IN THE TWENTY-NINTH JUDICIAL DISTRICT
WYANDOTTE COUNTY DISTRICT COURT
CIVIL DEPARTMENT

TOM ALONZO, SHARON AL-UQDAH, AMY CARTER, CONNIE BROWN COLLINS, SHEYVETTE DINKENS, MELINDA LAVON, ANA MARCELA MALDONADO MORALES, LIZ MEITL, RICHARD NOBLES, ROSE SCHWAB, and ANNA WHITE,

Plaintiffs,

v.

SCOTT SCHWAB, Kansas Secretary of State and Kansas Chief Election Officer, in his official capacity, and MICHAEL ABBOTT, Wyandotte County Election Commissioner, in his official capacity,

Defendants.

Case No. 2022-CV-000090

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 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 The American Journal of Political Science and 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.

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

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

6. Plaintiffs' counsel asked me to analyze the Substitute Senate Bill 355 districting plan for Kansas' congressional districts (the "2022 Enacted Plan"), as enacted on February 9, 2022 by the Kansas Legislature following an override of the governor's veto. Plaintiffs' counsel

asked me to produce a set of computer-simulated plans for Kansas' congressional districts by following non-partisan, traditional districting criteria. Plaintiffs' counsel asked me to compare the district-level partisan attributes of the Enacted Plan to those of the computer-simulated plans and to identify any districts in the Enacted Plan that are partisan outliers.

7. ***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 and racial considerations when drawing districts. Instead, the computer simulations are programmed to draw districting plans following various traditional districting goals, such as equalizing population, avoiding county and Voting Tabulation District (VTD) splits, 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 am able to determine whether the enacted plan could have been the product of something other than partisan considerations. With respect to Kansas' 2022 Congressional Enacted Plan, I determined that it could not.

8. I produced a set of 1,000 random computer-simulated plans for Kansas' congressional districts using a computer algorithm programmed to strictly follow nonpartisan, traditional districting criteria. These traditional districting criteria include criteria enumerated in

the "Guidelines and Criteria for 2022 Kansas Congressional and State Legislative Redistricting," as adopted by the Kansas Legislature's House and Senate Redistricting Committees (hereinafter: "The Guidelines and Criteria").

9. 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 map-drawers are not motivated primarily by partisan goals. By comparing the Enacted Plan against the distribution of simulated plans with respect to partisan measurements, I am able to determine the extent to which a map-drawer's subordination of nonpartisan districting criteria, such as geographic compactness and preserving county and precinct boundaries, was motivated by partisan goals.

10. 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 map-drawers.[1] In recent years, several courts have also relied upon computer simulations to assess partisan bias in enacted districting plans.[2]

11. ***Redistricting Criteria:*** I programmed the computer algorithm to create 1,000 independent simulated plans adhering to the following five traditional districting criteria:

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[1] *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.

[2] *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).

a) Population Equality[3]: Because Kansas' 2020 Census population was 2,937,880, districts in every four-member congressional plan have an ideal population of 734,470. Accordingly, the computer simulation algorithm populated each districting plan such that all four districts have a population of precisely 734,470, with zero deviations.

b) Contiguity[4]: The simulation algorithm required all congressional districts to be geographically contiguous.

c) Minimizing County Splits[5]: The simulation algorithm avoided splitting any of Kansas' 105 counties, except when doing so was necessary to avoid violating one of the aforementioned criteria. For the purpose of creating equally populated districts, each newly drawn congressional district required only one county split. But the fourth and final district drawn in Kansas need not create an additional county split, since this final district should simply be the remaining area unassigned to the first three districts. Therefore, an entire plan of four congressional districts requires only three county splits. Accordingly, I required that every simulated plan contain no more than three county splits. The simulation algorithm allows a single county to be split more than once, but this virtually never occurs in the 1,000 simulated plans.

d) Minimizing VTD Splits[6]: Kansas is divided into 4,240 VTDs. The computer simulation algorithm attempted to keep these VTDs intact and not split them into multiple districts, except when doing so is necessary for creating equally populated districts. For the purpose of creating equally populated districts, each newly drawn

[3] The Guidelines and Criteria state: "Districts are to be as nearly equal to 734,470 population as practicable."
[4] The Guidelines and Criteria state: "Districts should be as compact as possible and contiguous."
[5] The Guidelines and Criteria state: "Whole counties should be in the same congressional district to the extent possible..."
[6] The Guidelines and Criteria state: "The 'building blocks' to be used for drawing district boundaries shall be Kansas counties and voting districts (VTDs) as described on the official 2020 Redistricting U.S. Census maps."

congressional district requires one VTD split. But the fourth and final district drawn in Kansas does need not create an additional VTD split, since this final district should simply be the remaining area unassigned to the first thirteen districts. Therefore, an entire plan of four congressional districts requires only three VTD splits. I therefore require that every simulated plan split only three VTDs in total.

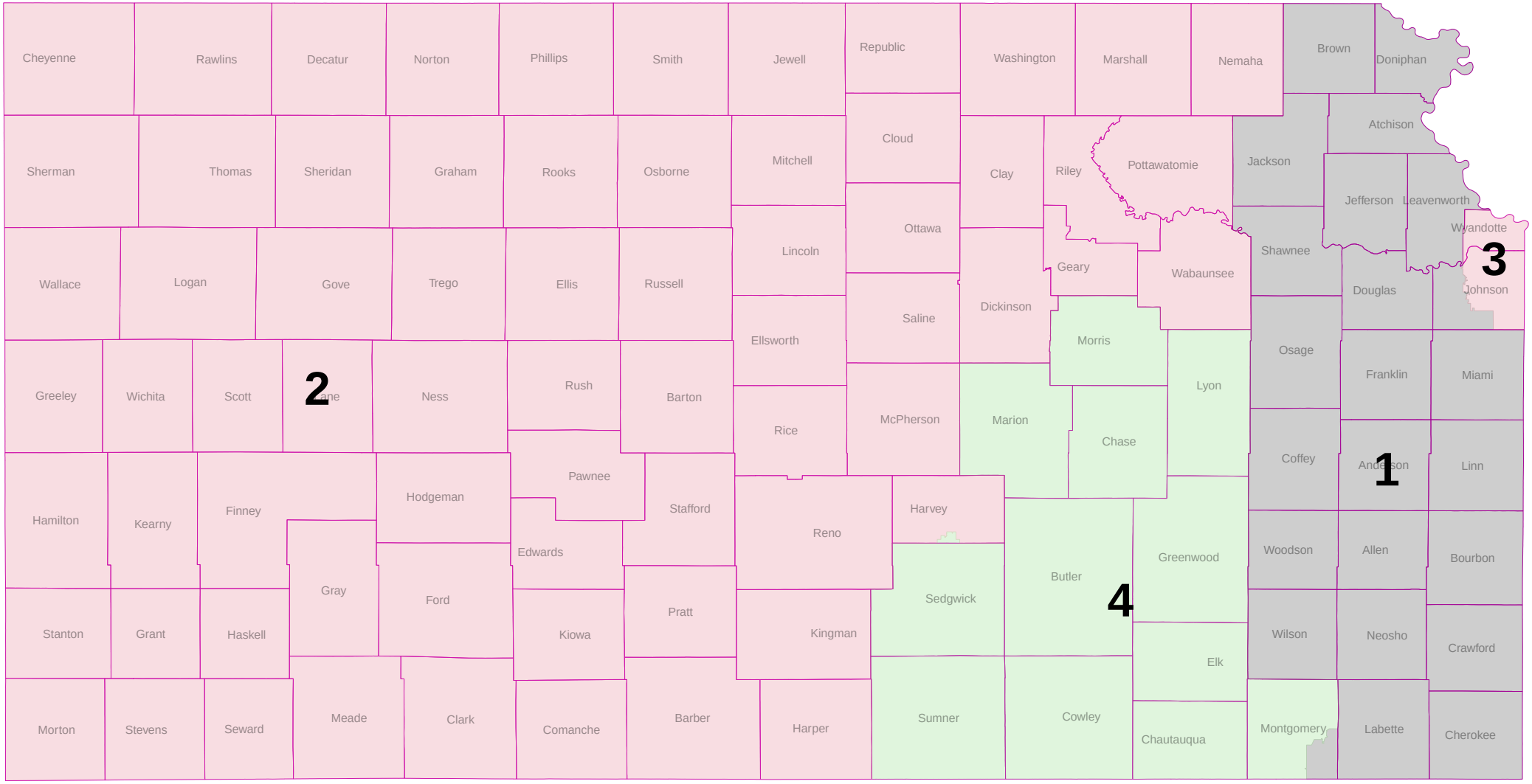
e) Geographic Compactness[7]: The simulation algorithm prioritized the drawing of geographically compact districts whenever doing so does not violate any of the aforementioned criteria.

f) Municipal Boundaries: Kansas contains 625 incorporated cities. The simulation algorithm favors not splitting these municipalities. In pursuing this criterion, the algorithm attempts to keep together only the portion of each city that lies within a single county.

12. On the following page of this report, Map 1 displays an example of one of the computer-simulated plans produced by the computer algorithm. The bottom portion of this Map also reports the population of each district, the compactness scores for each district, and the county splits and VTD splits created by the plan. As with every simulated plan, this plan contains exactly three VTD splits and three county splits.

[7] The Guidelines and Criteria state: "Districts should be as compact as possible and contiguous."

Map 1: Example of a Computer−Simulated Congressional Plan



District:	Population:	Reock:	Popper−Polsby:
1	734,470	0.419	0.408
2	734,470	0.411	0.509
3	734,470	0.512	0.506
4	734,470	0.558	0.458
Plan Average:	734,470	0.475	0.47

3 Split Counties:
Harvey (Districts 2, 4)
Johnson (Districts 1, 3)
Montgomery (Districts 1, 4)

3 Split VTD's:
VTD 000310 in Harvey County (Districts 2 and 4)
VTD 00117A in Johnson County (Districts 1 and 3)
VTD 000410 in Montgomery County (Districts 1 and 4)

The Enacted Plan's Compliance with Traditional Districting Criteria

13. I assessed whether the 2022 Enacted Plan complies with the six traditional districting criteria described above, and I describe my findings in this section. I found that the Enacted Plan does not violate equal population, nor do its districts violate contiguity or split an unusually large number of municipalities.

14. However, by comparing the Enacted Plan to the 1,000 computer-simulated plans, I found that the Enacted Plan fails to minimize county splits, fails to minimize VTD splits, and is significantly less geographically compact than is reasonably possible. I describe these findings below in detail.

15. ***Minimizing County Splits:*** In comparing the total number of county splits in the Enacted Plan and in the computer-simulated plans, I counted the total number of counties that are split into multiple districts. I found that the Enacted Plan contains four total split counties, which are detailed in Table 1.

Table 1: Split Counties in the 2022 Enacted Plan

	County:	**Congressional Districts:**
1	Douglas	1 and 2
2	Jackson	1 and 2
3	Pawnee	1 and 4
4	Wyandotte	2 and 3
Total:		4 Split Counties

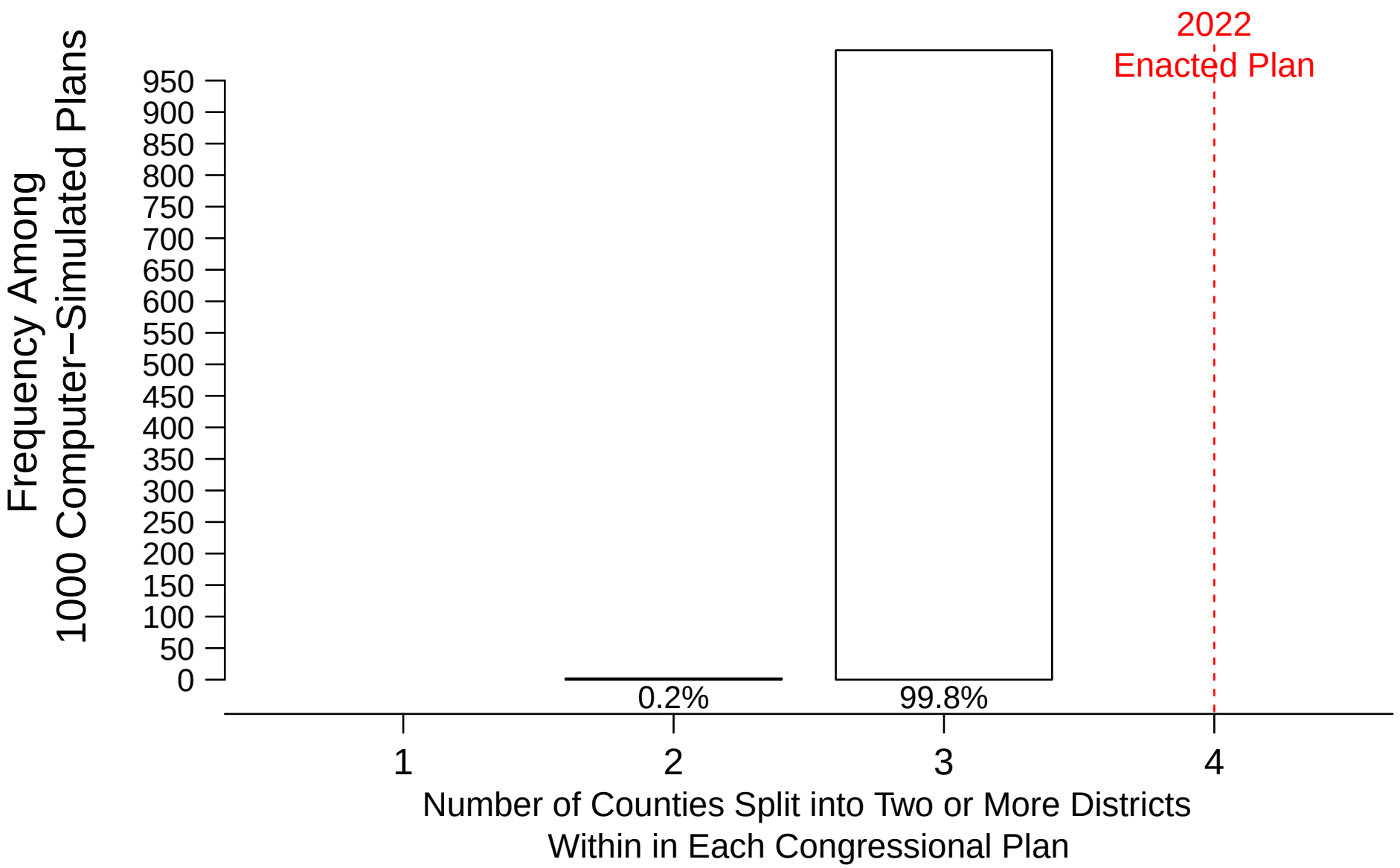
16. As explained in the previous section, a congressional plan in Kansas needs to contain only three county splits if the map-drawer is attempting to minimize the splitting of counties. The Enacted Plan's four county splits is therefore one more split than is necessary. This "extra" split is specifically found at the border between District 1 and District 2. In general, the

border between any two congressional districts in Kansas needs to split only one county, at most. But in the Enacted Plan, the border between Districts 1 and 2 creates two county splits: One split of Douglas County and one split of Jackson County. Splitting both Douglas and Jackson Counties was not necessary for equalizing the populations of Districts 1 and 2.

17. Indeed, I found that the computer simulation algorithm was always able to draw equally populated congressional districting plans that split only three counties in Kansas. As the upper half of Figure 1 illustrates, all 1,000 computer-simulated plans contain exactly three split counties. The Enacted Plan clearly contains more county splits than one would expect from a map-drawing process prioritizing county boundaries.

Figure 1:

Number of Split Counties
in 2022 Enacted Plan and 1,000 Computer−Simulated Plans



18. ***Minimizing VTD Splits*:** The Legislature's Guidelines and Criteria mandate that "[t]he 'building blocks' to be used for drawing district boundaries shall be Kansas counties and voting districts (VTDs) as described on the official 2020 Redistricting U.S. Census maps." As explained earlier in this report, each newly drawn congressional district need only split one VTD for the purpose of equalizing the district's population. But the fourth and final district drawn in Kansas does not need to split an additional VTD, since this final district should simply be the remaining area unassigned to the first three districts. Therefore, an entire plan of four congressional districts needs to split only three VTDs.

19. In contrast, the Enacted Plan splits 19 VTDs[8]—far more than is necessary to draw equally populated districts and comply with other traditional districting criteria. Among these 19 split VTDs, 13 VTDs are split in a manner such that populated portions of the VTD are split into two districts. Table 2 details these 13 split VTDs, identifying the Enacted Plan districts to which each VTD is assigned.

20. The Enacted Plan's 19 total split VTDs, including 13 split VTDs involving populated areas, are far more than is necessary to draw equally populated districts and comply with other traditional districting criteria. As explained earlier, only three split VTDs are necessary in order to produce an equally populated congressional plan in Kansas. Thus, as Figure 2 illustrates, every one of the 1,000 computer-simulated plans contains exactly three split VTDs, and the Enacted Plan's 13 split VTDs involving populated areas is clearly far more than necessary.

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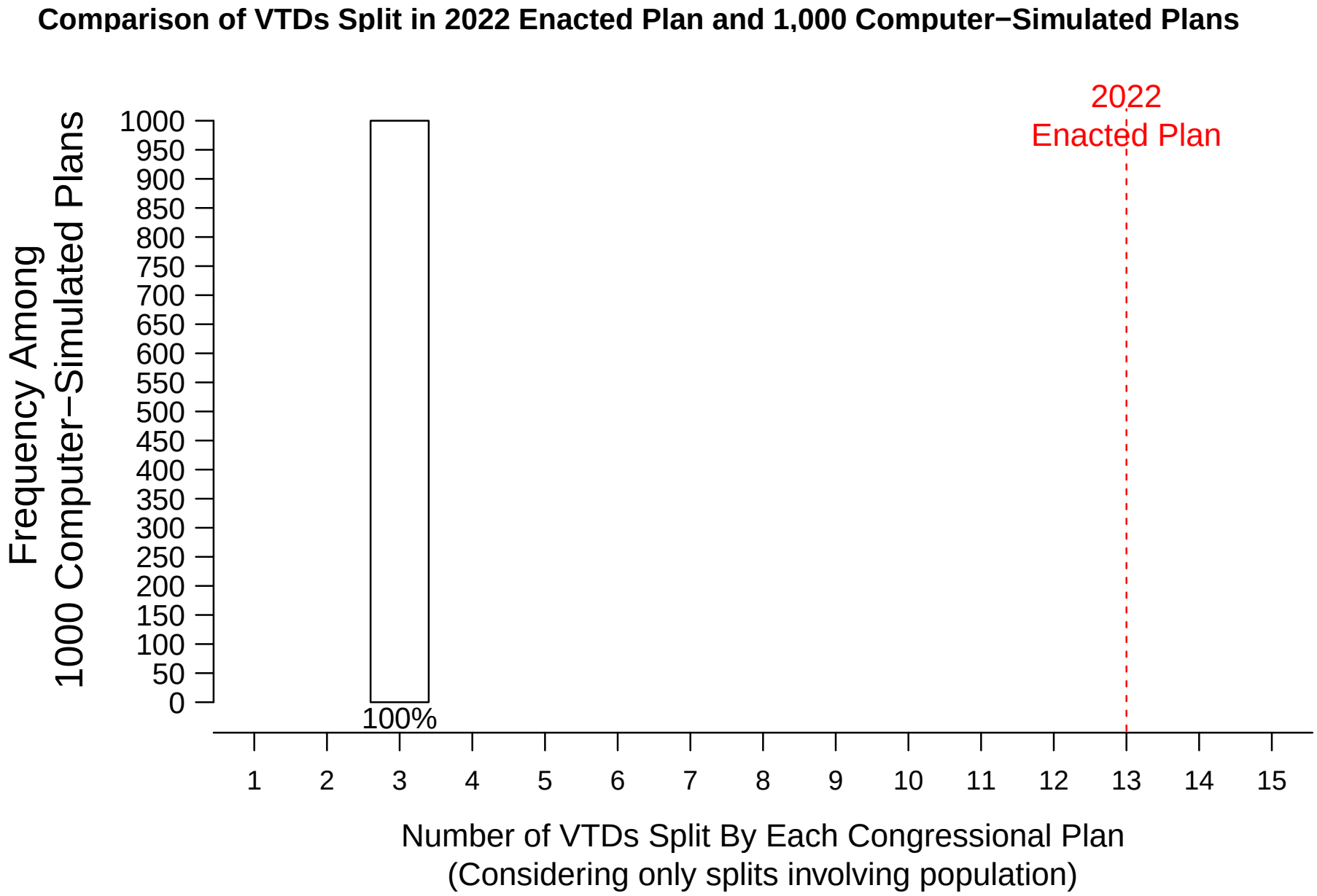
[8] *See* Kansas Legislative Research Department's Maptitude January 20, 2022 report for the 2022 Enacted Plan, available at: http://www.kslegresearch.org/KLRD-web/Publications/Redistricting/2022-Plans/M3_AdAstra_2-packet.pdf.

[10] E.g., Alan Abramowitz, Brad Alexander, and Matthew Gunning. "Incumbency, Redistricting, and the Decline of Competition in U.S. House Elections." *The Journal of Politics.* Vol. 68, No. 1 (February 2006): 75-88.

Table 2:
Split Voting Tabulation Districts (VTDs) in the 2022 Enacted Plan Involving Population

County:	VTD Number:	VTD name:	Districts:
Douglas County	20045120030	East Wakarusa Precinct 65 Part 4 H46	Districts 1 and 2
Douglas County	20045120080	Kanwaka Township Precinct 56 S2	Districts 1 and 2
Douglas County	20045120320	Lecompton Township Precinct 57 S2	Districts 1 and 2
Jackson County	20085000120	Liberty Township	Districts 1 and 2
Jackson County	20085000160	Straight Creek Township	Districts 1 and 2
Pawnee County	20145000070	Larned Township	Districts 1 and 4
Pawnee County	20145000080	Larned Ward 1	Districts 1 and 4
Pawnee County	20145000090	Larned Ward 2	Districts 1 and 4
Pawnee County	20145000110	Larned Ward 4	Districts 1 and 4
Wyandotte County	20209140030	Edwardsville Precinct 2	Districts 2 and 3
Wyandotte County	20209600520	Kansas City Ward 9 Precinct 08	Districts 2 and
Wyandotte County	20209600540	Kansas City Ward 9 Precinct 10	Districts 2 and 3
Wyandotte County	20209600760	Kansas City Ward 9 Precinct 16	Districts 2 and 3
Total VTDs Split Involving Population:		**13 Split VTDs**	

Figure 2:


Comparison of VTDs Split in 2022 Enacted Plan and 1,000 Computer−Simulated Plans
2022
Enacted Plan
Frequency Among
1000 Computer−Simulated Plans
1000
950
900
850
800
750
700
650
600
550
500
450
400
350
300
250
200
150
100
50
0
100%
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
Number of VTDs Split By Each Congressional Plan
(Considering only splits involving population)

21. ***Measuring Geographic Compactness***: The Legislature's Guidelines and Criteria mandate that "Districts should be as compact as possible."

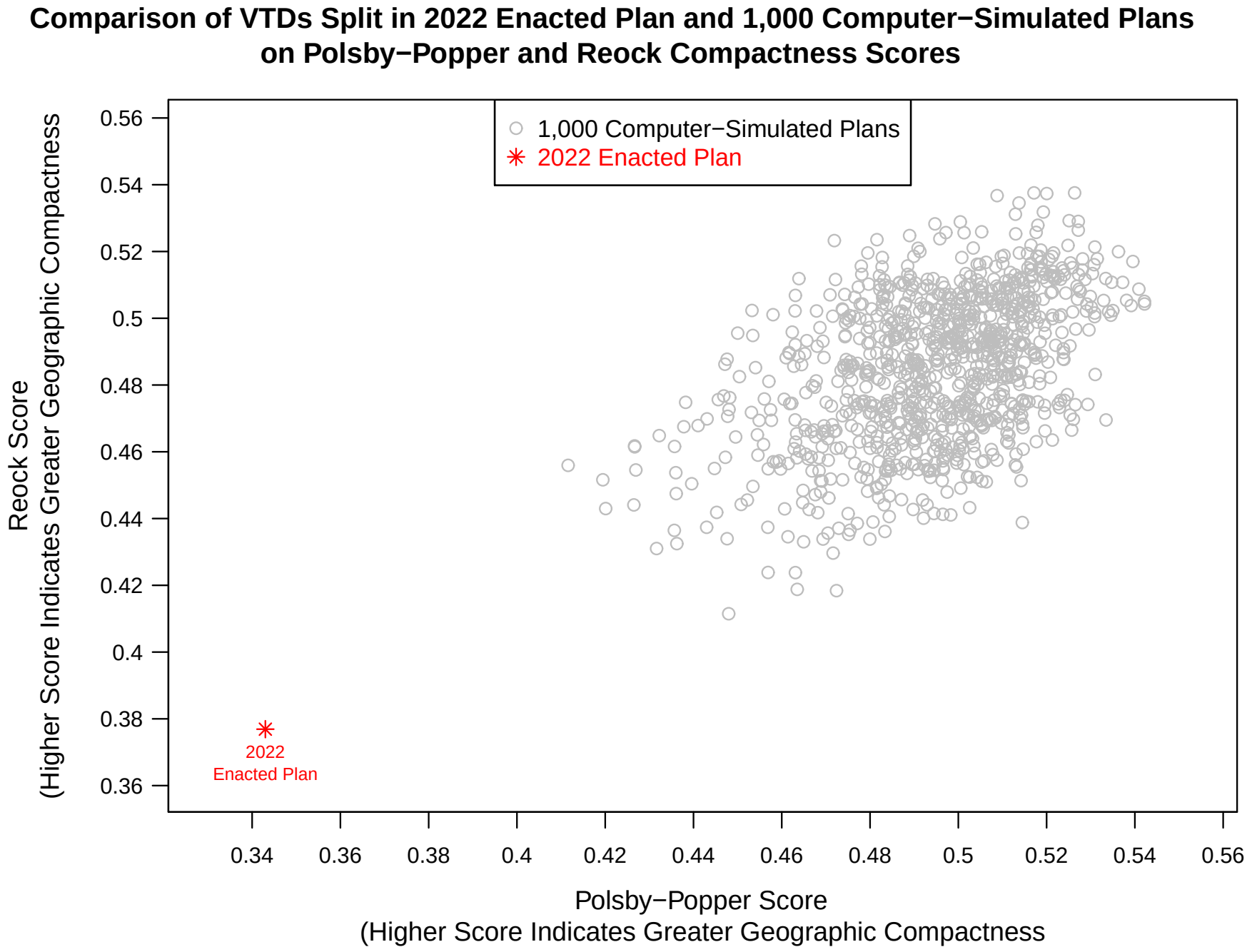
22. In evaluating whether the Enacted Plan follows the compactness requirement of the Legislature's Guidelines and Criteria, it is useful to compare the compactness of the Enacted Plan and the 1,000 computer-simulated plans. The computer-simulated plans were produced by a computer algorithm adhering strictly to traditional districting criteria and ignoring any partisan considerations. Thus, the compactness scores of these computer-simulated plans illustrate the statistical range of compactness scores that could be reasonably expected to emerge from a districting process that solely seeks to follow traditional districting criteria while ignoring partisan considerations. I therefore compare the compactness of the simulated plans and the Enacted Plan using two commonly used measures of compactness in redistricting.

24. First, I calculate the average Polsby-Popper score of each plan's districts. The Polsby-Popper score for each individual district is calculated as the ratio of the district's area to the area of a hypothetical circle whose circumference is identical to the length of the district's perimeter; thus, higher Polsby-Popper scores indicate greater district compactness. The 2022 Enacted Plan has an average Polsby-Popper score of 0.343 across its four congressional districts. As illustrated in Figure 3, every single one of the 1,000 computer-simulated Congressional plans in this report exhibits a significantly higher Polsby-Popper score than the Enacted Plan. In fact, the middle 50% of these 1,000 computer-simulated plans have an average Polsby-Popper score ranging from 0.483 to 0.510, and the most compact computer-simulated plan has a Polsby-Popper score of 0.542. Hence, it is clear that the Enacted Plan is significantly less compact, as measured by its Polsby-Popper score, than what could reasonably have been expected from a districting process adhering to the compactness requirement in the Legislature's Guidelines and

Criteria.

25. Second, I calculate the average Reock score of the districts within each plan. The Reock score for each individual district is calculated as the ratio of the district's area to the area of the smallest bounding circle that can be drawn to completely contain the district; thus, higher Reock scores indicate more geographically compact districts. The 2022 Enacted Plan has an average Reock score of 0.377 across its four congressional districts. As illustrated in Figure 3, every single one of the 1,000 computer-simulated Congressional plans exhibits a significantly higher Reock score than the Enacted Plan. In fact, the middle 50% of these 1,000 computer-simulated plans have an average Reock score ranging from 0.469 to 0.502, and the most compact computer-simulated plan has an average Reock score of 0.538. Hence, it is clear that the 2022 Enacted Plan is significantly less compact, as measured by its Reock score, than what could reasonably have been expected from a districting process adhering to the compactness requirement in the Legislature's Guidelines and Criteria.

Figure 3:


Comparison of VTDs Split in 2022 Enacted Plan and 1,000 Computer−Simulated Plans
on Polsby−Popper and Reock Compactness Scores
1,000 Computer−Simulated Plans
2022 Enacted Plan
2022
Enacted Plan
Reock Score
(Higher Score Indicates Greater Geographic Compactness
0.56
0.54
0.52
0.5
0.48
0.46
0.44
0.42
0.4
0.38
0.36
0.34
0.36
0.38
0.4
0.42
0.44
0.46
0.48
0.5
0.52
0.54
0.56
Polsby−Popper Score
(Higher Score Indicates Greater Geographic Compactness

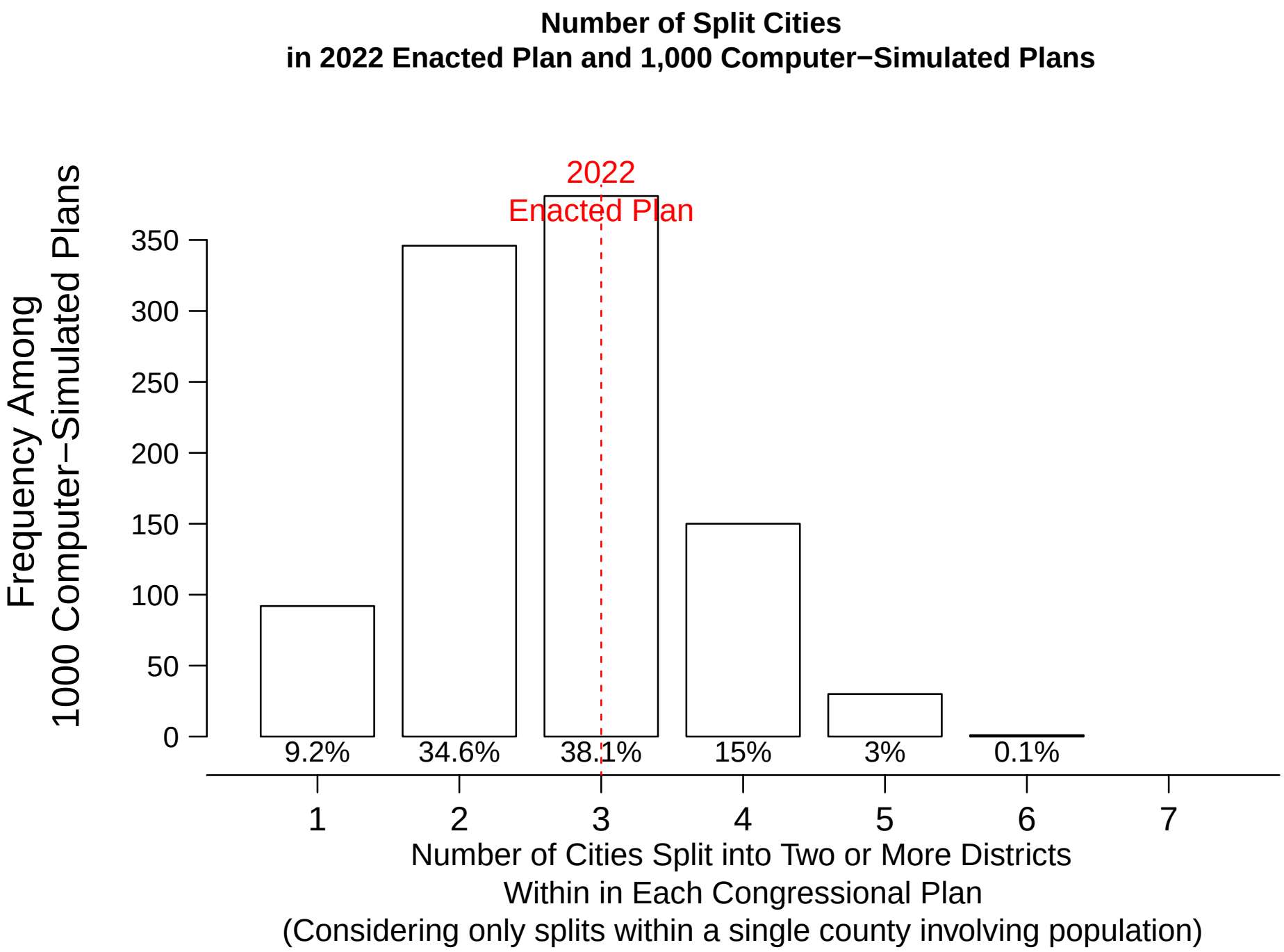
26. ***Avoiding Municipality Splits:*** In comparing the total number of municipality splits in the Enacted Plan and in the computer-simulated plans, I counted the total number of Kansas's 625 cities that are split into multiple districts. Specifically, I counted only the portion of each city that lies within a single county because the Legislature's Guidelines and Criteria prioritized avoiding county splits. Hence, if a city is spread across two or more counties, I considered each county's portion of that city as a separate city. I found that the Enacted Plan splits three cities, as detailed in Table 3.

Table 3: Split Municipalities in the 2022 Enacted Plan

	City:	**Congressional Districts:**
1	Edwardsville (20000)	2 and 3
2	Kansas City (36000)	2 and 3
3	Larned (38700)	1 and 4
Total:		3 Split Cities

27. As Figure 4 illustrates, three split cities was also the most common outcome among the 1,000 computer-simulated plans. The median simulated plan split exactly three cities as well. Hence, based on Figure 4, I conclude that the 2022 Enacted Plan's splitting of three cities was reasonable and consistent with a mapdrawing process seeking to avoid municipal splits.

Figure 4:


Number of Split Cities
in 2022 Enacted Plan and 1,000 Computer−Simulated Plans
2022
Enacted Plan
Frequency Among
1000 Computer−Simulated Plans
350
300
250
200
150
100
50
0
9.2%
34.6%
38.1%
15%
3%
0.1%
1
2
3
4
5
6
7
Number of Cities Split into Two or More Districts
Within in Each Congressional Plan
(Considering only splits within a single county involving population)

Measuring the Partisanship of Districting Plans

28. In general, I use actual election results from recent, statewide election races in Kansas to assess the partisan performance of the 2022 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 within each simulated plan and within the Enacted Plan. All of these calculations thus allow me to directly compare the partisanship of the Enacted Plan and the simulated plans. These partisan comparisons allow me to determine whether 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 congressional candidates.

29. In general, the most reliable method of comparing the partisanship of different congressional districts within a state is to calculate the percentage of votes from these districts favoring Republican or Democratic candidates in recent, competitive statewide elections, such as the Presidential, Gubernatorial, Attorney General, and US Senate elections. Recent statewide elections provide the most reliable basis for comparisons of different precincts' partisan tendencies because in any statewide election, the anomalous candidate-specific effects that shape the election outcome are equally present in all precincts across the state. Statewide elections are thus a better basis for comparison than the results of congressional (or "endogenous") elections because the particular outcome of any congressional election may deviate from the long-term

partisan voting trends of that district, due to factors idiosyncratic to the district as currently constructed. Such factors can include the presence or absence of a quality challenger, anomalous difference between the candidates in campaign efforts or campaign finances, incumbency advantage, candidate scandals, and coattail effects.[10] Because these idiosyncratic factors would change if the district were drawn differently, it is particularly unsuitable to use election results from an existing district when comparing the partisanship of districts in a newly-enacted plan or a computer-simulated plan that would have different boundaries than those used in past congressional elections.

30. 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 map-drawers 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 2022 Enacted Plan and in the computer-simulated plans, as described below.

31. ***The 2016-2020 Statewide Election Composite:*** To measure the partisanship of all districts in the computer-simulated plans and the 2022 Enacted Plan, I used the results from every statewide general election contest for a political (non-judicial) office held in Kansas during 2016-2020. In other words, I used the results of the following nine elections: 2016 US President, 2016 US Senator, 2018 Governor, 2018 Attorney General, 2018 Insurance Commissioner, 2018

Secretary of State, 2018 Treasurer, 2020 US President, and 2020 US Senator.

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

33. I refer to the aggregated election results from these nine statewide elections as the "2016-2020 Statewide Election Composite." For the 2022 Enacted Plan districts and for all districts in each of the 1,000 computer-simulated plans, I calculate the percentage of total two-party votes across these nine elections that were cast in favor of Republican candidates in order to measure the average Republican vote share of the district. In the following section, I present district-level comparisons of the Enacted Plan and simulated plan districts in order to identify whether any individual districts in the Enacted Plan are partisan outliers. I also present plan-wide comparisons of the Enacted Plan and the simulated plans in order to identify the extent to which the Enacted Plan is a statistical outlier in terms of common measures of districting plan partisanship.

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

34. In this section, I present partisan comparisons of the 2022 Enacted Plan to the computer-simulated plans at both a district-by-district level as well as a plan-wide level using several common measures of districting plan partisanship. First, I compare the district-level Republican vote share of the Enacted Plan's districts and the districts in the computer-simulated plans. Next, I compare the number of Republican-favoring districts in the Enacted Plan and in the computer-simulated plans. Finally, I use some common measures of partisan bias to compare the Enacted Plan to the computer-simulated plans. Overall, I find that three of the four individual districts in the 2022 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. Moreover, I find that at the plan-wide level, the Enacted Plan creates a degree of partisan bias favoring Republicans that is more extreme than the vast majority of the computer-simulated plans. I describe these findings in detail below:

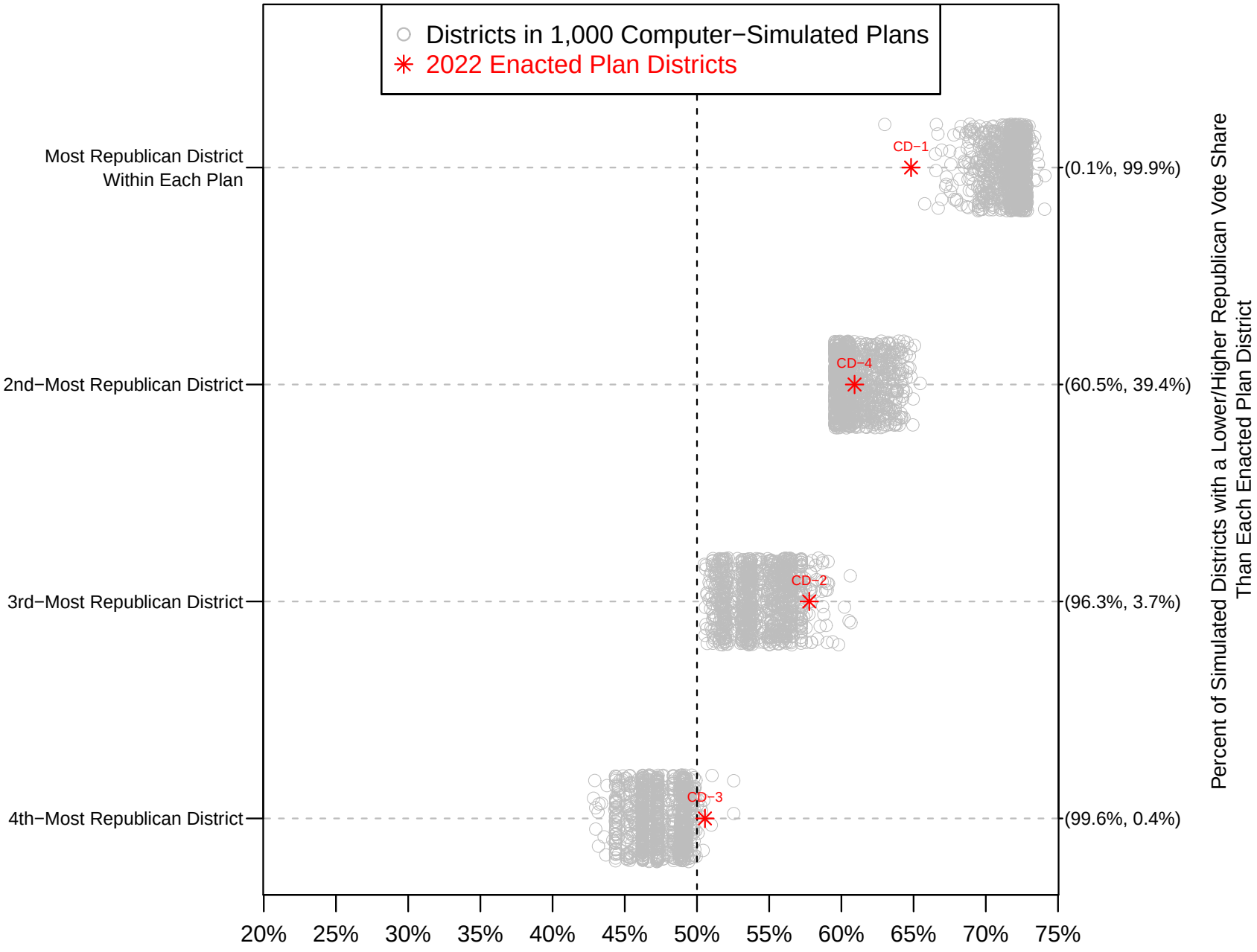
35. ***Partisan Outlier Districts in the Enacted Plan***: In Figure 5, I directly compare the partisan distribution of districts in the Enacted Plan to the partisan distribution of districts in the 1,000 computer-simulated plans. I first order the Enacted Plan's districts from the most to the least-Republican district, as measured by Republican vote share using the 2016-2020 Statewide Election Composite. The most-Republican district appears on the top row, and the least-Republican district appears on the bottom row. Next, I analyze each of the 1,000 computer-simulated plans and similarly order each simulated plan's districts from the most- to the least-Republican district. I then directly compare the most-Republican Enacted Plan district (CD-1) to the most-Republican simulated district from each of the 1,000 computer-simulated plans. In

other words, I compare one district from the Enacted Plan to 1,000 computer-simulated districts, and I compare these districts based on their Republican vote share. I then directly compare the second-most-Republican district in the Enacted Plan to the second-most-Republican district from each of the 1,000 simulated plans. I conduct the same comparison for each of the four districts in the Enacted Plan, comparing the Enacted Plan district to its computer-simulated counterparts from each of the 1,000 simulated plans.

36. Thus, the top row of Figure 5 directly compares the partisanship of the most-Republican Enacted Plan district (CD-1) to the partisanship of the most-Republican district from each of the 1,000 simulated plans. The two percentages (in parentheses) in the right margin of this Figure report the percentage of these 1,000 simulated districts that are less Republican than, and more Republican than, the Enacted Plan district. Similarly, the second row of this Figure compares the second-most-Republican district from each plan, the third row compares the third-most-Republican district from each plan, and the fourth row compares the least-Republican district from each plan. In each row of this Figure, the Enacted Plan's district is depicted with a red star and labeled in red with its district number; meanwhile, the 1,000 computer-simulated districts are depicted with 1,000 gray circles on each row.

Figure 5:

Comparisons of 2022 Enacted Plan Districts to 1,000 Computer−Simulated Plans' Districts



37. As the bottom row of Figure 5 illustrates, the least-Republican district in the Enacted Plan (CD-3) is more heavily Republican than 99.6% of the least-Republican districts in each of the 1,000 computer-simulated plans. This calculation is numerically reported in the right margin of the Figure. Nearly every one of the computer-simulated counterpart districts would have been less favorable to Republicans than CD-3 in terms of partisanship: CD-3 exhibits a Republican vote share of 50.6%, while nearly all 1,000 of the least-Republican districts in the computer-simulated plans would have exhibited a lower Republican vote share and would therefore have been more favorable to Democrats. In fact, 98.8% (988 out of 1,000) of the simulated plans contained a Democratic-favoring district in which the Republican vote share of the least-Republican district was under 50%.

38. It is thus clear that CD-3 cracks Democratic voters by eliminating what would normally have been a Democratic-favoring district in nearly all computer-simulated plans. The 50.6% Republican vote share of CD-3 is higher than the least-Republican district in 99.6% of the computer-simulated plans. I therefore identify CD-3 as an extreme partisan outlier when compared to its 1,000 computer-simulated counterparts, using a standard threshold test of 95% for statistical significance.

39. The next-to-bottom row of Figure 5 reveals a similar finding regarding CD-2 in the Enacted Plan. This row illustrates that the third-most-Republican district in the 2022 Enacted Plan (CD-2) is more heavily Republican than 96.3% of the third-most-Republican districts in each of the 1,000 computer-simulated plans. Nearly all of its computer-simulated counterpart districts would have been more politically moderate than CD-2 in terms of partisanship: CD-2 exhibits a Republican vote share of 57.8%, while 96.3% of the third-most-Republican districts in the computer-simulated plans would have exhibited a lower Republican vote share closer to 50%

and would therefore have been more politically competitive. In other words, CD-2 creates a safer Republican district than the third-most-Republican district in 96.3% of the computer-simulated plans. I therefore identify CD-3 as a partisan outlier when compared to its 1,000 computer-simulated counterparts, again using a standard threshold test of 95% for statistical significance.

40. It is especially notable that these two aforementioned Enacted Plan districts – the two least-Republican districts (CD-2 and CD-3) – were drawn to include more Republican voters than nearly all of their counterpart districts in the 1,000 computer-simulated plans. These "extra" Republican voters in the two least-Republican districts in the Enacted Plan had to come from one of the safer Republican districts in the Enacted Plan. Having more Republican voters in these least-Republican districts (CD-2 and CD-3) enhances Republican candidate performance in these districts.

41. Indeed, the top row in Figure 5 confirms this precise effect. The top row of Figure 5 compares the most-Republican district within the Enacted Plan and the 1,000 computer-simulated plans. In every congressional plan, this most-Republican district is whichever district contains Western Kansas. Figure 5 reveals that the most-Republican district in the Enacted Plan (CD-1) is significantly less Republican than the most-Republican district in 99.9% of the computer-simulated plans. In most of the computer-simulated plans, the Western Kansas district has a Republican vote share of 68%-73%. But the Enacted Plan's CD-1 has a Republican vote share of only 64.8%. Even though CD-1 is primarily based in Western Kansas, the district was also drawn to include two Democratic-leaning college towns in Northeast Kansas – Lawrence and Manhattan. The inclusion of these two heavily Democratic municipalities in the district caused CD-1 to have a Republican vote share significantly lower than 99.9% of the most-Republican districts in each of the 1,000 simulated plans. This unnaturally low Republican vote

share in CD-1, a safe Republican district, allowed the Enacted Plan's CD-2 and CD-3 to have higher Republican vote shares than nearly all of their computer-simulated counterpart districts, as illustrated in Figure 5.

42. I therefore identify three districts in the Enacted Plan as partisan statistical outliers (CD-1, 2, and 3). CD-1 is significantly less Republican than 99.9% of the most-Republican districts in each of the 1,000 simulated plans, which allows CD-2 and CD-3 to be more heavily Republican than nearly all of their counterpart computer-simulated plan districts.

43. The Appendix of this report contains nine additional Figures (Figures A1 through A9) that each contain a similar analysis of the Enacted Plan districts and the computer-simulated plan districts. Each of these nine Figures in the Appendix measures the partisanship of districts using one of the individual nine elections included in the 2016-2020 Statewide Election Composite. These nine Figures generally demonstrate that the same extreme partisan outlier patterns observed in Figure 5 are also present when district partisanship is measured using any one of the nine statewide elections held in Kansas during 2016-2020.

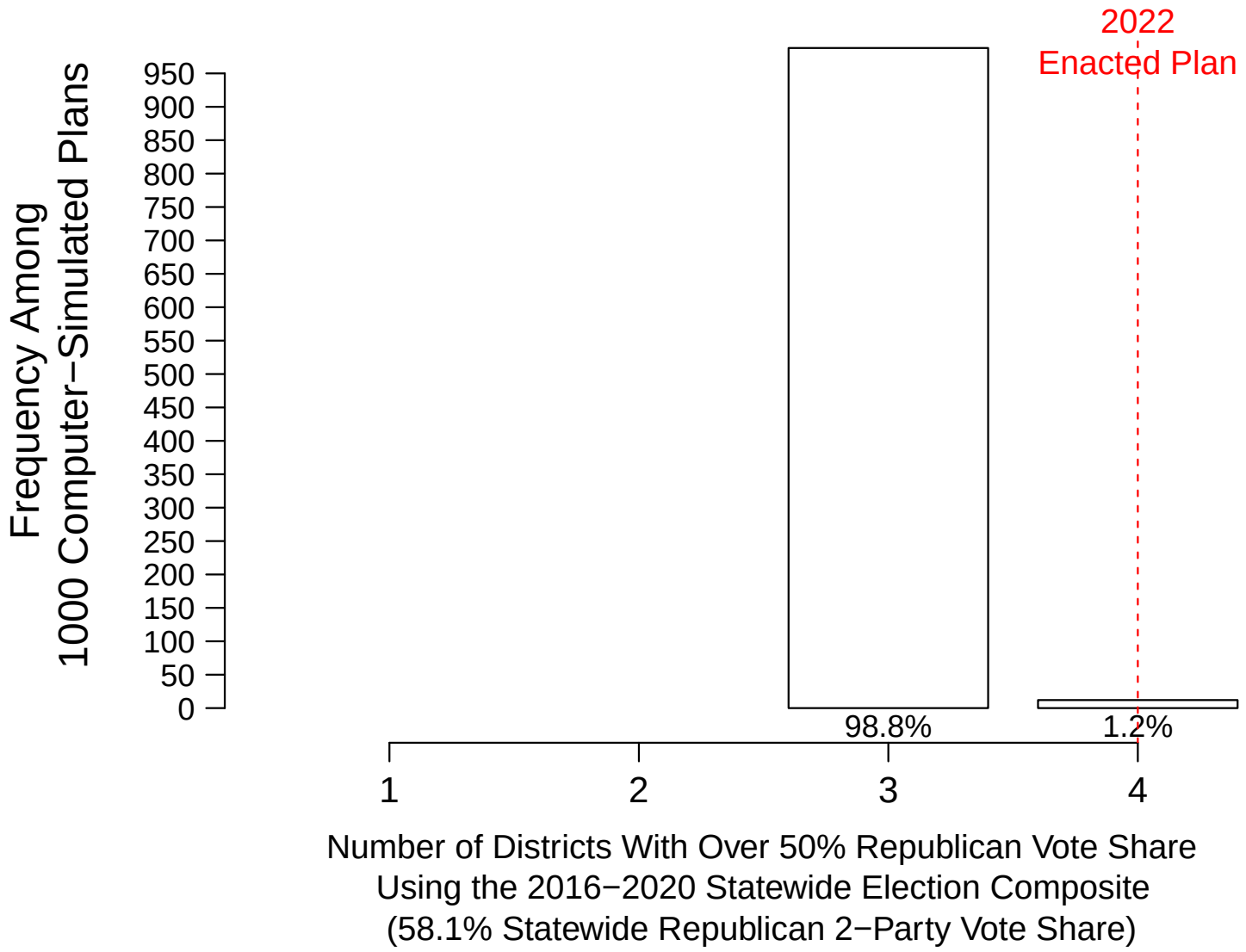
44. ***Number of Democratic and Republican Districts:*** Figure 6 compares the partisan breakdown of the computer-simulated plans to the partisanship of the Enacted Plan. Specifically, Figure 6 uses the 2016-2020 Statewide Election Composite to measure the number of Republican-favoring districts created in each of the 1,000 simulated plans. Across the entire state, Republican candidates collectively won a 58.1% share of the votes in the nine elections in the 2016-2020 Statewide Election Composite. But in the 2022 Enacted Plan, Republicans have over a 50% vote share in all four of the congressional districts. In other words, the Enacted Plan created four Republican-favoring districts, as measured using the 2016-2020 Statewide Election Composite. By contrast, only 1.2% of the computer-simulated plans create four Republican-

favoring districts. The remaining 98.8% of the computer-simulated plans create only three Republican-favoring districts and one Democratic-favoring district.

45. Hence, in terms of the total number of Republican-favoring districts created by the plan, the 2022 Enacted Plan is a statistical outlier when compared to the 1,000 computer-simulated plans. The Enacted Plan creates more Republican districts than 98.8% of the computer-simulated plans, which were drawn using a non-partisan districting process adhering to traditional districting criteria. I characterize the Enacted Plan's creation of four Republican districts as a statistical outlier among the computer-simulated plans because the Enacted Plan exhibits an outcome that is more favorable to Republicans than virtually all of the simulated plans.

Figure 6:

Comparisons of 2022 Enacted Plan to 1,000 Computer−Simulated Plans



46. ***The Efficiency Gap:*** Another commonly used measure of a districting plan's partisan bias is the efficiency gap.[11] To calculate the efficiency gap of the Enacted Plan and every computer-simulated plan, I first measure the number of Republican and Democratic votes within each Enacted Plan district and each computer-simulated district, as measured using the 2016-2020 Statewide Election Composite. Using this measure of district-level partisanship, I then calculate each districting plan's efficiency gap using the method outlined in *Partisan Gerrymandering and the Efficiency Gap.*[12] Districts are classified as Democratic wins if, using the 2016-2020 Statewide Election Composite, the sum total of Democratic votes in the district during these elections exceeds the sum total of Republican votes; otherwise, the district is classified as a Republican win. For each party, I then calculate the total sum of surplus votes in districts the party won and lost votes in districts where the party lost. Specifically, in a district lost by a given party, all of the party's votes are considered lost votes; in a district won by a party, only the party's votes exceeding the 50% threshold necessary for victory are considered surplus votes. A party's total wasted votes for an entire districting plan is the sum of its surplus votes in districts won by the party and its lost votes in districts lost by the party. The efficiency gap is then calculated as total wasted Democratic votes minus total wasted Republican votes, divided by the total number of two-party votes cast statewide across all nine elections

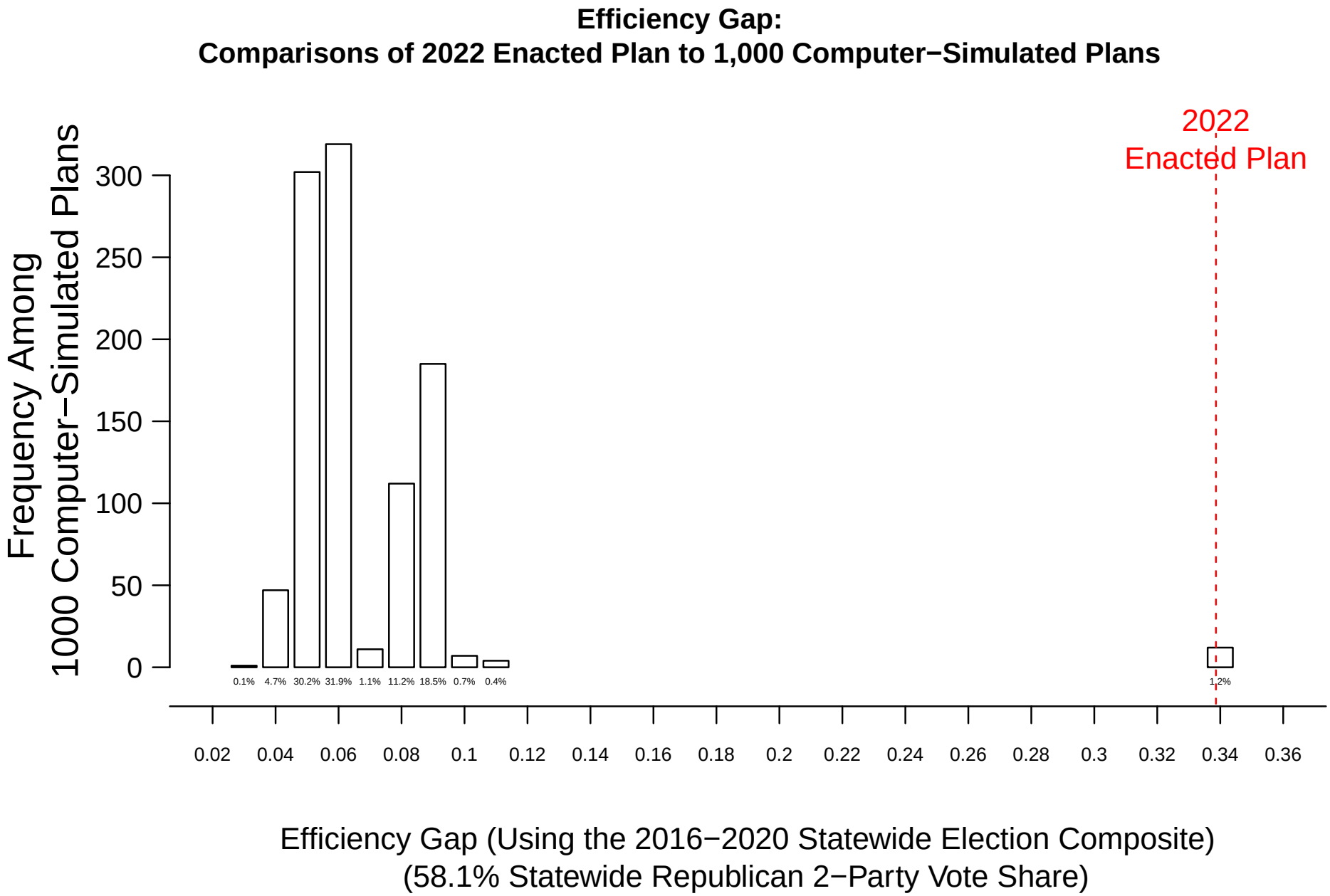
47. Thus, the theoretical importance of the efficiency gap is that it tells us the degree to which more Democratic or Republican votes are wasted across an entire districting plan. A significantly positive efficiency gap indicates far more Democratic wasted votes, while a significantly negative efficiency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

[11] Eric McGhee, "Measuring Partisan Bias in Single-Member District Electoral Systems." Legislative Studies Quarterly Vol. 39, No. 1: 55–85 (2014).
[12] Nicholas O. Stephanopoulos & Eric M. McGhee, *Partisan Gerrymandering and the Efficiency Gap*, 82 University of Chicago Law Review 831 (2015).

48. I analyze whether the 2022 Enacted Plan's efficiency gap arises naturally from a map- drawing process strictly adhering to nonpartisan, traditional districting criteria, or whether the skew in the Enacted Plan's efficiency gap is explainable only as the product of a map-drawing process that intentionally favored one party over the other. By comparing the efficiency gap of the Enacted Plan to that of the computer-simulated plans, I am able to evaluate whether the Enacted Plan's efficiency gap could have reasonably resulted from adherence to traditional districting criteria.

49. Figure 7 compares the efficiency gaps of the Enacted Plan and of the 1,000 computer-simulated plans. Specifically, Figure 7 contains a histogram describing the distribution of the efficiency gaps exhibited by each of the 1,000 simulated plans. Additionally, the red vertical dashed line indicates the efficiency gap of the Enacted Plan. The results in Figure 7 illustrate that the Enacted Plan exhibits an efficiency gap of +33.9%, indicating that the plan results in far more wasted Democratic votes than wasted Republican votes. Specifically, the difference between the total number of wasted Democratic votes and wasted Republican votes amounts to 33.9% of the total number of votes statewide. The Enacted Plan's efficiency gap is larger than the efficiency gaps exhibited by 98.8% of the computer-simulated plans. This comparison reveals that the significant level of Republican bias exhibited by the Enacted Plan cannot be explained by Kansas's political geography or adherence to traditional districting criteria alone.

Figure 7:


Efficiency Gap:
Comparisons of 2022 Enacted Plan to 1,000 Computer−Simulated Plans
2022
Enacted Plan
Frequency Among
1000 Computer−Simulated Plans
300
250
200
150
100
50
0
0.1%
4.7%
30.2%
31.9%
1.1%
11.2%
18.5%
0.7%
0.4%
1.2%
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2
0.22
0.24
0.26
0.28
0.3
0.32
0.34
0.36
Efficiency Gap (Using the 2016−2020 Statewide Election Composite)
(58.1% Statewide Republican 2−Party Vote Share)

Conclusions Regarding Partisanship and Traditional Districting Criteria

50. The analyses described thus far in this report lead me to two main findings: First, the 2022 Enacted Plan clearly subordinated the traditional districting criteria of geographic compactness, minimizing county splits, and minimizing VTD splits. The Legislature's plan fails to minimize county splits, fails to minimize VTD splits, and is significantly less geographically compact than is reasonably possible under a districting process following traditional districting criteria. The Enacted Plan's subordination of these three traditional districting criteria is especially noteworthy given that the Legislature's 2022 Guidelines and Criteria clearly emphasize the importance of county boundaries and VTDs while mandating that "districts should be as compact as possible."

51. Second, I found that the 2022 Enacted Plan is an extreme partisan outlier when compared to computer-simulated plans produced by a process following the Adopted Criteria. The Enacted Plan contains individual districts that are partisan outliers when compared to the simulated plans' individual districts, and, at a statewide level, the Enacted Plan creates a level of pro-Republican bias more extreme than in over 98% of the computer-simulated plans.

52. Based on these two main findings, I conclude that partisanship predominated in the drawing of the 2022 Enacted Plan, and partisanship subordinated the traditional districting principles of avoiding county splits, avoiding VTD splits, and geographic compactness. Because the Enacted Plan fails to follow the traditional districting principles mandated by the Legislature's 2022 Guidelines and Criteria and simultaneously creates an extreme level of 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

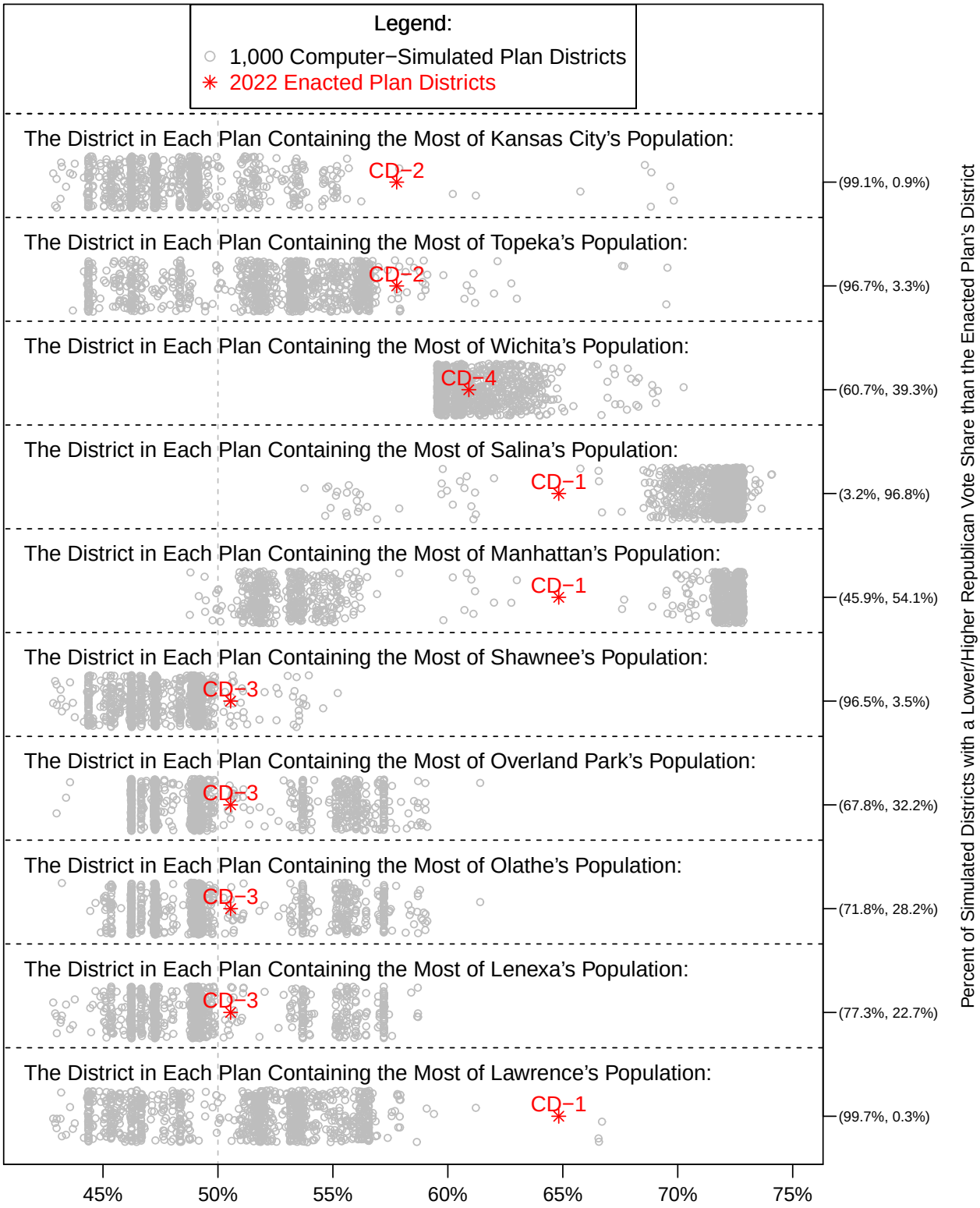
traditional districting principles, the Legislature's Enacted Plan was able to achieve an extreme partisan outcome that would not have normally occurred under a partisan-neutral districting process following traditional districting principles.

Municipal-Level Comparisons of Enacted Plan and Simulated Plan Districts

53. I have thus far compared the 2022 Enacted Plan to the simulated plans at a statewide level using several common measures of partisan bias and by identifying individual districts that are partisan outliers. However, I also analyzed the extent to which partisan bias in the map-drawing process affected specific cities within Kansas. I found that for certain cities, the Enacted Plan's district containing the city exhibits extreme partisan bias when compared to the computer-simulated districts containing the same city. Below, I describe my findings regarding the partisan bias caused by the Enacted Plan's district boundaries for the ten largest cities in Kansas.

54. Figure 8 summarizes this analysis. Specifically, Figure 8 contains a separate row for each of Kansas' ten largest cities. For each city, I identified the Enacted Plan district containing the majority or the entirety of the city's population. I also identified the district within each of the 1,000 computer-simulated plans containing most of the same city's population. Within each row of Figure 8, I then compared the partisanship of the Enacted Plan district to the 1,000 computer-simulated districts containing the same city. Within each row, the red star indicates the Republican vote share, measured using the 2016-2020 Statewide Election Composite, of the Enacted Plan's district containing the city. The 1,000 gray circles within each row indicate the Republican vote share of the 1,000 computer-simulated districts containing the same city. Finally, the two percentages (in parentheses) in the right margin report the percentage of these 1,000 simulated districts that are less Republican than, and more Republican than, the Enacted Plan district.

Figure 8: Comparison of Individual Districts' Republican Vote Shares in the 2022 Plan and in 1,000 Computer−Simulated Plans



55. For example, the top row of Figure 8 analyzes the districts in each plan containing most of Kansas City's population. Under the Enacted Plan, most of Kansas City is assigned to CD-2, which has a Republican vote share of 57.8%, as measured using the 2016-2020 Statewide Election Composite. By contrast, 99.1% of the 1,000 simulated districts containing most of Kansas City's population exhibit a lower Republican vote share than the Enacted Plan's CD-2. In fact, 83.7% of the simulated plans place Kansas City into a Democratic-favoring district, and 97.6% of the simulated plans place Kansas City into a district with under 55% Republican vote share. Hence, it is clear that the Enacted Plan's placement of Kansas City into a 57.8% Republican district is a statistically anomalous outcome that cannot be explained by a map-drawing process adhering to traditional districting criteria.

56. The second row of Figure 8 illustrates a similar finding regarding Topeka. Under the Enacted Plan, most of Topeka is assigned to CD-2, which has a Republican vote share of 57.8%, as measured using the 2016-2020 Statewide Election Composite. By contrast, 96.7% of the 1,000 simulated districts containing most of Topeka's population exhibit a lower Republican vote share than the Enacted Plan's CD-2. Hence, it is clear that the Enacted Plan's placement of Topeka into a 57.8% Republican district is a statistically anomalous outcome that cannot be explained by a map-drawing process adhering to traditional districting criteria. Instead, Topeka would almost always have been placed into a more politically competitive district under the computer-simulated plans.

57. The sixth row of Figure 8 illustrates a similar finding regarding Shawnee. Under the Enacted Plan, most of Shawnee is assigned to CD-3, a Republican-favoring district with a Republican vote share of 50.6%, as measured using the 2016-2020 Statewide Election Composite. By contrast, 96.5% of the 1,000 computer simulated districts containing most of

Shawnee's population exhibit a lower Republican vote share than the Enacted Plan's CD-3. In fact, 96.1% of the simulated plans place Shawnee into a Democratic-favoring district. Hence, it is clear that the Enacted Plan's placement of Shawnee into a Republican-favoring district is a statistically anomalous outcome that cannot be explained by a map-drawing process adhering to traditional districting criteria.

58. Finally, the bottom row of Figure 8 illustrates a similar finding regarding Lawrence. Under the Enacted Plan, most of Lawrence is assigned to CD-1, a heavily Republican-favoring district with a Republican vote share of 64.8%, as measured using the 2016-2020 Statewide Election Composite. By contrast, 99.7% of the 1,000 computer simulated plans place Lawrence into a more politically competitive district with a lower Republican vote share than the Enacted Plan's CD-1. In fact, 36.2% of the simulated plans even place Lawrence into a Democratic-favoring district. Hence, it is clear that the Enacted Plan's placement of Lawrence into such a heavily Republican district is a statistically anomalous outcome that cannot be explained by a map-drawing process adhering to traditional districting criteria.

Communities of Interest

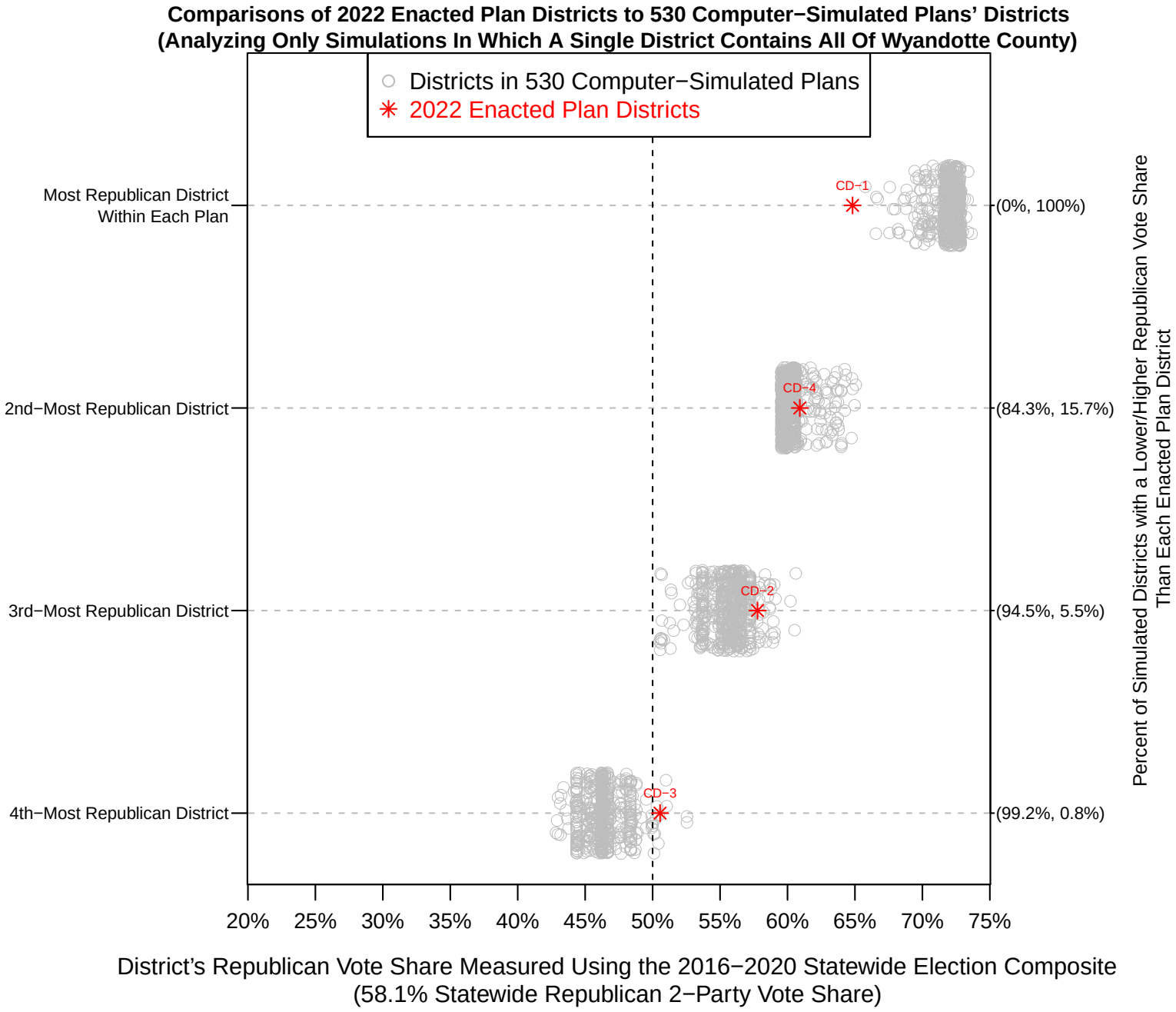
59. Although the districting simulation algorithm prioritizes the preservation of county and municipal boundaries, the algorithm does not guarantee that every single computer-simulated map will protect a particular community of interest, such as a particular county or a particular city. For example, one simulated map may split Sedgwick County, while a different simulated map may instead split neighboring Harvey County.

60. After the 1,000 computer-simulated Congressional plans were completed, plaintiffs' counsel asked me to separately analyze the partisanship of only those simulated plans in which Wyandotte County is kept together within a single district. Plaintiffs' counsel additionally asked me to separately analyze the partisanship of the simulated plans in which the entirety of Wyandotte County and a northeastern portion of Johnson County are both assigned to the same district. Plaintiffs' counsel informed me that a significant amount of the community of interest testimony submitted to the House and Senate Redistricting Committees focused on Wyandotte County and the northeastern portion of Johnson County bordering Wyandotte County.

61. ***Simulated Plans with Wyandotte County Preserved Intact:*** I first analyzed each of the 1,000 computer-simulated Congressional plans, and I identified those plans in which the entirety of Wyandotte County is assigned to a single district. I found that 530 of the 1,000 computer-simulated plans, or 53%, have this characteristic. Figure 9 compares the partisan distribution of districts in the Enacted Plan to the partisan distribution of districts in these 530 computer-simulated plans, following exactly the same format as Figure 5. As before, the most-Republican district from every simulated plan and the 2022 Enacted Plan appears on the top row, and the least-Republican district from every plan appears on the bottom row of Figure 9. As

before, the partisanship of every district is measured along the horizontal axis using the 2016-2020 Statewide Election Composite. And as before, for each row, the two percentages (in parentheses) in the right margin of Figure 9 report the percentage of the 530 simulated districts that are less Republican than, and more Republican than, the Enacted Plan district described on the row.

Figure 9:

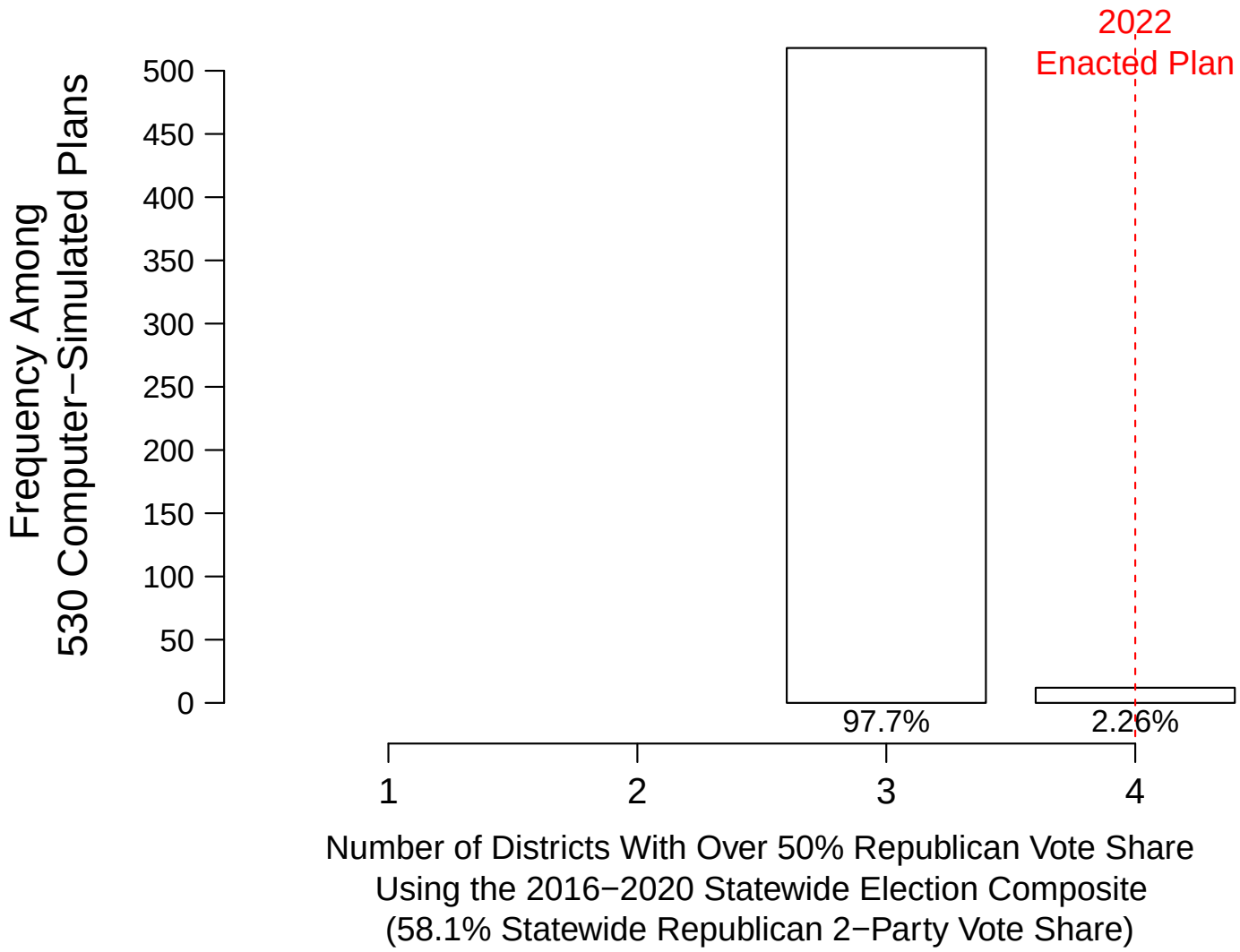

Comparisons of 2022 Enacted Plan Districts to 530 Computer−Simulated Plans' Districts
(Analyzing Only Simulations In Which A Single District Contains All Of Wyandotte County)
Districts in 530 Computer−Simulated Plans
2022 Enacted Plan Districts
Most Republican District Within Each Plan
2nd−Most Republican District
3rd−Most Republican District
4th−Most Republican District
CD−1
CD−4
CD−2
CD−3
(0%, 100%)
(84.3%, 15.7%)
(94.5%, 5.5%)
(99.2%, 0.8%)
20%
25%
30%
35%
40%
45%
50%
55%
60%
65%
70%
75%
District's Republican Vote Share Measured Using the 2016−2020 Statewide Election Composite
(58.1% Statewide Republican 2−Party Vote Share)
Percent of Simulated Districts with a Lower/Higher Republican Vote Share Than Each Enacted Plan District

62. Overall, Figure 9 reveals that when I analyze only those 530 simulated plans in which Wyandotte County is not split, the district-level partisan results are very similar to the results for the full set of 1,000 simulated plans. Most importantly, Figure 9 reveals that the least-Republican district in the Enacted Plan (CD-3) is more heavily Republican than 99.2% of the least-Republican districts in each of the 530 computer-simulated plans. Similarly, the third-most-Republican district in the 2022 Enacted Plan (CD-2) is more heavily Republican than 94.5% of the third-most-Republican districts in each of the 530 computer-simulated plans. And finally, the top row reveals that the most-Republican district in the Enacted Plan (CD-1) is significantly less Republican than the most-Republican district in 100% of the computer-simulated plans.

63. Figure 10 contains a histogram comparing the partisan breakdown of the 2022 Enacted Plan to the partisan breakdown of the 530 computer-simulated plans in which Wyandotte County is not split. As before, Figure 10 uses the 2016-2020 Statewide Election Composite to measure the number of Republican-favoring districts created in each of the simulated plans and in the Enacted Plan. The results in Figure 10 are virtually identical to the earlier results in Figure 6 describing the full set of 1,000 simulated plans. Figure 10 reveals that only 2.26% of the 530 computer-simulated plans create four Republican-favoring districts. The remaining 97.7% of the computer-simulated plans create only three Republican-favoring districts and one Democratic-favoring district. Hence, the 2022 Enacted Plan's creation of four Republican-favoring districts is clearly a statistical outlier when compared to the 530 computer-simulated plans that preserve Wyandotte County intact.

Figure 10:

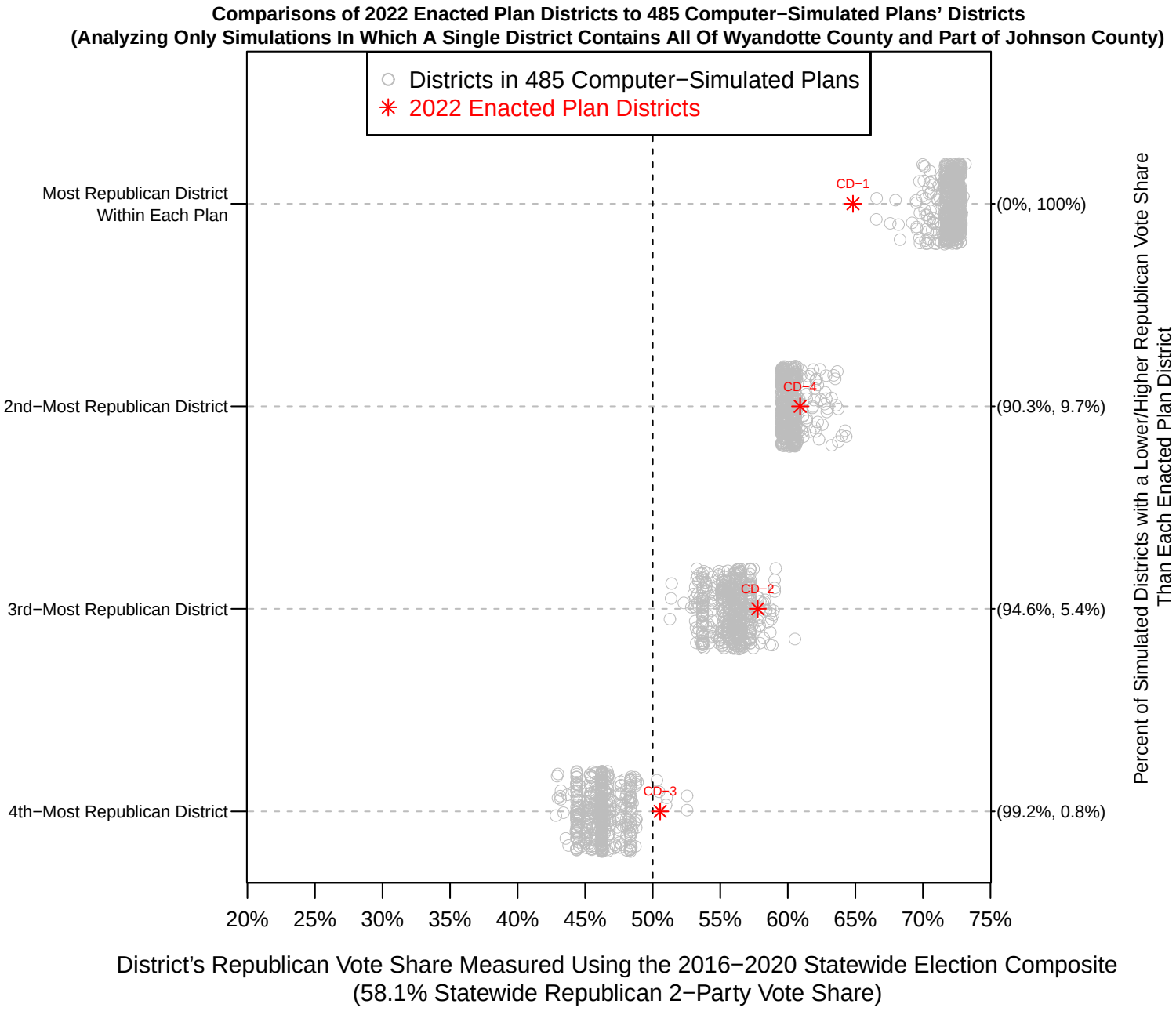
Comparisons of 2022 Enacted Plan to 530 Computer−Simulated Plans
In Which A Single District Contains All Of Wyandotte County



64. ***Simulated Plans Combining Wyandotte with Northeastern Johnson Counties:*** I analyzed each of the 1,000 computer-simulated Congressional plans, and I identified those plans in which the entirety of Wyandotte County is assigned to the same congressional district as the northeastern portion of Johnson County. I found that 485 of the 1,000 computer-simulated plans, or 48.5%, have this characteristic. Figure 11 compares the partisan distribution of districts in the Enacted Plan to the partisan distribution of districts in these 485 computer-simulated plans, following exactly the same format as Figure 5.

65. Overall, Figure 11 reveals that when I analyze only those 485 simulated plans in which Northeastern Johnson County and all of Wyandotte County are kept together, the district-level partisan results are very similar to the results for the full set of 1,000 simulated plans. Most importantly, Figure 11 reveals that the least-Republican district in the Enacted Plan (CD-3) is more heavily Republican than 99.2% of the least-Republican districts in each of the 485 computer-simulated plans. Similarly, the third-most-Republican district in the 2022 Enacted Plan (CD-2) is more heavily Republican than 94.6% of the third-most-Republican districts in each of the 485 computer-simulated plans. And finally, the top row reveals that the most-Republican district in the Enacted Plan (CD-1) is significantly less Republican than the most-Republican district in 100% of the computer-simulated plans.

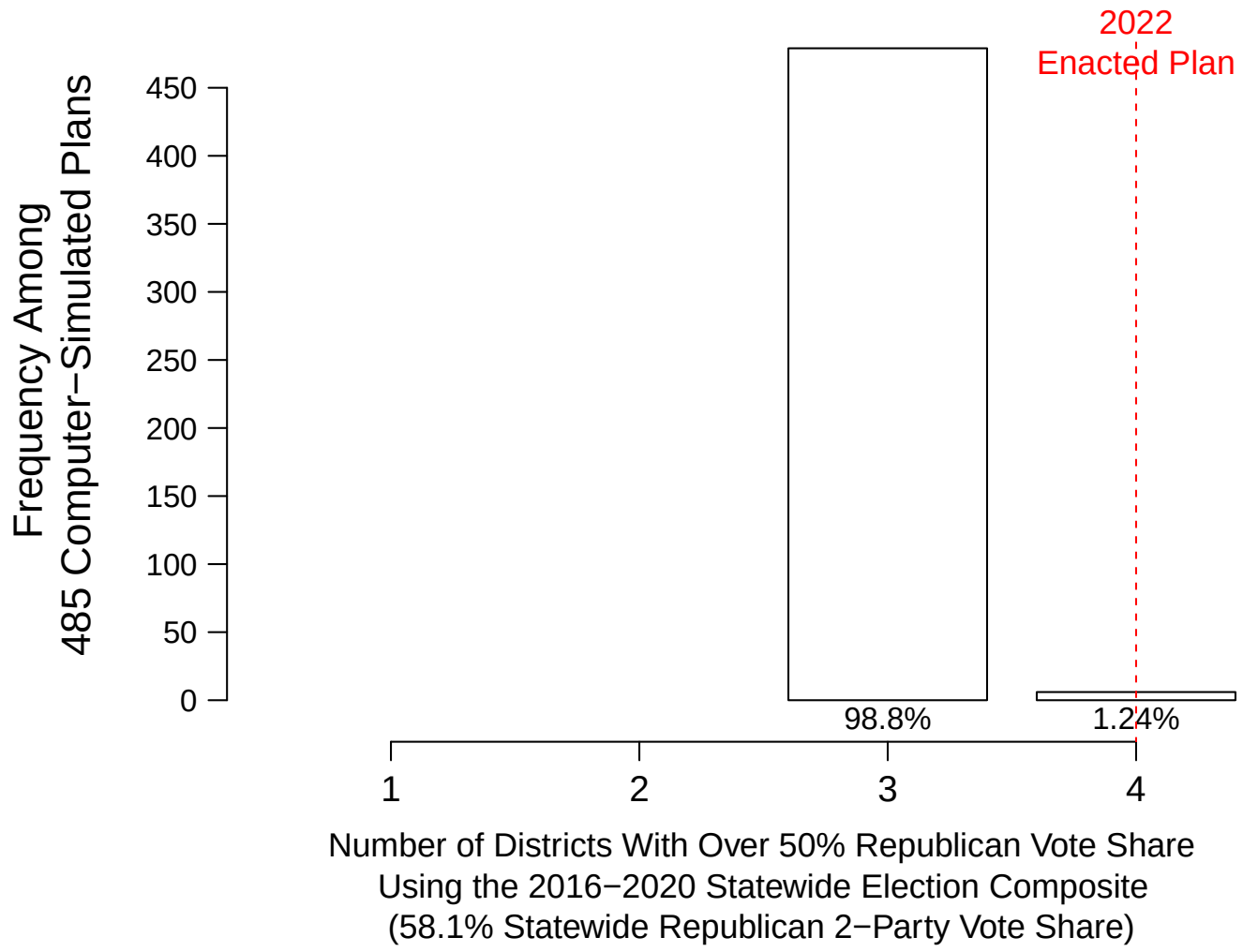
Figure 11:


Comparisons of 2022 Enacted Plan Districts to 485 Computer−Simulated Plans' Districts
(Analyzing Only Simulations In Which A Single District Contains All Of Wyandotte County and Part of Johnson County)
Districts in 485 Computer−Simulated Plans
2022 Enacted Plan Districts
Most Republican District Within Each Plan
2nd−Most Republican District
3rd−Most Republican District
4th−Most Republican District
CD−1
CD−4
CD−2
CD−3
(0%, 100%)
(90.3%, 9.7%)
(94.6%, 5.4%)
(99.2%, 0.8%)
Percent of Simulated Districts with a Lower/Higher Republican Vote Share Than Each Enacted Plan District
20%
25%
30%
35%
40%
45%
50%
55%
60%
65%
70%
75%
District's Republican Vote Share Measured Using the 2016−2020 Statewide Election Composite
(58.1% Statewide Republican 2−Party Vote Share)

66. Figure 12 contains a histogram comparing the partisan breakdown of the 2022 Enacted Plan to the partisan breakdown of the 485 computer-simulated plans in which Wyandotte County and Northeastern Johnson County are assigned to the same district. The results in Figure 12 are virtually identical to the earlier results in Figure 6 describing the full set of 1,000 simulated plans. Figure 12 reveals that only 1.24% of the 485 computer-simulated plans create four Republican-favoring districts. The remaining 98.8% of the computer-simulated plans create only three Republican-favoring districts and one Democratic-favoring district. Hence, the 2022 Enacted Plan's creation of four Republican-favoring districts is clearly a statistical outlier when compared to the 485 computer-simulated plans that keep Wyandotte County and Northeastern Johnson County together in the same district.

Figure 12:

Comparisons of 2022 Enacted Plan to 485 Computer−Simulated Plans
In Which A Single District Contains All Of Wyandotte County and Part of Johnson County



Kansas' Political Geography Did Not Cause the Enacted Plan's Extreme Partisan Bias

67. How does Kansas' political geography affect the partisan characteristics of the 2022 Enacted Plan? Democratic voters tend to be geographically concentrated in the urban cores of the Kansas City Metro Area and other cities, including Wichita, Topeka, Lawrence, and Manhattan. As I have explained in my prior academic research,[13] these large urban clusters of Democratic voters, combined with the traditional districting principle of drawing geographically compact districts, can sometimes result in urban districts that "naturally" pack together Democratic voters, thus boosting the Republican vote share of other surrounding suburban and rural districts.

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

69. This districting simulation analysis allowed me to identify the degree to which the electoral bias in Kansas' 2022 Enacted Congressional Plan is caused by Kansas' political

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

geography and how much is caused by the map-drawer's intentional efforts to favor one political party over the other. Kansas' natural political geography, combined with the application of traditional districting principles, almost never resulted in a simulated congressional plan containing four Republican-favoring districts and zero Democratic-favoring districts.

70. The 2022 Enacted Plan's creation of four Republican-favoring districts clearly goes beyond any "natural" level of electoral bias caused by Kansas' political geography or the political composition of the state's voters. The Enacted Plan is a statistical outlier in terms of its partisan characteristics when compared to the 1,000 computer-simulated plans. The Enacted Plan creates more Republican-favoring districts than 98.8% of the simulated plans. This extreme, additional level of partisan bias in the 2022 Enacted Plan can be directly attributed to the map-drawer's clear efforts to favor the Republican Party. This additional level of partisan bias was not caused by Kansas' political geography.

The Racial Composition of the Most-Democratic District

71. The computer simulation algorithm produced Congressional plans in a race-blind manner. In other words, the algorithm ignored all racial considerations and did not access any racial data while constructing districts. After the 1,000 computer-simulated Congressional plans were completed, plaintiffs' counsel asked me to compare the racial composition of the most-Democratic district within every plan, including the 1,000 simulated plans and the 2022 Enacted Plan.

72. Within each Congressional plan, I identify the "most-Democratic district" as the one with the lowest Republican vote share, even if that district's Republican vote share is over 50%. I then calculated the total minority Voting Age Population (VAP) of the most-Democratic district in each plan. Specifically, when calculating the total minority VAP of each district, I calculated the percentage of the district's VAP that identifies as either of the following: 1) Latino or Hispanic ethnicity; or 2) Any racial group other than single-race White. Hence, I include all mixed-race individuals as minorities under this calculation.

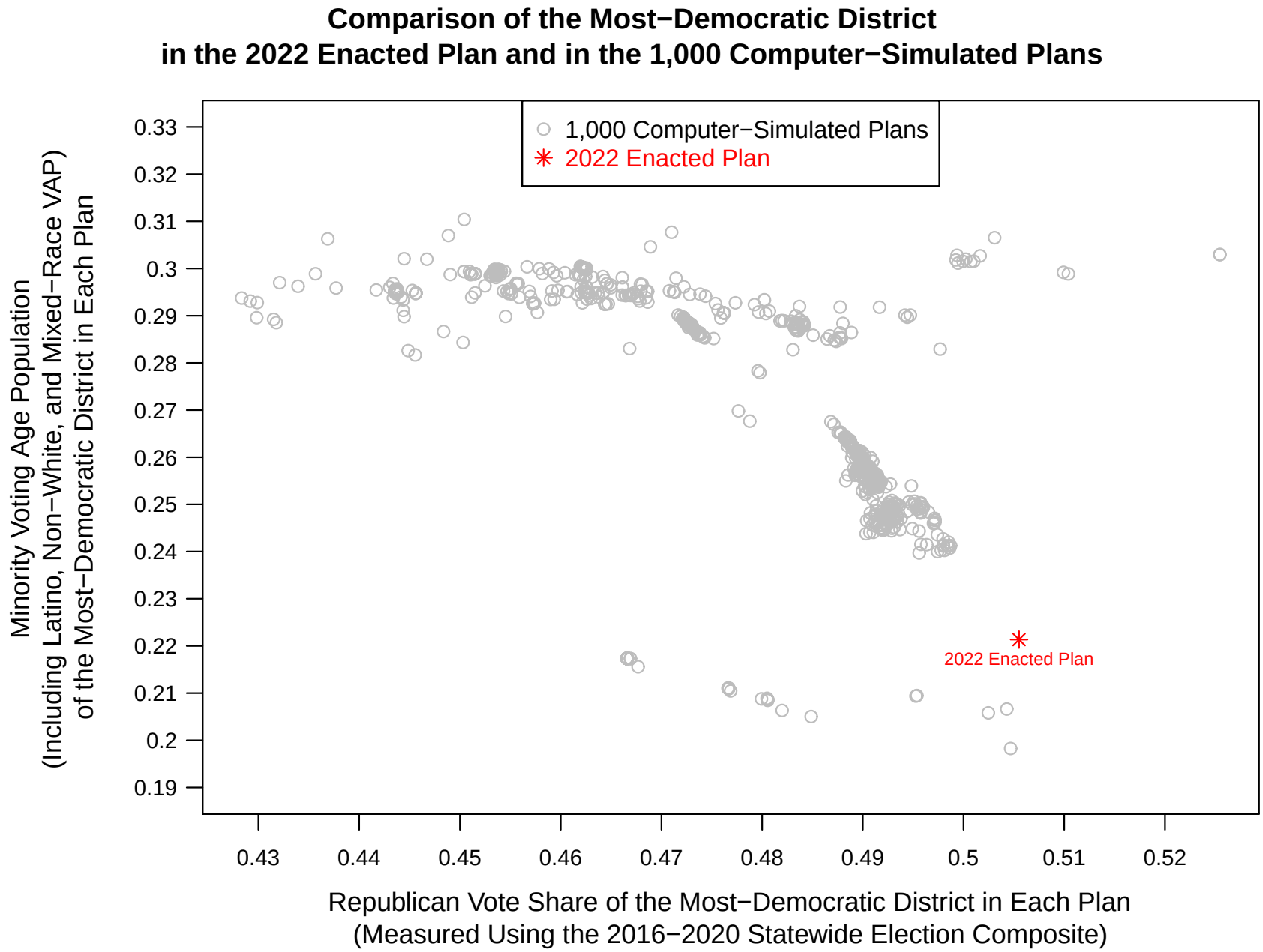
73. The 2022 Enacted Plan contains four Republican-favoring districts, as measured using the 2016-2020 Statewide Election Composite, and CD-3's Republican vote share of 50.6% is the lowest among the Enacted Plan's four districts. CD-3 contains a minority Voting Age Population (VAP) of 22.14%. I calculated the minority VAP of the most-Democratic district within each of the 1,000 computer-simulated plans, and I compared the minority VAP of the most-Democratic district within the 2022 Enacted Plan to those within the simulated plans.

74. Figure 13 displays the results of my analysis. In this Figure, the red star denotes the most-Democratic district within the Enacted Plan (CD-3), while the 1,000 gray circles represent the most-Democratic district within each of the 1,000 simulated plans. The vertical axis

indicates each district's minority VAP, while the horizontal axis indicates the district's Republican vote share, as measured using the 2016-2020 Statewide Election Composite.

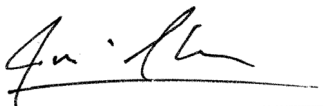
75. The results in Figure 13 indicate that the Enacted Plan's CD-3 exhibits an unusually low minority VAP when compared to the minority VAP of the most-Democratic district in each of the computer-simulated plans. The most-Democratic districts in the vast majority of the simulated plans have a minority VAP between 24% to 30%. By contrast, CD-3's minority VAP of 22.14% is lower than 94.9% of the most-Democratic districts in the 1,000 simulated plans.

Figure 13:


Comparison of the Most−Democratic District
in the 2022 Enacted Plan and in the 1,000 Computer−Simulated Plans
1,000 Computer−Simulated Plans
2022 Enacted Plan
2022 Enacted Plan
Minority Voting Age Population
(Including Latino, Non−White, and Mixed−Race VAP)
of the Most−Democratic District in Each Plan
0.33
0.32
0.31
0.3
0.29
0.28
0.27
0.26
0.25
0.24
0.23
0.22
0.21
0.2
0.19
0.43
0.44
0.45
0.46
0.47
0.48
0.49
0.5
0.51
0.52
Republican Vote Share of the Most−Democratic District in Each Plan
(Measured Using the 2016−2020 Statewide Election Composite)

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

This 7th day of March, 2022.



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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."
***American Journal of Political Science*. 57(1): 200-217.**

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."
***Quarterly Journal of Political Science*. Volume 10, No. 1: 5-40.**

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."
***Electoral Studies.* Volume 44 (December 2016): 329-340.**

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.**

Chen, Jowei and Nicholas Stephanopoulos, 2020. "The Race-Blind Future of Voting Rights."
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."
Wisconsin Law Review, Forthcoming, Volume 2021, Number 1.

Chen, Jowei and Nicholas Stephanopoulos, 2021. "Democracy's Denominator."
California Law Review, Accepted for Publication, Volume 109.

Non-Peer-Reviewed Publication:

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

Conference Service:

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

Conference Presentations and Working Papers:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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