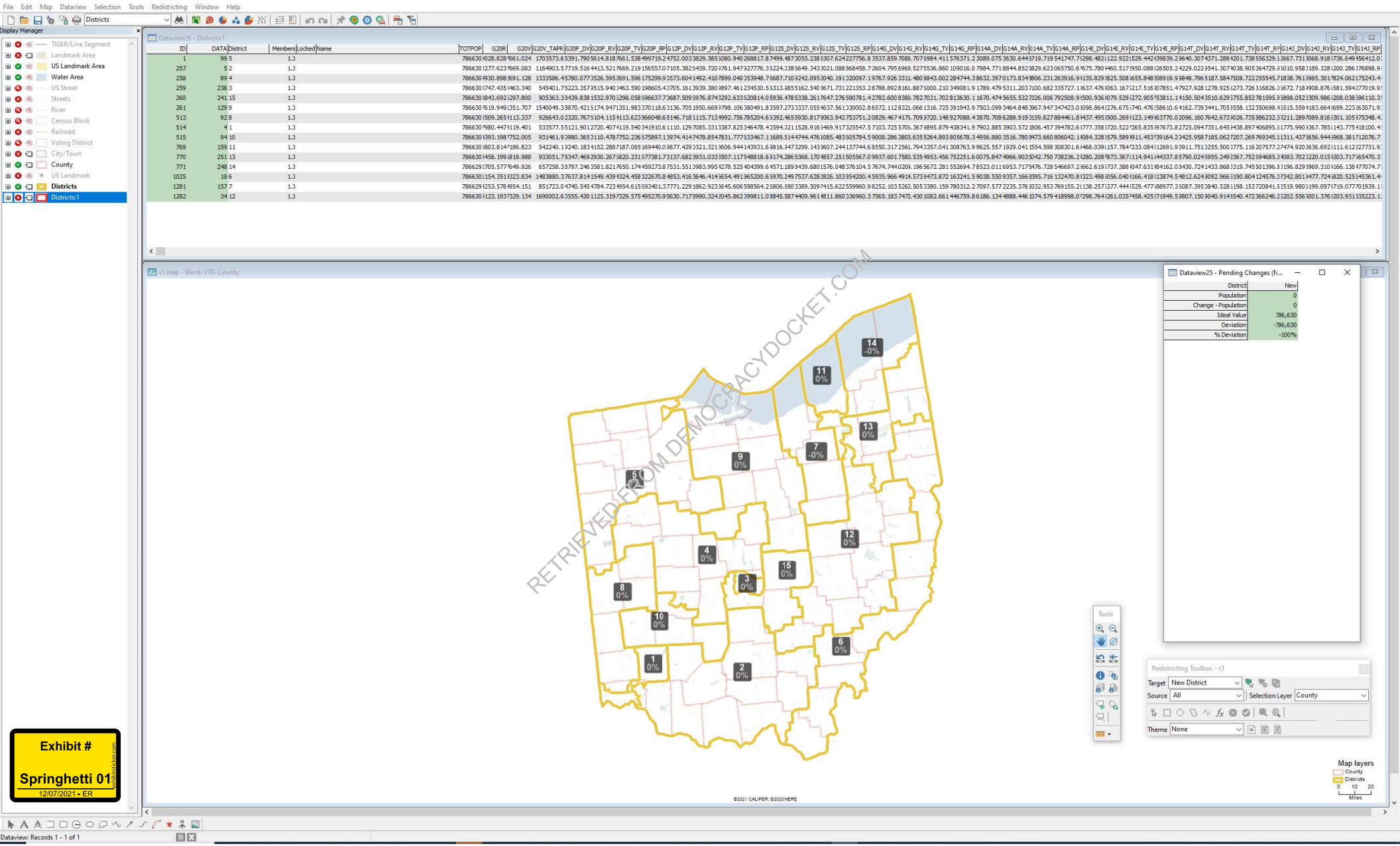
Competitive CDs (+/- 3.5%) using FED data		Competitive CDs (+/- 3.5%) using all data	
6	McColley (SB 258)	4	McColley (SB 258)
4	Yuko Sykes (SB 237) Sept 29th	4	Yuko Sykes (SB 237) Sept 29th
4	Yuko Sykes (SB 237) Nov 10th	4	Yuko Sykes (SB 237) Nov 10th
4	House Dem (HB 483)	4	House Dem (HB 483)
0	Current Map	1	Current Map

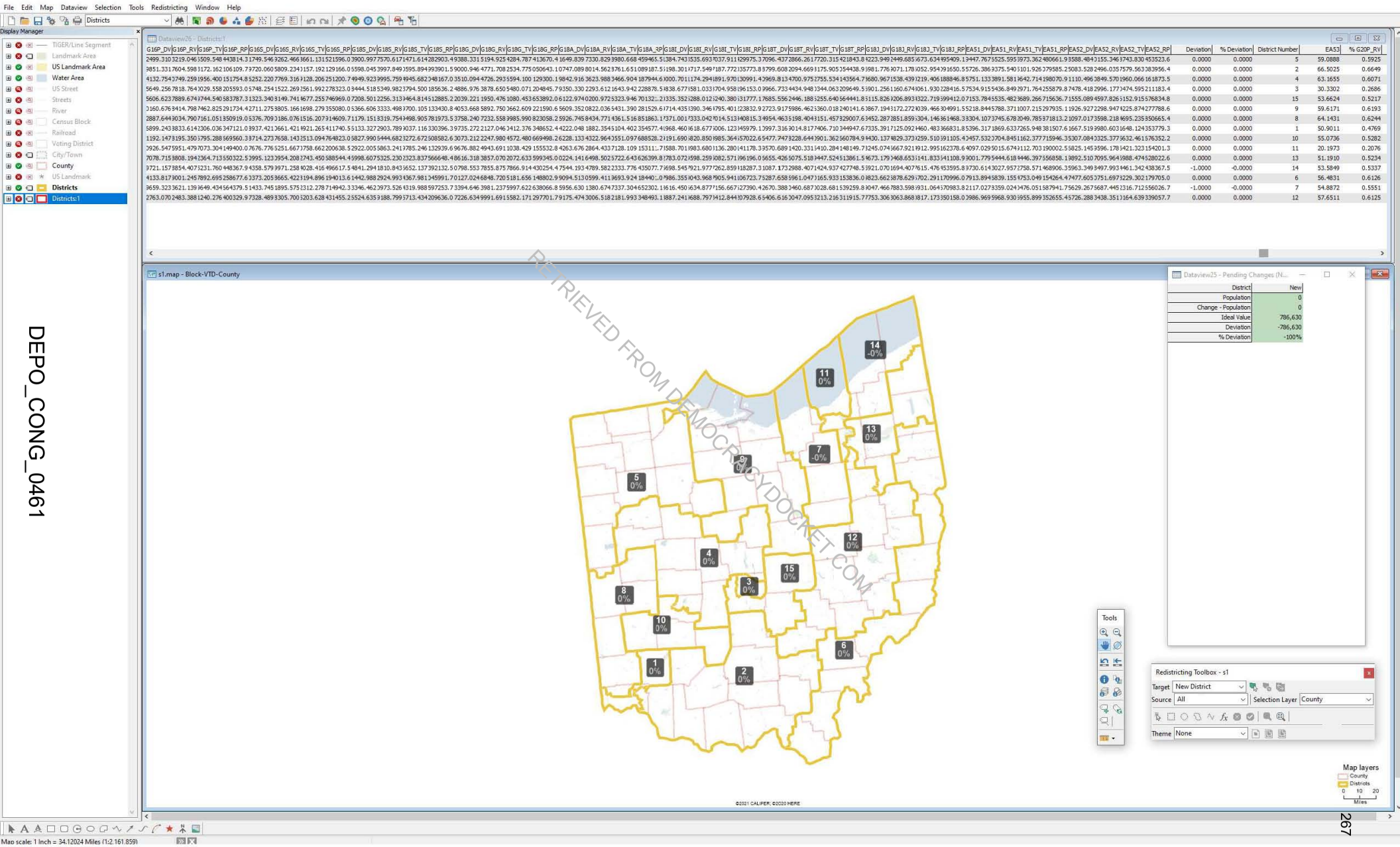
Competitive CDs (+/- 3%) using FED data		Competitive CDs (+/- 3%) using all data	
5	McColley (SB 258)	3	McColley (SB 258)
4	Yuko Sykes (SB 237) Sept 29th	3	Yuko Sykes (SB 237) Sept 29th
4	Yuko Sykes (SB 237) Nov 10th	3	Yuko Sykes (SB 237) Nov 10th
4	House Dem (HB 483)	2	House Dem (HB 483)
0	Current Map	1	Current Map

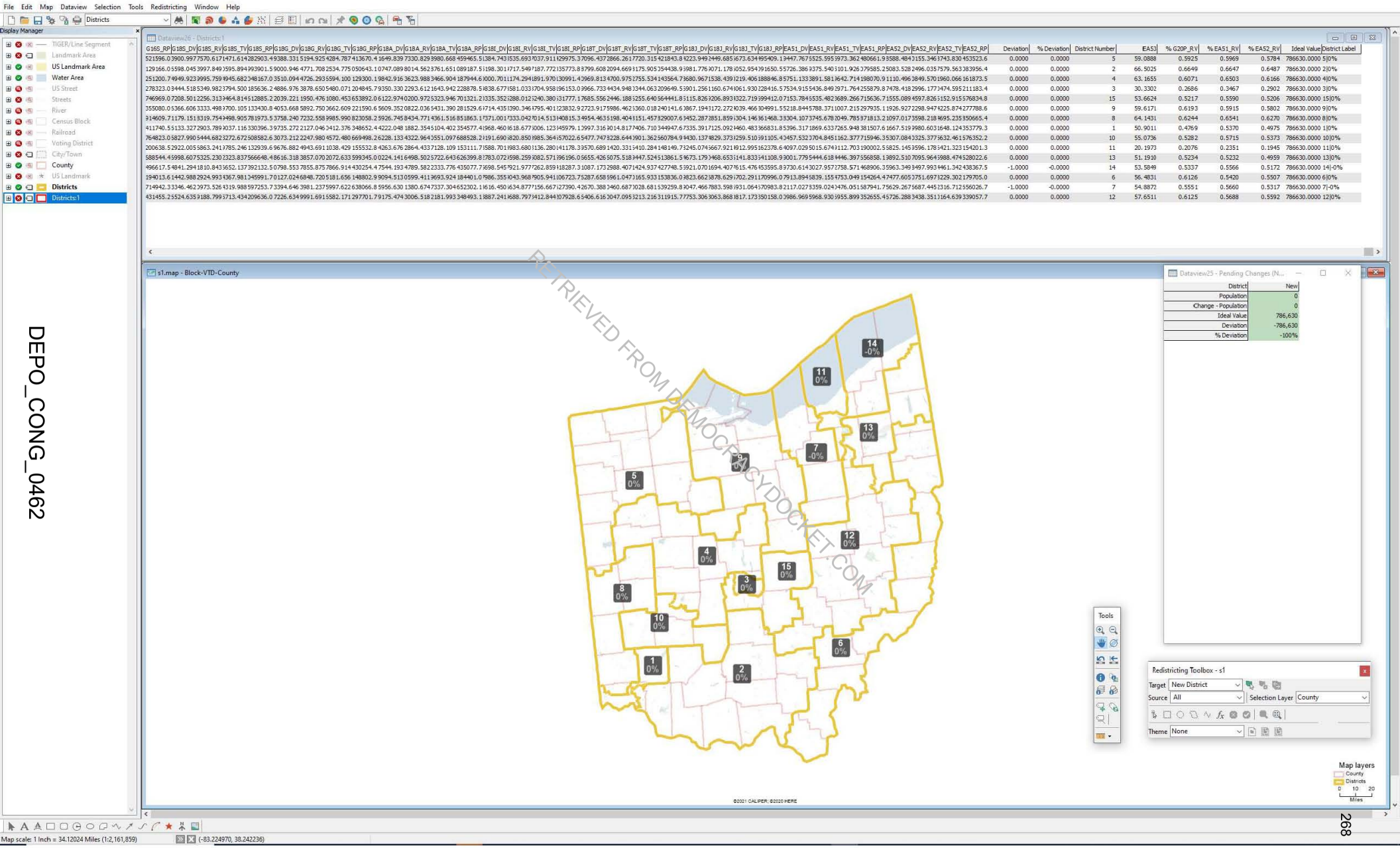
Competitive CDs (+/- 2.5%) using FED data		Competitive CDs (+/- 2.5%) using all data	
4	McColley (SB 258)	3	McColley (SB 258)
3	Yuko Sykes (SB 237) Sept 29th	2	Yuko Sykes (SB 237) Sept 29th
3	Yuko Sykes (SB 237) Nov 10th	2	Yuko Sykes (SB 237) Nov 10th
3	House Dem (HB 483)	1	House Dem (HB 483)
0	Current Map	0	Current Map

Competitive CDs (+/- 2%) using FED data		Competitive CDs (+/- 2%) using all data	
2	McColley (SB 258)	3	McColley (SB 258)
3	Yuko Sykes (SB 237) Sept 29th	2	Yuko Sykes (SB 237) Sept 29th
3	Yuko Sykes (SB 237) Nov 10th	2	Yuko Sykes (SB 237) Nov 10th
2	House Dem (HB 483)	0	House Dem (HB 483)
0	Current Map	0	Current Map

Competitive CDs (+/- 1.5%) using FED data		Competitive CDs (+/- 1.5%) using all data	
2	McColley (SB 258)	2	McColley (SB 258)
2	Yuko Sykes (SB 237) Sept 29th	1	Yuko Sykes (SB 237) Sept 29th
2	Yuko Sykes (SB 237) Nov 10th	1	Yuko Sykes (SB 237) Nov 10th
1	House Dem (HB 483)	0	House Dem (HB 483)
0	Current Map	0	Current Map







From: Springhetti, Blake
Sent: Monday, November 15, 2021 6:53 PM
To: Morrison, Christine; Disantis, Paul
Subject: content
Attachments: Substitute Senate Bill 258.HighlightBrief.docx; Substitute Senate Bill 258.HighlightBrief.pdf; Substitute Senate Bill 258.Memo.docx; Substitute Senate Bill 258.Memo.pdf

The highlight brief is skimmed down with non-constitutional facts added. The memo is the same document I sent earlier that has a lot more information.
Blake

Substitute Senate Bill 258: A Congressional Redistricting Plan

Highlights and Key Facts

County Splits

- Sub. Senate Bill 258 includes 76 whole counties, which is more whole counties than any Ohio congressional plan approved in over 50 years.
- Sub. Senate Bill 258 splits less counties than the House Democrat proposal and Senate Democrat proposal.
- The Ohio Constitution allows for 23 split counties, this plan splits only 12.
- The map approved in 2011 split 23 counties.
- Each congressional district that is not wholly contained in a single county includes at least one whole county within the congressional district boundary.

County Subdivisions Splits

- Sub. Senate Bill 258 splits 14 subdivisions – the House Democrat plan split 21 subdivisions.
- *Columbus:* Approximately 70 percent of Columbus and the subdivisions circumscribed by Columbus, is within Congressional District 3. Columbus is larger than one ratio of representation and must be split into at least two congressional districts.
    - *A higher percentage than both democrat proposals.*
- *Cleveland:* First split in congressional plans dating back to the late 1800s, Cleveland is wholly contained within Congressional District 11.
- *Cincinnati:* Wholly contained within one congressional district for the first time in over 100 years.
- *Akron:* Currently divided into two congressional districts, is wholly contained within Congressional District 13.
- *Dayton:* Wholly contained within Congressional District 10 and is paired with Wright-Patterson Air Force Base.
- *Toledo:* Currently divided into two congressional districts, is wholly contained within Congressional district 9.
- Only three of the top one-hundred most populous cities are split.

Partisan Leanings

- Sub. Senate Bill 258 could create six republican leaning congressional districts, seven competitive congressional districts and two democrat leaning congressional districts.
- Under this plan, in a good election year in which republicans recruit good candidates, republicans can win more than eleven of fifteen districts.
- Sub. Senate Bill 258 would create more competitive congressional districts than any proposal introduced in the General Assembly.
- In the House democrat proposal, eight of fifteen congressional districts would favor one political party by over 60 percent.

Incumbents

- The House democrat proposal paired seven of twelve republican incumbents, clearly unduly disfavoring republican incumbents.
- Cincinnati must be whole and two incumbents live within city limits. Each proposed congressional plan introduced pairs those two incumbents.
- Otherwise, Sub. Senate Bill 258 would *not* pair any republican or democrat incumbent (that is assumed to be running for reelection to Congress) into a single congressional district.

Substitute Senate Bill 258: A Congressional Redistricting Plan

Highlights and Key Facts

County Splits

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- *Akron:* Currently divided into two congressional districts, is wholly contained within Congressional District 13.
- *Dayton:* Wholly contained within Congressional District 10 and is paired with Wright-Patterson Air Force Base.
- *Toledo:* Currently divided into two congressional districts, is wholly contained within Congressional district 9.
- Only three of the top one-hundred most populous cities are split.

Partisan Leanings

- Sub. Senate Bill 258 could create six republican leaning congressional districts, seven competitive congressional districts and two democrat leaning congressional districts.
- Under this plan, in a good election year in which republicans recruit good candidates, republicans can win more than eleven of fifteen districts.
- Sub. Senate Bill 258 would create more competitive congressional districts than any proposal introduced in the General Assembly.
- In the House democrat proposal, eight of fifteen congressional districts would favor one political party by over 60 percent.

Incumbents

- The House democrat proposal paired seven of twelve republican incumbents, clearly unduly disfavoring republican incumbents.
- Cincinnati must be whole and two incumbents live within city limits. Each proposed congressional plan introduced pairs those two incumbents.
- Otherwise, Sub. Senate Bill 258 would *not* pair any republican or democrat incumbent (that is assumed to be running for reelection to Congress) into a single congressional district.

Substitute Senate Bill 258: A Congressional Redistricting Plan

Highlights and Key Facts

For at least the next decade, Ohio will have fifteen Representatives to Congress, down from sixteen over the past decade. Ohio's population is 11,799,448 and when divided by fifteen equals 786,629.8. To achieve the lowest deviation from 786,629.8, the plan consists of thirteen congressional districts with a population of 786,630 and two congressional districts (Congressional District 6 and Congressional District 12) with a population of 786,629.

The Ohio Constitution clarifies county subdivision boundaries that perforate multiple counties are considered to be separate subdivisions and are not split. Example: Dublin City exists in three counties – Franklin, Delaware and Union. All three portions of Dublin can be in three different congressional districts and is not considered to be split. The same applies to any noncontiguous portions of a subdivision.

It is important to note that the language referencing statewide partisan elections over the last decade in Article XI, section 6, (B), part of the rules for drawing a legislative redistricting plan does not exist in Article XIX or apply to drawing congressional district plans. Substitute Senate Bill 258 complies with all mandatory requirements of Article XIX of the Ohio Constitution and the Voting Rights Act. The plan also achieves certain aspirational sections of Article XIX.

Article XIX requirements for drawing Congressional Districts

- Article XIX, section 2, (B)(4)(a), specifies a congressional district plan shall attempt to include a "significant" portion of any municipal corporation or township in a single congressional district that qualifies with the criteria in that section, which today only applies to Columbus.
- In determining the population of Columbus, this section specifies that county subdivisions circumscribed by the jurisdiction are to be included in the population count.
- Article XIX, section 2 (B)(4)(b), which today applies to Cleveland and Cincinnati, specifies that neither city may be split into more than one congressional district.
- Article XIX, section 2 (B)(5) requires 65 counties be wholly contained in a congressional district and permits eighteen counties to be split once (meaning a portion of the county boundary is included in two congressional districts) and five counties may be split twice (meaning a portion of the county boundary is included in three congressional districts).
- Congressional districts shall be contiguous and compactness shall be attempted.
- If a congressional district contains territory within a split county, the territory within that county must be contiguous.
- No two congressional districts can share territory of more than one county, except for counties with population over 400,000. This rule does not apply to the following counties -- Franklin, Cuyahoga, Hamilton, Summit, Montgomery and Lucas.
- The authority drawing congressional districts shall attempt to include at least one whole county in each congressional district, except for congressional districts wholly contained within one county or that cannot be drawn in that manner while complying with federal law.
- If passed with a simple majority vote, the plan shall not unduly favor or disfavor a political party or its incumbents.
- The plan shall not unduly split governmental units, giving preference to counties, and then townships and municipal corporations.

County and Political Subdivision Splits

- Three counties - Franklin, Cuyahoga and Hamilton - all of which have a population greater than one ratio of representation - must be split due to population requirements.
- Sub. Senate Bill 258 includes 76 whole counties and 12 split counties, with two counties split between three congressional districts (Cuyahoga and Hamilton).
- The map approved in 2011 split 23 counties total, with 2 counties split between four congressional districts and 5 counties split between three congressional districts.
- Each congressional district that is not wholly contained in a single county includes at least one whole county within the congressional district boundary.
- Sub. Senate Bill 258 splits less counties than the House Democrat proposal, Senate Democrat proposal and the contest winner map.
- Sub. Senate Bill 258 splits 14 subdivisions – the House Democrat plan split 21 subdivisions.
- Sub. Senate Bill 258 splits the below counties and subdivisions
    - *Clark County: Mad River Township*
    - *Cuyahoga County: Rocky River and Oakwood*
    - *Fairfield County: Columbus (counts as a split because the city boundary within the county is split between two congressional districts)*
    - *Franklin County: Columbus*
    - *Hamilton County: Glendale and Sycamore Township*
    - *Holmes County: Berlin Township*
    - *Lorain County: Columbia Township*
    - *Ross County: Union Township*
    - *Shelby County: Green Township*
    - *Summit County: Cuyahoga Falls*
    - *Washington County: Belpre Township*
    - *Wood County: Perrysburg Township*

Urban Cities

- *Columbus:* Approximately 70 percent of Columbus and the subdivisions circumscribed by Columbus, is within Congressional District 3, with a small portion within Congressional District 15. Columbus is larger than one ratio of representation and must be split into at least two congressional districts.
    - A higher percentage than both democrat proposals.
- *Cleveland:* Wholly contained within Congressional District 11.
- *Cincinnati:* Wholly contained within Congressional District 1.
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Ten-year Election Results, Partisan Leanings and Incumbents

Ten- year Election Results

- The below statistics were developed using statewide federal election data over the last ten years.
    - Presidential races in 2012 (**Obama** vs Romney), 2016 (**Trump** vs Clinton) and 2020 (**Trump** vs Biden)
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District	Population	Deviation	FED Election Data
1	786,630	0	51.5
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13	786,630	0	48.6
14	786,630	0	53.2
15	786,630	0	53.7

Note: Uses Federal election data from Presidential and U.S. Senate races between 2012 and 2020
Note: Prior election results do not guarantee future election outcomes

Partisan Leanings

- Sub. Senate Bill 258 could create six republican leaning congressional districts, seven competitive congressional districts and two democrat leaning congressional districts.
- Congressional districts are considered competitive if the district leans politically toward one party by four percent or less.
- Congressional Districts 2, 4, 5, 7, 8 and 12 could lean republican by 54 percent or more.
- Congressional Districts 1, 6, 9, 10, 13, 14, and 15 could lean +/- four percent.
- Congressional Districts 3 and 11 could lean democrat by 54 percent or more.
- Sub. Senate Bill 258 would create more competitive congressional districts than any proposal introduced in the General Assembly.

Incumbents

- Cincinnati must be whole and two incumbents live within city limits. Each proposed congressional plan introduced pairs those two incumbents.
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For at least the next decade, Ohio will have fifteen Representatives to Congress, down from sixteen over the past decade. Ohio's population is 11,799,448 and when divided by fifteen equals 786,629.8. To achieve the lowest deviation from 786,629.8, the plan consists of thirteen congressional districts with a population of 786,630 and two congressional districts (Congressional District 6 and Congressional District 12) with a population of 786,629.

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Note: Uses Federal election data from Presidential and U.S. Senate races between 2012 and 2020
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- Sub. Senate Bill 258 could create six republican leaning congressional districts, seven competitive congressional districts and two democrat leaning congressional districts.
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- Cincinnati must be whole and two incumbents live within city limits. Each proposed congressional plan introduced pairs those two incumbents.
- Otherwise, Sub. Senate Bill 258 would not pair any republican or democrat incumbent (that is assumed to be running for reelection to Congress) into a single congressional district.

Substitute Senate Bill 258

Highlights and Key Facts

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The Ohio Constitution clarifies subdivision boundaries that perforate multiple counties are considered to be separate subdivisions and are not split. Example: Dublin City exists in three counties – Franklin, Delaware and Union counties. All three pieces of Dublin can be in three different districts and is not considered to be split. The same applies to any noncontiguous portions of a subdivision.

Substitute Senate Bill 258 Complies with all mandatory requirements of Article XIX of the Ohio Constitution. The plan also achieves certain aspirational sections of Article XIX.

Requirements of Article XIX in drawing Congressional Districts

- Article XIX, section 2, (B)(4)(a), specifies a congressional district plan shall attempt to include a "significant" portion of any municipal corporation or township in a single district that qualifies with the criteria in that section, which today only applies to Columbus.
- In determining the population of Columbus, this section specifies that county subdivisions circumscribed by the jurisdiction are to be included in the population count.
- Approximately 70 percent of Columbus is within one congressional district, a percentage cited as significant in public testimony before the Ohio Redistricting Commission.
- Article XIX, section 2 (B)(4)(b), which today applies to Cleveland and Cincinnati, specifies that neither city may be split into more than one congressional district.
- Section 2, (B)(5) of Article XIX requires 65 counties be wholly contained in a congressional district and permits eighteen counties to be split once (meaning a portion of the county boundary is included in two districts) and five counties may be split twice (meaning a portion of the county boundary is included in three districts).
- Districts shall be compact and contiguous.
- If a district contains territory within a split county, any territory within that county must be contiguous.
- No two districts can share territory of more than one county, except for counties with population over 400,000. This rule does not apply to the following counties -- Franklin, Cuyahoga, Hamilton, Summit, Montgomery and Lucas.
- The authority drawing districts shall attempt to include at least one whole county in each congressional district, except for district wholly contained within one county or than cannot be drawn in that manner while complying with federal law.
- If passed with a simple majority vote, the plan shall not unduly favor or disfavor a political party or its incumbents.
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- The map approved in 2011 split 23 counties total, with 2 counties split between four districts and 5 counties split between three districts.
- Each congressional district that is not wholly contained in a single county, includes at least one whole county within the district boundary.
- Sub. Senate Bill 258 splits less counties than the House Democrat proposal, Senate Democrat proposal and the Fair Districts Ohio contest winner map.
- Sub. Senate Bill 258 splits 14 subdivisions – the House Democrat plan split 21 subdivisions.
- Three of Ohio's 100 most populous cities are split (Columbus, Cuyahoga Falls and Rocky River)
- Sub. Senate Bill 258 splits the below counties and subdivisions
    - Clark County: Mad River Township
    - Cuyahoga County: Rocky River and Oakwood
    - Fairfield County: Columbus (counts as a split because the city boundary within the county is split between two districts)
    - Franklin County: Columbus
    - Hamilton County: Glendale and Sycamore Township
    - Holmes County: Berlin Township
    - Lorain County: Columbia Township
    - Ross County: Union Township
    - Shelby County: Green Township
    - Summit County: Cuyahoga Falls
    - Washington County: Belpre Township
    - Wood County: Perrysburg Township

Urban Cities

- A significant portion of Columbus is within Congressional District 3, with a small portion within Congressional District 15. Columbus is larger than one ratio of representation and must be split into at least two districts.
- Cleveland is wholly contained within Congressional District 11.
- Cincinnati is wholly contained within Congressional District 1.
- Akron is wholly contained within Congressional District 13.
- Dayton in wholly contained within Congressional District 10.
- Toledo is wholly contained within Congressional district 9.

10-year Election Results, Partisan Makeup and Incumbents

10 year Election Results

- The below statistics were developed using statewide federal election results and geography over the last ten years.
    - Presidential races in 2012 (**Obama** vs Romney), 2016 (**Trump** vs Clinton) and 2020 (**Trump** vs Biden)
    - US Senate Races in 2012 (**Brown** vs Mandel), 2016 (**Portman** vs Strickland) and 2018 (**Brown** vs Renacci)
- Include districts specific political measurements here?????

Partisan Makeup

- Sub. Senate Bill 258 could create six republican leaning districts, seven competitive districts and two democrat leaning districts.
- Congressional districts are considered competitive if the district could have favored or disfavored one political party by 3.75% or less.
- Congressional Districts 2, 4, 5, 7, 8 and 12 could lean republican by 53.75% or more.
- Congressional Districts 1, 6, 9, 10, 13, 14, and 15 could lean +/- 3.75%.
- Congressional Districts 3 and 11 could lean democrat by 53.75% or more.
- Sub. Senate Bill 258 would create more competitive districts than any proposal introduced in the General Assembly.
    - Eight of fifteen congressional districts in the House Democrat proposed map could favor one political party by over 60 percent.

Incumbents

- Cincinnati must be whole and two incumbents live within city limits. Each proposed congressional plan introduced pairs those two incumbents.
- Otherwise, sub. Senate Bill 258 would not pair any returning democrat or republican incumbent into a single district.

CD #	Population	Deviation	FED 12 to 20
1	786,630	0	51.5
2	786,630	0	65.1
3	786,630	0	30.4
4	786,630	0	66.0
5	786,630	0	58.8
6	786,629	-1	52.9
7	786,630	0	56.7
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9	786,630	0	47.7
10	786,630	0	52.2
11	786,630	0	19.4
12	786,629	-1	61.3
13	786,630	0	48.6
14	786,630	0	53.2
15	786,630	0	53.7

7 Competitive Districts
+/- 4%

Note: Uses Federal election data from Presidential and U.S. Senate races between 2012 and 2020
Note: Prior election results do not guarantee future election outcomes

7 Competitive CDs +/- 3.75% to 3.80%

CD 7 Gibbs	56.7	CD 9 Kaptur	47.7	CD 11 Brown	19.4
CD 5 Latta	58.8	CD 13 Gonz/open	48.6	CD 3 Beatty	30.4
CD 12 Balder	61.3	CD 1 Chabot	51.5		
CD 8 Davids	62.0	CD 10 Turner	52.2		
CD 2 Wenst	65.1	CD 6 Johnson	52.9		
CD 4 Jordan	66.0	CD 14 Joyce	53.2		
		CD 15 Carey	53.8		

			ALL 16 to 20	PRES R/D 20 only	PRES R/D/I 20 only	FED 12 to 20
1	786,630		51.5	48.37	49.1	51.5
2	786,630		66.7	67.26	68.2	65.1
3	786,630		29.7	26.41	26.8	30.4
4	786,630		67.3	65.99	67.0	66.0
5	786,630		60.8	61.85	62.8	58.8
6	786,629	-1	56.3	61.01	61.8	52.9
7	786,630		57.9	58.44	59.3	56.7
8	786,630		62.5	60.67	61.6	62.0
9	786,630		50.3	51.38	52.3	47.7
10	786,630		53.3	50.91	51.8	52.2
11	786,630		19.8	20.30	20.5	19.4
12	786,629	-1	63.1	65.32	66.3	61.3
13	786,630		49.2	49.03	49.6	48.6
14	786,630		54.1	55.01	55.7	53.2
15	786,630		53.9	52.11	52.9	53.8

CERTIFICATE OF SERVICE

I, Freda J. Levenson, hereby certify that on this 13th day of December, 2021, I caused a true and correct copy of the following documents to be served by email upon the counsel listed below:

1. **Supplement to Relators' Merit Brief - Volumes 1 and 2**

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/s/ Freda J. Levenson
Freda J. Levenson (0045916)
Counsel for Relators