No. ______

IN THE SUPREME COURT OF ILLINOIS

TONY MCCOMBIE, in her official capacity as Minority Leader of the Illinois House of Representatives and individually as a registered voter; ROBERT BERNAS, individually as a registered voter; THOMAS J. BROWN, individually as a registered voter; and SERGIO CASILLAS VAZQUEZ, individually as a registered voter; JOHN COUNTRYMAN, individually as a registered voter; and ASHLEY HUNSAKER, individually as a registered voter, Plaintiffs, v. ILLINOIS STATE BOARD OF ELECTIONS and JENNIFER M. BALLARD CROFT, CRISTINA D. CRAY, LAURA K. DONAHUE, TONYA L. GENOVESE, CATHERINE S. MCCRORY, RICK S. TERVEN, SR., CASANDRA B. WATSON, and JACK VRETT, all named in their official capacities as members of the State Board of Elections, Defendants.	Original Action under Article IV, Section 3 of the Illinois Constitution

EXPERT REPORT OF JOWEI CHEN, Ph.D.

I, Dr. Jowei Chen, upon my oath, declare and say as follows:

1. I am over the age of eighteen (18) and competent to testify as to the matters set forth herein.

2. 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 and a Research Associate at the Spatial Social Science Laboratory at Stanford University. 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.

3. I have published academic papers on legislative districting and political geography in several political science journals, including *Yale Law Journal*, *Stanford Law Review*, *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. In 2019, Common Cause honored me as a "Defender of Democracy" for developing the use of random computer-simulated districting maps in partisan gerrymandering court challenges around the country.[1]

4. 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] https://www.commoncause.org/press-release/common-cause-honors-four-defenders-of-democracy/

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); *Adams v. DeWine* (Ohio 2021); *Harper v. Hall* (N.C. Super. 2021); *Rivera v. Schwab and Abbott* (Wyandotte County D. Ct. 2022); *Norelli v. David Scanlan* (Hillsborough County Super. Ct. 2022); *Republican Part of New Mexico v. Oliver et al.* (Lea County D. Ct. 2023). I have testified 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); *Harper v. Hall* (N.C. Super.

2021); *Rivera v. Schwab and Abbott* (Wyandotte County D. Ct. 2022); *Republican Part of New Mexico v. Oliver et al.* (Lea County D. Ct. 2023).

5. I have been retained by Plaintiffs' counsel in the above-captioned matter. I am being compensated $700 per hour for my work in this case.

6. ***Questions Addressed:*** Plaintiffs' counsel asked me to analyze Illinois' state house districting map (hereinafter: the "Enacted Plan"), as passed by the Illinois General Assembly through Senate Bill 927 and signed into law by Governor Pritzker on September 24, 2021. Plaintiffs' counsel instructed me to produce a set of random, non-partisan computer-simulated plans for Illinois' state House districts adhering to the traditional districting criteria of population equality, contiguity, and compactness, as detailed later in this report. Plaintiffs' counsel also instructed me to ensure that each computer-simulated plan contains at least as many majority-Black and majority-Latino districts as the Enacted Plan. Plaintiffs' counsel asked me to answer the following questions:

> 1) What are the compactness scores of House District 89 in the 1981 Legislative Redistricting Commission plan (the "*Schrage* District"), which was invalidated by the Illinois Supreme Court in *Schrage v. State Bd. of Elections* (1981)?
>
> 2) What are the compactness scores of the districts in the Enacted Plan, and do any Enacted Plan districts have worse compactness scores than the *Schrage* District?
>
> 3) What are the Black and Latino percentages of the Enacted Plan districts, and how many majority-Black and majority-Latino districts does the Enacted Plan contain?
>
> 4) Taking into account the goal of creating at least as many majority-Black and majority-Latino districts as the Enacted Plan, is it necessary to draw House districts that are less compact than the *Schrage* District?
>
> 5) How do the computer-simulated plans compare to the Enacted Plan in terms of partisanship, both statewide and at the district level?
>
> 6) How do the majority-Black districts in the Enacted Plan compare to simulated majority-Black districts with respect to both their compactness and their partisan composition?

7. ***Summary of Findings:*** I digitized the *Schrage* District and measured its compactness using the Reock and Polsby-Popper scores. I then found that 52 of the 118 House districts in the current Enacted Plan exhibit worse compactness scores than the *Schrage* District's scores. By programming a partisan-blind algorithm to produce a large number of computer-simulated maps, I determined that when drawing a statewide House plan, it is not necessary to draw districts that are less compact than the *Schrage* District. All 10,000 of the computer-simulated plans that the algorithm produced either match or exceed the Enacted Plan's number of majority-Black and majority-Latino districts, and none of the simulated plans contain a single district with compactness scores worse than the *Schrage* District's Reock or Polsby-Popper scores.

8. Furthermore, using the results of recent competitive statewide elections from 2014 to 2022, I found that the Enacted Plan creates a significant pro-Democratic electoral bias, resulting in 4 to 11 fewer Republican-favoring districts when compared to the median outcome among the non-partisan computer-simulated plans. Using each of these competitive statewide elections, the partisan difference between the Enacted Plan and the computer-simulated maps is statistically significant, with the Enacted Plan creating fewer Republican-favoring districts than nearly all the computer-simulated plans.

9. Importantly, the Enacted Plan's pro-Democratic electoral bias is largest in elections in which Republican candidates have their strongest performances. When Republican candidates win 47% to 52% of the statewide vote, the Enacted Plan delivers the greatest reduction in the number of Republican-favoring districts, compared to the median computer-simulated plan. By creating the largest pro-Democratic electoral bias in elections in which Republican candidates have their strongest performances, the Enacted Plan effectively serves as

an insurance policy for the House Democrats, insuring against large seat losses when Democratic candidates have their worst performances in terms of statewide vote share.

10. A district-level comparison of the Enacted Plan to the computer-simulated plans reveals how the Enacted Plan created this significant degree of partisan bias: When compared to the simulated plans, the Enacted Plan effectively removed Republican voters from districts that would otherwise have been electorally competitive or slightly Republican-leaning, thus weakening these districts' likelihood of electing a Republican. These displaced Republican voters were instead placed in districts that were already extremely safe Republican or extremely safe Democratic districts; placing these Republican voters into such lopsided districts had almost no effect on these districts' likelihood of electing a Republican or a Democrat.

11. I found that the Enacted Plan's mapmakers carried out this strategy by sacrificing the compactness of the majority-Black districts in Cook County in order to add Republican voters to these otherwise extremely Democratic districts. Almost all of the Enacted Plan's majority-Black districts in Cook County have compactness scores lower than the *Schrage* District, and these majority-Black districts also have more Republican voters than the vast majority of the computer-simulated plans' majority-Black districts. Visually, it is clear how these two outlier characteristics of the Enacted Plan's majority-Black districts are related: The Enacted Plan's mapmakers created long, thin, non-compact districts in order to connect majority-Black districts in Cook County to Republican precincts in the suburbs of the Chicago metro area. Connecting these Republican voters into majority-Black, heavily Democratic districts through very long, thin, non-compact districts effectively removed these Republicans from suburban districts that would have been more electorally competitive or Republican-leaning.

12. This report is organized as follows: I first analyze the compactness of the *Schrage* District and identify the Enacted Plan districts with worse compactness scores than the *Schrage* District. I then identify the majority-Black and majority-Latino districts in the Enacted Plan. Next, I describe the computer-simulated plans, which are programmed to create at least as many majority-Black and majority-Latino districts as the Enacted Plan, while avoiding districts less compact than the *Schrage* District. I compare the partisan characteristics of the Enacted Plan to the computer-simulated plans, both statewide and at a district-by-district level. Finally, I compare the majority-Black districts in the Enacted Plan to those in the simulated plans, both in terms of their compactness and their partisanship.

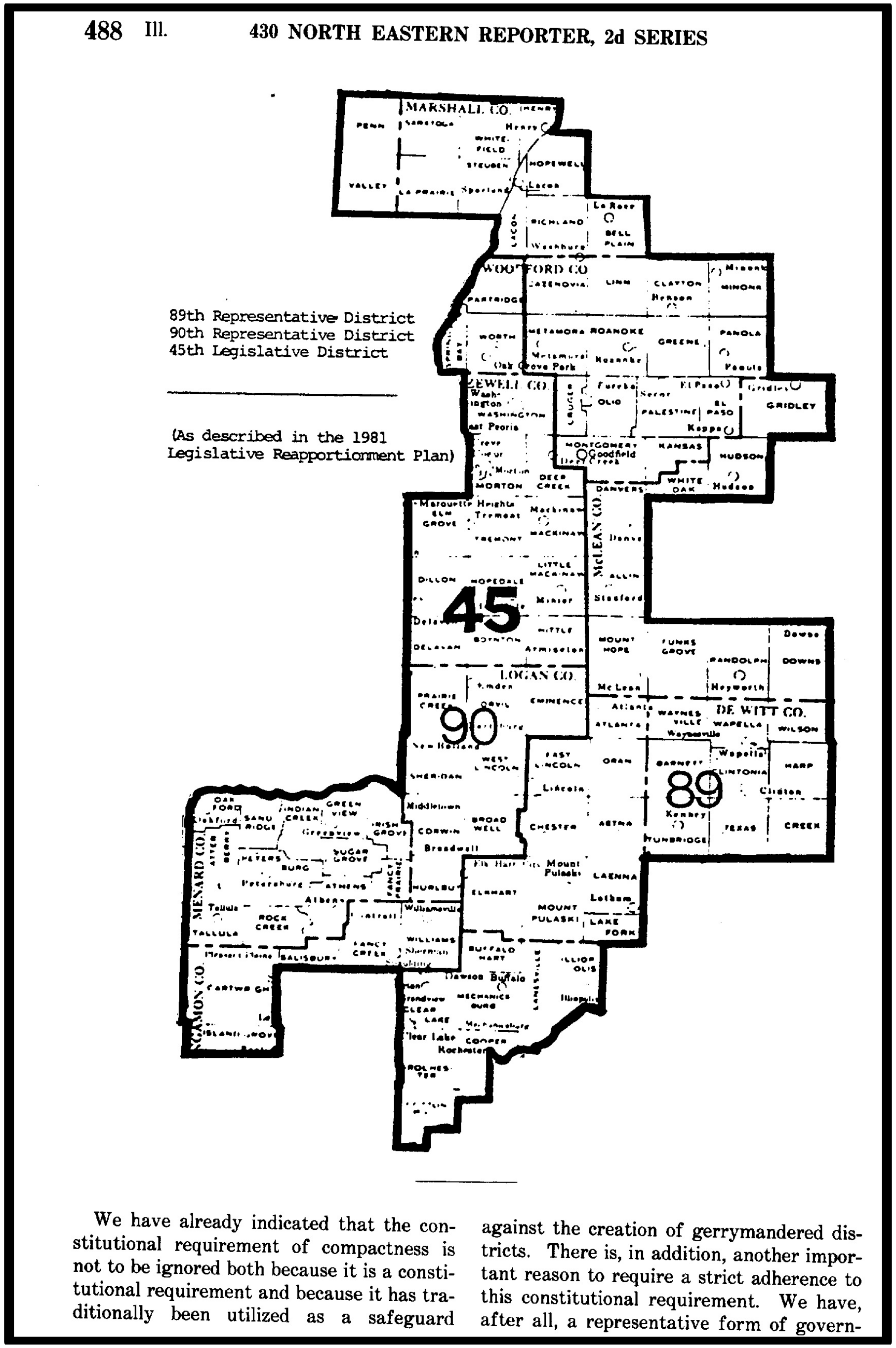
Compactness Scores of the 2021 Enacted House Plan Districts And *Schrage v. State Bd. of Elections* (1981)

13. In *Schrage v. State Bd. of Elections* (1981), the Illinois Supreme Court invalidated House District 89 in the 1981 House Plan (hereinafter: the "*Schrage* District"). Plaintiffs' counsel provided me a copy of the Supreme Court's opinion in the case, which included a visual depiction of the invalidated *Schrage* District, as well as the legal description of the invalidated district prepared by the Legislative Redistricting Commission in 1981.

14. Based on this legal description as well as the Supreme Court's visual depiction, I produced a digitization of the invalidated *Schrage* District. The map on the right half of Figure 1 displays my digitization of the *Schrage* District. As detailed in the Legislative Redistricting Commission's legal description, the borders of the *Schrage* District mostly follow township boundaries and includes portions of DeWitt, Logan, Marshall, McLean, Sangamon, Stark, and Woodford Counties. The left half of Figure 1 displays the Illinois Supreme Court's visual depiction of the invalidated *Schrage* District, House District 89, as well as the adjoining House

Figure 1: The 1981 House Plan District 89, Invalidated in Schrage v. State Bd. of Elections (1981)

Illinois Supreme Court's Visual Depiction of House District 89, Invalidated in Schrage v. State Bd. of Elections (1981):



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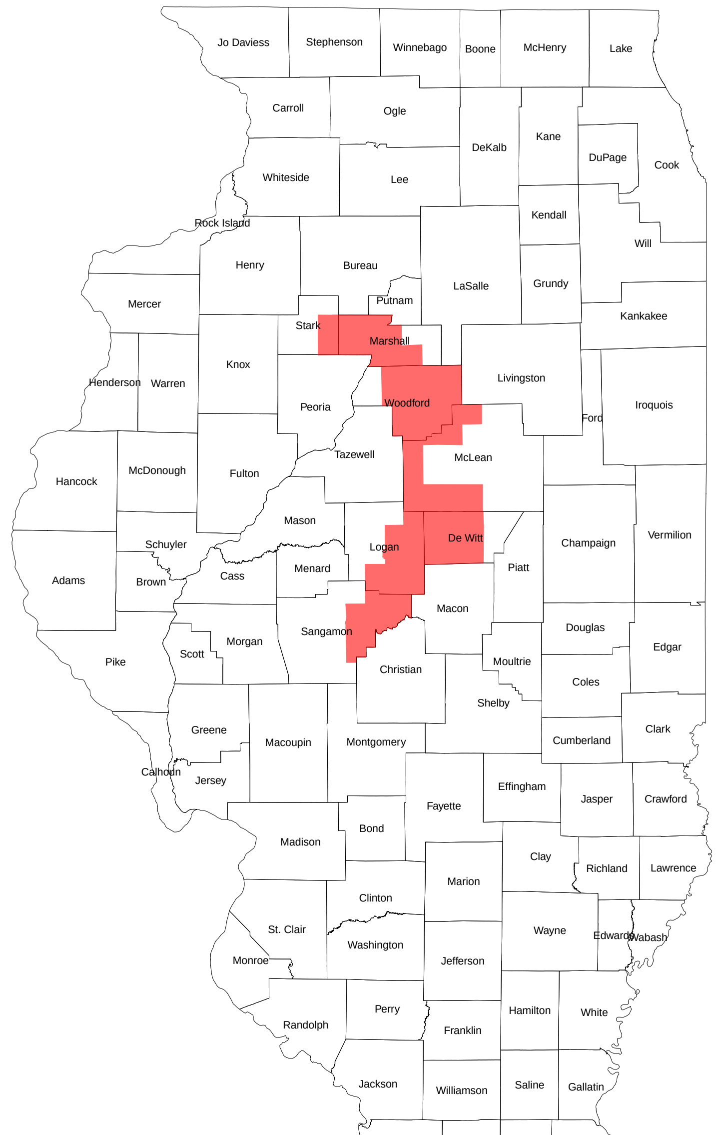
We have already indicated that the constitutional requirement of compactness is not to be ignored both because it is a constitutional requirement and because it has traditionally been utilized as a safeguard against the creation of gerrymandered districts. There is, in addition, another important reason to require a strict adherence to this constitutional requirement. We have, after all, a representative form of govern-

Digitization of 1981 House Plan District 89, Based on Legislative Redistricting Commission's Legal Description:



Compactness Scores for 1981 House Plan District 89:

Reock: 0.29395

Polsby−Popper: 0.17476

District 90. Together, these two House Districts comprised Senate District 45 in the original 1981 Senate Plan and are both displayed in the Supreme Court's map.

15. Next, I calculated the compactness scores for the invalidated *Schrage* District using my digitization of the original House District 89 from the 1981 House Plan. I calculated the compactness of the *Schrage* District, as well as all other House districts analyzed in this report, using the two most common measures of compactness in redistricting: The Polsby-Popper score and the Reock score. Both measures of compactness are commonly used by redistricting map-drawers across many states, as well as in the academic literature by scholars of redistricting.

16. ***The Polsby-Popper Score***: The Polsby-Popper score for any 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, on a scale of 0 to 1. Therefore, higher Polsby-Popper scores indicate greater district compactness, while lower scores indicate a less compact district. I found that the *Schrage* District has a Polsby-Popper score of 0.17476.

17. ***The Reock Score:*** The Reock score for any 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, on a scale of 0 to 1. Therefore, higher Reock scores indicate more geographically compact districts, while lower scores indicate a less compact district. I found that the *Schrage* District has a Reock score of 0.29395.

18. I then calculated the Polsby-Popper and Reock scores for each of the 118 House Districts in the 2021 Enacted Plan and compared them to the compactness scores for the *Schrage* District. Table 1 reports the Polsby-Popper and Reock scores for each Enacted Plan district. To calculate these compactness scores for the Enacted Plan districts, I obtained a shapefile of the

Table 1:
Compactness Scores of Districts in the 2021 Enacted House Plan

House District:	Reock:	Polsby−Popper:
1	0.15051	0.14744
2	0.31472	0.29501
3	0.09530	0.12380
4	0.12748	0.17932
5	0.11052	0.13195
6	0.18095	0.14860
7	0.36611	0.30686
8	0.12875	0.10367
9	0.21381	0.20836
10	0.29289	0.18621
11	0.27788	0.20194
12	0.36166	0.29245
13	0.26927	0.19544
14	0.33254	0.33464
15	0.23540	0.16826
16	0.27475	0.24617
17	0.29095	0.29357
18	0.25530	0.23050
19	0.38585	0.26224
20	0.49797	0.23954
21	0.30283	0.12603
22	0.45000	0.53501
23	0.31080	0.28612
24	0.49762	0.19740
25	0.14344	0.12834
26	0.07890	0.06947
27	0.10194	0.09692
28	0.13664	0.13729
29	0.23807	0.23525
30	0.37229	0.19913
31	0.10515	0.09916
32	0.07526	0.10035
33	0.13414	0.13818
34	0.16653	0.17479
35	0.15911	0.19840
36	0.18383	0.24641
37	0.49515	0.45198
38	0.36934	0.36961
39	0.16659	0.21029
40	0.31392	0.22507
41	0.43663	0.23720
42	0.41195	0.36217
43	0.33774	0.21376
44	0.51380	0.50683
45	0.34743	0.19491
46	0.25655	0.22270
47	0.44624	0.25089
48	0.26595	0.28996
49	0.35517	0.14578
50	0.59975	0.45115
51	0.51863	0.32703
52	0.28821	0.22835
53	0.21706	0.28230
54	0.38815	0.33188
55	0.48358	0.21618
56	0.15262	0.14532
57	0.27836	0.15172
58	0.44411	0.32990
59	0.25696	0.15978
60	0.38063	0.17621
61	0.45218	0.29257
62	0.30969	0.20854
63	0.40486	0.35027
64	0.39283	0.36559
65	0.51698	0.37754
66	0.34741	0.25311
67	0.37212	0.18096
68	0.19594	0.12986
69	0.33588	0.28796
70	0.33109	0.32814
71	0.27398	0.31271
72	0.20595	0.29931
73	0.39054	0.26950
74	0.32750	0.30222
75	0.60195	0.48256
76	0.20716	0.17881
77	0.27253	0.20956
78	0.46178	0.33553
79	0.29719	0.27424
80	0.16808	0.16807
81	0.44646	0.32610
82	0.46744	0.33096
83	0.29124	0.19181
84	0.41963	0.40512
85	0.42850	0.33283
86	0.41957	0.47076
87	0.61413	0.57233
88	0.51512	0.36578
89	0.19074	0.20005
90	0.23099	0.26822
91	0.13086	0.17266
92	0.49048	0.24659
93	0.36944	0.33567
94	0.36951	0.19385
95	0.18839	0.10420
96	0.11195	0.12389
97	0.54478	0.29932
98	0.39992	0.23176
99	0.20941	0.23077
100	0.36581	0.43042
101	0.28520	0.19940
102	0.44218	0.29269
103	0.40100	0.31321
104	0.27333	0.20442
105	0.51933	0.34229
106	0.35049	0.29339
107	0.55184	0.48949
108	0.41796	0.30151
109	0.42182	0.27230
110	0.35234	0.36788
111	0.39846	0.21951
112	0.35272	0.16950
113	0.23945	0.16647
114	0.44102	0.23733
115	0.41699	0.42057
116	0.32092	0.35037
117	0.49569	0.31288
118	0.45068	0.30316

Note: Highlighted scores indicate districts with a lower Reock score or a lower Polsby−Popper score than District 89 in the 1981 House Plan, which was invalidated in Schrage v. State Bd. of Elections (1981).

Enacted Plan districts from the Illinois State Board of Elections website.[2] All scores that are lower than the *Schrage* District's compactness scores are highlighted in yellow in Table 1.

19. In total, 52 of the 118 House districts in the 2021 Enacted Plan have compactness scores lower than the *Schrage* District, as detailed in Table 2. In the Enacted Plan, 49 House districts have a lower Reock score than the *Schrage* District, while 25 House districts have a lower Polsby-Popper score than the *Schrage* District. 22 House Districts have both a lower Reock score and a lower Polsby-Popper score than the *Schrage* District.

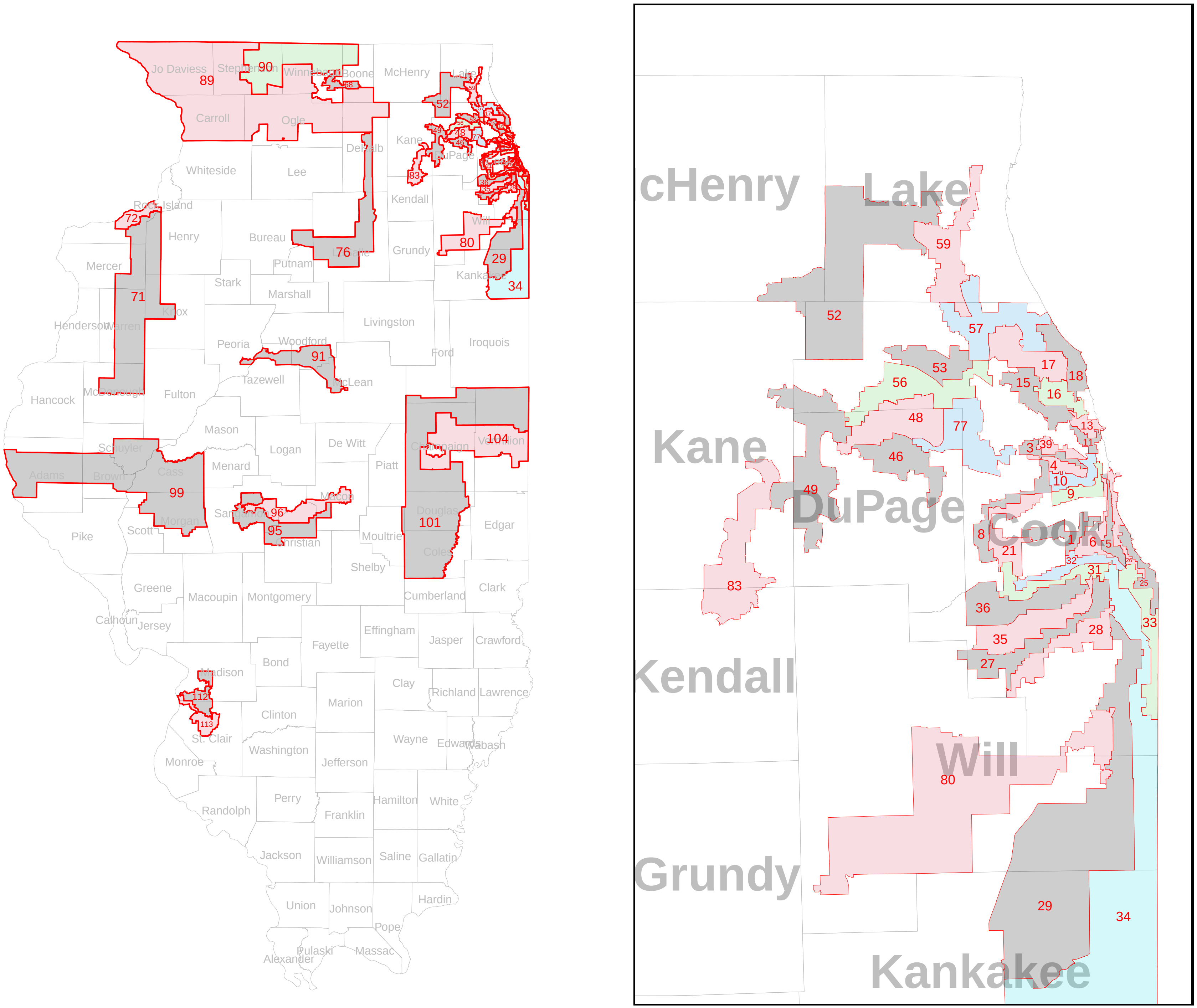
Table 2:

2021 Enacted Plan Districts with Both Lower Reock and Lower Polsby-Popper Scores than the Schrage District:	22 House Districts
2021 Enacted Plan Districts with Lower Reock Scores (but Higher Polsby-Popper Scores) than the Schrage District:	27 House Districts
2021 Enacted Plan Districts with Lower Polsby-Popper Scores (but Higher Reock Scores) than the Schrage District:	3 House Districts

20. Figure 2 presents a map identifying the 2021 Enacted House Plan districts that have lower compactness scores than the *Schrage* District. The districts shaded in Figure 2 are the 52 Enacted Plan districts that have a lower Reock score than the *Schrage* District, a lower Polsby-Popper score than the *Schrage* District, or both. The Figure 2 map illustrates that these 52 Enacted Plan districts are located throughout the state. Many of these districts are primarily

[2] The shapefile was downloaded from: https://www.elections.il.gov/agencyforms/Redistricting%202022%20Shape%20Files/IL%20State%20Representative%20Districts/

Figure 2:
2021 House Plan Districts with Compactness Scores Lower than District 89 from the 1981 House Plan (Schrage v. State Bd. of Elections)



based in the Chicago metropolitan area, but many others are in the Central and Western portions of the state, while two are in the Metro East area.

21. Across its 118 House districts, the 2021 Enacted Plan exhibits an average Reock score of 0.32665 and an average Polsby-Popper score of 0.25798. Plaintiffs' counsel instructed me to ensure that all computer-simulated House districting plans produced and analyzed in this report exhibit an average Reock score no lower than the Enacted Plan's average Reock score and an average Polsby-Popper score no lower than the Enacted Plan's average Polsby-Popper score.

Majority-Black and Majority-Latino Districts in the 2021 Enacted House Plan

22. Plaintiffs' counsel asked me to determine the number of majority-Black and majority-Latino districts in the 2021 Enacted Plan. I obtained the block assignment file of the Enacted Plan from the Illinois State Board of Elections website.[3] I analyzed this block assignment file to calculate the racial and ethnic characteristics of the Enacted Plan districts. For each district in the Enacted Plan, I calculated the Latino share and the Black share of the Voting Age Population (VAP) and of the Citizen Voting Age Population (CVAP). The VAP calculations come from 2020 Census data, while the CVAP calculations come from the most recent American Community Survey, as described below.

23. **2020 Census P.L. 94-171 Redistricting Data:** The racial and ethnic breakdowns of the VAP in this report are calculated from block-level 2020 Census data. After each decade's Census, the Bureau releases redistricting data summary files per Public Law (PL) 94-171 (the "PL 94-171 redistricting data"). These data files report each Census block's population count, as

[3] The block assignment file was downloaded from: https://www.elections.il.gov/agencyforms/Redistricting%202022%20Shape%20Files/IL%20State%20Representative%20Districts/

well as various racial and ethnic breakdowns of each block's population. The PL 94-171 redistricting data report these racial and ethnic counts for the Voting Age Population, but not for the Citizen Voting Age Population.

24. **American Community Survey (ACS) 5-Year Estimates:** The ACS is a continually ongoing survey that samples a small percentage of the US population. For each 5-year period (e.g., 2015-2019), the Census Bureau releases ACS estimates based on survey responses collected during the period. ACS estimates are often used to measure various population characteristics, such as a racial minority's share of the total population or Citizen Voting Age Population (CVAP). To analyze the racial and ethnic breakdown of the Enacted Plan's districts, I use the 2015-2019 ACS 5-Year estimates, as these data were the most recent ACS estimates available when the General Assembly drew the 2021 Enacted Plan.

25. The ACS 5-Year estimates are released at the level of Census block groups, but not at the level of individual Census blocks. I thus disaggregate the ACS 5-Year estimates down to the block level, to estimate the racial and ethnic breakdown of the CVAP in each district. It is common for experts to disaggregate ACS 5-Year block group CVAP estimates in this manner. Specifically, disaggregating ACS 5-Year data down to the block level means that each ACS-reported population at the block group level must be allocated among the individual blocks within the block group. For example, suppose that the ACS reports that 100 individuals reside in block group 1, and this block group consists of Census Blocks A, B, and C. The process of disaggregation requires that we estimate how many of these 100 individuals reside within Census Block A, how many reside within Block B, and how many reside in Block C. As is typical for redistricting experts working with ACS CVAP estimates, I disaggregate the CVAP estimates for any block group down to its individual Census blocks by using the 2020 Census Voting Age

Population (VAP) of each block. Using the earlier example, if the ACS estimates that 100 individuals reside within block group 1, then I allocate these 100 individuals to the three Census blocks within the block group proportionally, based on the VAP of the three Census blocks. Disaggregating CVAP estimates from the block group to the block level in this manner is common among redistricting experts and academic scholars of redistricting.

26. Table 3 reports the racial and ethnic characteristics of each district in the 2021 Enacted House Plan. Specifically, each row reports the calculations for one district within the Enacted Plan. Within each row, the second column reports the Latino share of the district's VAP, while the third column reports the Black share of the district's VAP. The calculations in this third column includes multi-racial Blacks and is sometimes referred to as "Any-Part Black" VAP.

27. The fourth column in Table 3 reports the Latino share of each district's CVAP. The fifth column reports the single-race Black share of the district's CVAP. "Single-race Black" refers to those individuals who identify only as Black and does not include anyone identifying as multi-racial.

28. The ACS CVAP data do not include breakdowns for every possible multi-racial combination. However, the ACS CVAP data do include breakdowns for two multi-racial groups that are partially Black: Individuals who are both Black and White, as well as individuals who are both Black and Native American. I therefore combine these multi-racial Blacks with single-race Blacks together to calculate the "Total Black" share of each district's CVAP. Hence, the "Total Black CVAP" of each district counts both single-race Blacks, as well as all groups of multi-racial Blacks for whom the ACS reports data.

Table 3:
Racial and Ethnic Composition of Districts in the 2021 Enacted House Plan

House District:	Latino VAP (2020 Census):	Any−Part Black VAP (2020 Census):	Latino CVAP (2015−19 ACS):	Single−Race Black CVAP (2015−19 ACS):	Total Black CVAP (2015−19 ACS):
1	76.09%	6.40%	64.78%	9.58%	9.79%
2	64.57%	4.42%	55.28%	4.13%	4.18%
3	54.13%	5.89%	47.61%	4.97%	5.31%
4	52.65%	14.45%	45.42%	15.97%	16.32%
5	5.00%	53.42%	4.41%	54.50%	55.28%
6	26.19%	47.41%	13.83%	57.72%	58.25%
7	22.49%	44.05%	14.58%	48.42%	49.11%
8	15.11%	51.26%	10.16%	54.59%	54.94%
9	9.32%	42.30%	8.01%	46.24%	46.73%
10	11.41%	40.77%	7.79%	43.03%	43.83%
11	9.43%	4.74%	8.19%	3.59%	4.07%
12	6.45%	5.55%	5.28%	5.39%	5.83%
13	14.24%	12.58%	11.41%	9.64%	10.30%
14	16.96%	20.98%	12.37%	19.19%	20.41%
15	14.48%	3.30%	12.53%	2.42%	2.62%
16	14.42%	10.15%	11.65%	8.37%	8.69%
17	6.67%	4.51%	5.03%	3.68%	3.88%
18	9.15%	14.60%	7.50%	13.36%	13.99%
19	27.32%	3.48%	24.04%	2.16%	2.74%
20	19.02%	1.78%	16.02%	1.06%	1.20%
21	51.74%	7.35%	42.79%	7.25%	7.44%
22	62.79%	2.50%	52.75%	2.66%	2.73%
23	84.44%	7.83%	71.16%	16.51%	16.69%
24	48.50%	4.68%	43.71%	3.77%	4.07%
25	18.15%	56.46%	16.61%	56.74%	57.77%
26	5.51%	48.26%	4.12%	52.56%	53.00%
27	6.49%	53.35%	4.93%	53.21%	53.72%
28	15.49%	46.75%	11.06%	49.79%	50.37%
29	6.12%	58.85%	3.98%	57.83%	58.39%
30	15.74%	53.25%	9.19%	55.78%	56.51%
31	11.23%	53.50%	8.81%	56.92%	57.37%
32	31.17%	52.22%	19.27%	61.51%	62.40%
33	20.83%	64.65%	15.68%	66.07%	66.62%
34	8.58%	69.16%	5.01%	68.22%	68.74%
35	8.67%	22.11%	6.99%	21.94%	22.23%
36	14.12%	14.12%	11.46%	14.13%	14.28%
37	6.40%	2.40%	5.50%	1.22%	1.39%
38	5.82%	48.67%	4.23%	49.33%	49.58%
39	51.61%	4.92%	45.66%	3.11%	3.58%
40	42.76%	5.62%	34.59%	4.86%	5.49%

Table 3 (Continued):
Racial and Ethnic Composition of Districts in the 2021 Enacted House Plan

House District:	Latino VAP (2020 Census):	Any−Part Black VAP (2020 Census):	Latino CVAP (2015−19 ACS):	Single−Race Black CVAP (2015−19 ACS):	Total Black CVAP (2015−19 ACS):
41	8.05%	5.85%	5.71%	5.63%	5.99%
42	7.55%	5.34%	5.87%	4.22%	4.66%
43	51.19%	7.12%	35.00%	7.73%	8.16%
44	26.93%	5.84%	19.65%	5.74%	6.30%
45	9.85%	3.37%	7.67%	2.90%	3.15%
46	23.85%	6.43%	15.12%	6.87%	7.62%
47	7.79%	4.17%	4.79%	3.92%	4.14%
48	12.35%	2.61%	9.00%	2.30%	2.42%
49	23.85%	4.79%	16.44%	3.84%	4.23%
50	48.78%	8.85%	36.91%	9.47%	9.94%
51	6.23%	1.86%	3.83%	1.63%	1.73%
52	9.57%	1.66%	6.17%	1.36%	1.46%
53	14.22%	3.37%	8.42%	2.96%	3.17%
54	14.00%	2.80%	8.73%	1.94%	2.30%
55	12.06%	3.16%	10.24%	3.34%	3.62%
56	16.91%	4.12%	11.73%	3.53%	3.88%
57	14.12%	1.87%	8.82%	1.93%	2.18%
58	9.75%	4.87%	6.65%	3.44%	3.78%
59	18.89%	2.85%	11.93%	2.51%	2.91%
60	50.27%	20.79%	31.34%	26.81%	28.00%
61	23.22%	13.35%	14.33%	11.71%	12.30%
62	27.32%	4.80%	16.89%	4.16%	4.59%
63	13.59%	1.64%	8.22%	1.37%	1.73%
64	9.04%	2.09%	6.45%	1.46%	1.57%
65	9.81%	2.36%	7.16%	2.24%	2.69%
66	16.92%	3.89%	11.77%	2.39%	2.75%
67	16.53%	22.04%	10.16%	20.19%	20.77%
68	17.48%	11.00%	11.29%	10.21%	11.07%
69	13.67%	2.05%	8.95%	2.05%	2.23%
70	9.00%	2.57%	6.65%	2.29%	2.37%
71	6.07%	8.40%	4.54%	5.76%	6.24%
72	13.74%	13.07%	10.59%	10.09%	11.03%
73	2.66%	1.57%	1.74%	0.85%	1.06%
74	12.24%	3.57%	9.27%	2.81%	3.07%
75	12.33%	5.01%	9.48%	4.66%	4.93%
76	11.66%	8.05%	7.64%	6.80%	7.15%
77	52.73%	3.99%	43.69%	3.02%	3.20%
78	14.76%	32.86%	10.54%	32.46%	33.19%
79	8.81%	25.64%	5.72%	23.34%	23.80%
80	15.37%	27.94%	11.05%	27.52%	28.15%

Table 3 (Continued):
Racial and Ethnic Composition of Districts in the 2021 Enacted House Plan

House District:	Latino VAP (2020 Census):	Any−Part Black VAP (2020 Census):	Latino CVAP (2015−19 ACS):	Single−Race Black CVAP (2015−19 ACS):	Total Black CVAP (2015−19 ACS):
81	6.81%	4.99%	5.80%	4.46%	4.69%
82	7.50%	3.51%	6.37%	4.03%	4.28%
83	20.63%	7.18%	14.35%	6.11%	6.59%
84	18.69%	11.93%	15.52%	12.09%	12.65%
85	23.27%	15.65%	14.71%	15.82%	16.64%
86	30.41%	17.34%	18.44%	19.37%	20.21%
87	2.14%	2.55%	1.83%	2.67%	2.82%
88	2.88%	4.65%	1.80%	3.99%	4.37%
89	4.43%	1.77%	2.38%	0.58%	0.98%
90	5.12%	6.49%	3.11%	5.12%	5.72%
91	5.84%	11.06%	3.75%	8.47%	8.92%
92	6.15%	28.14%	3.81%	25.20%	26.48%
93	3.10%	2.61%	1.91%	2.15%	2.32%
94	1.77%	1.87%	1.23%	1.71%	1.86%
95	2.18%	9.00%	1.49%	7.14%	7.67%
96	2.89%	29.14%	2.00%	23.80%	25.41%
97	15.85%	9.56%	13.63%	9.32%	9.66%
98	22.57%	15.26%	17.34%	14.16%	14.72%
99	3.98%	6.72%	2.33%	6.18%	6.48%
100	1.23%	1.49%	0.77%	1.10%	1.18%
101	4.04%	2.91%	2.64%	2.07%	2.33%
102	1.68%	2.92%	1.28%	2.94%	3.08%
103	9.19%	18.49%	5.83%	17.03%	17.85%
104	5.51%	15.04%	3.33%	14.39%	14.87%
105	2.91%	2.51%	2.14%	2.32%	2.52%
106	5.87%	1.47%	3.82%	0.85%	1.09%
107	2.09%	1.01%	0.72%	0.93%	1.12%
108	1.27%	1.94%	0.93%	1.65%	1.79%
109	2.67%	2.70%	1.80%	2.30%	2.38%
110	1.99%	3.85%	1.11%	3.75%	4.06%
111	3.38%	10.04%	1.71%	8.05%	8.47%
112	5.66%	15.67%	3.38%	13.58%	14.40%
113	4.64%	31.21%	3.74%	25.47%	26.33%
114	2.38%	34.90%	1.52%	37.98%	38.24%
115	2.44%	5.92%	1.67%	6.56%	6.65%
116	1.45%	3.21%	1.26%	3.06%	3.25%
117	1.86%	4.41%	1.02%	3.83%	4.06%
118	3.79%	11.13%	2.72%	11.76%	12.29%

Note: 'Total Black CVAP' includes those identifying as single−race Black, mixed−race Black and White, or mixed−race Black and Native American.

29. In Table 3, each percentage reporting that either Latinos or Blacks comprise over 50% of a district's VAP or CVAP is highlighted in yellow. Additionally, Table 4 identifies and counts the majority-Black and majority-Latino districts in the Enacted Plan. As identified in Table 3 and summarized in Table 4, the Enacted Plan contains 11 majority-Latino VAP districts and 4 majority-Latino CVAP districts. As the Enacted Plan contains more majority-Latino VAP districts than majority-Latino CVAP districts, Plaintiffs' counsel therefore instructed me to ensure that all computer-simulated House districting plans produced and analyzed in this report also contain at least 11 majority-Latino VAP districts.

30. As identified in Table 3 and summarized in Table 4, the Enacted Plan contains 10 majority-Black VAP districts, 12 majority-single-race-Black CVAP districts, and 13 majority-Total Black CVAP districts. Among these three types of majority-Black districts, counting each district's Total Black CVAP is the broadest definition, resulting in the largest number of majority-Black districts in the Enacted Plan. Plaintiffs' counsel therefore instructed me to ensure that all computer-simulated House districting plans produced and analyzed in this report contain at least 13 majority-Total Black CVAP districts, thus either matching or exceeding the Enacted Plan's total.

The Computer-Simulated Districting Algorithm

31. ***The Use of Computer-Simulated Districting Plans:*** 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 nonpartisan districting plans that adhere to traditional districting criteria using US Census geographies as building blocks. This simulation process ignores all partisan

Table 4:
Number of Majority−Black and Majority−Latino Districts in the 2021 Enacted House Plan

2021 House Plan Districts Containing Over 50% Latino VAP:

11 Districts
(HD−1, HD−2, HD−3, HD−4, HD−21, HD−22, HD−23, HD−39, HD−43, HD−60, HD−77)

2021 House Plan Districts Containing Over 50% Any−Part Black VAP:

10 Districts
(HD−5, HD−8, HD−25, HD−27, HD−29, HD−30, HD−31, HD−32, HD−33, HD−34)

2021 House Plan Districts Containing Over 50% Latino CVAP:

4 Districts
(HD−1, HD−2, HD−22, HD−23)

2021 House Plan Districts Containing Over 50% Single−Race Black CVAP:

12 Districts
(HD−5, HD−6, HD−8, HD−25, HD−26, HD−27, HD−29, HD−30, HD−31, HD−32, HD−33, HD−34)

2021 House Plan Districts Containing Over 50% Total Black CVAP:

13 Districts
(HD−5, HD−6, HD−8, HD−25, HD−26, HD−27, HD−28, HD−29, HD−30, HD−31, HD−32, HD−33, HD−34)

considerations when drawing districts. Instead, the computer simulations are programmed to draw districting plans following various traditional districting goals, such as equalizing population, drawing contiguous districts, and pursuing geographic compactness. By randomly generating a large number of districting plans that closely adhere to these traditional districting criteria, I am able to assess an enacted plan drawn by a state legislature and determine whether partisan goals motivated the legislature to deviate from these traditional districting criteria. More specifically, by holding constant the application of nonpartisan, traditional districting criteria through the simulations, I can determine whether the enacted plan could have been the product of something other than partisan considerations. With respect to Illinois' 2021 Enacted House Plan, I determined that it could not.

32. I produced a set of 10,000 random computer-simulated plans for Illinois' House districts using a computer algorithm programmed to strictly follow nonpartisan, traditional districting criteria, including population equality, ensuring district contiguity, and pursuing geographic compactness. By randomly drawing districting plans with a process designed to strictly follow nonpartisan, traditional districting criteria, the computer simulation process gives us an indication of the range of districting plans that plausibly and likely emerge when mapmakers are not motivated primarily by partisan goals. By comparing the Enacted Plan against the distribution of simulated plans with respect to partisan measurements, I can determine the extent to which a mapmaker's subordination of nonpartisan districting criteria, such as geographic compactness, was motivated by partisan goals.

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

mapmakers.[4] In recent years, several courts have also relied upon computer simulations to assess partisan bias in enacted districting plans.[5]

34. ***Redistricting Criteria:*** I programmed the computer algorithm to create 10,000 independent simulated plans adhering to the following four districting criteria:

a. Population Equality: Illinois' 2020 Census population was 12,812,508, so districts in every 118-district House plan have an ideal population of 108,580.6. The Enacted House Plan's districts have populations ranging from 108,339 to 108,861. I therefore programmed the computer simulation algorithm to keep all district populations within these same bounds, with no computer-simulated district having a population smaller than 108,339 or larger than 108,861.

b. Contiguity: The simulation algorithm required all legislative districts to be geographically contiguous.

c. Racial Considerations: As explained in the previous section, Plaintiffs' counsel instructed me to ensure that every computer-simulated plan contains at least 11 majority-Latino VAP districts and at least 13 majority-Total Black CVAP districts.

d. Geographic Compactness: I determined that it was possible for the computer simulation algorithm to produce House plans in which all 118 districts have a Reock score no lower than the *Schrage* District's Reock score (0.29395) and a

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[4] *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.

[5] *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); *Harper v. Hall* (N.C. Feb 14, 2022).

Polsby-Popper score no lower than the *Schrage* District's Polsby-Popper score (0.17476), while also complying with the three afore-mentioned criteria. Therefore, I programmed the algorithm to guarantee that each of the 118 House districts in every computer-simulated plan has a Reock score and a Polsby-Popper no lower than the *Schrage* District's compactness scores. Additionally, I also programmed the algorithm to guarantee that each simulated House plan exhibits an average Reock score no lower than the 2021 Enacted Plan's average Reock score of 0.32665 and an average Polsby-Popper score no lower than the Enacted Plan's average Polsby-Popper score of 0.25798.

35. Table 5 summarizes the characteristics of the 2021 Enacted House Plan and the computer-simulated plans. As explained earlier, every computer-simulated plan contains at least 11 majority-Latino VAP districts and 13 majority-Black CVAP districts, matching or exceeding the Enacted House Plan. With respect to the districting criteria described above, the main difference between the Enacted House Plan and the computer-simulated plans is in geographic compactness. Whereas 52 House districts in the Enacted Plan have compactness scores lower than the *Schrage* District, none of the 118 districts in any of the 10,000 simulated plans exhibit Reock or Polsby-Popper scores worse than the *Schrage* District's compactness scores.

Table 5:
Summary of the Enacted 2021 House Plan and the Computer-Simulated House Plans:

	2021 Enacted House Plan:	**10,000 Computer-Simulated House Plans**
Description:	Current Enacted Plan	Simulated House maps drawn using only non-partisan districting criteria
District Populations:	108,339 to 108,861	108,339 to 108,861
Number of Majority-Black CVAP Districts:	13	13 to 15
Number of Majority-Latino VAP Districts:	11	11 to 12
Number of Districts with a Worse Reock Score than the Schrage District:	49 of 118 districts	0 districts
Number of Districts with a Worse Polsby-Popper Score than the Schrage District:	25 of 118 districts	0 districts
Number of Republican-Favoring Districts, Measured Using the Statewide Election Composite	40 Republican Districts	47 Republican Districts in the median simulated plan

Measuring the Partisanship of Districting Plans

36. In general, I use actual election results from recent, statewide election races in Illinois over the past decade to assess the partisan performance of the 2021 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-leaning districts under each election within each simulated plan and within the Enacted Plan. All 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 the partisanship of individual districts and the partisan distribution of seats in the Enacted Plan could reasonably have arisen from a non-partisan districting process adhering to traditional districting criteria. Past voting history in federal and statewide elections is a strong predictor of future voting history. 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 legislative candidates.

37. To compare the partisanship of different districts, I calculated the percentage of votes from each district favoring the Republican or the Democratic candidate in recent, competitive statewide elections, such as the Presidential, Gubernatorial, Attorney General, Secretary of State, Treasurer, Comptroller, and US Senate elections. Recent statewide elections provide a reliable basis for comparisons of different precincts' partisan tendencies because they provide information about voting patterns throughout the entire state.

38. I do not use the election results from past state House races in measuring the partisanship of districts analyzed in this report. First, many of Illinois' House of Representatives

election contests are uncontested in each election, so voters in many parts of the state are not choosing between competitive candidates from both major political parties. Second, even when both parties do field candidates, the candidates for each party are different across different districts, as is the quality of the party's candidates. In other words, state legislative election results are not measuring the same underlying voter partisanship when these results come from different state House districts. Therefore, I instead use the results of statewide elections, as every voter in Illinois chooses from among the same set of candidates on the ballot in statewide election contests.

39. 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 particularly 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. As a result, based on my expertise and my experience studying redistricting practices across many states, I have observed that legislative mapmakers generally do not rely heavily on voter registration data in assessing the partisan performance of districts. I therefore use results from recent statewide elections in order to measure the partisanship of districts in the 2021 Enacted Plan and in the computer-simulated plans, as described below.

40. ***Statewide Elections During 2014-2022:*** To measure the partisanship of each district in the computer-simulated plans and in the 2021 Enacted Plan, I used the results from each competitive statewide general election contest for a political office held in Illinois during 2014-2022. In this context, "competitive" means that the candidates had the ability to compete, regardless of whether the ultimate outcome was close. Specifically, plaintiffs' counsel instructed

me to analyze election contests in which both the Democratic and the Republican candidate expanded at least $250,000 on the election; the $250,000 threshold is relevant in Illinois because campaign contribution limits are lifted in Illinois statewide elections if a candidate reaches the self-funding threshold of $250,000 or if independent expenditures exceed $250,000. I identified 16 statewide general election contests during 2014-2022 in which both the Democrat and the Republican candidate reached $250,000 in campaign expenditures. The results of the November 2024 statewide elections in Illinois are not yet available in the form of a merged precinct shapefile, so I only analyzed statewide elections through November 2022.

41. Using this definition of competitive elections, Illinois had a total of 16 competitive statewide election contests during 2014-2022, and Table 6 lists these 16 elections. Table 6 also reports the Republican share of the two-party vote in each of these elections, along with the number of House districts in the 2021 Enacted Plan that favored the Republican candidate in each election.

42. I obtained precinct-level results for each of these 16 election contests during 2014-2022, 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 the Republican candidate than for the Democratic candidate in each election. I use these calculations to measure the partisan performance of each simulated plan analyzed in this report and of the 2021 Enacted Plan. In other words, I look at the precincts that would comprise a particular district in each simulated plan and, using the actual election results from those precincts, I calculate whether voters in that simulated district collectively cast more votes for the Republican candidate or for the Democratic candidate in each of the 16 statewide election

Table 6: List of Competitive Statewide Elections, 2014−2022

Election contest:	Republican Share of Two−Party Vote:	2021 Enacted House Plan Districts Favoring the Republican Candidate:
2014 US Senate	44.35%	47 Districts
2014 Governor	52.02%	67 Districts
2014 Comptroller	52.04%	67 Districts
2014 Treasurer	49.85%	63 Districts
2016 US President	40.98%	35 Districts
2016 US Senate	42.03%	36 Districts
2016 Comptroller	47.33%	57 Districts
2018 Governor	41.59%	37 Districts
2018 Attorney General	43.86%	40 Districts
2020 US President	41.34%	32 Districts
2020 US Senate	41.44%	33 Districts
2022 Attorney General	44.43%	37 Districts
2022 Governor	43.56%	33 Districts
2022 Secretary of State	44.53%	37 Districts
2022 Treasurer	44.47%	37 Districts
2022 US Senate	42.21%	31 Districts
Statewide Election Composite	44.33%	40 Districts

contests. I performed such calculations for each district under each simulated plan to measure the number of districts Democrats or Republicans would have won under that particular simulated districting map under each statewide election.

43. ***The Statewide Election Composite:*** In addition to calculating whether each House district favors the Republican candidate in each of the 16 separate election contests, I also aggregated together the vote counts of all 16 elections together. Specifically, for any particular district, I added up all the votes cast in favor of the 16 Republican candidates in these statewide elections, and I separately added together all the votes cast in favor of the 16 Democratic candidates in these elections. For each district, I then calculated the Republican share of the aggregated two-party votes across all 16 election contests cast by the district's voters. I refer to this aggregated Republican two-party vote share as the "Statewide Election Composite" measure. I analyze every Enacted Plan district and every computer-simulated plan district by calculating its Republican vote share using the Statewide Election Composite, as well as the Republican vote share using each the results of the 16 statewide elections separately.

44. It is common for both redistricting scholars and redistricting map-drawers to use an aggregated measure of partisanship, based on recent statewide elections, when evaluating the partisanship of a districting plan. Aggregating the results of several recent statewide elections addresses concerns about the influence of anomalous election-specific or candidate-specific factors when measuring voters' partisanship using past election results.

45. In the following section, I 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. I also present district-level

comparisons of the 2021 Enacted Plan and simulated plan districts in order to identify whether any individual districts in the Enacted Plan are partisan outliers.

Plan-Wide and District-Level Partisan Comparisons
Of the Enacted Plan and Simulated Plans

46. In this section, I present partisan comparisons of the 2021 Enacted Plan to the computer-simulated plans at both a district-by-district level as well as a plan-wide level using each of the 16 statewide election contests. First, I compare the number of Republican-favoring districts in the Enacted Plan and in the computer-simulated plans. Next, I compare the district-level Republican vote share of the Enacted Plan's districts and the districts in the computer-simulatedplans. Overall, I find that at the plan-wide level, the Enacted Plan creates a degree of partisan bias favoring Democrats that is more extreme than virtually all the computer-simulated plans. I find that the Enacted Plan creates 4 to 11 fewer Republican-favoring districts than the median computer-simulated plan. The size of this pro-Democratic electoral bias in the Enacted Plan is largest precisely in elections in which Republican candidates perform unusually well in terms of their statewide vote share.

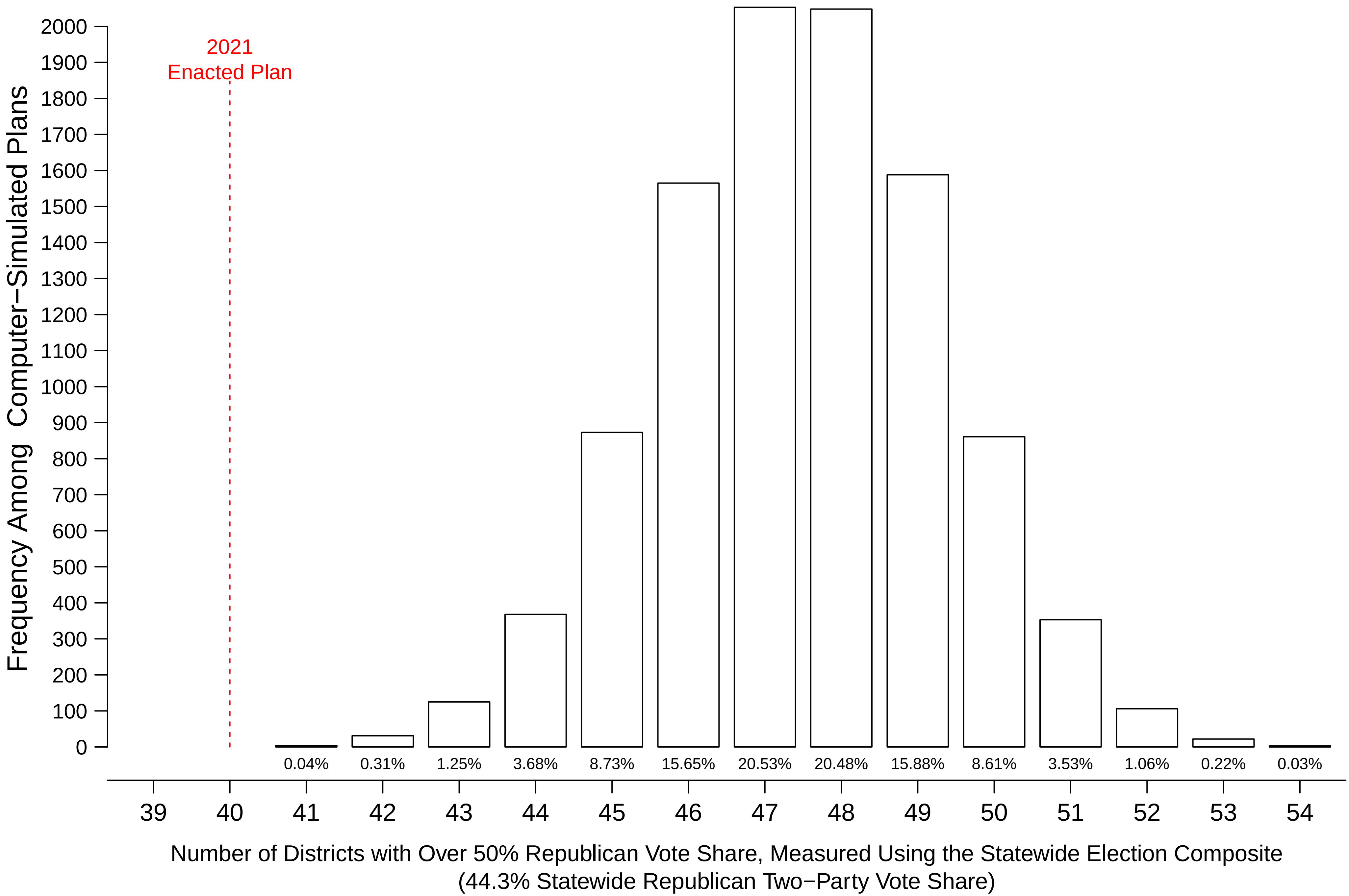
47. I also find that a large number of the individual districts in the 2021 Enacted Plan are statistical outliers, exhibiting extreme partisan characteristics that are rarely or never observed in the computer-simulated plan districts drawn with strict adherence to non-partisan, traditional districting criteria. When compared to the simulated plans, the Enacted Plan effectively removed Republican voters from districts that would otherwise have been electorally competitive or slightly Republican-leaning, thus weakening these districts' likelihood of electing a Republican. These removed Republican voters were instead placed in districts that were already extremely safe Republican or extremely safe Democratic districts; placing these

Republican voters into such lopsided districts had almost no effect on these districts' likelihood of electing a Republican or a Democrat in those safe districts.

48. I describe these findings in detail in the sections below. I first describe the plan-wide level findings regarding the pro-Democratic electoral bias created by the Enacted Plan. I later describe the individual district-level analysis, which illustrates how the Enacted Plan was able to create its significant pro-Democratic electoral bias of 4 to 11 fewer Republican-favoring districts.

49. ***Number of Democratic and Republican Districts:*** Using the Statewide Election Composite, Figure 3 compares the partisan breakdown of the computer-simulated plans to the partisanship of the Enacted Plan. In this Figure, the histogram illustrates the distribution of the 10,000 simulated plans in terms of the number of districts within each plan that favored Republicans – in other words, the number of districts with over a 50% or higher Republican vote share, measured using the Statewide Election Composite. The percentages below each bar in the histogram report the precise percentage of simulated plans that produced each number of Republican-favoring districts; for example, the Figure reports that 20.53% of the simulated plans produced exactly 47 Republican districts. Overall, the histogram reveals that the vast majority of the computer-simulated plans produced from 45 to 50 Republican-favoring districts. Meanwhile, the Enacted Plan, depicted with a dashed red line in this Figure, produced only 40 Republican-favoring districts, fewer than all 10,000 of the simulated plans. In this respect, the Enacted Plan is an extreme statistical outlier, producing fewer Republican-favoring districts than all 10,000 of the simulated plans. I thus conclude with extremely high statistical certainty that the enacted plan created a pro-Democratic partisan outcome that would not have occurred under a districting process adhering to non-partisan traditional criteria. In fact, the Enacted Plan produced seven

Figure 3: Comparison of Enacted Plan to Computer−Simulated Plans: Number of Districts with Over 50% Republican Vote Share, Measured Using the Statewide Election Composite (44.3% Statewide Republican Two−Party Vote Share)

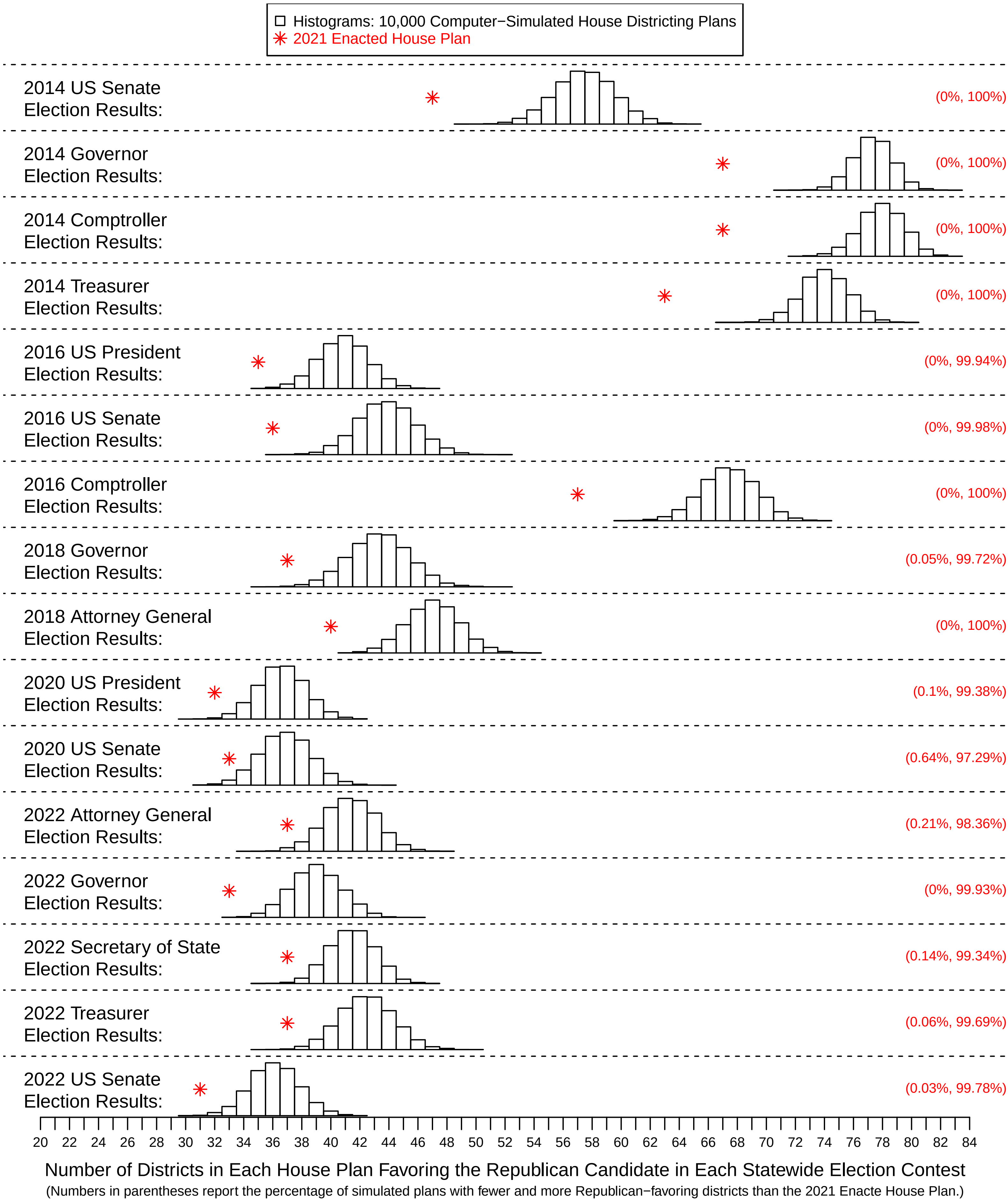


fewer Republican-favoring districts, as measured using the Statewide Election Composite, than the most common outcome among the computer-simulated plans.

50. Figure 4 compares the partisan breakdown of the computer-simulated plans to the partisanship of the Enacted Plan, using each of the individual 16 competitive statewide elections. Specifically, Figure 4 contains 16 rows, and each of the 16 rows corresponds to one of the 16 statewide elections. Within each row, a red star reports the number of districts in the Enacted Plan that favored the Republican candidate in the statewide election, while the histogram illustrates the distribution of the 10,000 simulated plans in terms of the number of districts within each plan that favored the Republican candidate. On the right side of Figure 4, the red percentages in parentheses report the percent of simulated plans that produced fewer Republican-favoring districts and the percent of simulated plans that produced more Republican-favoring districts than the Enacted Plan. These two percentages do not necessarily add up to 100% if some simulated plans have exactly the same number of Republican-favoring districts as the Enacted Plan.

51. For example, the top row of Figure 4 corresponds to the 2014 US Senate election, in which Democrat Dick Durbin defeated Republican Jim Oberweis. The histogram in this top row illustrates that the vast majority of the computer-simulated plans produced between 55 to 60 districts favoring the Republican candidate in this election. No simulated plan produced fewer than 49 such Republican-favoring districts, and the most common outcome among the simulated plans was 57 Republican-favoring districts. By contrast, however, the Enacted Plan contains only 47 districts favoring the Republican candidate. In this respect, the Enacted Plan is an extreme statistical outlier, producing fewer Republican-favoring districts than all 10,000 of the simulated plans. I thus conclude with extremely high statistical certainty that the enacted plan created a

Figure 4: Partisan Comparison of 2021 Enacted Plan to Computer−Simulated Plans Using the Results of Each Statewide Election Contest



pro-Democratic partisan outcome that would not have occurred under a districting process adhering to non-partisan traditional criteria. In fact, the Enacted Plan produced ten fewer Republican-favoring districts than the most common outcome among the computer-simulated plans.

52. The second row of Figure 4 reveals a similar finding with respect to the 2014 Governor election, in which Republican Bruce Rauner defeated Democrat Pat Quinn. The histogram in this row illustrates that the vast majority of the computer-simulated plans produced 75 to 79 districts favoring the Republican candidate in this election. No simulated plan produced fewer than 71 such Republican-favoring districts, and the most common outcome among the simulated plans was 77 Republican-favoring districts. By contrast, however, the Enacted Plan contains only 67 districts favoring the Republican candidate. In this respect, the Enacted Plan is an extreme statistical outlier, producing fewer Republican-favoring districts than all 10,000 of the simulated plans. I thus conclude with extremely high statistical certainty that the enacted plan created a pro-Democratic partisan outcome that would not have occurred under a districting process adhering to non-partisan traditional criteria. In fact, the Enacted Plan produced ten fewer Republican-favoring districts than the most common outcome among the computer-simulated plans.

53. Similarly, using the results of the 2018 Governor election, in which Democrat JB Pritzker defeated Republican Bruce Rauner, the vast majority of computer-simulated plans produced 40 to 46 Republican-favoring districts. Meanwhile, the Enacted Plan produced only 37 Republican-favoring districts, an outcome which was fewer Republican districts than in 99.72% of the computer-simulated plans.

54. Finally, in the 2022 Governor election, in which Democrat JB Pritzker defeated Republican Darren Bailey, the vast majority of computer-simulated plans produced 36 to 42 Republican-favoring districts. Meanwhile, the Enacted Plan produced only 33 Republican-favoring districts, an outcome which was fewer Republican districts than in 99.93% of the computer-simulated plans.

55. In fact, every row in Figure 4 reveals a similar finding that the Enacted Plan is a statistical outlier, producing fewer Republican-favoring districts than all or nearly all of the computer-simulated plans. Under 14 out of the 16 statewide elections, the Enacted Plan creates more Democratic-favoring districts than over 99% of the computer-simulated plans. Under the remaining 2 statewide elections, the Enacted Plan still creates more Democratic-favoring districts than over 97% of the computer-simulated plans. Together, the 16 elections analyzed in Figure 4 produce a consistent pattern: Under a wide variety of competitive electoral environments, the 2021 Enacted Plan produces more Democratic-favoring districts than almost all of the 10,000 computer-simulated plans. Overall, these findings illustrate that the Enacted Plan creates a pro-Democratic bias when compared to non-partisan districting maps that strictly follow traditional districting principles, and the pro-Democratic bias in the Enacted Plan is durable and persists under a wide variety of relatively competitive electoral environments.

56. Appendix A presents more detailed versions of each of these 16 histograms in Figure 4, reporting the precise percentage of simulations that contain each observed number of Republican-favoring districts under each of the 16 statewide elections.

57. Table 7 calculates and reports the partisan difference between the Enacted Plan and the median computer-simulated plan in terms of the number of Republican-favoring districts. There are 17 rows in Table 7, with the first 16 rows corresponding to one of the 16 statewide

Table 7: Republican−Favoring Districts in the Enacted Plan and in the Median Computer−Simulated Plan

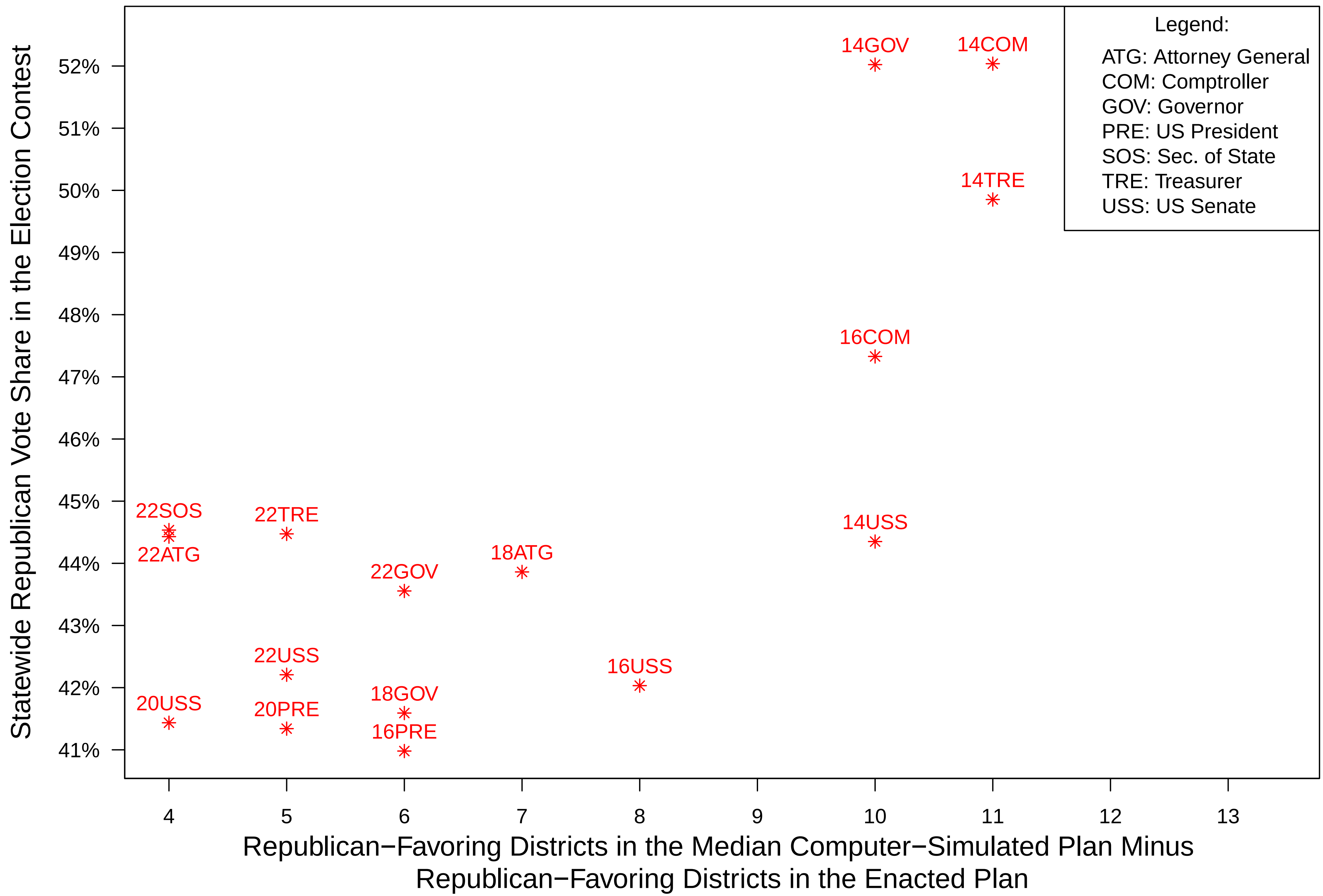
Election contest:	Statewide Republican Share Of Two−Party Vote:	Enacted Plan Districts Favoring the Republican Candidate:	Districts Favoring the Republican Candidate in the Median Simulated Plan:	Difference Between Median Simulated Plan and Enacted Plan:
2014 US Senate	44.35%	47 Districts	57 Districts	+10 Districts
2014 Governor	52.02%	67 Districts	77 Districts	+10 Districts
2014 Comptroller	52.04%	67 Districts	78 Districts	+11 Districts
2014 Treasurer	49.85%	63 Districts	74 Districts	+11 Districts
2016 US President	40.98%	35 Districts	41 Districts	+6 Districts
2016 US Senate	42.03%	36 Districts	44 Districts	+8 Districts
2016 Comptroller	47.33%	57 Districts	67 Districts	+10 Districts
2018 Governor	41.59%	37 Districts	43 Districts	+6 Districts
2018 Attorney General	43.86%	40 Districts	47 Districts	+7 Districts
2020 US President	41.34%	32 Districts	37 Districts	+5 Districts
2020 US Senate	41.44%	33 Districts	37 Districts	+4 Districts
2022 Attorney General	44.43%	37 Districts	41 Districts	+4 Districts
2022 Governor	43.56%	33 Districts	39 Districts	+6 Districts
2022 Secretary of State	44.53%	37 Districts	41 Districts	+4 Districts
2022 Treasurer	44.47%	37 Districts	42 Districts	+5 Districts
2022 US Senate	42.21%	31 Districts	36 Districts	+5 Districts
Statewide Election Composite	44.33%	40 Districts	47 Districts	+7 Districts

elections, and the 17th row corresponding to the Statewide Election Composite. Within each row, the second column of Table 7 reports the statewide Republican vote share in the election, and the third column reports the number of Enacted Plan districts that favored the Republican candidate in the election. The fourth column reports the number of districts favoring the Republican candidate in the median computer-simulated plan. The final row then calculates the difference in the number of Republican districts in the Enacted Plan and the number in the median simulated plan.

58. Overall, Table 7 illustrates that when using any of the 16 statewide elections, as well as using the Statewide Election Composite, the Enacted Plan produces several fewer Republican-favoring districts, compared to the median computer-simulated plan. The difference between the Enacted Plan and the median simulated plan ranges from 4 to 11 fewer Republican-favoring districts. Hence, Table 7 illustrates that under any reasonably competitive electoral environment, the Enacted Plan creates an electoral bias harming Republicans by several seats, compared to the median districting plan produced by a non-partisan map-drawing process following traditional districting principles.

59. Figure 5 graphically illustrates the information from Table 7 regarding the 16 statewide elections. Specifically, Figure 5 plots 16 different data points, corresponding to each of the 16 statewide elections listed in Table 7. Each election is labeled with both a red star and an abbreviation; for example, '14GOV' denotes the 2014 Governor election. For each election, the horizontal axis measures the statewide Republican vote share in the election, while the vertical axis measures the difference between the Enacted Plan and the median simulated plan in terms of the plan's number of Republican-favoring districts, as calculated in the final column of Table 7.

Figure 5: Partisan Differences by Election
Between the Enacted Plan and in the Median Computer−Simulated Plan



60. Overall, Figure 5 reveals a striking pattern: There is a statistically strong, positive correlation between the statewide Republican vote share in an election and the gap between the partisanship of the Enacted Plan and the median computer-simulated plan. The election contests that result in the largest gap between the number of Republican districts in the Enacted Plan and the median simulated plan are also the elections with the highest statewide Republican vote shares. These elections appear in the upper right corner of Figure 5: The 2014 Governor, 2014 Comptroller, 2014 Treasurer, and 2016 Comptroller elections were the elections that produced the four highest statewide Republican vote shares, with Republicans winning between 47% to 52% of the statewide vote. These four election contests also resulted in the four largest gaps between the number of Republican districts in the Enacted Plan and the median simulated plan. Using the results of each of these four election contests, the Enacted Plan produces either 10 or 11 more Republican-favoring districts than the median simulated plan.

61. This statistically strong, positive correlation illustrated in Figure 5 illustrates an important feature of the Enacted Plan. The Enacted Plan creates an electoral bias favoring Democrats in all elections, but the magnitude of this electoral bias is largest in elections in which Republican candidates have their strongest performances. As the upper right corner of Figure 5 illustrates, when Republican candidates win between 47% to 52% of the statewide vote, the Enacted Plan delivers the greatest reduction in the number of Republican-favoring districts, compared to the median computer-simulated plan.

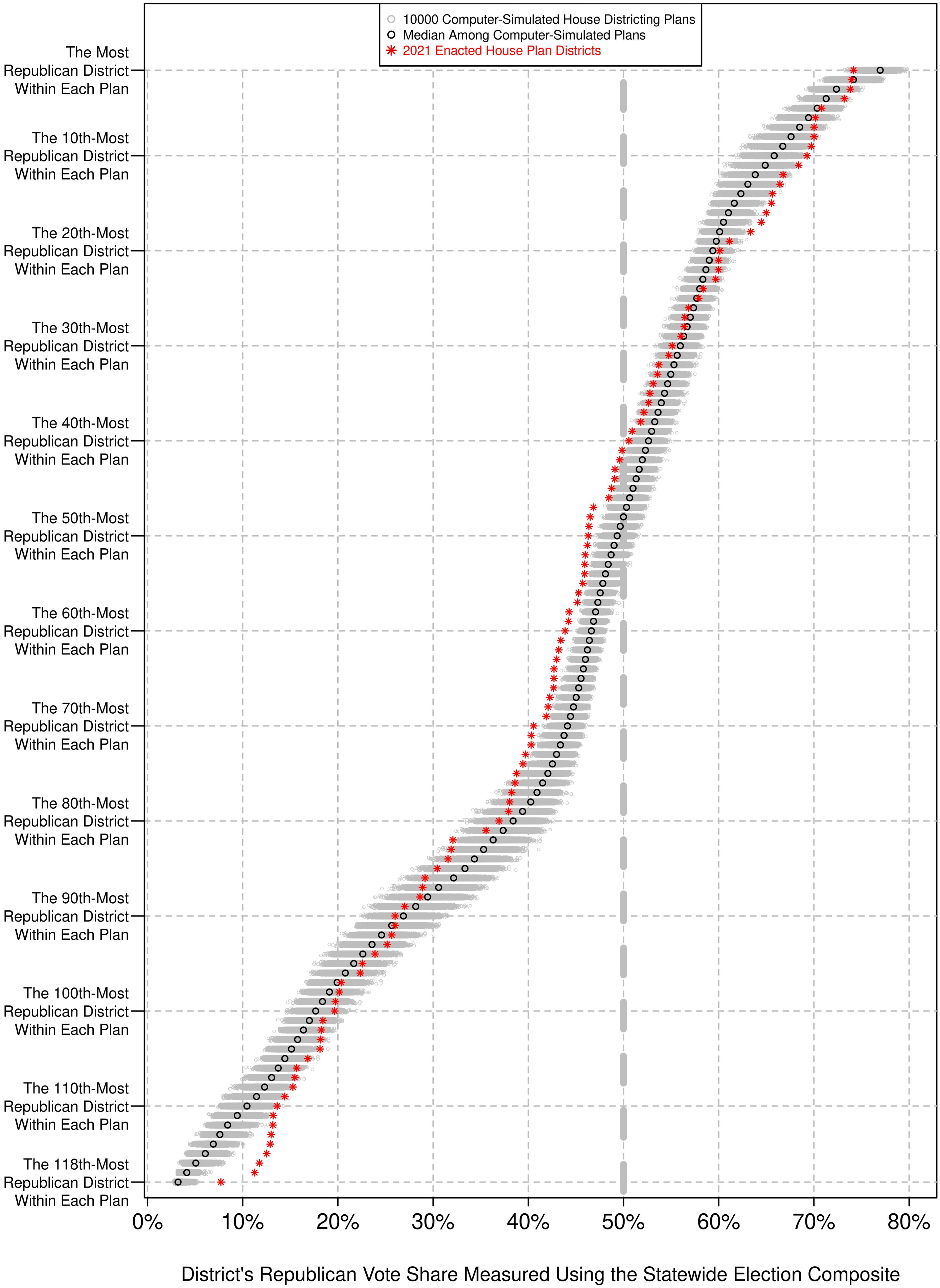
62. By creating the largest pro-Democratic electoral bias in elections in which Republican candidates have their strongest performances, the Enacted Plan effectively serves as an insurance policy for the House Democrats, insuring against large seat losses when Democratic candidates have their worst performances in terms of statewide vote share. Importantly, this

effective insurance policy means that the Enacted Plan delivers the largest number of additional Democratic seats precisely in elections when Republicans perform unusually well, and the Democratic Party is in greatest danger of losing its supermajority status in the House. Such elections are depicted in the upper right of Figure 5.

63. ***Partisan Outlier Districts in the Enacted Plan***: Figure 6 directly compares the partisan distribution of districts in the Enacted Plan to the partisan distribution of districts in the 10,000 computer-simulated plans. This Figure contains 118 rows, corresponding to the 118 districts in each House plan. Each row contains exactly one district from the Enacted Plan and one district from each of the 10,000 computer-simulated plans. In each row of Figure 6, the Enacted Plan's district is depicted with a red star, while the 10,000 computer-simulated districts are depicted with 10,000 gray circles on each row. The horizontal axis in Figure 6 measures each district's Republican vote share, as measured by the Statewide Election Composite.

64. Across the 118 rows in Figure 6, the Enacted Plan's districts are ordered from the most to the least-Republican district, as measured by the district's Republican vote share using the Statewide Election Composite. The most-Republican district appears on the top row, and the least-Republican district appears on the bottom row. Next, I calculated the Republican vote share of each of the 10,000 computer-simulated plans and similarly ordered each simulated plan's districts from the most- to the least-Republican district. Thus, the top row of Figure 6 directly compares the most-Republican Enacted Plan district to the most-Republican simulated district from each of the 10,000 computer-simulated plans. In other words, I compare one district from the Enacted Plan to 10,000 computer-simulated districts, and I compare these districts based on their Republican vote share, using the Statewide Election Composite. Similarly, the second row of the Figure directly compares the second-most-Republican district in the Enacted Plan to the

Figure 6:
2021 House Plan versus Computer-Simulated Maps, Compared Using the Statewide Election Composite



second-most Republican district from each of the 10,000 simulated plans. I conduct an analogous comparison for each of the 118 districts in the Enacted Plan, comparing the Enacted Plan district to its computer-simulated counterparts from each of the 10,000 simulated plans.

65. For each of the 118 rows in Figure 6, I calculated the percentage of the 10,000 simulated plans whose district in the row has a higher or a lower Republican vote share than the Enacted Plan's district in the same row. For each of the 118 rows, these percentages are reported in Table 8. For example, the second row of Table 8 reports that in Figure 6, the second-most-Republican district in the Enacted Plan, as measured by the Statewide Election Composite, is HD-107, which has a Republican vote share of 73.95%. Table 8 reports that HD-107 is more Republican than 44.22% of the simulated plans' second-most-Republican district and less Republican than 55.78% of the simulated plans' second-most-Republican district.

66. Overall, the results in Figure 6 reveal a dramatic contrast between the partisanship of the Enacted Plan's districts and the partisanship of computer-simulated districts drawn under a non-partisan districting process. The most striking disparity between the Enacted Plan and the computer-simulated plans in this Figure appears in the range from the 37th to the 76th rows from the top of this Figure. These rows depict the 37th to the 76th-most Republican districts in each plan. Within each of these 40 rows in Figure 6, the Enacted Plan's district has a lower Republican vote share than all 10,000 of the computer-simulated districts within the same row. Hence, the Enacted Plan districts in these 40 rows are more favorable to the Democrats than 100% of the computer-simulated districts in their respective rows in Figure 6.

67. This contrast between the Enacted Plan's districts and the simulated districts is notable because these rows – depicting the 37th to the 76th-most Republican districts in each plan – represent a middle range of districts that are relatively competitive or moderately Democratic-

Table 8:
Percent of Simulated Districts More Republican or Less Republican than Each Enacted Plan District

Row in Figure 5:	Enacted Plan District:	Enacted Plan District's Republican Vote Share (Statewide Election Composite):	% of Simulated Districts with a Lower / Higher Republican Vote Share than the Enacted District:
Most Republican District:	HD−102	74.16%	0% / 100%
2nd−Most Republican District:	HD−107	73.95%	7.1% / 92.9%
3rd−Most Republican District:	HD−110	73.82%	48.05% / 51.95%
4th−Most Republican District:	HD−116	73.2%	70.1% / 29.9%
5th−Most Republican District:	HD−117	70.81%	23.4% / 76.6%
6th−Most Republican District:	HD−87	70.15%	49.81% / 50.19%
7th−Most Republican District:	HD−100	70.02%	84.57% / 15.43%
8th−Most Republican District:	HD−106	70.01%	97.89% / 2.11%
9th−Most Republican District:	HD−109	69.73%	99.63% / 0.37%
10th−Most Republican District:	HD−99	69.28%	99.91% / 0.09%
11th−Most Republican District:	HD−101	68.39%	99.99% / 0.01%
12th−Most Republican District:	HD−105	66.76%	99.97% / 0.03%
13th−Most Republican District:	HD−115	66.43%	100% / 0%
14th−Most Republican District:	HD−89	65.65%	100% / 0%
15th−Most Republican District:	HD−108	65.54%	100% / 0%
16th−Most Republican District:	HD−88	65%	100% / 0%
17th−Most Republican District:	HD−73	64.47%	100% / 0%
18th−Most Republican District:	HD−94	63.36%	100% / 0%
19th−Most Republican District:	HD−93	61.13%	100% / 0%
20th−Most Republican District:	HD−37	60.12%	99.98% / 0.02%
21st−Most Republican District:	HD−75	59.99%	99.98% / 0.02%
22nd−Most Republican District:	HD−90	59.98%	100% / 0%
23rd−Most Republican District:	HD−69	59.68%	100% / 0%
24th−Most Republican District:	HD−64	58.37%	99.99% / 0.01%
25th−Most Republican District:	HD−74	57.9%	99.98% / 0.02%
26th−Most Republican District:	HD−70	56.83%	99.16% / 0.84%
27th−Most Republican District:	HD−95	56.45%	99.32% / 0.68%
28th−Most Republican District:	HD−82	56.38%	99.84% / 0.16%
29th−Most Republican District:	HD−65	56.03%	99.92% / 0.08%
30th−Most Republican District:	HD−118	55.12%	99.61% / 0.39%
31st−Most Republican District:	HD−52	54.75%	99.75% / 0.25%
32nd−Most Republican District:	HD−71	53.71%	97.75% / 2.25%
33rd−Most Republican District:	HD−63	53.57%	99.36% / 0.64%
34th−Most Republican District:	HD−47	53.12%	99.46% / 0.54%
35th−Most Republican District:	HD−111	52.78%	99.64% / 0.36%
36th−Most Republican District:	HD−104	52.64%	99.88% / 0.12%
37th−Most Republican District:	HD−51	52.14%	99.93% / 0.07%
38th−Most Republican District:	HD−48	51.81%	99.96% / 0.04%
39th−Most Republican District:	HD−68	50.91%	99.65% / 0.35%
40th−Most Republican District:	HD−45	50.56%	99.65% / 0.35%

Table 8 (continued):
Percent of Simulated Districts More Republican or Less Republican than Each Enacted Plan District

Row in Figure 5:	Enacted Plan District:	Enacted Plan District's Republican Vote Share (Statewide Election Composite):	% of Simulated Districts with a Lower / Higher Republican Vote Share than the Enacted District:
41st−Most Republican District:	HD−79	49.85%	99.03% / 0.97%
42nd−Most Republican District:	HD−66	49.6%	99.5% / 0.5%
43rd−Most Republican District:	HD−91	49.1%	99.19% / 0.81%
44th−Most Republican District:	HD−97	49.08%	99.81% / 0.19%
45th−Most Republican District:	HD−20	48.74%	99.89% / 0.11%
46th−Most Republican District:	HD−112	48.46%	99.89% / 0.11%
47th−Most Republican District:	HD−83	46.83%	75.64% / 24.36%
48th−Most Republican District:	HD−49	46.5%	72.62% / 27.38%
49th−Most Republican District:	HD−41	46.36%	81.61% / 18.39%
50th−Most Republican District:	HD−114	46.29%	90.34% / 9.66%
51st−Most Republican District:	HD−61	46.2%	95.47% / 4.53%
52nd−Most Republican District:	HD−53	45.98%	96.65% / 3.35%
53rd−Most Republican District:	HD−54	45.93%	98.91% / 1.09%
54th−Most Republican District:	HD−81	45.92%	99.78% / 0.22%
55th−Most Republican District:	HD−42	45.72%	99.91% / 0.09%
56th−Most Republican District:	HD−55	45.28%	99.79% / 0.21%
57th−Most Republican District:	HD−76	45.15%	99.9% / 0.1%
58th−Most Republican District:	HD−62	44.28%	98.7% / 1.3%
59th−Most Republican District:	HD−67	44.22%	99.61% / 0.39%
60th−Most Republican District:	HD−80	43.86%	99.52% / 0.48%
61st−Most Republican District:	HD−113	43.41%	99.31% / 0.69%
62nd−Most Republican District:	HD−56	43.2%	99.66% / 0.34%
63rd−Most Republican District:	HD−35	42.97%	99.8% / 0.2%
64th−Most Republican District:	HD−46	42.7%	99.87% / 0.13%
65th−Most Republican District:	HD−86	42.7%	99.99% / 0.01%
66th−Most Republican District:	HD−96	42.66%	100% / 0%
67th−Most Republican District:	HD−36	42.26%	100% / 0%
68th−Most Republican District:	HD−57	42.08%	100% / 0%
69th−Most Republican District:	HD−72	41.88%	100% / 0%
70th−Most Republican District:	HD−85	40.55%	99.39% / 0.61%
71st−Most Republican District:	HD−92	40.32%	99.5% / 0.5%
72nd−Most Republican District:	HD−98	40.3%	99.84% / 0.16%
73rd−Most Republican District:	HD−59	39.7%	99.17% / 0.83%
74th−Most Republican District:	HD−77	39.43%	99.22% / 0.78%
75th−Most Republican District:	HD−84	38.76%	95.53% / 4.47%
76th−Most Republican District:	HD−44	38.6%	97.46% / 2.54%
77th−Most Republican District:	HD−58	38.25%	97.65% / 2.35%
78th−Most Republican District:	HD−50	38.04%	98.65% / 1.35%
79th−Most Republican District:	HD−15	37.92%	99.66% / 0.34%
80th−Most Republican District:	HD−43	36.92%	97.85% / 2.15%

Table 8 (continued):
Percent of Simulated Districts More Republican or Less Republican than Each Enacted Plan District

Row in Figure 5:	Enacted Plan District:	Enacted Plan District's Republican Vote Share (Statewide Election Composite):	% of Simulated Districts with a Lower / Higher Republican Vote Share than the Enacted District:
81st−Most Republican District:	HD−17	35.57%	89.93% / 10.07%
82nd−Most Republican District:	HD−21	32.08%	19.45% / 80.55%
83rd−Most Republican District:	HD−19	31.89%	39.95% / 60.05%
84th−Most Republican District:	HD−22	31.57%	59.57% / 40.43%
85th−Most Republican District:	HD−16	30.43%	58.12% / 41.88%
86th−Most Republican District:	HD−2	29.16%	59.93% / 40.07%
87th−Most Republican District:	HD−60	28.9%	81.76% / 18.24%
88th−Most Republican District:	HD−38	28.63%	94.14% / 5.86%
89th−Most Republican District:	HD−29	27.02%	90.79% / 9.21%
90th−Most Republican District:	HD−103	26.01%	93.89% / 6.11%
91st−Most Republican District:	HD−12	26%	99.29% / 0.71%
92nd−Most Republican District:	HD−28	25.66%	99.87% / 0.13%
93rd−Most Republican District:	HD−27	25.17%	100% / 0%
94th−Most Republican District:	HD−18	23.9%	100% / 0%
95th−Most Republican District:	HD−7	22.58%	99.99% / 0.01%
96th−Most Republican District:	HD−8	22.35%	100% / 0%
97th−Most Republican District:	HD−11	20.35%	99.84% / 0.16%
98th−Most Republican District:	HD−1	20.14%	99.97% / 0.03%
99th−Most Republican District:	HD−30	19.74%	100% / 0%
100th−Most Republican District:	HD−31	19.66%	100% / 0%
101st−Most Republican District:	HD−24	18.42%	100% / 0%
102nd−Most Republican District:	HD−34	18.25%	100% / 0%
103rd−Most Republican District:	HD−78	18.18%	100% / 0%
104th−Most Republican District:	HD−3	18.12%	100% / 0%
105th−Most Republican District:	HD−40	16.84%	100% / 0%
106th−Most Republican District:	HD−26	15.67%	100% / 0%
107th−Most Republican District:	HD−39	15.47%	100% / 0%
108th−Most Republican District:	HD−9	15.27%	100% / 0%
109th−Most Republican District:	HD−10	14.42%	100% / 0%
110th−Most Republican District:	HD−13	13.62%	100% / 0%
111th−Most Republican District:	HD−4	13.2%	100% / 0%
112th−Most Republican District:	HD−32	13.17%	100% / 0%
113th−Most Republican District:	HD−33	12.99%	100% / 0%
114th−Most Republican District:	HD−23	12.89%	100% / 0%
115th−Most Republican District:	HD−5	12.52%	100% / 0%
116th−Most Republican District:	HD−14	11.76%	100% / 0%
117th−Most Republican District:	HD−6	11.25%	100% / 0%
118th−Most Republican District:	HD−25	7.71%	100% / 0%

leaning in the simulated plans. Hence, by decreasing the Republican vote share of the districts in these middle 40 rows, the Enacted Plan is able to significantly increase the number of districts that Democrats are likely to win. Within this middle range, districts that would have been relatively competitive in the simulated plans instead become slightly Democratic-leaning under the Enacted Plan, and districts that would have been slightly Democratic-leaning in the simulated plans instead become relatively safer Democratic districts under the Enacted Plan.

68. Indeed, in Figure 6, the Enacted Plan districts from the 41st to the 46th rows have slightly below a 50% Republican vote share, whereas the vast majority of the computer-simulated districts in these same rows have over a 50% Republican vote share. Hence, these rows partially illustrate how the Enacted Plan effectively "flipped" Republican-leaning districts in the computer-simulated plans into Democratic-leaning districts.

69. If the Enacted Plan districts in the 41st to the 46th rows contained fewer Republican voters than the computer-simulated districts in these same rows, then what happened to these "missing" Republican voters that would have been placed into this middle range of districts under the computer-simulated plans? Figure 6 clearly illustrates that the Enacted Plan placed these "missing" Republican voters into the most safely Democratic districts at the bottom of Figure 6 and into several of the most safely Republican districts near the top of Figure 6.

70. As the bottom row in Figure 6 and in Table 8 illustrate, the most-Democratic district in the Enacted Plan contains more Republican voters than 100% of the most-Democratic districts in each of the 10,000 computer-simulated plans. It is thus clear that more Republican votes are "wasted" in the most-Democratic district of the Enacted Plan than in the most-Democratic district of any of the 10,000 computer-simulated plans. I therefore identify the Enacted Plan district in this row as an extreme partisan outlier when compared to its 10,000

computer-simulated counterparts, using a standard threshold test of 95% for statistical significance.

71. In fact, each of the bottom twelve rows in Figure 6 reveals a similar contrast. The Enacted Plan's district in each row is more Republican than over 99% of the 10,000 computer-simulated districts within the same row. All twelve of these rows are extremely safe Democratic districts, both in the Enacted Plan and in the computer-simulated plans. Hence, each of the Enacted Plan's districts in these bottom twelve rows effectively "wastes" more Republican votes than the computer-simulated districts in the same row, as the districts in these rows are extremely unlikely to favor a Republican candidate in any election.

72. The same pattern emerges near the top of Figure 6, which depicts the safest Republican districts in the Enacted Plan and the simulated plans. Specifically, consider the 8th to the 18th rows from the top of Figure 6, which depict the 8th to the 18th-most Republican districts in each plan. Within Figure 6, these eleven rows are part of an upper range of districts that are always very safely Republican in any statewide election. Within each of these eleven rows, the Enacted Plan's district in the row is more Republican than over 99% of the 10,000 computer-simulated districts within the same row. As the districts in all eleven of these rows are always safely Republican, each of the Enacted Plan's districts in these bottom twelve rows effectively "wastes" more Republican votes than the computer-simulated districts in the same row, as adding additional Republican voters to the districts in these rows is unlikely to ever change the outcomes of the election contests in these districts.

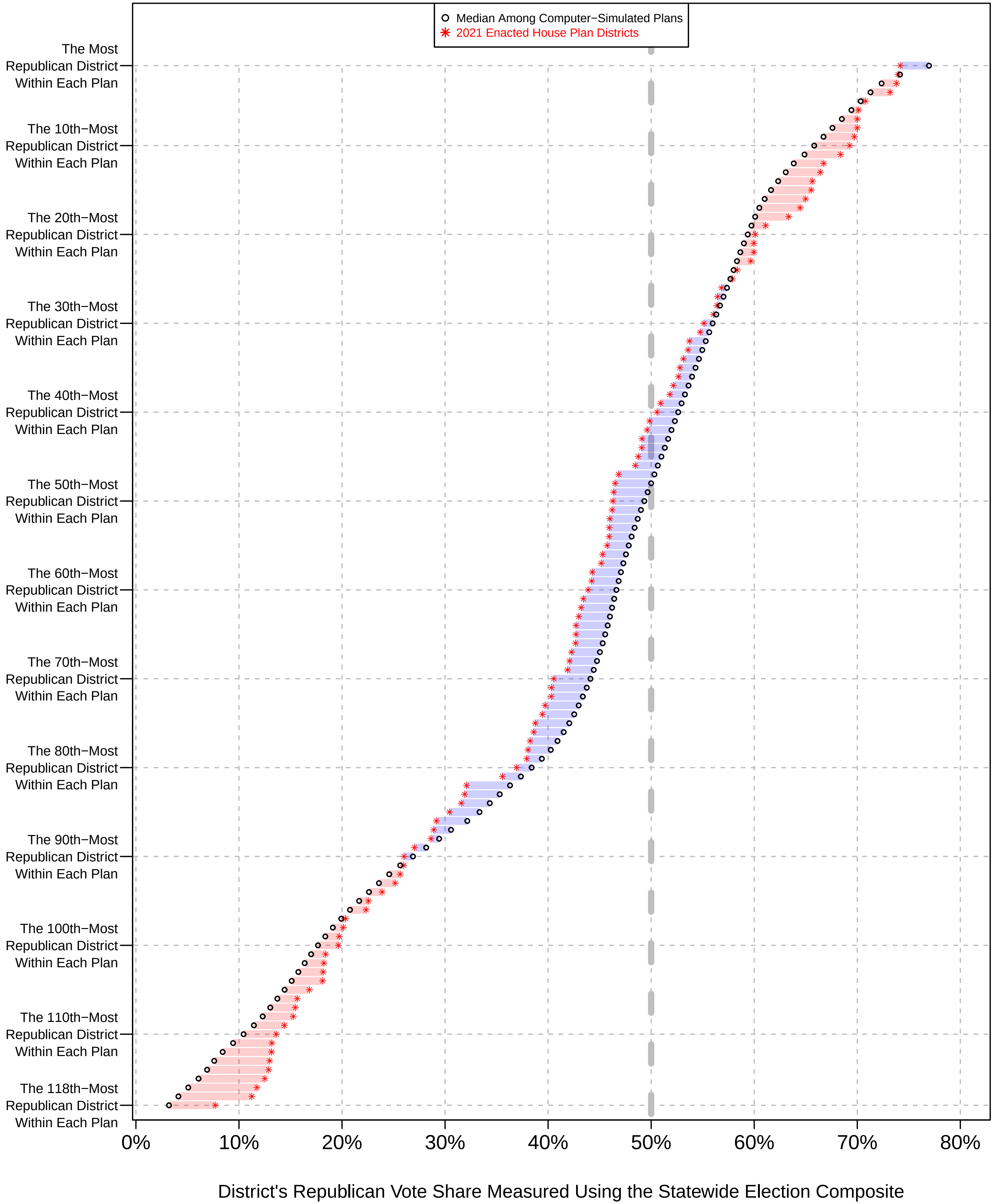
73. Overall, Figure 6 and Table 8 reveal the three coordinated methods through which the Enacted Plan created several additional Republican seats, when compared to the computer-simulated plans. First, the Enacted Plan removed Republican voters from the middle range of

districts that would have been relatively electorally competitive, thereby reducing the number of districts in this middle range that Republicans are likely to win. Second, some of these “missing” Republican voters were placed into the most overwhelmingly Democratic districts, as illustrated in the bottom twelve rows in Figure 6. Finally, other “missing” Republican voters were placed into already-safe Republican districts, where adding even more Republican voters is unlikely to change any House election outcomes. In summary, the Enacted Plan removed Republican voters from relatively competitive districts and placed them instead into overwhelmingly Democratic districts or lopsidedly safe Republican districts.

74. Appendix B of this report contains 16 additional figures following the same layout as Figure 6. However, each of the 16 figures in Appendix B is based upon measuring the partisanship of each Enacted Plan district and each computer-simulated district using one of the 16 individual statewide election contests, instead of using the Statewide Election Composite. Overall, the patterns and the findings revealed by each one of these 16 figures are generally the same as for Figure 6.

75. These three coordinated methods by which the Enacted Plan created several additional Republican districts, compared to the simulated plans, are also illustrated in Figure 7. Similar to Figure 6, this Figure also has 118 rows, with the 118 districts in the Enacted Plan depicted with red stars and arranged in order from the most Republican on the top row to least Republican on the bottom row. However, instead of showing the corresponding district from all 10,000 computer-simulated plans on each row, Figure 7 depicts only the median of the 10,000 computer-simulated districts with a black circle on each row. In the top row, for example, the black circle depicts the median Republican vote share of the 10,000 simulated plans’ most-

Figure 7:
2021 House Plan versus Computer−Simulated Maps, Compared Using the Statewide Election Composite



Republican district. Similarly, in the second row, the black circle depicts the median Republican vote share of the simulated plans' second-most-Republican district.

76. Additionally, within each row, the gap between the Enacted Plan district (red star) and the median simulated district (black circle) is shaded in. The shading in each row is red if the Enacted Plan district is more heavily Republican than the median simulated district, and the shading is blue if the Enacted Plan district is less Republican than the median simulated district.

77. Altogether, the shading across the rows of Figure 7 reveal three distinct sections: The middle range of districts, extending from the 26th to the 90ths rows in Figure 7, includes the relatively most competitive districts, and the Enacted Plan's district in each of these rows always has a lower Republican vote share than the median simulated district within the same row. The bottom section of Figure 7, extending from the 91st row to the 118th row, depict overwhelmingly Democratic districts, and the Enacted Plan's district in each of these rows always has a higher Republican vote share when compared to the median simulated district within the same row. The third section in Figure 7 is the upper range of districts, extending from the 3rd row to the 23rd row. The Enacted Plan's district in each of these upper rows always has a higher Republican vote share when compared to the median simulated district within the same row.

78. These three distinct sections in Figure 7 correspond to the three coordinated methods by which the Enacted Plan created several additional Republican districts, as described earlier in the discussion of Figure 6. In Figure 7, the middle section of blue rows depict the relatively competitive districts in which the Enacted Plan's districts are drawn to be more favorable to Democrats than the simulated plan's districts. Meanwhile, the lower and upper sections of Figure 7, which generally depict extremely Republican or extremely Democratic

districts, are largely shaded in red, indicating that the Enacted Plan's district in each row contains more Republican voters than the simulated plan's districts for the same row.

79. Appendix C of this report contains 16 additional figures following the same layout as Figure 7. However, each of the 16 figures in Appendix C is based upon measuring the partisanship of each Enacted Plan district and each computer-simulated district using one of the 16 individual statewide election contests, instead of using the Statewide Election Composite. Overall, the patterns and the findings revealed by each one of these 16 figures are generally the same as for Figure 7.

The Compactness and Partisanship of the Enacted Plan's Majority-Black Districts

80. How did the Enacted Plan effectively "waste" Republican voters by moving them into some of the most heavily-Democratic districts in the Enacted Plan, as described in the previous section? In this section, I illustrate how the geographic distortion of the majority-Black districts in the Enacted Plan played an important role in causing these "wasted" Republican votes. Specifically, the Enacted Plan's mapmakers used extremely long, narrow, and geographically non-compact districts to connect heavily Black neighborhoods in Chicago's South Side with Republican precincts in the suburbs of the Chicago metro area. These non-compact, majority-Black districts effectively removed Republican voters from suburban districts that would have been more electorally competitive or Republican-leaning.

81. The Enacted Plan contains 13 majority-Black CVAP districts, as detailed in Table 2. Given that Blacks in Illinois overwhelmingly favor Democratic candidates, it is not surprising that every majority-Black district overwhelmingly favors Democratic candidates, both in the Enacted Plan and in the computer-simulated plans. For example, Table 7 reports that all 13 of the

majority-Black districts in the Enacted Plan are among the 30 most-heavily Democratic districts in the Enacted Plan, and each of the Enacted Plan's 13 majority-Black districts has a Republican vote share of 27% or lower, as measured using the Statewide Election Composite. Hence, majority-Black districts in Illinois are unquestionably safe Democratic districts, with Republican candidates having no realistic chance of winning a state House race in such districts.

82. Therefore, geographically contorting their district boundaries to bring suburban Republican voters into these otherwise majority-Black districts would have no significant effect on these districts' certainty of electing Democratic House candidates. In the Enacted Plan, the geographic non-compactness of these majority-Black districts is apparent in several ways. First, it is visually apparent in Figure 2 that many of the majority-Black districts in the Enacted Plan, such as HD-27, 28, 29, 31, and 34, are long and extremely narrow, connecting Black neighborhoods in Chicago's South Side with suburbs in the metro area. Second, Table 1 confirms that 12 of the 13 majority-Black districts in the Enacted Plan (HD-5, 6, 8, 25, 26, 27, 28, 29, 31, 32, 33, and 34) have compactness scores that are lower than the compactness scores of the *Schrage* District. Finally, as a group, the 13 majority-Black districts exhibit an average Reock score of 0.152 and an average Polsby-Popper score of 0.136, both of which are well below the compactness scores of the *Schrage* District.

83. What would have been the partisan and racial composition of these majority-Black districts if the Enacted Plan's mapmakers had not drawn districts with such low compactness scores below those of the *Schrage* District? Figures 8 and 9 compare the majority-Black districts in the Enacted Plan to the majority-Black districts in each of the 10,000 computer-simulated plans. As none of the 118 districts in any computer-simulated plan have compactness scores below the *Schrage* District, this comparison allows me to evaluate how the Enacted Plan's

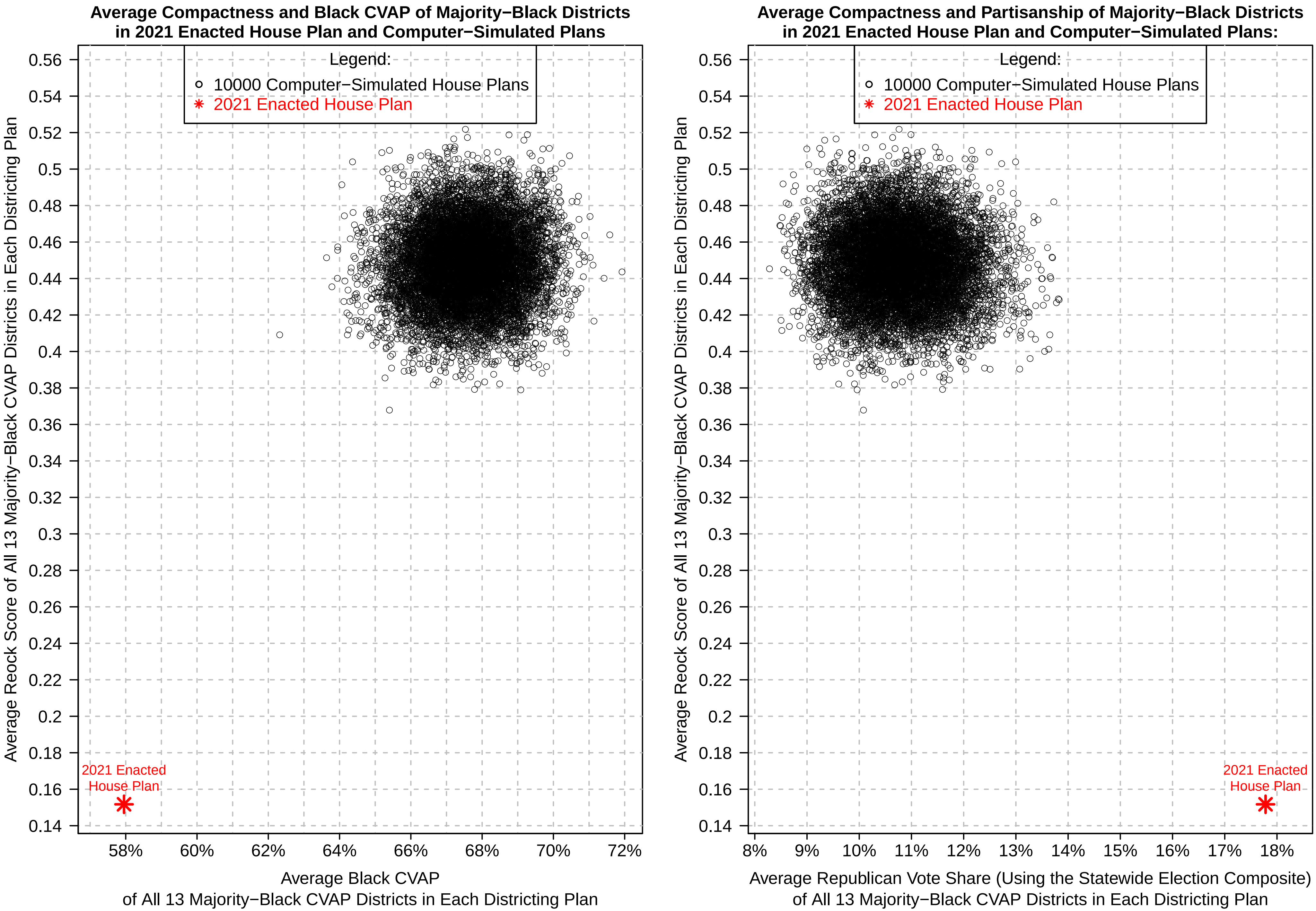
use of geographically non-compact, majority-Black districts affected the partisanship of these districts.

84. In the left plot in Figure 8, the vertical axis measures the average Reock score of the 13 majority-Black districts in each plan, while the horizontal axis measures the average Black CVAP of the 13 majority-Black districts. In the right plot in Figure 8, the horizontal axis measures the average Republican vote share of the 13 majority-Black districts, using the Statewide Election Composite. Note that for purposes of these calculations, if a computer-simulated plan contains more than 13 majority-Black districts, I included only the 13 districts with the highest Black CVAP from each plan.

85. Overall, Figure 8 illustrates three findings: First, as 12 of the 13 majority-Black districts in the Enacted Plan have compactness scores below the *Schrage* District, the average Reock score of the 13 Enacted Plan districts is therefore significantly below the average Reock score of the 13 majority-Black districts within each of the 10,000 simulated plans. Second, the Enacted Plan's majority-Black districts have an average Black CVAP that is significantly below those exhibited by all 10,000 of the simulated plans. Finally, the Enacted Plan's majority-Black districts have an average Republican vote share that is significantly higher than those exhibited by all 10,000 of the simulated plans.

86. Together, these findings from Figure 8 illustrate how the non-compactness of the Enacted Plan's majority-Black districts enabled the mapmakers to "waste" additional Republican votes in these majority-Black districts. As noted earlier, every majority-Black district in any Illinois House plan is an overwhelmingly safe Democratic district. The Enacted Plan's mapmakers thus added extra Republican voters to these majority-Black districts from geographically distant suburbs without sacrificing these districts' near-certainty of favoring

Figure 8:



Note: For computer−simulated plans containing more than 13 majority−Black CVAP Districts, only the 13 districts with the highest Black CVAP within the plan are considered.

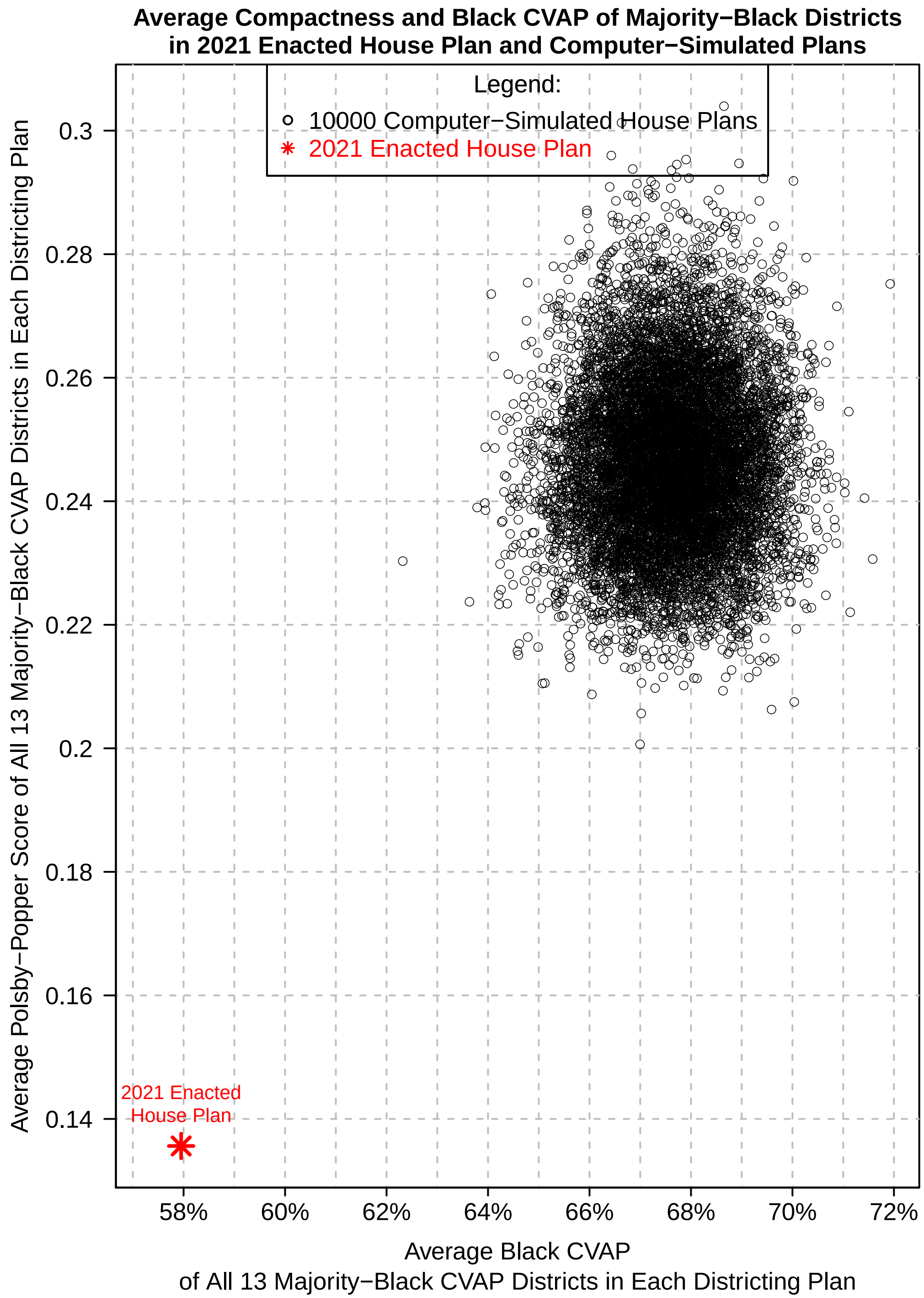
Democrat candidates. The addition of these suburban Republican voters to the majority-Black districts very significantly harmed the Reock compactness scores of these majority-Black districts, as illustrated in Figure 8. Adding these extra suburban Republicans to the majority-Black districts also resulted in the Enacted Plan's majority-Black districts having significantly higher Republican vote shares and lower Black CVAP proportions than observed in the simulated plans' majority-Black districts. In summary, drawing long, narrow districts with compactness scores below the *Schrage* District enabled the Enacted Plan's mapmakers to "waste" suburban Republican votes in otherwise safe Democratic, majority-Black districts.

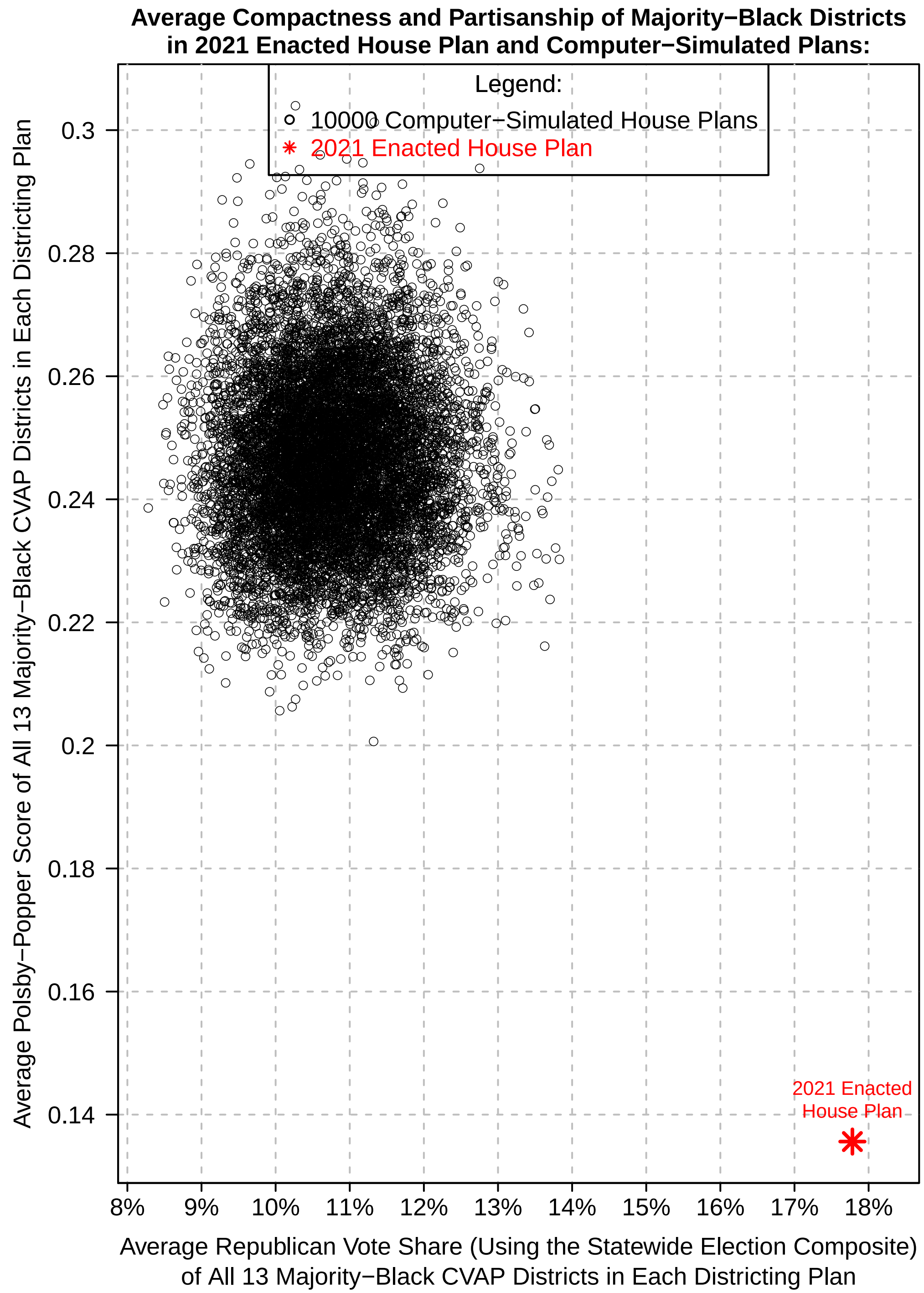
87. Figure 9 is identical to Figure 8, except that the vertical axis in both plots in Figure 9 measures the geographic compactness of the majority-Black districts in each plan using the districts' average Polsby-Popper scores, rather than their Reock scores. Using the Polsby-Popper measure of district compactness, Figure 9 illustrates exactly the same patterns and the same findings as Figure 8, as described above.

88. Figures 8 and 9 measured the partisanship of the Enacted Plan's majority-Black districts at an aggregate level, illustrating that the average Republican vote share of the Enacted Plan's 13 majority-Black districts is significantly higher than those of the 10,000 simulated plans. Additionally, I compared the individual district-level partisanships of the Enacted Plan's majority-Black districts to those of the simulated plans in Table 9.

89. Specifically, Table 9 contains 13 columns, with each column corresponding to one of the 13 majority-Black districts in the Enacted Plan. These districts are labeled along the bottom of Table 9 (e.g., HD-5, HD-6, etc.). Table 9 also contains 17 rows, with each row corresponding to one of the 16 statewide election contests or to the Statewide Election Composite, and these elections are labeled on the left of Table 9. Each percentage reported in

Figure 9:





Note: For computer−simulated plans containing more than 13 majority−Black CVAP Districts, only the 13 districts with the highest Black CVAP within the plan are considered.

Table 9: Percentage of Majority−Black Districts in Simulated Plans With a Lower Republican Vote Share than Each Majority−Black District from the 2021 Enacted House Plan, As Measured Using Each Statewide Election:

	HD−5	HD−6	HD−8	HD−25	HD−26	HD−27	HD−28	HD−29	HD−30	HD−31	HD−32	HD−33	HD−34
2014 US Senate	68.60%	57.37%	89.35%	46.92%	74.49%	91.76%	93.55%	97.40%	86.44%	78.05%	66.92%	71.40%	79.96%
2014 Governor	72.41%	58.51%	90.91%	52.39%	81.50%	89.82%	91.81%	95.45%	87.98%	77.75%	63.73%	70.50%	79.91%
2014 Comptroller	71.81%	60.64%	96.95%	46.89%	79.31%	90.40%	92.01%	94.15%	86.76%	78.17%	64.67%	68.88%	77.24%
2014 Treasurer	71.81%	60.00%	93.80%	51.71%	81.02%	91.29%	92.35%	95.28%	87.62%	77.41%	63.27%	69.02%	77.77%
2016 US President	60.63%	58.71%	80.34%	46.94%	69.60%	96.09%	96.78%	98.88%	84.58%	85.36%	70.27%	72.60%	81.29%
2016 US Senate	75.35%	65.22%	91.29%	48.63%	83.18%	96.28%	96.07%	98.69%	85.67%	82.98%	66.91%	70.56%	80.19%
2016 Comptroller	74.94%	62.34%	94.46%	55.27%	83.55%	96.26%	95.94%	97.69%	87.03%	81.58%	64.53%	69.19%	79.31%
2018 Governor	74.66%	63.79%	98.20%	48.39%	82.57%	97.75%	98.09%	99.10%	86.49%	83.31%	66.21%	69.16%	82.33%
2018 Attorney General	71.33%	66.05%	95.28%	43.14%	78.98%	97.25%	98.03%	98.84%	86.23%	83.33%	69.53%	70.50%	81.50%
2020 US President	59.37%	68.41%	84.50%	28.90%	70.04%	98.63%	98.94%	99.34%	85.06%	92.47%	76.88%	70.60%	84.56%
2020 US Senate	73.85%	69.61%	92.23%	36.09%	79.45%	99.18%	99.05%	99.52%	85.15%	92.43%	74.69%	69.89%	86.84%
2022 Attorney General	62.48%	69.82%	91.61%	30.78%	73.85%	98.08%	98.58%	99.21%	84.28%	91.38%	78.12%	68.06%	86.05%
2022 Governor	53.14%	65.97%	89.25%	30.48%	68.17%	98.40%	98.98%	99.35%	84.18%	92.60%	79.46%	68.73%	87.18%
2022 Secretary of State	60.99%	70.44%	93.05%	29.30%	72.98%	98.29%	98.91%	99.36%	84.74%	92.42%	78.76%	67.61%	87.05%
2022 Treasurer	65.49%	70.62%	92.35%	31.17%	75.19%	98.71%	99.10%	99.50%	84.35%	92.24%	78.40%	68.00%	86.74%
2022 US Senate	59.97%	68.11%	91.86%	32.20%	72.82%	98.34%	98.87%	99.38%	84.28%	92.06%	78.04%	67.97%	86.08%
Statewide Election Composite	69.22%	64.72%	91.58%	43.19%	77.03%	97.55%	98.13%	99.10%	85.51%	85.35%	71.02%	70.56%	82.42%

Majority−Black CVAP Districts from the 2021 Enacted House Plan

Note: For computer−simulated plans containing more than 13 majority−Black CVAP districts, only the 13 districts with the highest Black CVAP within the plan are considered.

Table 9 is a comparison of an Enacted Plan district's partisanship to the partisanship of all of the majority-Black districts in the 10,000 computer-simulated plans. Specifically, Table 9 reports the percentage of the majority-Black districts in the simulated plans that have a lower Republican vote share than each of the Enacted Plan's majority-Black districts, measured using each statewide election contest. For example, the first percentage reported in the upper-left corner of Table 9 reports that 68.60% of the majority-Black computer-simulated districts have a lower Republican vote share, using the 2014 US Senate election results, than HD-5.

90. Overall, Table 9 reveals that 12 of the 13 majority-Black districts in the Enacted Plan are more Republican than the vast majority of the computer-simulated plans' majority-Black districts. This finding emerges consistently regardless of which individual election is used to measure the partisanship of districts. Only one of the Enacted Plan's majority-Black districts – HD-25 – fails to follow this pattern. Overall, Table 9 illustrates that at the individual district level, it is clear the Enacted Plan's mapmakers moved extra Republican voters into the majority-Black districts, compared to computer-simulated plans that were drawn by a partisan-blind algorithm.

Conclusions Regarding Partisanship and Traditional Districting Criteria

91. The analyses described in this report lead me to two main findings: First, the 2021 Enacted Plan clearly subordinated the traditional districting criterion of geographic compactness, as measured using the compactness scores of the *Schrage* District. Of the Enacted Plan's 118 House districts, 52 districts have compactness scores below those of the *Schrage* District, including 12 of the 13 majority-Black districts in the Enacted Plan. Second, I found that the 2021 Enacted Plan is an extreme partisan outlier when compared to computer-simulated plans

produced by a non-partisan map-drawing process following traditional districting criteria, including equal population and avoiding districts less compact than the *Schrage* District. The partisan outlying nature of the Enacted Plan is apparent both at a plan-wide level and at the individual district level.

92. Based on these two collective findings, I conclude that partisanship predominated in the drawing of the 2021 Enacted Plan, and partisanship subordinated the traditional districting principles of drawing geographically compact districts. Because the Enacted Plan failed to follow the traditional districting principle of geographic compactness and instead created an extreme level of pro-Democratic partisan bias, I therefore conclude that the partisan bias of the Enacted Plan did not naturally arise by chance from a districting process adhering to traditional districting principles. Instead, I conclude that partisan goals predominated in the drawing of the Enacted Plan. By subordinating the geographic compactness of House districts, the General Assembly's Enacted Plan was able to achieve an extreme partisan outcome that would not have normally occurred under a partisan-neutral districting process following traditional districting principles.

I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge.

This 28th day of January, 2025.

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Dr. Jowei Chen

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Curriculum Vitae

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Academic Positions:

Associate Professor (2015-present), Assistant Professor (2009-2015), Department of Political Science, University of Michigan.
Research Associate Professor (2016-present), Faculty Associate (2009-2015), Center for Political Studies, University of Michigan.
W. Glenn Campbell and Rita Ricardo-Campbell National Fellow, Hoover Institution, Stanford University, 2013.
Principal Investigator and Senior Research Fellow, Center for Governance and Public Policy Research, Willamette University, 2013 – Present.

Education:

Ph.D., Political Science, Stanford University (June 2009)
M.S., Statistics, Stanford University (January 2007)
B.A., Ethics, Politics, and Economics, Yale University (May 2004)

Publications:

Chen, Jowei and Neil Malhotra. 2007. "The Law of k/n: The Effect of Chamber Size on Government Spending in Bicameral Legislatures."
American Political Science Review. 101(4): 657-676.

Chen, Jowei, 2010. "The Effect of Electoral Geography on Pork Barreling in Bicameral Legislatures."
American Journal of Political Science. 54(2): 301-322.

Chen, Jowei, 2013. "Voter Partisanship and the Effect of Distributive Spending on Political Participation."
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Chen, Jowei and Jonathan Rodden, 2013. "Unintentional Gerrymandering: Political Geography and Electoral Bias in Legislatures"
Quarterly Journal of Political Science, 8(3): 239-269.

Bradley, Katharine and Jowei Chen, 2014. “Participation Without Representation? Senior Opinion, Legislative Behavior, and Federal Health Reform.”
Journal of Health Politics, Policy and Law. 39(2), 263-293.

Chen, Jowei and Tim Johnson, 2015. “Federal Employee Unionization and Presidential Control of the Bureaucracy: Estimating and Explaining Ideological Change in Executive Agencies.”
Journal of Theoretical Politics, Volume 27, No. 1: 151-174.

Bonica, Adam, Jowei Chen, and Tim Johnson, 2015. “Senate Gate-Keeping, Presidential Staffing of ‘Inferior Offices’ and the Ideological Composition of Appointments to the Public Bureaucracy.”
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Chen, Jowei and Jonathan Rodden, 2015. “Cutting Through the Thicket: Redistricting Simulations and the Detection of Partisan Gerrymanders.”
Election Law Journal. Volume 14, Number 4: 331-345.

Chen, Jowei and David Cottrell, 2016. “Evaluating Partisan Gains from Congressional Gerrymandering: Using Computer Simulations to Estimate the Effect of Gerrymandering in the U.S. House.”
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Chen, Jowei, 2017. “Analysis of Computer-Simulated Districting Maps for the Wisconsin State Assembly.”
Election Law Journal. Volume 16, Number 4 (December 2017): 417-442.

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Yale Law Journal, Forthcoming. Volume 130, Number 4: 778-1049.

Kim, Yunsieg and Jowei Chen, 2021. "Gerrymandered by Definition: The Distortion of 'Traditional' Districting Principles and a Proposal for an Empirical Redefinition."
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Chen, Jowei and Nicholas Stephanopoulos, 2021. "Democracy's Denominator."
California Law Review, Accepted for Publication, Volume 109.

Non-Peer-Reviewed Publication:

Chen, Jowei and Nicholas Stephanopoulos. February 24, 2021. Washington Post Op-Ed.
https://www.washingtonpost.com/outlook/2021/02/24/gerrymandering-count-people-adults/

Chen, Jowei. October 4, 2017. Time Magazine Op-Ed.
http://time.com/4965673/wisconsin-supreme-court-gerrymandering-research/

Chen, Jowei and Jonathan Rodden. January 2014. New York Times Op-Ed.
https://www.nytimes.com/2014/01/26/opinion/sunday/its-the-geography-stupid.html
Media Coverage: The Atlantic

Alexander et al. v. South Carolina State Conference of the NAACP, et al., No. 22-807
Amicus Brief, August 18, 2023

Merrill et al. v. Milligan et al., Nos. 21-1086, 21-1087.
Amicus Brief, July 18, 2022

Gill et al. v. Whitford et al., No. 16-1161.
Amicus Brief, September 5, 2017

Chen, Jowei and Tim Johnson. 2017. "Political Ideology in the Bureaucracy."
***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
September 2021, Duke University, Redistricting and American Democracy Conference
July 2022, ICPSR Blalock Lecture, University of Michigan

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:

"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

Appendix A:

Figure A1: Comparison of Enacted Plan to Computer−Simulated Plans: Number of Districts Favoring the Republican Candidate in the 2014 US Senate Election (44.4% Statewide Republican Two−Party Vote Share)

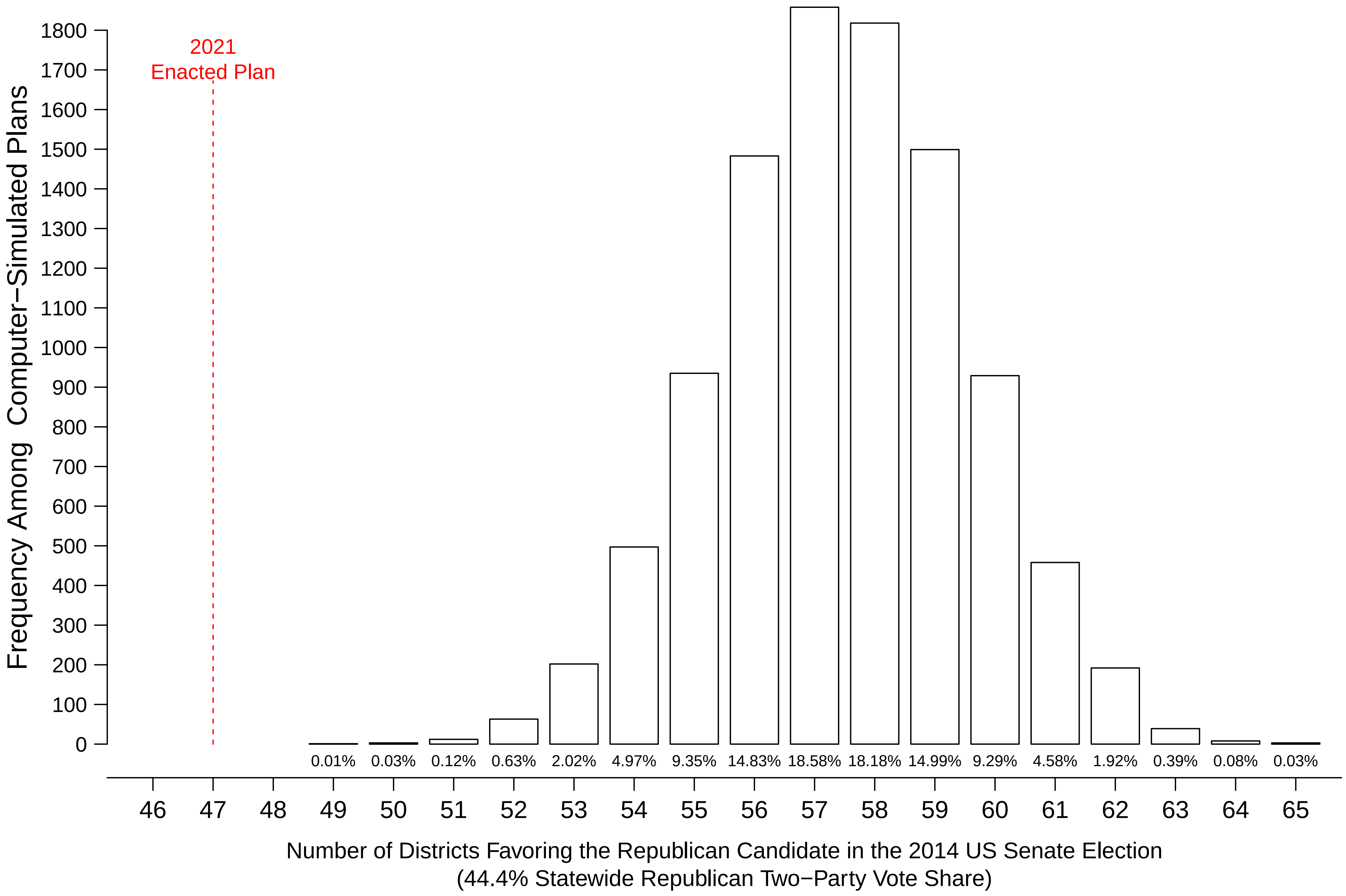
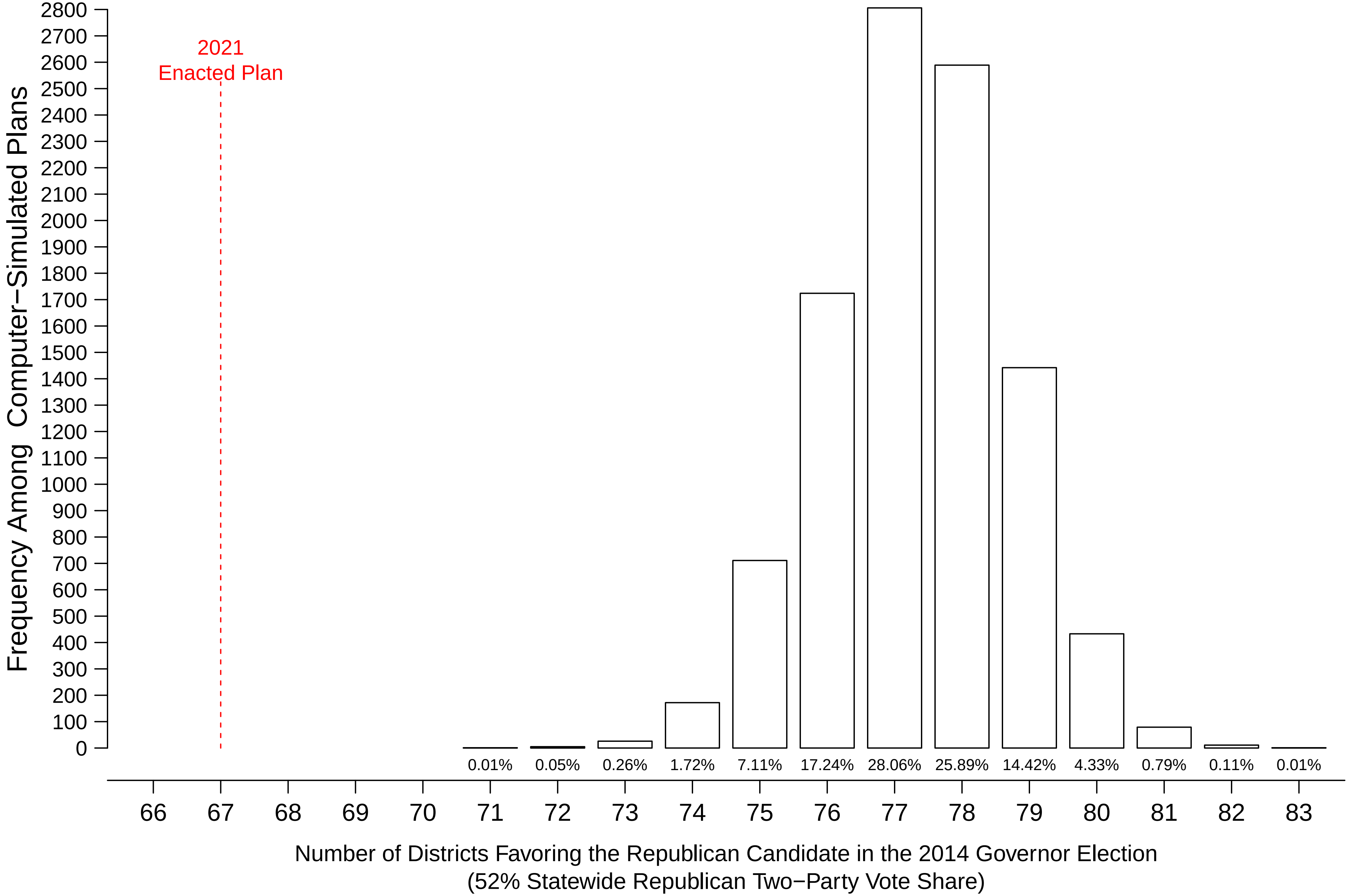


Figure A2: Comparison of Enacted Plan to Computer−Simulated Plans: Number of Districts Favoring the Republican Candidate in the 2014 Governor Election (52% Statewide Republican Two−Party Vote Share)



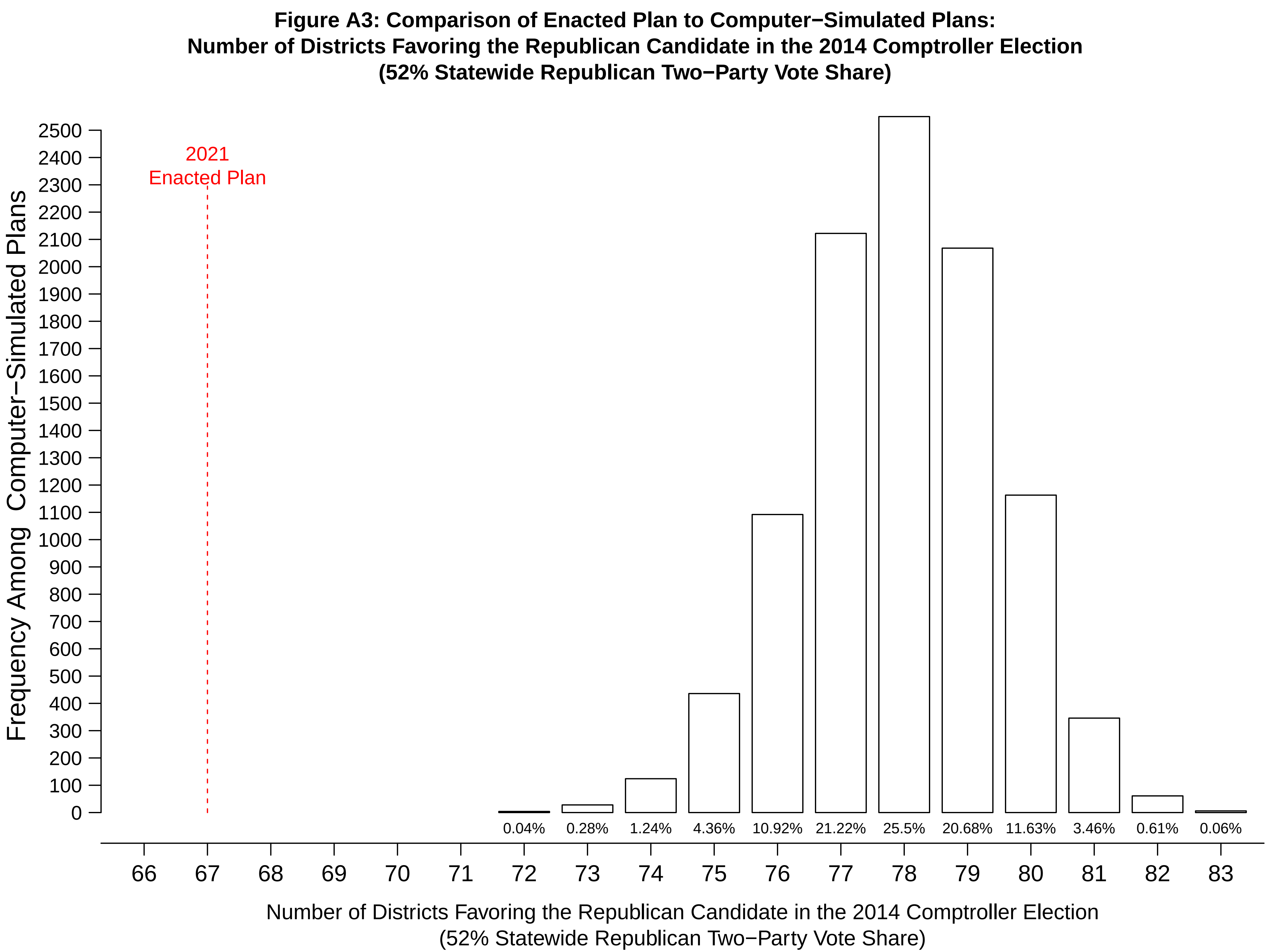


Figure A3: Comparison of Enacted Plan to Computer−Simulated Plans:
Number of Districts Favoring the Republican Candidate in the 2014 Comptroller Election
(52% Statewide Republican Two−Party Vote Share)
2021
Enacted Plan
Frequency Among Computer−Simulated Plans
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
2100
2200
2300
2400
2500
0.04%
0.28%
1.24%
4.36%
10.92%
21.22%
25.5%
20.68%
11.63%
3.46%
0.61%
0.06%
66
67
68
69
70
71
72
73
74
75
76
77
78
79
80
81
82
83
Number of Districts Favoring the Republican Candidate in the 2014 Comptroller Election
(52% Statewide Republican Two−Party Vote Share)

Figure A4: Comparison of Enacted Plan to Computer−Simulated Plans:
Number of Districts Favoring the Republican Candidate in the 2014 Treasurer Election
(49.9% Statewide Republican Two−Party Vote Share)

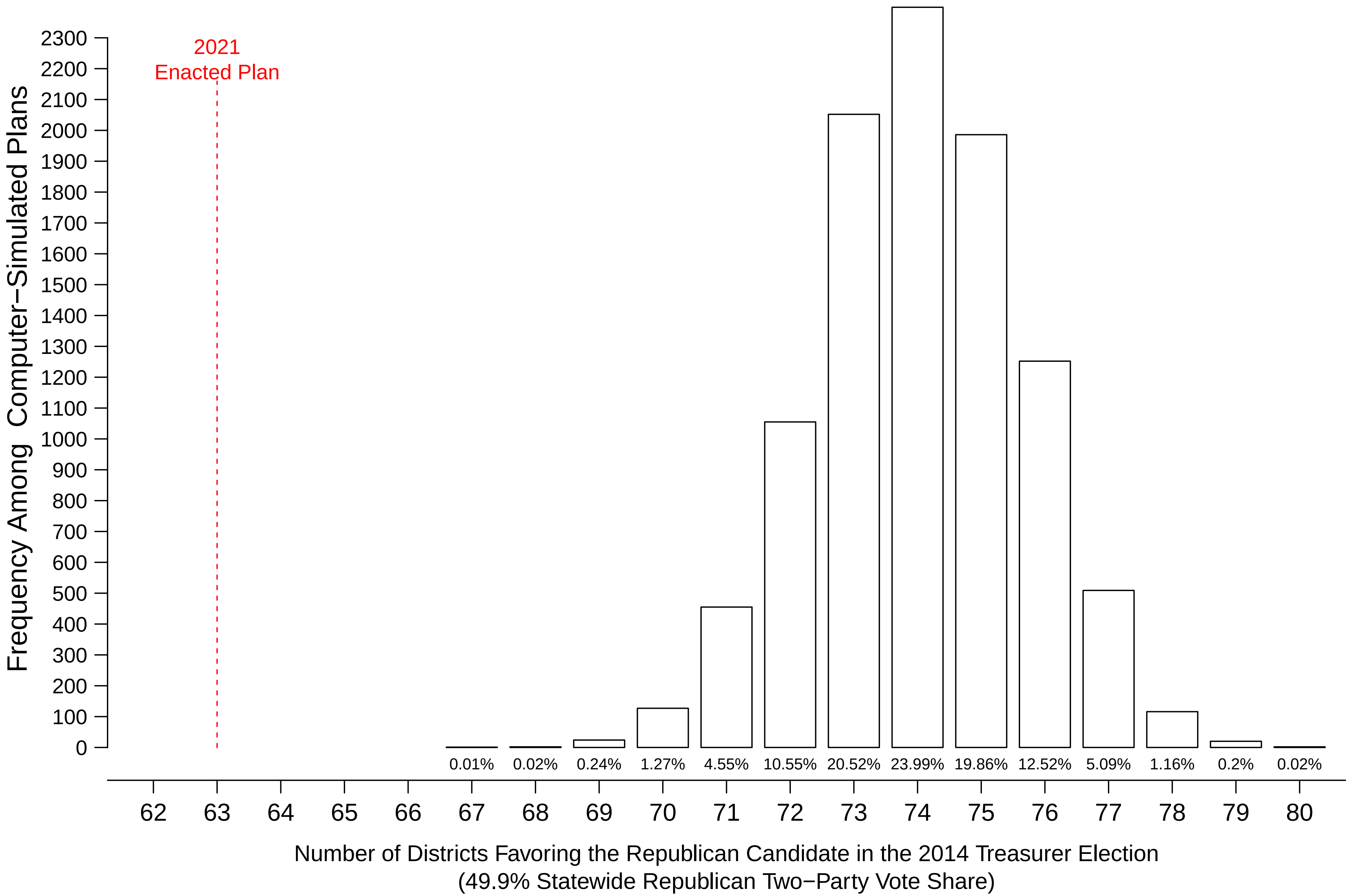


Figure A5: Comparison of Enacted Plan to Computer−Simulated Plans:
Number of Districts Favoring the Republican Candidate in the 2016 US President Election
(41% Statewide Republican Two−Party Vote Share)

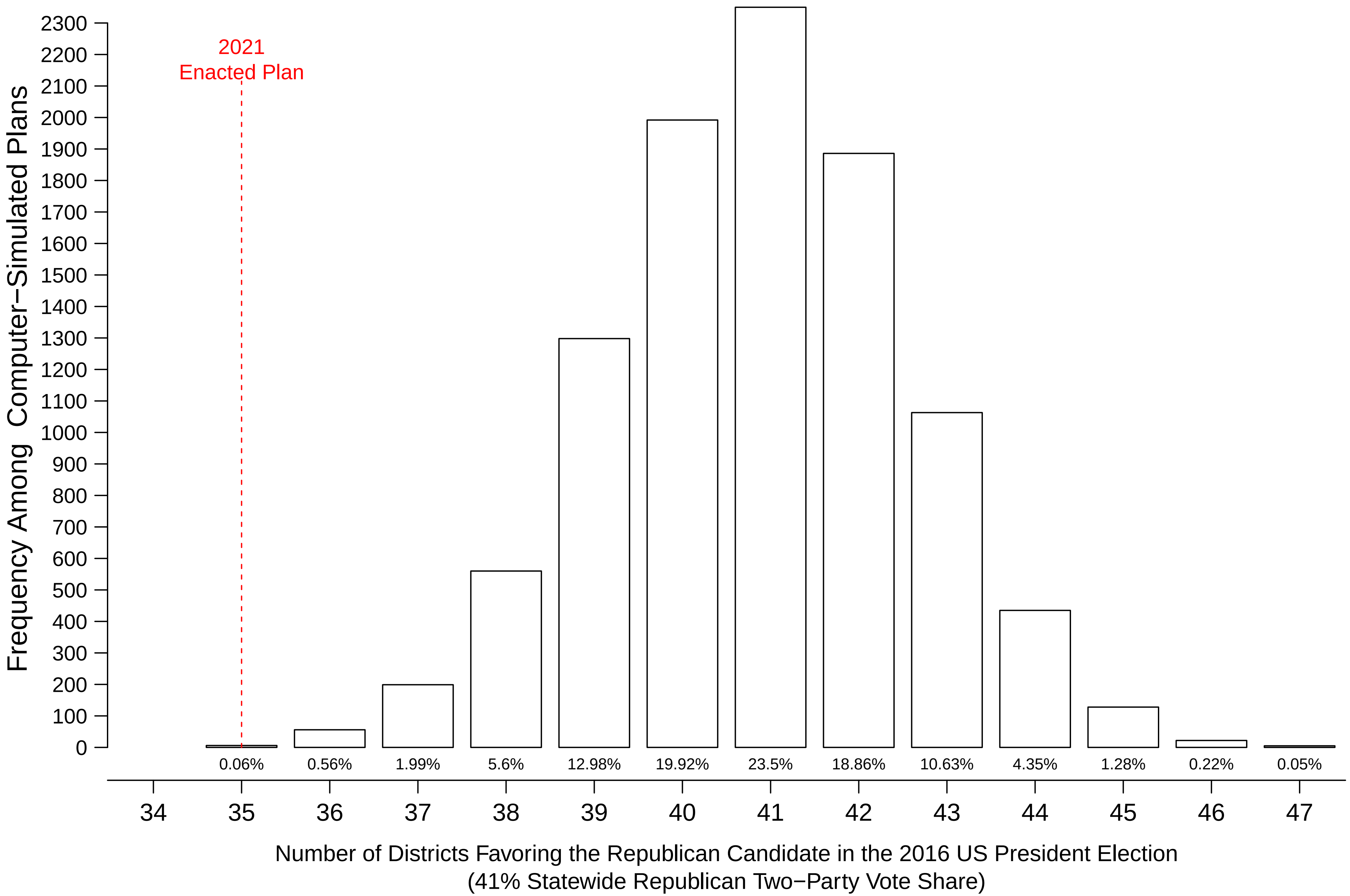


Figure A6: Comparison of Enacted Plan to Computer−Simulated Plans: Number of Districts Favoring the Republican Candidate in the 2016 US Senate Election (42% Statewide Republican Two−Party Vote Share)

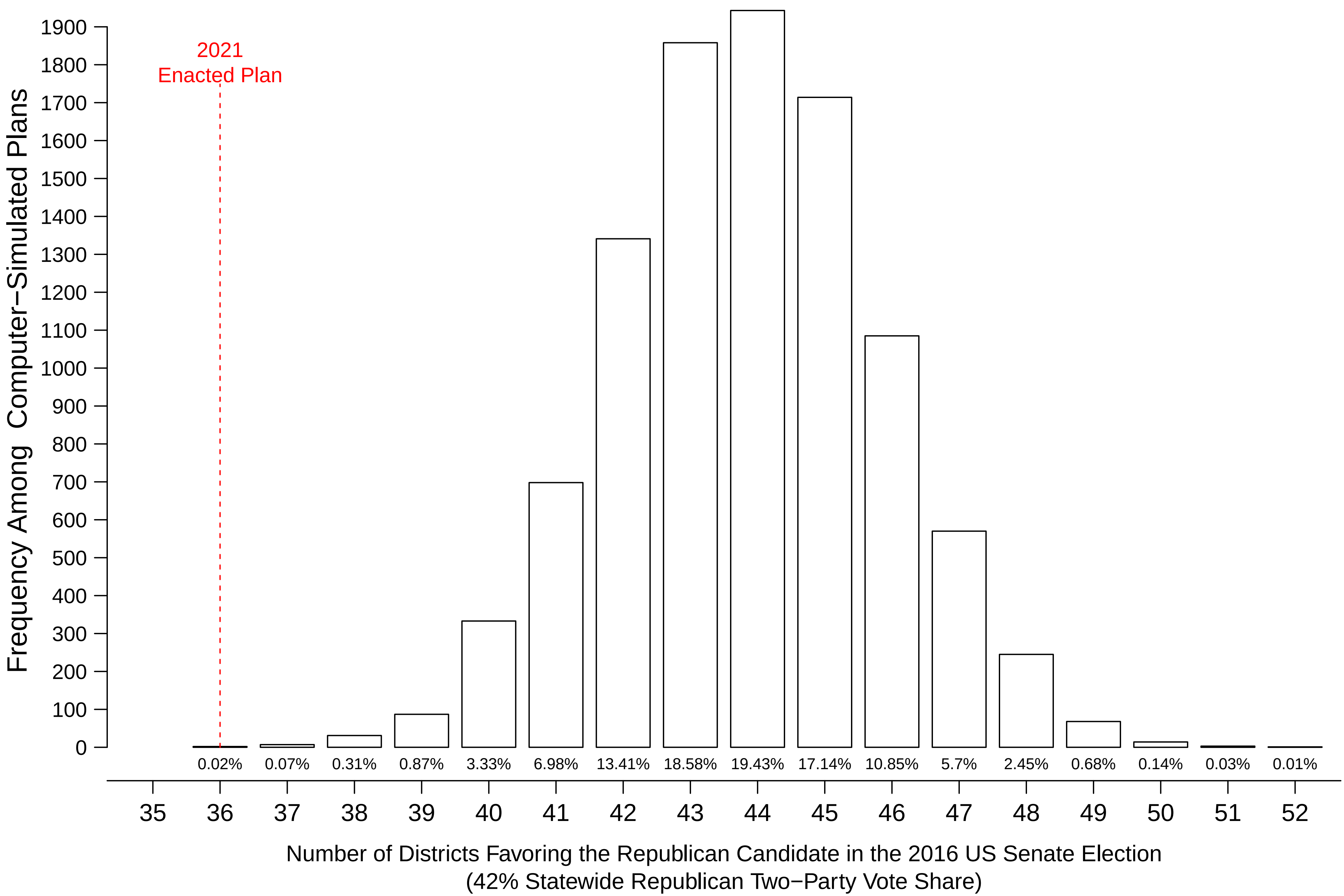


Figure A7: Comparison of Enacted Plan to Computer−Simulated Plans: Number of Districts Favoring the Republican Candidate in the 2016 Comptroller Election (47.3% Statewide Republican Two−Party Vote Share)

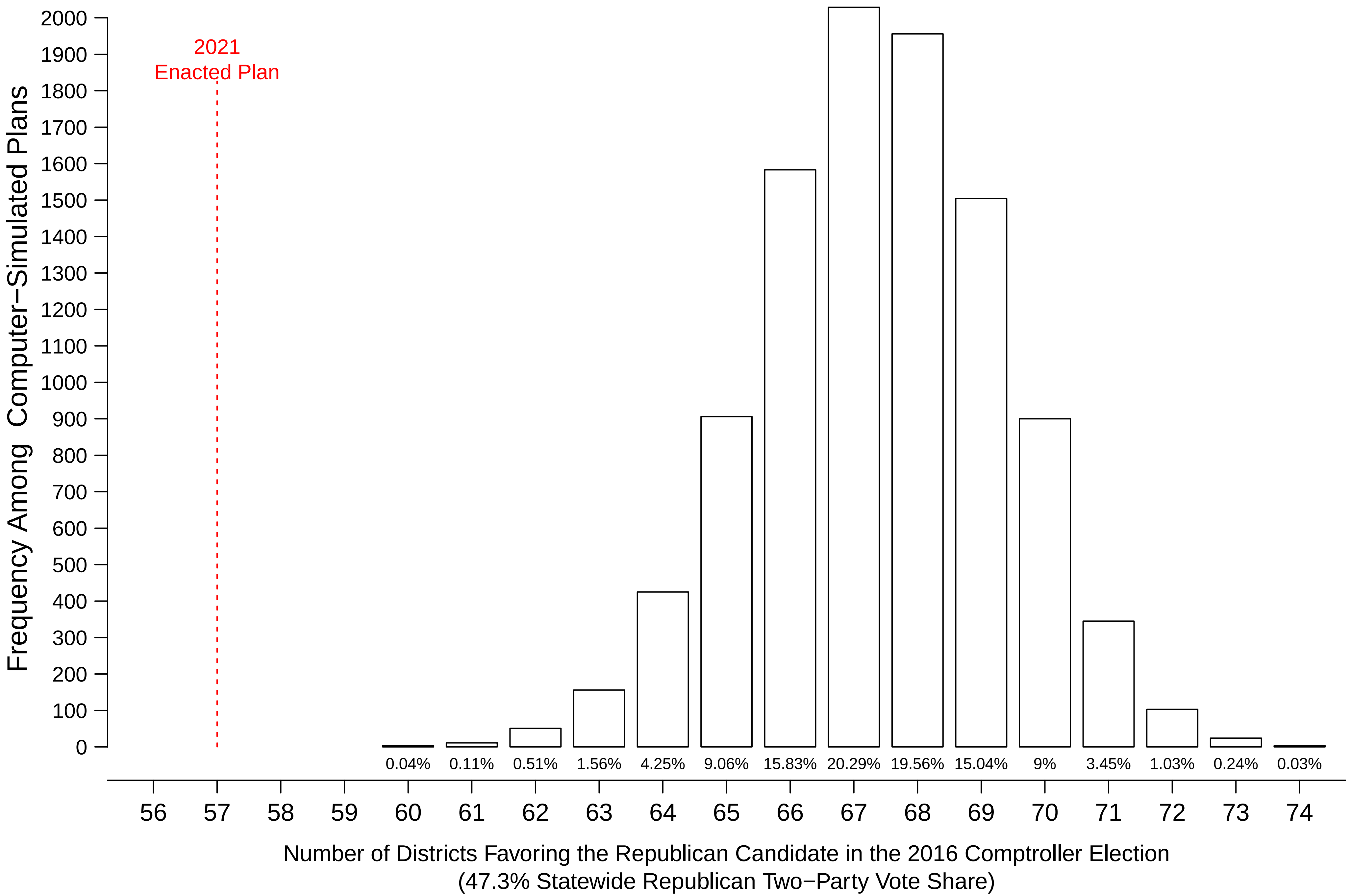


Figure A8: Comparison of Enacted Plan to Computer−Simulated Plans: Number of Districts Favoring the Republican Candidate in the 2018 Governor Election (41.6% Statewide Republican Two−Party Vote Share)

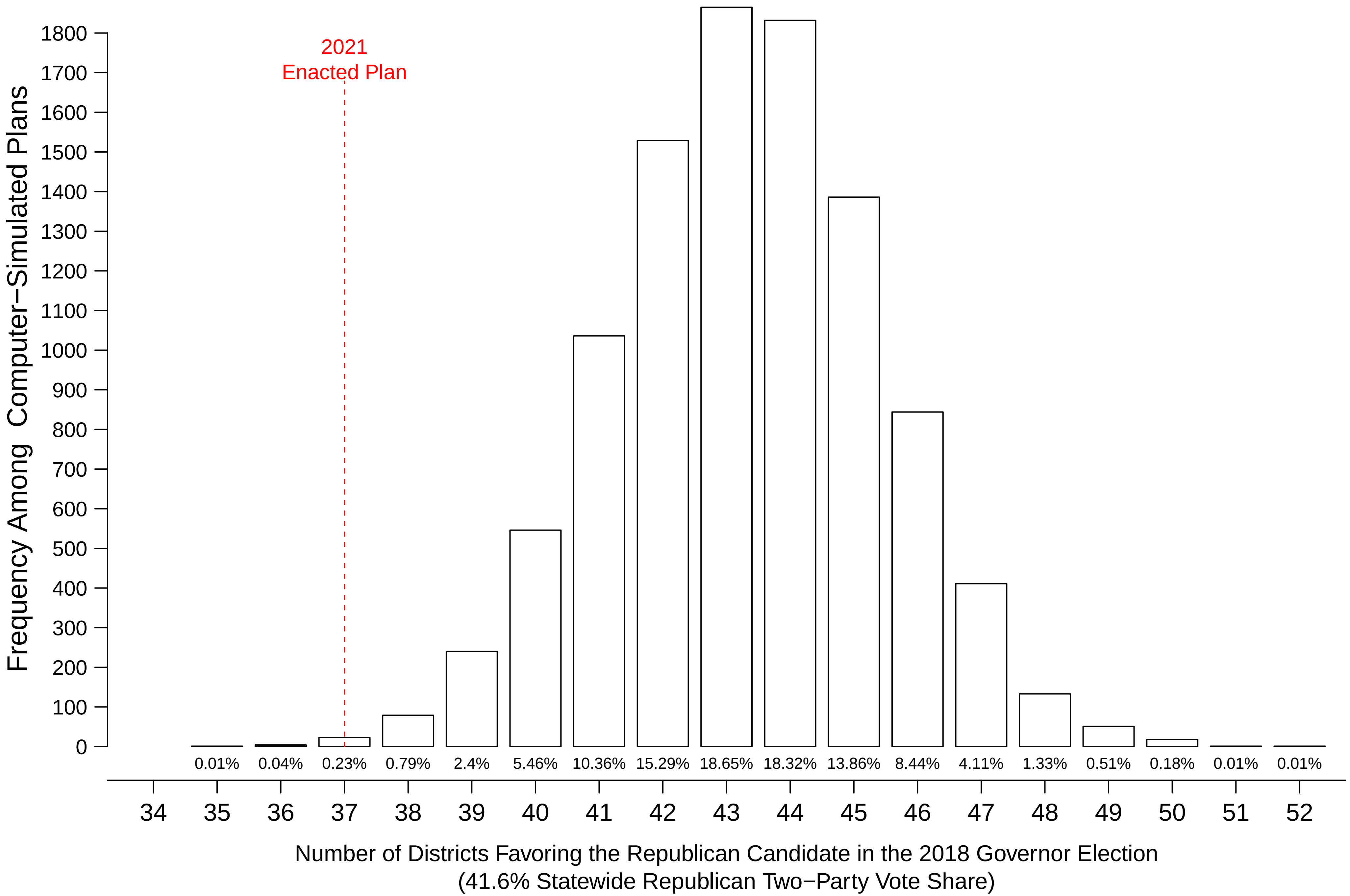


Figure A9: Comparison of Enacted Plan to Computer−Simulated Plans: Number of Districts Favoring the Republican Candidate in the 2018 Attorney General Election (43.9% Statewide Republican Two−Party Vote Share)

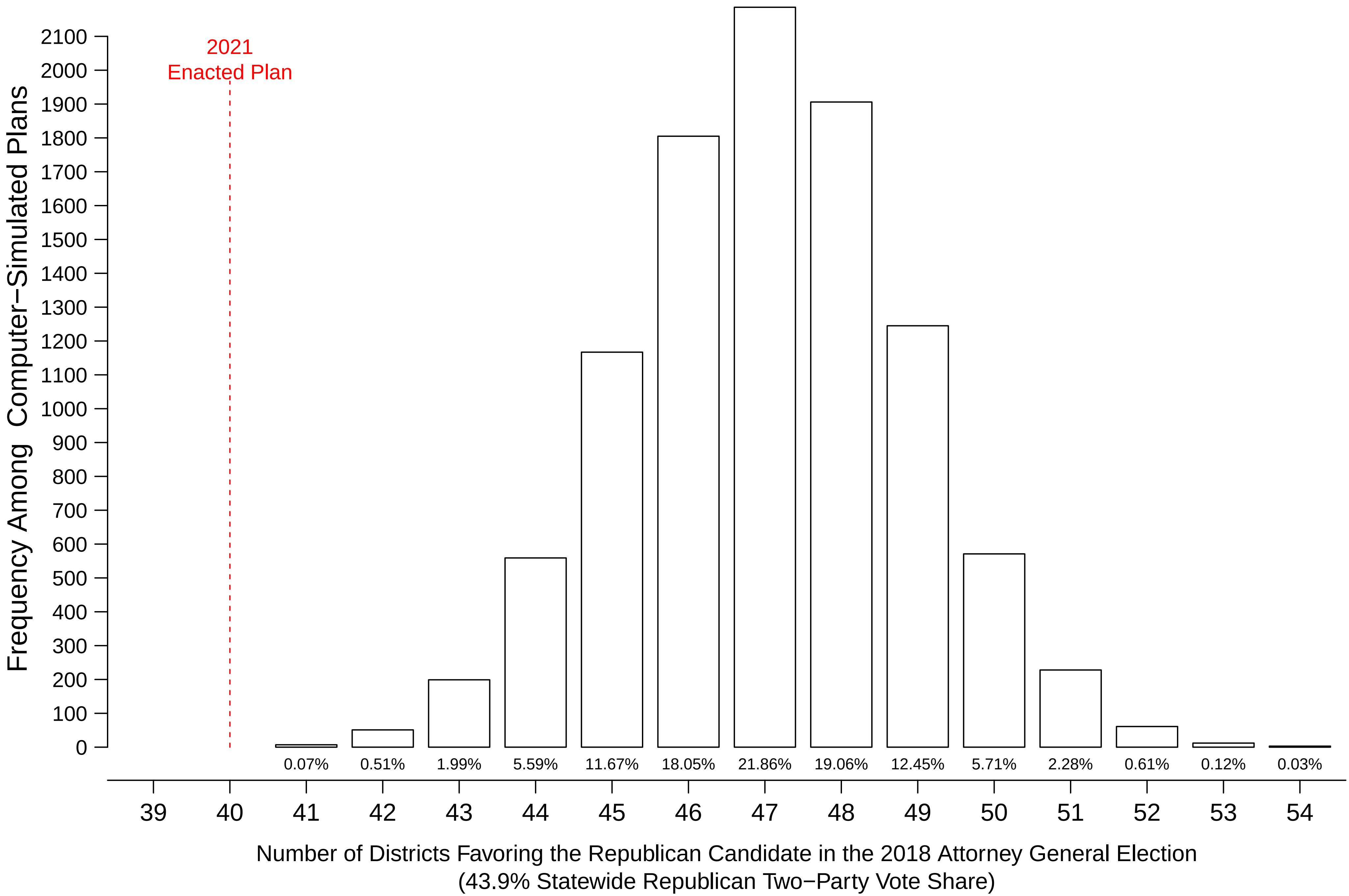


Figure A10: Comparison of Enacted Plan to Computer−Simulated Plans: Number of Districts Favoring the Republican Candidate in the 2020 US President Election (41.3% Statewide Republican Two−Party Vote Share)

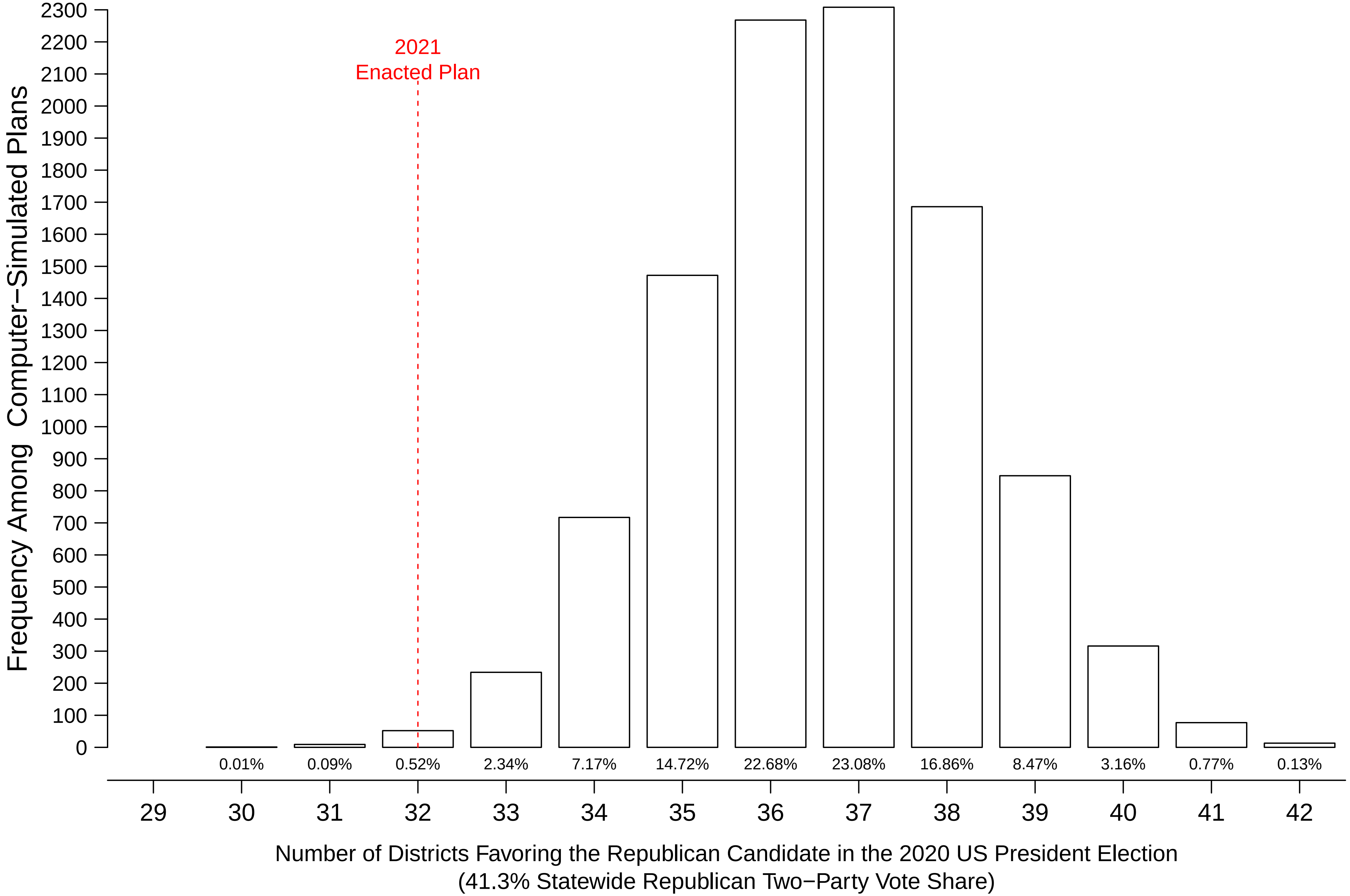


Figure A11: Comparison of Enacted Plan to Computer−Simulated Plans:
Number of Districts Favoring the Republican Candidate in the 2020 US Senate Election
(41.4% Statewide Republican Two−Party Vote Share)

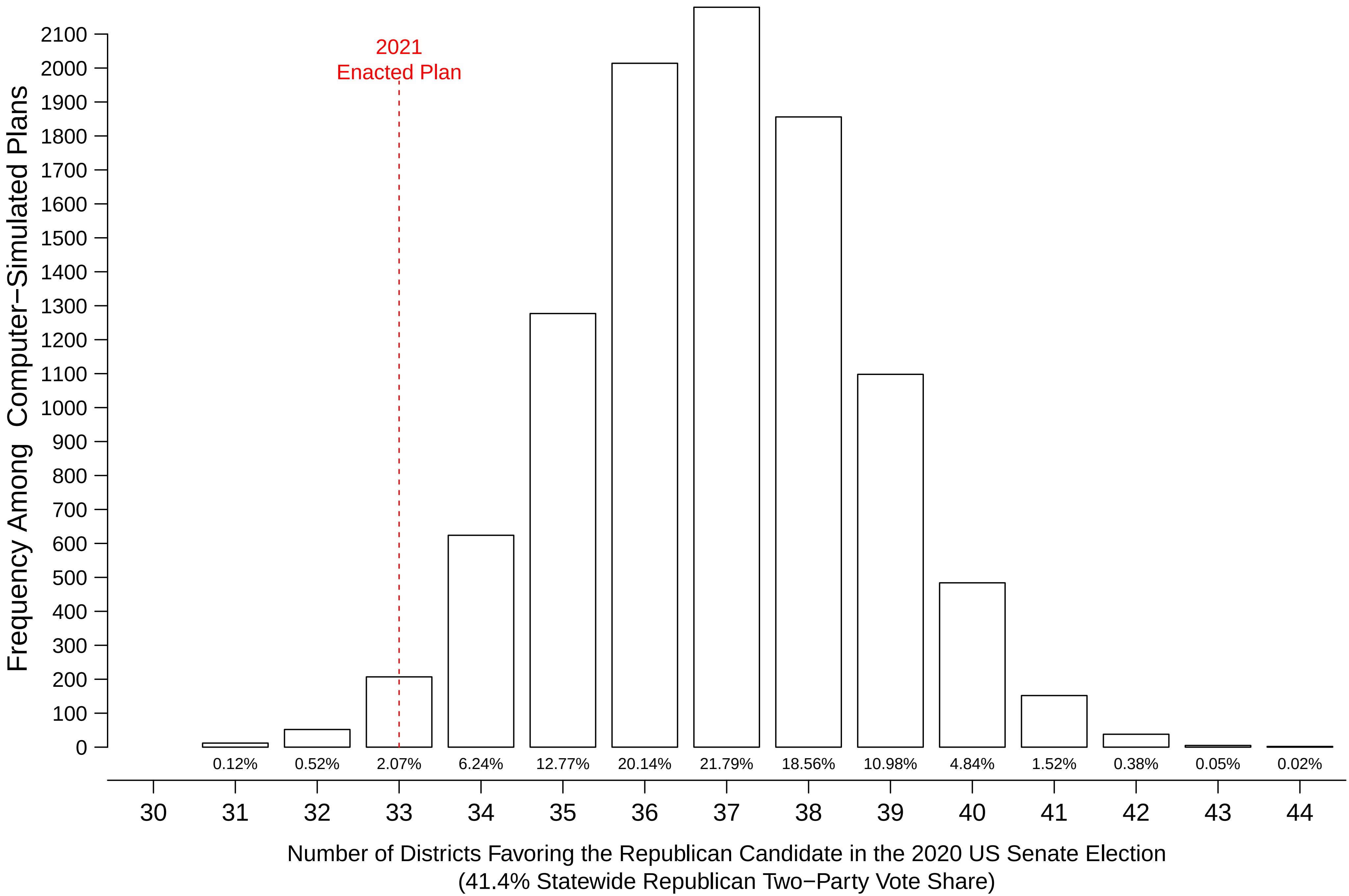
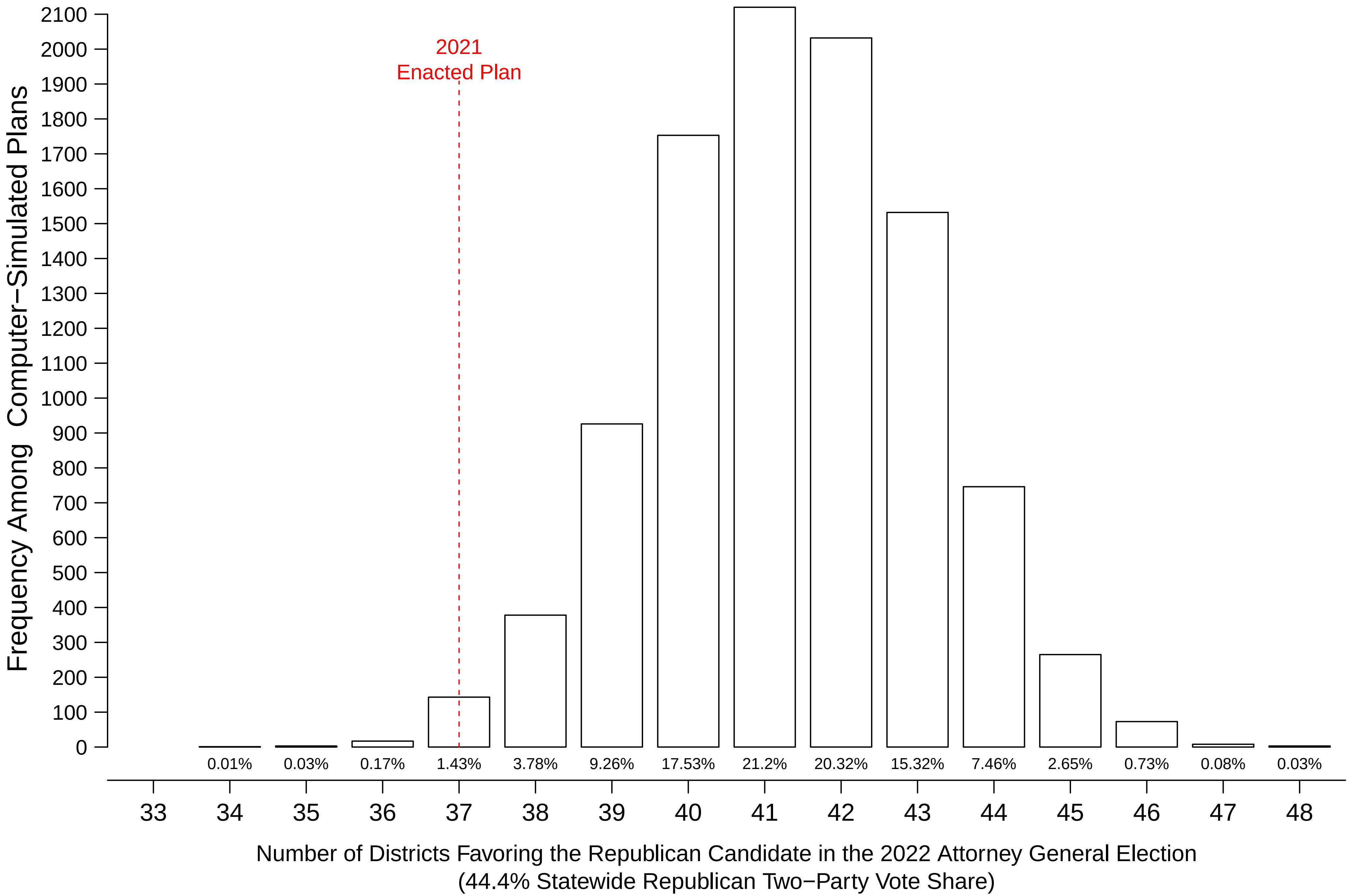


Figure A12: Comparison of Enacted Plan to Computer−Simulated Plans:
Number of Districts Favoring the Republican Candidate in the 2022 Attorney General Election
(44.4% Statewide Republican Two−Party Vote Share)



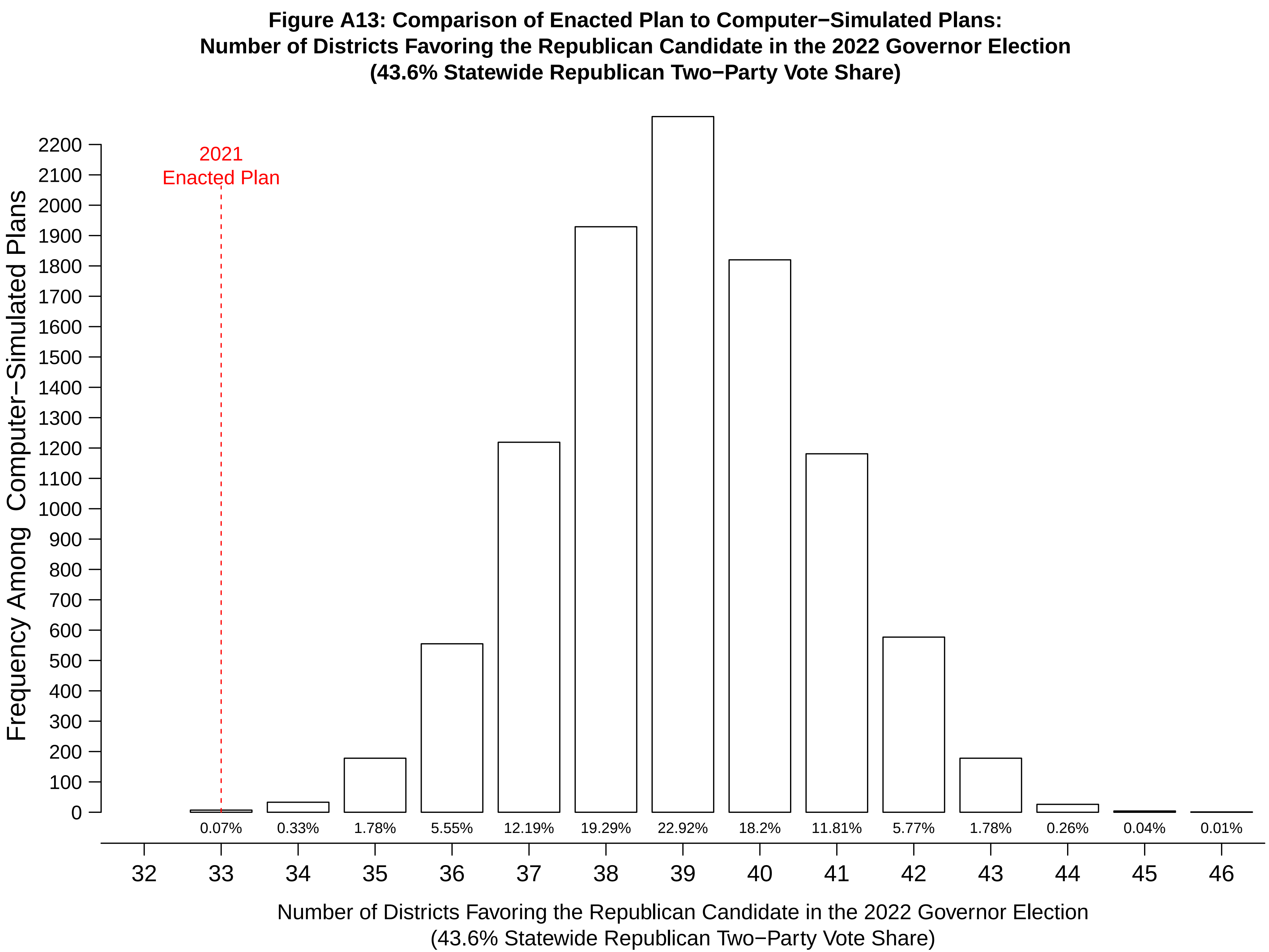


Figure A13: Comparison of Enacted Plan to Computer−Simulated Plans:
Number of Districts Favoring the Republican Candidate in the 2022 Governor Election
(43.6% Statewide Republican Two−Party Vote Share)
2021
Enacted Plan
Frequency Among Computer−Simulated Plans
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
2100
2200
0.07%
0.33%
1.78%
5.55%
12.19%
19.29%
22.92%
18.2%
11.81%
5.77%
1.78%
0.26%
0.04%
0.01%
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
Number of Districts Favoring the Republican Candidate in the 2022 Governor Election
(43.6% Statewide Republican Two−Party Vote Share)

Figure A14: Comparison of Enacted Plan to Computer−Simulated Plans:
Number of Districts Favoring the Republican Candidate in the 2022 Secretary of State Election
(44.5% Statewide Republican Two−Party Vote Share)

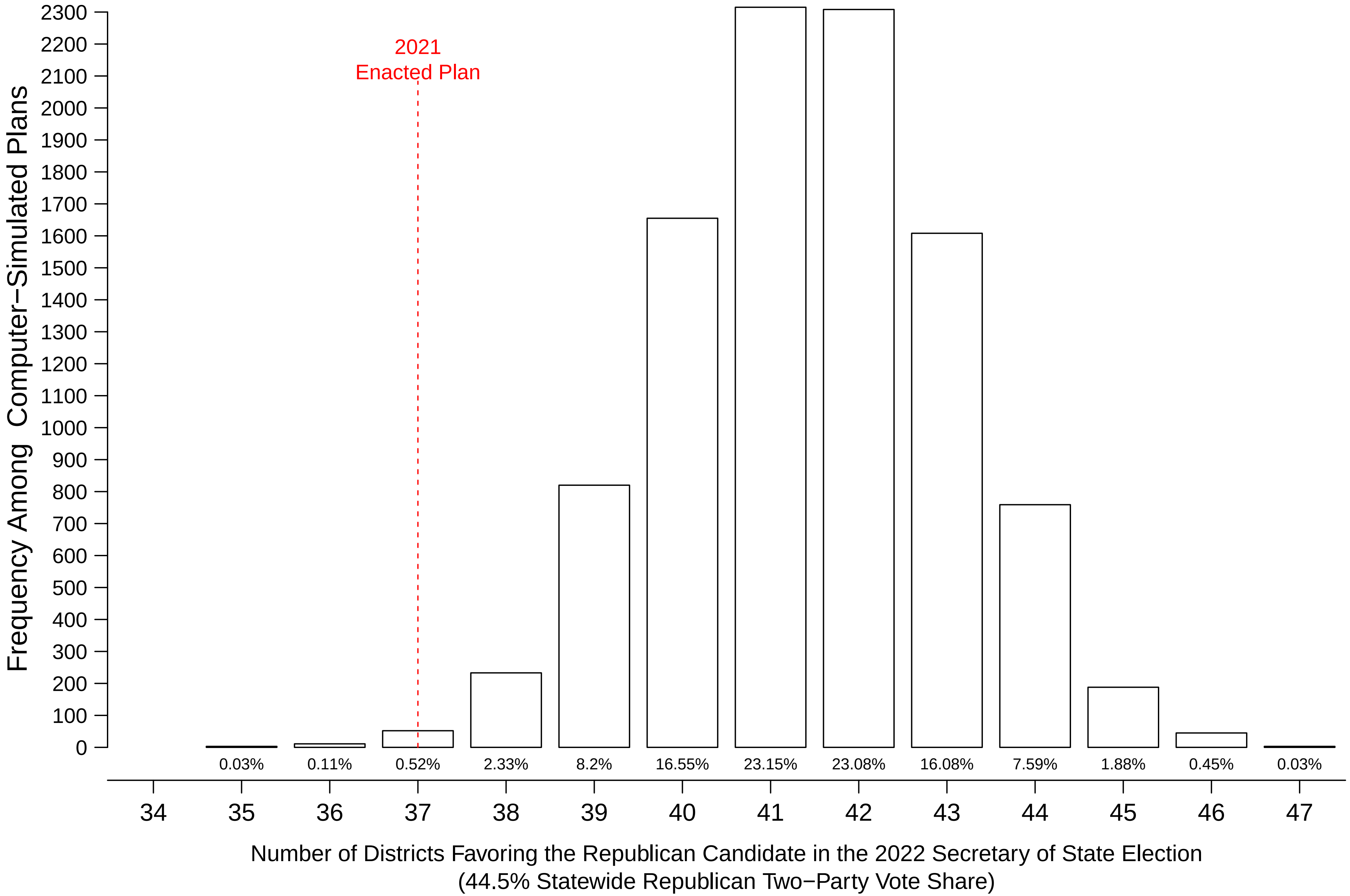


Figure A15: Comparison of Enacted Plan to Computer−Simulated Plans:
Number of Districts Favoring the Republican Candidate in the 2022 Treasurer Election
(44.5% Statewide Republican Two−Party Vote Share)

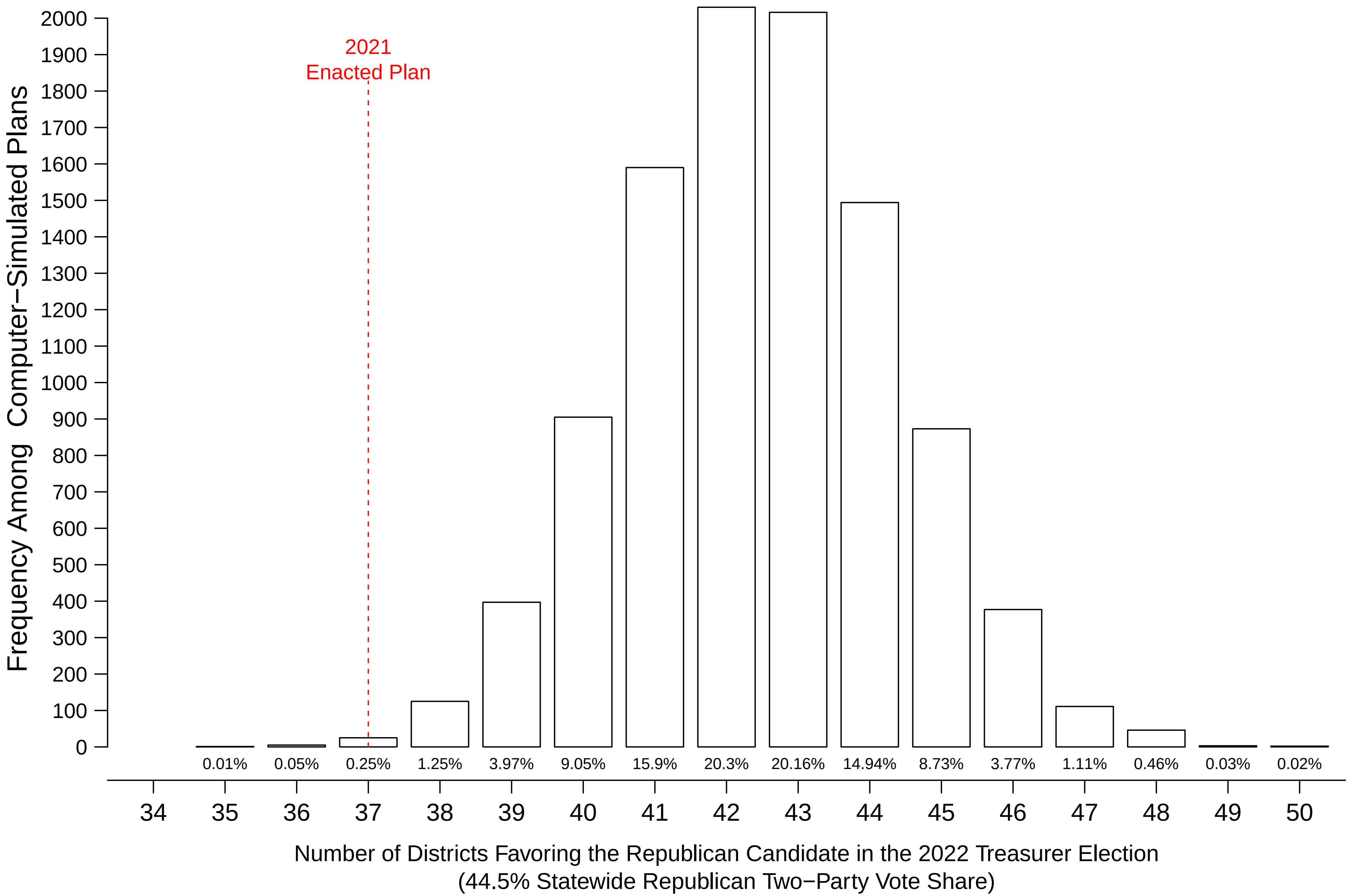
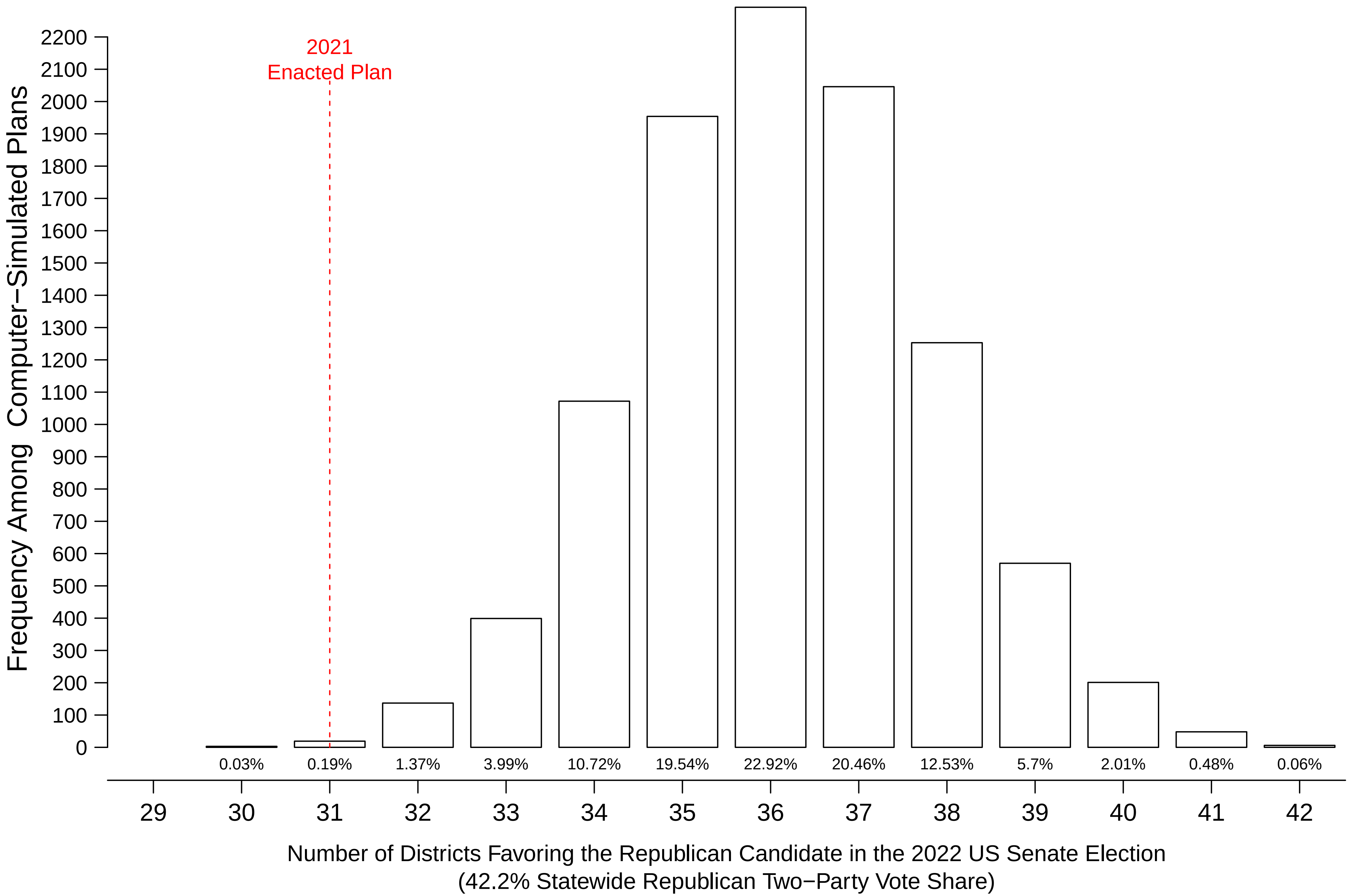


**Figure A16: Comparison of Enacted Plan to Computer−Simulated Plans:
Number of Districts Favoring the Republican Candidate in the 2022 US Senate Election
(42.2% Statewide Republican Two−Party Vote Share)**



Appendix B:

Figure B1:
2021 House Plan versus Computer-Simulated Maps, Compared Using the 2014 US Senate Election Results

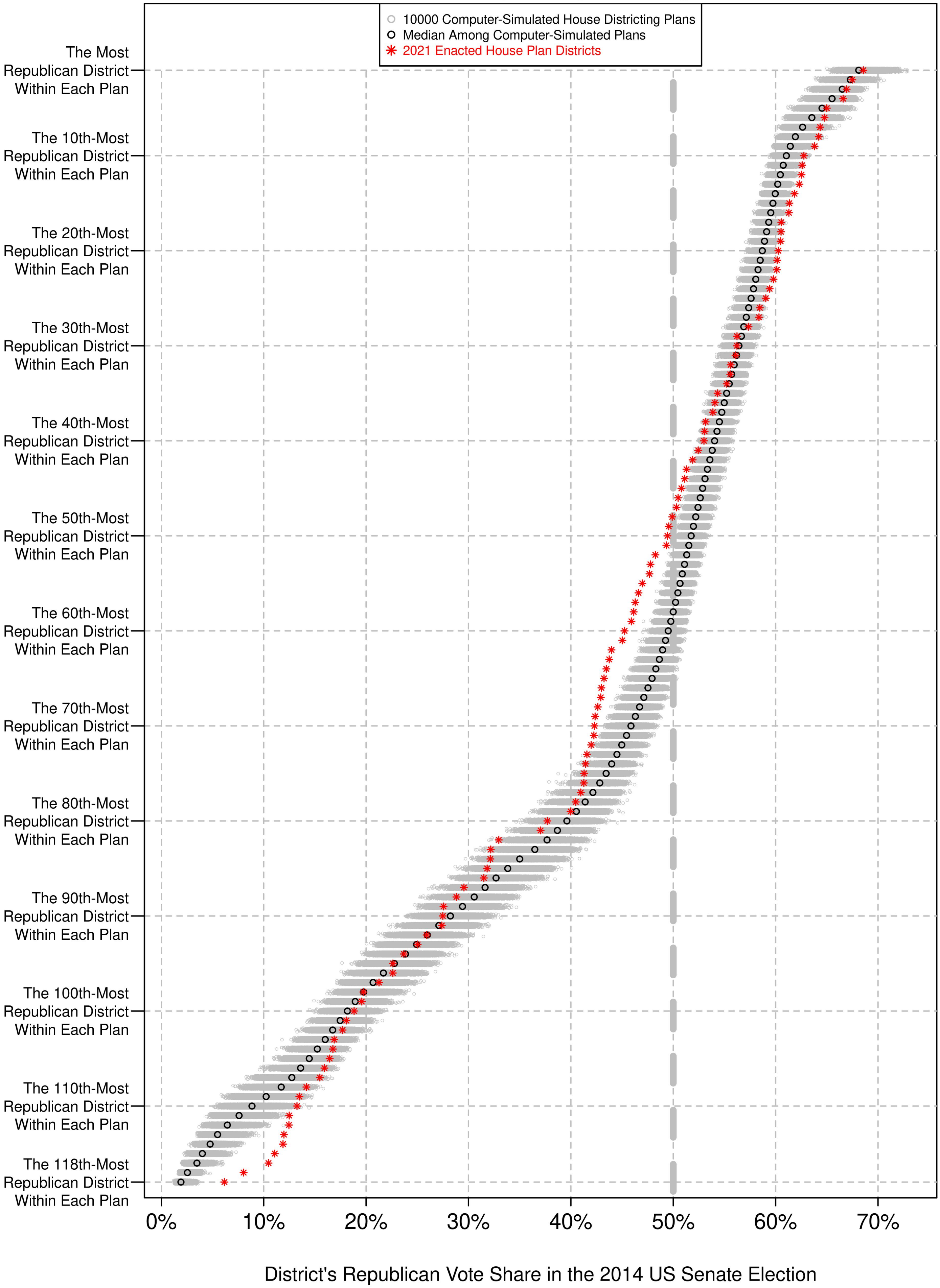


Figure B2:
2021 House Plan versus Computer-Simulated Maps, Compared Using the 2014 Governor Election Results

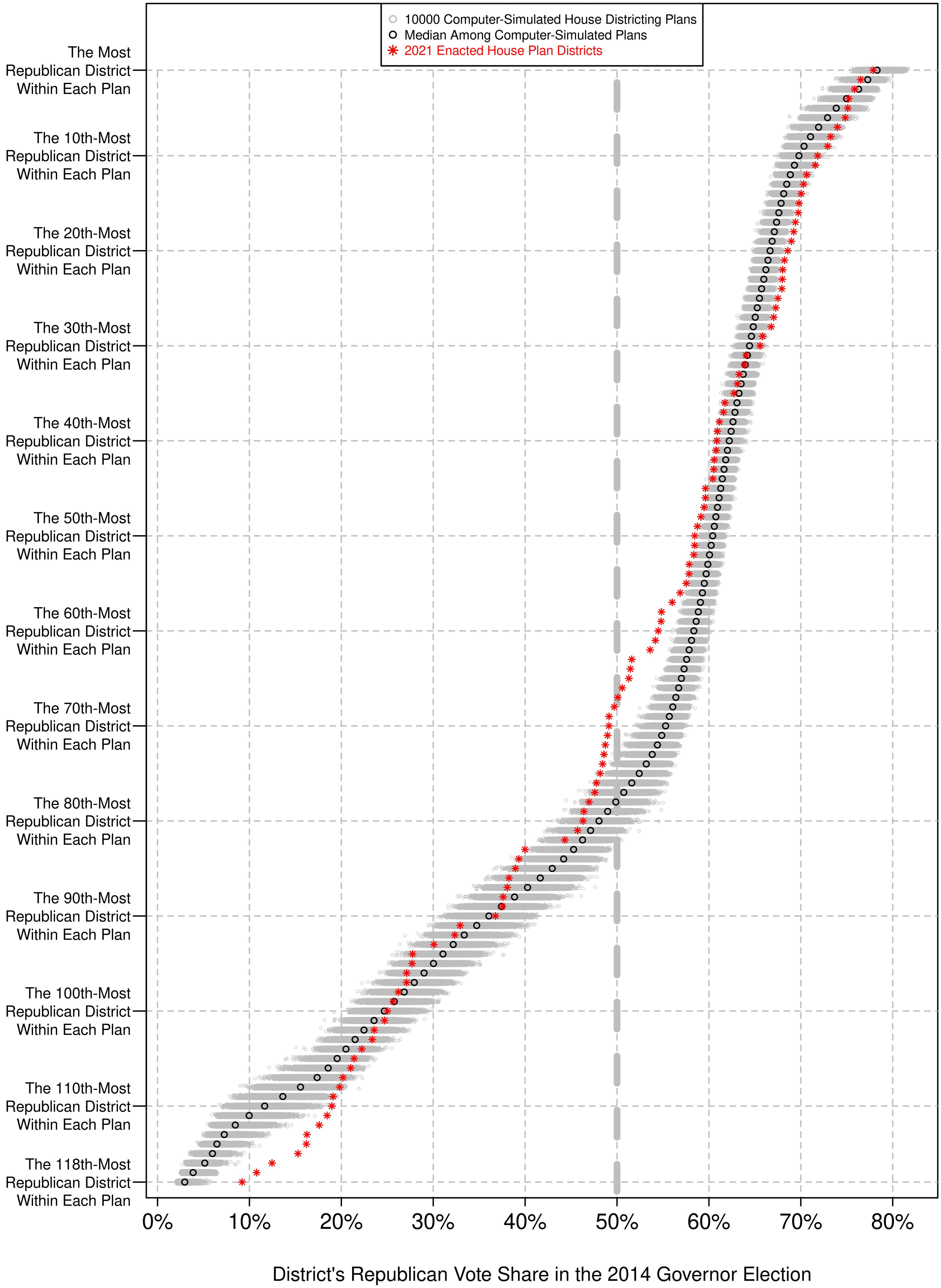


Figure B3:
2021 House Plan versus Computer-Simulated Maps, Compared Using the 2014 Comptroller Election Results

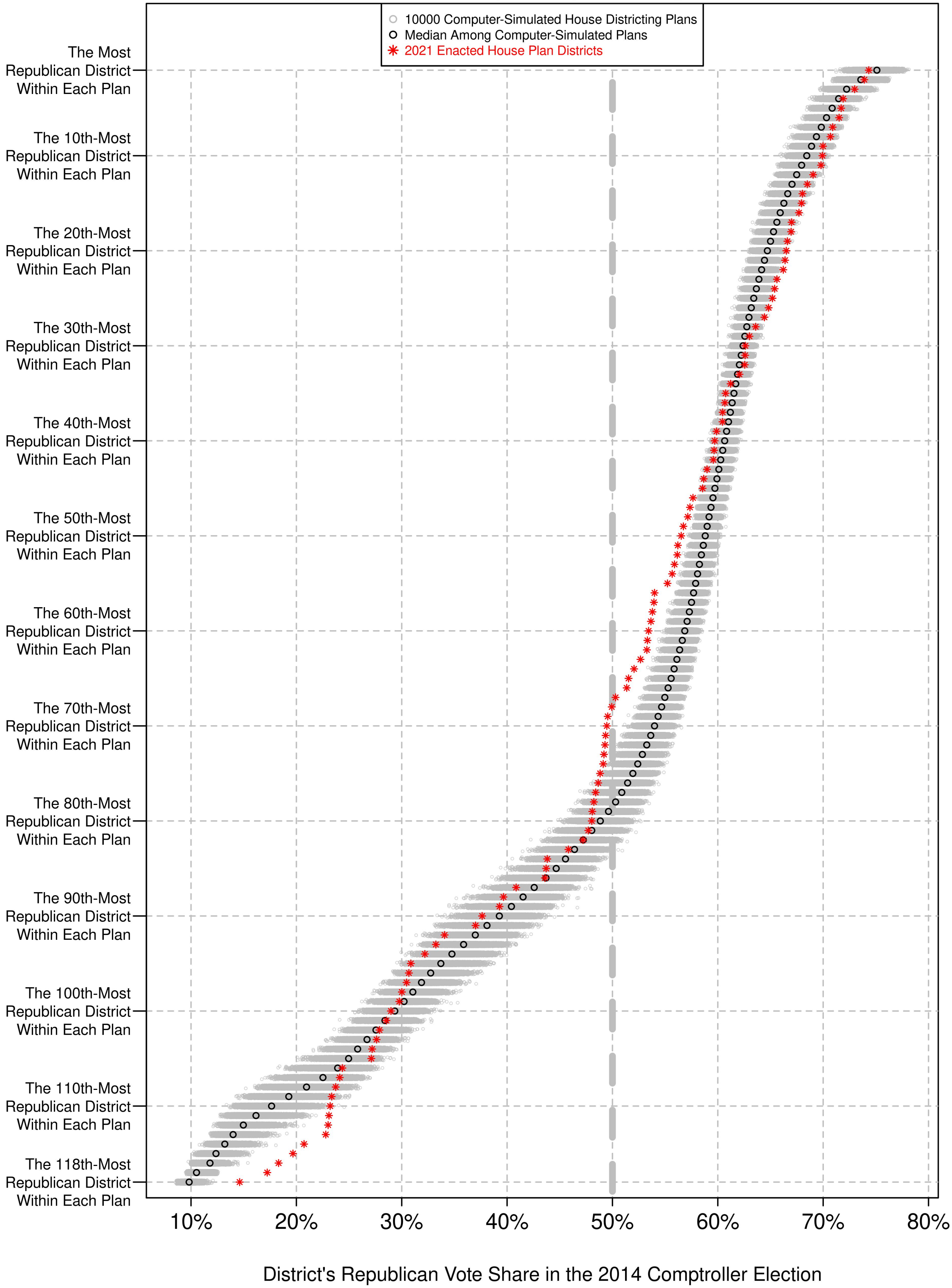


Figure B4:
2021 House Plan versus Computer-Simulated Maps, Compared Using the 2014 Treasurer Election Results

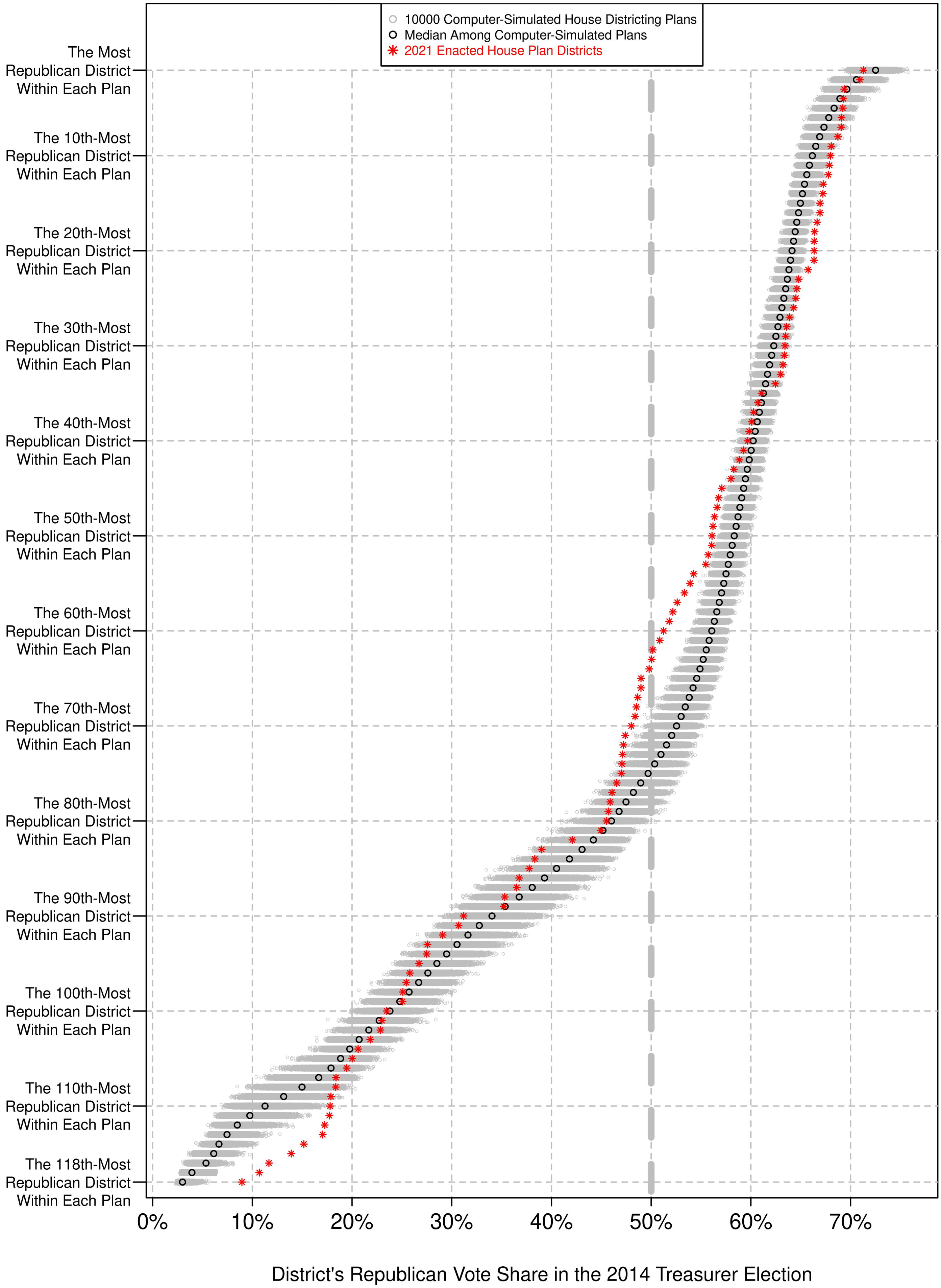


Figure B5:
2021 House Plan versus Computer-Simulated Maps, Compared Using the 2016 US President Election Results

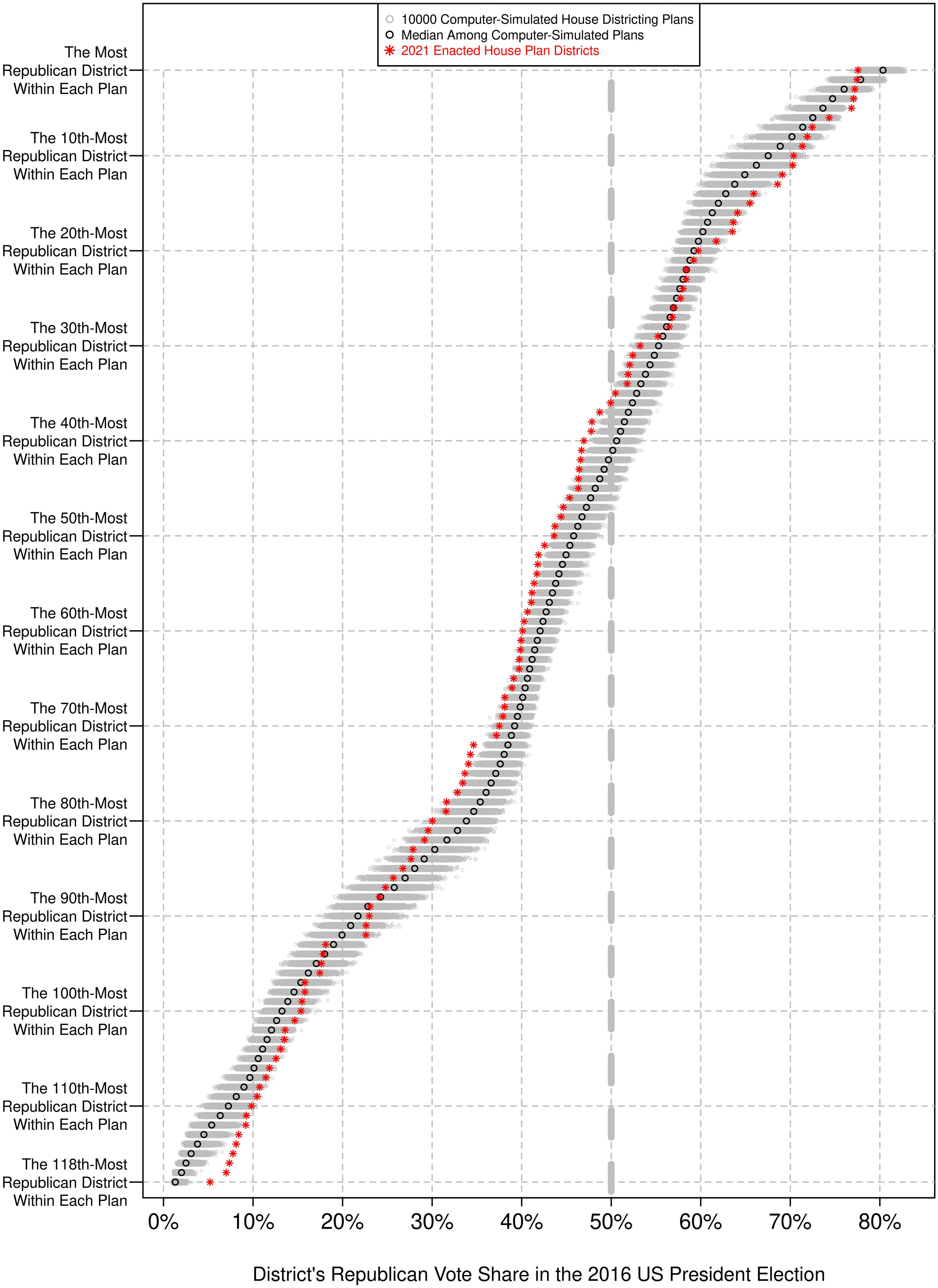


Figure B6:
2021 House Plan versus Computer-Simulated Maps, Compared Using the 2016 US Senate Election Results

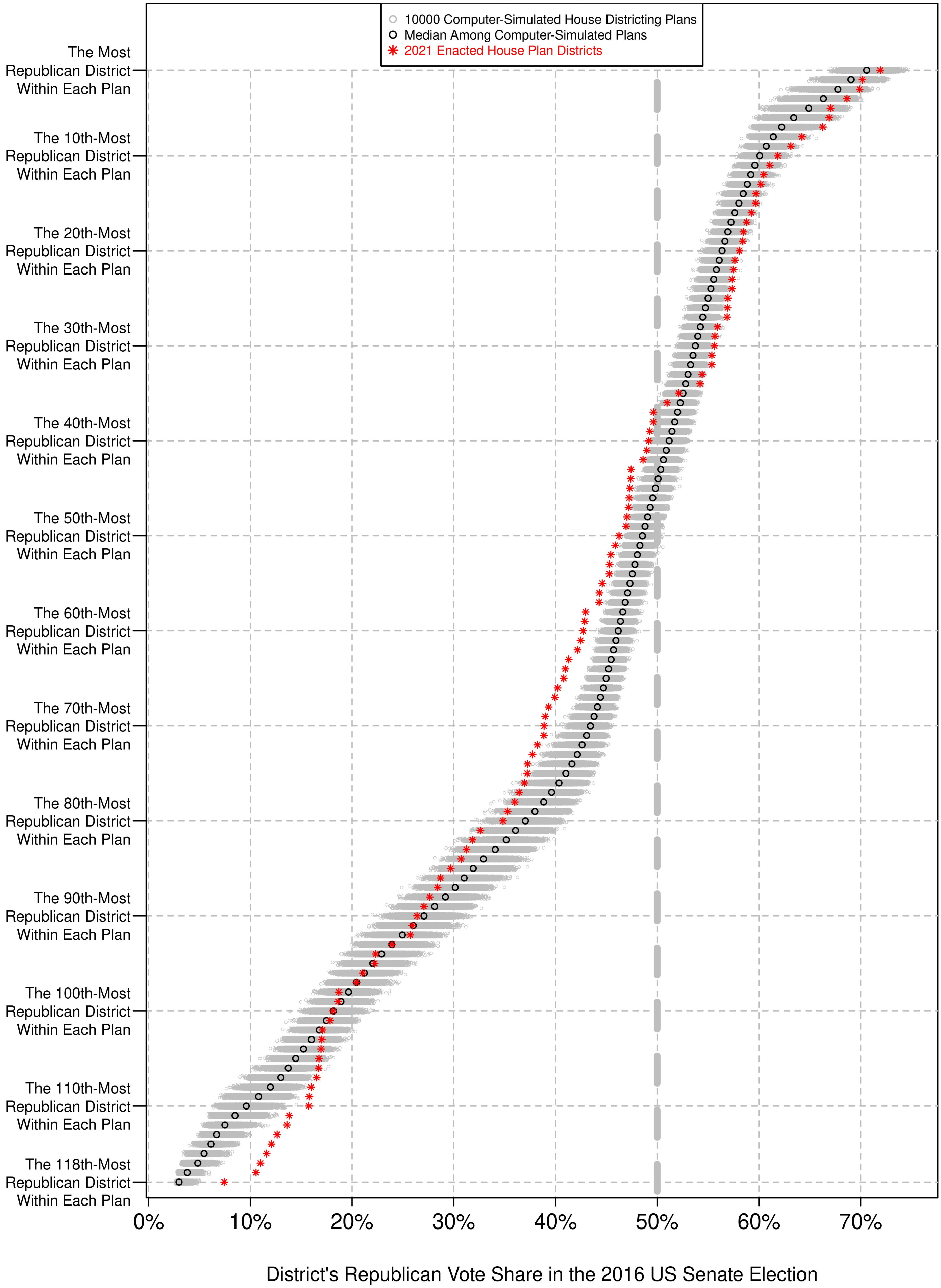


Figure B7:
2021 House Plan versus Computer-Simulated Maps, Compared Using the 2016 Comptroller Election Results

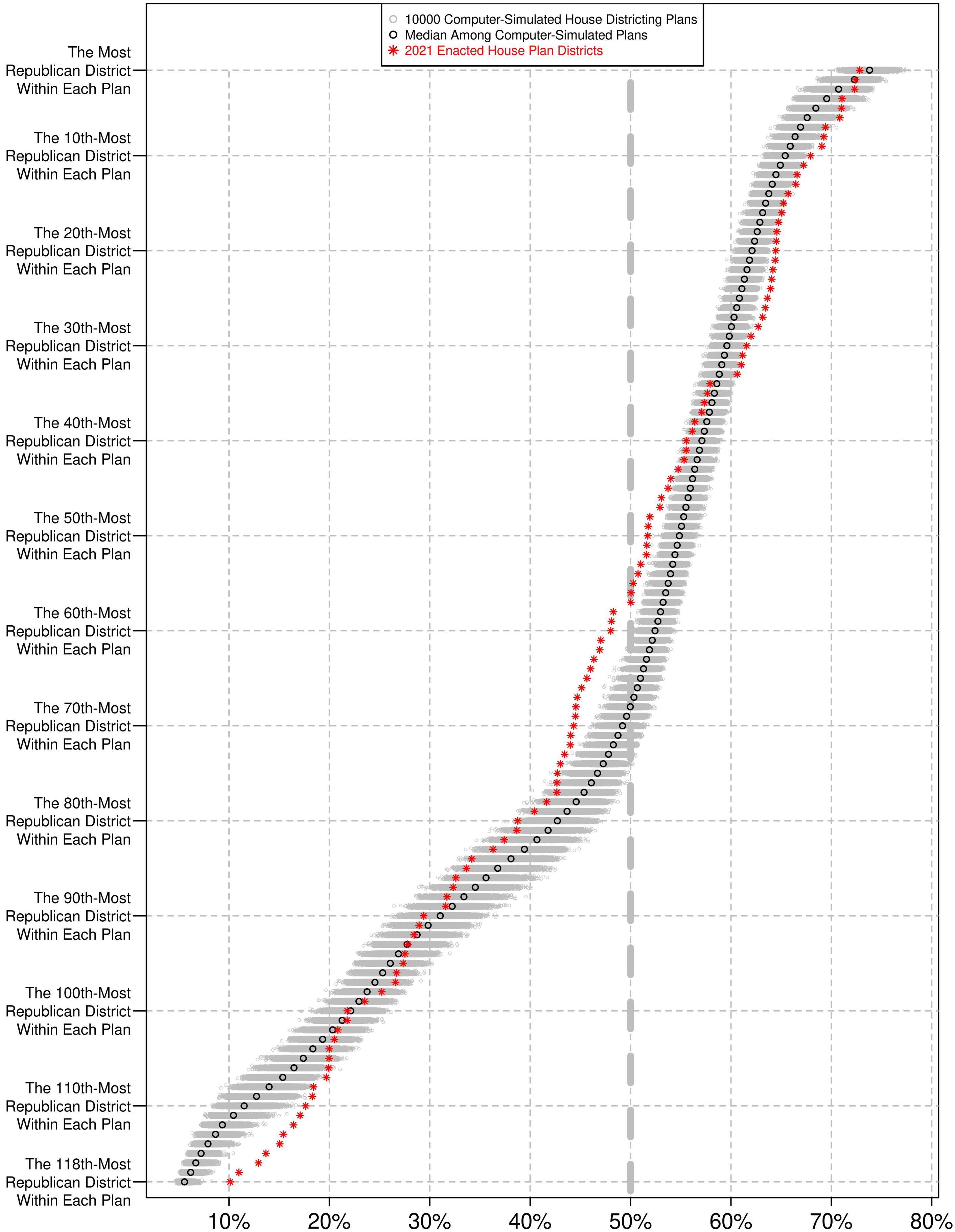


Figure B8:
2021 House Plan versus Computer-Simulated Maps, Compared Using the 2018 Governor Election Results

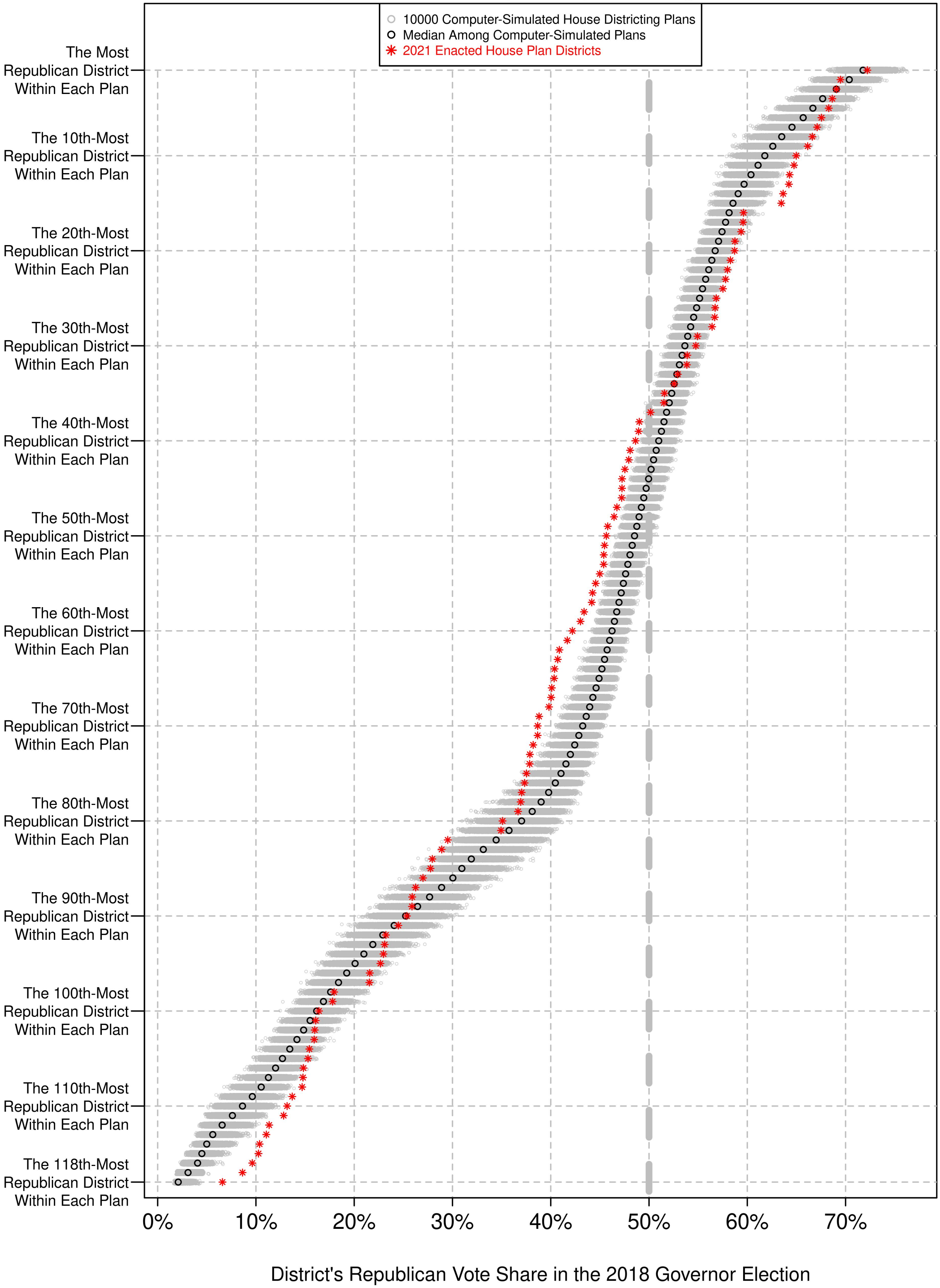


Figure B9:
2021 House Plan versus Computer-Simulated Maps, Compared Using the 2018 Attorney General Election Results

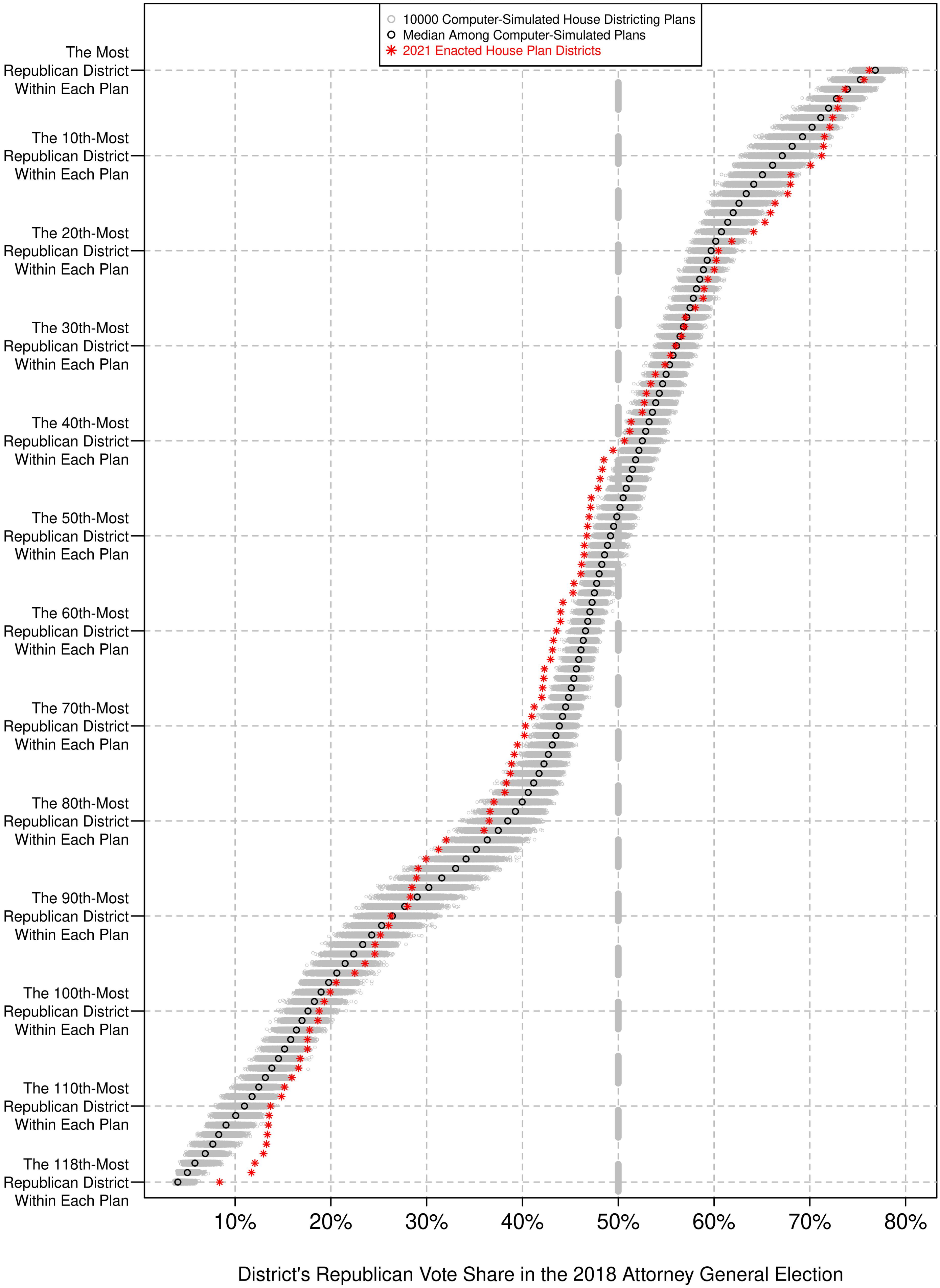


Figure B10:
2021 House Plan versus Computer-Simulated Maps, Compared Using the 2020 US President Election Results

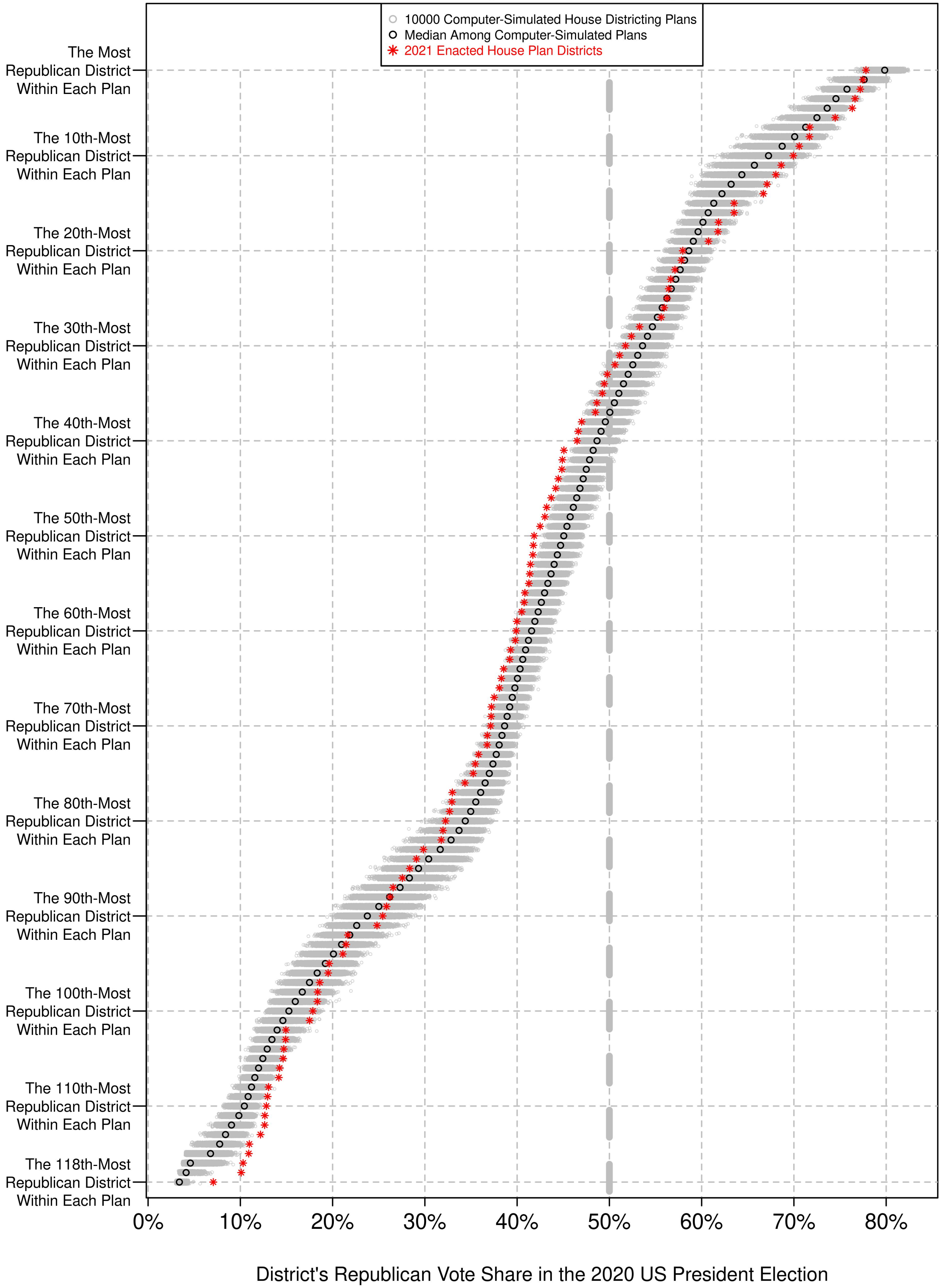


Figure B11:
2021 House Plan versus Computer-Simulated Maps, Compared Using the 2020 US Senate Election Results

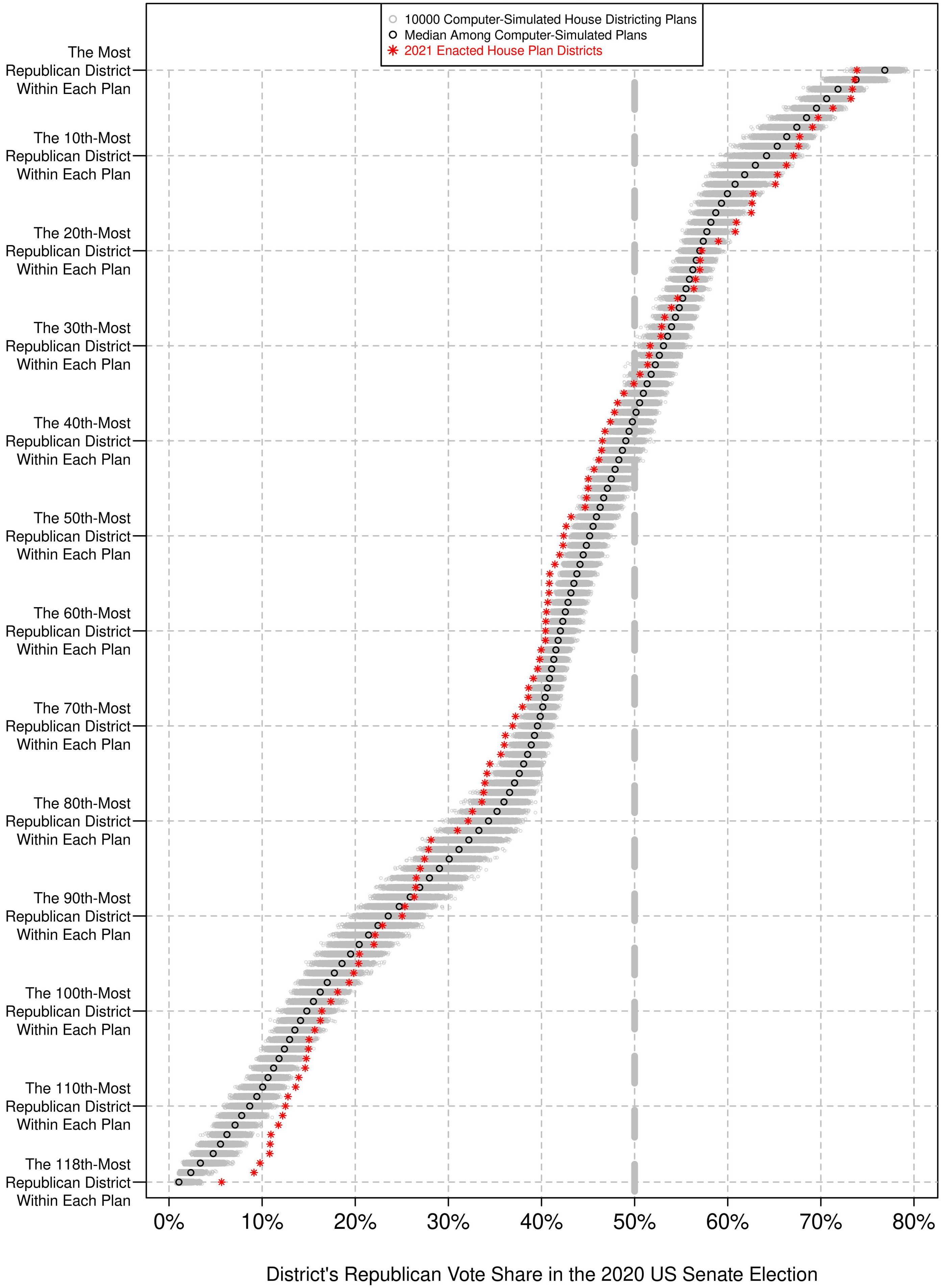


Figure B12:
2021 House Plan versus Computer-Simulated Maps, Compared Using the 2022 Attorney General Election Results

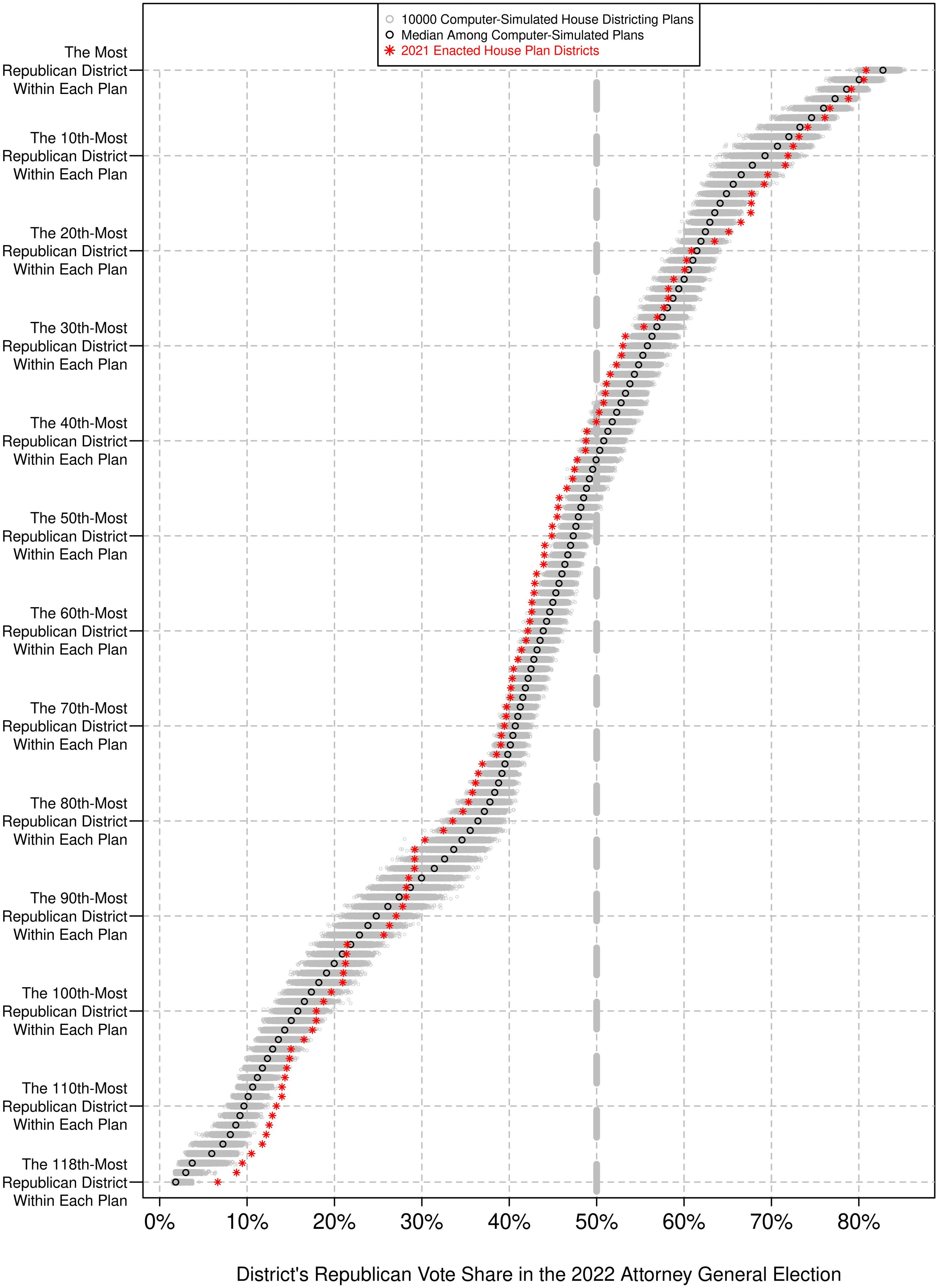


Figure B13:
2021 House Plan versus Computer-Simulated Maps, Compared Using the 2022 Governor Election Results

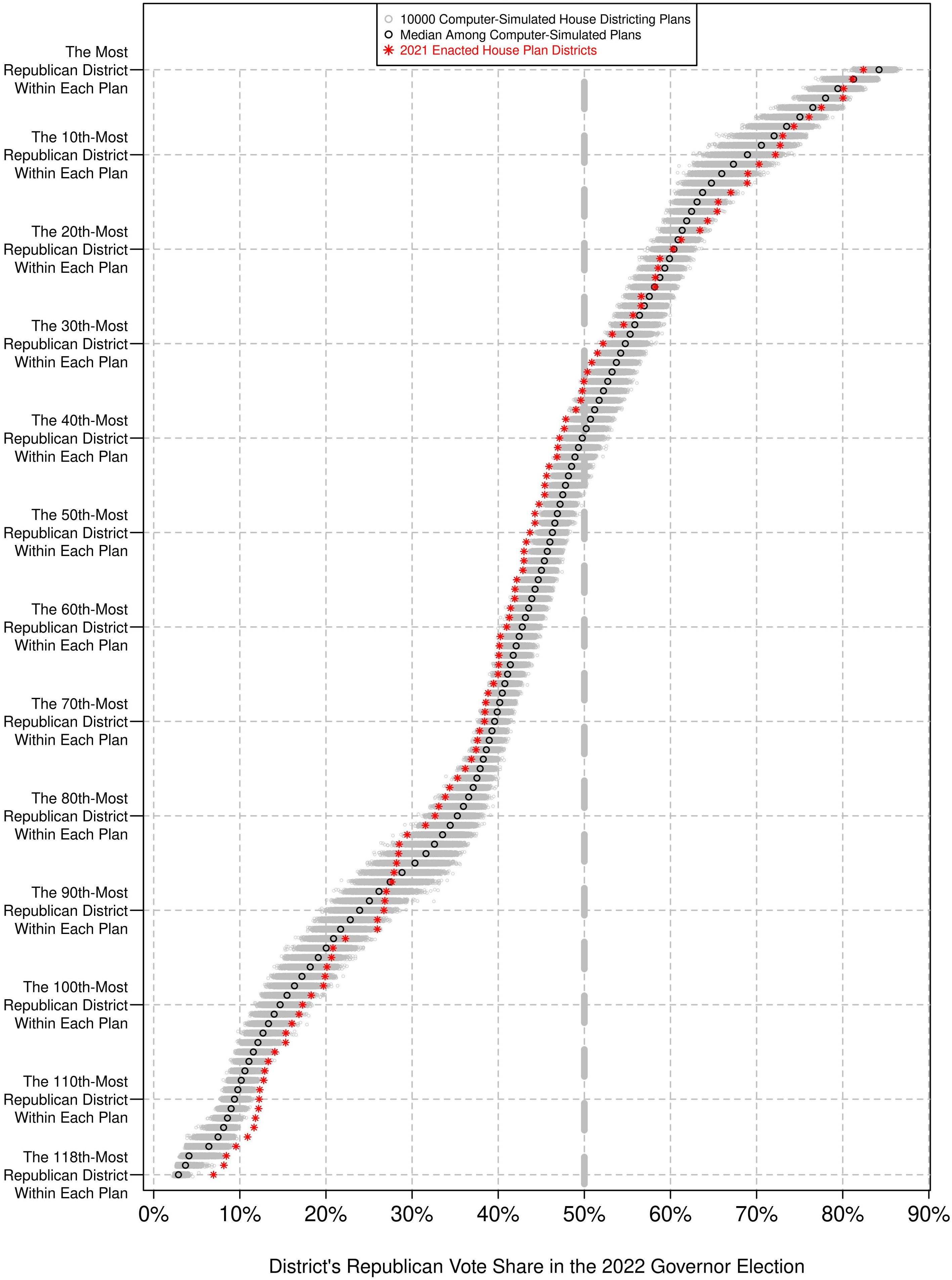


Figure B14:
2021 House Plan versus Computer-Simulated Maps, Compared Using the 2022 Secretary of State Election Result

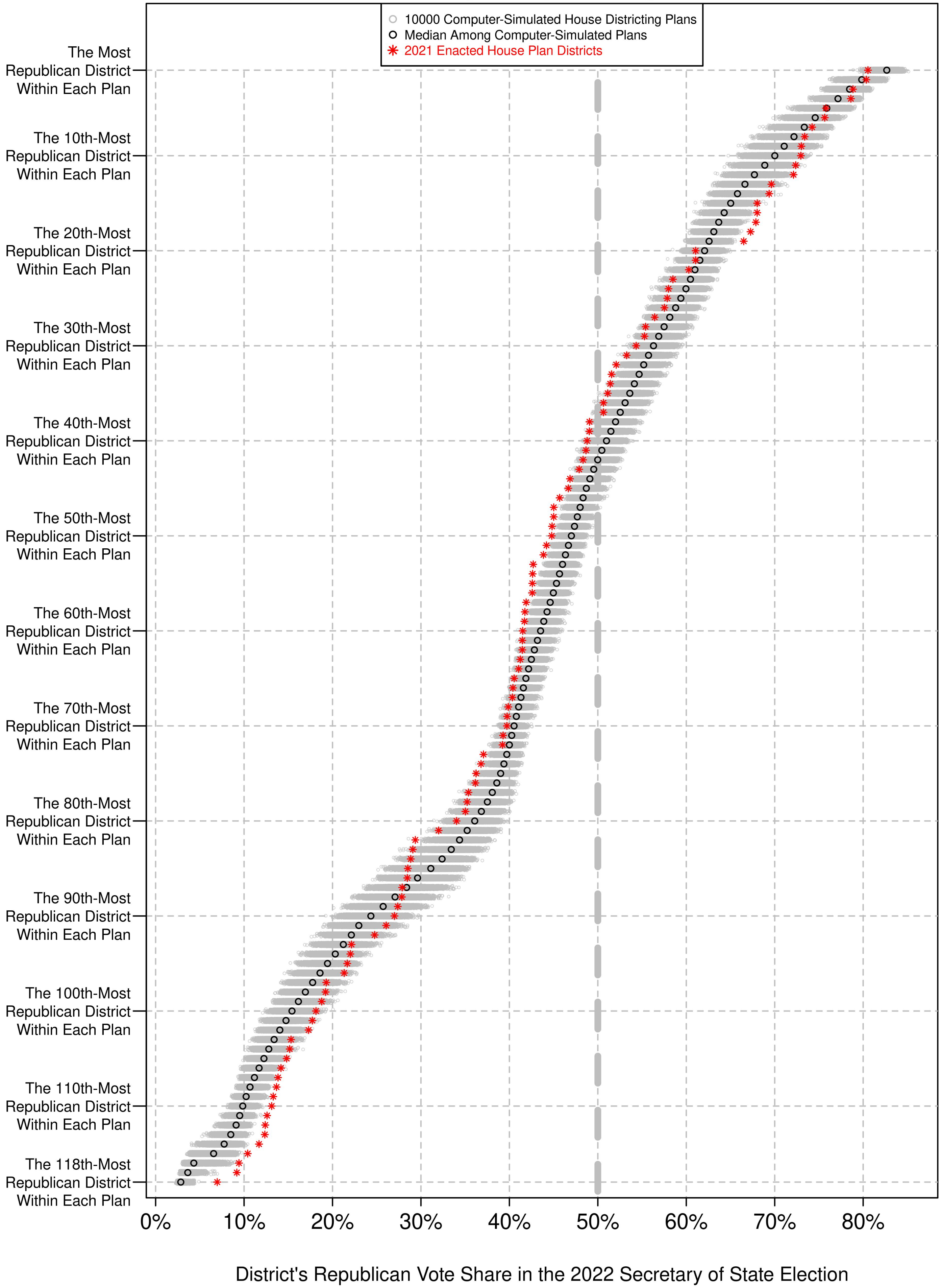


Figure B15:
2021 House Plan versus Computer-Simulated Maps, Compared Using the 2022 Treasurer Election Results

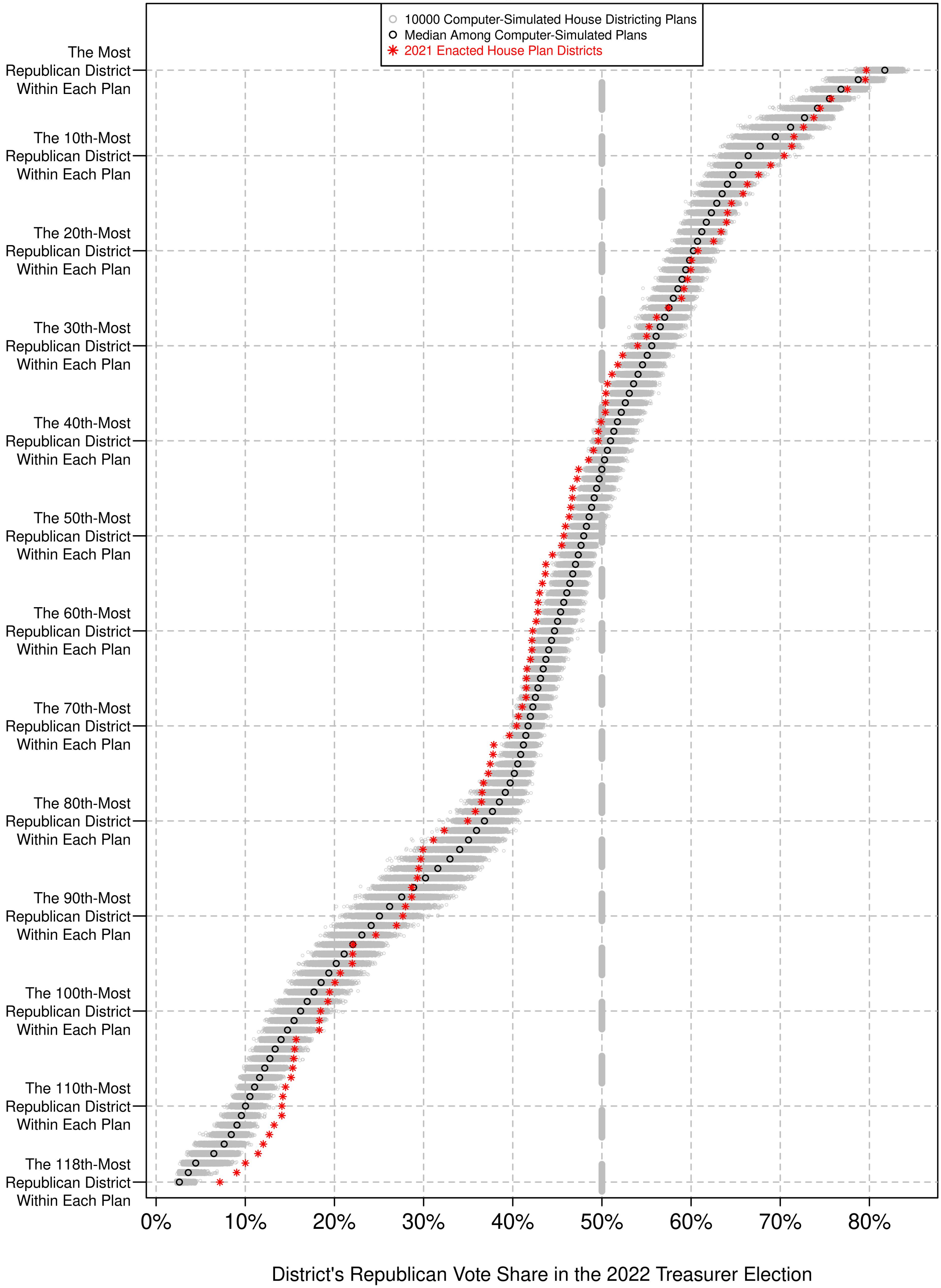
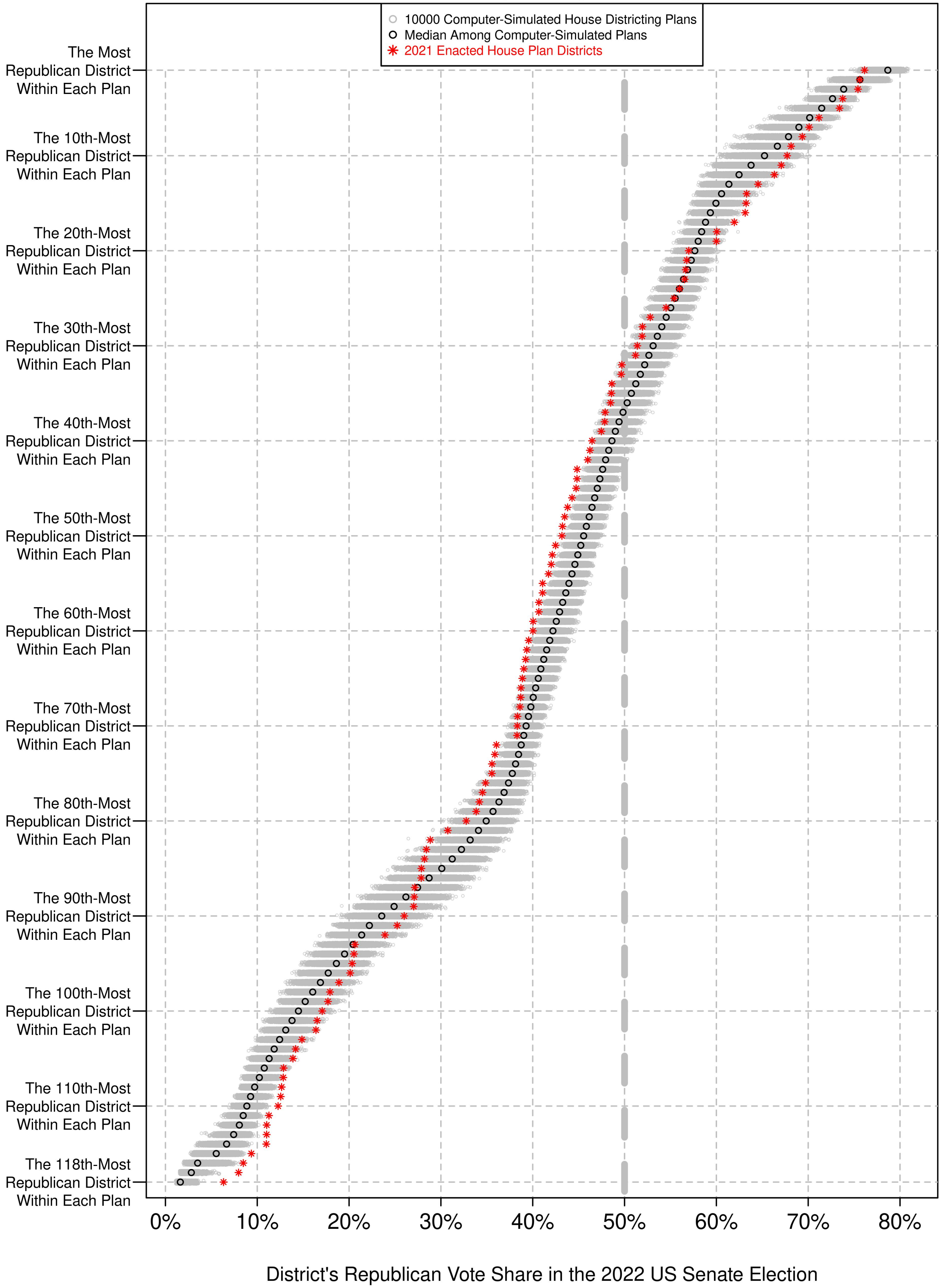


Figure B16:
2021 House Plan versus Computer-Simulated Maps, Compared Using the 2022 US Senate Election Results



Appendix C:

Figure C1:
2021 House Plan versus Computer−Simulated Maps, Compared Using the 2014 US Senate Election Results

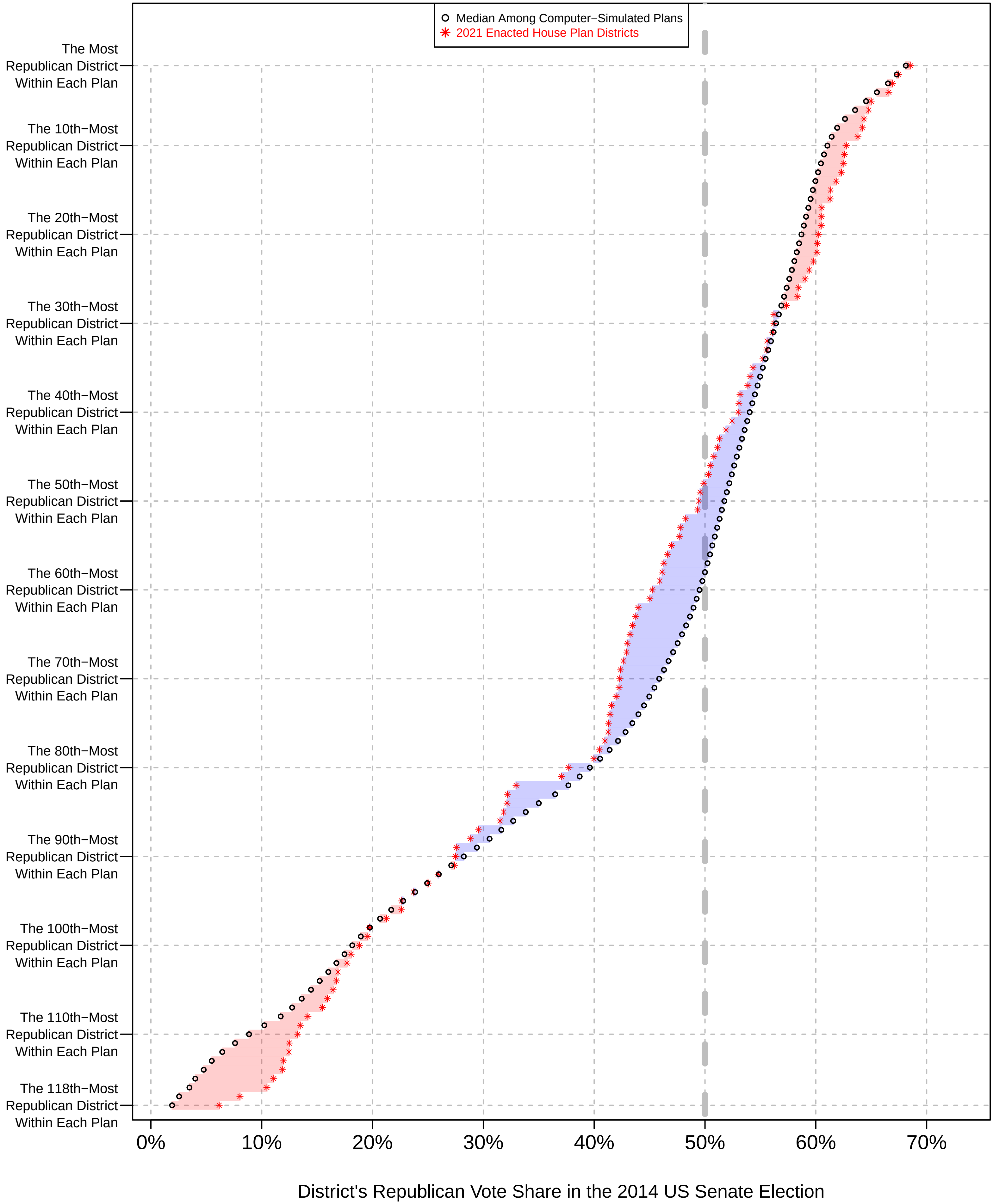


Figure C2:
2021 House Plan versus Computer−Simulated Maps, Compared Using the 2014 Governor Election Results

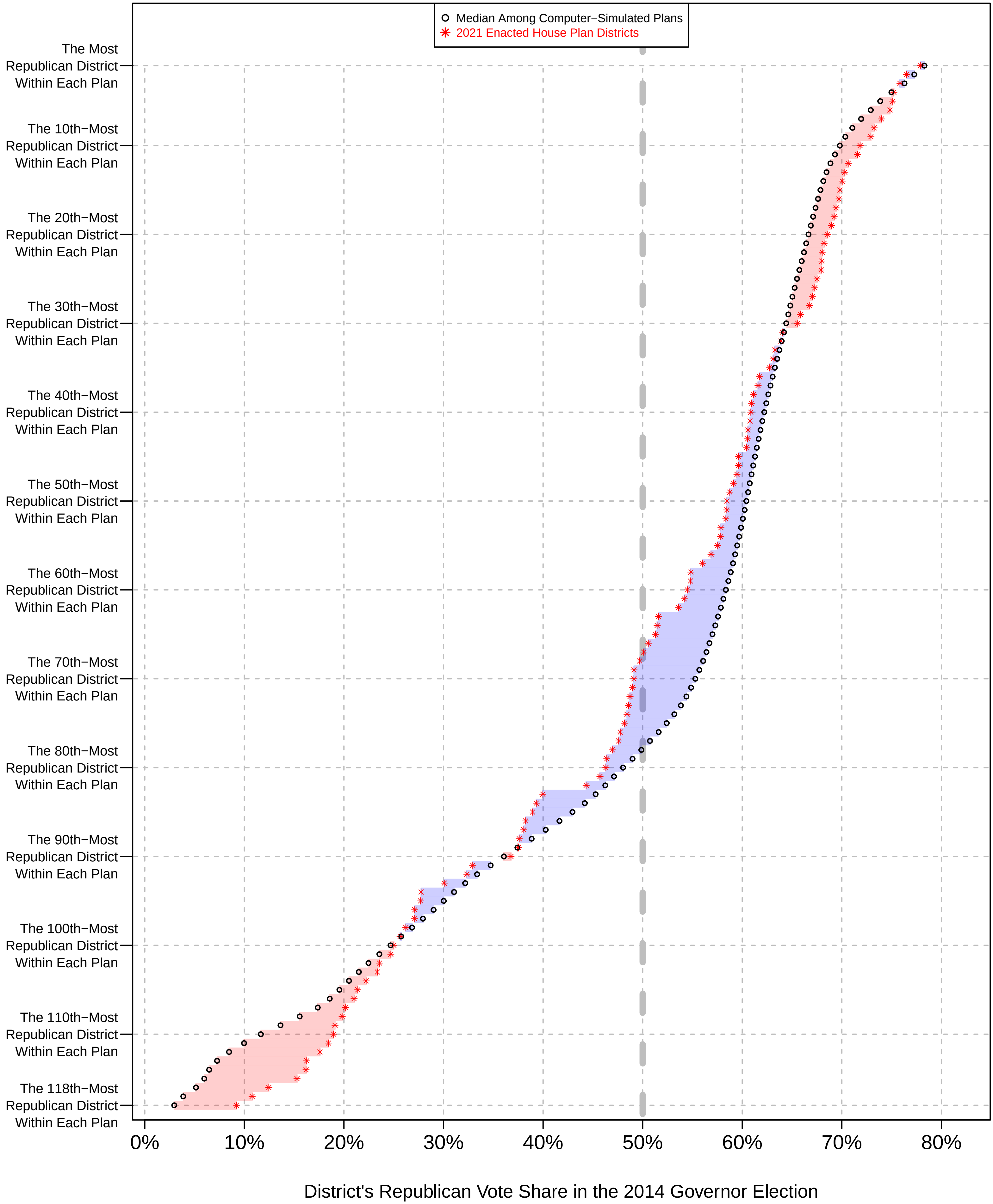


Figure C3:
2021 House Plan versus Computer−Simulated Maps, Compared Using the 2014 Comptroller Election Results

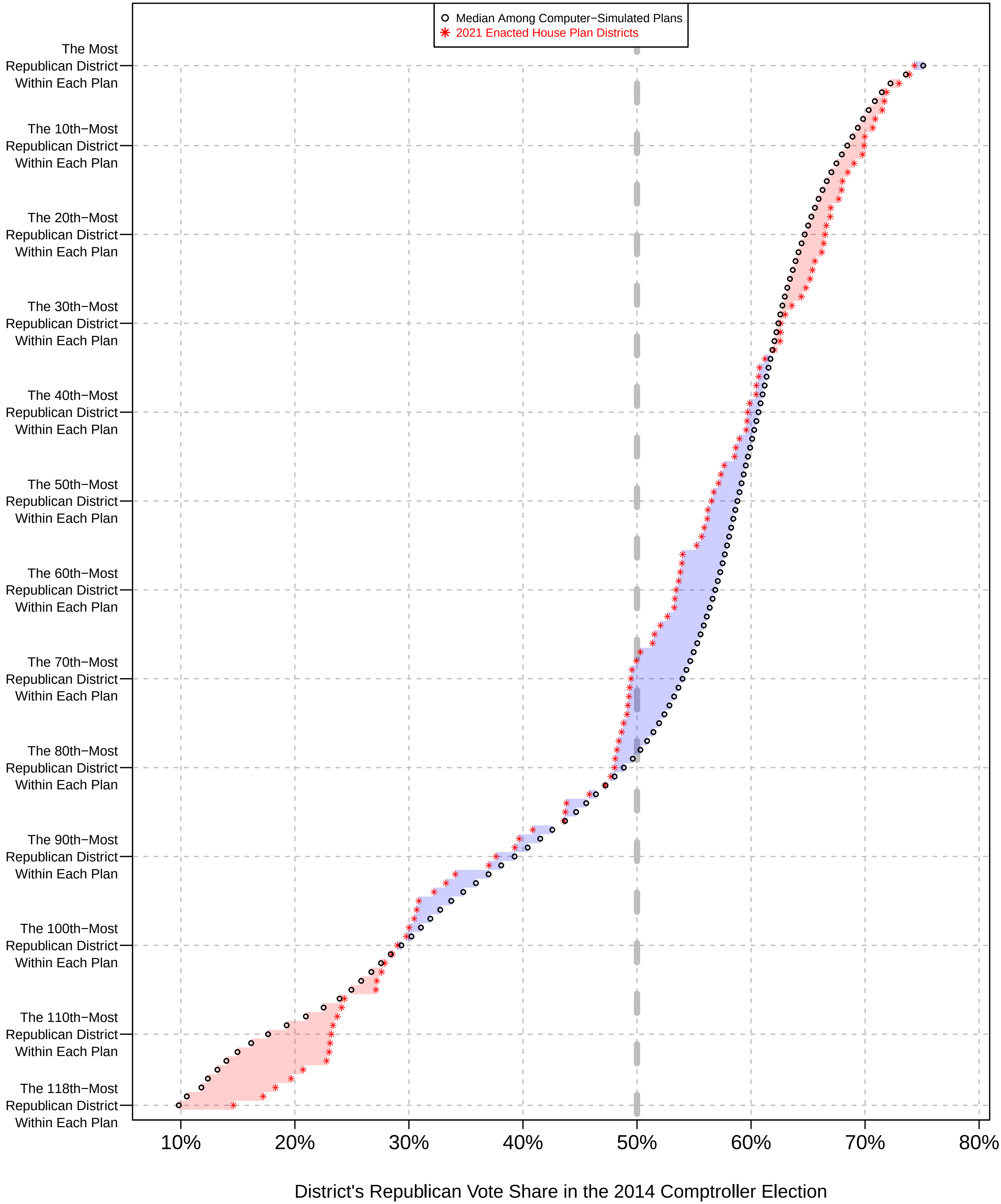


Figure C4:
2021 House Plan versus Computer−Simulated Maps, Compared Using the 2014 Treasurer Election Results

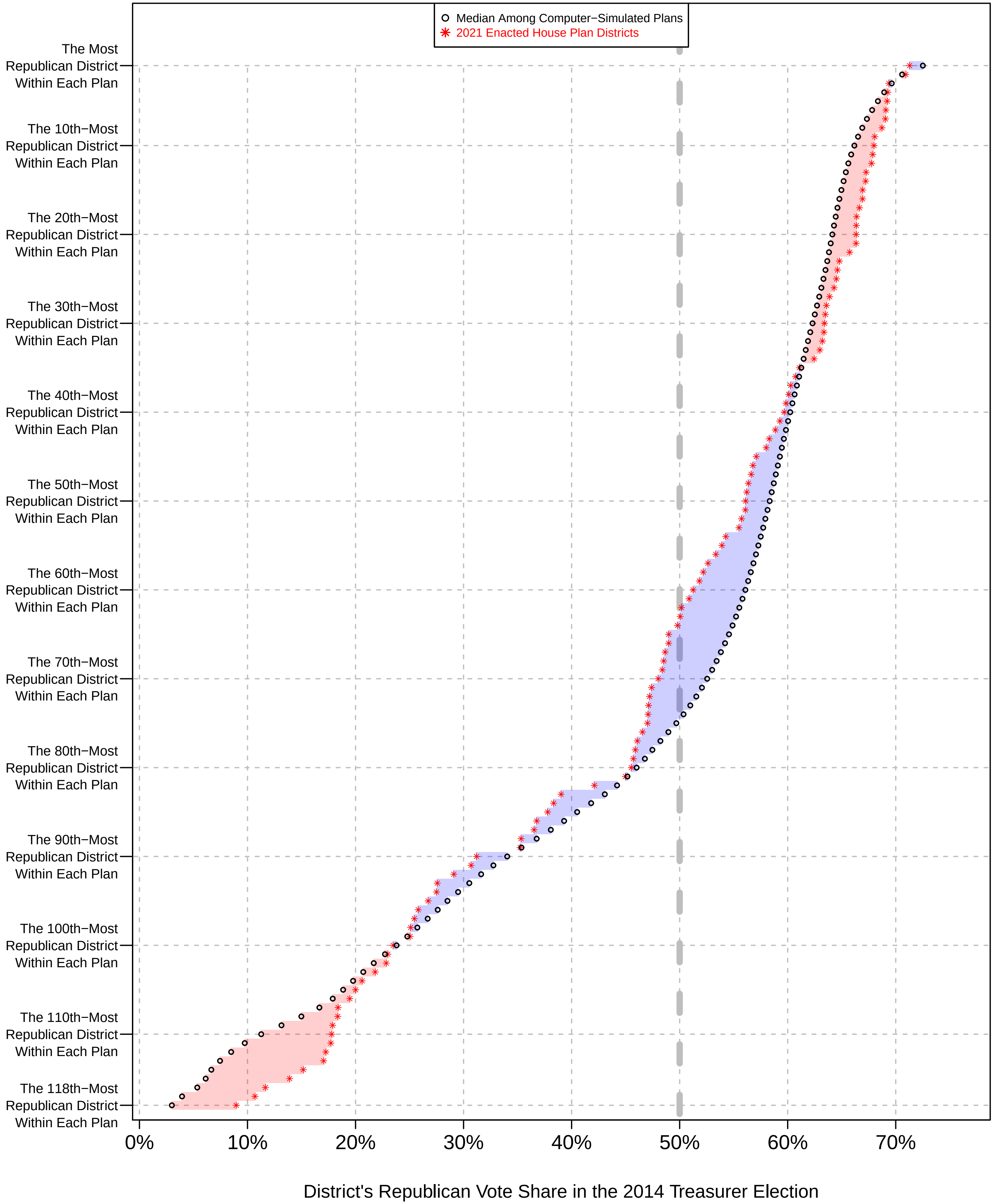


Figure C5:
2021 House Plan versus Computer−Simulated Maps, Compared Using the 2016 US President Election Results

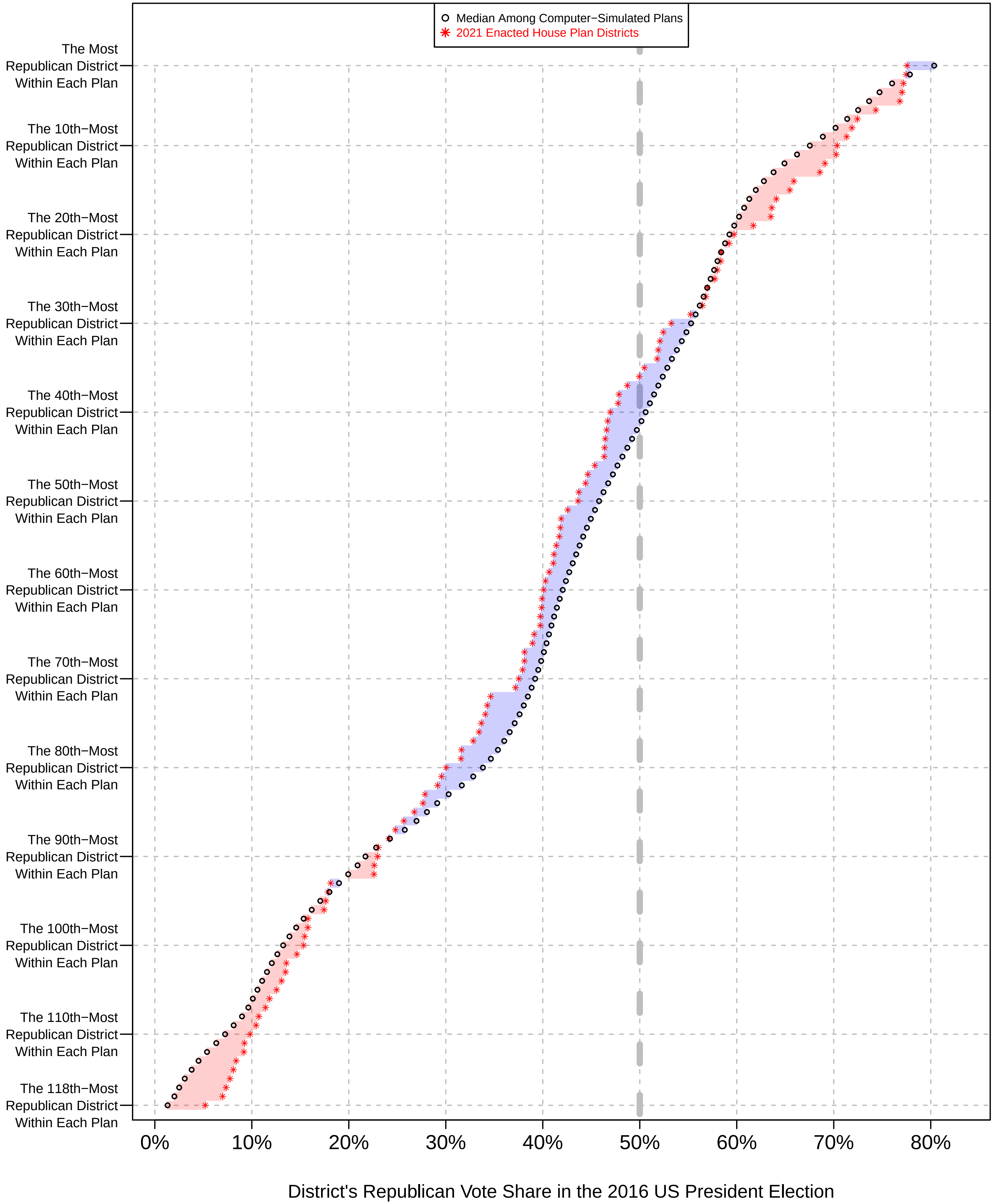


Figure C6:
2021 House Plan versus Computer−Simulated Maps, Compared Using the 2016 US Senate Election Results

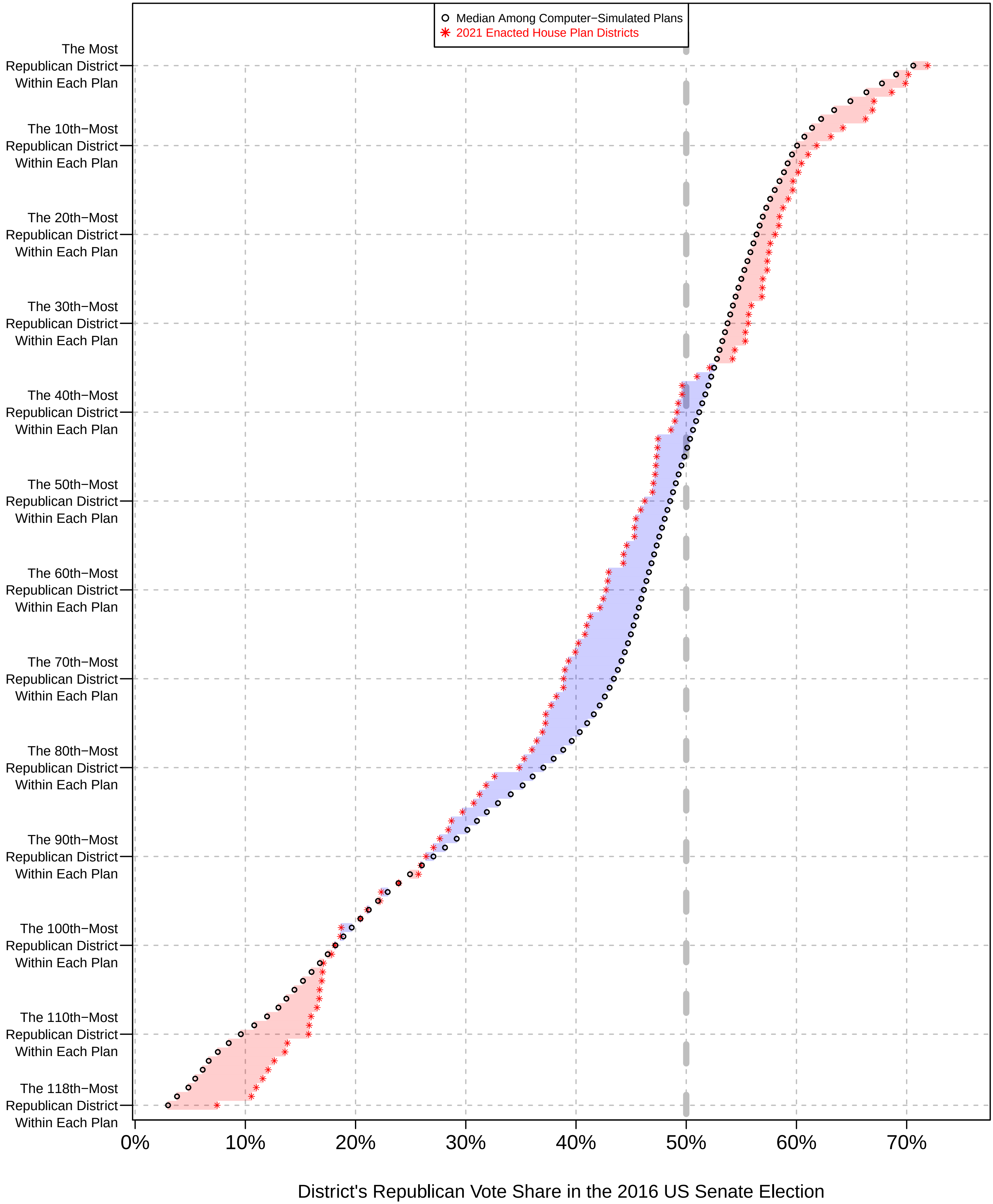


Figure C7:
2021 House Plan versus Computer−Simulated Maps, Compared Using the 2016 Comptroller Election Results

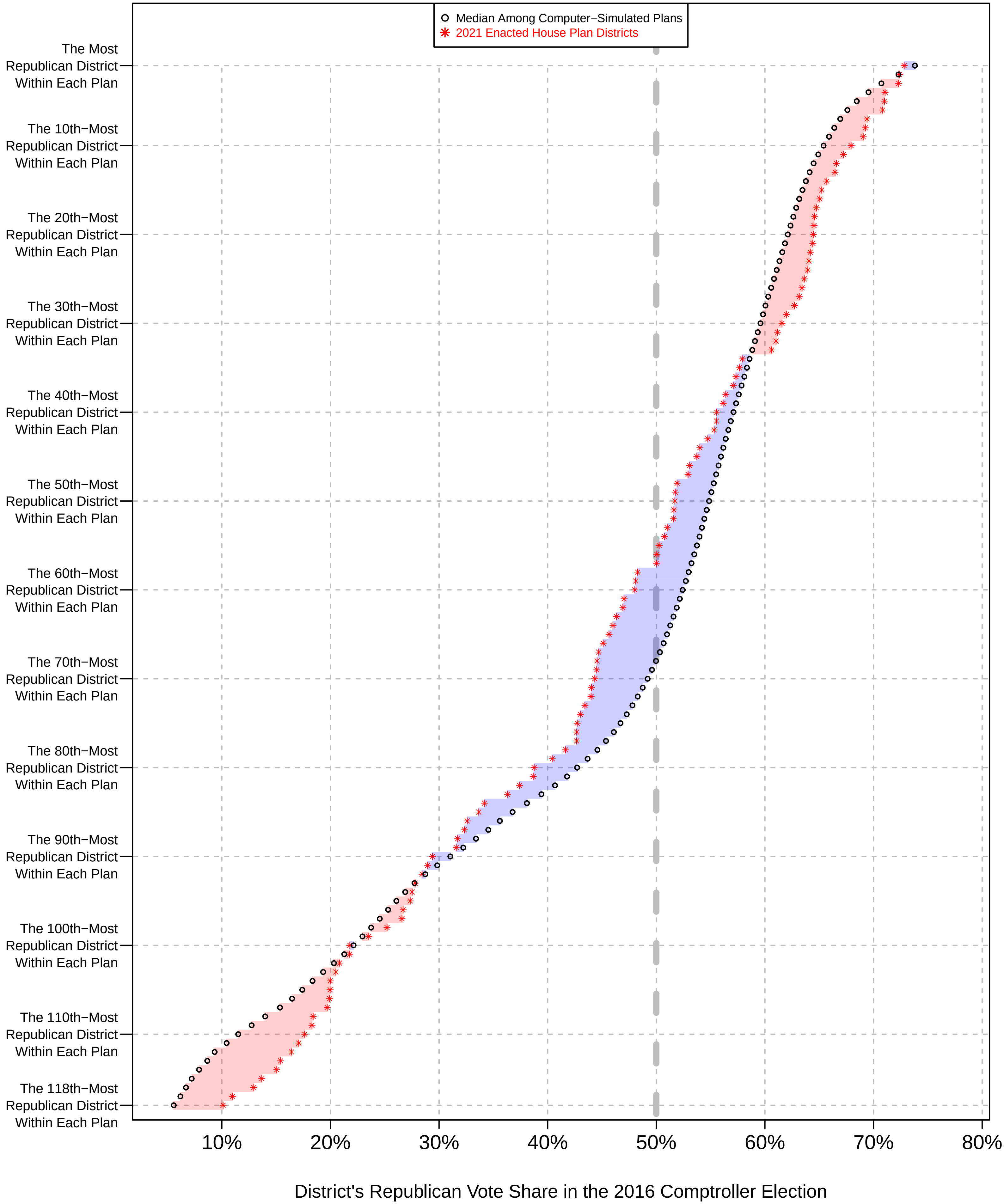


Figure C8:
2021 House Plan versus Computer−Simulated Maps, Compared Using the 2018 Governor Election Results

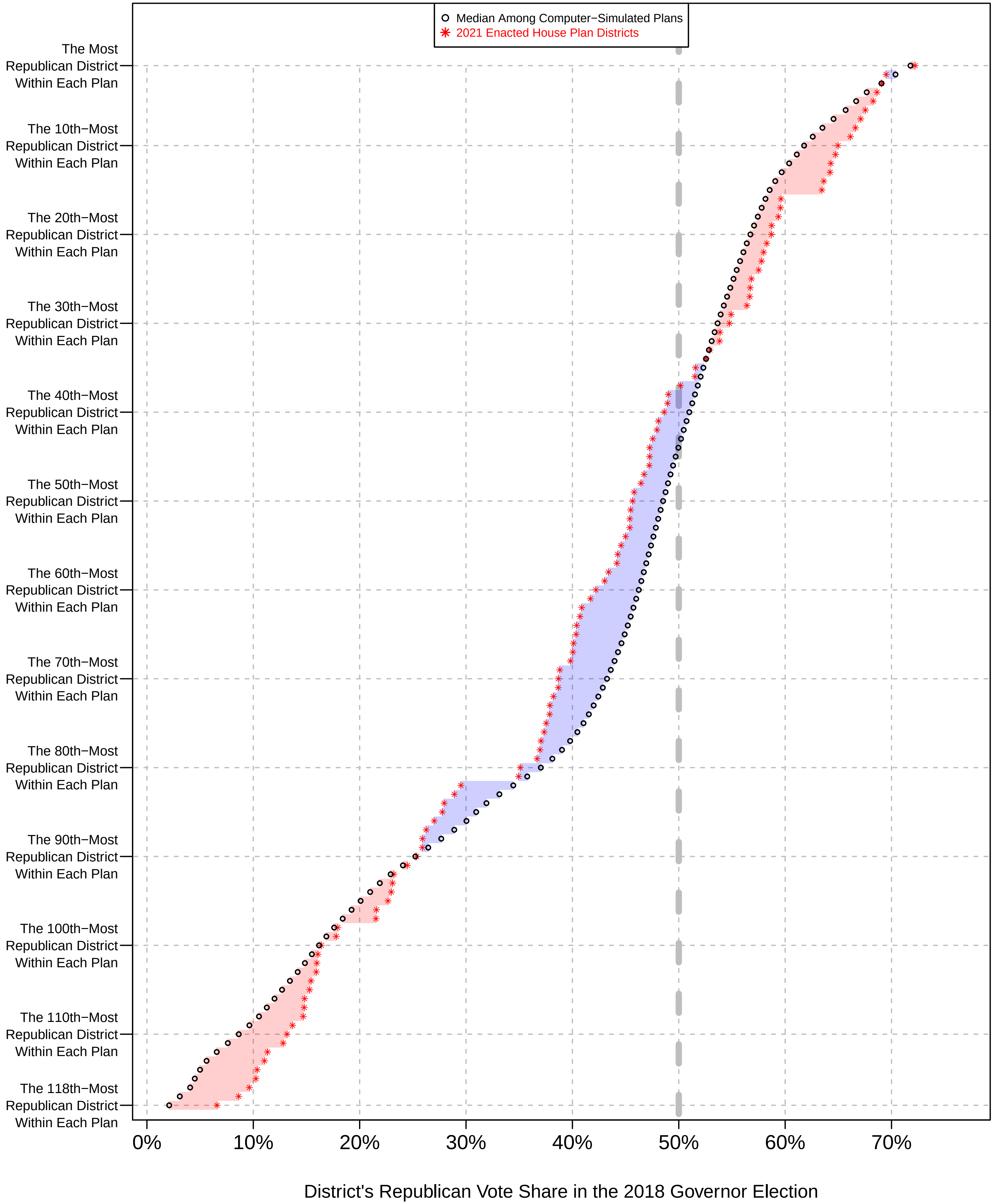


Figure C9:
2021 House Plan versus Computer−Simulated Maps, Compared Using the 2018 Attorney General Election Results

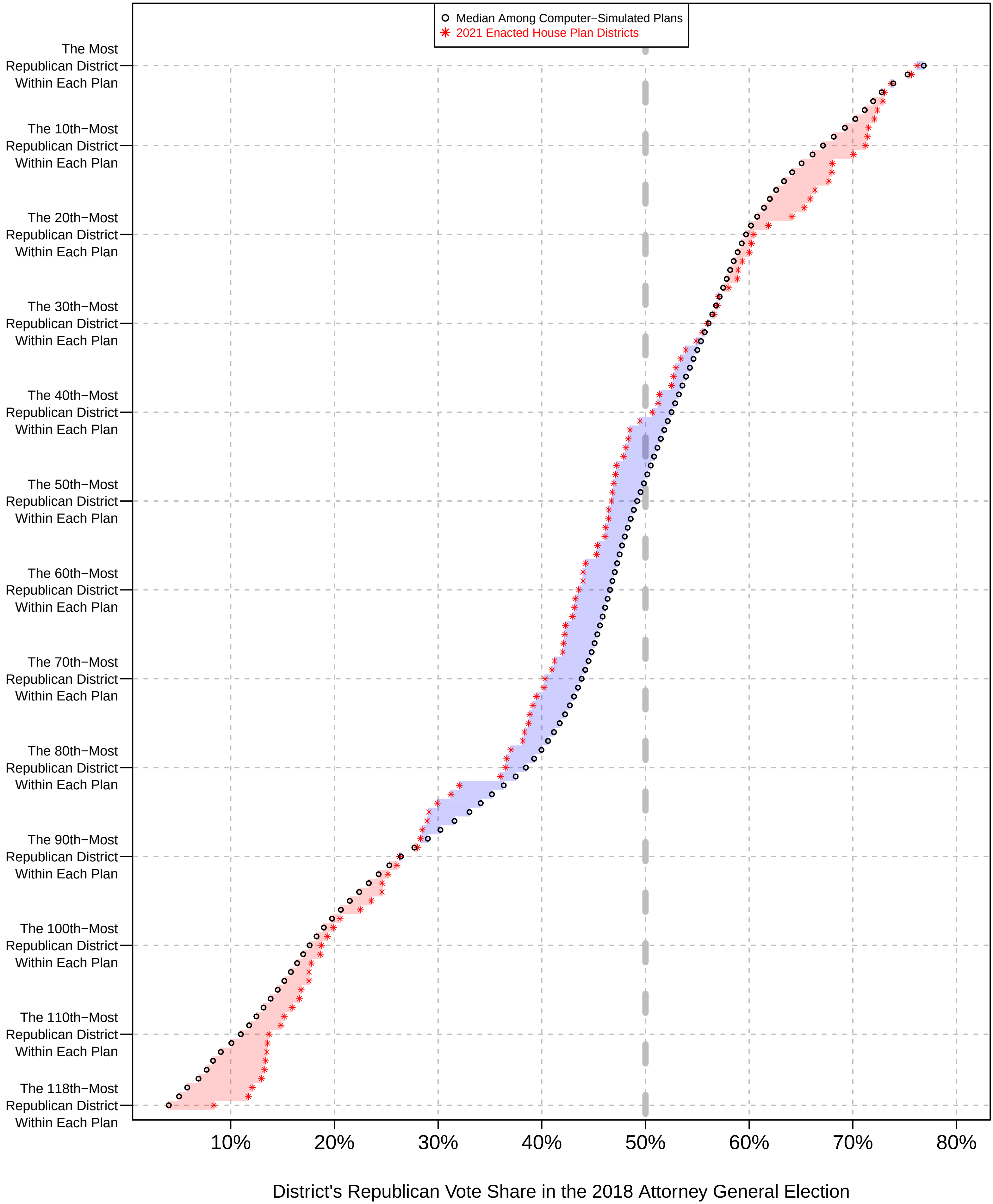


Figure C10:
2021 House Plan versus Computer−Simulated Maps, Compared Using the 2020 US President Election Results

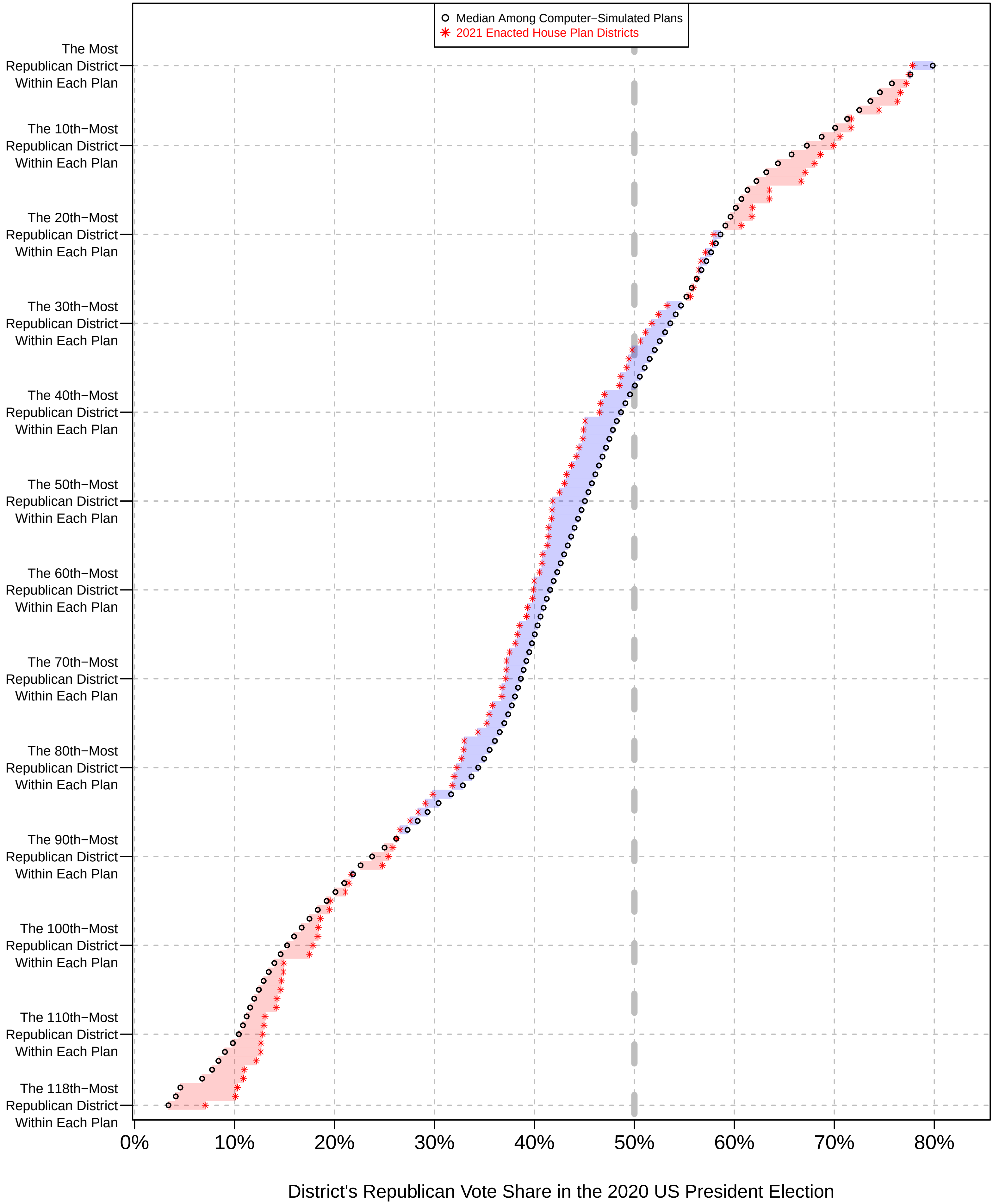


Figure C11:
2021 House Plan versus Computer−Simulated Maps, Compared Using the 2020 US Senate Election Results

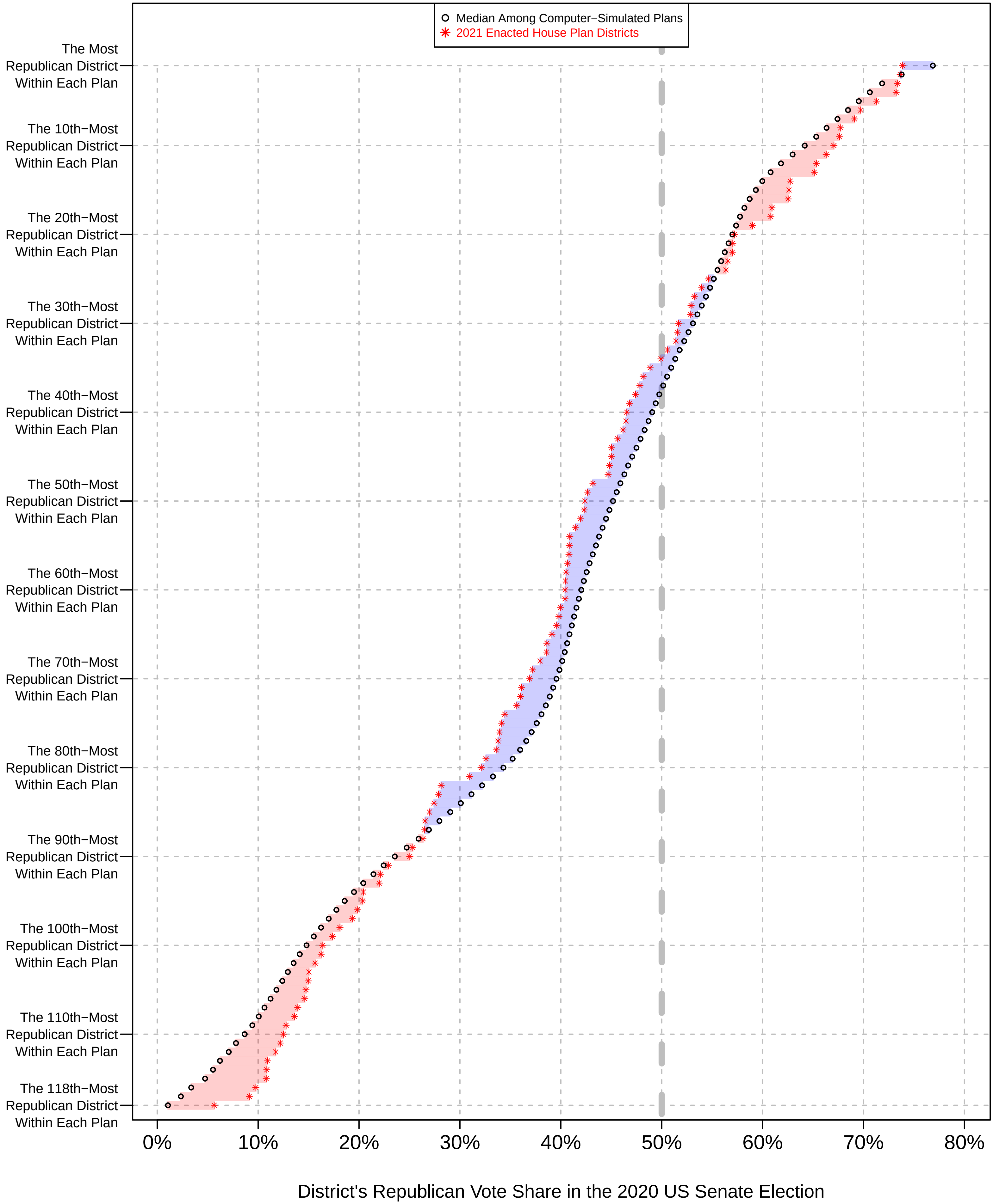


Figure C12:
2021 House Plan versus Computer−Simulated Maps, Compared Using the 2022 Attorney General Election Results

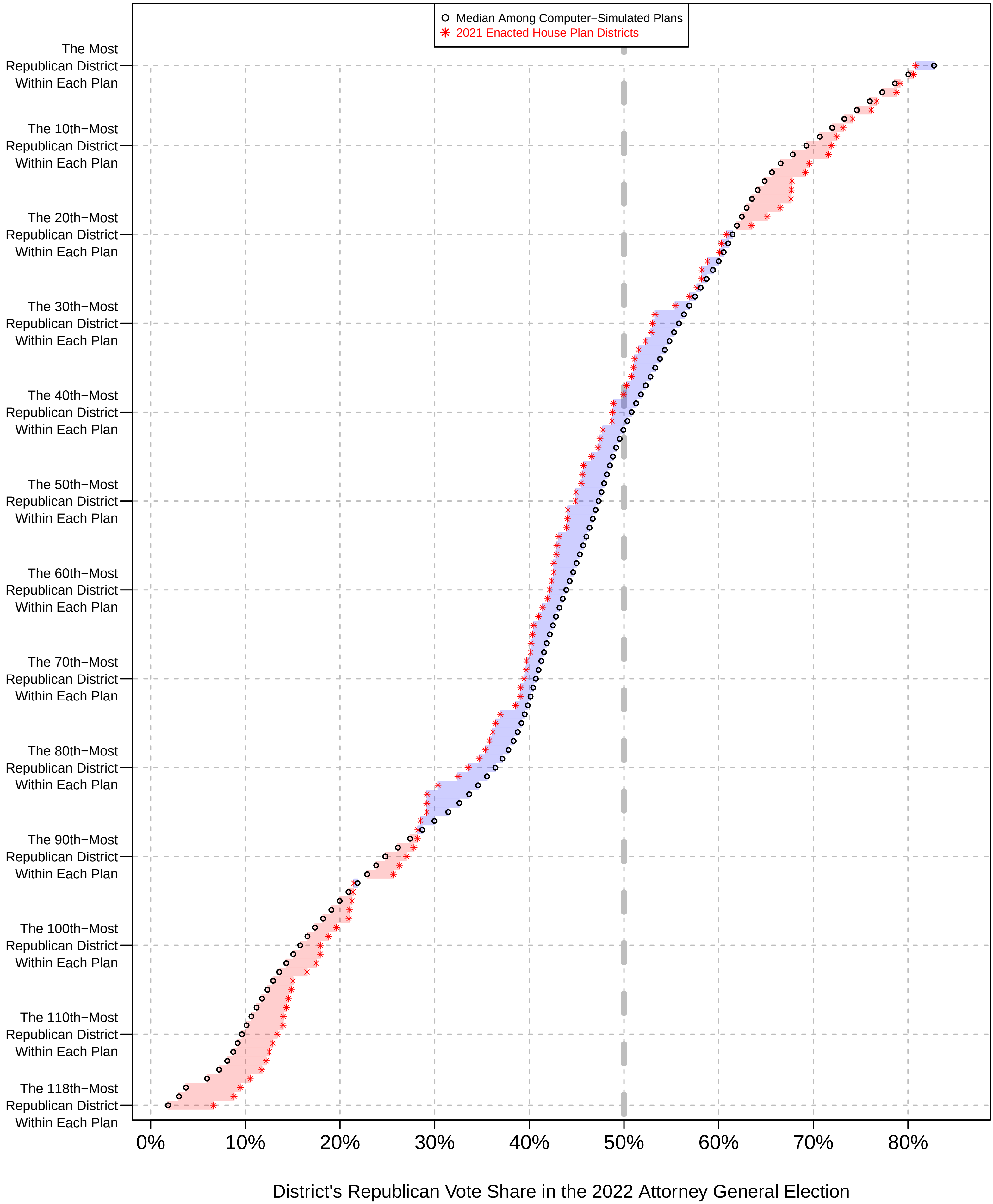


Figure C13:
2021 House Plan versus Computer−Simulated Maps, Compared Using the 2022 Governor Election Results

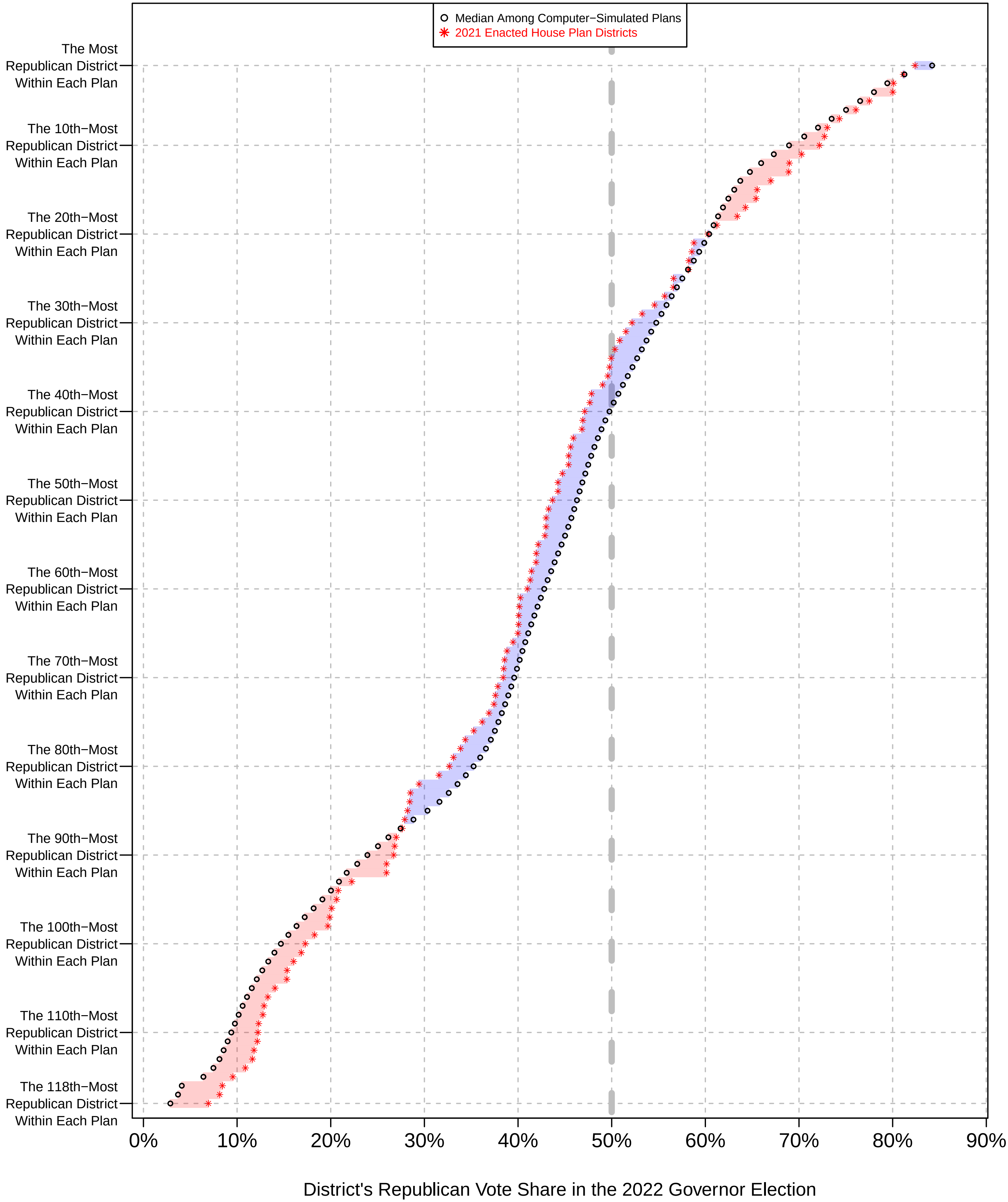


Figure C14:
2021 House Plan versus Computer−Simulated Maps, Compared Using the 2022 Secretary of State Election Results

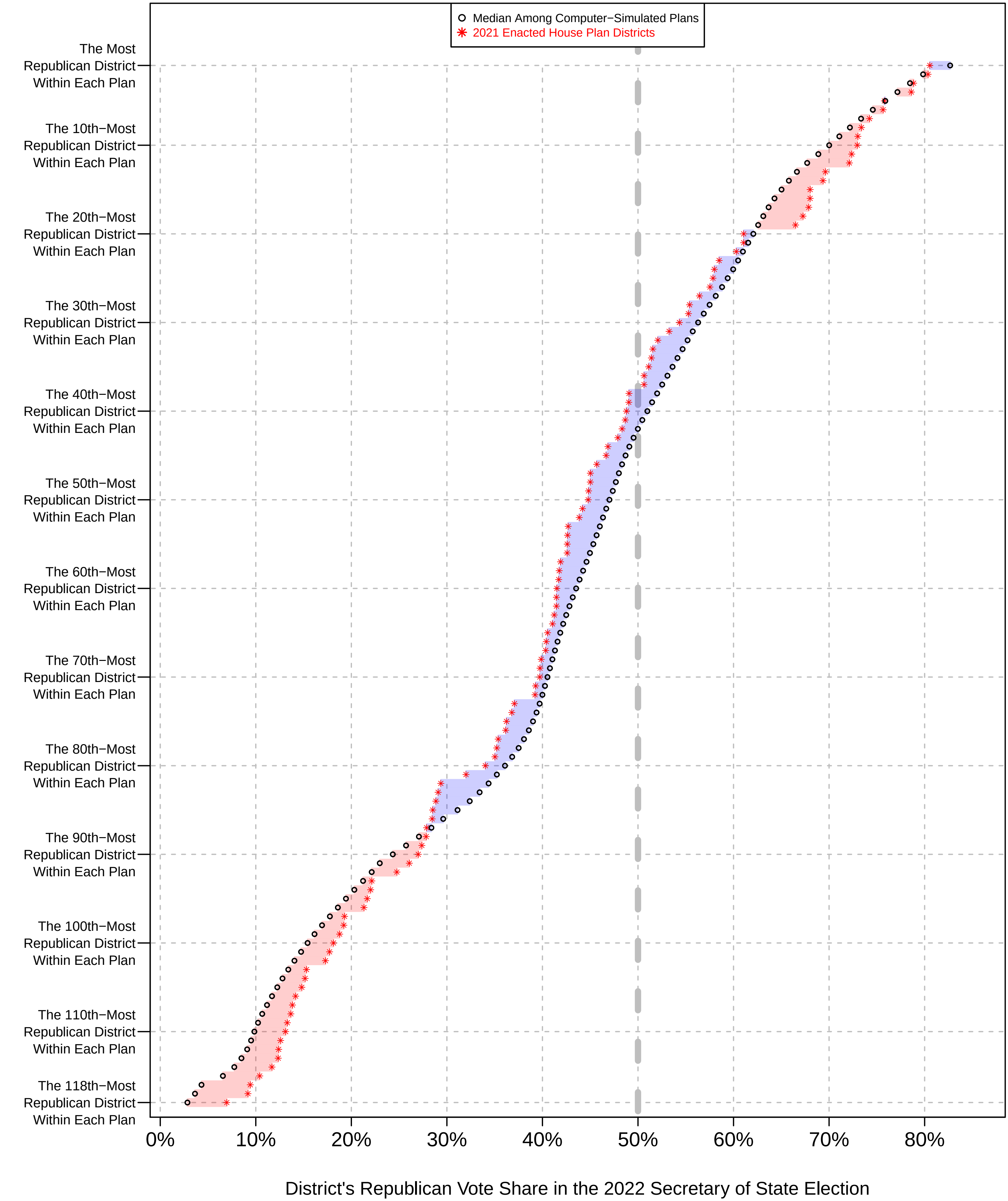


Figure C15:
2021 House Plan versus Computer−Simulated Maps, Compared Using the 2022 Treasurer Election Results

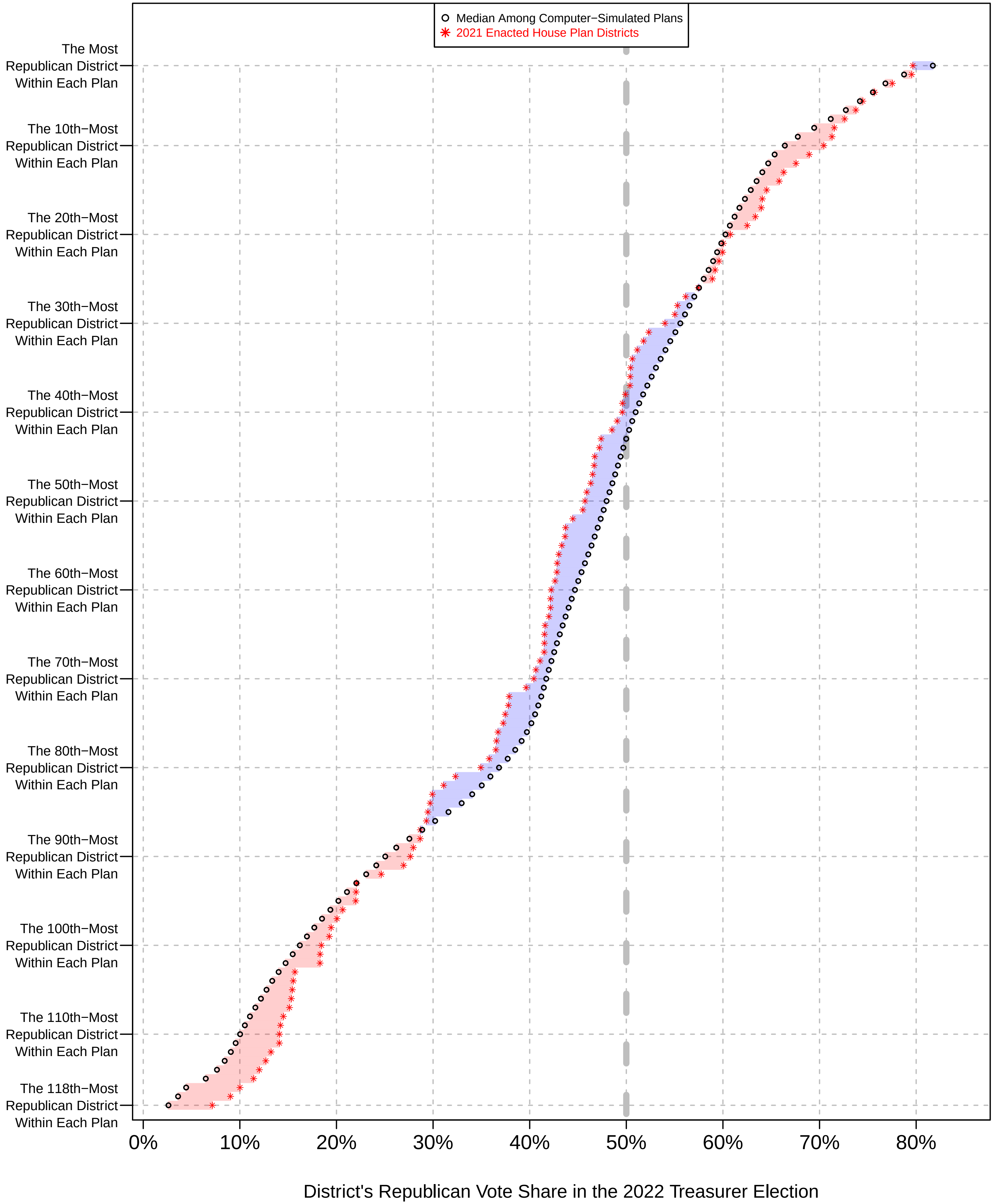


Figure C16:
2021 House Plan versus Computer−Simulated Maps, Compared Using the 2022 US Senate Election Results