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. JOWEI CHEN

I, Jowei Chen, 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 OF FINDINGS

1. Relators' counsel asked me to analyze Ohio's 2021 Congressional Plan (the "Enacted Plan"), as created by the General Assembly's Substitute Senate Bill 258. Specifically, I was asked to analyze:

    a. Does the 2021 Enacted Plan favor either the Democratic or Republican party in a manner that cannot be explained by the redistricting criteria required by the Ohio Constitution?

    b. Can the 2021 Enacted Plan's treatment of Ohio's most populous counties be explained by the redistricting criteria required by the Ohio Constitution?

    c. Is the 2021 Enacted Plan a product of an attempt to draw districts that are compact?

    d. How do the 2021 Enacted Plan's competitive districts affect the partisan characteristics of the map, if at all?

    e. Can the partisan characteristics of the 2021 Enacted Plan be explained by Ohio's political geography?

2. Article XIX, Section (1)(C)(3) of the Ohio Constitution mandates three requirements for a congressional plan passed by a simple majority of each house of the General Assembly. First, the plan may not "unduly favor[] or disfavor[] a political party." Second, the plan

may not unduly split counties, townships, and municipal corporations. Third, the General Assembly "shall attempt to draw districts that are compact."

3. In summary, I found that the Enacted Plan (a) does clearly and decidedly favor the Republican Party; (b) contains certain splits of political subdivisions that are unnecessary to achieve compliance with any districting requirements; and (c) contains districts that are less compact than those in other plans drawn in compliance with the Ohio Constitution. When compared to 1,000 computer-simulated districting plans drawn according to the nonpartisan criteria specified by the Ohio Constitution,[1] the Enacted Plan is an extreme partisan outlier, both at a statewide level and with respect to the partisan characteristics of its individual districts. The Enacted Plan exhibits partisan characteristics that are more favorable to the Republican Party than the partisan characteristics of nearly all of the computer-simulated plans. These partisan characteristics of the Enacted Plan were enabled by the drawing of districts that are far less geographically compact than was reasonably possible across the state, particularly in Hamilton, Franklin, and Cuyahoga Counties. Most notably, the Enacted Plan creates an extreme partisan outcome in its Cincinnati-based district (CD-1) by splitting Hamilton County excessively and sacrificing geographic compactness in this district. Similarly, the Enacted Plan creates an extreme partisan outcome in Cuyahoga County by unnaturally packing Democratic voters, and in Franklin County by sacrificing geographic compactness to create anomalously partisan districts.

II. QUALIFICATIONS

4. I am an Associate Professor in the Department of Political Science at the University of Michigan, Ann Arbor. I am also a Research Associate Professor at the Center for Political Studies of the Institute for Social Research at the University of Michigan. In 2004, I received a B.A. in Ethics, Politics, and Economics from Yale University. In 2007, I received a M.S. in Statistics from Stanford University, and in 2009, I received a Ph.D. in Political Science from Stanford University. A copy of my current C.V. is included in the Appendix.

5. I have published academic papers on legislative districting and political geography in several political science journals, including *The American Journal of Political Science*, *The American Political Science Review*, and *Election Law Journal*. My academic areas of expertise include legislative elections, spatial statistics, geographic information systems (GIS) data, redistricting, racial politics, legislatures, and political geography. I have expertise in the use of computer simulations of legislative districting and in analyzing political geography, elections, and redistricting.

6. I have authored expert reports in the following redistricting court cases: *The League of Women Voters of Florida v. Detzner* (Fla. 2d Judicial Cir. Leon Cnty. 2012); *Romo v. Detzner* (Fla. 2d Judicial Cir. Leon Cnty. 2013); *Missouri National Association for the Advancement of Colored People v. Ferguson-Florissant School District & St. Louis County*

[1] Block assignments files for each of the 1,000 plans have been submitted to the Court under separate cover. *See* Affidavit of Derek S. Clinger (December 10, 2021).

Board of Election Commissioners (E.D. Mo. 2014); *Raleigh Wake Citizens Association v. Wake County Board of Elections* (E.D.N.C. 2015); Brown v. Detzner (N.D. Fla. 2015); *City of Greensboro v. Guilford County Board of Elections* (M.D.N.C. 2015); *Common Cause v. Rucho* (M.D.N.C 2016); *The League of Women Voters of Pennsylvania v. Commonwealth of Pennsylvania* (No. 261 M.D. 2017); *Georgia State Conference of the NAACP v. The State of Georgia* (N.D. Ga. 2017); *The League of Women Voters of Michigan v. Johnson* (E.D. Mich. 2017); *Whitford v. Gill* (W.D. Wis. 2018); *Common Cause v. Lewis* (N.C. Super. 2018); *Harper v. Lewis* (N.C. Super. 2019); *Baroody v. City of Quincy, Florida* (N.D. Fla. 2020); *McConchie v. Illinois State Board of Elections* (N.D. Ill. 2021). I have testified either at deposition or at trial in the following cases: *Romo v. Detzner* (Fla. 2d Judicial Cir. Leon Cnty. 2013*); Missouri National Association for the Advancement of Colored People v. Ferguson-Florissant School District & St. Louis County Board of Election Commissioners* (E.D. Mo. 2014); *Raleigh Wake Citizens Association v. Wake County Board of Elections* (E.D.N.C. 2015); *City of Greensboro v. Guilford County Board of Elections* (M.D.N.C. 2015); *Common Cause v. Rucho* (M.D.N.C. 2016); *The League of Women Voters of Pennsylvania v. Commonwealth of Pennsylvania* (No. 261 M.D. 2017); *Georgia State Conference of the NAACP* v. *The State of Georgia* (N.D. Ga. 2017); *The League of Women Voters of Michigan v. Johnson* (E.D. Mich. 2017); *Whitford v. Gill* (W.D. Wis. 2018); *Common Cause v. Lewis* (N.C. Super. 2018); *Baroody v. City of Quincy, Florida* (N.D. Fla. 2020); *McConchie v. Illinois State Board of Elections* (N.D. Ill. 2021).

7. I have been retained by Relators in the above-captioned matter. I am being compensated $550 per hour for my work in this case.

III. DATA SOURCES

8. I relied upon the following data files. First, I downloaded the 2020 decennial Census PL 94-171 redistricting data files[2] reporting population at the Census block level in Ohio, as released in the Census Bureau's "legacy format data" on August 12, 2021. Second, I downloaded Census Bureau shapefiles[3] depicting the 2020 boundaries of Ohio's Census geographies, including Ohio's Census blocks, cities, villages, townships, and counties. Third, I downloaded shapefiles reporting the precinct-level election results of Ohio's 2016, 2018, and 2020 statewide election contests from Redistricting Data Hub.[4] Finally, Relators' counsel provided me with a block assignment file depicting the geographic boundaries of the 2021 Enacted Plan.

IV. THE USE OF COMPUTER-SIMULATED DISTRICTING PLANS

9. In conducting my academic research on legislative districting, partisan and racial gerrymandering, and electoral bias, I have developed various computer simulation programming techniques that allow me to produce a large number of non-partisan districting plans that adhere to traditional districting criteria using U.S. Census geographies

[2] Available at: https://www2.census.gov/programs-surveys/decennial/2020/data/01-Redistricting_File--PL_94-171/Ohio/

[3] Available at: https://www2.census.gov/geo/tiger/TIGER2020PL/STATE/39_OHIO/39/

[4] Available at: https://redistrictingdatahub.org/state/ohio/

as building blocks. This simulation process ignores all partisan and racial considerations when drawing districts. Instead, the computer simulations are programmed to draw districting plans following various traditional districting goals, such as equalizing population, avoiding county, municipal, and township splits, and attempting to draw geographically compact districts.

10. By randomly generating a large number of districting plans that adhere to these nonpartisan districting criteria, I am able to assess an enacted plan drawn by a state legislature and determine whether the partisan characteristics of the enacted plan are within the normal range of districting plans produced by a districting process following these criteria. If the enacted plan is a statistical outlier compared to the partisan characteristics of the computer-simulated plans, then I can conclude that the enacted plan's partisanship is not the product of following the non-partisan districting criteria. By holding constant the application of the nonpartisan districting criteria through the simulations, I am able to determine whether the enacted plan could have been the product of something other than partisan considerations. With respect to Ohio's 2021 Congressional Enacted Plan, I determined that it could not.

11. I produced a set of 1,000 valid computer-simulated plans for Ohio's congressional districts using a computer algorithm programmed to follow the required districting criteria enumerated in Article XIX of the Ohio Constitution. In following these constitutional criteria, the computer algorithm uses the same general approach that I employed in creating the simulated congressional and legislative districting plans that I analyzed as an expert witness in several prior partisan gerrymandering redistricting cases, including *Common Cause v. Lewis* (2019), *Harper v. Lewis* (2019), *Whitford v. Gill* (2018), *The League of Women Voters of Pennsylvania v. Commonwealth of Pennsylvania* (2017), *The League of Women Voters of Michigan v. Johnson* (2017), *Common Cause v. Rucho* (2016), *City of Greensboro v. Guilford County Board of Elections* (2016), and *Raleigh Wake Citizens Association v. Wake County Board of Elections* (2015).

12. By randomly drawing districting plans with a process designed to strictly follow non-partisan districting criteria, the computer simulation process gives us an indication of the range of districting plans that plausibly and likely emerge when map-drawers are not motivated primarily by partisan goals. By comparing the Enacted Plan against the distribution of simulated plans with respect to partisan measurements, I am also able to determine the extent to which the map-drawer deviated from non-partisan districting criteria, such as geographic compactness, thereby enabling the map-drawer to produce an enacted plan with extreme partisan characteristics.

13. These computer simulation methods are widely used by academic scholars to analyze districting maps. For over two decades, political scientists have used such computer-simulated districting techniques to analyze the racial and partisan intent of legislative map-

drawers.[5] In recent years, several courts have also relied upon computer simulations to assess partisan bias in enacted districting plans.[6]

V. DISTRICTING CRITERIA REQUIRED BY THE OHIO CONSTITUTION

14. I programmed the computer algorithm to create 1,000 independent simulated plans adhering to the following districting criteria, which are required by Article XIX of the Ohio Constitution:

    a) Population Equality: Because Ohio's 2020 Census population was 11,799,448, districts in every 15-member congressional plan have an ideal population of 786,629.9. Accordingly, the computer simulation algorithm populated each districting plan such that precisely two districts have a population of 786,629, while the remaining thirteen districts have a population of 786,630 (Article XIX, Section 2(B)(3)).

    b) Contiguity: The simulation algorithm required districts to be composed of geographically contiguous territory (Article XIX, Section 2(B)(3)).

    c) Minimizing County Splits: The simulation algorithm avoided splitting any of Ohio's 88 counties, except when doing so was necessary to avoid violating one of the aforementioned criteria. When a county is divided into two districts, the county is considered to have one split. A county divided into three districts is considered to have two splits. For the purpose of creating equally populated districts, each newly drawn congressional district requires only one county split. But the fifteenth and final district drawn in Ohio need not create an additional county split, since this final district should simply be the remaining area unassigned to the first fourteen districts. Therefore, an entire plan of 15 congressional districts requires only 14 county splits. Accordingly, the algorithm required that every simulated plan contain only 14 county splits, which is exactly the same number of county splits the 2021 Enacted Plan contains. Article XIX, Section 2(B)(5) of the Ohio Constitution allows a county to be split up to twice, so I allow some of these 14 county splits to occur within the same county. As a result, the total number of counties containing one or more splits may be fewer than 14.

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[5] *See, e.g.*, Carmen Cirincione, Thomas A. Darling, Timothy G. O'Rourke. "Assessing South Carolina's 1990s Congressional Districting," Political Geography 19 (2000) 189–211; Jowei Chen, "The Impact of Political Geography on Wisconsin Redistricting: An Analysis of Wisconsin's Act 43 Assembly Districting Plan." Election Law Journal _____.

[6] *See, e.g.*, *League of Women Voters of Pa. v. Commonwealth*, 178 A. 3d 737, 818-21 (Pa. 2018); *Raleigh Wake Citizens Association v. Wake County Board of Elections*, 827 F.3d 333, 344-45 (4th Cir. 2016); *City of Greensboro v. Guilford County Board of Elections*, No. 1:15-CV-599, 2017 WL 1229736 (M.D.N.C. Apr 3, 2017); *Common Cause v. Rucho*, No. 1:16-CV-1164 (M.D.N.C. Jan 11, 2018*); The League of Women Voters of Michigan v. Johnson* (E.D. Mich. 2017); *Common Cause v. David Lewis* (N.C. Super. 2018).

d) Township and Municipal Corporation Boundaries: The simulation algorithm avoided splitting any of Ohio's townships, cities, and villages, except when doing so was necessary to avoid violating one of the aforementioned criteria. In doing so, the algorithm followed several principles described in the Ohio Constitution. First, Cleveland and Cincinnati are never split into multiple districts (Article XIX, Section 2(B)(4)(b)). Second, a non-contiguous fragment of a township or municipal corporation that is assigned to a different district than the main portion of that township or municipal corporation does not count as a township or municipal split (Article XIX, Section 2(C)(1)). Third, a township or municipal corporation that crosses a county border can be split at that county border without counting as a split township or municipal corporation (Article XIX, Section 2(C)(2)). Finally, following the Census Bureau's depiction of Ohio's township boundaries, any area that has been annexed into a municipal corporation is considered part of that municipal corporation, rather than part of the township.[7]

e) Geographic Compactness: Following the Ohio Constitution's requirements for a congressional map passed by a simple majority of each house of the General Assembly, the simulation algorithm favors geographic compactness in the drawing of districts whenever doing so does not violate any of the aforementioned criteria (Article XIX, Section 1(C)(3)(c)).

f) Prohibiting Double Traversals: At the conclusion of the districting simulation algorithm, the computer is instructed to reject any plan containing a double traversal. In other words, a district containing non-contiguous area within any single county is prohibited, as specified in Article XIX, Section 2(B)(6).

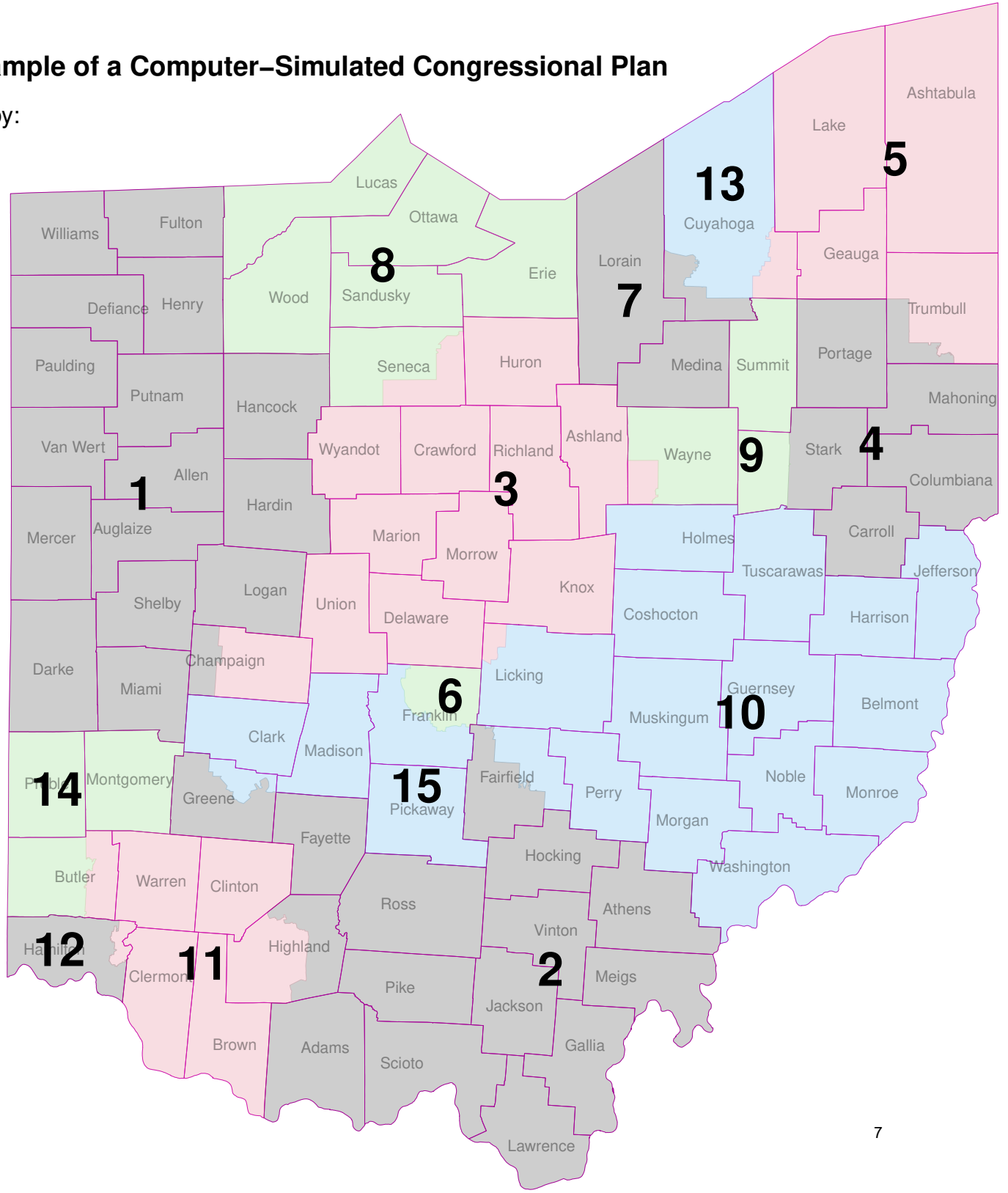
15. On the following page of this report, Figure 1 displays an example of one of the computer-simulated plans produced by the computer algorithm. The left half of this Figure also reports the population of each district, the compactness scores for each district, and the counties split by the plan.

[7] The number of township and municipal corporation splits in the simulated plans range from 13-19, with the vast majority of plans including 14-16 splits. The map-drawers of the Enacted Plan purport that it has 14 such splits. A histogram showing the number of split townships and municipal corporations in the 1,000 computer-simulated plans is included in the Appendix. Also included in the Appendix are figures showing that, even considering only those simulated plans with 13 or 14 township and municipal corporation splits, the Enacted Plan is a partisan outlier.

Figure 1: Example of a Computer−Simulated Congressional Plan

District:	Population:	Reock:	Popper−Polsby:
1	786,630	0.62	0.562
2	786,630	0.37	0.216
3	786,630	0.412	0.377
4	786,630	0.642	0.559
5	786,630	0.558	0.58
6	786,630	0.55	0.527
7	786,629	0.554	0.452
8	786,629	0.435	0.507
9	786,630	0.461	0.409
10	786,630	0.502	0.403
11	786,630	0.513	0.415
12	786,630	0.391	0.348
13	786,630	0.536	0.525
14	786,630	0.459	0.483
15	786,630	0.308	0.307
Average:	786,629.9	0.487	0.445

13 Split Counties:
Butler (Districts 11, 14)
Champaign (Districts 1, 3)
Cuyahoga (Districts 13, 5, 7)
Fairfield (Districts 10, 2)
Franklin (Districts 15, 6)
Greene (Districts 15, 2)
Hamilton (Districts 11, 12)
Highland (Districts 11, 2)
Licking (Districts 10, 3)
Seneca (Districts 3, 8)
Stark (Districts 4, 9)
Trumbull (Districts 4, 5)
Wayne (Districts 3, 9)



VI. DISTRICTING REQUIREMENTS UNDER ARTICLE XIX, SECTION (1)(C)(3)

16. Article XIX, Section (1)(C)(3) of the Ohio Constitution mandates three requirements for a congressional plan passed by a simple majority of each house of the General Assembly. First, the plan may not "unduly favor[] or disfavor[] a political party." Second, the plan may not unduly split counties, townships, and municipal corporations. Third, the General Assembly "shall attempt to draw districts that are compact."

17. Throughout the remainder of this report, I evaluate the General Assembly's compliance with these three mandates by comparing the 2021 Enacted Plan to the 1,000 computer-simulated plans, which were produced by a computer algorithm following the constitutional districting criteria outlined above. By comparing the Enacted Plan to the computer-simulated plans, I am able to assess whether the Enacted Plan's partisan characteristics, governmental division splits, and compactness can be explained by other redistricting criteria. I determined that they cannot.

VII. MEASURING THE PARTISAN CHARACTERISTICS OF OHIO CONGRESSIONAL DISTRICTS

18. I use actual election results from recent, statewide election races in Ohio to assess the partisan performance of the Enacted Plan and the computer-simulated plans analyzed in this report. Overlaying these past election results onto a districting plan enables me to calculate the Republican (or Democratic) share of the votes cast from within each district in the Enacted Plan and in each simulated plan. I am also able to count the total number of Republican and Democratic-favoring districts within each simulated plan and within the Enacted Plan. All of these calculations thus allow me to directly compare the partisanship of the Enacted Plan and the simulated plans. These partisan comparisons allow me to determine whether or not the partisanship of individual districts and the partisan distribution of seats in the Enacted Plan could reasonably have arisen from a districting process adhering to the Ohio Constitution and its explicit prohibition on unduly favoring either political party. Voting history in federal and statewide elections is a strong predictor of future voting patterns. Mapmakers thus can and do use past voting history to identify the class of voters, at a precinct-by-precinct level, who are likely to vote for Republican or Democratic congressional candidates.

19. In general, a reliable method of comparing the partisanship of different congressional districts within a state is to calculate the percentage of votes from these districts favoring Republican (or Democratic) candidates in recent, competitive *statewide* elections, such as the Presidential, Gubernatorial, Attorney General, and U.S. Senate elections. Recent statewide elections provide reliable bases for comparisons of different precincts' partisan tendencies because in any statewide election, the anomalous candidate-specific effects that shape the election outcome are equally present in all precincts across the state. Statewide elections are thus a better basis for comparison than the results of congressional (or "endogenous") elections because the particular outcome of any congressional election may deviate from the long-term partisan voting trends of that district, due to factors idiosyncratic to the district as currently constructed. Such factors can include the presence or absence of a quality challenger, anomalous difference between the candidates in

campaign efforts or campaign finances, incumbency advantage, candidate scandals, and coattail effects.[8] Because these idiosyncratic factors would change if the district were drawn differently, it is particularly unsuitable to use election results from an existing district when comparing the partisanship of districts in a newly-enacted plan or a computer-simulated plan that would have different boundaries than those used in past congressional elections.

20. Moreover, statewide elections are also a more reliable indicator of a district's partisanship than partisan voter registration counts. Voter registration by party is a uniquely unreliable method of comparing districts' partisan tendencies because many voters who consistently support candidates from one party nevertheless do not officially register with either major party, while others vote for candidates of one party while registering with a different party.[9] As a result, based on my expertise and my experience studying redistricting practices across many states, legislative map-drawers generally do not rely heavily on voter registration data in assessing the partisan performance of districts.

21. ***The 2016-2020 Statewide Election Composite:*** To measure the partisanship of all districts in the computer-simulated plans and the 2021 Enacted Plan, I used the results of all statewide election contests held in Ohio for political (non-judicial) offices during 2016-2020. There were nine such elections: The 2016 U.S. President, 2016 U.S. Senator, 2018 Attorney General, 2018 Auditor, 2018 Governor, 2018 Secretary of State, 2018 Treasurer, 2018 U.S. Senator, and 2020 U.S. President elections.

22. I obtained precinct-level results for these nine elections, and I disaggregated these election results down to the Census block level. I then aggregated these block-level election results to the district level within each computer-simulated plan and the Enacted Plan, and I calculated the number of districts within each plan that cast more votes for Republican than Democratic candidates. I use these calculations to measure the partisan performance of each simulated plan analyzed in this report and of the Enacted Plan. In other words, I look at the Census blocks that would comprise a particular district in a given simulation and, using the actual election results from those Census blocks, I calculate whether voters in that simulated district collectively cast more votes for Republican or Democratic candidates in the 2016-2020 statewide election contests. I performed such calculations for each district under each simulated plan to measure the number of districts Democrats or Republicans would win under that particular simulated districting map.

23. I refer to the aggregated election results from these nine statewide elections as the "2016-2020 Statewide Election Composite." For the Enacted Plan districts and for all districts in each of the 1,000 computer-simulated plans, I calculate the percentage of total two-party votes across these nine elections that were cast in favor of Republican candidates in order to measure the average Republican vote share of the district. In the following section, I present district-level comparisons of the Enacted Plan and simulated plan districts in order

[8] *E.g.*, Alan Abramowitz, Brad Alexander, and Matthew Gunning. "Incumbency, Redistricting, and the Decline of Competition in U.S. House Elections." *The Journal of Politics.* Vol. 68, No. 1 (February 2006): 75-88.
[9] Kenneth J. Meier, "Party Identification and Vote Choice: The Causal Relationship" Vol. 28, No. 3 (Sep., 1975):496-505.

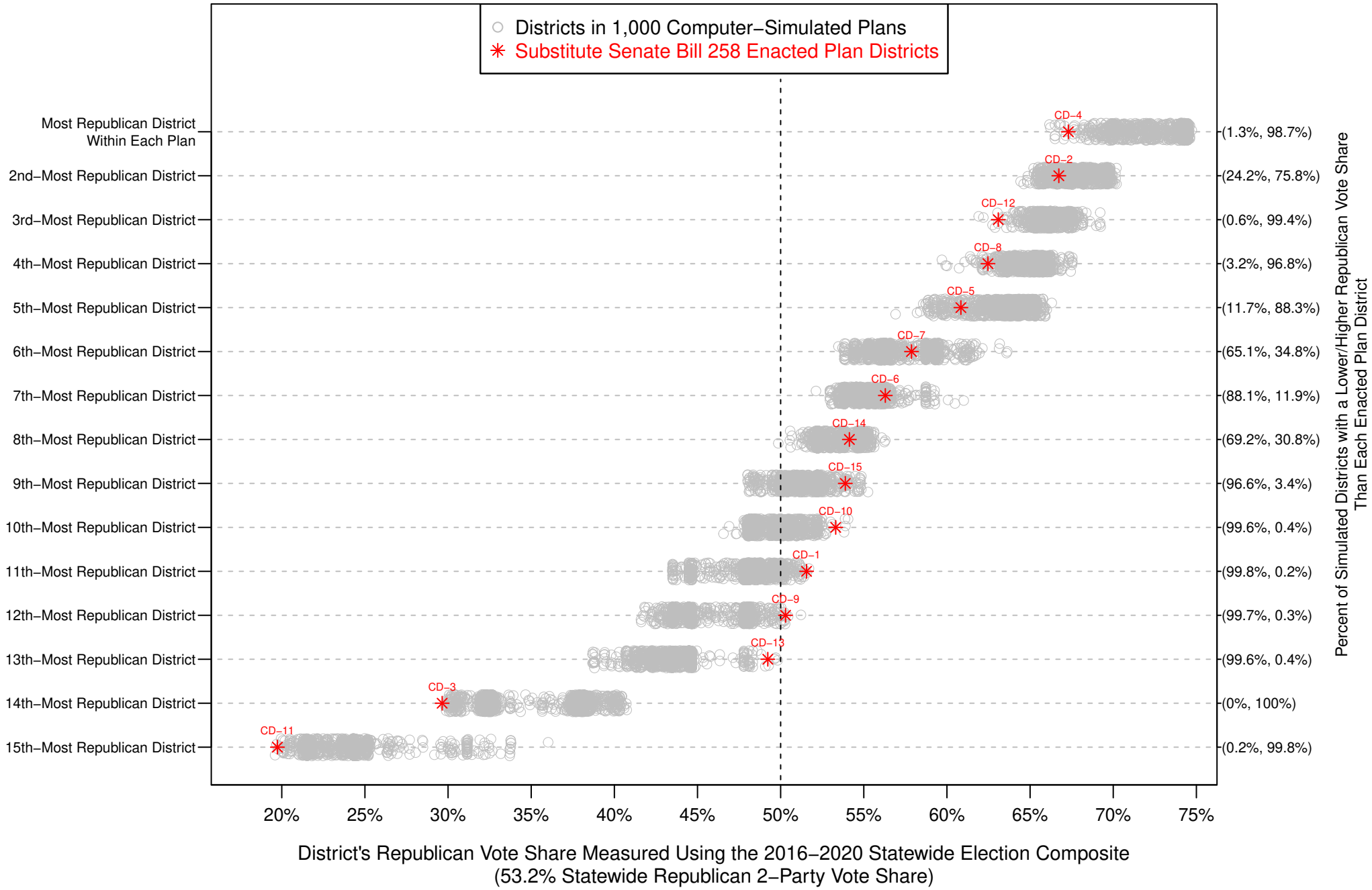
to identify whether any individual districts in the Enacted Plan are partisan outliers. I also present plan-wide comparisons of the Enacted Plan and the simulated plans in order to identify the extent to which the Enacted Plan is a statistical outlier in terms of common measures of districting plan partisanship.

VIII. PARTISAN CHARACTERISTICS OF THE ENACTED PLAN

24. In this section, I present partisan comparisons of the Enacted Plan to the computer-simulated plans at both a district-by-district level as well as a plan-wide level using several common measures of districting plan partisanship. First, I compare the district-level Republican vote share of the Enacted Plan's districts and the districts in the computer-simulated plans. Next, I compare the number of Republican-favoring districts (that is, the number of districts with a two-party Republican vote share of greater than 50%) in the Enacted Plan and in the computer-simulated plans. Finally, I use several common measures of partisan bias to compare the Enacted Plan to the computer-simulated plans. Overall, I find that several individual districts in the Enacted Plan are statistical outliers, exhibiting extreme partisan characteristics that are rarely or never observed in the computer-simulated plan districts drawn according to the Ohio Constitution's districting requirements. The partisan characteristics of the Enacted Plan are consistent with an effort to favor the Republican party by packing Democratic voters into a small number of districts that very heavily favor the Democratic party. Moreover, I find that at the plan-wide level, the Enacted Plan creates a degree of partisan bias favoring Republicans that is more extreme than the vast majority of the computer-simulated plans. I describe these findings in detail below:

25. ***Partisan Outlier Districts in the Enacted Plan***: In Figure 2, I directly compare the partisan distribution of districts in the Enacted Plan to the partisan distribution of districts in the 1,000 computer-simulated plans. I first order the Enacted Plan's districts from the most- to the least-Republican district, as measured by Republican vote share using the 2016-2020 Statewide Election Composite. The most-Republican district appears on the top row, and the least-Republican district appears on the bottom row of Figure 2. Next, I analyze each of the 1,000 computer-simulated plans and similarly order each simulated plan's districts from the most- to the least-Republican district. I then directly compare the most-Republican Enacted Plan district (CD-4) to the most-Republican simulated district from each of the 1,000 computer-simulated plans. In other words, I compare one district from the Enacted Plan to 1,000 computer-simulated districts, and I compare these districts based on their Republican vote share. I then directly compare the second-most-Republican district in the Enacted Plan to the second-most-Republican district from each of the 1,000 simulated plans. I conduct the same comparison for each district in the Enacted Plan, comparing the Enacted Plan district to its computer-simulated counterparts from each of the 1,000 simulated plans.

Figure 2: Comparisons of Enacted Plan Districts to 1,000 Computer–Simulated Plans' Districts



26. Thus, the top row of Figure 2 directly compares the partisanship of the most-Republican Enacted Plan district (CD-4) to the partisanship of the most-Republican district from each of the 1,000 simulated plans. The two percentages (in parentheses) in the right margin of this Figure report the percentage of these 1,000 simulated districts that are less Republican than, and more Republican than, the Enacted Plan district. Similarly, the second row of this Figure compares the second-most-Republican district from each plan, the third row compares the third-most-Republican district from each plan, and so on. In each row of this Figure, the Enacted Plan's district is depicted with a red star and labeled in red with its district number; meanwhile, the 1,000 computer-simulated districts are depicted with 1,000 gray circles on each row.

27. In the Enacted Plan as well as in most computer-simulated plans, the most Democratic district in Ohio is the district containing Cleveland and surrounding areas. As the bottom row of Figure 2 illustrates, the most-Democratic district in the Enacted Plan (CD-11) is *more* heavily Democratic than 100% of the most-Democratic districts in each of the 1,000 computer-simulated plans. This calculation is numerically reported in the right margin of the Figure. Every single one of the computer-simulated counterpart districts would have been more politically moderate than CD-11 in terms of partisanship: CD-11 exhibits a Republican vote share of 19.7%, while all 1,000 of the most Democratic districts in the computer-simulated plans would have exhibited a higher Republican vote share. In other words, CD-11 packs together Democratic voters in the Cleveland area to a more extreme extent than the most-Democratic district in 100% of the computer-simulated plans. I therefore identify CD-11 as an extreme partisan outlier when compared to its 1,000 computer-simulated counterparts, using a standard threshold test of 95% for statistical significance.

28. The next-to-bottom row of Figure 2 reveals a similar finding regarding the Enacted Plan's CD-3, which is located in and around Columbus. This row illustrates that the second-most Democratic district in the Enacted Plan (CD-3) is *more* heavily Democratic than 100% of the second-most Democratic districts in each of the 1,000 computer-simulated plans. Every single one of its computer-simulated counterpart districts would have been more politically moderate than CD-3 in terms of partisanship: CD-3 exhibits a Republican vote share of 29.6%, while 100% of the second-most-Democratic districts in the computer-simulated plans would have exhibited a higher Republican vote share. In other words, CD-3 packs together Democratic voters to a more extreme extent than the second-most-Democratic district in 100% of the computer-simulated plans. I therefore identify CD-3 as an extreme partisan outlier when compared to its 1,000 computer-simulated counterparts, using a standard threshold test of 95% for statistical significance.

29. Meanwhile, the top row of Figure 2 reveals a similar finding: As the top row illustrates, the most Republican district in the Enacted Plan (CD-4) is *less* heavily Republican than 98.7% of the most Republican districts in each of the 1,000 computer-simulated plans. It is thus clear that CD-4 "cracks" Democratic voters who would otherwise reside in surrounding districts by placing them into CD-4.

30. It is especially notable that these three aforementioned Enacted Plan districts – the most-Republican district (CD-4) and the two most-Democratic districts (CD-3 and CD-11) in the

Enacted Plan – were drawn to include more Democratic voters than virtually all of their counterpart districts in the 1,000 computer-simulated plans. These "extra" Democratic voters in the three most partisan-extreme districts in the Enacted Plan had to come from the remaining twelve more moderate districts in the Enacted Plan. Having fewer Democratic voters in these more moderate districts enhances Republican candidate performance in these districts.

31. Indeed, the ninth through thirteenth rows in Figure 2 confirm this precise effect. These five rows in Figure 2 compare the partisanship of districts in the ninth, tenth, eleventh, twelfth, and thirteenth-most Republican districts within the Enacted Plan and the 1,000 computer-simulated plans. In all five of these rows, the Enacted Plan district is a partisan outlier. In each of these five rows, the Enacted Plan's district is more heavily Republican than over 95% of its counterpart districts in the 1,000 computer-simulated plans. The five Enacted Plan districts in these five rows (CD-1, 9, 10, 13, and 15) are more heavily Republican than nearly all of their counterpart computer-simulated plan districts because the three most partisan-extreme districts in the Enacted Plan (CD-3, 4, and 11) are more heavily Democratic than nearly all of their counterpart districts in the computer-simulated plans.

32. I therefore identify the five Enacted Plan districts in the ninth through thirteenth rows (CD-1, 9, 10, 13, and 15) of Figure 2 as partisan statistical outliers. Each of these five districts has a Republican vote share that is higher than over 95% of the computer-simulated districts in its respective row in Figure 2. I also identify the three Enacted Plan districts in the top row and in the bottom two rows (CD-3, 4, and 11) of Figure 2 as partisan statistical outliers. Each of these three districts has a Republican vote share that is lower than over 95% of the computer-simulated districts in its respective row in Figure 2.

33. In summary, Figure 2 illustrates that eight of the 15 districts in the Enacted Plan are partisan outliers: Five districts (CD-1, 9, 10, 13, and 15) in the Enacted Plan are more heavily Republican than over 95% of their counterpart computer-simulated plan districts, while three districts (CD-3, 4, and 11) are more heavily Democratic than over 98% of their counterpart districts in the computer-simulated plans.

34. The Appendix of this report contains nine additional Figures (Figures A1 through A9) that each contain a similar analysis of the Enacted Plan districts and the computer-simulated plan districts. Each of these nine Figures in the Appendix measures the partisanship of districts using one of the individual nine elections included in the 2016-2020 Statewide Election Composite. These nine Figures generally demonstrate that the same extreme partisan outlier patterns observed in Figure 2 are also present when district partisanship is measured using any one of the nine statewide elections held in Ohio during 2016-2020.

35. ***Number of Democratic and Republican Districts:*** I compared the partisan breakdown of the computer-simulated plans to the partisanship of the Enacted Plan, using the 2016-2020 Statewide Election Composite to measure the number of Republican-favoring districts created in each of the 1,000 simulated plans. Across the entire state, Republican candidates collectively won a 53.2% share of the votes in the nine elections in the 2016-2020 Statewide Election Composite. But among the 15 districts in the Enacted Plan, Republicans have over a 50% vote share in 12 out of 15 districts. In other words, the Enacted Plan

created 12 Republican-favoring districts, as measured using the 2016-2020 Statewide Election Composite. By contrast, only 1.3% of the computer-simulated plans create 12 Republican-favoring districts, and no computer-simulated plan ever creates more than 12 Republican districts.

36. Hence, in terms of the total number of Republican-favoring districts created by the plan, the 2021 Enacted Plan is a statistical outlier when compared to the 1,000 computer-simulated plans. The Enacted Plan creates the maximum number of Republican districts that ever occurs in any computer-simulated plan, and the Enacted Plan creates more Republican districts than 98.7% of the computer-simulated plans, which were drawn using a nonpartisan process adhering to the districting requirements in the Ohio Constitution. I characterize the Enacted Plan's creation of 12 Republican districts as a statistical outlier among the computer-simulated plans because the Enacted Plan exhibits an outcome that is more favorable to Republicans than over 98.7% of the simulated plans.

37. ***The Efficiency Gap:*** Another commonly used measure of a districting plan's partisan bias is the efficiency gap.[10] To calculate the efficiency gap of the Enacted Plan and every computer-simulated plan, I first measure the number of Republican and Democratic votes within each Enacted Plan district and each computer-simulated district, as measured using the 2016-2020 Statewide Election Composite. Using this measure of district-level partisanship, I then calculate each districting plan's efficiency gap using the method outlined in *Partisan Gerrymandering and the Efficiency Gap.*[11] Districts are classified as Democratic victories if, using the 2016-2020 Statewide Election Composite, the sum total of Democratic votes in the district during these elections exceeds the sum total of Republican votes; otherwise, the district is classified as Republican. For each party, I then calculate the total sum of surplus votes in districts the party won and lost votes in districts where the party lost. Specifically, in a district lost by a given party, all of the party's votes are considered lost votes; in a district won by a party, only the party's votes exceeding the 50% threshold necessary for victory are considered surplus votes. A party's total wasted votes for an entire districting plan is the sum of its surplus votes in districts won by the party and its lost votes in districts lost by the party. The efficiency gap is then calculated as total wasted Democratic votes minus total wasted Republican votes, divided by the total number of two-party votes cast statewide across all nine elections.

38. Thus, the importance of the efficiency gap is that it tells us the degree to which more Democratic or Republican votes are wasted across an entire districting plan. A significantly positive efficiency gap indicates far more Democratic wasted votes, while a significantly negative efficiency gap indicates far more Republican wasted votes.

39. I analyze whether the Enacted Plan's efficiency gap arises naturally from a map-drawing process adhering to the required districting criteria in the Ohio Constitution, or rather,

[10] Eric McGhee, "Measuring Partisan Bias in Single-Member District Electoral Systems." Legislative Studies Quarterly Vol. 39, No. 1: 55–85 (2014).

[11] Nicholas O. Stephanopoulos & Eric M. McGhee, *Partisan Gerrymandering and the Efficiency Gap,* 82 University of Chicago Law Review 831 (2015).

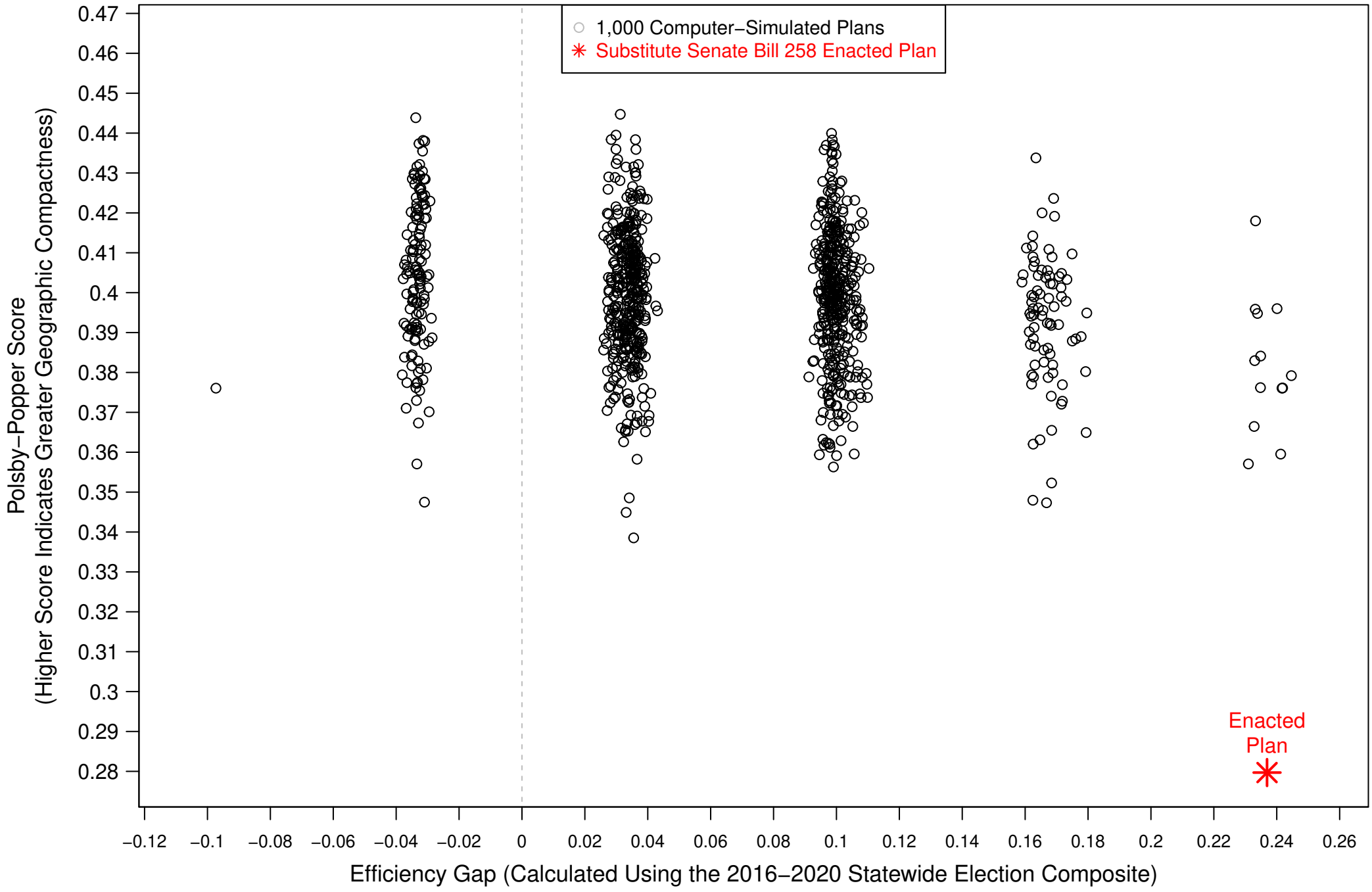
whether the skew in the Enacted Plan's efficiency gap is explainable only as the product of a map-drawing process that intentionally favored one party over the other. By comparing the efficiency gap of the Enacted Plan to that of the computer-simulated plans, I am able to evaluate whether or not such the Enacted Plan's efficiency gap could have realistically resulted from adherence to the Ohio Constitution.

40. Figure 3 compares the efficiency gaps of the Enacted Plan and of the 1,000 computer-simulated plans. As before, the 1,000 circles in this Figure represent the 1,000 computer-simulated plans, while the red star in the lower right corner represents the Enacted Plan. Each plan is plotted along the horizontal axis according to its efficiency gap, while each plan is plotted along the vertical axis according to its Polsby-Popper score.[12]

41. The results in Figure 3 illustrate that the Enacted Plan exhibits an efficiency gap of +23.7%, indicating that the plan results in far more wasted Democratic votes than wasted Republican votes. Specifically, the difference between the total number of wasted Democratic votes and wasted Republican votes amounts to 23.7% of the total number of votes statewide. The Enacted Plan's efficiency gap is larger than the efficiency gaps exhibited by 99.5% of the computer-simulated plans. This comparison reveals that the significant level of Republican bias exhibited by the Enacted Plan cannot be explained alone by Ohio's political geography or the redistricting criteria in the Ohio Constitution.

[12] See paragraph 57, *infra*, for a definition of the Polsby-Popper score.

Figure 3:
Comparisons of Substitute Senate Bill 258 Enacted Plan to 1,000 Computer–Simulated Plans on Efficiency Gap and Compactness



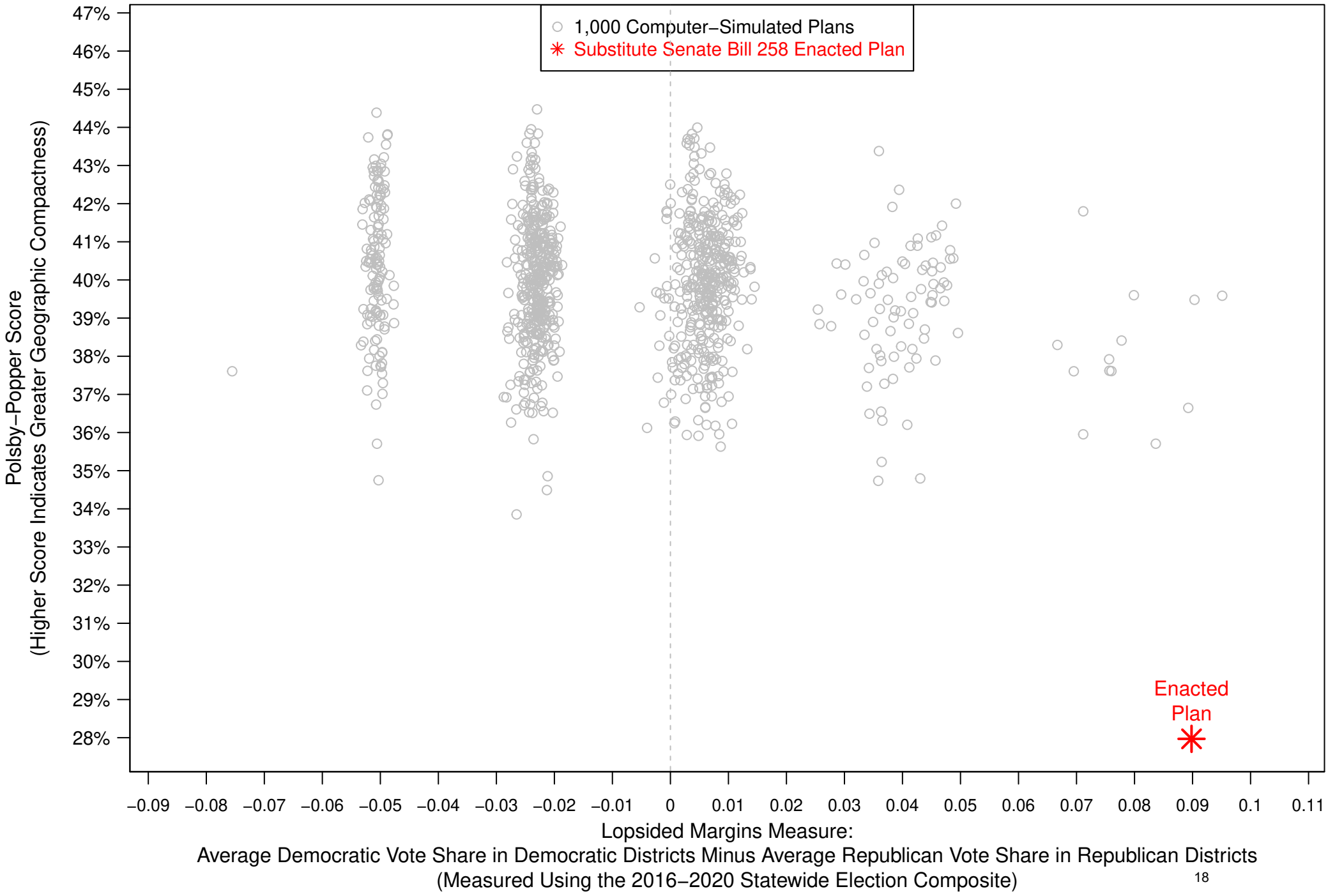
42. ***The Lopsided Margins Measure:*** Another measure of partisan bias in districting plans is the "lopsided margins" test. The basic premise captured by this measure is that a partisan-motivated map-drawer may attempt to pack the opposing party's voters into a small number of extreme districts that are won by a lopsided margin. Thus, for example, a map-drawer attempting to favor Party A may pack Party B's voters into a small number of districts that very heavily favor Party B. This packing would then allow Party A to win all the remaining districts with relatively smaller margins. This sort of partisan manipulation in districting would result in Party B winning its districts by extremely large margins, while Party A would win its districts by relatively small margins. In other words, by packing most of Party B's voters into a handful of districts, and drawing remaining districts as nominally "competitive" but favoring Party A, Party A can maximize its expected performance in an election.

43. Hence, the lopsided margins test is performed by calculating the difference between the average margin of victory in Republican-favoring districts and the average margin of victory in Democratic-favoring districts. The 2021 Enacted Plan contains three Democratic-favoring districts (CD-3, 11, and 13), and these three districts have an average Democratic vote share of 67.1%, as measured using the 2016-2020 Statewide Election Composite. By contrast, the Enacted Plan contains twelve Republican-favoring districts (CD-1, 2, 4, 5, 6, 7, 8, 9, 10, 12, 14, and 15), and these twelve districts have an average Republican vote share of 58.1%. Hence, the difference between the average Democratic margin of victory in Democratic-favoring districts and the average Republican margin of victory in Republican-favoring districts is +9.0%, which is calculated as 67.1% - 58.1%. I refer to this calculation of +9.0% as the Enacted Plan's lopsided margins measure.

44. How does this +9.0% lopsided margins measure of the Enacted Plan compare to the same calculation for the 1,000 computer-simulated plans? Figure 4 reports the lopsided margins calculations for the Enacted Plan and for the simulated plans. In Figure 4, each plan is plotted along the horizontal axis according to its lopsided margins measure and along the vertical axis according to its Polsby-Popper score.[13]

[13] *Id.*

Figure 4:
Comparisons of Substitute Senate Bill 258 Enacted Plan to 1,000 Computer–Simulated Plans on Lopsided Margins Measure and Compactness



45. Figure 4 reveals that the Enacted Plan's +9.0% lopsided margins measure is an extreme outlier compared to the lopsided margins measures of the 1,000 computer-simulated plans. Over 99.8% of the simulated plans have a smaller lopsided margins measure than the Enacted Plan. In fact, a significant minority (40.6%) of the 1,000 simulated plans have a lopsided margins measure of between -2% to +2%, indicating a plan in which Democrats and Republicans win their respective districts by similar average margins.

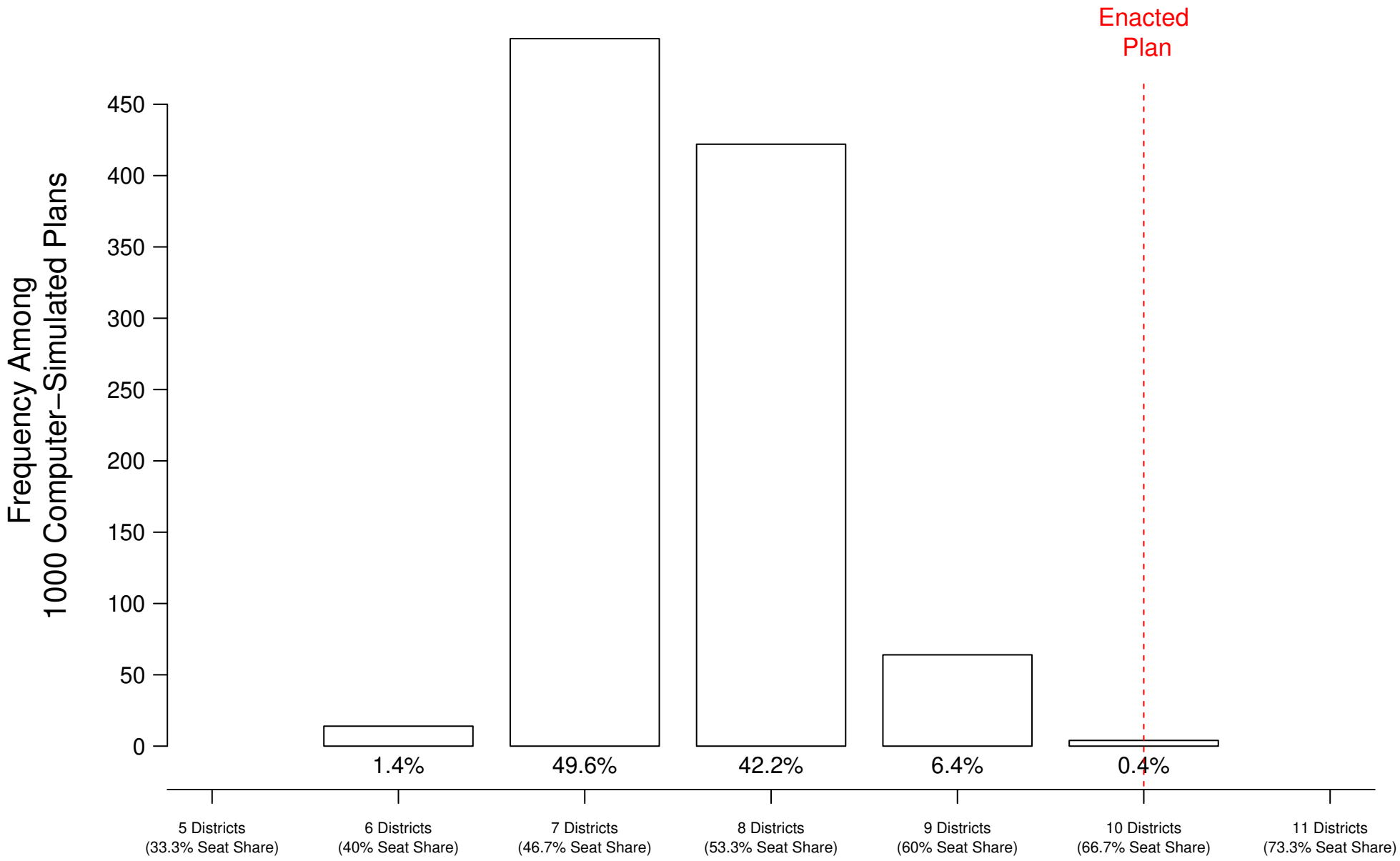
46. By contrast, the Enacted Plan's lopsided margins measure of +9.0% indicates that the Enacted Plan creates districts in which Democrats are extremely packed into their districts, while the margin of victory in Republican districts is significantly smaller. The "lopsidedness" of the two parties' average margin of victory is extreme when compared to the computer-simulated plans. The finding that all 1,000 simulated plans have a smaller lopsided margins measure indicates that the Enacted Plan's extreme packing of Democrats into Democratic-favoring districts was not simply the result of Ohio's political geography, combined with adherence to the districting criteria in the Ohio Constitution.

47. ***Partisan Symmetry Based on Uniform Swing:*** Another common measure of partisan bias is based on the concept of partisan symmetry and asks the following question: Under a given districting plan and given a particular election-based measure of district partisanship, what share of seats would each party win in a hypothetical tied election (i.e., 50% vote share for each of two parties). To approximate the district-level outcomes in a hypothetical tied election, one normally uses a uniform swing in order to simulate a tied statewide election. We then calculate whether each party would receive more than or less than 50% of the seats under this hypothetical tied election in a given districting plan. This particular measure is often referred to in the academic literature as "partisan bias." In order to avoid confusion with other measures of partisan bias described in this report, I will refer to this measure as "Partisan Symmetry Based on Uniform Swing."

48. Specifically, I use the 2016-2020 Statewide Election Composite to calculate the Partisan Symmetry measure for both the Enacted Plan and for the computer-simulated plans. The 2016-2020 Statewide Election Composite produces a statewide Republican vote share of 53.2%. Therefore, I use a uniform swing of -3.2% in order to estimate the partisanship of districts under a hypothetical tied election in which each party wins exactly 50% of the statewide vote. In other words, this uniform swing subtracts 3.2% from the Republican vote share in every district, both in the Enacted Plan and in all simulated plans.

49. After applying this -3.2% uniform swing, I compare the number of Republican-favoring districts in the Enacted Plan and the simulated plans. In the Enacted Plan, 67.7% of the districts (10 out of 15) are Republican-favoring after applying the uniform swing. I then report the Republicans' seat share (67.7%) under this hypothetical tied election in Figure 5 as the "Partisan Symmetry Based on Uniform Swing" measure for the Enacted Plan. Figure 5 also reports the calculations for all 1,000 simulated plans using this identical method.

Figure 5:
Comparisons of Substitute Senate Bill 258 Enacted Plan to 1,000 Computer–Simulated Plans
On Partisan Symmetry Based on Uniform Swing



50. Figure 5 reveals that in over 90% of the 1,000 simulated plans, the "Partisan Symmetry Based on Uniform Swing" measure would be quite close to 50%, either at 46.7% or 53.3%. This measure is close to 50% in over 90% of the simulated plans because the Republicans would win either 7 or 8 districts in a hypothetical tied election, and the Democrats would win the remaining 7 or 8 districts. In other words, each party would win approximately 50% of the districts in a hypothetical election in which each party's statewide vote share is exactly 50%.

51. By contrast, the Enacted Plan's measure of 66.7% in Figure 5 would be a statistical outlier and is more favorable to Republicans than in over 99% of the simulated plans. Substantively, this 66.7% measure reflects the Enacted Plan's creation of a durable Republican majority for Ohio's congressional delegation, such that even when Democrats win 50% of the statewide vote, Republicans will still be favored in two-thirds (10 out of 15) of the congressional districts, while Democrats will only be favored in one-third (5 out of 15) of the districts.

IX. PARTISAN OUTLIER DISTRICTS IN FRANKLIN, CUYAHOGA, AND HAMILTON COUNTIES

52. I have thus far compared the Enacted Plan to the simulated plans at a statewide level using several common measures of partisan bias and by identifying individual districts that are partisan outliers. However, I also analyzed the extent to which partisan favoritism affected the map-drawing process within Ohio's three largest counties: Franklin, Cuyahoga, and Hamilton Counties. I analyzed the extent to which individual districts in these counties favor a certain political party, split political subdivisions, or lack compactness. I found that the Enacted Plan districts in these three counties are outliers on each of these three metrics, in ways that systematically favor the Republican Party.

53. Specifically, I found that the Enacted Plan's districts in each of Franklin, Cuyahoga, and Hamilton Counties exhibit more favorable partisan characteristics for the Republican Party than the vast majority of districts covering the same local areas in the 1,000 computer-simulated plans.

54. In particular, the Enacted Plan splits Hamilton County excessively, thereby placing Cincinnati into a district that is more Republican than in virtually all of the 1,000 computer-simulated districts containing Cincinnati. The Enacted Plan's splitting of Hamilton County into three districts is an outcome that occurs in under 2% of the computer-simulated plans. Over 98% of the simulated plans split Hamilton County into just two districts. By excessively splitting up voters in Hamilton County, the Enacted Plan managed to combine Cincinnati with more Republican voters in Warren County, thereby splitting Hamilton County into three Republican-favoring districts.

55. Moreover, by comparing the compactness of these computer-simulated districts within these three counties to the Enacted Plan's districts, I found that the Enacted Plan achieved extreme partisan characteristics in these three counties by sacrificing geographic compactness. The compactness scores of the Enacted Plan's districts in these three counties are significantly lower than the compactness scores of virtually all the simulated districts

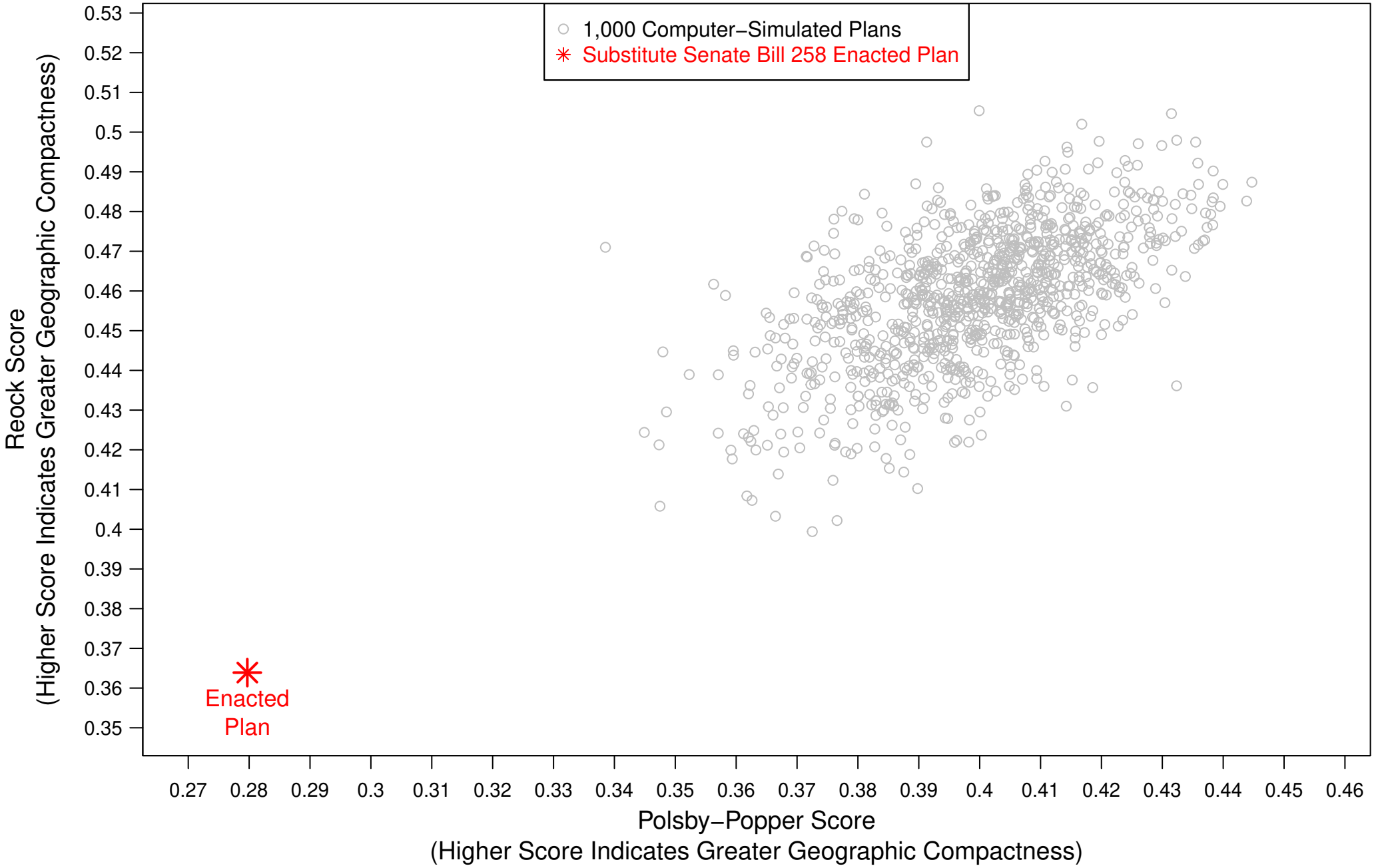
within these same three counties. Thus, it is clear the Enacted Plan's districts in these counties were not drawn in an attempt to favor compactness. Instead, the districts in these counties were clearly drawn to create the most favorable outcome possible for the Republican Party.

56. Article XIX, Section (1)(C)(3) of the Ohio Constitution requires that the General Assembly "shall attempt to draw districts that are compact." In evaluating whether the Enacted Plan follows the compactness requirement of Section (1)(C)(3), it is useful to compare the compactness of the Enacted Plan and the 1,000 computer-simulated plans, both at a plan-wide level and for individual districts in particular counties. The computer-simulated plans were produced by a computer algorithm adhering to the Ohio Constitution's required districting criteria in Article XIX, including ignoring partisan considerations. Thus, the compactness scores of these computer-simulated plans illustrate the statistical range of compactness scores that could be reasonably expected to emerge from a districting process that solely seeks to follow the required constitutional criteria while ignoring partisan considerations.

57. First, I calculate the average Polsby-Popper score of each plan's districts. The Polsby-Popper score for each individual district is calculated as the ratio of the district's area to the area of a hypothetical circle whose circumference is identical to the length of the district's perimeter; thus, higher Polsby-Popper scores indicate greater district compactness. The 2021 Enacted Plan has an average Polsby-Popper score of 0.28 across its 15 congressional districts. As illustrated in Figure 6, every single one of the 1,000 computer-simulated plans in this report exhibits a higher Polsby-Popper score than the Enacted Plan. In fact, the middle 50% of these 1,000 computer-simulated plans have an average Polsby-Popper score ranging from 0.39 to 0.41, and the most compact computer-simulated plan has a Polsby-Popper score of 0.44. Hence, it is clear that the Enacted Plan is significantly less compact, as measured by its Polsby-Popper score, than what could reasonably have been expected from a districting process adhering to the Ohio Constitution's requirements.

58. Second, I calculate the average Reock score of the districts within each plan. The Reock score for each individual district is calculated as the ratio of the district's area to the area of the smallest bounding circle that can be drawn to completely contain the district; thus, higher Reock score indicate more geographically compact districts. The 2021 Enacted Plan has an average Reock score of 0.36 across its 14 congressional districts. As illustrated in Figure 6, every single one of the 1,000 computer-simulated House plans in this report exhibits a higher Reock score than the Enacted Plan. In fact, the middle 50% of these 1,000 computer-simulated plans have an average Reock score ranging from 0.46 to 0.47, and the most compact computer-simulated plan has an average Reock score of 0.50. Hence, it is clear that the Enacted Plan is significantly less compact, as measured by its Reock score, than what could reasonably have been expected from a districting process adhering to the Ohio Constitution's requirements.

Figure 6:
Comparisons of Substitute Senate Bill 258 Enacted Plan to 1,000 Computer–Simulated Plans on Polsby–Popper and Reock Compactness Scores



59. Beyond these statewide comparisons, it is also clear that in Franklin, Hamilton, and Cuyahoga Counties, the Enacted Plan contains individual districts that are significantly less compact than the simulated plans' districts in these same counties. Furthermore, I found that the lower compactness of these individual districts enabled the General Assembly to draw these districts with extreme partisan characteristics. Below, I describe and illustrate my findings for these three counties in detail:

X. THE ENACTED PLAN'S DISTRICTS IN FRANKLIN COUNTY

60. Franklin County's population exceeds the required population for a single congressional district. A congressional plan must contain one district that lies fully within Franklin County, and one district must contain a significant portion of Columbus. For the Enacted Plan and each of the 1,000 computer-simulated plans, I analyze two relevant districts:

    a. The district that contains the largest amount of Columbus' population, which is generally also the required district lying fully within Franklin County; and

    b. The district that contains the second-most amount of Columbus' population.

61. Figure 7a and Figure 7b contain two maps. The map in Figure 7a depicts the boundaries of the Enacted Plan's two Columbus-area districts. The map in Figure 7b depicts the boundaries of the Columbus-area districts that had the highest average Polsby-Popper compactness scores among all 1,000 computer-simulated plans. Figures 7a and 7b also report the Polsby-Popper scores and Republican vote shares of these two districts in the Enacted Plan and in the computer-simulated plan.

Figure 7a: Franklin County Districts (CD–3 and CD–15) in the 2021 Enacted Plan:

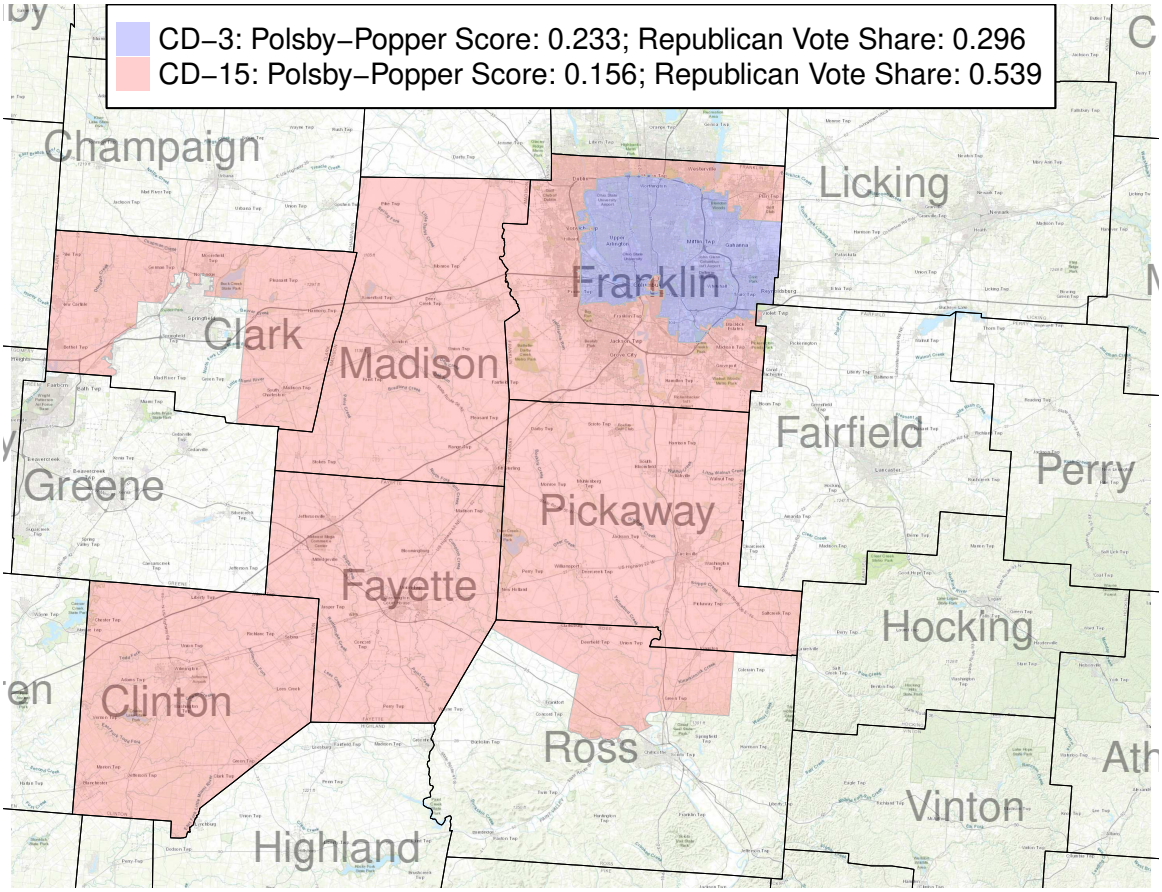
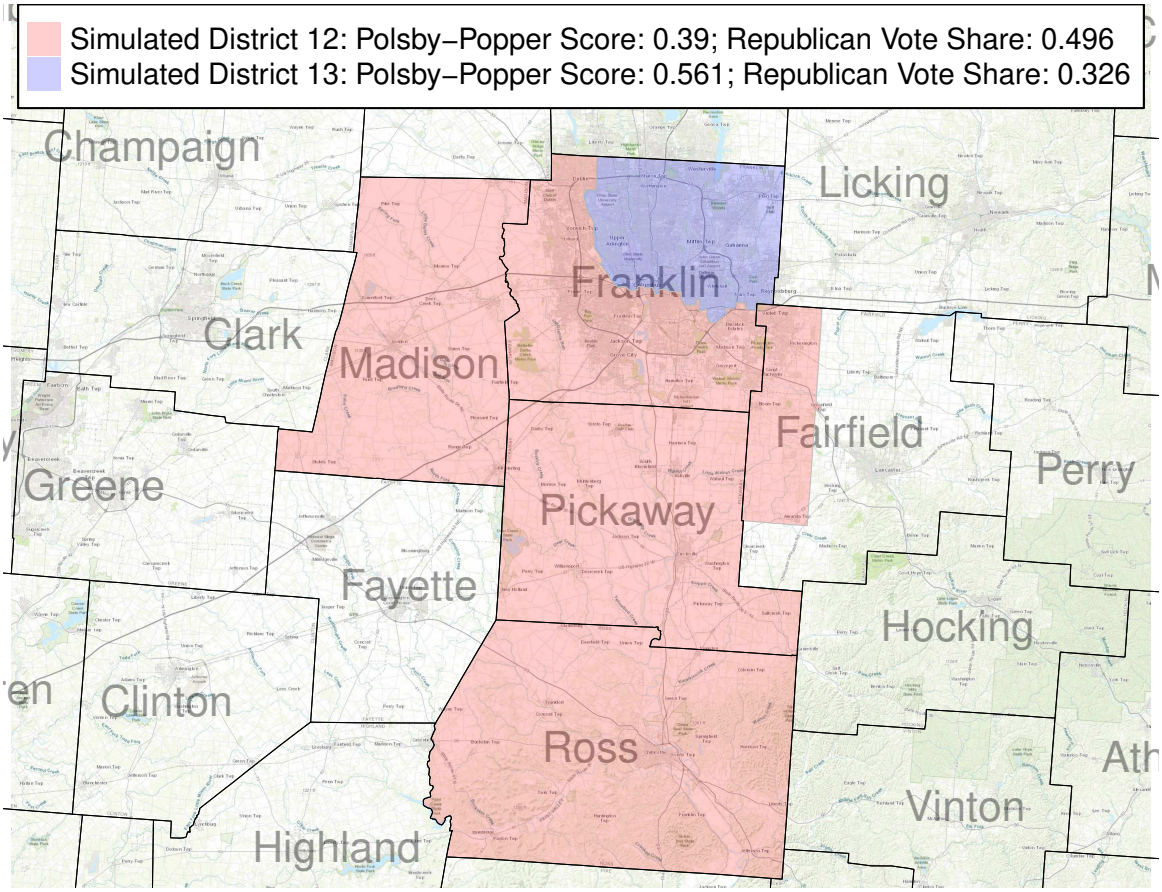


Figure 7b: Computer–Simulated Plan with the Most Compact Franklin County Districts (Computer–Simulated Plan #138 of 1000)

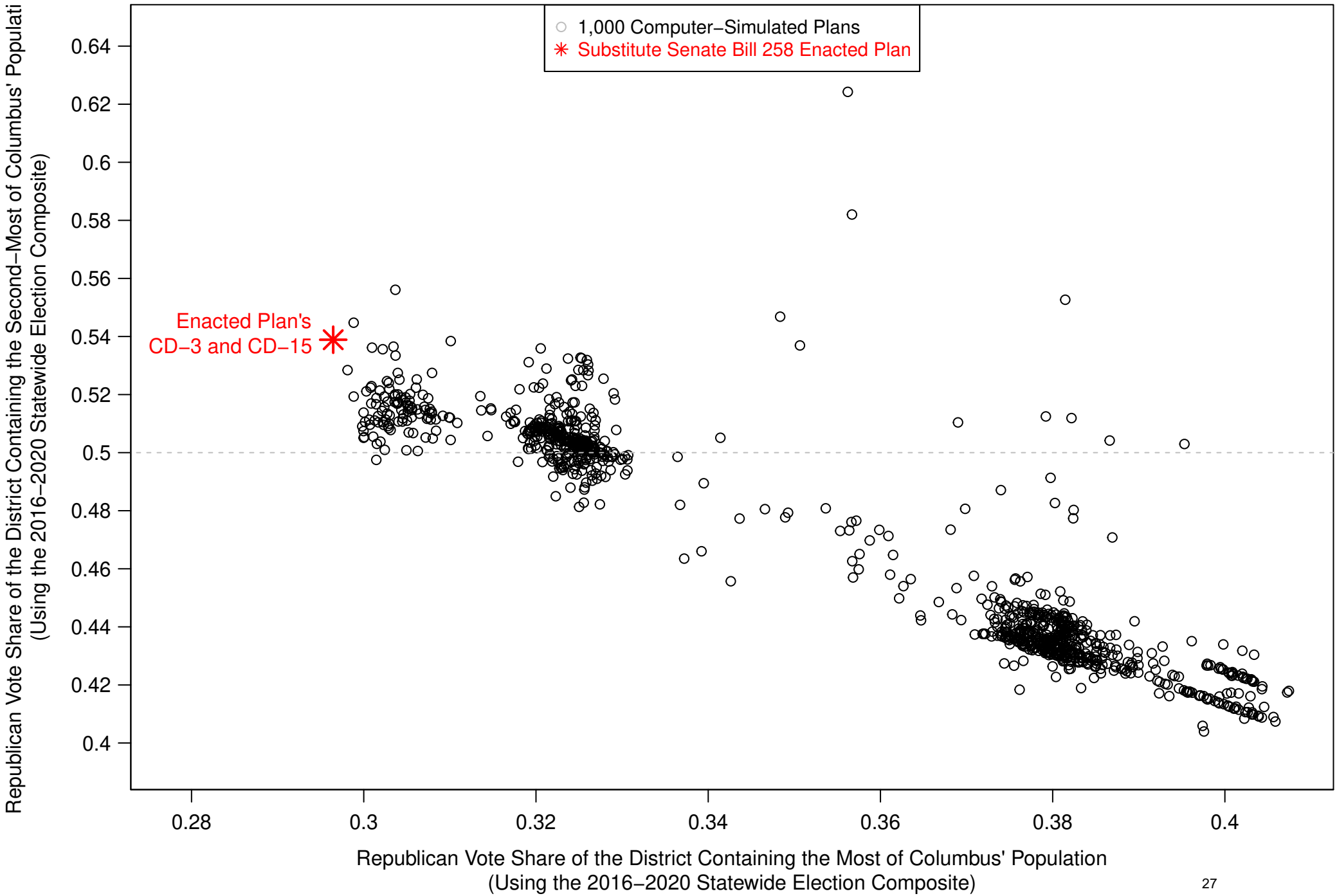


62. For the Enacted Plan and the 1,000 simulated plans, Figure 8 compares the Republican vote share, as measured using the 2016-2020 Statewide Election Composite, of the two districts containing the most and second-most amount of Columbus' population. Figure 8 contains 1,000 black circles, indicating the 1,000 simulated plans, and a red star representing the Enacted Plan. Each plan is plotted in this Figure along the horizontal axis according to the Republican vote share of the plan's district containing the most amount of Columbus' population. The vertical axis then reports the Republican vote share of the plan's district containing the second-most amount of Columbus' population.

63. Columbus' voters are heavily Democratic, while the surrounding suburbs in Franklin County are more Republican. As Figure 8 makes clear, there is a direct tradeoff between the Republican vote shares of the two Columbus districts in any congressional plan. Increasing the number of Republican voters in one Columbus district necessarily means decreasing Republican voters in the other Columbus district. Figure 8 also illustrates that among the 1,000 simulated plans, the district containing the most sizeable portion of Columbus' population is more heavily Democratic, with around a 30-40% Republican vote share, while the district containing the second-most sizeable portion of Columbus' population contains a Republican vote share of generally between 41-51%.

64. Figure 8 reveals that the Enacted Plan's two Columbus-area districts are clear partisan outliers: CD-3, which contains most of Columbus' population, is more heavily Democratic than all 1,000 of the simulated plans' districts with the most Columbus population. Consequently, the Enacted Plan's CD-15, which contains the second-most of Columbus' population, is more heavily Republican than 98% of the simulated plans' districts with the second-most Columbus population. Specifically, CD-15 has a 53.9% Republican vote share, while by contrast, the vast majority of the simulated districts with the second-most Columbus population are either Democratic-favoring districts or have Republican vote shares very close to 50%.

Figure 8:
Comparisons of Columbus−Area Districts in the Enacted Plan and 1,000 Computer−Simulated Plans



65. Figures 9 and 10 illustrate in detail how statistically extreme the partisanship of the Enacted Plan's two Columbus-area districts are: Figure 9 shows that the Enacted Plan's CD-3 packs together Democratic voters to a more extreme extent than every simulated plan's district containing the most Columbus population. In most simulated plans, this district would generally range from 32% to 40% Republican vote share. The Enacted Plan's CD-3 has a Republican vote share of 29.7%, which is lower than in all 1,000 of the simulated plans.

66. Figure 10 similarly illustrates how statistically extreme the partisanship of the Enacted Plan's CD-15 is. CD-15 contains a Republican vote share of 53.9%, while the most common outcome in the simulated plans' districts containing the second-most of Columbus' population is 43%-44%. Over 98% of these simulated districts are less Republican-favorable than the Enacted Plan's CD-15. It is therefore clear that CD-15 and CD-3 were drawn in order to create a more Republican-favorable outcome than would normally emerge from a districting process following the Ohio Constitution's Article XIX requirements.

Figure 9: District Containing the Most of Columbus' Population in the Enacted Plan and 1,000 Computer–Simulated Plans

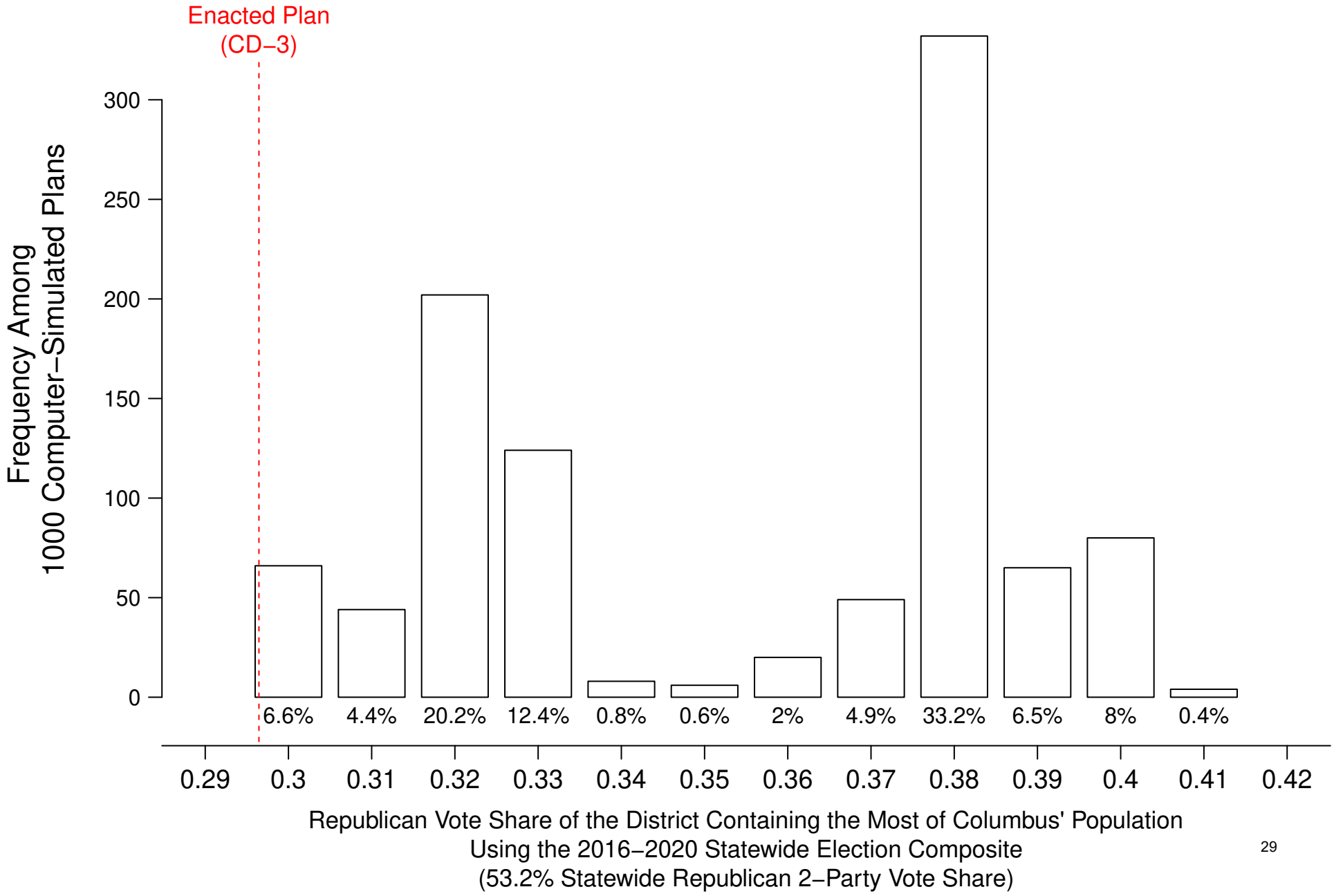
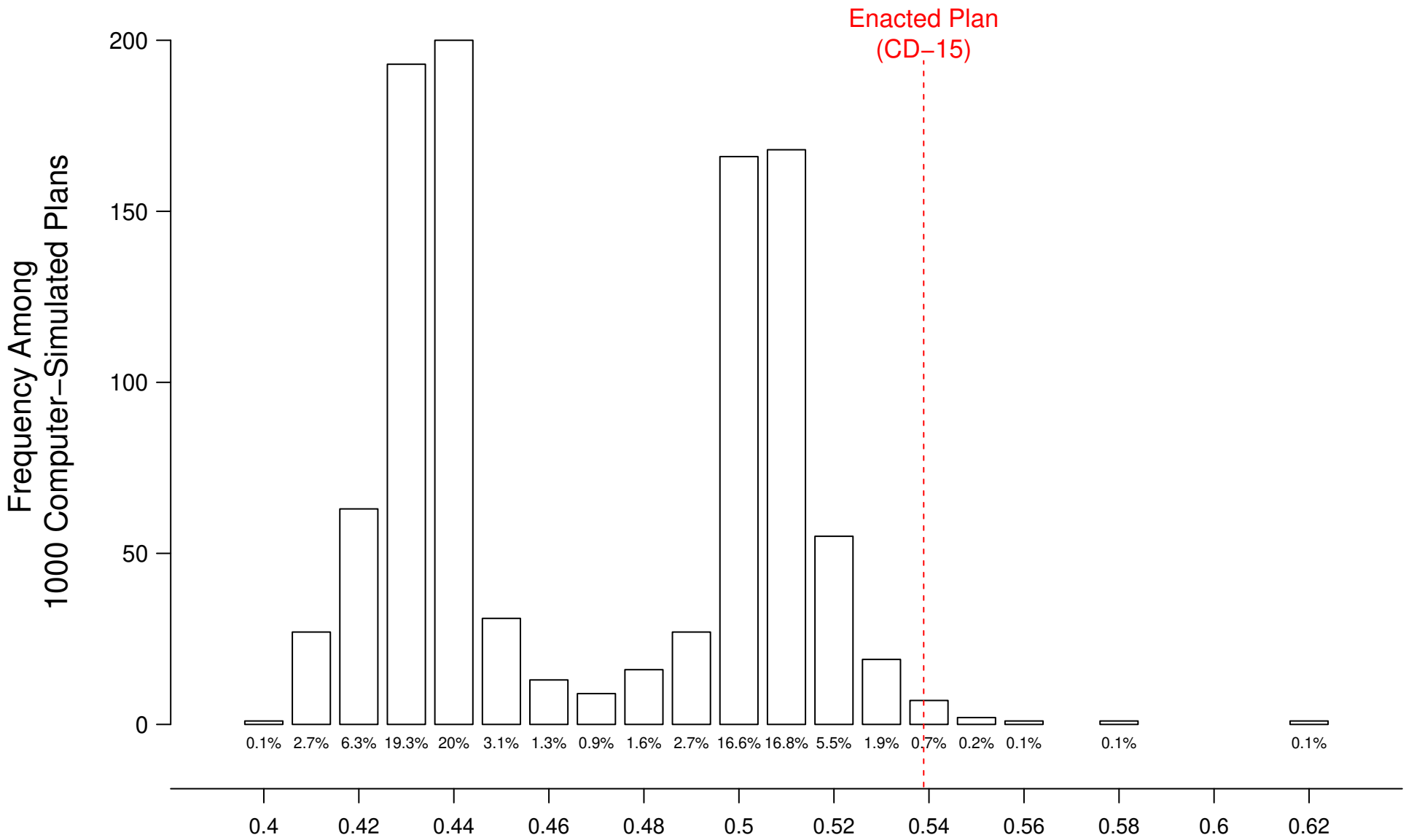


Figure 10: District Containing the Second−Most of Columbus' Population in the Enacted Plan and 1,000 Computer−Simulated Plans



67. Finally, Figures 11 and 12 illustrate *how* the General Assembly was able to create such statistically anomalous outcomes with respect to the partisan characteristics of CD-3 and CD-15. In Figure 11, the vertical axis compares the Polsby-Popper compactness scores of the district containing the most of Columbus' population in the Enacted Plan and in the computer-simulated plans. As explained earlier, higher Polsby-Popper scores indicate greater district compactness. The horizontal axis reports the Republican vote shares of these Columbus districts. Figure 11 reveals that CD-3 is less geographically compact than nearly every computer-simulated district containing the most of Columbus' population. Hence, it is clear that the Enacted Plan was able to create an anomalously extreme Democratic district in CD-3 by sacrificing the geographic compactness of the district. It is also clear that CD-3 is much less compact than Columbus-area districts that would reasonably emerge from a map-drawing process following the Ohio Constitution's Article XIX requirements.

68. Figure 12 illustrates a similar comparison of the compactness scores of the district containing the second-most of Columbus' population in the Enacted Plan and in the simulated plans. Once again, the horizontal axis reports the Republican vote shares of these districts. Figure 12 reveals that CD-15 is less geographically compact than nearly every computer-simulated district containing the most of Columbus' population. Hence, it is clear that the Enacted Plan was able to create an anomalous 53.9% Republican district in CD-15 by sacrificing the geographic compactness of the district. It is also clear that CD-15 is much less compact than Columbus-area districts that would reasonably emerge from a map-drawing process following the Ohio Constitution's Article XIX requirements.

69. I therefore conclude that the Enacted Plan's Columbus-area districts, CD-3 and CD-15, were collectively drawn in a manner that clearly favors the Republican Party, and these two districts are clearly much less geographically compact than one could reasonably expect from a districting process that follows the districting requirements of the Ohio Constitution.

Figure 11: Comparisons of the District Containing the Most of Columbus' Population in the Enacted Plan and 1,000 Computer–Simulated Plans

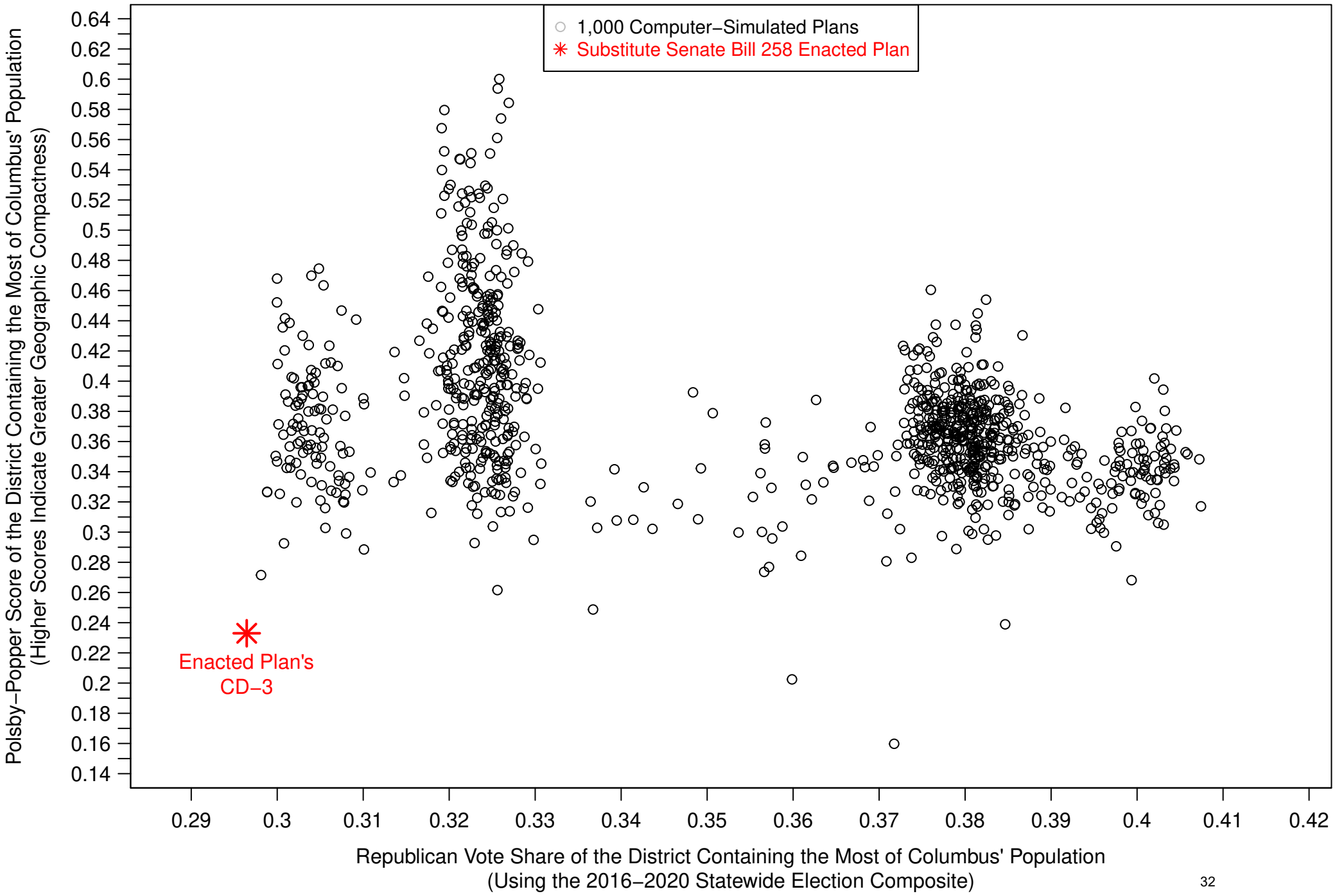
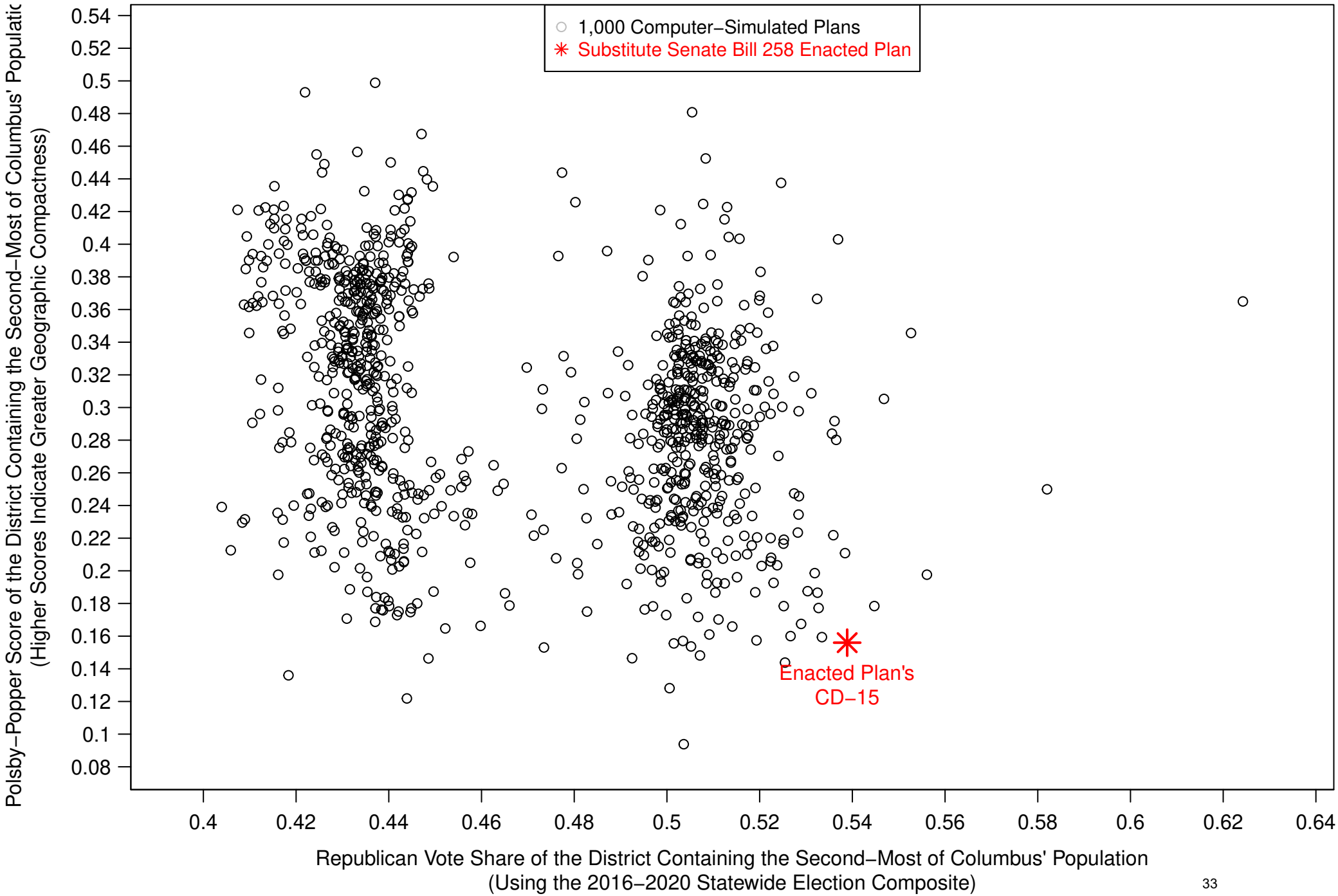


Figure 12:
Comparisons of the District Containing the Second−Most of Columbus' Population
in the Enacted Plan and 1,000 Computer−Simulated Plans



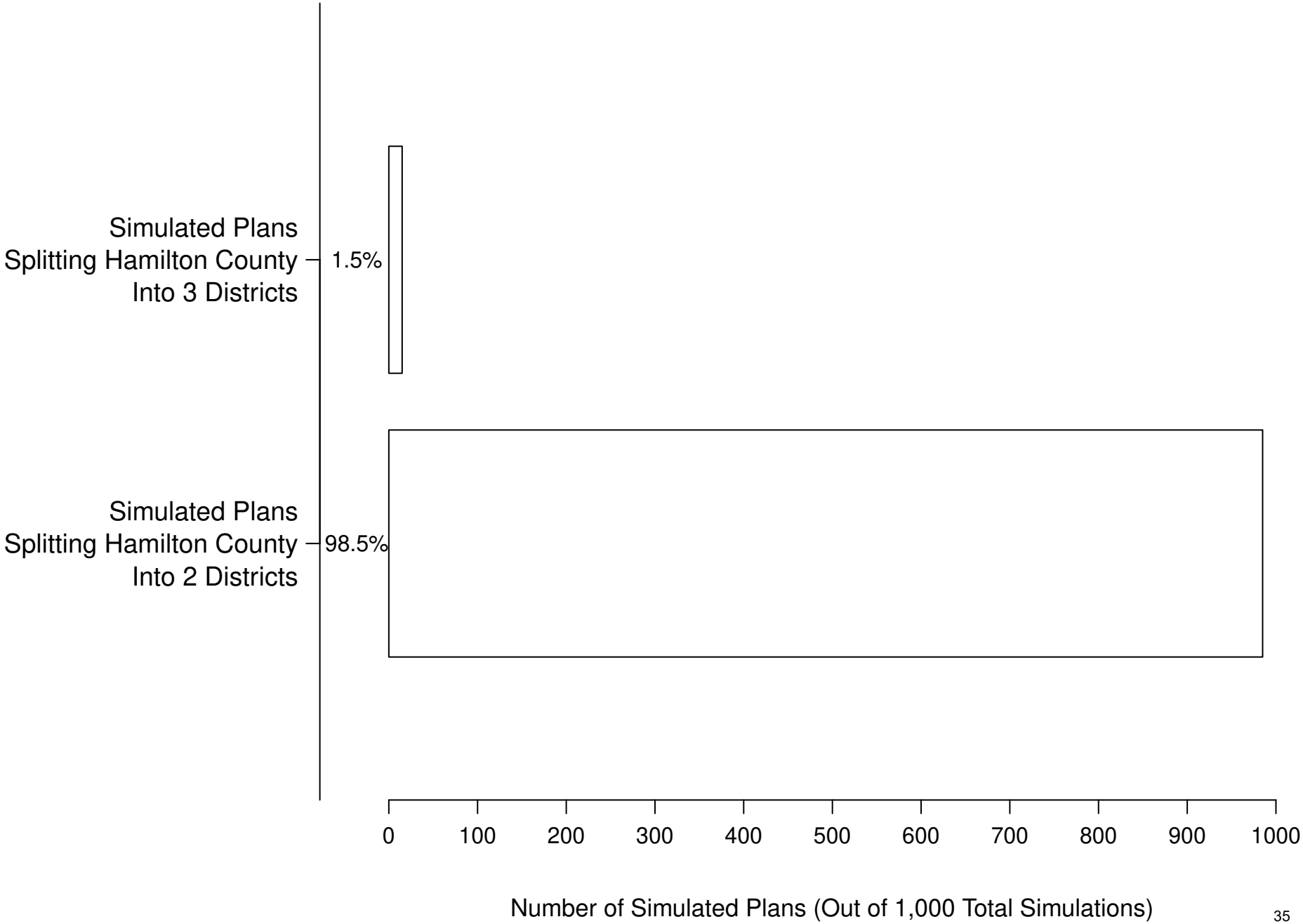
XI. THE ENACTED PLAN'S DISTRICTS IN HAMILTON COUNTY

70. Hamilton County's population exceeds the required population for a single congressional district, so splitting Hamilton County is clearly permissible under the Ohio Constitution. However, Section (1)(C)(3) requires that the congressional plan not "unduly split counties."

71. To follow this constitutional requirement, my computer simulation algorithm split counties only for the purpose of equalizing district populations. As explained earlier in this report, the computer-simulated plans, as well as the Enacted Plan, always contain exactly 14 total county splits, with any county divided into three districts being counted as two total county splits. Hence, the Enacted Plan certainly does not create an excessively large number of total county splits *statewide*.

72. However, the Enacted Plan's splitting of Hamilton County into three districts is statistically anomalous when compared to the 1,000 simulated plans' districts in Hamilton County. As Figure 13 illustrates, only 1.3% of the simulated plans similarly split Hamilton County into three districts. The remaining 98.7% of the simulated plans only split Hamilton County into two districts. This finding, when combined with my findings below regarding the extreme partisanship and the low compactness score of the Enacted Plan's Cincinnati-based district, collectively indicate a districting process in the Hamilton County area that was inconsistent with the Article XIX, Section (1)(C)(3) requirements. Below, I detail my findings regarding the extreme partisanship and the low compactness score of the Enacted Plan's Cincinnati-based district.

Figure 13: Splits of Hamilton County in Computer–Simulated Plans



73. In the Enacted Plan, as in all 1,000 computer-simulated plans, Cincinnati is always kept together in a single district, following Article XIX, Section 2(B)(4)(b) of the Ohio Constitution. I analyzed and compared these Cincinnati-based districts in the simulated plans and in the Enacted Plan with respect to their partisan characteristics and their compactness scores.

74. Figure 14a and Figure 14b contain two maps. The map in Figure 14a depicts the boundaries of the Enacted Plan's CD-1. The map in Figure 14b depicts the boundaries of the Cincinnati-based district that had the highest average Polsby-Popper compactness scores among all 1,000 computer-simulated plans. Figures 14a and 14b also report the Polsby-Popper scores and Republican vote shares of these two districts in the Enacted Plan and in the computer-simulated plan.

Figure 14a:
CD–1 of the 2021 Enacted Plan:

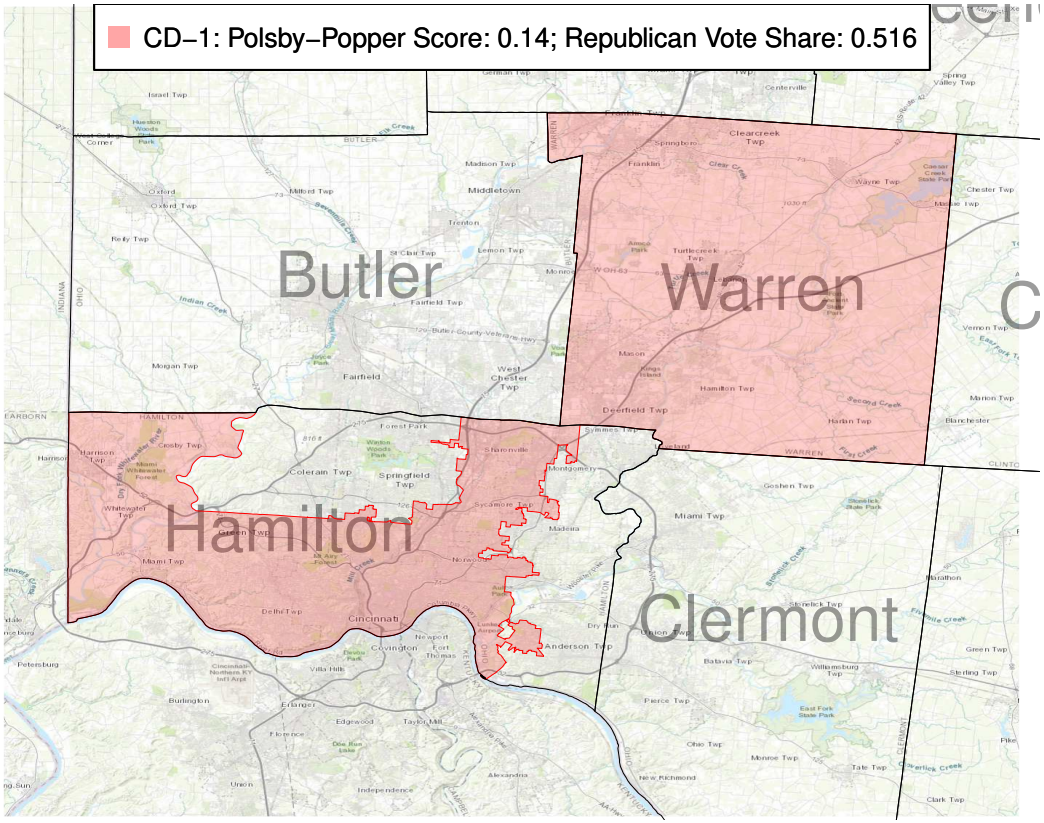
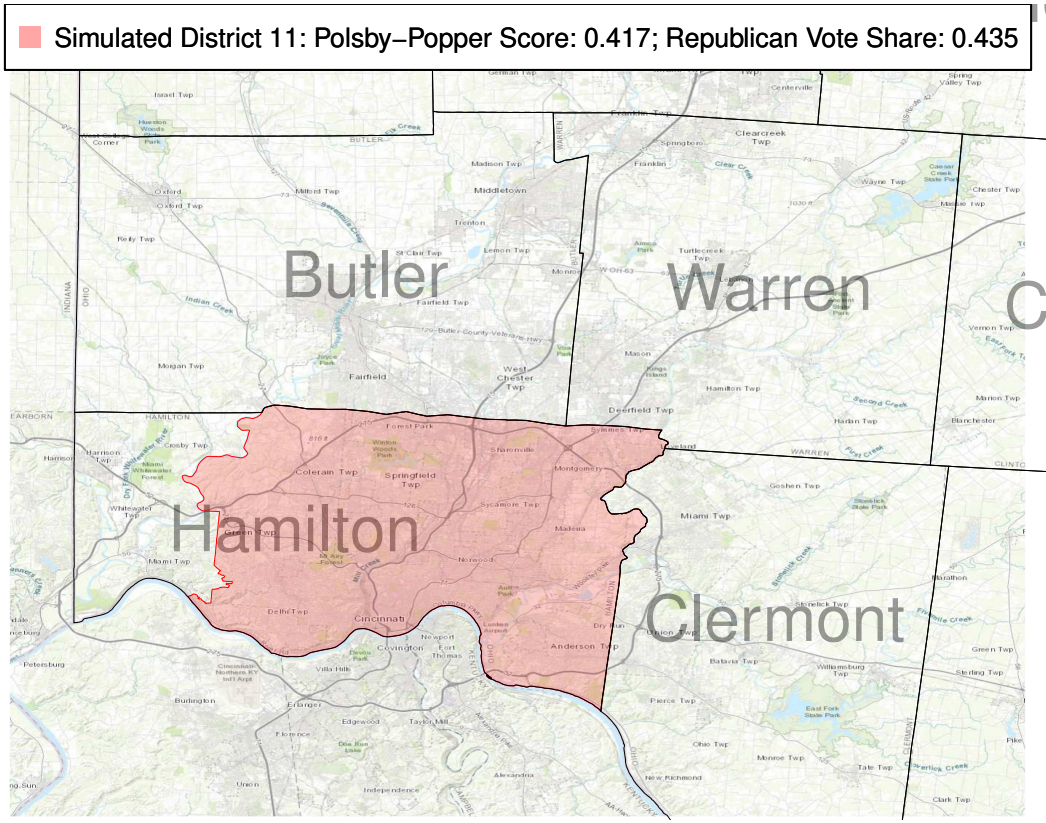


Figure 14b: Computer–Simulated Plan with the Most Compact Cincinnati District (Simulated Plan #639 of 1000):



75. Figure 15 reports the Republican vote share of every computer-simulated district containing Cincinnati, as well as the Enacted Plan's Cincinnati-based district (CD-1). Cincinnati is a heavily Democratic city surrounded by Republican suburbs in Hamilton County. Thus, it should not be surprising that the vast majority of the simulated districts containing all of Cincinnati are also Democratic-favoring districts. In fact, over 80% of the Cincinnati-based simulated districts have a Republican vote share of 45% or lower, indicating that they clearly favor Democratic candidates by a safe margin. The vast majority of these computer-simulated districts containing Cincinnati are also fully within Hamilton County, following the Section (1)(C)(3) prohibition against unduly splitting counties.

76. But the Enacted Plan's CD-1 is a statistical outlier in terms of its partisanship when compared to these computer-simulated Cincinnati districts. The Enacted Plan's CD-1 has a Republican vote share of 51.6%, which is higher than over 98% of the simulated districts containing Cincinnati. The Enacted Plan's CD-1 achieves this unnaturally high Republican vote share by splitting Hamilton County into three districts and combining the Cincinnati portion of Hamilton County with Warren County, whose voters are far more Republican than Cincinnati's, thereby increasing the Republican vote share of CD-1 to 51.6%.

77. By connecting Warren County with the fragmented portion of Hamilton County containing Cincinnati, CD-1 of the Enacted Plan also exhibits a very non-compact shape, as evidenced by a compactness score much lower than the Cincinnati-based district in virtually all of the computer-simulated districts. Figure 16 compares the Polsby-Popper compactness score of the Enacted Plan's CD-1 to the Polsby-Popper score of all 1,000 of the Cincinnati-based simulated districts. This Figure illustrates that the vast majority of the simulated plans create a Cincinnati district a Polsby-Popper score of 0.34 to 0.42. Over 99% of the simulated districts containing Cincinnati have a higher Polsby-Popper score than CD-1. Hence, it is clear that the geographic shape of the Enacted Plan's CD-1 does not reflect a reasonable attempt to draw geographically compact districts in the Cincinnati area. Instead, I concluded that CD-1 was drawn to create a Republican-favorable district in Cincinnati, and this effort resulted in a district that was more favorable to the Republican Party than the Cincinnati district in over 97% of the computer-simulated plans.

Figure 15:
Comparisons of Cincinnati's District in the Enacted Plan and 1,000 Computer−Simulated Plans

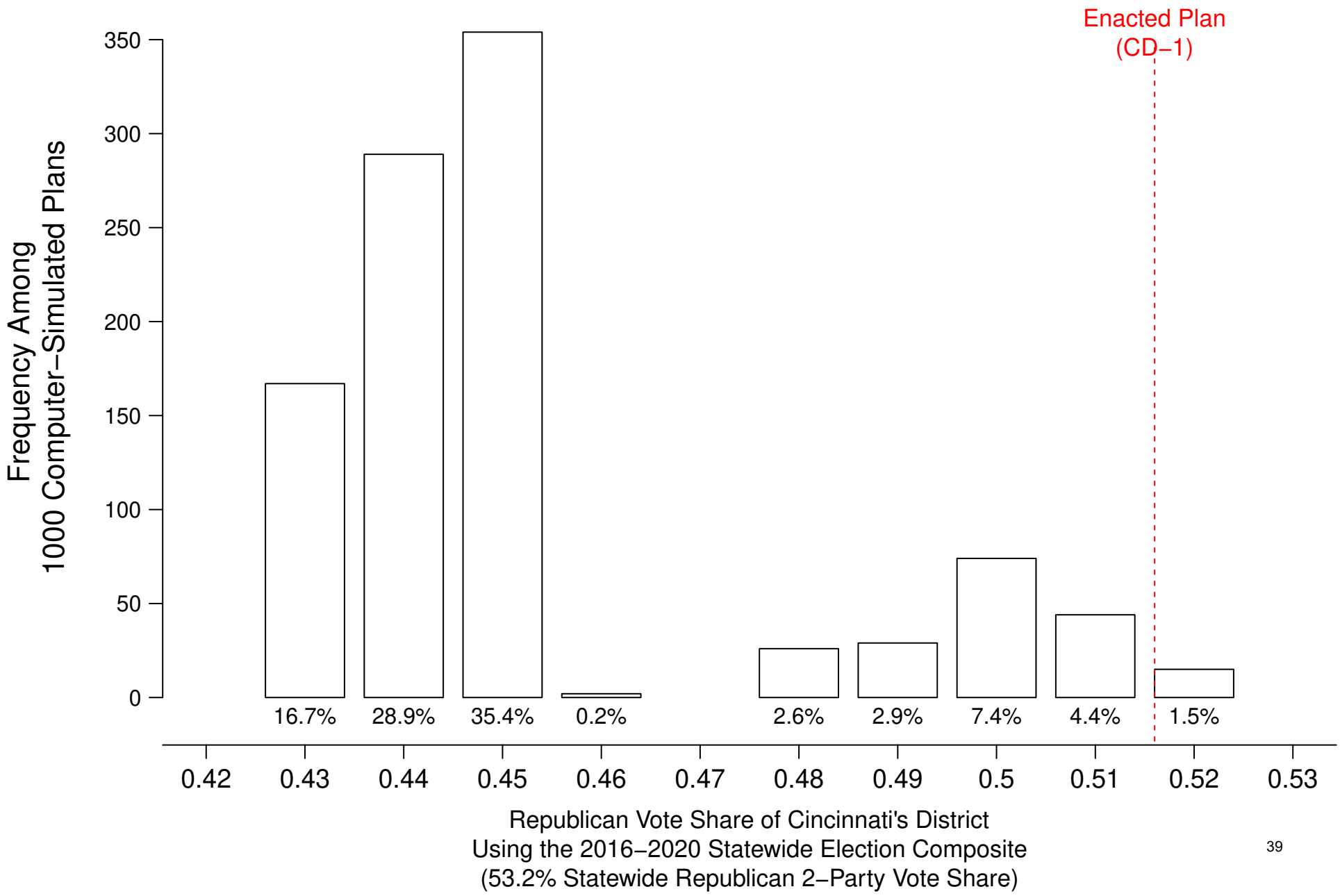
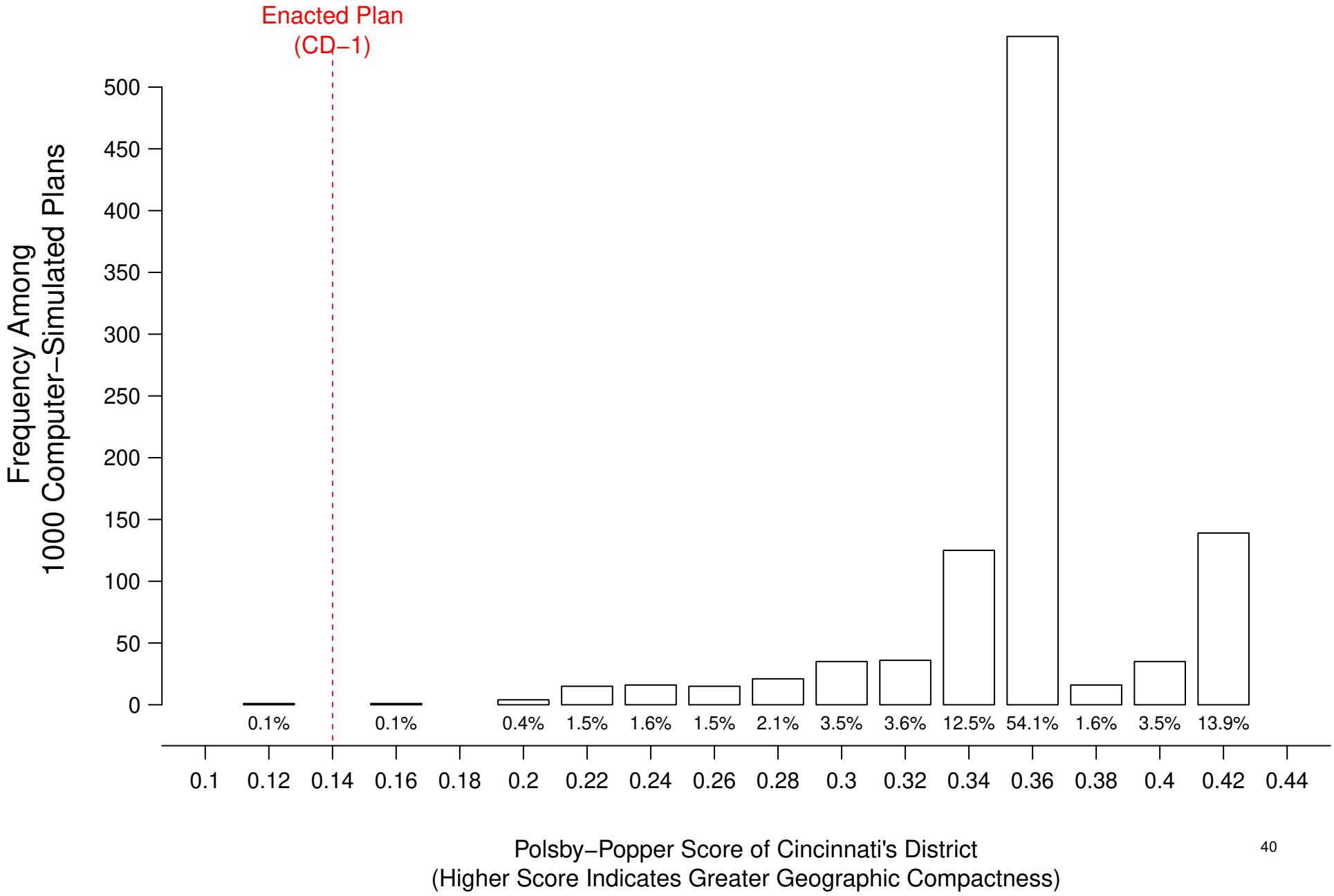


Figure 16:
Comparisons of Cincinnati's District in the Enacted Plan and 1,000 Computer−Simulated Plans



XII. THE ENACTED PLAN'S DISTRICTS IN CUYAHOGA COUNTY

78. Cuyahoga County's population exceeds the required population for a single congressional district, so the county will generally be split into either two or three districts, with one of these districts containing all of Cleveland (Article XIX, Section 2(B)(4)(b)). Across the Enacted Plan and each of the 1,000 computer-simulated plans, I compare the one district in each plan containing all of Cleveland.

79. Figure 17a and Figure 17b contain two maps. The map in Figure 17a depicts the boundaries of the Enacted Plan's Cleveland-based district, CD-11. The map in Figure 17b depicts the boundaries of the Cleveland-based district that had the highest Polsby-Popper compactness score among all 1,000 computer-simulated plans. Figures 17a and 17b also report the Polsby-Popper scores and Republican vote shares of these districts from the Enacted Plan and the computer-simulated plan.

Figure 17a: CD–11 of the 2021 Enacted Plan:

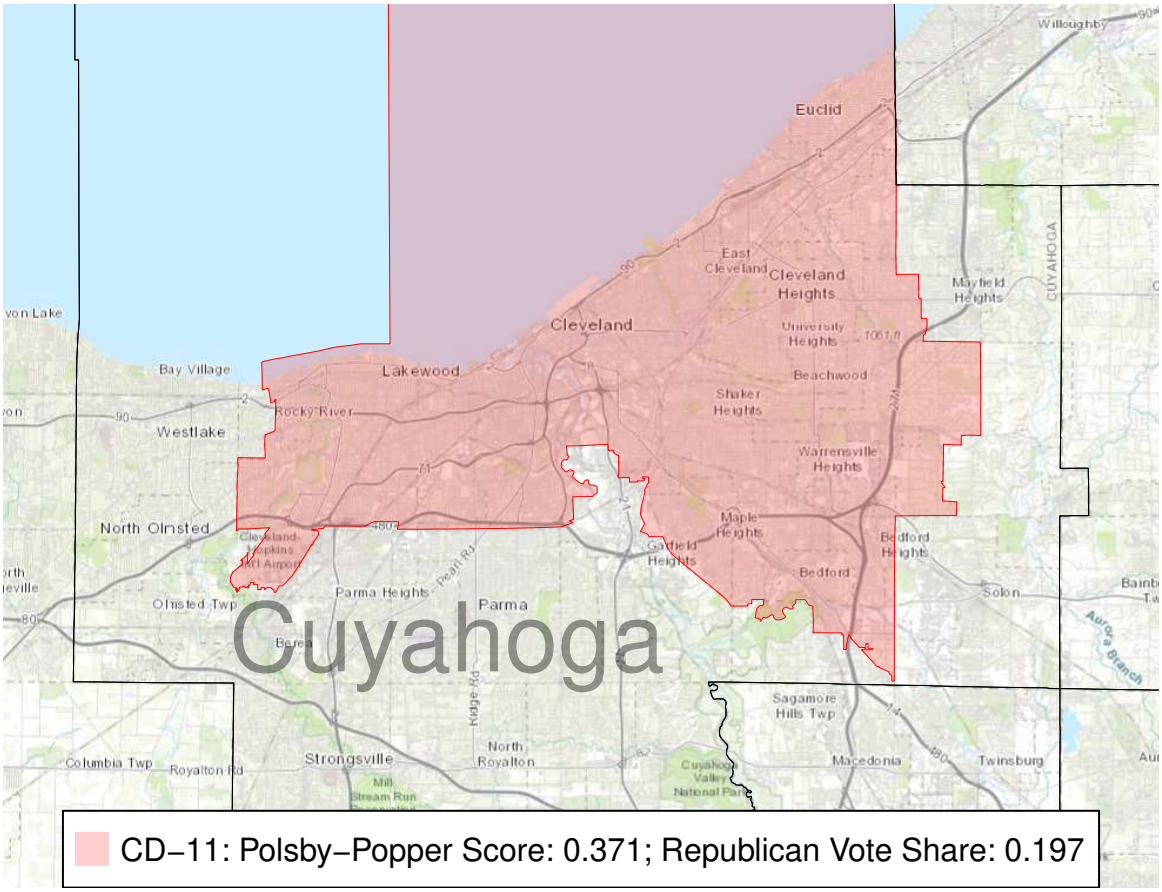
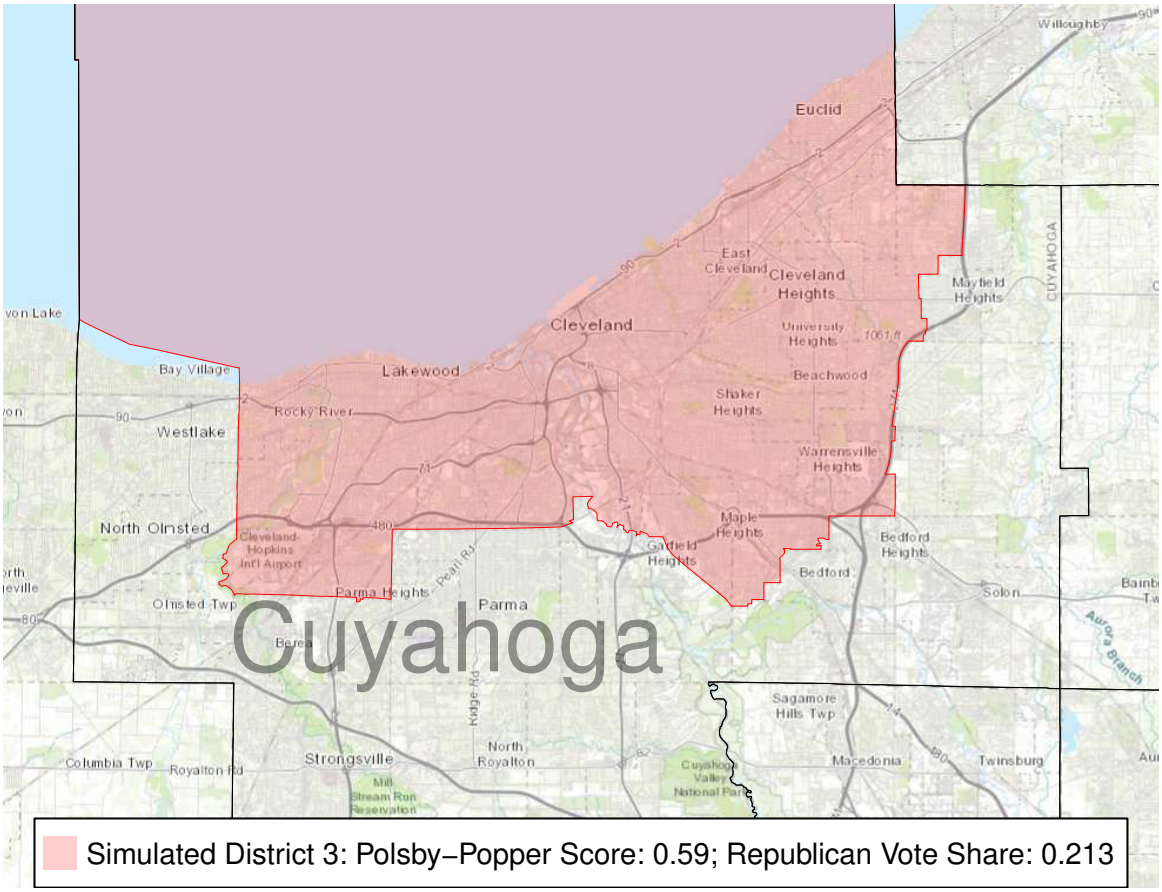


Figure 17b: Computer–Simulated Plan with the Most Compact Cleveland District (Simulated Plan #440 of 1000):



80. For the Enacted Plan and the 1,000 simulated plans, Figure 18 compares the Enacted Plan's CD-11 to the 1,000 simulated plans' Cleveland-based districts with respect to their partisanship and their Polsby-Popper compactness scores. Figure 18 contains 1,000 black circles, indicating the 1,000 simulated plans, and a red star representing the Enacted Plan. Each plan is plotted in this Figure along the horizontal axis according to the district's Republican vote share. The vertical axis then reports the district's Polsby-Popper compactness score, with higher scores indicating greater district compactness.

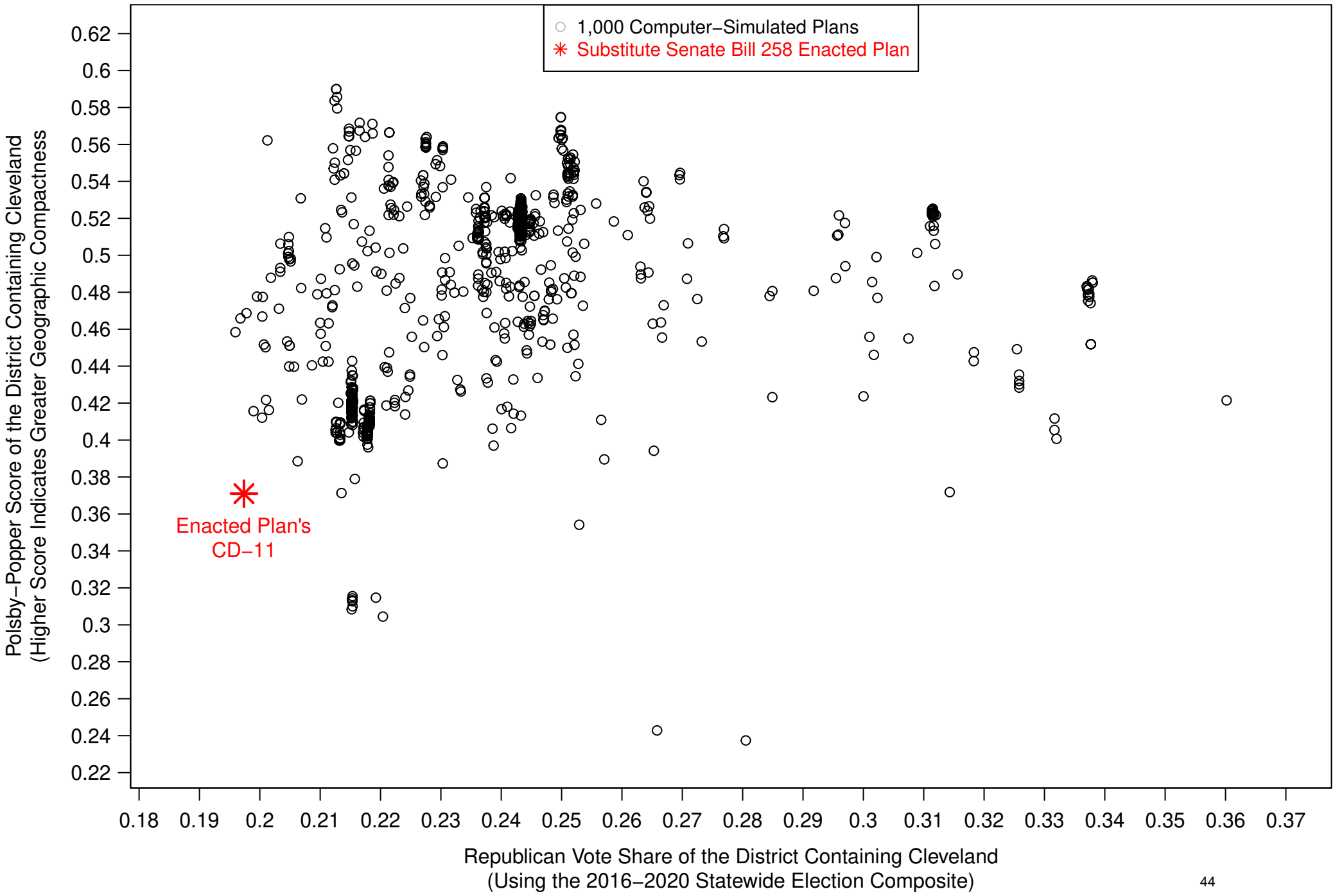
81. Cleveland voters are heavily Democratic, so any Cleveland-based district will always have a significant Democratic majority. As the 1,000 simulated districts in Figure 18 illustrate, there is no reasonable possibility that the Cleveland-based district could be drawn to have a Republican majority.

82. Instead, the Enacted Plan's CD-11 creates an extreme partisan outlier in the opposite direction. CD-11 has a Republican vote share of only 19.7%, which is lower than the Cleveland-based district in 99.8% of the computer-simulated plans. Figure 18 makes clear that Democratic voters are packed together in CD-11 to a more extreme extent than naturally occurs in virtually all of the simulated plans, which were produced by following the districting criteria mandated in Ohio's Constitution.

83. The vertical axis of Figure 18 reveals that CD-11's Polsby-Popper compactness score of 0.371 is lower than the Polsby-Popper score of 98.8% of the simulated Cleveland-based districts. The vast majority of the Cleveland-based simulated districts have Polsby-Popper scores generally ranging from 0.4 to 0.55. I therefore concluded that the Enacted Plan's CD-11 was not drawn by a districting process following Section (1)(C)(3)'s requirement regarding district compactness. CD-11 is clearly less geographically compact than is reasonable for a Cleveland-based district, and the district appears instead to have been drawn in order to create an extreme packing of Democratic voters that would not have naturally emerged from drawing a more compact Cleveland-based district.

84. I therefore conclude that the Enacted Plan's Cleveland-based districts, CD-11, was not drawn in a manner that is consistent with the Ohio Constitution's Article XIX, Section (1)(C)(3) requirements. This district was drawn in a manner that clearly favors the Republican Party by unnaturally packing together Democratic voters to an extent that is not explained by Cuyahoga County's political geography. This unnatural packing of Democrats was accomplished by drawing districting lines in CD-11 that exhibit a lower Polsby-Popper compactness score than is reasonably possible for the Cleveland-based district in the 1,000 computer-simulated plans.

Figure 18:
Comparisons of Cleveland's District in the Enacted Plan and 1,000 Computer–Simulated Plans



XIII. THE RELATIONSHIP BETWEEN COMPETITIVENESS AND PARTISANSHIP IN THE ENACTED PLAN

85. Relators' counsel also asked me to analyze how the Enacted Plan's competitive districts affect the partisan characteristics of the plan. For the purpose of this inquiry, I used the 2016-2020 Statewide Election Composite and defined a "competitive district" the same way that the map-drawers of the Enacted Plan did: that is, a "competitive district" is one with a two-party Republican vote share between 46% and 54%.[14]

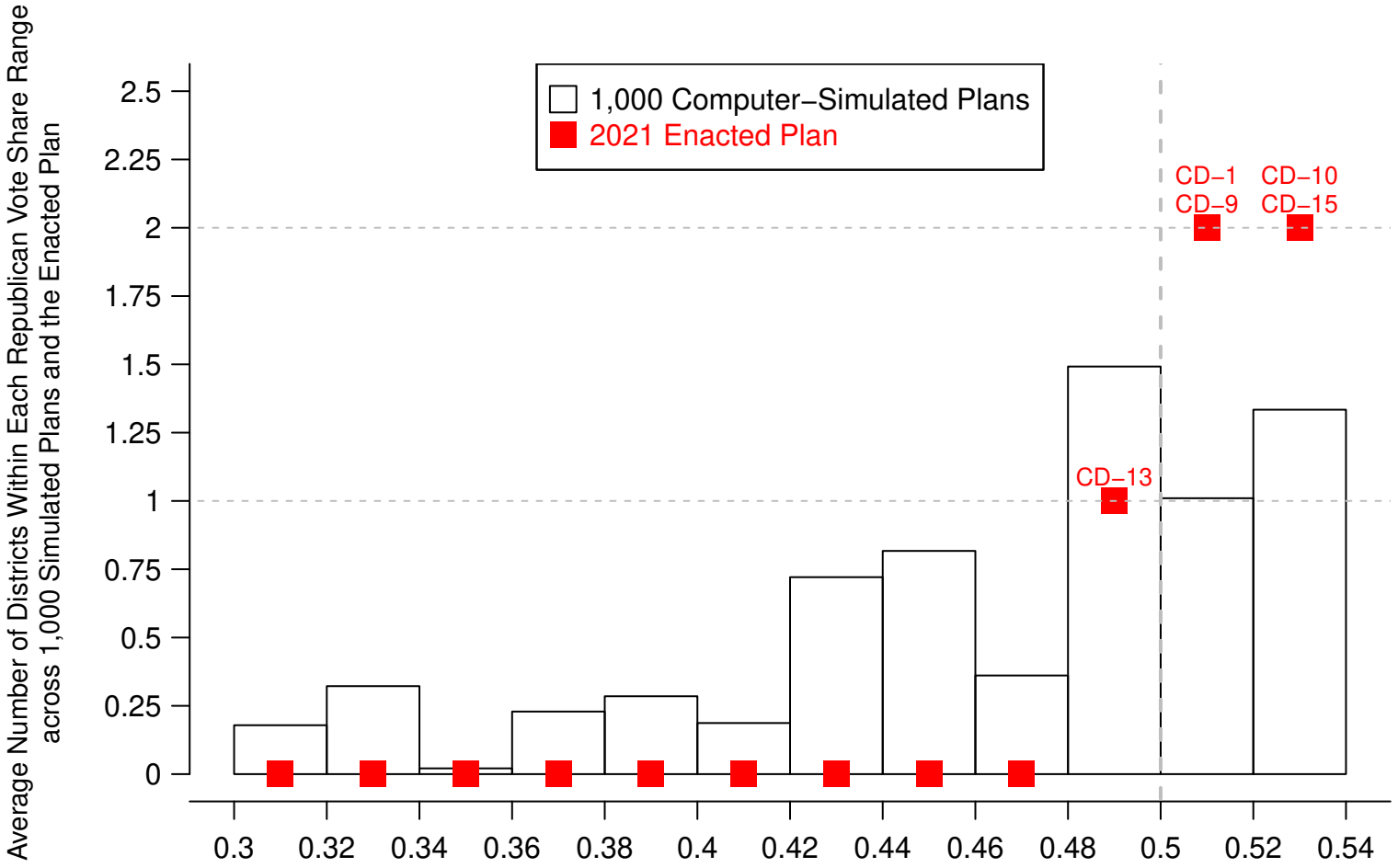
86. The Enacted Plan contains five competitive districts using this definition: CD-1 (51.6% Republican vote share), CD-9 (50.3%), CD-10 (53.3%), CD-13 (49.2%), and CD-15 (53.9%). Among these five competitive districts, four are Republican-favoring, while one is Democratic-favoring.

87. How does the number of Republican-favoring and Democratic-favoring competitive districts in the Enacted Plan compare to the number of such districts in the 1,000 computer-simulated plans? To analyze this question, I counted the average number of districts in each computer-simulated plan containing a Republican vote share within the range of 52-54%, then 50-52%, then 48-50%, and so on. I also counted the number of Enacted Plan districts within each of these two-percent ranges of partisanship.

88. Figure 19 summarizes this analysis. As an example, the last column in Figure 19 reports the number of districts in the Enacted and the simulated plans with a Republican vote share in the range of 52-54%. The red square reports the number of Enacted Plan districts in this partisanship range, while the black bar reports the average number of districts in the 1,000 simulated plans within this partisanship range. Similarly, the next-to-last column in this Figure compares the number of Enacted Plan districts and average number of simulated plan districts in the range of 50-52% Republican vote share.

[14] *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).

Figure 19:
Comparisons of 2021 Enacted Plan to 1,000 Computer–Simulated Plans
On Number of Districts Within Each Partisanship Range



89. These final two columns reveal that the Enacted Plan contains more Republican-favoring competitive districts than in the average computer-simulated plan. The Enacted Plan contains two districts within the 50-52% Republican vote share range, while the average simulated plan contains only 1.0. Similarly, the Enacted Plan contains two districts within the 52-54% Republican vote share range, while the simulated plan contains only 1.3.

90. But Figure 19 reveals the opposite finding with respect to Democratic-favoring competitive districts. For every single two-percent interval analyzed in this Figure, the Enacted Plan contains fewer Democratic-favoring competitive districts than the average simulated plan. For example, the average simulated plan contains 1.5 districts within the 48-50% Republican vote share range, but the Enacted Plan contains only 1. Similarly, the average simulated plan contains 0.4 districts within the 46-50% Republican vote share range, but the Enacted Plan contains none.

91. In fact, the same finding holds for every two-percent partisanship range from 30 to 46% Republican vote share. The Enacted Plan contains zero Democratic-favoring districts within this range of partisanship, while the average simulated plan contains some districts within this range.

92. Overall, Figure 19 reveals a clear partisan asymmetry in the Enacted Plan's competitive districts when compared to the competitive districts in the computer-simulated plans. The Enacted Plan certainly contains more Republican-favoring competitive districts than the average simulated plan does. But the Enacted Plan created these Republican-favoring competitive districts at the expense of Democratic-favoring competitive districts, as well as safe Democratic-favoring districts (with a Republican vote share under 46%). In other words, the Enacted Plan created far more Republican-favoring competitive districts with Republican vote shares of 50-54%, compared to the average simulated plan. And this relative abundance of Republican-favoring competitive districts came at the expense of having relatively fewer Democratic-favoring districts than appear in the average computer-simulated plan.

XIV. OHIO'S POLITICAL GEOGRAPHY DID NOT CAUSE THE ENACTED PLAN'S EXTREME PARTISAN BIAS

93. How does Ohio's political geography affect the partisan characteristics of the 2021 Enacted Plan? Democratic voters tend to be geographically concentrated in the urban cores of several of the state's largest cities, including Columbus, Cleveland, Cincinnati, Toledo, Akron, and Dayton. As I have explained in my prior academic research,[15] these large urban clusters of Democratic voters, combined with the common districting principle of drawing geographically compact districts, can sometimes result in urban districts that "naturally" pack together Democratic voters, thus boosting the Republican vote share of other surrounding suburban and rural districts.

[15] Jowei Chen and Jonathan Rodden, 2013. "Unintentional Gerrymandering: Political Geography and Electoral Bias in Legislatures" Quarterly Journal of Political Science, 8(3): 239-269; Jowei Chen and David Cottrell, 2016. "Evaluating Partisan Gains from Congressional Gerrymandering: Using Computer Simulations to Estimate the Effect of Gerrymandering in the U.S. House." Electoral Studies, Vol. 44, No. 4: 329-430.

94. More importantly, my prior academic research explained how I can estimate the precise level of electoral bias in districting caused by a state's unique political geography: I programmed a computer algorithm that draws districting plans using Ohio's unique political geography, including the state's census population data and political subdivision boundaries. In this report, I have also programmed the algorithm to follow the Ohio Constitution's Article XIX districting criteria. I then analyzed the partisan characteristics of the simulated districting plans using Ohio's precinct-level voting data from past elections. Hence, the entire premise of conducting districting simulations is to fully account for Ohio's unique political geography, its political subdivision boundaries, and its unique constitutional districting requirements.

95. This districting simulation analysis allowed me to identify how much of the electoral bias in Ohio's 2021 Enacted Congressional Plan is caused by Ohio's political geography and how much is caused by the map-drawer's intentional efforts to favor one political party over the other. Ohio's natural political geography, combined with the Ohio's Constitution's Article XIX districting requirements, almost never resulted in simulated congressional plans containing 12 Republican-favoring districts out of 15 total districts.

96. The 2021 Enacted Plan's creation of 12 Republican-favoring districts goes well beyond any "natural" level of electoral bias caused by Ohio's political geography or the political composition of the state's voters. The Enacted Plan is a statistical outlier in terms of its partisan characteristics when compared to the 1,000 computer-simulated plans. The Enacted Plan creates more Republican-favoring districts than 98.7% of the simulated plans. This extreme, additional level of partisan bias in the 2021 Enacted Plan can be directly attributed to the map-drawer's clear efforts to favor the Republican Party. This additional level of partisan bias was not caused by Ohio's political geography.

Jowei Chen

Dr. Jowei Chen

JURAT

STATE OF FLORIDA
COUNTY OF SAINT LUCIE

Sworn to before me this 10th day of December 2021.

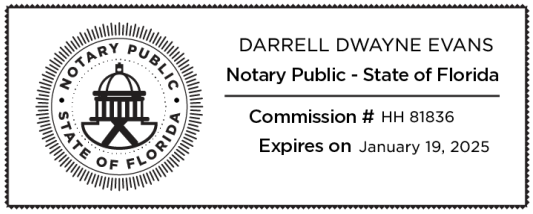
By Jowei Chen

Form of ID Produced: Driver's License

Darrell Dwayne Evans

Notary Public Darrell Dwayne Evans

My commission expires 01/19/2025



Notarized online using audio-video communication

Appendix

Figure A1: Comparison of Substitute Senate Bill 258 Enacted Plan to 1,000 Computer−Simulated Plans: Districts' Republican Vote Share Measured Using the 2016 US President Election Results

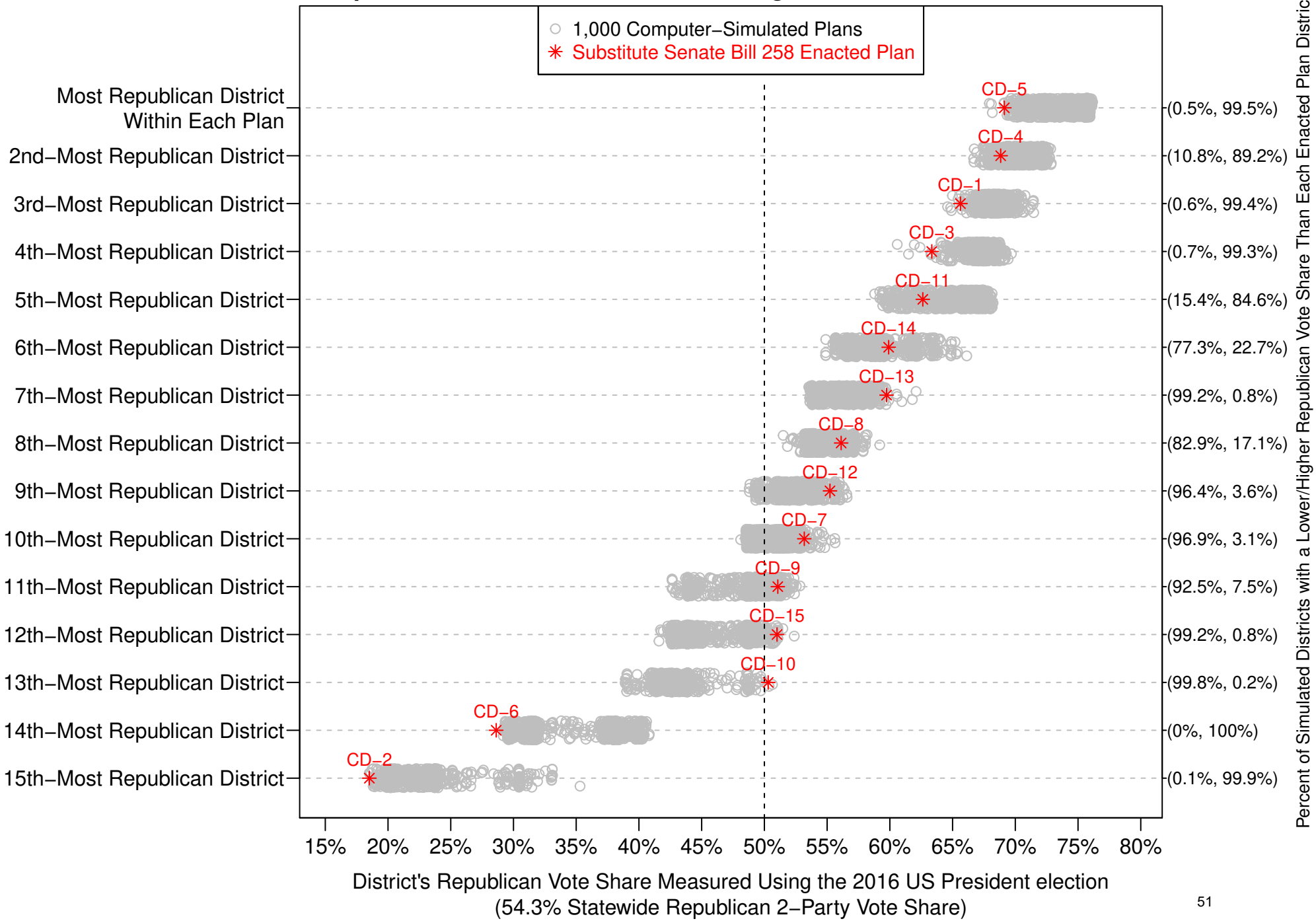


Figure A2: Comparison of Substitute Senate Bill 258 Enacted Plan to 1,000 Computer–Simulated Plans: Districts' Republican Vote Share Measured Using the 2016 US Senator Election Results

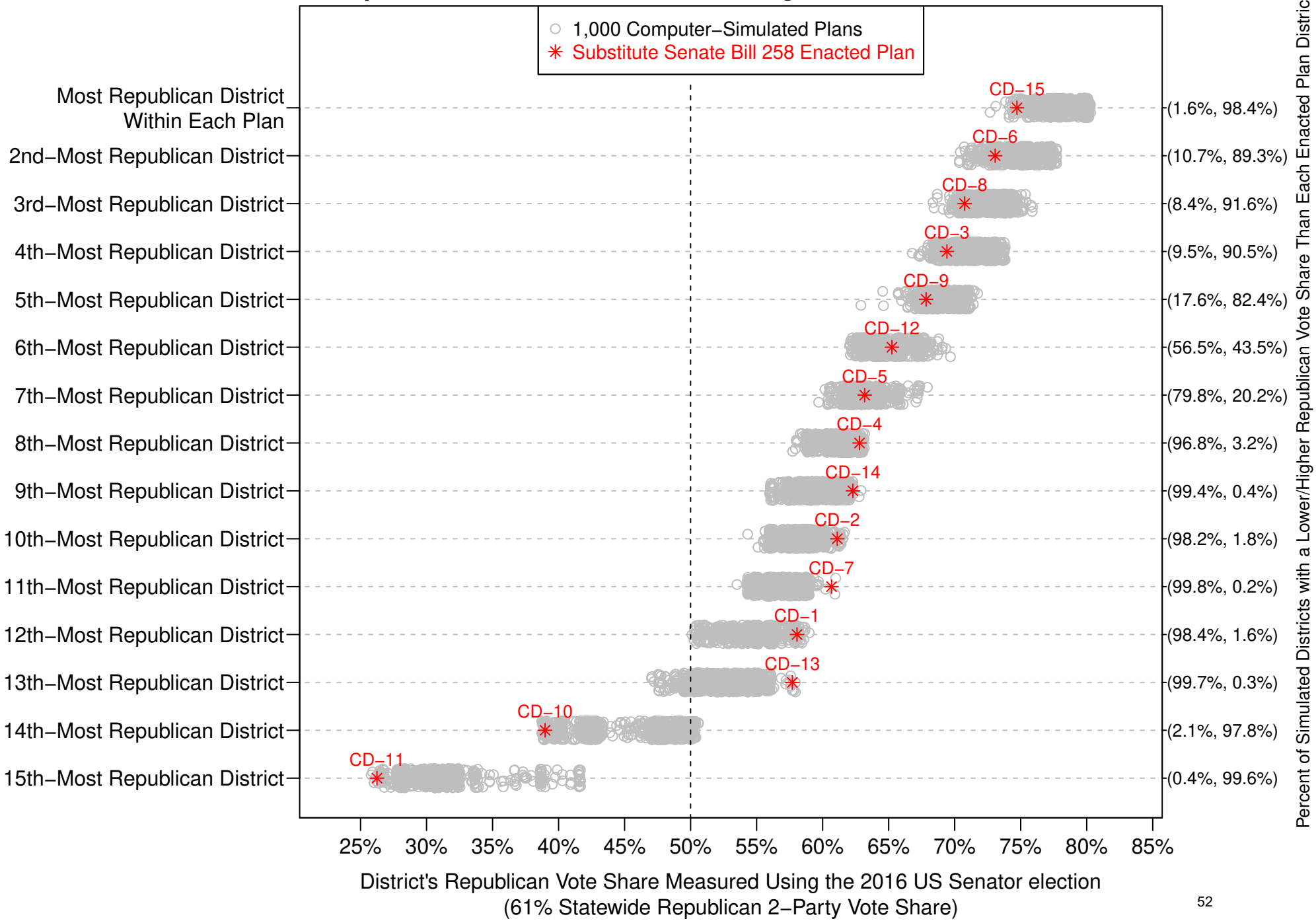


Figure A3: Comparison of Substitute Senate Bill 258 Enacted Plan to 1,000 Computer–Simulated Plans: Districts' Republican Vote Share Measured Using the 2018 Attorney General Election Results

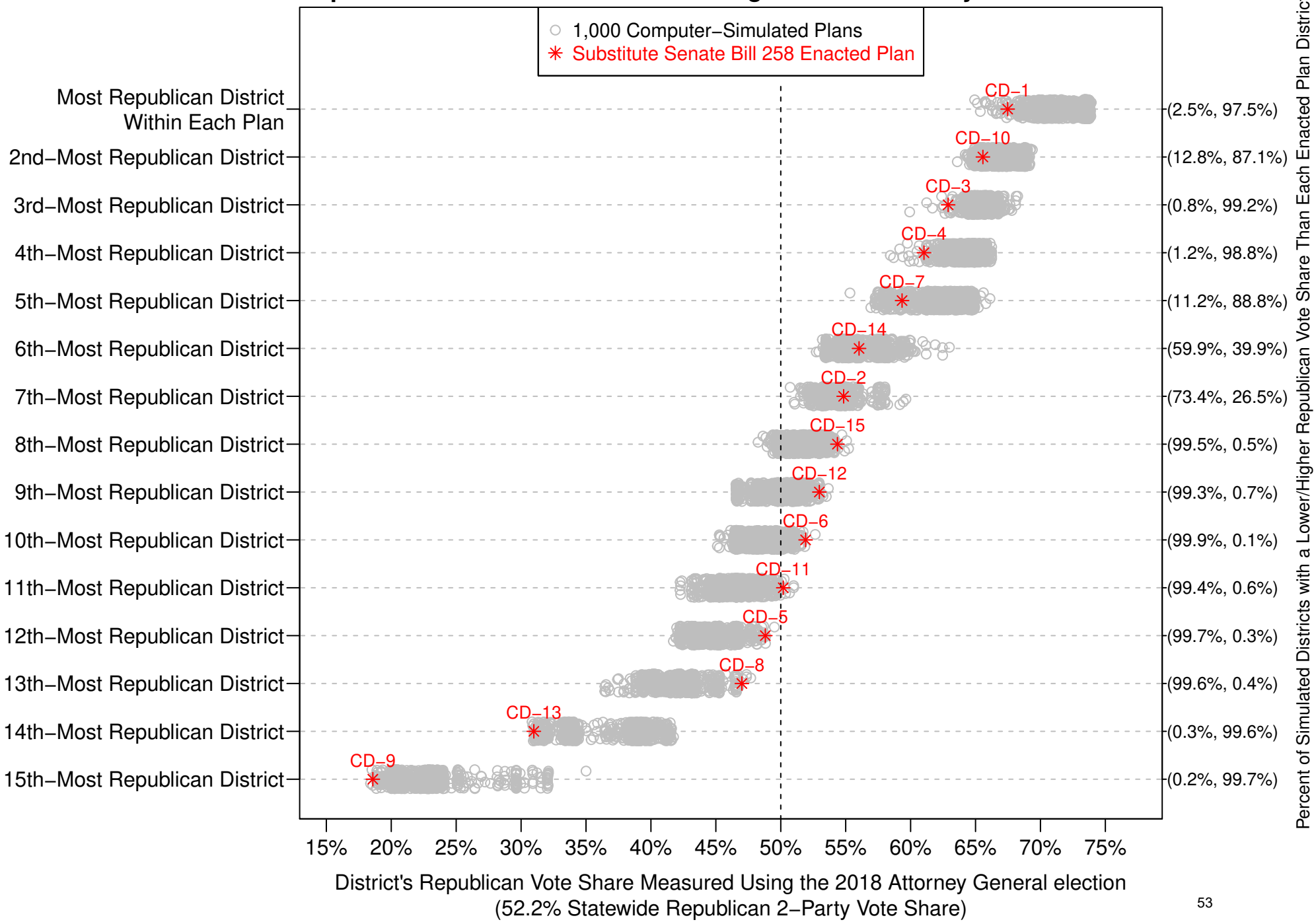


Figure A4: Comparison of Substitute Senate Bill 258 Enacted Plan to 1,000 Computer–Simulated Plans: Districts' Republican Vote Share Measured Using the 2018 Auditor Election Results

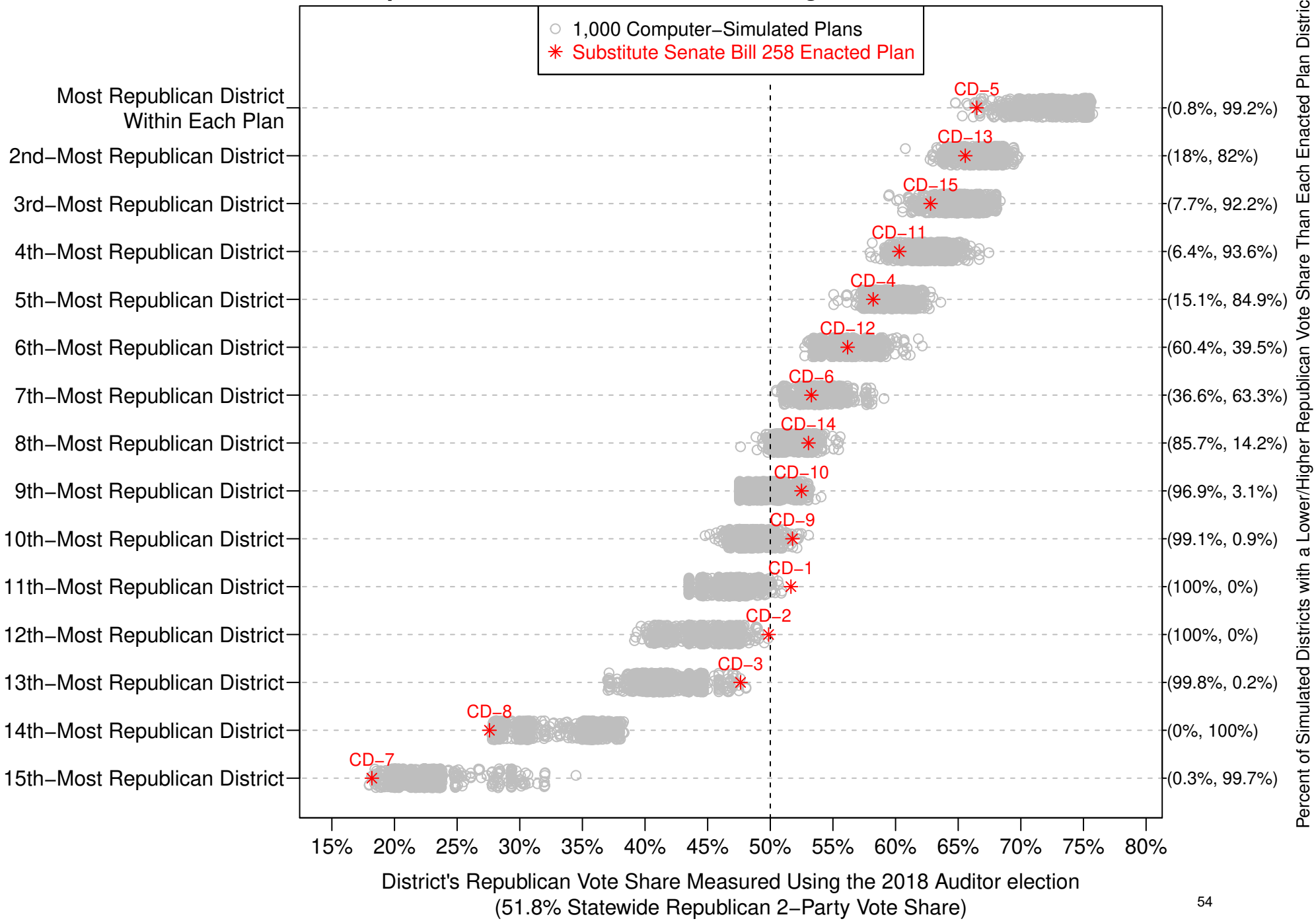


Figure A5: Comparison of Substitute Senate Bill 258 Enacted Plan to 1,000 Computer–Simulated Plans: Districts' Republican Vote Share Measured Using the 2018 Governor Election Results

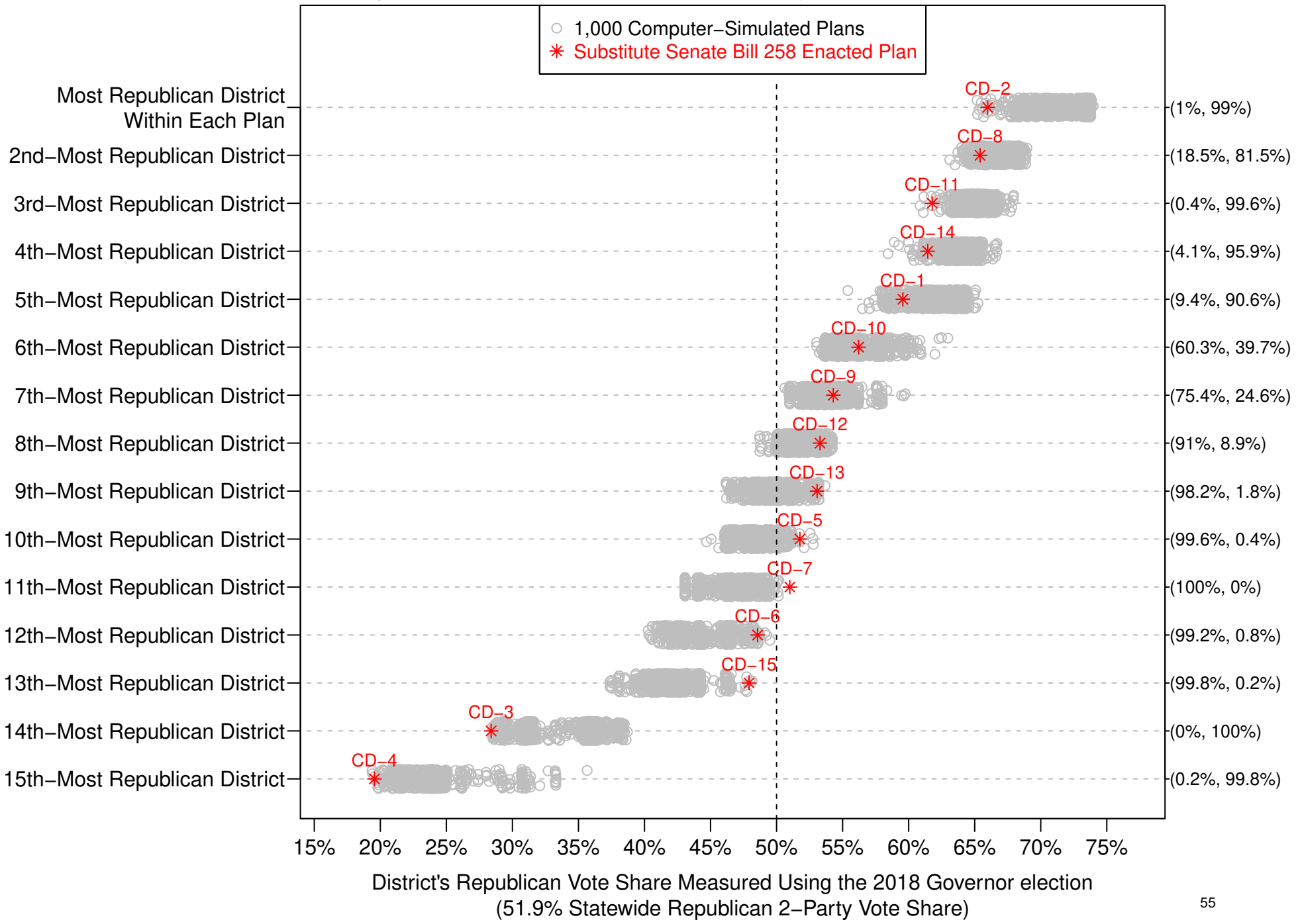


Figure A6: Comparison of Substitute Senate Bill 258 Enacted Plan to 1,000 Computer–Simulated Plans: Districts' Republican Vote Share Measured Using the 2018 Secretary of State Election Results

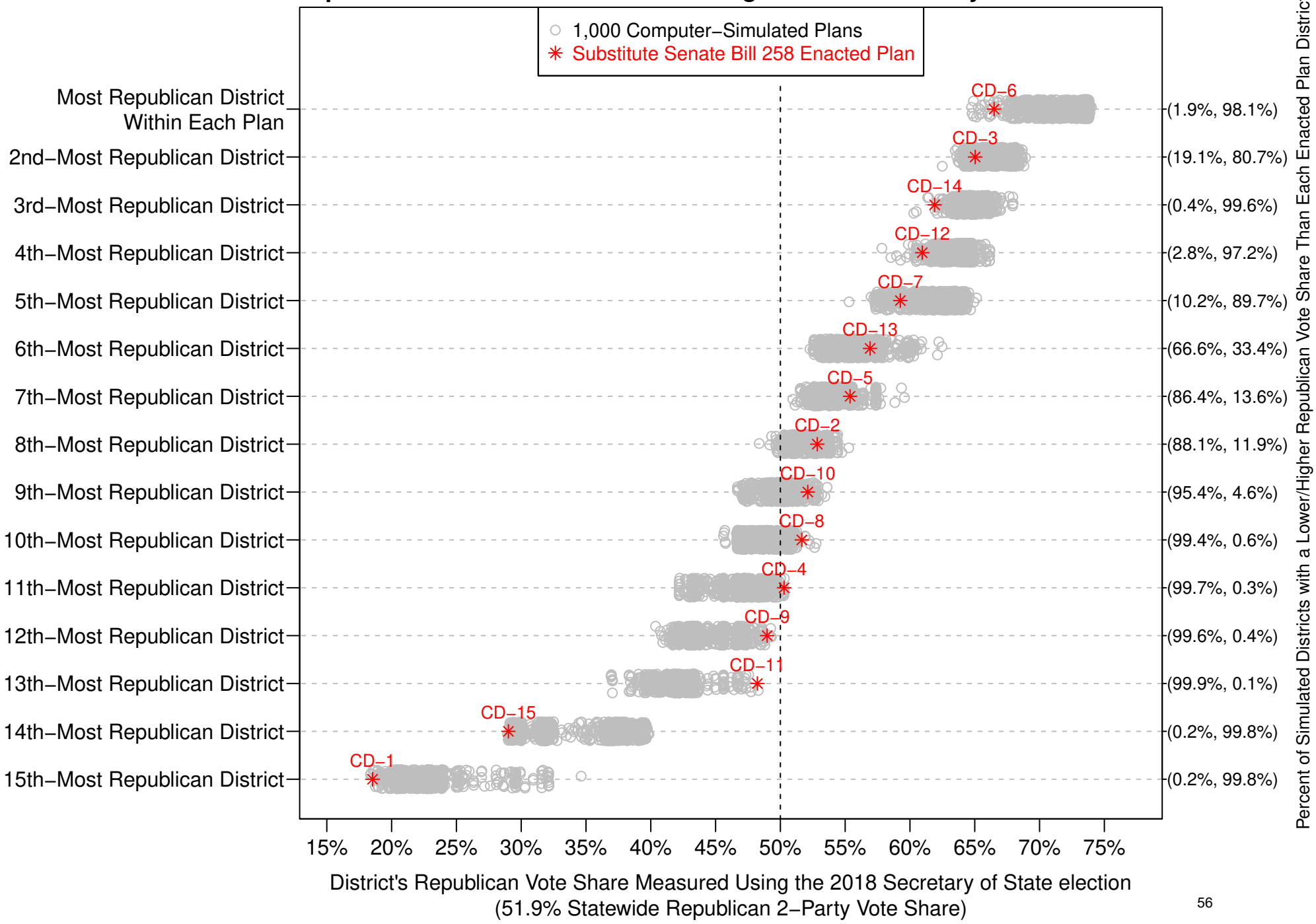


Figure A7: Comparison of Substitute Senate Bill 258 Enacted Plan to 1,000 Computer–Simulated Plans: Districts' Republican Vote Share Measured Using the 2018 Treasurer Election Results

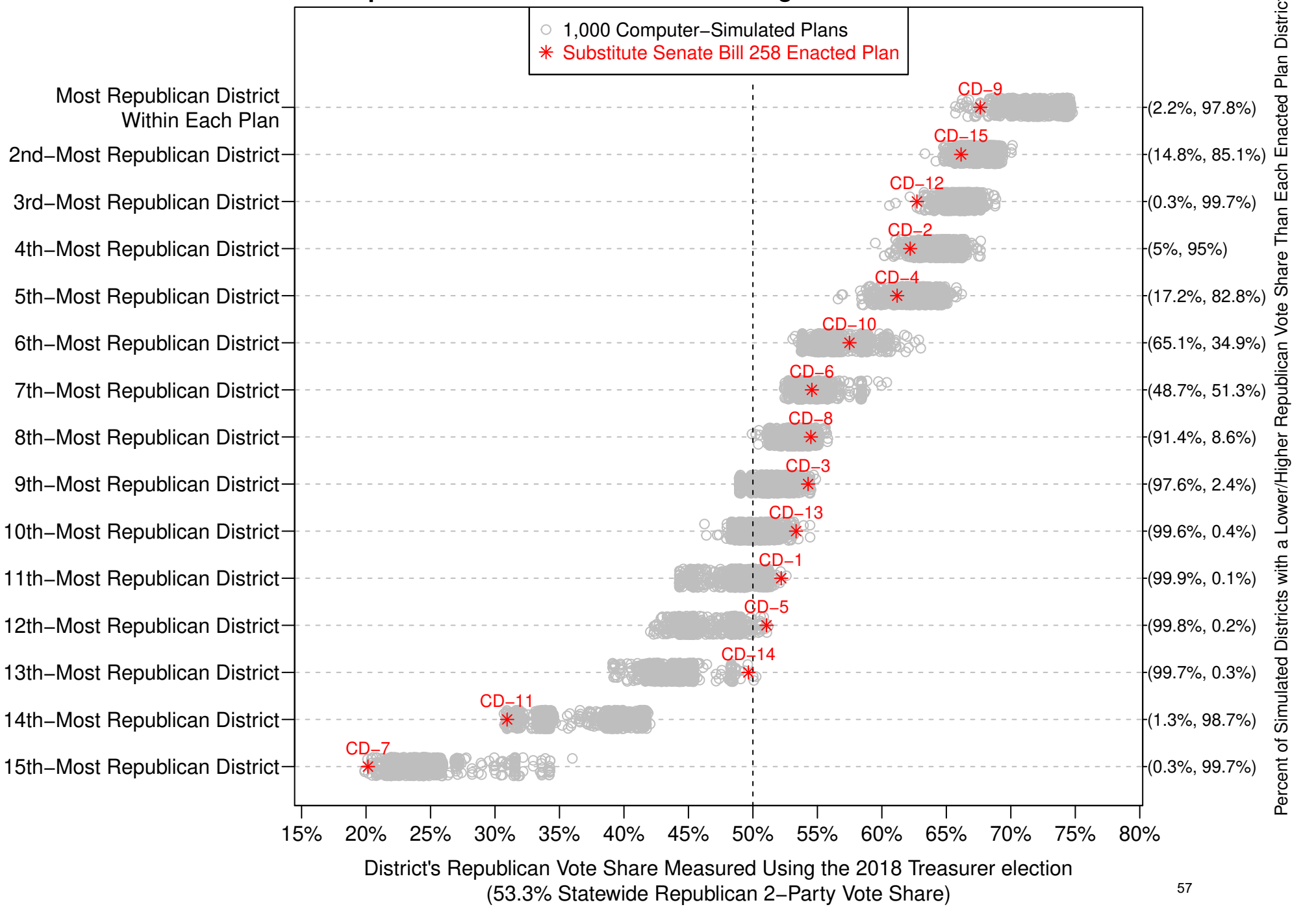


Figure A8: Comparison of Substitute Senate Bill 258 Enacted Plan to 1,000 Computer−Simulated Plans: Districts' Republican Vote Share Measured Using the 2018 US Senator Election Results

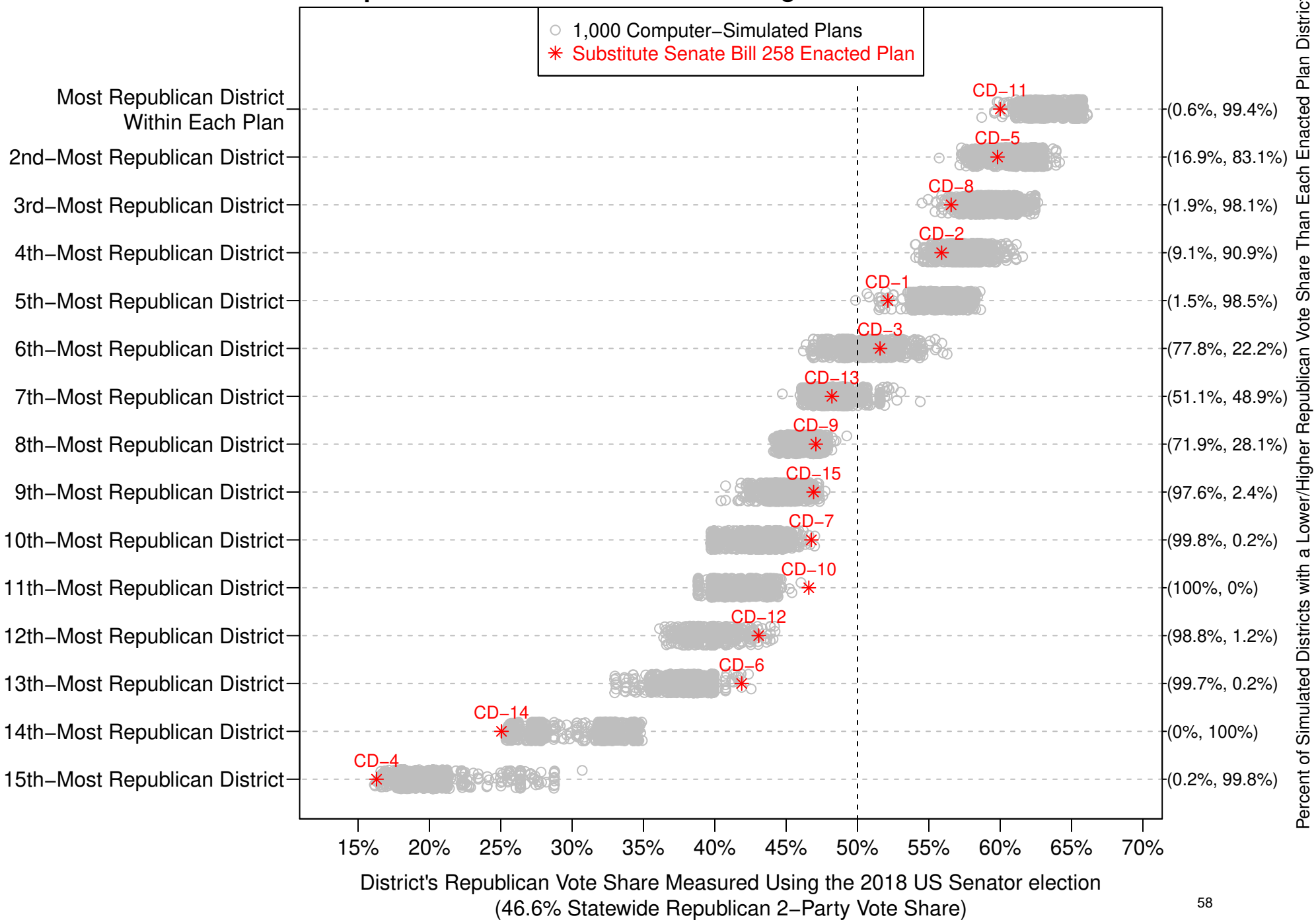


Figure A9: Comparison of Substitute Senate Bill 258 Enacted Plan to 1,000 Computer–Simulated Plans: Districts' Republican Vote Share Measured Using the 2020 US President Election Results

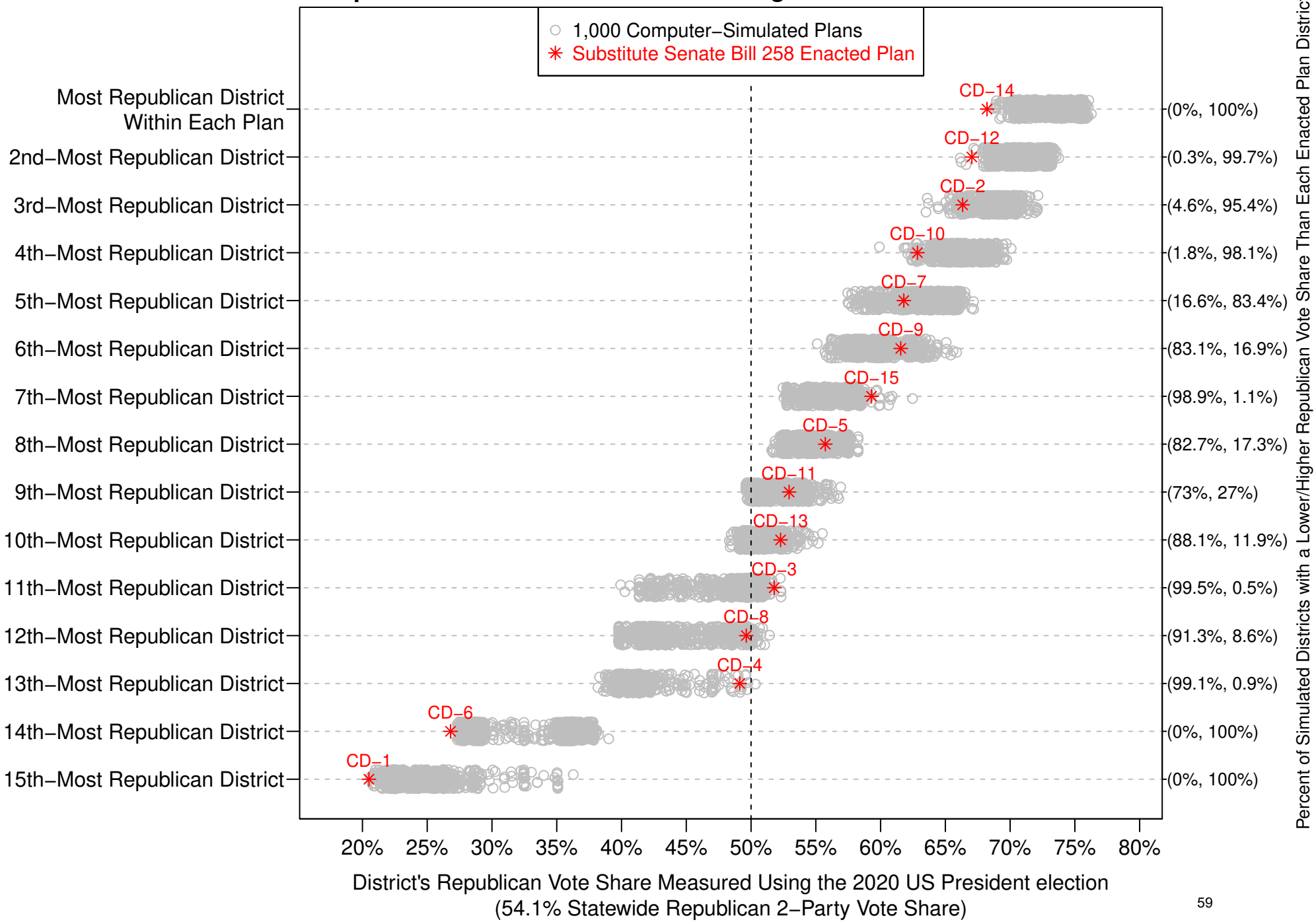


Figure B1:
Split Municipal Corporations and Townships in the 1,000 Computer–Simulated Plans

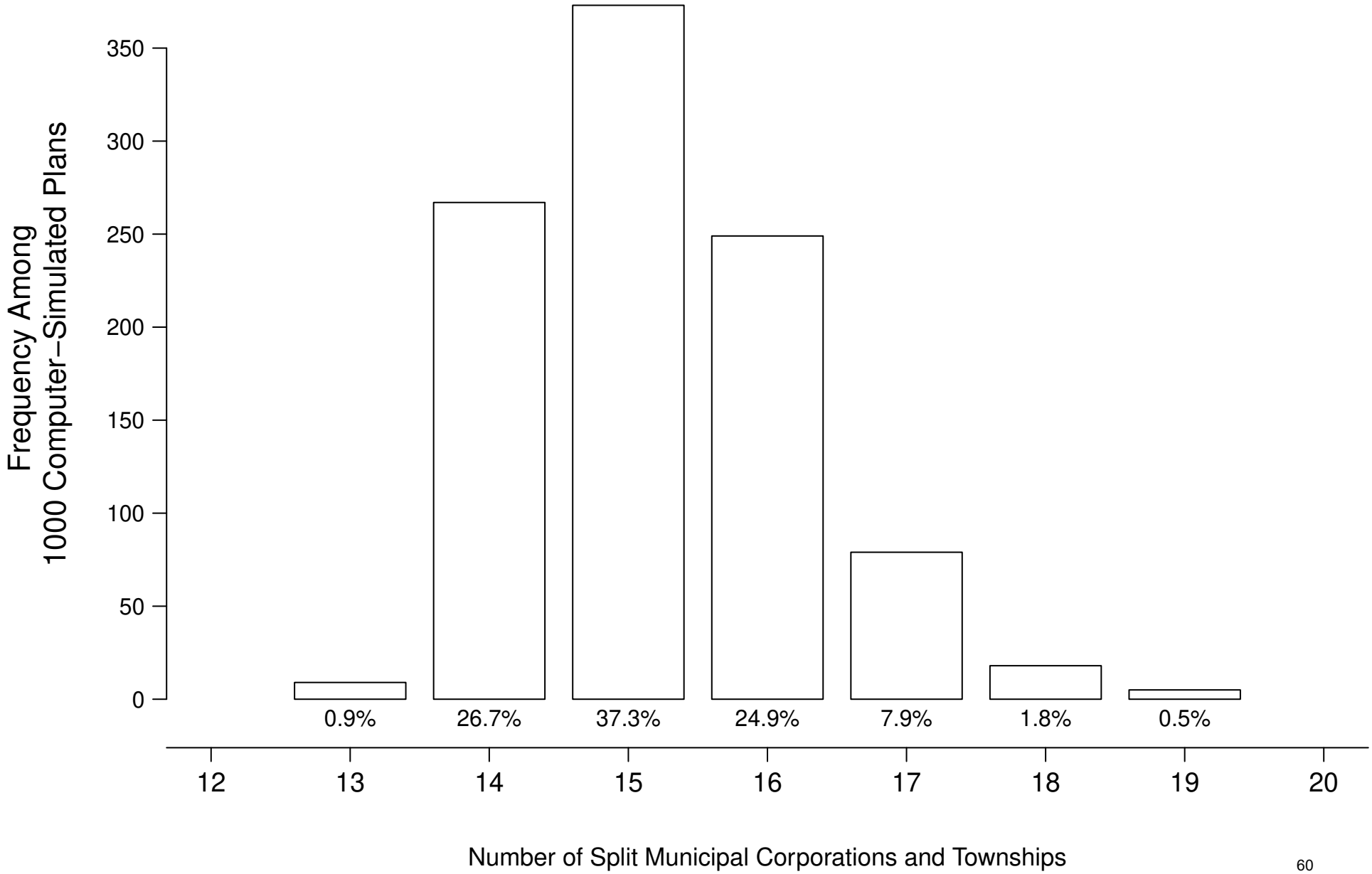
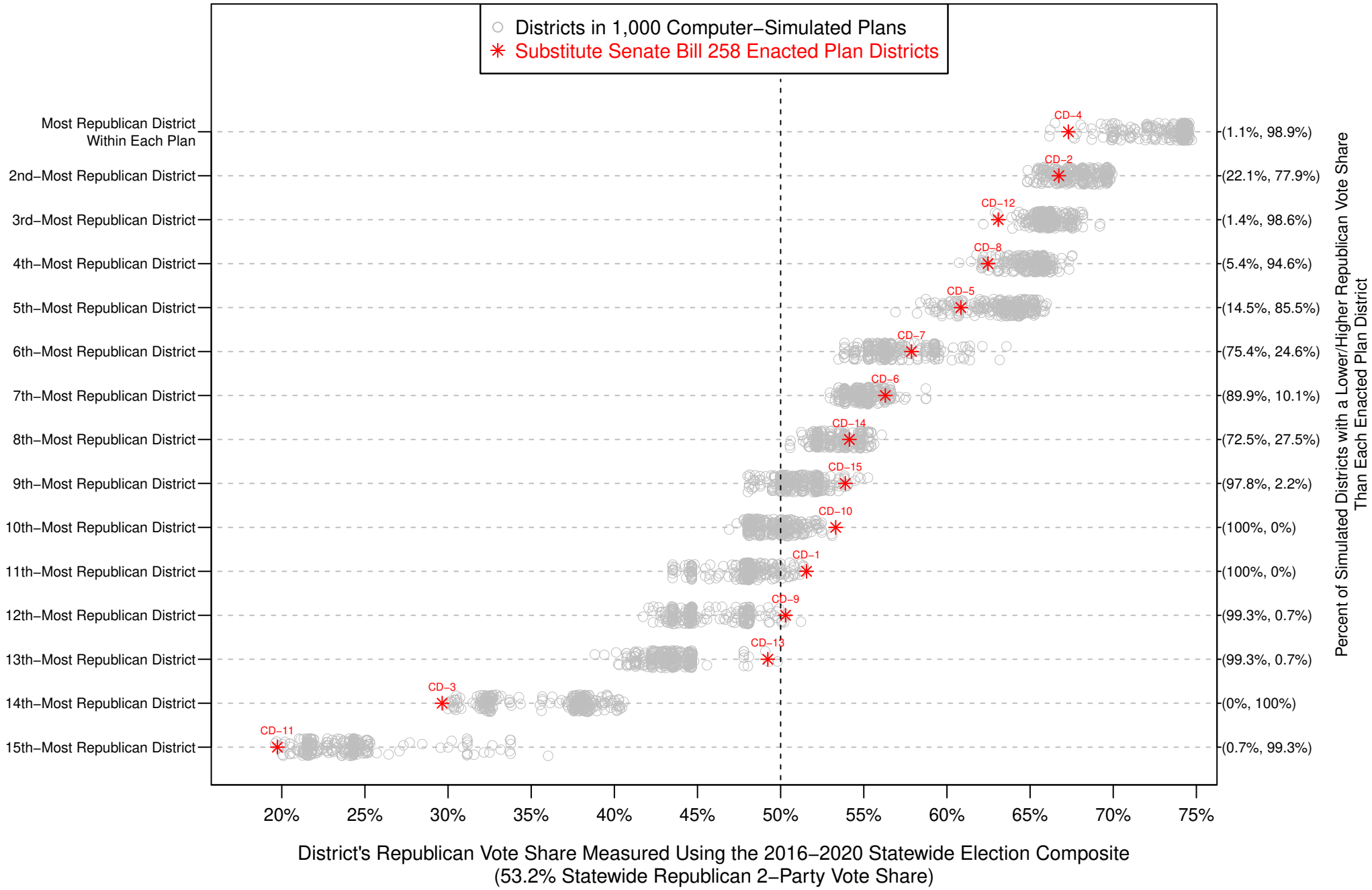


Figure B2: Comparisons of Enacted Plan Districts to Districts in the 276 Computer–Simulated Plans Containing 14 or Fewer Split Townships and Municipal Corporations



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Curriculum Vitae

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Publications:

Chen, Jowei and Neil Malhotra. 2007. "The Law of k/n: The Effect of Chamber Size on Government Spending in Bicameral Legislatures."
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***Global Encyclopedia of Public Administration, Public Policy, and Governance*.**

Research Grants:

"How Citizenship-Based Redistricting Systemically Disadvantages Voters of Color". 2020 ($18,225). Combating and Confronting Racism Grant. University of Michigan Center for Social Solutions and Poverty Solutions.

Principal Investigator. National Science Foundation Grant SES-1459459, September 2015 – August 2018 ($165,008). "The Political Control of U.S. Federal Agencies and Bureaucratic Political Behavior."

"Economic Disparity and Federal Investments in Detroit," (with Brian Min) 2011. Graham Institute, University of Michigan ($30,000).

"The Partisan Effect of OSHA Enforcement on Workplace Injuries," (with Connor Raso) 2009. John M. Olin Law and Economics Research Grant ($4,410).

Invited Talks:

September, 2011. University of Virginia, American Politics Workshop.
October 2011. Massachusetts Institute of Technology, American Politics Conference.
January 2012. University of Chicago, Political Economy/American Politics Seminar.
February 2012. Harvard University, Positive Political Economy Seminar.
September 2012. Emory University, Political Institutions and Methodology Colloquium.
November 2012. University of Wisconsin, Madison, American Politics Workshop.
September 2013. Stanford University, Graduate School of Business, Political Economy Workshop.
February 2014. Princeton University, Center for the Study of Democratic Politics Workshop.
November 2014. Yale University, American Politics and Public Policy Workshop.
December 2014. American Constitution Society for Law & Policy Conference: Building the Evidence to Win Voting Rights Cases.
February 2015. University of Rochester, American Politics Working Group.
March 2015. Harvard University, Voting Rights Act Workshop.
May 2015. Harvard University, Conference on Political Geography.
Octoer 2015. George Washington University School of Law, Conference on Redistricting Reform.
September 2016. Harvard University Center for Governmental and International Studies, Voting Rights Institute Conference.
March 2017. Duke University, Sanford School of Public Policy, Redistricting Reform Conference.
October 2017. Willamette University, Center for Governance and Public Policy Research
October 2017, University of Wisconsin, Madison. Geometry of Redistricting Conference.
February 2018: University of Georgia Law School
September 2018. Willamette University.
November 2018. Yale University, Redistricting Workshop.
November 2018. University of Washington, Severyns Ravenholt Seminar in Comparative Politics.
January 2019. Duke University, Reason, Reform & Redistricting Conference.

February 2019. Ohio State University, Department of Political Science. Departmental speaker series.
March 2019. Wayne State University Law School, Gerrymandering Symposium.
November 2019. Big Data Ignite Conference.
November 2019. Calvin College, Department of Mathematics and Statistics.
September 2020 (Virtual). Yale University, Yale Law Journal Scholarship Workshop

Conference Service:

Section Chair, 2017 APSA (San Francisco, CA), Political Methodology Section
Discussant, 2014 Political Methodology Conference (University of Georgia)
Section Chair, 2012 MPSA (Chicago, IL), Political Geography Section.
Discussant, 2011 MPSA (Chicago, IL) "Presidential-Congressional Interaction."
Discussant, 2008 APSA (Boston, MA) "Congressional Appropriations."
Chair and Discussant, 2008 MPSA (Chicago, IL) "Distributive Politics: Parties and Pork."

Conference Presentations and Working Papers:

"Ideological Representation of Geographic Constituencies in the U.S. Bureaucracy," (with Tim Johnson). 2017 APSA.

"Incentives for Political versus Technical Expertise in the Public Bureaucracy," (with Tim Johnson). 2016 APSA.

"Black Electoral Geography and Congressional Districting: The Effect of Racial Redistricting on Partisan Gerrymandering". 2016 Annual Meeting of the Society for Political Methodology (Rice University)

"Racial Gerrymandering and Electoral Geography." Working Paper, 2016.

"Does Deserved Spending Win More Votes? Evidence from Individual-Level Disaster Assistance," (with Andrew Healy). 2014 APSA.

"The Geographic Link Between Votes and Seats: How the Geographic Distribution of Partisans Determines the Electoral Responsiveness and Bias of Legislative Elections," (with David Cottrell). 2014 APSA.

"Gerrymandering for Money: Drawing districts with respect to donors rather than voters." 2014 MPSA.

"Constituent Age and Legislator Responsiveness: The Effect of Constituent Opinion on the Vote for Federal Health Reform." (with Katharine Bradley) 2012 MPSA.

"Voter Partisanship and the Mobilizing Effect of Presidential Advertising." (with Kyle Dropp) 2012 MPSA.

"Recency Bias in Retrospective Voting: The Effect of Distributive Benefits on Voting Behavior." (with Andrew Feher) 2012 MPSA.

"Estimating the Political Ideologies of Appointed Public Bureaucrats," (with Adam Bonica and Tim Johnson) 2012 Annual Meeting of the Society for Political Methodology (University of North Carolina)

"Tobler's Law, Urbanization, and Electoral Bias in Florida." (with Jonathan Rodden) 2010 Annual Meeting of the Society for Political Methodology (University of Iowa)

"Unionization and Presidential Control of the Bureaucracy" (with Tim Johnson) 2011 MPSA.

"Estimating Bureaucratic Ideal Points with Federal Campaign Contributions" 2010 APSA. (Washington, DC).

"The Effect of Electoral Geography on Pork Spending in Bicameral Legislatures," Vanderbilt University Conference on Bicameralism, 2009.

"When Do Government Benefits Influence Voters' Behavior? The Effect of FEMA Disaster Awards on US Presidential Votes," 2009 APSA (Toronto, Canada).

"Are Poor Voters Easier to Buy Off?" 2009 APSA (Toronto, Canada).

"Credit Sharing Among Legislators: Electoral Geography's Effect on Pork Barreling in Legislatures," 2008 APSA (Boston, MA).

"Buying Votes with Public Funds in the US Presidential Election," Poster Presentation at the 2008 Annual Meeting of the Society for Political Methodology (University of Michigan).

"The Effect of Electoral Geography on Pork Spending in Bicameral Legislatures," 2008 MPSA.

"Legislative Free-Riding and Spending on Pure Public Goods," 2007 MPSA (Chicago, IL).

"Free Riding in Multi-Member Legislatures," (with Neil Malhotra) 2007 MPSA (Chicago, IL).

"The Effect of Legislature Size, Bicameralism, and Geography on Government Spending: Evidence from the American States," (with Neil Malhotra) 2006 APSA (Philadelphia, PA).

Reviewer Service:

American Journal of Political Science
American Political Science Review
Journal of Politics
Quarterly Journal of Political Science
American Politics Research
Legislative Studies Quarterly
State Politics and Policy Quarterly
Journal of Public Policy
Journal of Empirical Legal Studies
Political Behavior
Political Research Quarterly
Political Analysis
Public Choice
Applied Geography

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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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