

**IN THE UNITED STATES DISTRICT COURT
FOR THE MIDDLE DISTRICT OF NORTH CAROLINA**

COMMON CAUSE, *et al.*,)
)
Plaintiffs,)
)
v.)
)
ROBERT A. RUCHO, in his official)
capacity as Chairman of the North Carolina)
Senate Redistricting Committee for the)
2016 Extra Session and Co-Chairman of the)
Joint Select Committee on Congressional)
Redistricting, *et al.*,)
)
Defendants.)

CIVIL ACTION
No. 1:16-CV-1026-WO-JEP

THREE-JUDGE COURT

League of Women Voters of North)
Carolina, *et al.*,)
)
Plaintiffs,)
)
v.)
)
Robert A. Rucho, in his official capacity as)
Chairman of the North Carolina Senate)
Redistricting Committee for the 2016 Extra)
Session and Co-Chairman of the 2016 Joint)
Select Committee on Congressional)
Redistricting, *et al.*,)
)
Defendants.)

CIVIL ACTION
No. 1:16-CV-1164-WO-JEP

THREE JUDGE COURT

Expert Report of Sean P. Trende

I, Sean P. Trende, do hereby declare the following:

1. I am over 18 years of age and am competent to testify regarding the matters discussed in this declaration.

2. My areas of expertise include political history, United States voting laws, redistricting, and the study of campaigns and elections.

3. I have been retained in this matter to provide expert testimony explaining how the efficiency gap will likely operate in practice. I am compensated at a rate of \$300 per hour, excluding travel time. All opinions contained in this declaration are offered to a reasonable degree of professional certainty.

4. My *curriculum vitae* is attached to this declaration as **Exhibit 1**.

EXPERT CREDENTIALS

5. I have studied and followed United States elections on both a part-time and full-time basis for almost two decades.

6. I received a B.A. from Yale University in 1995, with a double major in history and political science.

7. I received a J.D. from Duke University in 2001.

8. I also received an M.A. from Duke University in 2001, in political science. My coursework was entirely at the graduate level, meaning that I was evaluated under the same expectations as Ph.D. students. As part of this coursework, I took two semesters of graduate level statistics.

9. I am currently enrolled as a doctoral student in political science at The Ohio State University. My focus is on American Politics, with a minor in methodology. I have taken most of my coursework in the Department of Statistics, including courses in regression analysis, probability theory, non-parametric statistics, survey methodology, and experimental design.

10. I joined RealClearPolitics in January of 2009 as their Senior Elections Analyst. I assumed a fulltime position with RealClearPolitics in March of 2010.

11. RealClearPolitics is a company of around 60 employees, with offices in Washington D.C. It produces one of the most heavily trafficked political websites in the world, which serves as a one-stop shop for political analysis from all sides of the political spectrum and is recognized as a pioneer in the field of poll aggregation. It produces original content, including both data analysis and traditional reporting. It is routinely cited by the most influential voices in politics, including David Brooks of *The New York Times*, Brit Hume of *Fox News*, Michael Barone of *The Almanac of American Politics*, Paul Gigot of *The Wall Street Journal*, and Peter Beinart of *The New Republic*.

12. My main responsibilities with RealClearPolitics consist of tracking, analyzing, and writing about elections. I also am in charge of rating the competitiveness of House of Representatives races, and collaborate in rating the competitiveness of Presidential, Senate and gubernatorial races. As a part of carrying out these responsibilities, I have studied and written extensively about demographic trends in the country, exit poll data at the state and federal level, public opinion polling, and voter turnout and voting behavior.

13. As part of familiarizing myself with how parties have drawn lines over the decades, as well as learning the political geography of the United States, I drew, using Adobe Illustrator, complete maps of every congressional district ever drawn, dating back to 1789. These maps were plotted on county maps of each state, tracing over images of maps taken from various Almanacs of American politics, or from my copy of Kenneth Martis' *The Historical Atlas of United States Congressional Districts: 1789-1983* (1982).

14. I served as a Senior Columnist for Dr. Larry Sabato's "Crystal Ball" from January 2014 through the end of last year. I had to stop writing for the Crystal Ball because schoolwork was taking up too much of my time.

15. The overarching purpose of my writings, both at RealClearPolitics and the Crystal Ball, is to try to convey more rigorous statistical understandings of elections than are typically found in journalistic coverage of elections for a lay audience.

16. I am the author of *The Lost Majority: Why the Future of Government is up For Grabs and Who Will Take It*. The book offers a revisionist take on realignment theory. It argues that realignments are a poor concept that should be abandoned. As part of this analysis, it conducts a thorough analysis of demographic and political trends beginning around 1920 and continuing through the modern times. The book has been placed on syllabi at universities, and cited in peer-reviewed literature.

17. I also authored a chapter in Dr. Larry Sabato's *Barack Obama and the New America: The 2012 Election and the Changing Face of Politics*, which discussed the demographic shifts accompanying the 2012 elections. I further authored a chapter in Dr. Sabato's *The Surge: 2014's Big GOP Win and What It Means for the Next Presidential Election*, which discusses demographics and Electoral College shifts. I authored a chapter in Dr. Sabato's forthcoming *Trumped: The 2016 Election That Broke All The Rules*.

18. I co-authored the 2014 *Almanac of American Politics*. The Almanac is considered the foundational text for understanding congressional districts and the representatives of those districts, as well as the dynamics in play behind those elections. PBS's Judy Woodruff described the book as "the oxygen of the political world," while NBC's Chuck Todd noted that "[r]eal political junkies get two *Almanacs*: one for the home and one for the office." My focus was

researching the history of and writing descriptions for many of the newly-drawn districts, including those for North Carolina.

19. I have spoken on these subjects before audiences from across the political spectrum, including at the Heritage Foundation, the American Enterprise Institute, the CATO Institute, the Bipartisan Policy Center, and the Brookings Institution. In 2012, I was invited to Brussels to speak about American elections to the European External Action Service, which is the European Union's diplomatic corps. I was selected by the United States Embassy in Sweden to discuss the 2016 elections to a series of audiences there.

20. It is my policy to appear on any news outlet that invites me, barring scheduling conflicts, and I have appeared on both Fox News and MSNBC to discuss electoral and demographic trends. I have spoken on a diverse array of radio shows such as First Edition with Sean Yoes, the Diane Rehm Show, the Brian Lehrer Show, the John Batchelor Show, the Bill Bennett Show, and Fox News Radio. I have been cited in major news publications, including *The New York Times*, *The Washington Post*, *The Los Angeles Times*, *The Wall Street Journal*, and *USA Today*.

21. I sit on the advisory panel for the "States of Change: Demographics and Democracy" project. This three-year project is sponsored by the Hewlett Foundation and involves three premier think tanks: The Brookings Institution, the American Enterprise Institute, and the Center for American Progress. The group takes a detailed look at trends among eligible voters and the overall population, both nationally and in key states, in an attempt to explain the impact of these changes on American politics, and to create population projections, which the Census Bureau abandoned in 1995.

22. I previously authored an expert report in *Dickson v. Rucho*, No. 11-CVS-16896 (N.C. Super Ct., Wake County), which involved North Carolina’s 2012 General Assembly and Senate maps. Although I was not called to testify, it is my understanding that my expert report was accepted without objection. I also authored an expert report in *Covington v. North Carolina*, Case No. 1:15-CV-00399 (M.D.N.C.), which involved almost identical challenges in a different forum.

23. I authored two expert reports in *NAACP v. McCrory*, No. 1:13CV658 (M.D.N.C.), which involved challenges to multiple changes to North Carolina’s voter laws, including the elimination of a law allowing for the counting of ballots cast in the wrong precinct. I was allowed to testify at trial. My testimony was solely on the “effect” prong of the Voting Rights Act claim. I did not examine the issues relating to intent.

24. I authored reports in *NAACP v. Husted*, No. 2:14-cv-404 (S.D. Ohio), and *Ohio Democratic Party v. Husted*, Case 15-cv-01802 (S.D. Ohio), which dealt with challenges to a variety of Ohio voting laws. I was allowed to testify at trial. The judge in the latter case ultimately refused to consider one opinion, which is not relevant to this report.

25. I authored an expert report in *Whitford v. Nichol*, No. 15-cv-421-bbc, a partisan gerrymandering case. I was allowed to testify at trial.

26. Although I do not testify in defense of voter identification laws, I served as a trial consultant in *Lee v. Virginia Board of Elections*, No. 3:15-cv-357.

27. I authored an expert report in *Feldman v. Arizona*, No. CV-16-1065-PHX-DLR, which dealt with an attempt to ban the practice of “ballot harvesting” in Arizona.

I. **There is no single “efficiency gap,” making it difficult to choose a standard.**

28. In the Wisconsin litigation, Dr. Jackman urged scrutiny when the absolute value of the efficiency gap (that is, the value of the efficiency gap when any negative signs are ignored) for state assembly districts in the first enacted year rose above .07; this contrasts with the .08 threshold recommended by the authors of the efficiency gap for such cases. *See* Nick Stephanopoulos & Eric McGee, “Partisan Gerrymandering and the Efficiency Gap,” 82 *U. Chicago L.R.*, 831, 837 (2015). If this case is successful, states with more than 15 congressional districts will trigger scrutiny if the absolute efficiency gap exceeds .075, while states with seven to 15 districts will trigger scrutiny if their absolute efficiency gap exceeded .12.

29. This contrasts with the two-seat threshold urged by Stephanopoulos and McGee. Stephanopoulos & McGee at 888 (“Since aggregate House seats are the parties’ main objective, it follows that the efficiency gap should be measured in seats rather than in percentage points.”). There is even an argument to be made that this sort of shift to seats is “necessary,” given that “[t]he efficiency gap becomes lumpier when there are fewer seats, because each seat accounts for a larger proportion of the seat total, and the efficiency gap thus shifts more as each seat changes hands.” Simon Jackman, Rebuttal Report, *Wisconsin v. Nichols* at 23, 24 (Dec. 21, 2015), Exhibit 2. There exists “no authority in the literature” for failing to convert efficiency gaps to seats at the congressional level or, for that matter, calculating efficiency gaps for states with fewer than eight seats. Jackman Rebuttal at 24.

30. In addition, states with fewer than *seven* congressional districts are, at least for now, beyond scrutiny, although a court could apparently employ an eight-state cutoff, which was the approach suggested by Stephanopoulos & McGee in their original article and by Dr. Jackman

17 months ago. *Id.*; *id.* at 25 (“Next take Trende’s consideration of Alabama’s congressional plan in 2002 (which had seven districts), Iowa’s congressional plan in 2002 (five districts), and Colorado’s congressional plans in 2002 and 2012 (seven districts each) (paragraphs 115-16, 119, 122). All four of these plans have fewer than eight districts, and so, based on the literature, should not be included in any efficiency gap analysis because of the measure’s lumpiness when applied to so few seats.”); Stephanopoulos & McGee at 836. For purposes of this case, of the 43 states that have more than one district, 19 states, consisting of 70 congressional districts, will have to have some additional test devised. Utilizing an eight-seat cutoff, that number grows to 22 states, containing 81 congressional districts.

31. Beyond that there is the question of the form of the efficiency gap. As discussed below, there are two different efficiency gap formulae. The formula utilized in the actual efficiency gap article is “Efficiency Gap = Seat Margin – (2 x Vote Margin).” This was also the formula utilized by Dr. Jackman in the Wisconsin litigation. Here, Dr. Jackman employs a more involved version of the efficiency gap, which is the total number of wasted Democratic votes, minus the total number of wasted Republican votes, divided by the total number of votes cast. In this version of the efficiency gap, wasted Republican votes are defined as the votes that a Republican wins when Republicans lose a particular seat. When a Republican wins a seat, wasted votes are the difference between the number of votes a Republican won in the seat and half the number of total votes cast in the district. The same is true for Democrats.

32. The choices made above are not immaterial. In their law review article, Mr. Stephanopoulos and Dr. McGee identify only four states that would trigger court scrutiny under the 2012 plan: Florida, Ohio, Pennsylvania and Virginia. Stephanopoulos & McGee at 837. Given that the efficiency gap for the 2016 North Carolina plan was lower than the 2012 plan, this

map would not be a gerrymander under the standard used in the law review. Dr. Jackman's metric, by contrast, would subject thirteen plans – over half of the plans that were drawn that year – to court scrutiny. These are: Alabama, Florida, Indiana, Massachusetts, Michigan, New Jersey, North Carolina, Ohio, Pennsylvania, South Carolina, Texas, Virginia, and Wisconsin. Obviously the standard upon which the Supreme Court decides is highly material.

33. Some of these standards have stronger empirical bases than others, but most involve at a least a degree of arbitrary decision. It is perhaps true that a court could ultimately settle upon an efficiency gap, much as it eventually settled upon a 10 percent cutoff for population deviations of state plans and 0 percent for federal plans. This, however, is true of any statistic; the court could also have settled upon a Reock score that it found represented too much boundary distortion. Regardless, my point is just that courts will have to make these sorts of decisions, that those decisions are consequential, and that the bases for those decisions are not always cut-and-dried.

II. The efficiency gap is not easy to calculate.

34. Contrary to the claims of the main efficiency gap article, the efficiency gap is not easily calculable. Stephanopoulos & McGee at 837. More precisely, while calculating the version of the efficiency gap utilized by Mr. Stephanopoulos and Dr. McGee is easy, and calculating the more involved version of the efficiency gap can become easy with a bit of practice, setting up the underlying data is difficult.

33. For example, Dr. Jackman encounters a large amount of missing data. Missing data are hardly a novel problem in statistics – entire courses are offered on how to deal with it, and it can comprise an entire unit in a survey methodology course. There are also multiple different ways to deal with imputations (which courts will likely have to choose between in

future cases), and criteria for sometimes discarding the missing observations. As Stephanopoulos and McGee explain:

The most defensible [imputation strategy] is to use variables that have been shown in the past to predict vote share, and then to impute values for uncontested races based on these variables. One might also examine how uncontested districts have turned out in previous years when those same seats were contested. Or one might simply assume that the opposing party would have received a certain vote share (for example, 25 percent) had it run a candidate in an uncontested district. Clearly, these imputation approaches can be more or less sophisticated, and can bring varying amounts of information to bear on the problem.

Stephanopoulos & McGee at 866.

34. For his part, Dr. Jackman utilizes Bayesian hierarchical modeling, using Markov Chain Monte Carlo runs, including 25,000 burn-in iterations, followed by an additional 150,000 iterations, saving every 30th iteration. While this isn't quite as exotic as it may sound, neither is it the sort of thing one encounters in a routine undergraduate statistics course. It is also not particularly simple to implement; it takes, by my count, twenty pages of computer code from Dr. Jackman's program to activate. Map drawers may or may not have the sophistication to run a model like this, and courts will have to eventually adjudicate between different imputation strategies, as they can yield different results.

35. Then there is the question of whether the "baseline" efficiency gap for a state should be zero. If random districts were drawn throughout the United States, according to Dr. Chen, we would ultimately end up with seat shares for parties that do not look dissimilar from what we have today on the national level. The problem for Democrats "is that they have overwhelming majorities not only in dense, poor urban centers, but also in isolated, far-flung college towns, historical mining areas and 19th-century manufacturing towns that are surrounded and ultimately overwhelmed by rural Republicans." *See* Jowei Chen and Jonathan Rodden, "Don't Blame the Maps," *New York Times* (Jan. 24, 2014).

36. So, while Indiana shows a strong first-year efficiency gap that is, in fact, more extreme than that of the present North Carolina map, Drs. Chen and Rodden find that randomly drawn maps would not produce drastic changes in seat allocations. In other words, if we accept the Chen and Rodden approach as applicable to gerrymandering cases, there may not be many votes wasted by any intent on the part of the legislature to create a gerrymander – though not all scholars accept that the Chen and Rodden approach as applicable. *See* Jackman Rebuttal at 20 (“While I respect Chen and Rodden’s contribution, there are several issues with their work that make it inapplicable here.”).

37. If there is spatial clustering, then where the baseline for an efficiency gap should be set is extremely difficult to calculate; indeed it may be impossible to translate a cluster-detecting algorithm to an efficiency gap. One could say in this circumstance that Indiana should be required to draw maps that minimize the efficiency gap, but this then effectively becomes a constitutional requirement for states to make “make up calls” for inefficient vote distributions, rather than a remedy for gerrymandering.

38. Likewise, although Illinois only shows a modest efficiency gap of .02, Drs. Chen and Rodden find that the number of seats won by Democrats far exceeds that which would be achieved under random maps. In other words, in Illinois, the baseline might need to be moved to the right to capture the gerrymandering of the Democrats there; otherwise the natural clustering of Democrats will mask what is, in fact, a heavy Democratic gerrymander. *Id.*

39. This is not an easy task. Dr. Chen’s code does not run well on the latest version of Java, and seems to produce compiler errors until an earlier version is found and the proper packages are added to the class path. To even understand how the code actually works, a researcher who encounters problems is forced to wade through code like this:

```

private ArrayList MuDeltaTauRhoTau(int dnumber, double targetpop, ArrayList Upsallan,
int nextcty){
Random GammaEpsilonNu = new Random(); boolean complete=false;
ArrayList PhiCauTauSigma = new ArrayList(); PhiCauTauSigma.clear(); int
DeltaPhiOmegaPhi=0; ArrayList borders1 = new ArrayList(); borders1.clear(); ArrayList
lastctygroup = new ArrayList(); lastctygroup.clear();
int TauRhoIota=0; ArrayList ctys_reached = new ArrayList(); int splitcty = 0;
while(true){ TauRhoIota++; if (TauRhoIota>5000000){return null;}

lastctygroup.clear();
for (int i=Upsallan.size()-1; i>=0; i--){
int pct = (Integer)Upsallan.get(i); int pcty = (Integer)phichizeta.get(pct);
if (pcty==nextcty){
if (borders1.contains(pct)){borders1.remove((Object)pct);}
PhiCauTauSigma.add(pct); Upsallan.remove((Object)pct);
DeltaPhiOmegaPhi+=(Integer)phiphiphi.get(pct); lastctygroup.add(pct);

boolean PhiCauTauSigma_cont0=IotaChiOmegaNu(PhiCauTauSigma,PhiChiBeta);
System.out.println("PhiCauTauSigma: "+PhiCauTauSigma.size()+" PhiCauTauSigma_cont0:
"+PhiCauTauSigma_cont0);

ArrayList PhiBetaOmegaRho = (ArrayList)PhiChiBeta.get(pct);
for (int j=0; j<PhiBetaOmegaRho.size(); j++){
int pb = (Integer)PhiBetaOmegaRho.get(j); System.out.println("pct: "+pct+"
PhiBetaOmegaRho: "+PhiBetaOmegaRho);
if(Upsallan.contains(pb) && !borders1.contains(pb)){borders1.add(pb); }

```

40. Beyond this, there exists a whole universe of techniques for discussing spatial clusters, all of which have their own problems, but which will have to be sorted through by courts to truly adjudicate these claims: nearest neighbor, Moran's various tests, the index of dissimilarity, Oden's I^* pop, Tango's MEET, and SaTScan, and the like.

III. The efficiency gap is proportional representation for first-past-the-post systems.

41. A system of proportional representation is easily defined and comprehended: Whatever share of the vote a party receives in a country corresponds more-or-less directly to the share of the seats they receive (I say more-or-less because countries frequently employ minimum vote share requirements to qualify for proportional representations). So, if we define VoteShare^* as a party's share of the vote, centered at 50% (i.e., its vote share minus 0.5), and define SeatShare^* as a party's share of seats, again centered at 50% (i.e., its seat share minus 0.5), we can see what I will call the bias of the plan. In equation form, it would look like this:

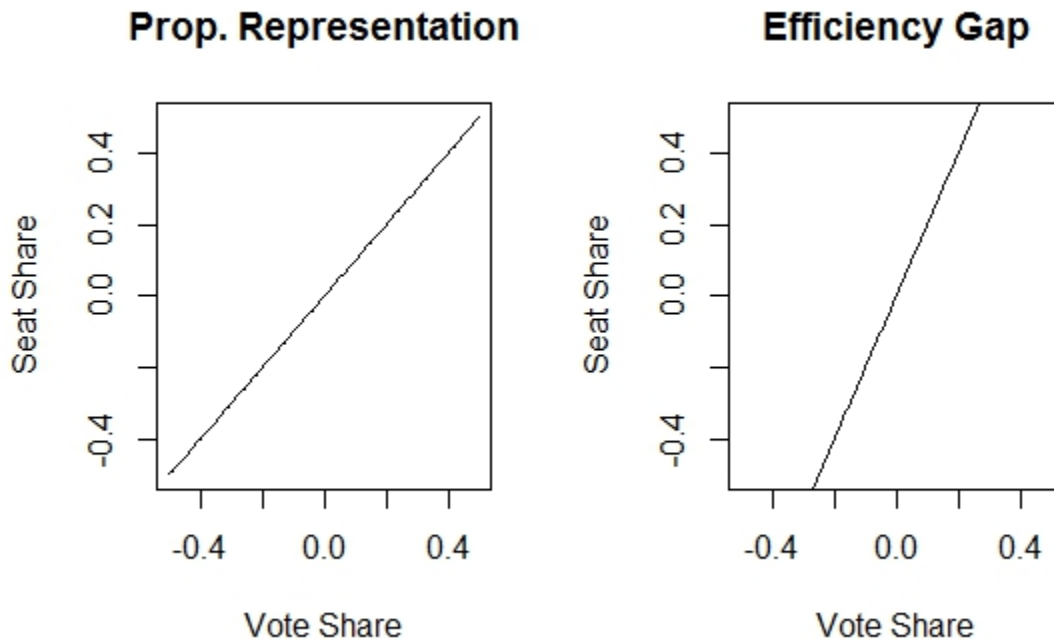
$$\text{Bias} = \text{VoteShare}^* - \text{SeatShare}^*$$

42. As Dr. Eric McGhee proved, when districts have equal populations, the complex version of the efficiency gap, utilized by Dr. Jackman here, simplifies to a simpler version utilized by Dr. Jackson in Wisconsin and Mr. Stephanopoulos and Dr. McGee in their law review article. Eric McGhee, *Measuring Partisan Bias in Single-Member District Electoral Systems* 39 *Leg. Stud. Q.* 55 (2014) [Ex. 3]; Stephanopoulos and McGee at 853. (“Instead, if we assume that all districts are equal in population (which is constitutionally required), and that there are only two parties (which is typical in [single member district] systems), then the computation reduces through simple algebra to something quite straightforward.”). Therefore, “[t]o produce partisan fairness—in the sense of equal wasted votes for each party—the bonus should be a precisely twofold increase in seat share for a given increase in vote share.” Stephanopoulos and McGee at 854. In equation form, it looks like this:

$$\text{Efficiency Gap} = 2(\text{VoteShare}^*) - \text{SeatShare}^*$$

43. See Stephanopoulos & McGee at 853. The similarities are quite striking: A party's share of the seats above or below 50 percent will equal its share of the votes, similarly adjusted, in an ideal proportional representation scheme. Under the efficiency gap, it simply

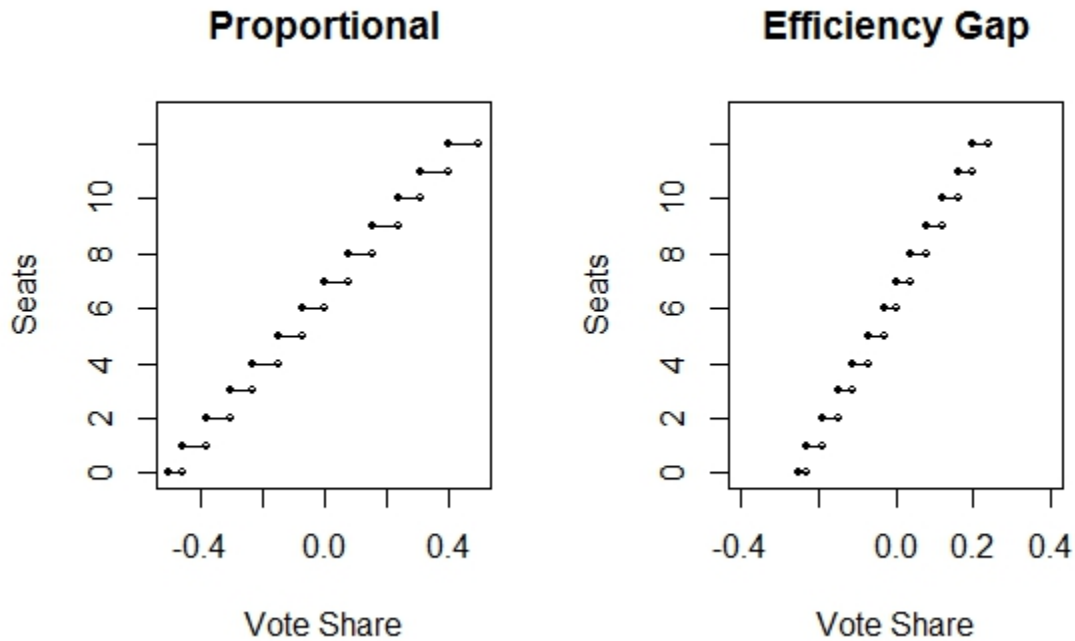
equals twice the adjusted vote share. Moreover, the efficiency gap is built upon direct proportionality in “wasted” votes. Stephanopoulos & McGee at 834 (“Algebraically, this means that Party A wins 20 percent (or 2) more seats than it would have had the parties wasted equal numbers of votes.”). To put this into graphical form, below are the ideal share of seats for a party, given a particular vote share under both the efficiency gap and proportional representation. Indeed, proportional representation is related to partisan symmetry as much as the efficiency gap is, in that both have partisan biases of zero in a 50-50 election. For that matter, pure proportional representation can be thought of as a focus on wasted votes as well, at the national level rather than the district level.



44. In other words, the efficiency gap allocates seats with a proportion of 2% of the seats for every 1% of the vote, rather than 1% of the seats for every 1% of the vote.

45. Of course, seat allocations are discrete, not continuous (in plain English, that means you can't have a fraction of a seat share). To see how actual seat allocation in North

Carolina would work under proportional representation and the efficiency gap, see the charts below:



46. Notice, though, that the vote share for the efficiency gap truncates. That is, it does not return a value if a party receives, say, 10 percent of the vote (-0.4 on the above charts). Stephanopoulos and McGee make a practical argument here that very few plans reach this level of vote share. It nevertheless seems like an odd theoretical construct that for some conceivable values of United States elections, a federal standard of gerrymandering would demand negative seats.

47. For a final illustration of how this works in reality, I have calculated, using the simplified version of the efficiency gap (which, insofar as I can tell, is the version that has been used in the published literature), the following tables. The columns represent the number of congressional districts in a state. The rows represent a given vote share in the state. The left and right cell entries represent the minimum and maximum number of seats you can have under the

efficiency gap, while the middle value represents the ideal number of seats. I have calculated them for states with between seven and 15 districts, and between 16 and 24 districts, to illustrate both of Dr. Jackman's thresholds.

48. Note that the allowable seats progress in a linear manner; for example, in the case of North Carolina (13 districts) each category of seats (minimum, ideal, and maximum) increases by one seat roughly every four percentage points (occasionally, due to rounding, it is not exactly four seats). For a state with 22 districts, they increase by one seat roughly every three percentage points of popular vote. One could conceivably generate a similar table using the more complex version of the efficiency gap, but it would require a multi-dimensional space. Regardless, the differences between the simple and complex efficiency gap calculation are relatively small overall; if one exclude Dr. Jackman's imputations, the r-square is .9403.

	7	8	9	10	11	12	13	14	15
.30	0,1,2	0,1,2	0,1,2	0,1,2	0,1,2	0,1,3	0,1,3	0,1,3	0,1,3
.31	0,1,2	0,1,2	0,1,2	0,1,2	0,1,3	0,1,3	0,2,3	0,2,3	0,2,4
.32	0,1,2	0,1,2	0,1,2	0,1,3	0,2,3	0,2,3	0,2,3	0,2,4	0,2,4
.33	0,1,2	0,1,2	0,1,3	0,2,3	0,2,3	0,2,3	1,2,4	1,2,4	1,2,4
.34	0,1,2	0,1,2	1,2,3	1,2,3	1,2,3	1,2,4	1,2,4	1,3,4	1,3,5
.35	1,1,2	1,2,3	1,2,3	1,2,3	1,2,4	1,2,4	1,3,4	1,3,4	1,3,5
.36	1,2,2	1,2,3	1,2,3	1,2,3	1,2,4	1,3,4	1,3,4	1,3,5	1,3,5
.37	1,2,3	1,2,3	1,2,3	1,2,4	1,3,4	1,3,4	2,3,5	2,3,5	2,4,5
.38	1,2,3	1,2,3	1,2,3	1,3,4	2,3,4	2,3,5	2,3,5	2,4,5	2,4,6
.39	1,2,3	1,2,3	1,3,4	2,3,4	2,3,4	2,3,5	2,4,5	2,4,6	2,4,6
.40	1,2,3	1,2,3	2,3,4	2,3,4	2,3,5	2,4,5	2,4,5	3,4,6	3,5,6
.41	1,2,3	2,3,4	2,3,4	2,3,4	2,4,5	2,4,5	3,4,6	3,4,6	3,5,7
.42	2,2,3	2,3,4	2,3,4	2,3,5	2,4,5	3,4,6	3,4,6	3,5,6	3,5,7
.43	2,3,3	2,3,4	2,3,4	2,4,5	3,4,5	3,4,6	3,5,6	3,5,7	4,5,7
.44	2,3,4	2,3,4	2,3,4	3,4,5	3,4,6	3,5,6	3,5,6	4,5,7	4,6,8
.45	2,3,4	2,3,4	3,4,5	3,4,5	3,4,6	3,5,6	4,5,7	4,6,7	4,6,8
.46	2,3,4	2,3,4	3,4,5	3,4,5	3,5,6	4,5,6	4,5,7	4,6,8	5,6,8
.47	2,3,4	3,4,4	3,4,5	3,4,6	4,5,6	4,5,7	4,6,7	4,6,8	5,7,8
.48	2,3,4	3,4,5	3,4,5	3,5,6	4,5,6	4,6,7	4,6,8	5,6,8	5,7,9
.49	3,3,4	3,4,5	3,4,5	4,5,6	4,5,7	4,6,7	5,6,8	5,7,8	5,7,9
.50	3,4,4	3,4,5	3,4,6	4,5,6	4,6,7	5,6,7	5,6,8	5,7,9	6,8,9
.51	3,4,4	3,4,5	4,5,6	4,5,6	4,6,7	5,6,8	5,7,8	6,7,9	6,8,10
.52	3,4,5	3,4,5	4,5,6	4,5,7	5,6,7	5,6,8	5,7,9	6,8,9	6,8,10
.53	3,4,5	4,4,5	4,5,6	4,6,7	5,6,7	5,7,8	6,7,9	6,8,10	7,8,10
.54	3,4,5	4,5,6	4,5,6	5,6,7	5,6,8	6,7,8	6,8,9	6,8,10	7,9,11
.55	3,4,5	4,5,6	4,5,6	5,6,7	5,7,8	6,7,9	6,8,9	7,8,10	7,9,11
.56	4,4,5	4,5,6	5,6,7	5,6,7	6,7,8	6,7,9	7,8,10	7,9,10	8,9,11
.57	4,4,5	4,5,6	5,6,7	5,6,8	6,7,8	6,8,9	7,8,10	7,9,11	8,10,11
.58	4,5,5	4,5,6	5,6,7	5,7,8	6,7,9	6,8,9	7,9,10	8,9,11	8,10,12
.59	4,5,6	4,5,6	5,6,7	6,7,8	6,7,9	7,8,10	7,9,10	8,10,11	8,10,12
.60	4,5,6	5,6,7	5,6,7	6,7,8	6,8,9	7,8,10	8,9,11	8,10,11	9,10,12
.61	4,5,6	5,6,7	5,6,8	6,7,8	7,8,9	7,9,10	8,9,11	8,10,12	9,11,13
.62	4,5,6	5,6,7	6,7,8	6,7,9	7,8,9	7,9,10	8,10,11	9,10,12	9,11,13
.63	4,5,6	5,6,7	6,7,8	6,8,9	7,8,10	8,9,11	8,10,11	9,11,12	10,11,13
.64	5,5,6	5,6,7	6,7,8	7,8,9	7,9,10	8,9,11	9,10,12	9,11,13	10,12,14
.65	5,6,6	5,6,7	6,7,8	7,8,9	7,9,10	8,10,11	9,10,12	10,11,13	10,12,14
.66	5,6,7	6,7,8	6,7,8	7,8,9	8,9,10	8,10,11	9,11,12	10,11,13	11,12,14
.67	5,6,7	6,7,8	6,8,9	7,8,10	8,9,11	9,10,12	9,11,12	10,12,13	11,13,14
.68	5,6,7	6,7,8	7,8,9	7,9,10	8,9,11	9,10,12	10,11,13	10,12,14	11,13,15
.69	5,6,7	6,7,8	7,8,9	8,9,10	8,10,11	9,11,12	10,11,13	11,12,14	11,13,15
.70	5,6,7	6,7,8	7,8,9	8,9,10	9,10,11	9,11,12	10,12,13	11,13,14	12,13,15

	1	2	3	4	5	6	7	8	9
1	0,2,3	0,2,3	0,2,3	0,2,3	0,2,3	1,2,4	1,2,4	1,2,4	1,2,4
2	1,2,3	1,2,3	1,2,4	1,2,4	1,2,4	1,3,4	1,3,4	1,3,4	1,3,5
3	1,2,3	1,2,4	1,3,4	1,3,4	1,3,4	1,3,5	1,3,5	1,3,5	2,3,5
4	1,3,4	1,3,4	2,3,4	2,3,4	2,3,5	2,3,5	2,4,5	2,4,5	2,4,6
5	2,3,4	2,3,4	2,3,5	2,3,5	2,4,5	2,4,5	2,4,6	2,4,6	3,4,6
6	2,3,4	2,3,5	2,4,5	2,4,5	2,4,5	3,4,6	3,4,6	3,5,6	3,5,7
7	2,4,5	2,4,5	3,4,5	3,4,6	3,4,6	3,5,6	3,5,6	3,5,7	3,5,7
8	3,4,5	3,4,5	3,4,6	3,5,6	3,5,6	3,5,7	4,5,7	4,6,7	4,6,8
9	3,4,5	3,4,6	3,5,6	4,5,6	4,5,7	4,5,7	4,6,7	4,6,8	4,6,8
10	3,4,6	3,5,6	4,5,6	4,5,7	4,6,7	4,6,7	5,6,8	5,6,8	5,7,9
11	4,5,6	4,5,6	4,5,7	4,6,7	5,6,8	5,6,8	5,7,8	5,7,9	5,7,9
12	4,5,6	4,5,7	4,6,7	5,6,8	5,6,8	5,7,8	5,7,9	6,7,9	6,8,9
13	4,5,7	5,6,7	5,6,7	5,6,8	5,7,8	6,7,9	6,7,9	6,8,10	6,8,10
14	5,6,7	5,6,7	5,6,8	5,7,8	6,7,9	6,8,9	6,8,10	7,8,10	7,9,10
15	5,6,7	5,6,8	5,7,8	6,7,9	6,8,9	6,8,10	7,8,10	7,9,10	7,9,11
16	5,6,8	6,7,8	6,7,9	6,8,9	6,8,10	7,8,10	7,9,10	7,9,11	8,10,11
17	6,7,8	6,7,8	6,8,9	7,8,9	7,8,10	7,9,10	8,9,11	8,10,11	8,10,12
18	6,7,8	6,7,9	7,8,9	7,8,10	7,9,10	8,9,11	8,10,11	8,10,12	9,11,12
19	6,7,9	7,8,9	7,8,10	7,9,10	8,9,11	8,10,11	8,10,12	9,11,12	9,11,13
20	6,8,9	7,8,9	7,9,10	8,9,11	8,10,11	9,10,12	9,11,12	9,11,13	10,12,13
21	7,8,9	7,8,10	8,9,10	8,10,11	8,10,12	9,10,12	9,11,13	10,12,13	10,12,14
22	7,8,10	8,9,10	8,9,11	8,10,11	9,10,12	9,11,12	10,11,13	10,12,14	11,12,14
23	7,9,10	8,9,10	8,10,11	9,10,12	9,11,12	10,11,13	10,12,14	11,12,14	11,13,15
24	8,9,10	8,10,11	9,10,11	9,11,12	10,11,13	10,12,13	11,12,14	11,13,15	12,13,15
25	8,9,10	9,10,11	9,10,12	10,11,12	10,12,13	11,12,14	11,13,14	12,13,15	12,14,16
26	8,10,11	9,10,11	9,11,12	10,11,13	11,12,14	11,13,14	12,13,15	12,14,16	13,14,16
27	9,10,11	9,11,12	10,11,13	10,12,13	11,12,14	11,13,15	12,14,15	13,14,16	13,15,17
28	9,10,11	10,11,12	10,12,13	11,12,14	11,13,14	12,13,15	12,14,16	13,15,16	14,15,17
29	9,11,12	10,11,12	11,12,13	11,13,14	12,13,15	12,14,15	13,15,16	13,15,17	14,16,18
30	10,11,12	10,12,13	11,12,14	11,13,14	12,14,15	13,14,16	13,15,17	14,16,17	15,16,18
31	10,11,12	11,12,13	11,13,14	12,13,15	12,14,15	13,15,16	14,15,17	14,16,18	15,17,19
32	10,12,13	11,12,14	12,13,14	12,14,15	13,14,16	14,15,17	14,16,17	15,17,18	15,17,19
33	11,12,13	11,13,14	12,13,15	13,14,15	13,15,16	14,16,17	15,16,18	15,17,19	16,18,20
34	11,12,13	12,13,14	12,14,15	13,14,16	14,15,17	14,16,18	15,17,18	16,17,19	16,18,20
35	11,12,14	12,13,15	13,14,15	13,15,16	14,16,17	15,16,18	16,17,19	16,18,20	17,19,21
36	12,13,14	12,14,15	13,14,16	14,15,17	15,16,18	15,17,18	16,18,19	17,18,20	17,19,21
37	12,13,14	13,14,15	13,15,16	14,16,17	15,16,18	16,17,19	16,18,20	17,19,21	18,20,21
38	12,13,15	13,14,16	14,15,16	15,16,17	15,17,18	16,18,19	17,18,20	18,19,21	18,20,22
39	13,14,15	13,15,16	14,15,17	15,16,18	16,17,19	16,18,20	17,19,21	18,20,22	19,21,22
40	13,14,15	14,15,16	14,16,17	15,17,18	16,18,19	17,18,20	18,19,21	19,20,22	19,21,23
41	13,14,16	14,15,17	15,16,18	16,17,19	16,18,19	17,19,20	18,20,21	19,21,22	20,22,23

IV. Dr. Jackman's imputations appear to include unrealistic values

51. I agree with Dr. Jackman (as well as Dr. McGee and Mr. Stephanopoulos) that missing election results have to be somehow estimated if the efficiency gap is to work. The number of districts in a given plan is often small, and missing data are relatively frequent – about one-in-seven elections in the dataset are uncontested. Even if the misses were completely random (which we don't really have reason to suspect is the case) in the aggregate, ignoring an uncontested election altogether could have a significant effect upon the estimated efficiency gap in individual states, especially in those states with small numbers of districts. With that said, the fact that missing data must be dealt with for the efficiency gap to work can also lead to the conclusion that the efficiency gap cannot be made to work. With imputations accounting for roughly one-in-seven elections in the dataset, Jackman Report at 21, making mistakes can skew the results badly.

52. First, the imputations require the researcher to assess counterfactuals, something Dr. McGee and Mr. Stephanopoulos identify, properly, as a problem with the partisan bias metric. Stephanopoulos & McGee at 835 (describing accessing the counterfactual as a “crucial problem” with partisan bias). In that instance we have to access the counterfactual of a 50-50 election; in this instance we have to attempt to access the counterfactual of a contested election. In some plans here, a majority of the districts are estimated off of hypothetical elections.

53. More importantly, a bad estimate may be worse than no estimate at all, and it isn't clear whether Dr. Jackman's estimates are better than no imputations at all. Some of his estimates for both turnout and election results seem unlikely to be accurate.

54. Counsel for plaintiffs produced a file entitled “districtLevel,” which appears to include the election returns upon which Dr. Jackman relies to compute his efficiency gap scores. The data for turnout, including imputed values, appear to be contained in a column entitled “totalTwoParty_bar.” In those cases where Dr. Jackman imputes values for turnout, he also includes estimates at the low end and high end for his selected “confidence level” (as a reasonable analogy, think of how political polling is often reported, with a given value, plus or minus a certain number of points, though the more precise analogy here would probably be internet polling). These uncontested elections, for which turnout and vote share are imputed, are identified as “FALSE” in a column labeled “contested.”

55. Over the course of the elections Dr. Jackman surveys, the average district received 190,700 votes. Among the elections for which we have actual data, the lowest reported turnout came in New York’s 12th Congressional District in 1978. In that election, Democrat Shirley Chisholm received 25,697 votes to Republican Charles Gibbs’ 3,580 votes. But even this was unusual. About 95 percent of elections for which we have actual data show at least 100,000 votes cast, and 99 percent of elections show at least 67,556 votes cast.

56. But 59 of Dr. Jackman’s 1,114 imputed values, or a little more than five percent of the elections for which he imputes values, show estimates that are lower than the lowest vote total that ever actually manifested in a contested election. Most of these are lower than the lowest vote total that ever actually manifested in a contested election by an order of magnitude. These are listed in the following table.

1	2	3	4	5	6	7	8
	stpost	year	district	dvote_bar	dvote_lo	totalTwoParty_bar	totalTwoParty_lo
1	CA	1972	15	1285.2	-1190	1938.3	-1845.6
2	CA	1982	3	1288.7	-1218	1974.7	-1977.6
3	CA	1982	25	1557.9	-1297	1993.9	-1770.5
4	CA	1982	43	729.5	-748	2016.9	-2010.8
5	FL	1992	14	712.4	-697	1998	-1868.6
6	FL	1992	17	1412.3	-1343	1972.8	-1865.6
7	FL	1992	21	775.6	-849	1976.3	-2268.4
8	FL	1994	14	672.7	-665	2002.9	-1920.6
9	FL	1994	17	1472.6	-1403	2004.6	-1945.9
10	FL	1994	21	602.7	-588	1967.1	-2030.5
11	FL	2012	4	723.7	-664	2066.2	-1833.5
12	FL	2012	21	1403.3	-1149	2070.6	-1929.6
13	FL	2012	25	856	-923	2008.1	-1917.3
14	FL	2014	4	615.1	-616	1946.9	-1801.3
15	FL	2014	21	1329.1	-1136	2070.1	-2057.7
16	FL	2014	25	823	-720	2079	-1863.4
17	GA	2002	5	1510.4	-1489	2042.2	-1596.2
18	GA	2002	10	467.4	-477	2011.2	-2025.2
19	GA	2004	5	1565.9	-1411	2007	-2125.7
20	GA	2004	10	484.1	-545	2022.2	-1696.3
21	GA	2008	4	1660.1	-1662	2013.4	-1715.5
22	NC	1998	7	1174.8	-1029	2070.1	-1804.8
23	NC	1998	10	652	-646	1996.9	-1900.4
24	NY	1972	9	1105.6	-1031	1989.7	-1799.7
25	OH	1982	3	1441.5	-1485	2005.8	-1851.3
26	OH	1984	3	1226.2	-1265	1953.3	-1763.8
27	TX	1972	1	1222.6	-1192	1957.6	-1922.4
28	TX	1972	10	1312.1	-1356	1957.9	-1900.1
29	TX	1972	11	1238.9	-1275	1971.5	-2006.8
30	TX	1972	12	1312.4	-1403	1979.2	-1864.2
31	TX	1972	14	1316.2	-1567	1959.9	-1848.2
32	TX	1972	15	1432.6	-1324	2046.9	-1907
33	TX	1972	16	1285.8	-1071	1971.4	-1695.1
34	TX	1972	17	1216.4	-1260	1984.4	-1950
35	TX	1972	19	1189	-1202	1957.6	-2215.6
36	TX	1972	20	1570.2	-1466	1985.9	-1925.4
37	TX	1972	23	1311.2	-1122	1976.7	-1834.3
38	TX	1974	20	17582.3	7075	20614.7	9009.1
39	TX	1982	1	1438.1	-1464	2006.3	-1874.9
40	TX	1982	2	1465.8	-1378	2036.2	-1839.8
41	TX	1982	6	1296.2	-1530	1916	-1794
42	TX	1982	10	1412.2	-1353	1960.7	-1870.2
43	TX	1982	11	1362.8	-1417	1992	-1766.7
44	TX	1982	20	1633.1	-1567	1996.7	-1806.2
45	TX	1982	22	626	-643	1986.4	-1978.5
46	TX	1992	3	519.5	-501	1998.5	-1781.2
47	TX	1992	7	484.7	-471	2022.8	-1989.4
48	TX	1994	3	459.5	-467	1991.7	-1658.4
49	TX	1994	7	415.9	-461	1912.4	-2121.4
50	TX	2002	7	620.7	-525	2051.4	-2001.3

	stpost	year	district	dvote_bar	dvote_lo	totalTwoParty_bar	totalTwoParty_lo
51	TX	2002	8	455.8	-470	1949.9	-2065.4
52	TX	2002	10	1329.9	-1292	2022.4	-1938.7
53	TX	2002	12	612.8	-631	1986.4	-1881.7
54	TX	2002	15	1357.6	-1358	2036.5	-2015.2
55	TX	2002	16	1387	-1398	1985.8	-2234.8
56	TX	2002	19	506.9	-506	2024	-1836
57	TX	2002	20	1387	-1194	2028.2	-1882.3
58	TX	2002	29	1407.9	-1476	1988	-2067.5
59	VA	1992	7	631.9	-712	2039.4	-1741.7

57. There may be something in the 3,000 lines of Dr. Jackman’s code that corrects for this, but I was not able to identify it. As you can see, 59 of Dr. Jackman’s imputed values show implausibly small results. The smallest reported result comes in Texas’ Seventh District in 1994, where Dr. Jackman suggests 1,912 votes would have been cast had the Republican, Bill Archer, drawn an opponent. This cannot be correct, given that Archer actually garnered 116,873 votes in 1994. See Philip D. Duncan & Christine C. Lawrence, *Politics in America 1996: The 104th Congress* 1269 (1995) [Note: Politics in America will hereinafter be referred to as simply *PIA*, followed by the appropriate year. Note further that Politics in America is somewhat counterintuitively dated for the year of the cycle *after* the election it covers. In other words, *PIA 1996* covers the 1994 elections. The same is true for Almanacs of American Politics]. In fact, it is doubtful whether any of these results represent realistic imputations.

58. These apparent errors are problematic for four practical reasons. First, these results create implausible variance values for Dr. Jackman’s estimates. As you can see from the table, Dr. Jackman’s low-end estimates for turnout and democratic vote share (*totalTwoParty_lo* and *dvote_lo*, respectively) contain negative values, which cannot occur. While this does not affect his estimated efficiency gaps directly, which are keyed off of the variables ending in “_bar,” they do affect his “error margins,” which will be calculated in part on the basis of these impossible values.

59. Second, the errors clearly affect Dr. Jackman's efficiency gap calculations at the granular level. Consider North Carolina in 1998. The state had an efficiency gap of $-.0168$ that year. According to Dr. Jackman's estimates, Mike McIntyre would have defeated his Republican opponent by 1174 votes to 895 votes, had he drawn an opponent. In North Carolina 10, Republican Cass Ballenger would have prevailed 1,345 to 652 had he drawn a Democratic opponent. If we multiply these values by 85, to roughly approximate overall turnout in North Carolina in other districts in 1998, the efficiency gap flips signs, and has a value of $.005$.

60. The deviations can be more extreme. Consider Texas's 1972 map, which presents with a modest efficiency gap of $.035$. If we take Dr. Jackman's estimates and multiply them by 75 – which would bring turnout roughly into line with that found in elections in Texas with actual returns in that year, the efficiency gap balloons to $.099$, which would be actionable under Plaintiffs' standard.

61. Third, although this might not be a significant problem if errors distribute randomly – 59 erroneous observations out of 7,900 elections might well “come out in the wash” – a close inspection of these data show that the errors are not random. Instead, they almost all occur in the first years of plans. So not only will their impact be concentrated in particular plans, they will be concentrated in the most important plans for purposes of this litigation.

62. Fourth, this may turn out to be a relatively simple coding error to correct, but that misses a larger point. If a well-respected political scientist like Dr. Jackman makes mistakes like these, it puts a bit of a lie to the claim that these procedures are simple to implement.

63. There also seem to be some problematic imputations for vote shares. While it was not practicable to review all 1,114 imputations in the available time, in the course of my investigation I observed a few imputed vote shares that seem highly unlikely as well.

64. For example, Dr. Jackman shows Alabama Congressmen Bill Nichols winning with just 56% of the vote, Tom Bevill winning just 55% of the vote, and Robert Jones winning just 56.4% of the vote. Given the error on Democratic vote totals – ignoring any effect from changing *overall* vote totals – the projected vote shares for these members of Congress drop as low as 38.5%, 40.1% and 38.6%, respectively. (I note that combining a high estimate for Democratic votes and low estimate for vote totals would yield 128% of the vote for Alabama’s Walter Flowers in 1972, though I presume Dr. Jackman truncates his output given how he wrote down his model).

65. During his 28-year career, the vote share that Robert Jones received ranged from between 71.3% of the vote and 91.62% of the vote against Republican opponents. Bill Nichols received between 58.39% of the vote and 83.71% of the vote during a 24-year career, with the 58.39% share coming the year he defeated a Republican incumbent to win his seat in Congress (1966). Setting aside that year, his lowest vote share was 75.57%. Tom Bevill’s lowest vote share was 64.36%, also in 1966, the year he won his seat. *See* Michael J. Dubin, *United States Congressional Elections, 1788-1997: The Official Results* (1998). It seems extremely unlikely that the most likely outcome in 1974 -- probably the best Democratic election in the past fifty years – would be an extremely close election result, with a reasonable chance that these Democrats would lose.

66. Likewise, in 1972 and 1974, Dr. Jackman suggests that Bob Sikes of Florida would have won with 59% and 58% of the vote, respectively. Over the course of his 38-year career in Congress, Sikes was rarely opposed. His lowest vote total, 80%, came in 1970. Interestingly, even the high-ends of Dr. Jackman’s estimates for Sikes’ vote shares – 78% and 79%, respectively – would represent the worst showings of his career. *Id.*

67. Finally, in 1998, Dr. Jackman suggests that Mike McIntyre would have received 56.8% of the vote. The 1998 elections were good for North Carolina Democrats, who won back control of the North Carolina House and picked up five state Senate seats. Michael J. Dubin, *Party Affiliations in the State Legislatures: A Year-By-Year Summary, 1796-2006* (2007). Nationally, Democrats became the first party to pick up House seats in a midterm election while holding the presidency since 1934. But between 1998 and the Republican wave of 2010, McIntyre never fell below 69 percent of the vote against Republicans. It seems unlikely that he would have been in real danger of losing in an otherwise good Democratic year.

68. Of course, there is no real way of knowing for certain whether these estimates are valid. This is because they all suffer from the same problem from which the partisan symmetry standard suffers: we don't have access to the counterfactual, and are ultimately estimating the result.

V. **There appear to be errors in Dr. Jackman's sensitivity testing (and what the tests really mean).**

69. Dr. Jackman produces a series of charts on pages 44 and 45 that constitute his sensitivity analysis. That is, these charts show how, at various thresholds of efficiency gaps, how many false positives, false negatives, and so forth would be produced. I will explore these in depth later on, but for now would like to discuss what appear to be errors in Dr. Jackman's analysis. Because I was not able to reproduce his results here, I'm unable to tell whether the errors are in his charts or in his written analysis. But they do not appear to match.

70. Dr. Jackman explains that Figure 14 of his plan shows the sensitivity analysis for plans with three or more elections from 1972 to 2016. Figure 15 shows the results using only maps since 2000. Dr. Jackman writes: "[g]enerally, the precision of a prognostic test based on the 1st election EG is high, approaching 90% once the 1st election EG is greater than .03 in

magnitude.” *Id.* at 46. But if one examines the relevant chart – the top-right pane on page 44 – at an efficiency gap of .03, the precision appears to be below 75 percent. While Dr. Jackman’s discussions of the percentage of plans that are flagged for having high efficiency gaps matches up with what is seen in the top left pane of page 44, he writes that “[a]t this threshold [.15] the precision of the test criterion remains high (or conversely, the false discovery rate stays low), but the false omission rate has climbed to 76%.” This again seems wrong; the bottom right pane of his chart suggests a false omission rate that is below the 75 percent line.

71. Dr. Jackman continues: “[t]he overall accuracy of the test falls to around 32% if one were to adopt a very stringent threshold such as $|1stEG| > .15$.” *Id.* But the accuracy at this rate, which is the bottom left corner, is above the 37.5 percent threshold. The rest of the numbers Dr. Jackman identifies seem to match up with this page.

72. Dr. Jackman then switches to the districting plans enacted since the 2000s, displayed on page 45. Dr. Jackman writes that “[t]he false discovery rates in Figure 15 are all zero once the 1st election EG is .03 or greater in magnitude.” *Id.* But this does not appear to be correct; the false discovery rate is in the middle-right-lower pane, and the line there does not appear to reach zero until an efficiency gap of approximately .125. Nor does the false positive rate appear to be “zero once beyond a 1st election EG of .03.” *Id.* At an efficiency gap of .03, the chart on page 45 seems to show a fairly substantial false positive rate of around 37 percent. Nor does the precision seem to reach 100 percent until the efficiency gap exceeds 12 percent.

73. Next, Dr. Jackman’s way of describing the tests, while easily accessible for people with a statistical background, may not be so easily digested by courts or lawyers. Although average people perform conditional probabilities all of the time (whether they know it or not), they don’t often encounter notation. Here is my interpretation of what Dr. Jackman’s

charts show. Because I wasn't able to reproduce his findings here, my descriptions are approximate.

74. Utilizing all plans with three or more elections as our test:

- 45 percent of plans would be flagged with an EG standard of .07, while 25 percent would be flagged utilizing a standard of .12;
- If a plan has an average efficiency gap score that is consistent with the first election, there is a 50 percent chance it will be identified as actionable with an EG standard of .07, and a 25 percent chance it would be identified as actionable with an EG standard of .12;
- If a plan has an average efficiency gap score that is *not* consistent with the first election, there is a 67.5 percent chance it won't be identified as actionable with an EG standard of .07, and an 85 percent chance it won't be identified as actionable with an EG standard of .12;
- If a plan is flagged as actionable, there is a 75 percent chance it will have an average efficiency gap consistent with the first election, with an EG standard of .07, and a 75 percent chance it will have an average efficiency gap consistent with the first election , with an EG standard of .12;
- Around 60 percent of cases will either be a true positive or true negative with an EG standard of .07, while 45 percent of cases will either be a true positive or true negative with an EG standard of .12;
- If a plan has an average efficiency gap that is *not* consistent with first election, there is a 37.5 percent chance it will nevertheless be flagged as actionable with an

EG standard of .07, and a 10 percent chance it will be identified as actionable with an EG standard of .12;

- If a plan is flagged as actionable, there is a 25 percent chance it will not have an average efficiency gap consistent with the first election, with an EG standard of .07, and a 25 percent chance it will have an average efficiency gap consistent with the first election , with an EG standard of .12;
- If a plan is not flagged as actionable, there is a 65 percent chance it will nevertheless have an average efficiency gap with an average that matches the sign of the first-year plan, with an EG standard of .07, and a similar chance with an EG standard of .12;

75. Utilizing all plans with three or more elections as our test, confining ourselves only to 21st century redistricting:

- 50 percent of plans would be flagged with an EG standard of .07, while 25 percent would be flagged utilizing a standard of .12;
- If a plan has an average efficiency gap score that is consistent with the first election, there is a 67.5 percent chance it will be identified as actionable with an EG standard of .07, and a 25 percent chance it would be identified as actionable with an EG standard of .12;
- If a plan has an average efficiency gap score that is *not* consistent with the first election, there is a 67.5 percent chance it won't be identified as actionable with an EG standard of .07, and an 87.5 percent chance it won't be identified as actionable with an EG standard of .12;

- If a plan is flagged as actionable, there is an 87.5 percent chance it will have an average efficiency gap consistent with the first election, with an EG standard of .07, and an 87.5 percent chance it will have an average efficiency gap consistent with the first election , with an EG standard of .12;
- Around 67.5 percent of cases will either be a true positive or true negative with an EG standard of .07, while 40 percent of cases will either be a true positive or true negative with an EG standard of .12;
- If a plan has an average efficiency gap that is *not* consistent with first election, there is a 35 percent chance it will nevertheless be flagged as actionable with an EG standard of .07, and a 7.5 percent chance it will be identified as actionable with an EG standard of .12;
- If a plan is flagged as actionable, there is a 7.5 percent chance it will not have an average efficiency gap consistent with the first election, with an EG standard of .07, and a 7.5 percent chance it will have an average efficiency gap consistent with the first election , with an EG standard of .12;
- If a plan is not flagged as actionable, there is a 70 percent chance it will nevertheless have an average efficiency gap with an average that matches the sign of the first-year plan, with an EG standard of .07, and a similar chance with an EG standard of .12.

75. Some of these strike me as having high rates of “misses,” but whether or not the Court is comfortable with these rates of misses is ultimately a question for the courts and lawyers, not the experts.

VI. The Efficiency Gap is not clearly the hallmark of a gerrymander, as commonly understood.

76. The efficiency gap should theoretically tell us something about gerrymandering on its own terms, if it is truly the “hallmark” of a gerrymander. If we have multiple instances of maps drawn by heavily Democratic legislatures, court-drawn maps, and commission-drawn maps that display large, or actionable, efficiency gaps, it calls into question whether the efficiency gap is as intimately tied to gerrymandering as plaintiffs suggest. At the very least, it provides further evidence that the baseline efficiency gap of zero that plaintiffs assume is not always appropriate.

77. Consider Alabama. In 1992, Democrats had a 27-8 lead in the state senate, an 81-23 lead in the state house, and control of the governorship. *The Almanac of American Politics 1994*, [hereinafter *AAP*] at 7 (1993). This would appear to be an unlikely candidate for a pro-Republican efficiency gap, to say nothing of an *actionable* Republican plan. Yet this is exactly what we see. The efficiency gap exceeded the threshold for an actionable efficiency gap in 1992, 1994, 1996, and 1998.

(Alabama 1992 redistricting. Maps from the *Almanac of American Politics* unless noted)



78. Interestingly, the 1994 efficiency gap favored *Democrats*. This underscores a consistent feature of the efficiency gap, developed in subsequent sections: It is highly dependent on factors that the metric itself does not take into account: incumbency, challenger quality, and the national environment. Because of this, on a very practical level, mapmakers are challenged with guessing what the environment and candidate choices will look like in the first year of implementation.

79. The Alabama example (as well as later ones) puts this in stark relief. Had the 1994 wave election come in 1992, we would see the map as a heavy Democratic gerrymander, because the wave would have inflated Republican vote scores without overcoming legendary Southern Democrats like Tom Bevill and Glen Browder. But 1992 was, generally speaking, a good Democratic year. Longtime Republican incumbent William Dickinson retired in the Second District, and George C. Wallace, Jr., ran for the seat. Wallace lost, but only by 3,000 votes, generating a huge number of wasted Democratic votes. *AAP 1994* at 14. In the 6th district, Democratic incumbent Ben Erdreich found himself placed in a district that was giving George H.W. Bush a 40-point win, due to the need to turn Erdreich's district into a minority-majority district to comply with the Voting Rights Act. But, given Erdreich's incumbency and the generally good Democratic environment, he lost by only seven points, creating a large number of wasted Democratic votes. *AAP 1994* at 22.

80. Then consider 1996. Browder and Bevill had held the third and fourth districts for years (decades in Bevill's case). In a good Republican year like 1994, Republicans might receive a fair number of votes, but they would almost always be wasted. A mapmaker would then have to decide how to deal with these popular incumbents. Then, in 1996, Browder decided to run for Senate (he did not clear the primary), while Bevill retired at 75 years young. The districts were

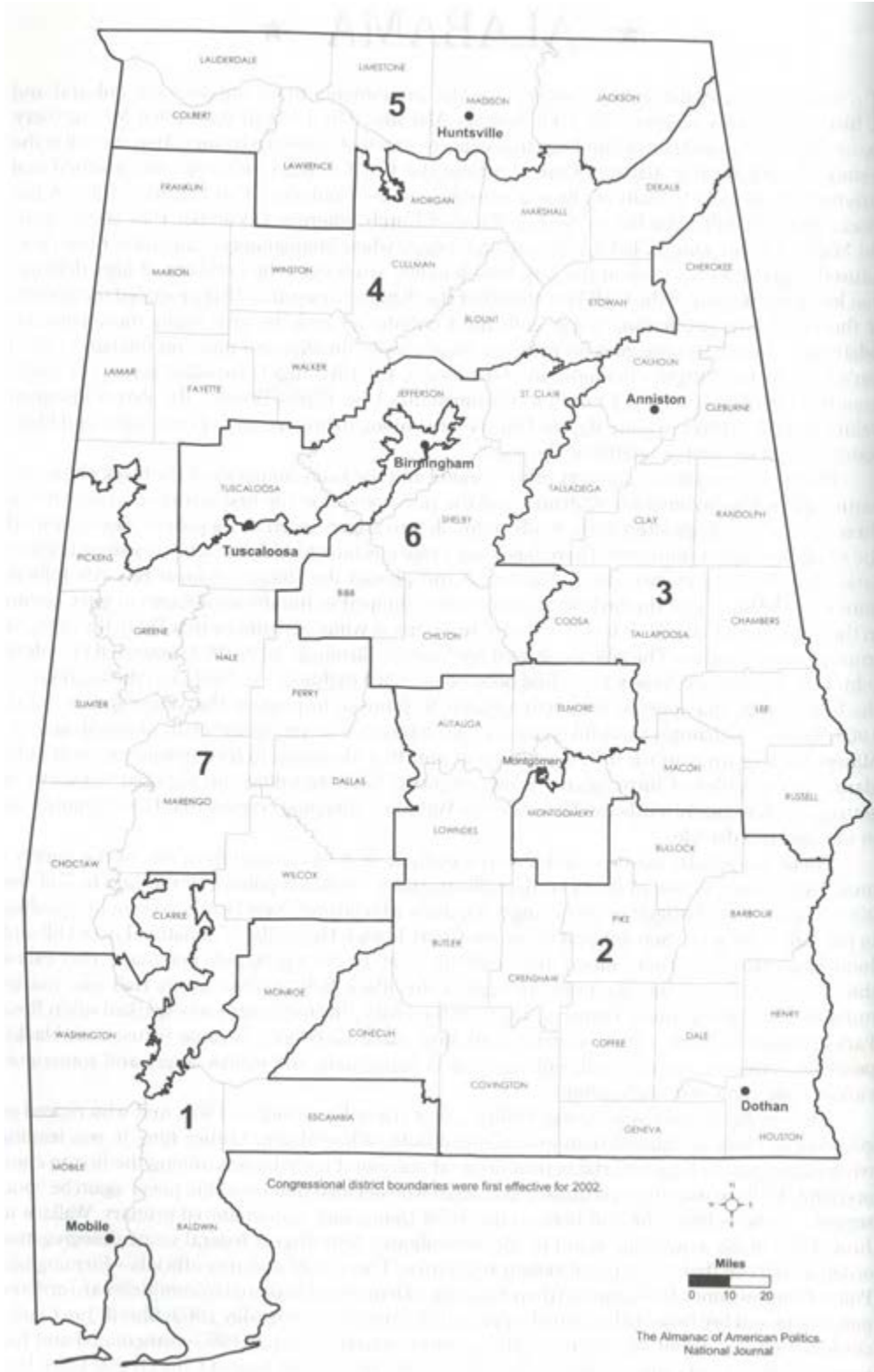
competitive; Bob Riley won by four points, while Robert Aderholt won by two, *PIA 1998* at 14, 16, which generated a huge number of wasted Democratic votes and a map that presents as an actionable Republican gerrymander. The seats were competitive again in 1998, creating a significant efficiency gap that year as well. But by 2000, Democrats had pretty well given up, and Republicans began to waste votes in these seats, and the efficiency gap disappeared.

81. To summarize, in Alabama in 1992, a map drawn by Democrats presents as an actionable Republican gerrymander three times, an actionable Democratic gerrymander once, and a weak Republican gerrymander once. This is a poor performance for something touted as the hallmark of a gerrymander. Moreover, given that this map can clearly present in different ways, a mapmaker would be charged with guessing what the national environment would be like in the first year of implementation, when popular incumbents will retire, when incumbents will find themselves saddled by scandal, and when parties will field strong challengers.

82. In 2002, Democrats attempted to maximize their precarious position in the state. As the Almanac of American Politics describes: “The Democrats in control of redistricting in Alabama in 2002 did a pretty good job of helping their party in drawing the boundaries of the state’s seven congressional districts, but not quite good enough of a job to add to the two seats they have held in 1994.” *AAP 2004* at 54. Democrats strengthened Bud Cramer in the 5th District, while making the 3rd District substantially more Democratic by increasing the African-American percentage from 25 percent to 32 percent. *Id.* In other words, the 2000 map in Alabama was a Democratic gerrymander; it was just an unsuccessful one. Mike Rogers won with just 50 percent of the vote, creating 87,351 wasted Democratic votes and just 1,909 wasted Republican votes. The result? A map that was created to maximize Democratic opportunities by

a Democratic legislature with a Democratic governor presents with a Republican-leaning efficiency gap that is almost actionable: -.114.

Alabama 2002 redistricting



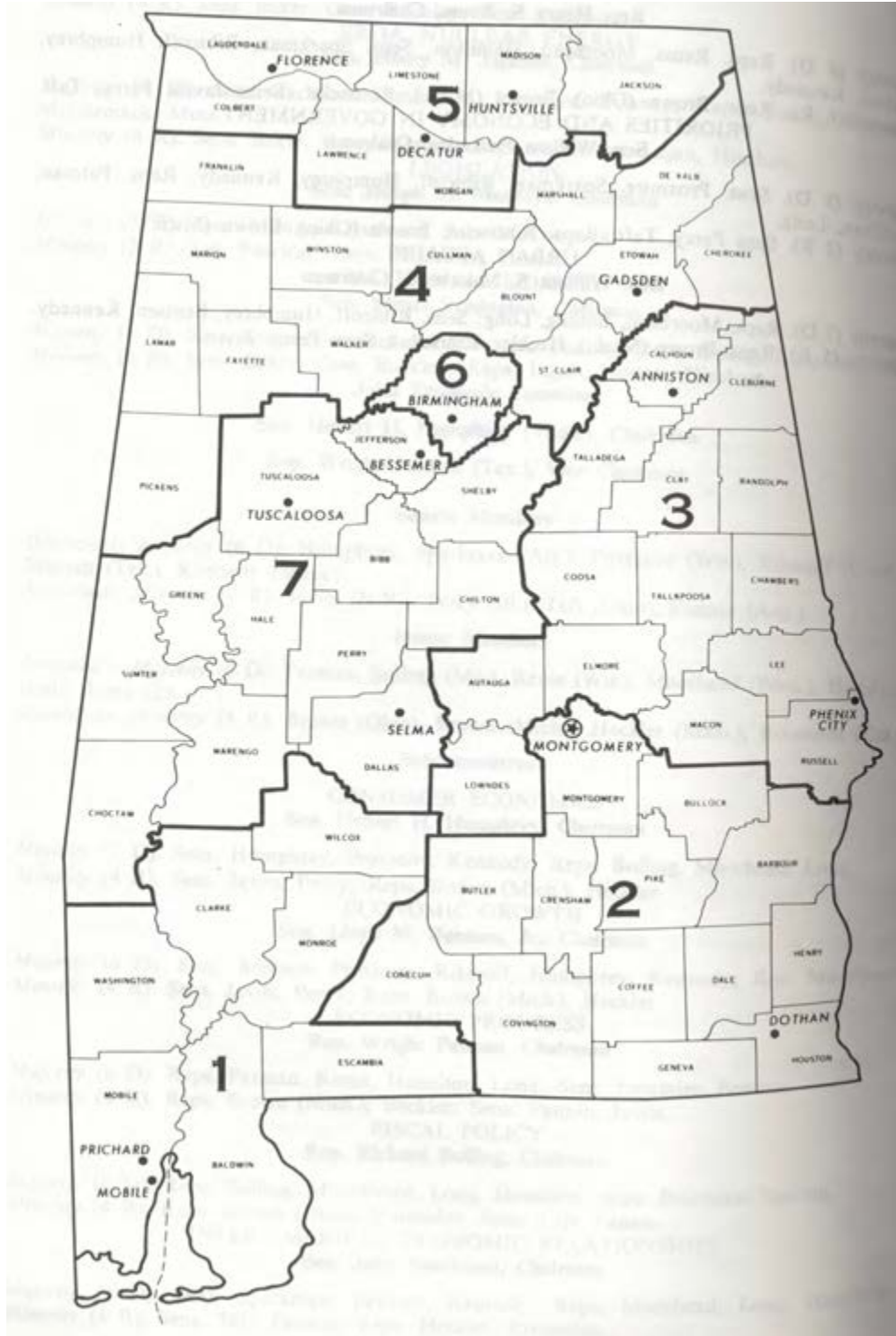
83. In fact, in 2010, when Republicans managed to capture the Fifth, the map appears to be a Republican gerrymander. Had the environment from 2010 presented in 2002, and had Cramer retired in 2002, it probably would have been an actionable gerrymander that year. The Democratic nature of the plan wasn't on full display until the Democratic wave to 2008, when Democrats managed to capture the 2nd district, which likely was possible only because of the national Democratic wave and the retirement of Republican incumbent Terry Everett. *AAP 2012* at 49. Again, we might ask ourselves, what if a Republican legislature had drawn the exact same map, and a Democratic wave had occurred? What might otherwise be considered a strong Republican gerrymander would be interpreted by courts as a Democratic map.

84. In fact, the history of Alabama politics during this time period shows that rather than being a clear-cut "hallmark of a gerrymander," interpreting the efficiency gap requires a fact-intensive inquiry. Across the four maps drawn by Democrats, the average efficiency gap leans Republican, with an average gap of $-.039$. It only leans Democratic 25 percent of the time.

85. Perhaps Alabama Democrats were particularly beneficent, but it is more likely that this is a function of the long-standing effects of a freak election: 1964. This was a combination of the fact that Southern cities and coastal plains had been trending Republican for a while, the fact that Democrats had failed to pass a redistricting plan in 1962 after losing a seat, so incumbents were running in new districts after having been elected at large in 1962, and, of course, the backlash to the passage of the Civil Rights Act of 1964. Republicans captured five of Alabama's eight congressional districts, wiping out 86 years of congressional seniority. Democrats defeated one of these representatives in 1966, and picked up an open seat that same year, but the remaining three members managed to survive.

86. It was not for lack of trying on the part of Democrats. During the 1970 redistricting, there were no Republican state senators, and just two Republican state representatives (out of 106). Dubin at 17. Alabama lost a seat in 1972, and Democrats attempted to eliminate William Dickinson by combining his district with that of longtime Democratic incumbent George Andrews, a race the *Almanac of American politics* expected Andrews “can be expected to win fairly easily.” *AAP 1972*, at 8; *AAP 1974*, at 8. This was probably a reasonable assumption, but then Andrews died unexpectedly in late 1971 at the relatively young age of 64. So, instead of running against a popular incumbent with 28 years of congressional seniority, Dickinson ran against a young state legislator. A race he probably would have lost, generating a large number of wasted Republican votes, turned into a narrow Republican win, generating a large number of Democratic votes.

(Alabama 1972 redistricting)



87. At the same time, the remaining two Republicans – Jack Edwards and John Buchanan – continued to win elections, although their vote shares were rarely above 60 percent.

The result? Relatively few wasted Republican votes, lots of wasted Democratic votes, and a negative efficiency gap in every year of the map's existence, with the exception of 1974 (when some of the imputation issues above play a role).

88. Notice too that efficiency gaps are close to zero in the 1980s. This is not a result of redistricting – the lines were barely changed in 1982. *AAP 1984* at 4. Instead it was a result of the sort of random effect that mapmakers couldn't predict with regularity: Buchanan lost the Republican primary in 1980 due, in part, to a series of votes cast that were perceived as being friendly to African-Americans. The man who defeated him, Albert Lee Smith, won narrowly in the Reagan landslide, creating a large number of wasted Democratic votes. Smith then lost in the good Democratic year of 1982, and a district that generated a large number of Democratic wasted votes began to generate wasted Republican votes.

89. I dwell at length on the Alabama example because it is a state whose politics I happen to know well, and also because it illustrates nicely just how reductionist it is to suggest that gerrymandering can be summarized by a single statistic. Gerrymandering has no particular hallmark; it is inherently a fact-intensive inquiry. This is especially true if we are going to measure it in terms of elections, which are frequently beset by unpredictable effects that have long-lasting consequences.

90. Or consider the 1982 California map. This is widely recognized as one of the more egregious partisan gerrymanders in history. It was designed by Rep. Phil Burton and the brother of future Rep. Howard Berman; the former famously referred to it as his "contribution to modern art." It was so egregious that it was repealed by referendum, and Stephanopoulos and McGee take particular pride in the fact that their metric identifies the Burton-mander as having one of the largest efficiency gaps in history. But it barely crosses Dr. Jackman's threshold for

actionability, at .0796. Moreover, Burton's response to the court ruling was to tweak some of the lines; contemporary sources refer to the 1984 map as "similar," AAP 1984, and "slightly revised." AAP 2004, at 155. Yet the map is no longer actionable in any of the remaining years.

91. Remaining California maps illustrate how the efficiency gap can go astray in the correct circumstances. The bipartisan "incumbent protection" map of 2002 actually shows as an actionable Republican gerrymander in 2006 and 2008, notwithstanding the fact that Democrats had controlled the process; had 2002 been a Democratic wave, the map might be actionable. The plan drawn by the independent redistricting commission displays as a Democratic gerrymander in 2014. This makes sense, as maps that seek to be fair by failing to threaten the other side's incumbents will tend to appear as gerrymanders in wave elections.

92. Colorado's 2002 map isn't actionable (it barely misses), but it illustrates nicely how a quite substantial efficiency gap can have nothing to do with gerrymandering, and everything to do with random effects. The map is actually a Democratic gerrymander that was selected by a state court judge; it drew the new 7th district in the older, more Democratic inner suburbs of Denver instead of the newer suburbs to the south, as Republicans preferred. AAP 2004 at 304. So why does it produce a Republican-leaning efficiency gap of -.1095 in its first year? Because the Democrat for whom this map was designed, Ed Perlmutter, declined to run in 2002, and a Republican, Bob Beauprez, won by 121 votes. That meant that all 81,668 votes cast for his opponent were wasted, while Republicans wasted just 61 votes. *Id.*

93. Those 61 votes were the difference between an almost-actionable efficiency gap (7,000 votes spread across the remaining districts are all that prevent it from being actionable) remaining districts are all that prevent it from being actionable), and a Democratic-leaning efficiency gap of .012. Put differently, a switch of 61 votes here would result in a swing

of 12% in the efficiency gap. But that is the sort of things that map drawers will have to plan for somehow. It also seems like an exaggeration to refer to those 61 votes switching as the hallmark of a gerrymander.

94. One of the more egregious examples of the efficiency gap at work is the fate of the Georgia plans. Here is how the Almanac of American Politics 2004 describes the processes:

“After the 1990 and 2000 Censuses, Georgia Democrats, led by Speaker Thomas Murphy, pushed through convoluted redistricting plans – arguably the most convoluted in the nation each time – to guarantee majorities for their party in the state’s House delegation. Both times they failed. In the 1990s Murphy tried to end the career of Newt Gingrich and strengthen incumbent Democrats. Instead, what was a 9-1 Democratic delegation in October 1992 was 8-3 Republican in April 1995, and Gingrich was Speaker of the House. A court-ordered redistricting in 1995 left virtually all incumbents with safe seats, and the balance remained 8-3. In 2001 the Democrats tried again, drawing several plans and negotiating among themselves. This time the boundaries were even more convoluted, and Democrats had a bit more success. But only a bit – plus some unintended consequences.”

AAP 2004, at 454. The Almanac continues:

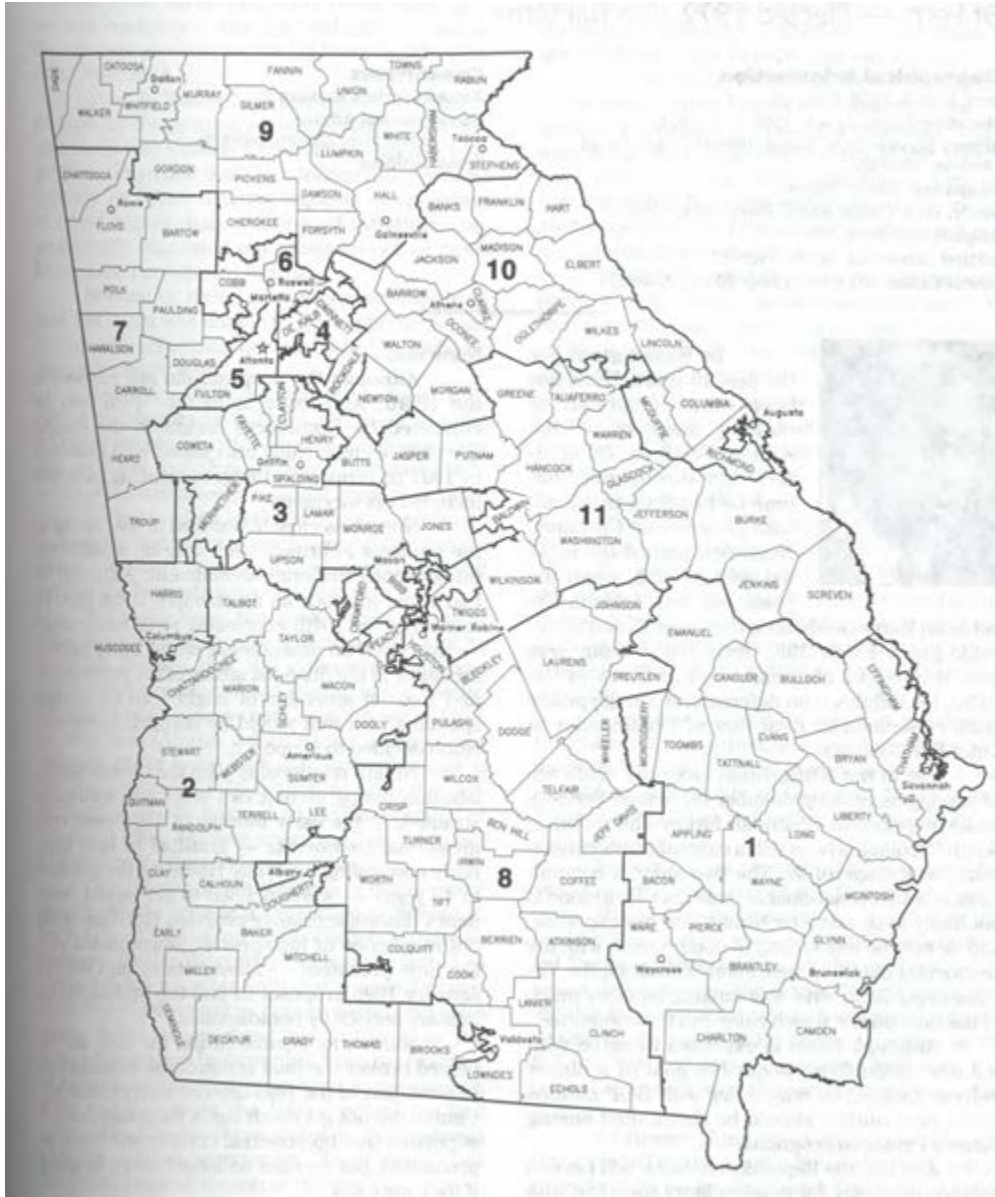
“Still, the Democrats’ plan must be admired for its creativity. The new 13th District sense narrow tentacles into 11 metro Atlanta counties to unite black neighborhoods along strip highways or in town centers with majority-black Clayton County just south of Atlanta. The new 11th District made a stab, though unsuccessful in 2002, at creating a Democratic district in Republican northernwest Georgia by excluding fast-growing mostly white areas and sending

in tentacles to south Cobb County with its increasing population The new 12th District for the most part has a regular shape and yet connects black neighborhoods in cities as distant as Savannah, Augusta and Athens. Heavily Republican areas are packed into five districts.”

Id.

95. This would seem to represent a classic candidate for an illegal Democratic gerrymander: Heavy partisan intent to gerrymander matched with bizarre lines. But this is not what happens. In its first year of implementation – the map designed to create a 9-1 Democratic advantage produces, narrowly, a Republican leaning efficiency gap, as Republicans won surprise victories in the 1st and 3rd districts. in two (Congressman Ben Jones, who played “Cooter” on the Dukes of Hazzard, lost the Democratic primary in the 10th district). Had Democrats won the races that they were supposed to win, the efficiency gap would likely have been actionable as a Democratic gerrymander. But because they were bad at gerrymandering, they receive a pass.

Georgia 1992 Redistricting (Politics in America 1996)

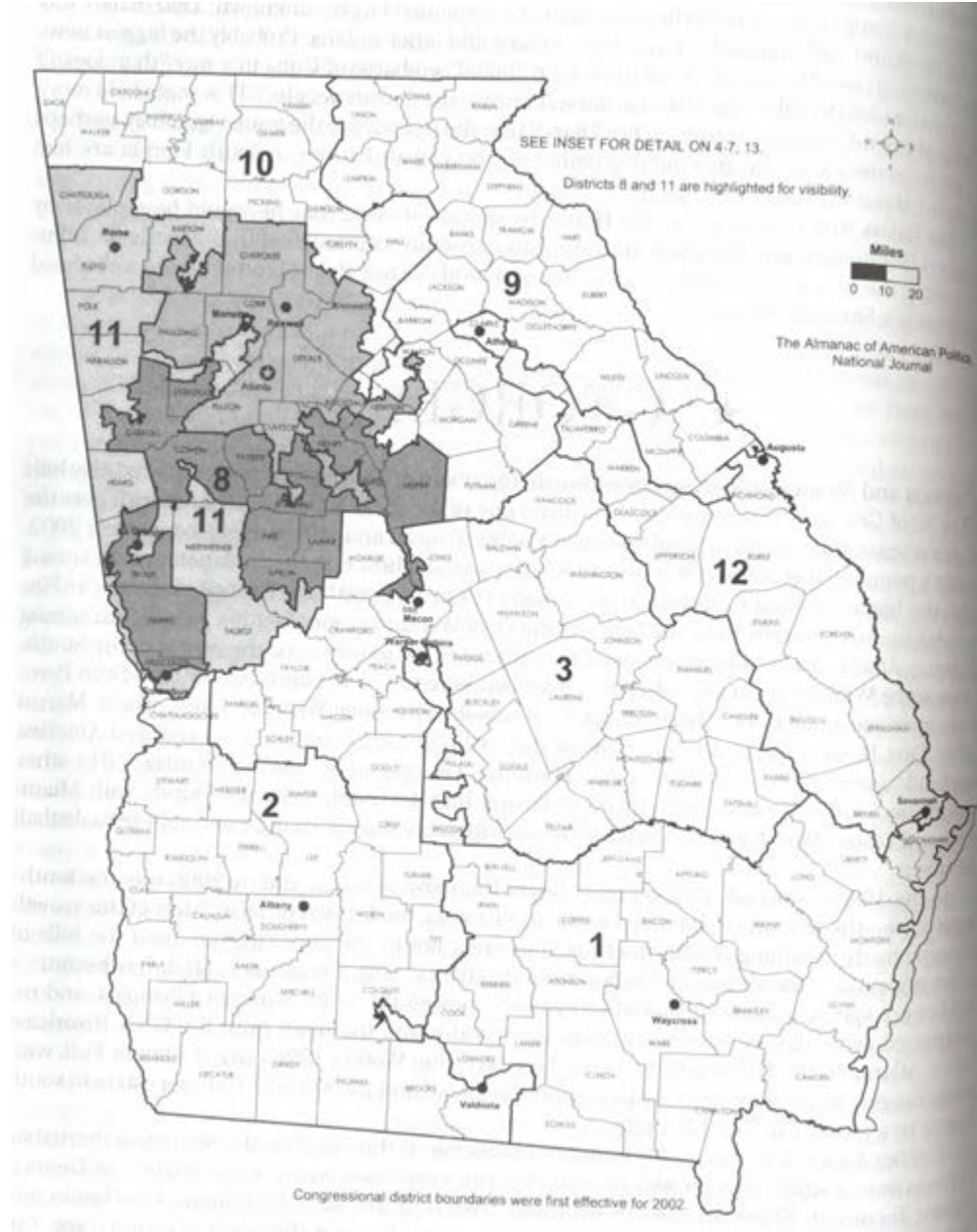


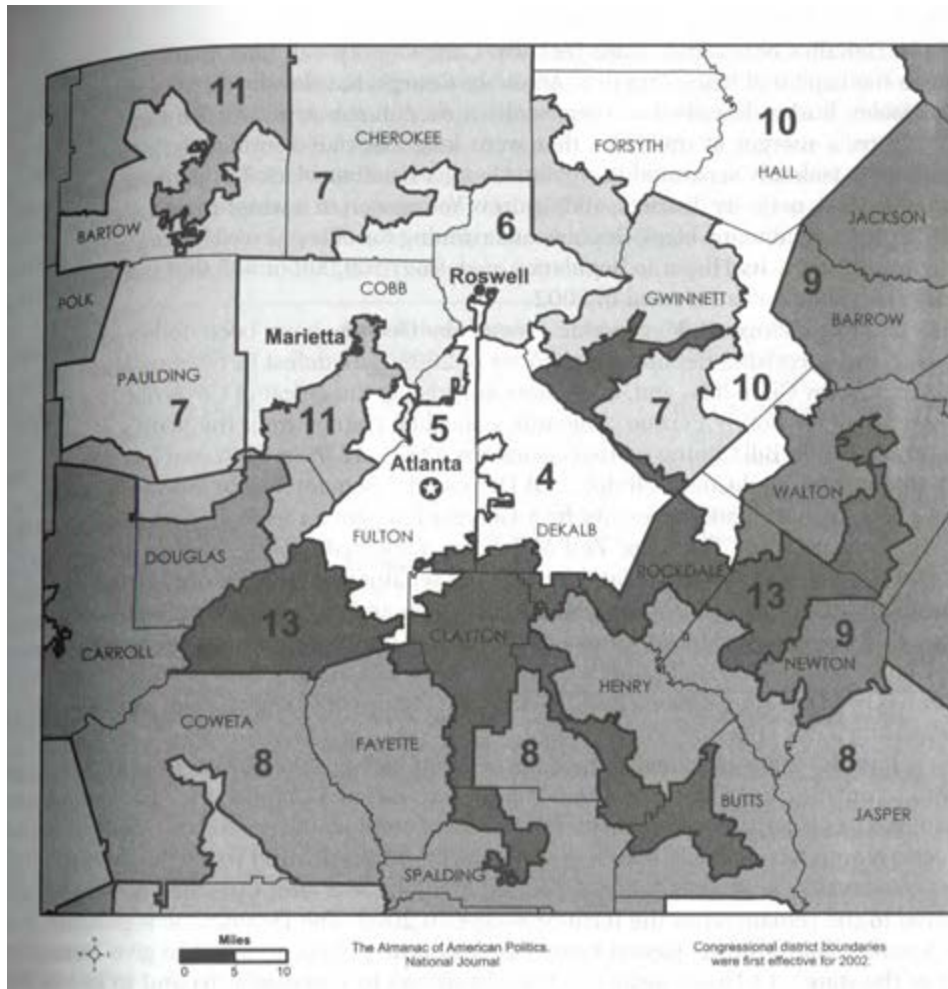
96. The map was eventually struck down as a *racial* gerrymander, and the subsequent map was drawn by Democrats. This map, however, does produce an actionable efficiency gap, that favors Republicans. According to the efficiency gap standard, the Democrats drew a map that was heavily in their favor; yet the efficiency gap was $-.161$ that year. Moreover, the map was negative over the duration of its implementation, so this shows up in Dr. Jackman's sensitivity analysis as an example of the efficiency gap performing exactly as it should perform. This shows

that it is possible to achieve a first-year efficiency gap that almost rivals that found in North Carolina, even with a map drawn by the opposing party with intent to favor that party. Far from being the hallmark of a gerrymander, the efficiency gap here is just a fluke outcome.

97. In 2002, Democrats drew an even more aggressive gerrymander. It at least shows up as Democratic-leaning, but not actionable. But again, this is a result of a few tight races not breaking their way. Had Democrats won in the 11th and 12th districts as intended, the efficiency gap would probably have been somewhere on the order of .16, and been actionable. Those two districts were decided by fewer than 10,000 votes, combined. Had 2002 not been a good Republican year overall (it was the second time the party holding the presidency picked up seats in a midterm since 1934), and had Democrats not nominated the son of the Senate majority leader for one district, who turned to have been arrested four times and been involved with multiple failed business ventures, it probably would have been actionable.

Georgia Redistricting 2002





98. Of course, in 2006, Republicans drew a gerrymander of their own. Their mid-decade redistricting was aimed at dislodging Jim Marshall in the third district and John Barrow in the 12th District. But this map actually has a Democratic lean, according the efficiency gap, although it is not actionable. Again, this shows how the interaction of the national environment and a few key candidates can radically alter efficiency gap scores. Both Marshall and Barrow survived, by a combined 1,308 votes. So there were almost no wasted Democratic votes in this district, but a great many wasted Republican votes. Had 655 votes flipped, the efficiency gap would have been -0.116, which would make more sense. Whether it would have been actionable then probably turns on the quality of Dr. Jackman’s imputation in the 5th district. If actual

turnout would be at the lower end of Dr. Jackman's estimation, then the map would have been actionable.

99. The efficiency gap results for Illinois are particularly bad. In 1982, a federal court selected a partisan Democratic plan, and Democrats picked up two seats. *AAP 1984*, at 326. Yet the map shows as an actionable Republican gerrymander, then has a Democratic efficiency gap for the remaining four years of the plan's life.

100. Much more egregious is the sequence from 2002 to 2012. In 2002, Republicans controlled the state senate and governorship, while Democrats controlled the state House. While the resulting plan was a "nightmare for those who believe redistricting plans should have compact and competitive districts," it nevertheless was a bipartisan plan that was aimed at protecting incumbents of both parties. *AAP 1994*, 528-29. It, however, shows up as an actionable Republican gerrymander in every year of the plan's existence, including in 2008, by which point Democrats held 12 of 19 seats.

101. Then came 2012. Here is how the Almanac describes the process:

"In 2011, the tables turned dramatically. Democrats had hung onto the Illinois legislature and governor's office in 2010, awarding them their only free hand in the country to give a large state's existing map a total makeover. Under heavy pressure from party leaders desperate to offset Republican gains in other states, Democrats in May 2011 released a map designed to eliminate up to six Republican seats. . . . In the Chicago suburbs, Democrats recrafted tea party crusader Joe Walsh's marginal 8th District into a Democratic stronghold anchored by Schaumburg. They also dismantled moderate Republican Judy Biggert's seat to forge a new

strongly Democratic 11th District anchored by Aurora and Joliet . . .

Along Chicago's North Shore, Democrats removed freshman Republican Robert Dold's Kenilworth home from the 10th District and pushed him north into more Democratic areas of Lake County.

AAP 2014 at 541.

The Almanac continues:

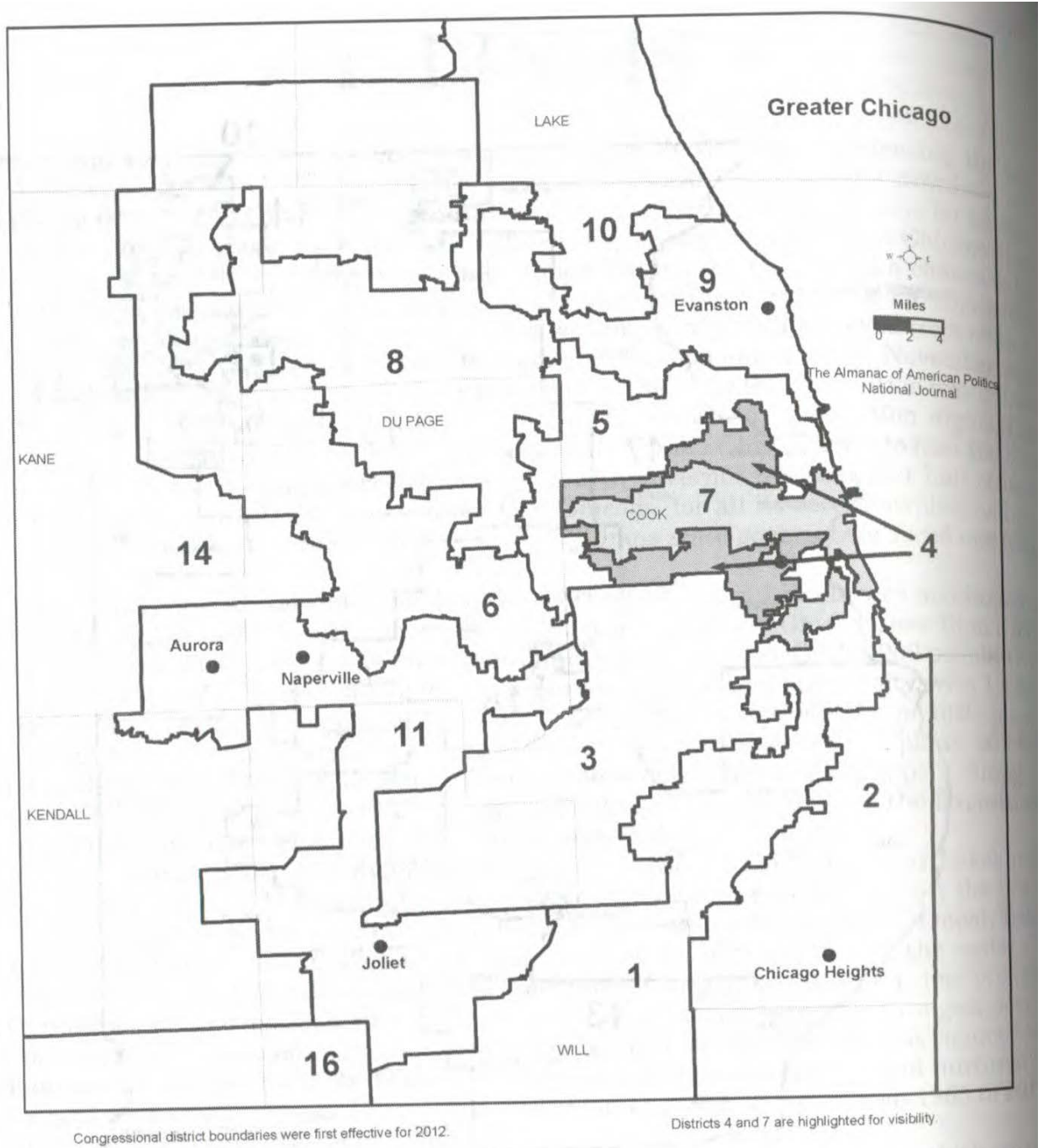
The bloodbath wasn't limited to Chicago. Along Illinois's northwestern border, Democrats stuffed Republican freshman Bobby Schilling's Quad Cities home base into a reconfigured 17th District with tentacles stretching into minority neighborhoods in Rockford and Peoria. And downstate, Democrats endangered Republican Tim Johnson by stretching his Champaign-based seat southwest to link up with other college enclaves such as Bloomington -Normal and Edwardsville. . . . In hindsight, Democrats' strategy largely paid off and generated a rare triumph in an otherwise wrenching redistricting year."

Id.

102. Not only that, but as discussed above, Jowei Chen, plaintiffs' own expert, identifies Illinois as a Democratic gerrymander in 2012. What does the efficiency gap show? A slight Democratic gerrymander of .023. In fact, over the course of the plan's implementation, its efficiency gap has actually been negative, indicating a slight Republican lean.

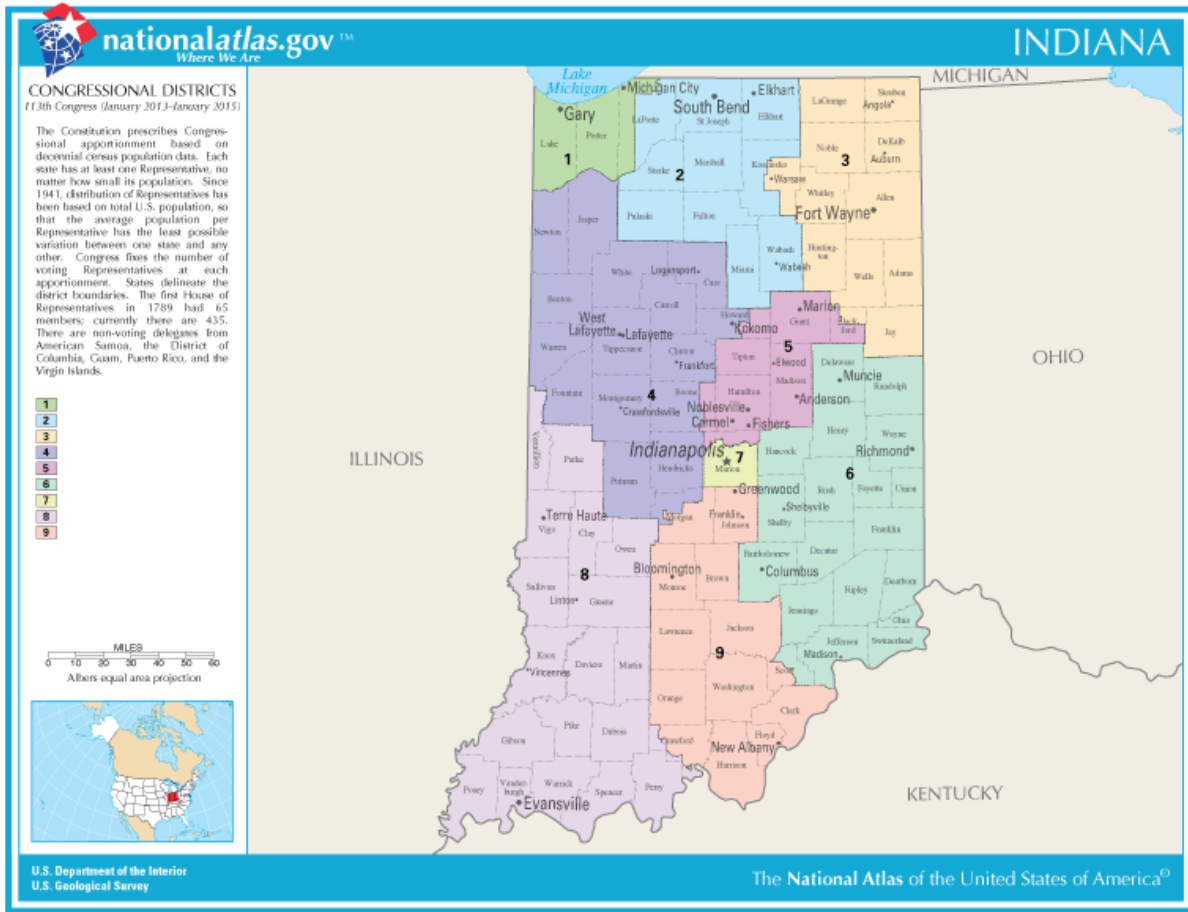
103. In short, the 2002 Illinois map, which was not a gerrymander, shows the supposed hallmark of a gerrymander, while the 2012 Illinois map, which was a gerrymander, lacks its supposed hallmark.

Illinois Redistricting, Chicago, 2012

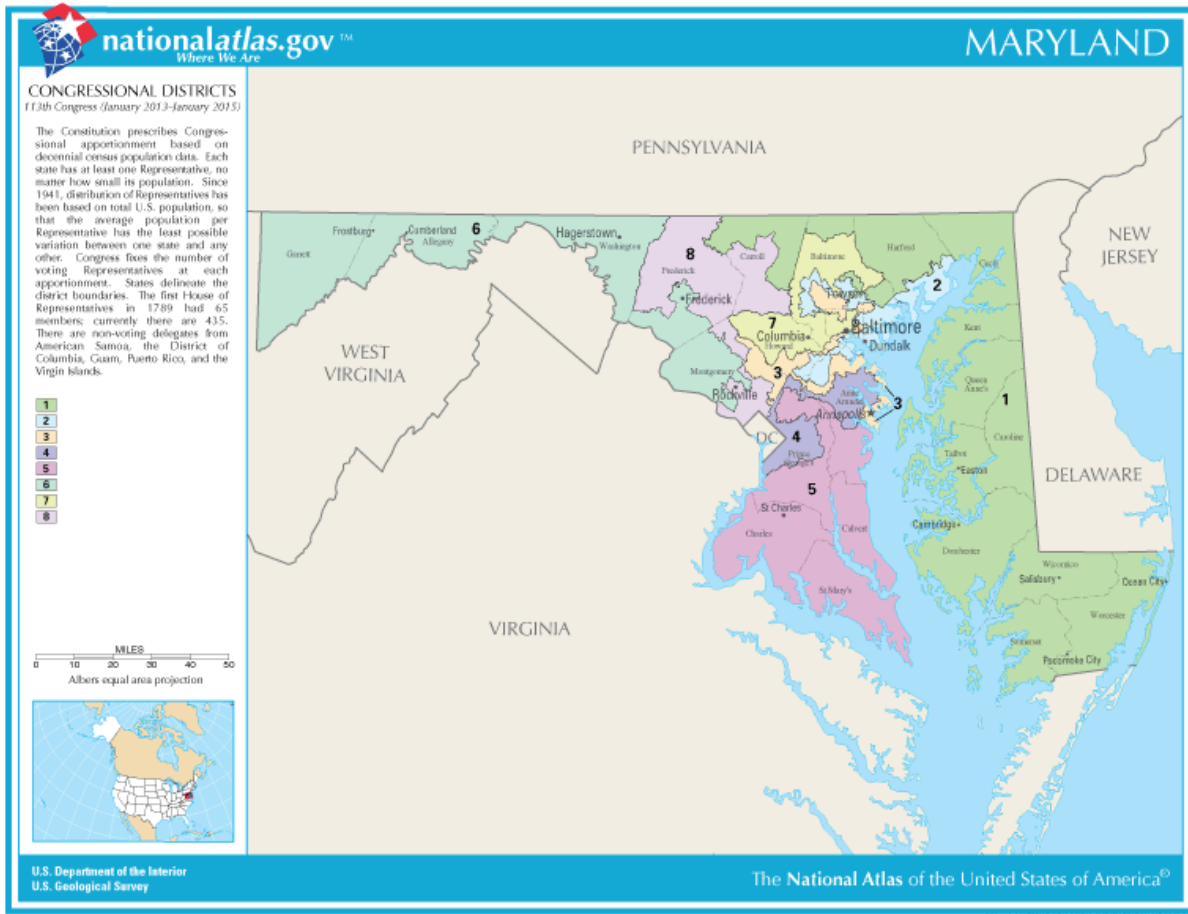


104. The Kentucky map in 1982 was drawn with overwhelming Democratic majorities in both chambers, as well as Democratic control of the governorship. Yet it bears the hallmark of a *Republican* gerrymander, with an efficiency gap of $-.129$.

105. The 2012 Indiana map also presents as Republican gerrymander, with an efficiency gap of -.201. But it is almost a paragon of regular lines, and, as mentioned above, Dr. Chen suggests that geography might be the culprit:



106. Indiana shows up as a gerrymander despite its regular lines. Yet *Maryland* shows up as a map with only a modest Democratic lean, despite the fact that it was drawn to defeat one of the two remaining Republican congressmen (after Democrats drew an actionable map in 2002 that resulted in the loss of two Republicans), and has lines that look like this, which exhibit almost no respect for traditional redistricting principles:



107. Stranger still is the 1992 efficiency gap. Democrats had control of the governorship, a 38-9 edge in the state senate, and a 116-25 edge in the state house. Yet the map they produced has a Republican lean in every year the plan was in effect, and was just 16 hundredths of a percentage point away from being flagged as a Republican gerrymander in 1992. Indeed, had the 1996, 1998 or 2000 elections occurred in 1992, it would have been flagged as a Republican gerrymander.

108. Again, this is not an instance of strange Democratic beneficence. Connie Morella was an unusually liberal Republican member of the House, who was able to win her district while Bill Clinton was carrying it by 18 points. *AAP 1994* at 591. In addition, longtime Democratic representative Beverly Byron lost a surprising primary against a liberal Democratic

representative; this enabled Republican Roscoe Bartlett to narrowly claim a district that had been Democratic since 1970. Finally, Republican Wayne Gilchrest won a narrow, four-point victory in a member-versus-member race against Democratic representative Thomas McMillen. Had Gilchrist and Bartlett lost – their combined margin was about 10,000 votes – the map would present as an actionable Democratic gerrymander. Again, about 10,000 votes is the difference between a map that is almost flagged as a Republican gerrymander.

109. New Jersey’s 2012 map would be flagged as a Republican gerrymander, with an efficiency gap of $-.174$, almost as large as that found in North Carolina. Yet New Jersey’s map is drawn by a bipartisan redistricting panel; its tiebreaking vote was cast in favor of a 6-6 map in 2012. Yet it presents as a heavy Republican gerrymander, with an efficiency gap of $-.17373$.

110. The 1982 map in Ohio is a Republican gerrymander according to the efficiency gap, with a score of $-.104$. This contrasts with contemporary descriptions of the process. The *Almanac of American Politics* writes: “Congressional redistricting was truly a bipartisan exercise in Ohio in 1982, not because its politicians are altruistic, but because the Democrats controlled the state House of Representatives and the Republicans the state Senate and governorship.” *AAP 1984* at 908. The map borders on becoming an actionable Democratic gerrymander in 1984, with a Democratic efficiency gap of $.0692$. Dr. Jackman considers this a separate map, but the changes made to the 1982 lines were marginal.

111. Then there is Texas, home to some of the nastiest redistricting wars in recent times. The efficiency gap metric, to its credit, properly identifies the 1992 map in Texas as being a political gerrymander, with an efficiency gap of $.158$.

112. The 2002 redistricting is less successful. The first map escapes scrutiny as a Democratic gerrymander, albeit by a slim margin. The 2004 redistricting, upheld in *LULAC*,

would receive scrutiny, despite Justice Kennedy's observation that the map merely made "the party balance more congruent to statewide party power."

113. Indeed, this is an interesting case. The efficiency gap met plaintiffs' proposed threshold and there was ample evidence of Texas' intent to gerrymander aggressively. Yet Justice Kennedy rejected the challenge.

114. Washington State holds the distinction of holding the largest Democratic efficiency gap in the history of the series -- .282 in 1978. Indeed, that map also produced the 8th, 17th and 19th most heavily Democratic maps in the series.

115. Yet little in the initial plan would have suggested that such a large waste of Republican votes was forthcoming, as the initial map was almost perfectly balanced: the gap was .013. What happened? The initial map hid the tendency of the underlying maps to produce massive Democratic efficiency gaps. It is a classic illustration of how small, unpredictable effects in the electorate can cause huge changes in the efficiency gap.

116. In 1972, Democrats won six of the state's seven congressional seats. They came up just short in a seventh, as Republican Joel Pritchard narrowly held the seat held by retiring Republican congressman Thomas Minor Pelly. The 2,602-vote margin resulted in almost all of the Democrats' wasted votes: 104,959 of the Democrats' 315,739 wasted votes came from this district. Republicans also fielded nominal candidates in the 5th, 6th and 7th districts, resulting in a large number of wasted votes. Interestingly, had the Democrat been successful in that race, the map would have shown an efficiency gap of .17, in line with other maps.

117. But Democrats never came close to capturing the first again. Offsetting this, however, Republicans held the Democrats to around 60 percent of the vote in the second through

fifth districts, and to seventy percent in the 6th and 7th. The result was a substantial reduction in wasted Democratic votes, and inflation in Republican votes. This repeated in 1976.

118. Then, in 1978, the perfect storm hit. Republicans fielded competitive candidates in all of the districts, falling just short in most of them. Democrats won 51 percent in the 2nd district, 59 percent in the 3rd district, 61 percent in the 4th district, 53 percent in the 5th district, 62 percent in the 6th district, and just 53 percent in the heavily Democratic 7th District, where a Republican won a fluke victory in a special election and acquitted himself well in the general election. In the process, Republicans racked up huge numbers of wasted votes, while their strong showing in the 1st district hurt them further.

119. But even this pales in comparison to what happened in the 1990s. That map opened with the fourth-largest Democratic efficiency gap in history; .2355, eclipsing all of North Carolina's maps. It then produced the largest Republican efficiency gap in the time series, of -.25887. The next year it repeated the feat, with an efficiency gap of -.2297. Then, suddenly, in 1998 it produced an almost negligible efficiency gap of .008, before then producing a healthy Democratic gap of .077.

120. How could this be? In the first year of implementation, Democrats won eight of the states nine seats, but did so very narrowly. Only two of those wins were with 57 percent of the vote or more. So Republicans racked up a lot of wasted votes, while Democrats' wasted votes were fairly contained, coming almost entirely from the eighth district. This, under plaintiffs' theory, is exactly what a gerrymander looks like.

121. Then the wave hit. In 1994 Republicans won seven of these districts, but did so very narrowly; they wasted only 30,068 votes total across the six seats they picked up. The Democratic incumbents who lost those districts, however, accounted for 528,755 wasted votes.

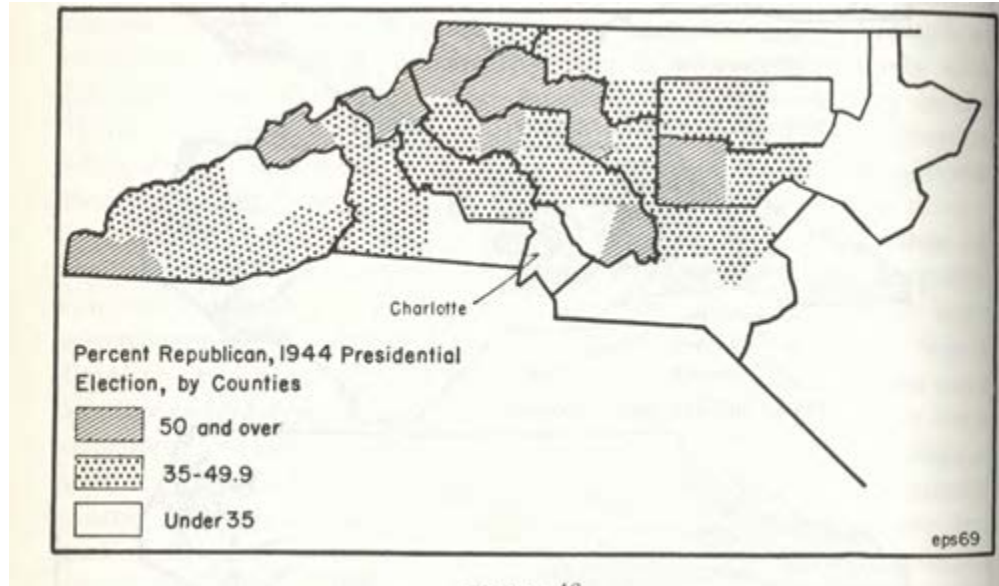
In 1996, we had a similar scenario. Democrats managed to defeat just one Republican, Randy Tate, narrowly, but came up short in the remaining districts. Republicans wasted just 30,586 votes across five districts this time. Democrats wasted 568,813.

122. By 1998, however, things reverted to normal. Rick White was defeated in the 1st Congressional District. Linda Smith ran for Senate; her district flipped. At the same time, Adam Smith became entrenched in the 9th District. He won only 51.5 percent of the vote when defeating Tate in 1996, but his margin ballooned to 65 percent in 1998. Overall, districts 1-5 produced just 30,500 wasted Republican votes and 569,000 wasted Democratic votes in 1996. They produced 234,000 wasted Republican votes in 1998, and 269,000 wasted Democratic votes in 1998. In 2000, Democrats picked up the 2nd district, which had been vacated by Jack Metcalf. This resulted in more wasted Republican votes, and a Democratic leaning efficiency gap.

123. These maps bear heavy indicia of gerrymandering – indeed, some of the heaviest on record. Yet they are probably not gerrymanders. The 1972 maps were drawn by a Democratic legislature and Republican governor. The 1992 maps were produced by an independent commission.

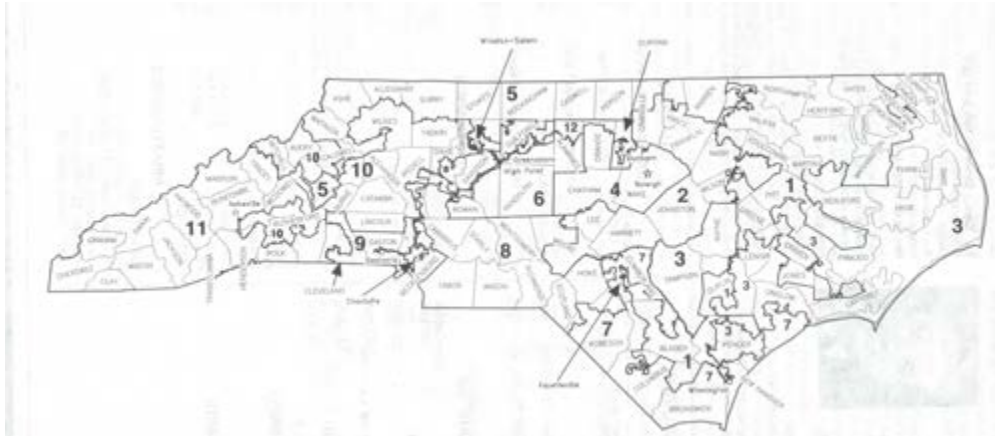
124. Finally, we come to North Carolina. North Carolina has a long history of partisan gerrymandering; in his classic work on the political dynamics of southern states, V.O. Key singled out North Carolina Democrats for drawing what we would today label wryly as “baconmanders”: Maps with stretched districts that pair Republican areas with Democratic areas. So, for example, one district in the 1940s stretched from Mecklenburg County to Yancey and Mitchell counties, while another wound from Stanley County up to Watauga, before hooking around to Alleghany County.

North Carolina, 1940s (Key, *Southern Politics* 226 (1949))



125. But of course, none of this compared to what came in 1992. The Democrats drew a map whose only competitor was Texas for bizarre district lines. It actually had a lengthy history: The first map Democrats drew created a majority black district in the east, but was struck down by the Bush Justice Department, which demanded a second minority-majority district. Republicans believed that this would help them weaken Charlie Rose and Bill Hefner in the 7th and 8th districts. But instead, Democrats drew the infamous 12th Congressional district, which snaked up I-85, connecting black populations in Charlotte, Winston-Salem, Greensboro, and Durham. *AAP 1994* at 942. These districts forced irregular lines, but Democrats went further, attaching a tendril into South Durham in an attempt to shore up Tim Valentine, utilized touch-point contiguity to prevent the Third District from extending down into Wilmington, and again to avoid wasting Democratic precincts in Howard Coble's district, and extended the Fifth down to Burke County. They utilized touchpoint contiguity a third time in the western portion of the state, extending Cass Ballenger's district to pick up Mitchell and Avery Counties, which were the two most Republican counties in the state in 1992.

North Carolina District, 1992 (*PIA 1996*)



126. But in 1994, this map actually produces a Republican lean, one that is a few votes shy of the threshold for being flagged. In fact, Dr. Jackman imputes values for the 6th District; if actual turnout proved to be slightly lower than Dr. Jackman's projections, or if the challenger's vote share were slightly higher than Dr. Jackman's projections, this map would be flagged.

127. Whatever the 1992 map is, it is not a Republican gerrymander. Yet if there had been a Republican wave in 1992 rather than 1994, that is exactly what the efficiency gap would suggest. Once again, a map that is plainly not a gerrymander bears the supposed hallmark of a gerrymander.

128. What happened in 1994? Republicans performed better. In 1992, the 2nd, 3rd, 4th, and 5th districts gave Democrats 55, 56, 66 and 64 percent of the vote. This resulted in around 69,000 wasted Democratic votes, and 366,000 wasted Republican votes. But in 1994, Republicans won those seats, though not by overwhelming margins. Suddenly *Democrats* wasted 267,000 votes in those seats, while Republicans wasted just 24,000 votes. Again, a shift in the environment produced a large efficiency gap.

129. The 1998 and 2000 maps contain more regularized lines, but both produce slight Republican efficiency gaps. This is odd, because the state sought to defend these maps in court

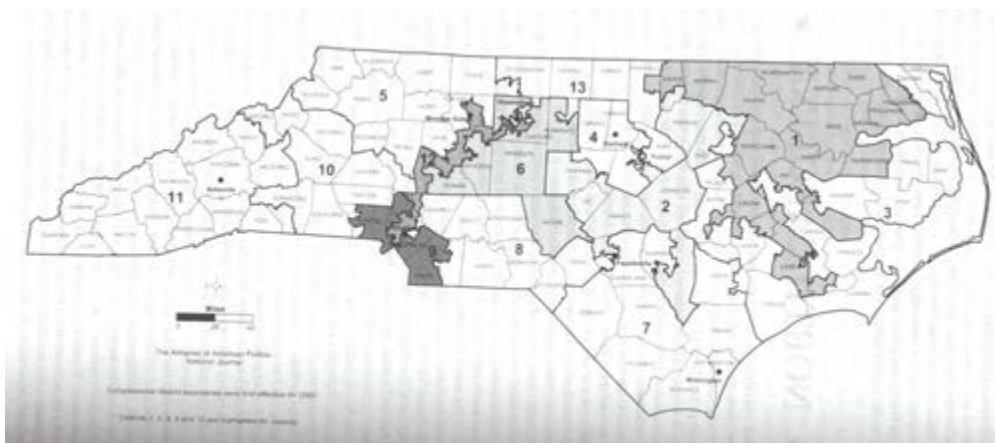
in part on the grounds that they were a Democratic gerrymander; Justice O'Connor ultimately agreed.

North Carolina 2000 (PIA 2002)



130. In 2002, the state returned to more irregular lines, in an attempt to create yet another Democratic district while strengthening the remaining Democratic incumbents. According to the Almanac, the map created a new Democratic district for Brad Miller (the Senate redistricting committee chairman), weakened Robin Hayes in the 8th districts, and shored up the 2nd and 7th districts. AAP 2004 at 1187.

North Carolina 2002



131. But the nature of the gerrymander wasn't apparent until 2010. According to the efficiency gap, the map actually had a slight Republican bias in 2002 and 2004. Even though Robin Hayes' Eighth District flipped in 2006, it does not change the efficiency gap much. Due to the Democratic wave and heightened African-American turnout (the largest increases in turnout statewide vis-à-vis 2004 were in the 1st and 12th districts), Democrats ended up wasting a lot of votes in their safe districts. Heath Shuler's win in 2006 does not change the efficiency gap for the same reason.

132. As the environment moved leftward, these maps performed as they "should," adding Democrats to the map as their statewide vote share grew. The reason these maps were Democratic maps, though, is that this function was a one-way ratchet. When the Republican wave election hit in 2010, they found themselves able to defeat just one Democratic incumbent. The Democrats' vote share in the 1st, 4th, 7th, 8th, 11th and 13th districts were all below 60 percent. The result was that Republicans wasted 560,000 votes in these districts, while Democrats wasted around 73,000 votes. Also, because the Democratic vote shares fell in Republican incumbent districts, there were few offsetting Democratic votes there.

133. The result would have been even more extreme had a longtime Democratic incumbent not made a key mistake. The Almanac describes the events: "[T]wo young Republican operatives approached the incumbent outside the House office buildings and asked him whether he supported the 'Obama agenda.' Etheridge asked them repeatedly in angry tones, who they were, and grabbed one by the wrist and the other, briefly, by the neck." AAP 2012 at 1246. Had Etheridge not done this, he probably would have won.

134. Had Etheridge taken a different route back to his office that day and won by the same margin by which Renee Ellmers actually won, the efficiency gap would have been .199,

larger than the efficiency gap produced by the present North Carolina map. So, while the 2002 Democratic gerrymander did not appear to be an extreme gerrymander in its first year, the potential was certainly there. All it took was the defeat of two Republican congressmen (one of whom was intentionally endangered by the map), and then a Republican wave election. This is the scenario that creates the cluster of Republican votes just shy of the 50 percent mark that plaintiffs describe as their hallmark of the gerrymander. It is just that in this map, this scenario doesn't unfold until the last year of enactment. Again, small events can have significant effects on the efficiency gap.

135. The 2012 maps also illustrate the impact small changes can have. Mike McIntyre was able to survive the 2012 election because he was a good congressman who tended to his district. Had Heath Shuler opted to run for re-election, or had Etheridge not imploded in 2010 and opted to run in 2012, there is really no reason to suspect they could not have performed as well as McIntyre (especially Shuler). Had this happened, the efficiency gap that year would have been -.09: not actionable. If those three had won narrow victories under the 2016 map, the efficiency gap would have been zero. Of course, as they retired, their districts would have flipped, and the efficiency gap likely would have swung rightward (although that was true of the 2002 map as well). But this again illustrates how the efficiency gap is not some intrinsic feature of plans, but is often dependent upon slight changes in elections.

136. Plaintiffs would likely respond that partisan intent acts as a further screen on gerrymandering. First, misses the point. The point is that the efficiency gap is not what it is being sold as: clear evidence of gerrymandering. Second, I am skeptical that this operates as a meaningful bar; plaintiffs have been able to take cases to trial alleging partisan motives underlying maps drawn by independent commissions in the past, see *Harris v. Arizona*

Independent Redistricting Comm'n, 578 U.S. ___ (2016), so I am not sure why a state could not be haled into court in other circumstances. Of course, the issue is not just that there are things that are plainly not gerrymanders that present as gerrymanders under the efficiency gap; it is that things that are plainly gerrymanders often appear not to be gerrymanders.

137. Finally, Plaintiffs may emphasize North Carolina's performance. But we are trying to ascertain a national standard, one that is manageable and easy to apply. The more that plaintiffs emphasize the particulars of North Carolina's current map, the more we see what a fact-intensive, arbitrary standard the plaintiffs' test is in practice.

138. The plaintiffs claims that the efficiency gap is the hallmark of a gerrymander. In reality, the meaning is much more ambiguous. I understand the intuition behind it. In fact, if elections occurred in the lab, they would probably be correct; under controlled conditions of similar incumbency, candidate quality, electoral environment, scandal, or Voting Rights Act requirements, and assuming there is no spatial clustering or other factors that might produce a baseline other than zero, they may even be correct.

139. But reality is messier. Incumbents survive races they were supposed to lose, or lose races that a map drawer might believe they were going to win. Wave elections hit in the first year of plan implementation, and skew the produced efficiency gap. Candidates grab reporters by the neck, and lose elections they were supposed to win. Right-wing Republican candidates win low turnout special elections in historically Democratic areas, and help to skew the efficiency gap in the subsequent elections. As the above analysis shows, these sorts of things are not one-off events; they occur with some regularity.

140. What the above really shows is that map drawers don't have nearly as much control over where efficiency gaps emerge as plaintiffs imagine. While I might agree with the

suggestion that what map-drawners are *trying* to do when gerrymandering is to waste the other sides' votes, to accomplish the feat they have to control facts on the ground to an unrealistic degree. In reality, actors with the intent to waste votes will end up failing, or even wasting their own votes with some regularity, while actors with a command to avoid wasting votes will often fail in their mission.

VII. It is unclear exactly why “Average Efficiency Gap” is of interest. It does not mean a voter’s influence is consistently degraded.

141. In the Wisconsin litigation, Dr. Jackman inquired whether “over the life of a redistricting plan,” the efficiency gap “remain[ed] on one side of zero or the other.” Jackman, WI Report, at 53. Indeed, this was a “key” inquiry, *id.* because it helped determine whether large values of the efficiency gap were likely to be repeated over the life of the plan. This is because “plan’s gaps vary substantially over the plans’ lifetimes,” Stephanopoulos & McGee at 836, indeed, this variation caused McGee to conclude initially that the efficiency gap demonstrated why Courts did not need to get involved with settling gerrymandering claims at all. McGee at 56.

142. From a theory standpoint, this made at least some sense. If a plan resulted in a sign *never* switching, it would mean that one side or the other would always have some votes wasted. While I’m not clear what the significance in practice would be if those numbers ended up small – having one wasted vote in four elections may not add up to a constitutional inequity – I understood the argument.

143. Here, Dr. Jackman switches his inquiry to the sign of the “average” efficiency gap. I am unsure what the significance of this is. The fact that a map might, on average, disadvantage one party or the other does not seem like clear evidence that a wrong has been committed. First, practically speaking, a plan *has* to favor one side or the other, at least on average. Second, as we’ve seen, maps can show strong efficiency gaps due to freakish results in

single elections. Averages are sensitive to outliers, especially with small numbers of observations. It's entirely possible for a map to favor the opposing party a majority of the time, yet show an average efficiency gap that favors the map-drawing party.

144. There are a large number of maps where the efficiency gap does not switch sign. This would seem to augur well for the efficiency gap. But when one digs down, the pattern does not match well with plaintiffs' system.

145. The following table displays the maps that, by my count, display consistent efficiency gaps across plans (Note: I disagree with Dr. Jackman's coding of Ohio in 1984, New York in 1974, and Washington in 1984, because the changes to the maps were trivial). It also details whether the plan is actionable – that is, whether you would be able to bring a cause of action – as well as whether the cause of action would be sensible – that is, whether the sign of the efficiency gap matches the party that drew the map.

State	Year	n	Actionable?	Sensible?
CA	1992	5	No	No
CA	2002	5	No	No
CO	2012	3	No	No
FL	1996	3	No	No
GA	1996	3	Yes	No
GA	2012	3	No	Yes
IL	2002	5	Yes	No
MD	1992	5	No	No
MD	2012	3	No	Yes
MA	1992	5	No	Yes
MA	2002	5	No	Yes
MN	1972	5	No	Yes
MN	2002	5	No	No
MO	2012	3	No	Yes
NJ	1972	5	No	No
NJ	2002	5	No	No
NJ	2012	3	Yes	No
NY	1972	5	No	Yes
NY	1982	5	No	No
NY	1992	3	No	No
NC	1972	5	No	Yes
OH	2002	5	No	Yes
TX	1974	4	No	Yes
TX	1996	3	Yes	No
WA	1972	5	Yes	No
WA	2012	3	No	No
AL	2012	3	Yes	Yes
FL	2002	5	Yes	Yes
FL	2012	3	Yes	Yes
IL	1972	5	Yes	Yes
IN	2012	3	Yes	Yes
MA	1982	5	Yes	Yes
MA	2012	3	Yes	Yes
MI	2002	5	Yes	Yes
MI	2012	3	Yes	Yes
OH	2012	3	Yes	Yes
PA	2012	3	Yes	Yes
SC	2012	3	Yes	Yes
TX	1984	4	Yes	Yes
TX	2006	3	Yes	Yes
TX	2012	3	Yes	Yes
WI	2012	3	Yes	Yes

146. In fact, it performs quite poorly. Of the 42 maps with consistent efficiency gaps, only about 38 percent occur in situations where both the party that benefits from the efficiency

gap had control of the process, and the map would be actionable under Dr. Jackman's suggested standard. About a quarter of the maps that produce consistent efficiency gaps occur in situations where the benefitting party did not have control of the process *and* the initial map isn't actionable. Further, there are only four maps in the dataset where the party that controlled redistricting benefitted from a consistent efficiency gap, where the gap was actionable, and where a map went through a complete five cycles.

VIII. The Efficiency Gap requires mapmakers to guess what the political environment will be in implementation year 1.

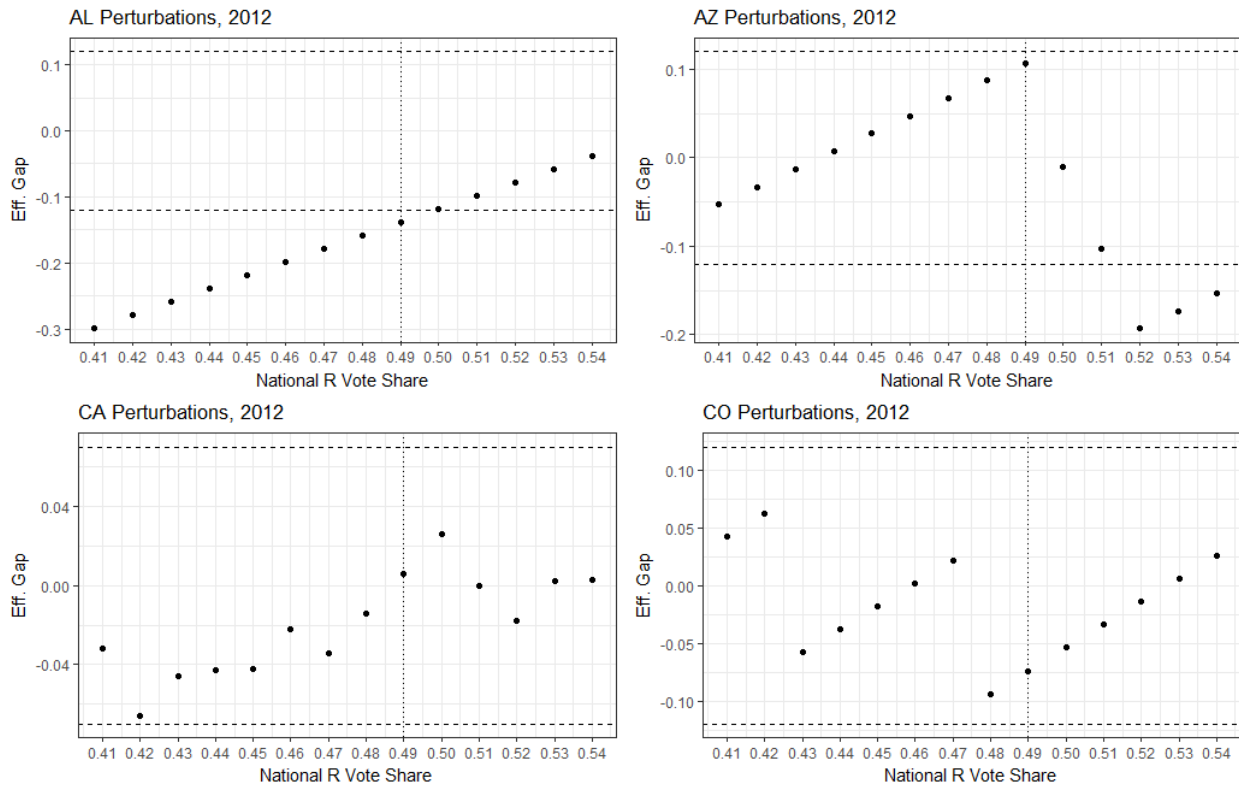
147. As we've seen, from a purely practical perspective, implementing the efficiency gap can be a difficult thing. A mapmaker must try to get a sense of what the national environment will be like in the first year of implementation, which lawmakers are likely to suffer a scandal, which lawmakers are likely to retire, and which lawmakers are likely to suffer a challenge. As we've seen, a large number of maps produce large efficiency gaps even though they are unlikely candidates for extreme gerrymanders, while others produce large effects that are fleeting. As we saw in Washington, the national environment can account for swings of over 50 percent with respect to efficiency gaps in sequential elections. Courts evaluating what mapmakers are doing will "get it right" a fair number of times with the efficiency gap, but they will get it flatly wrong a fair number of times as well.

148. To show how dependent mapmakers are on guessing what the first year environment would look like, we can explore more fully the "perturbations" Dr. Jackman utilizes. To be clear, I'm not at all certain this is permissible, as this is the exact same exercise Dr. Jackman, Stephanopoulos and McGee, and courts have rejected with respect to measuring partisan symmetry. *See also* Jackman, 24 British J. Poli. Sci, at 335, cited in Stephanopoulos &

McGee at 860 n. 139. But, if it is somehow permissible to use to test a statistic, but impermissible to create the statistic itself, we should look at some more perturbations.

149. My approach is as follows: During the time period Dr. Jackman explores, the Republican share of the two-party vote has varied between 41 percent in 1974 and 54 percent in 1994. In 2012, Republicans won 49 percent of the two party vote. So for each state in Dr. Jackman’s database, I added one percentage point to the Republican vote total, and recorded what the efficiency gap would be. I then added two percentage points, three percentage points, and so forth, until we simulated a 1994 vote share. I then did the reverse, to simulate a 1974 environment.

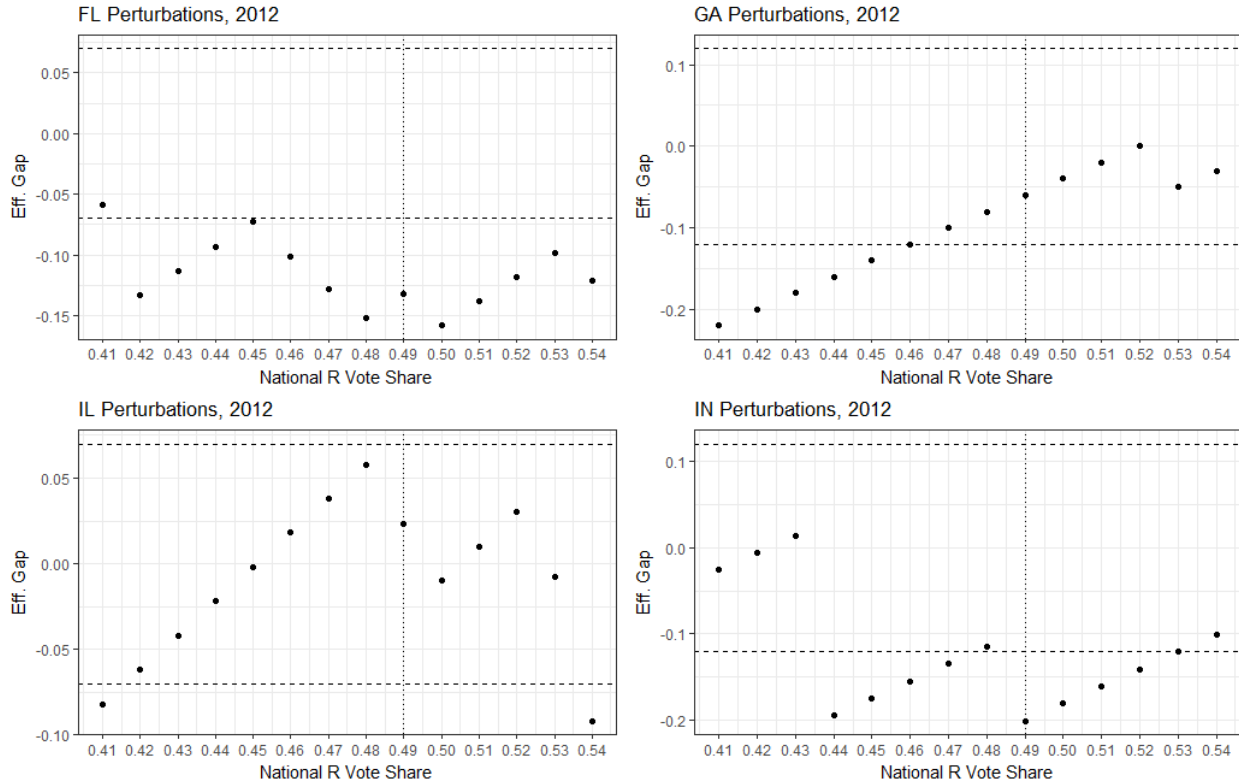
150. I then plotted these results. The two horizontal lines indicate the range where a map is “safe.” The vertical line shows 49 percent, which is the baseline for 2012.



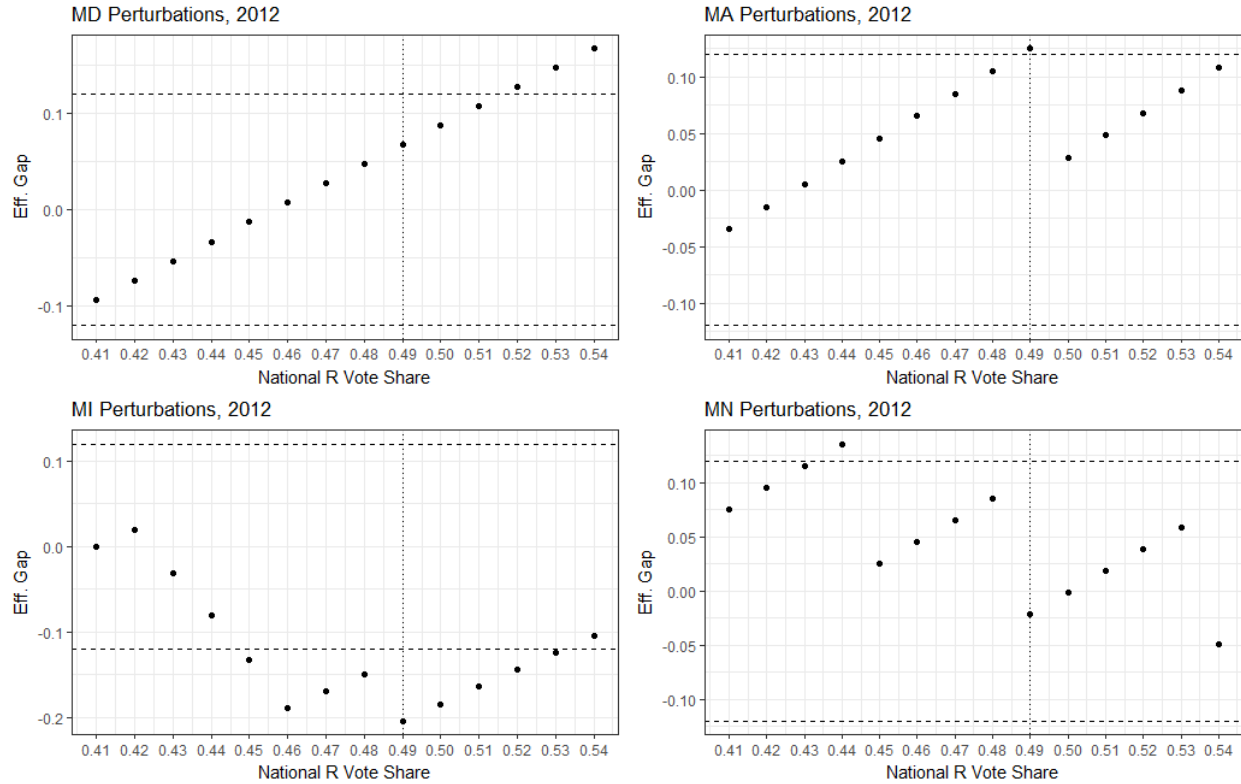
151. First, notice the linear relationship here. This further underscores the fact that the relationship between the efficiency gap and vote share is a proportional one. Notice also the large effect that flipping a seat has. These are the sorts of things mapmakers will have to predict.

152. Alabama's map is actionable, but only because the Republican national vote share fell below 49 percent of the two-party vote. Had Republicans done a bit better, the map would not be actionable.

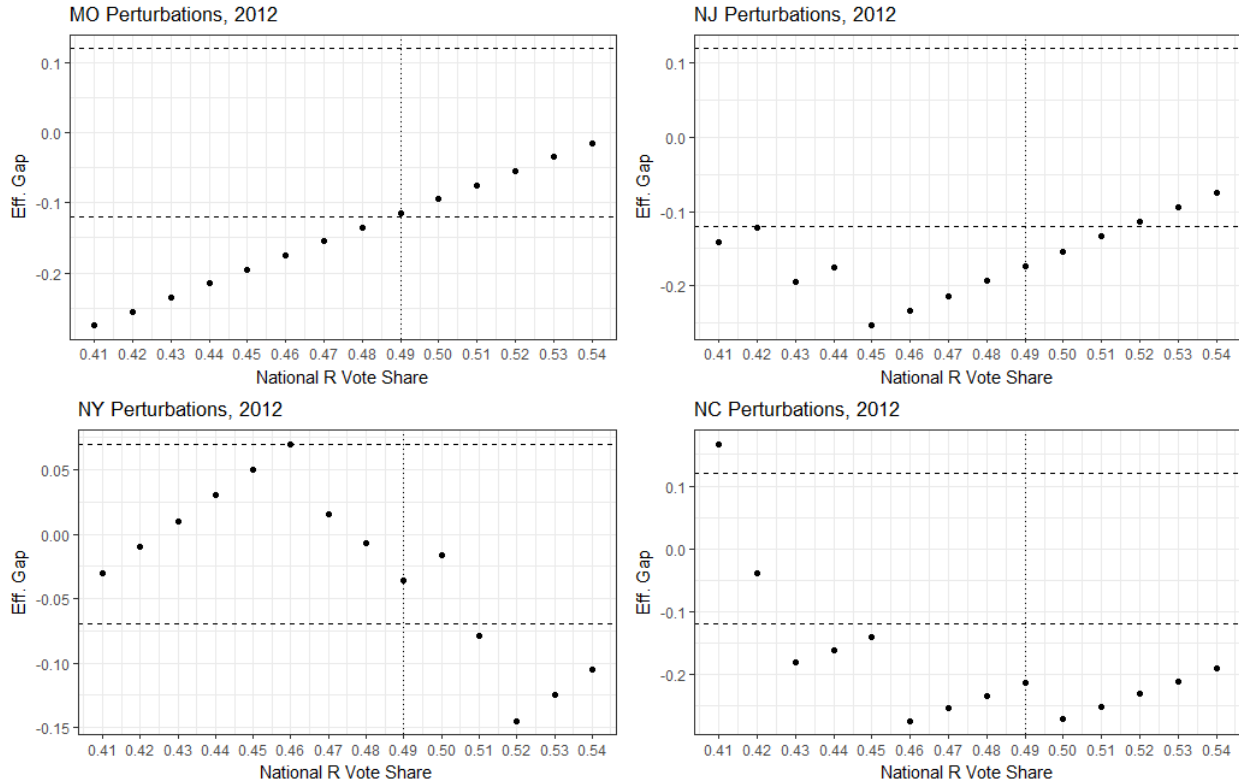
153. In Arizona, we see the efficiency gap's quirks on display. Between 41 percent and 49 percent of the two-party vote, the map is safe, although it approaches an actionable Democratic gerrymander (even though it was drawn by an independent commission). But in a marginally better environment than 2012, Ron Barber in AZ-02 loses, and the map goes from an almost-actionable Democratic map to a Republican efficiency gap. With another percentage point, Ann Kirkpatrick loses to Jonathan Paton, and the map has become an almost-actionable Republican gerrymander. In wave elections, utilizing Dr. Jackman's approach, we'd suddenly have an actionable Republican gerrymander, as Kyrsten Sinema would lose.



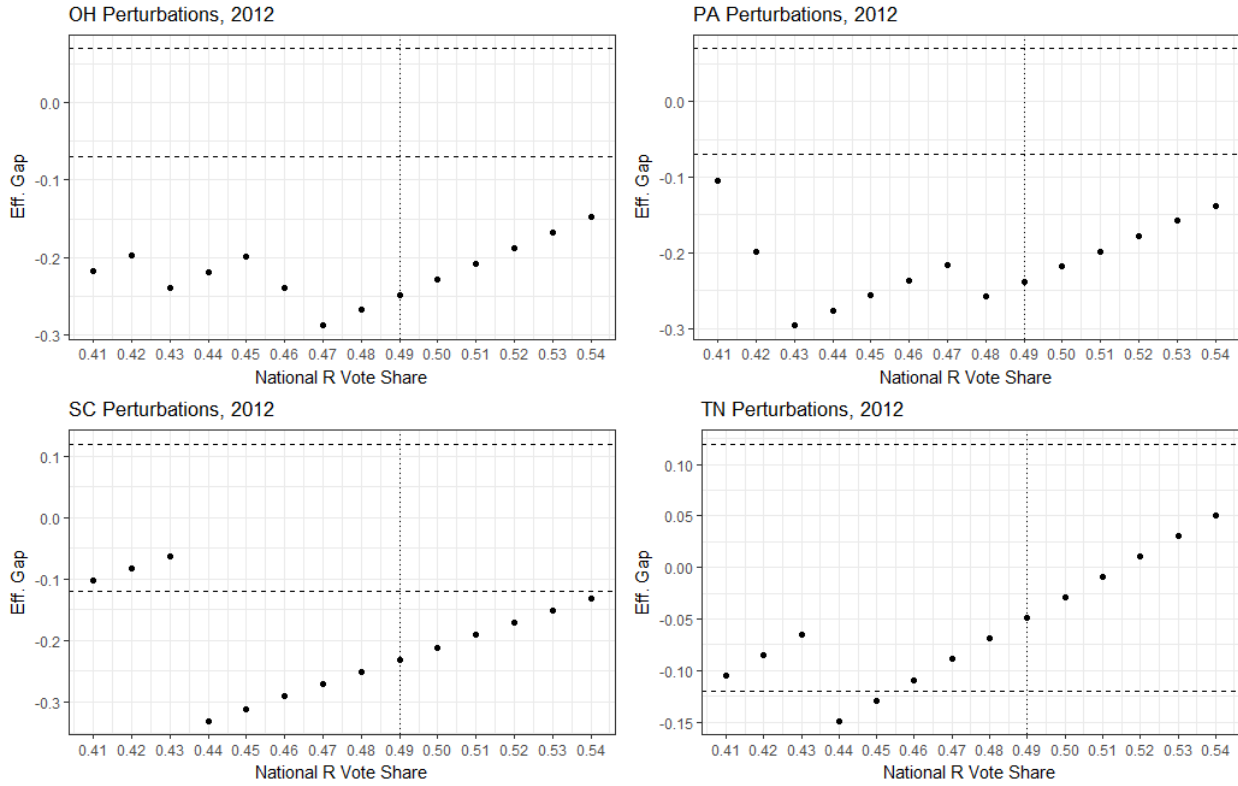
154. Every map in the above four panels produces actionable efficiency gaps under certain circumstances. Illinois is actually identified as a *Republican* gerrymander in sufficiently good and bad GOP years, while Florida gets a pass in a truly bad Democratic year. Georgia becomes a Republican gerrymander in an environment like 2006 or 2008, while Indiana likewise is very fact-dependent. If Republicans had done a fraction worse, Jackie Walorski would have lost, and the map would be fine. Or, if the national environment had matched 2014 or 2010, the seat share would have matched the vote share sufficiently.



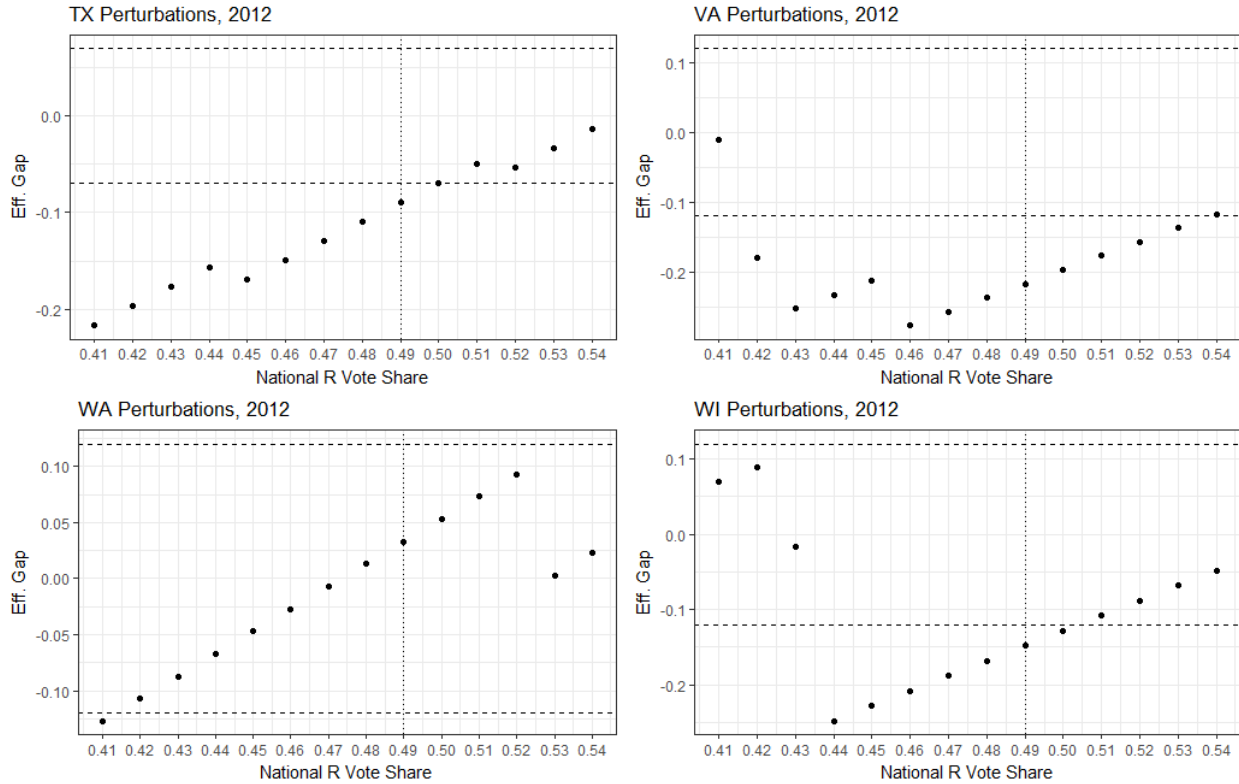
155. Once again, whether maps trigger their efficiency gap thresholds depends on the environment. Lest one believe that the maps with one value outside the safe harbor are truly safe, consider Massachusetts, whose map would be brought into Court because the single value that would trigger scrutiny is what actually happened in 2012.



156. Again, all of the maps above are actionable under some environments, and not actionable under others. The New York map could be a Republican gerrymander in a very good Republican year, even though it was drawn by a political science professor and redistricting expert, Nathan Persily. North Carolina's 2012 map appears to be a Republican gerrymander in most years, but appears to be a Democratic gerrymander in a blowout Democratic year.

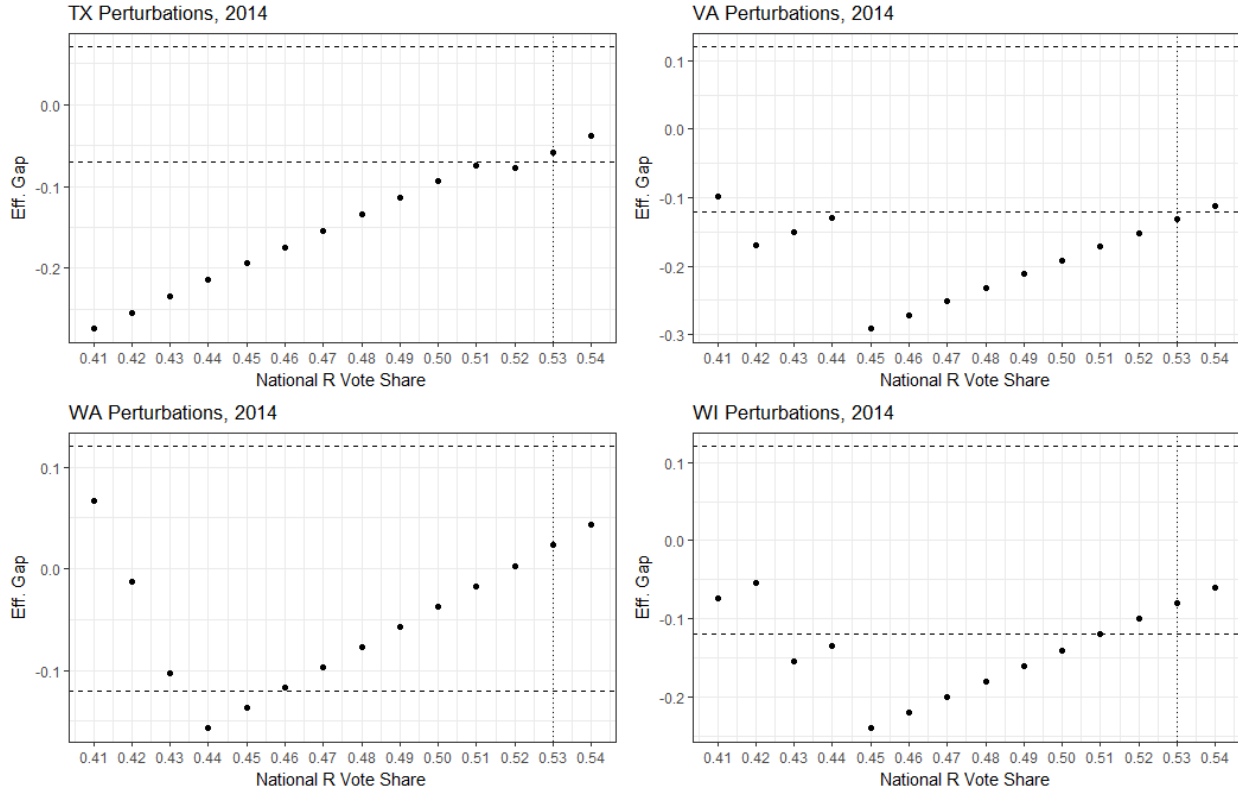


157. The efficiency gaps in Ohio and Pennsylvania are fairly stable, but Tennessee and South Carolina are environment-specific.

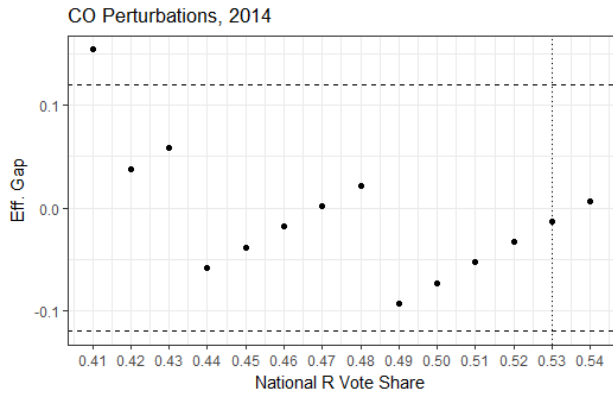
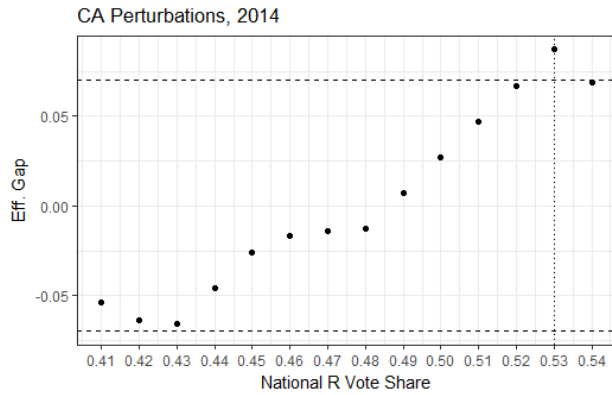
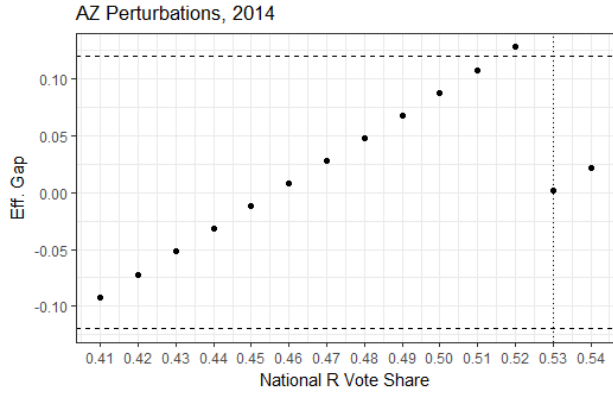
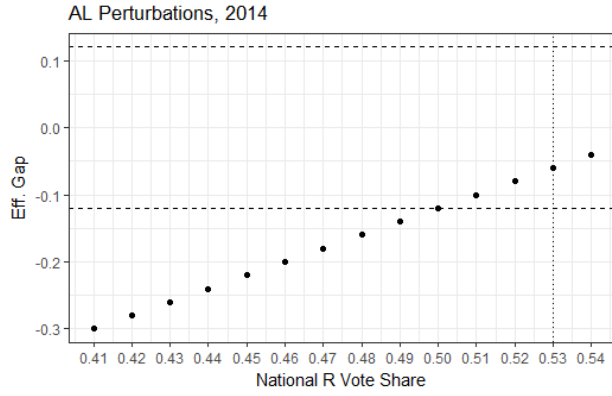


158. All of these maps are actionable under the right set of circumstances, and are safe under the right set of circumstances.

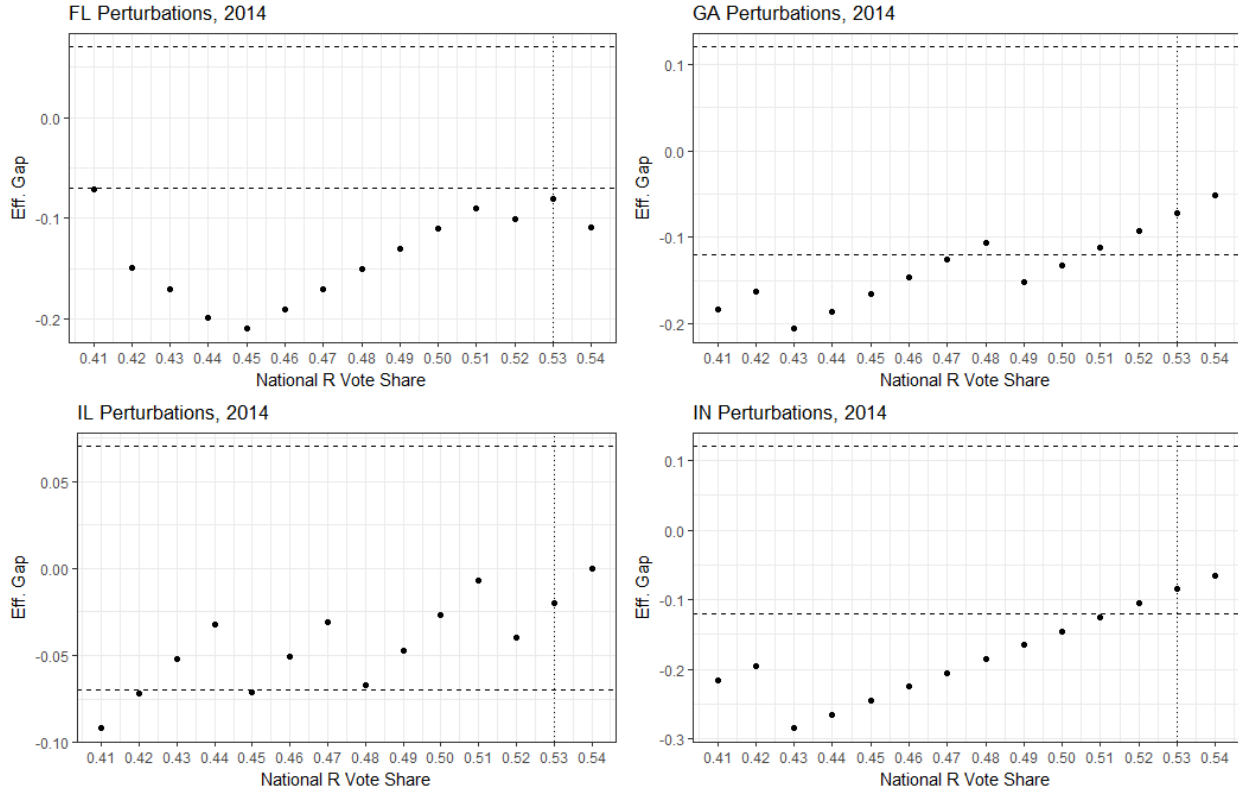
159. But, of course, this is about more than the national environment. Efficiency gaps can be affected by retirements, candidate quality, scandals, and a host of other issues. If we run the perturbations for the 2014 maps, a different set of outcomes emerges. Compare the charts above with the charts below. Note that none of the maps receive scrutiny at the same values of the popular vote share. If Republicans had done a few points better under the 2012 set of candidates, imputations, retirements, and so forth, the Texas map would have escaped scrutiny. But under the 2014 values, it is not:



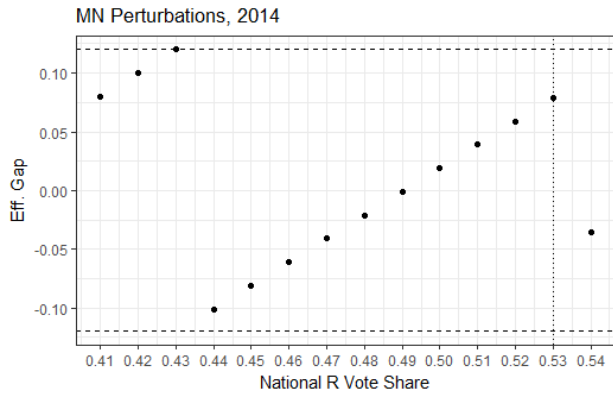
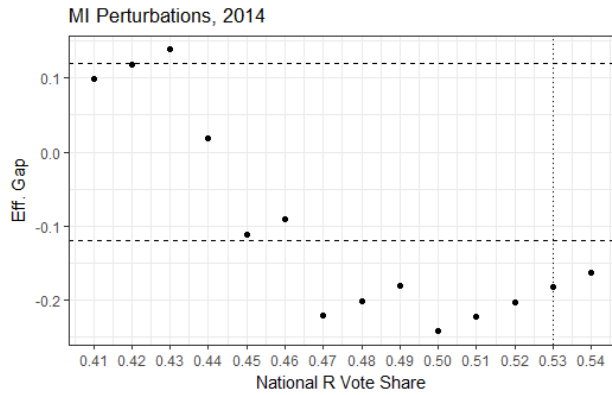
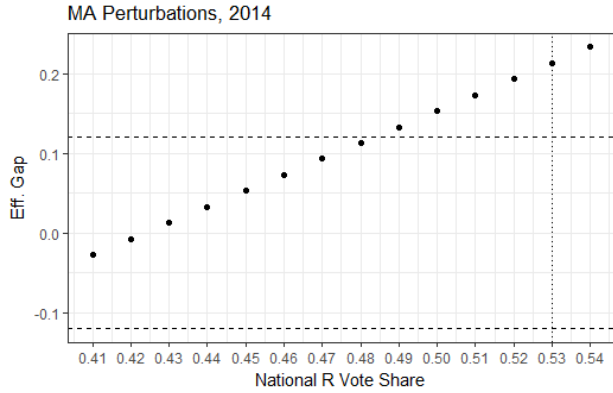
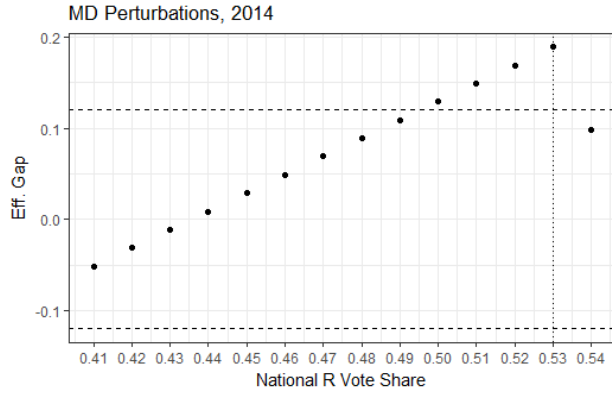
160. Notice that while Arizona triggered scrutiny under a fair number of popular vote values in 2012, under the 2014 set of candidates, it only does so under one. Also, while Arizona became a Republican gerrymander at high values, here it becomes a Democratic gerrymander at one high value.



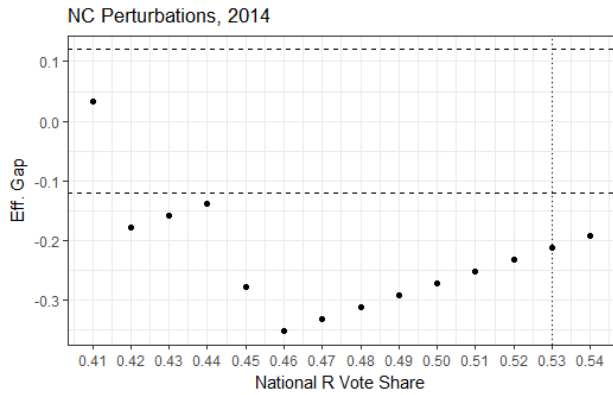
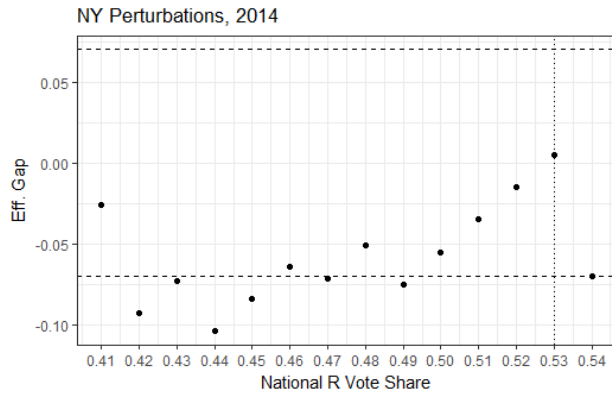
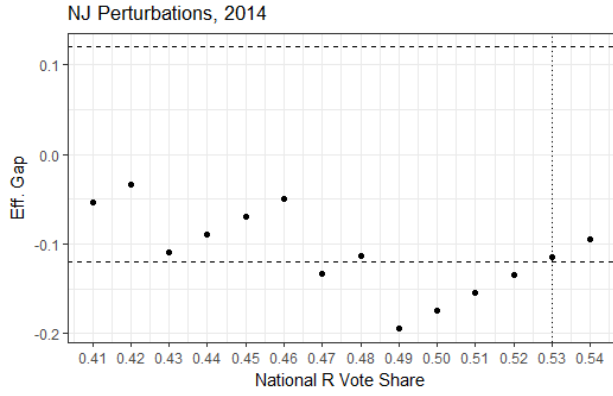
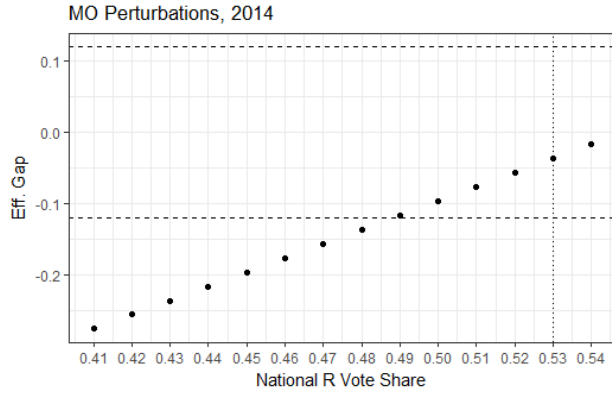
161. Here are Florida, Georgia, Illinois and Indiana. Note, for example, that while Indiana received scrutiny in most scenarios in 2012, here it receives scrutiny in all but three. Georgia escaped scrutiny most of the time in 2012, here it receives scrutiny most of the time.



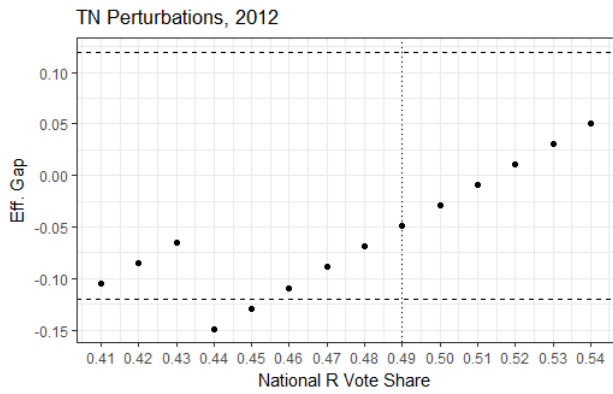
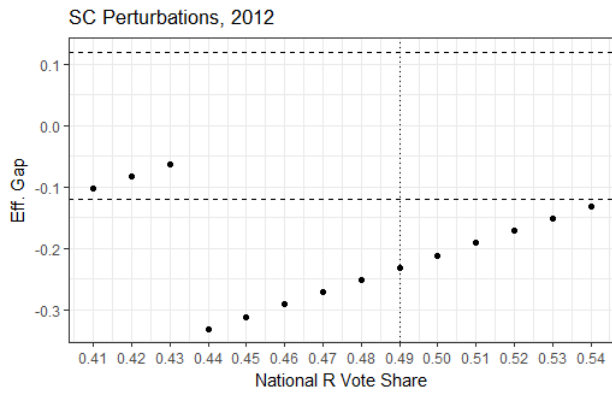
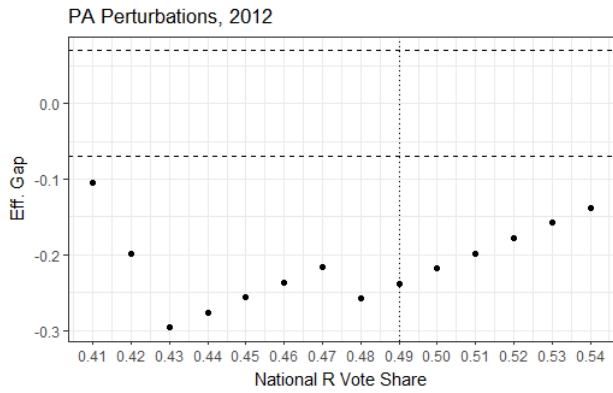
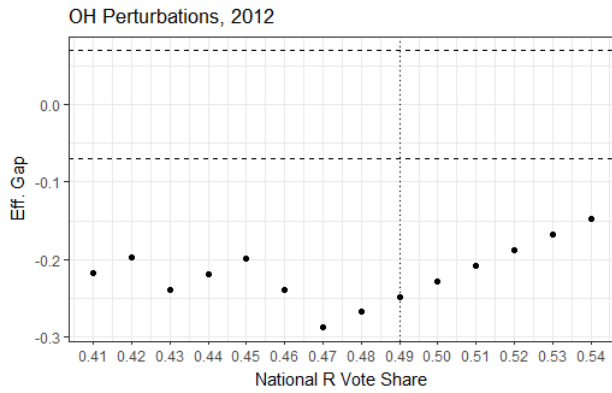
162. Massachusetts almost always avoids scrutiny under 2012, because Republicans fielded a good candidate in the 6th District that year against a scandal-plagued incumbent. He almost won. So in slightly better environments than actually played out in 2012, Richard Tisei wins, and Democrats waste a lot of votes. Tisei was back in 2014, but Tierney lost in the Democratic primary, and Tisei lost by 14 points. Therefore, improving the environment for Republicans only wastes more Republican votes.



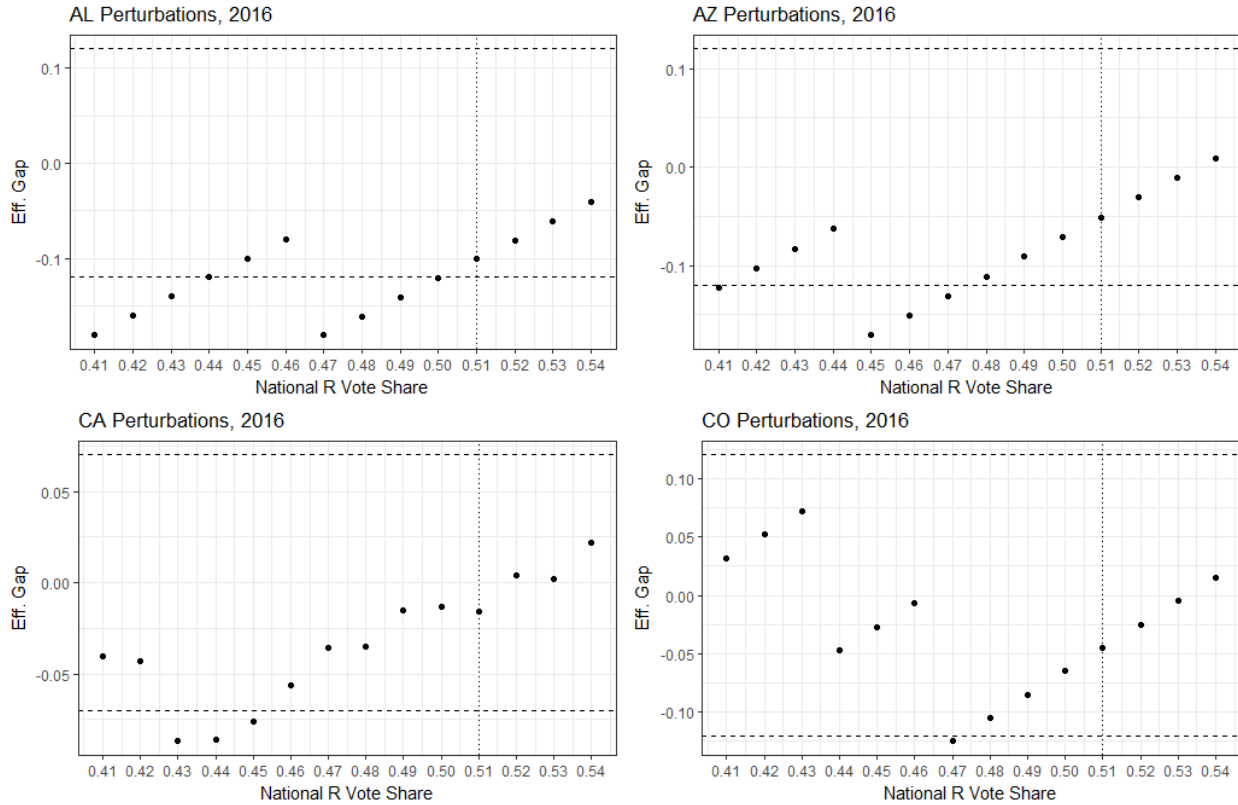
163. Here is 2014 for Missouri, New Jersey, New York and North Carolina. Recall that on the basis of 2012 outcomes, we expected New York to be a Republican gerrymander if Republicans received 53 percent of the vote nationally. As it turns out, an *actual* election where Republicans received 53 percent of the vote nationally resulted in an efficiency gap near zero (and that leaned a bit to the left, in fact).

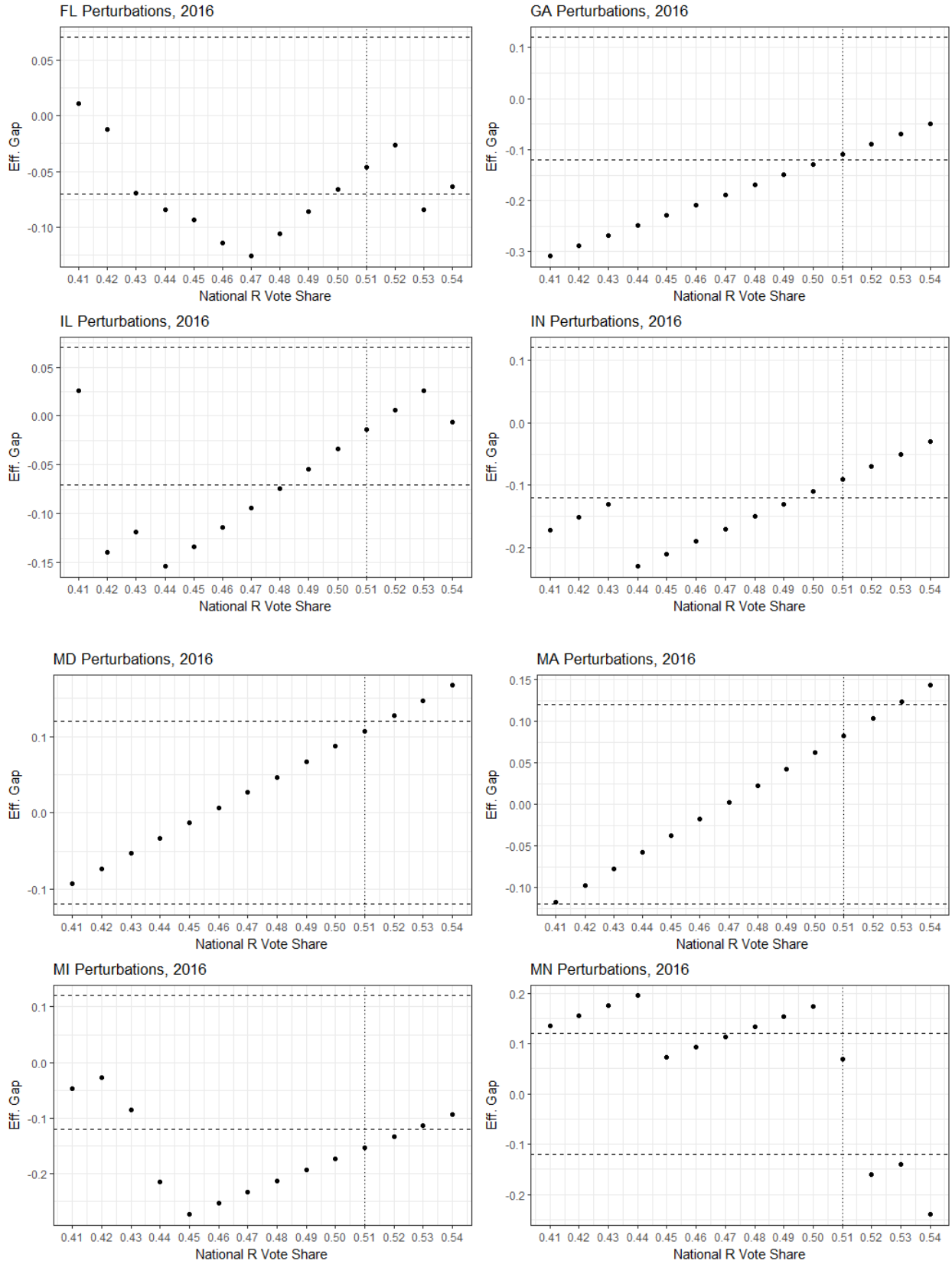


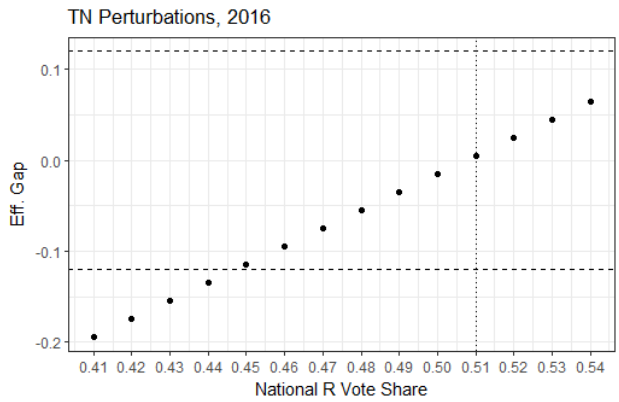
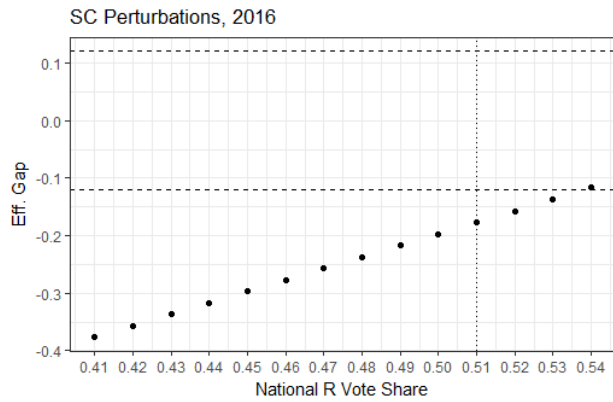
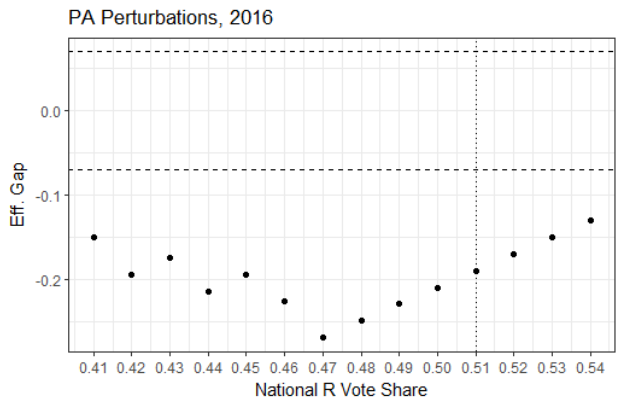
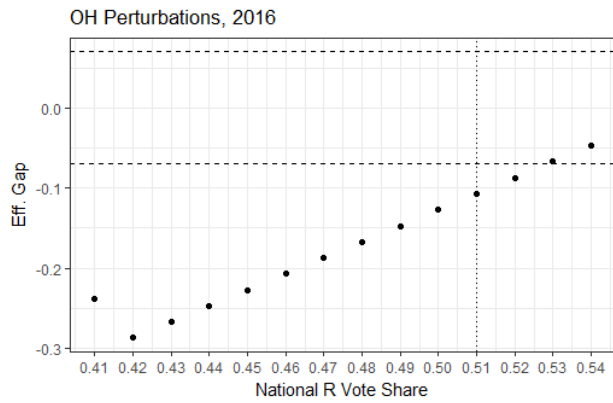
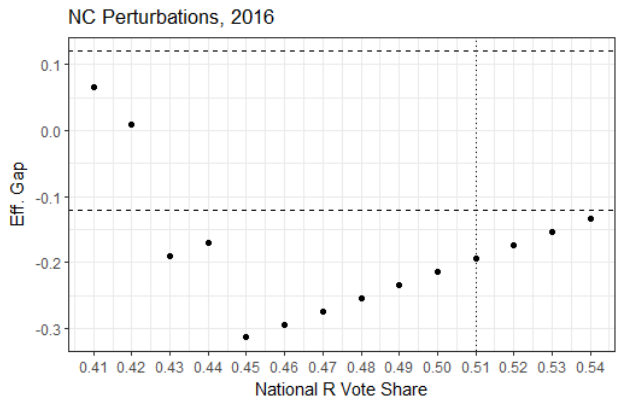
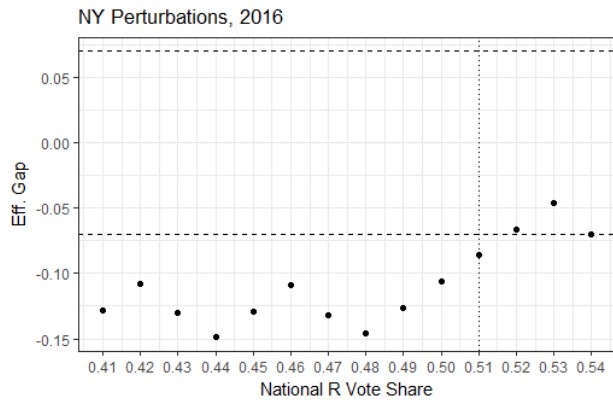
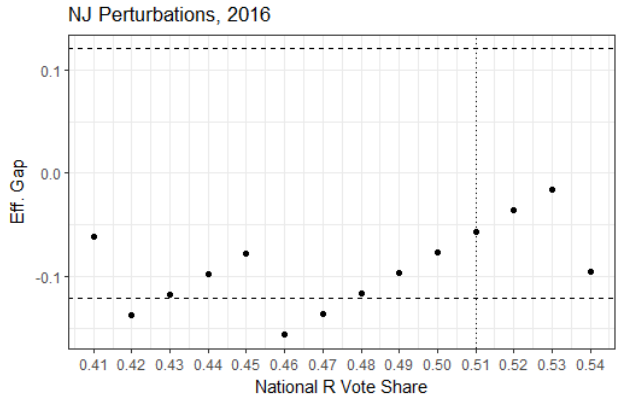
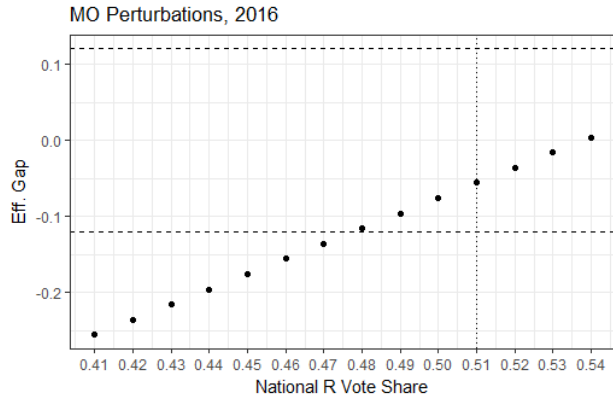
164. Here are Ohio, Pennsylvania, South Carolina and Tennessee.

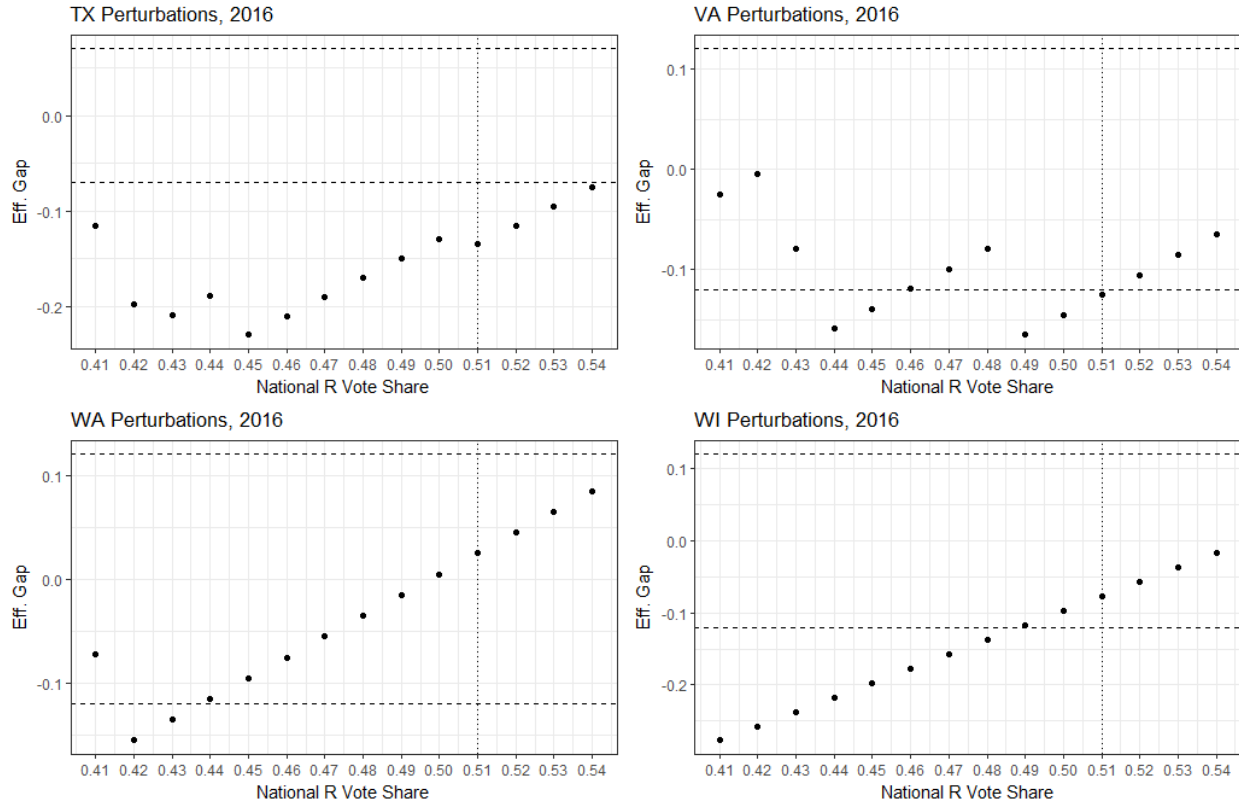


165. Here are the 2016 values. Note that the differences in within-state distributional shape are even more extreme here. Note too that a state like Ohio, which had actionable efficiency gaps in every scenario in 2012 and 2014, now has efficiency gaps that are not actionable in environments that are only modestly better than what occurred in 2016. Had the candidate matrix looked in 2016 like it did in 2014, Ohio's map would survive scrutiny.









166. The mechanics of this are quite difficult for mapmakers to game out. Most maps have scenarios in which they produce actionable efficiency gaps, and most maps have scenarios in which they do not. Moreover, those scenarios change from year-to-year. Yet map drawers will have to figure out a way to anticipate these changes.

IX. The Efficiency Gap does nothing to address distorted boundaries, violations of communities of interest, or “Congressmen choosing their constituents,” and could encourage uncompetitive districts and entrenched majorities.

167. Notably, the efficiency gap does not address some of the more common objections to gerrymandering: distorted boundaries and “congressmen choosing their constituents.” Plaintiffs’ approach is largely indifferent to process and to traditional redistricting principles, so long as a large efficiency gap is not produced in the first year of operation.

168. Perhaps more importantly, the efficiency gap could actually worsen two of the biggest complaints about gerrymanders: That they entrench majorities, and that they reduce competitive districts.

169. Consider an extreme example from North Carolina, which illustrates nicely how the efficiency gap can incentivize things. Assume that in a particular year, Democrats win 2,000,005 votes, while Republicans win 2,000,004 votes. These are split up into evenly-matched seats, such that in a completely neutral year, with evenly matched and evenly funded incumbent candidates, Democrats will win seven districts with one more vote than Republicans, and vice versa. This results in an efficiency gap of .05.

170. If this scenario repeated itself, Democrats would control the congressional delegation by one seat in every election, on the basis of just one vote. This is what I mean when I say the efficiency gap is indifferent to party control.

171. But now assume that a Democratic incumbent stumbles down the stretch, and a Republican manages to win one of these districts narrowly. Suddenly, the efficiency gap shifts by a tenth point to -.054.

172. As an even more extreme example, imagine that there is a uniform national swing of 1 percent. Suddenly, the efficiency gap is an astonishing -.675. This is because the swing districts held by Democrats all flip, and suddenly, Republicans control the delegation with just 51 percent of the vote.

173. This may seem far-fetched, but it should sound familiar. This is basically what happened in Washington in the 1990s. The independent redistricting panel drew a large number of competitive seats, that went back-and-forth between the parties during the 1990s. The efficiency gap ping-ponged back-and-forth accordingly.

174. The bottom line is that competitive districts generate a large amount of uncertainty with respect to the efficiency gap, because small perturbations in the national environment, or freak candidate effects produce outsized swings in the gap. You see this in the perturbation charts above, where changes in the national vote produce small shifts in the efficiency gap, until a seat flips, in which case a substantial movement ensues.

175. There are many responses to this, but one possible response is to stop drawing competitive districts, and instead draw a large number of entrenched seats that guarantee single party control, but are unlikely to violate the efficiency gap.

176. Instead, a mapmaker could simply look at the chart at the beginning of the report. For a state with 13 districts, 8 safely Republican districts are acceptable when Republicans receive between 48 and 63 percent of the vote. If a party was fairly comfortable its statewide vote share was unlikely to fall below 48 percent statewide, this would be a safe bet. True, the first-year efficiency gap may fall below 48 percent in a bad enough Republican year. But in the unlikely event that this occurred, mapmakers could just redraw the map. and hope for a better environment for Republicans in the following year. Likewise, if Wisconsin Republicans were to redraw the general assembly map with 50 safe Republican seats and 49 safe Democratic seats, they would be more-or-less guaranteed control of the chamber, provided their vote share statewide didn't fall below 47 percent. Given that it would be more difficult to convince quality challengers to run in districts where they would have no chance of winning, the odds of this occurring could be slight.

177. Of course, parties would probably not take a course of action this extreme. But it would be wholly permissible for them to do so and it does illustrate the perverse incentives that flow from the efficiency gap.

X. **It is not clear why we would assume that Party Control Drives Efficiency Gaps**

178. Two final points can be addressed briefly. First, Dr. Jackman claims that party control is a primary driver of efficiency gaps. While I don't doubt that Republicans draw maps that lean Republican compared to those drawn by independent redistricting commissions and Democratic legislatures, and while I appreciate the power of regression analysis, I am unconvinced that the correlation Dr. Jackman finds has causal power.

179. Seat share over time does not look like the chart Dr. Jackman creates in Figure 9. It is a stepwise pattern, with horizontal lines extending, generally speaking, over the course of the decade. Party control is constant.

180. Yet the efficiency gap, as described by Stephanopoulos and McGee, does not follow this stepwise pattern. It rises gradually, over the course of multiple decades, with hardly any notable movement in most redistricting years.

181. More importantly, it rises fairly substantially during the 1990s, when Republicans were mostly shut out of redistricting. I do not see how Republicans can be responsible for a phenomenon related to a process in which they did not participate is beyond me.

XI. **Dr. Chen's approach did not perform well in Wisconsin.**

182. Second, while I have generally avoided commenting on Dr. Chen's approach, I note that he filed an amicus brief in the Wisconsin litigation, employing a similar technique. See Exhibit 4. Although I am favorably disposed toward Dr. Chen's work, it has remained mostly theoretical. Its application in Wisconsin, however, reveals problems.

183. In his report, Dr. Chen's simulations produced efficiency gaps between .03 and -.06. The problem is that Wisconsin maps produced absolute efficiency gaps in excess of .06 in

1998, 2000 and 2002, and in the neighborhood of .1 in 2004 and 2006. *See* Jackman report in 72, Exhibit 5.

184. This isn't a problem in and of itself, but the 1992 and 2002 maps were drawn by a court, with the 1992 map drawn by a panel that included one of the judges from the eventual *Nichol* majority. It seems highly unlikely that those panels acted with partisan intent. The upshot of this is that for whatever reason, Dr. Chen's algorithm does not appear to sample from the full universe of plans drawn without partisan intent, and falling outside of the intervals of his results does not seem to prove that partisan intent is responsible for that disparity.

Pursuant to 28 U.S.C. § 1746, I declare under penalty of perjury under the laws of the United States that the foregoing statements are true and correct.

This the 3rd day of April, 2017.



Sean P. Trende