IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF NORTH CAROLINA
CIVIL ACTION NO. 5:15-cv-156

RALEIGH WAKE CITIZENS ASSOCIATION, INC, JANNET B. BARNES, BEVERLEY S. CLARK, WILLIAM B. CLIFFORD, BRIAN FITZSIMMONS, GREG FLYNN, DUSTIN MATTHEW INGALLS, AMY T. LEE, ERVIN PORTMAN, SUSAN PORTMAN, JANE C. ROGERS, BARBARA D.VANDENBERGH, JOHN G.VANDENBERGH, AMY WOMBLE, and PERRY WOODS,

Plaintiffs,

v. Civ. No. 5:15-cv-156

THE WAKE COUNTY BOARD OF ELECTIONS,

Defendant.

EXPERT REPORT OF JOWEI CHEN, Ph.D.

I am an Associate Professor in the Department of Political Science at the University of Michigan, Ann Arbor. I am also a Faculty Associate at the Center for Political Studies of the Institute for Social Research at the University of Michigan as well as a Research Associate at the Spatial Social Science Laboratory at Stanford University. In 2007, I received a M.S. in Statistics from Stanford University, and in 2009, I received a Ph.D. in political science from Stanford University. I have published academic papers on political geography and districting in top political science journals, including *The American Journal of Political Science* and *The American Political Science Review*, and *The Quarterly Journal of Political Science*. My academic areas of expertise include spatial statistics, redistricting, gerrymandering, the Voting Rights Act, legislatures, elections, and political geography. In particular, I have expertise in the use of computer algorithms and geographic information systems (GIS) to study questions related to political and economic geography and redistricting.

I have provided expert reports in the following redistricting court cases: Missouri National Association for the Advancement of Colored People v. Ferguson-Florissant School District and St. Louis County Board of Election Commissioners (E.D. Mo. 2014); Rene Romo et al. v. Ken Detzner et al. (Fla. 2d Judicial Cir. Leon Cnty. 2013); The League of Women Voters of Florida et al. v. Ken Detzner et al. (Fla. 2d Judicial Cir. Leon Cnty. 2012).

The attorneys for the plaintiffs in this case have asked me to analyze the seven single-member districting plan and the two super-district plan created by Session Law 2015-4 (Session Bill 181) and Session Law 2013-110 (Senate Bill 325) for future Wake County Board of County Commissioners elections and Wake County Board of Education elections, respectively. More

specifically, I was asked to analyze: 1) Whether the population deviations in these districting plans were motivated by partisan purpose; and 2) Whether race predominated in the drawing of District 4 of the seven single-member districting plan.

In conducting my academic research on legislative districting, partisan and racial gerrymandering, and electoral bias, I have developed various computer simulation programming techniques that allow me to randomly produce a large number of alternative districting plans in any given state or county using either precincts or census blocks as building blocks. Most importantly, these computer simulations can be programmed to optimize districts with respect to various traditional districting goals, such as avoiding malapportionment and minimizing population deviations, maximizing geographic compactness, and preserving municipal boundaries and precinct boundaries. By generating a large number of randomly drawn districting plans that closely follow these traditional districting criteria, I am able to assess an enacted plan drawn by a state legislature and determine whether racial and partisan goals may have motivated the legislature to deviate from traditional districting criteria.

I use this simulation approach to analyze the enacted seven-member and two super-district plans drawn by the North Carolina General Assembly in several ways. First, I analyze the General Assembly's districting plans and identify areas in which these enacted plans deviate significantly from having equally populated districts. To analyze the General Assembly's motivations for these population deviations, I use computer simulations to randomly generate hundreds of districting plans that optimize on four criteria: Equal apportionment within 1% of ideal district population, preservation of precinct boundaries, preservation of municipal boundaries, and maximization of geographic compactness.

I then compare the computer-generated, non-partisan districting plans to the plans drawn by the General Assembly with respect to several measures of racial composition and partisanship. The results show that across multiple districts in both the seven-member and the two super-district plans, deviations from the ideal district population appear to be associated with an effort to maximize the number of Republican-favoring districts. The General Assembly's enacted districting plans create a partisan distribution of seats falling completely outside the range of outcomes that are possible under a non-partisan districting process that creates equally populated districts while maximizing compactness and preserving precinct and municipal boundaries.

Additionally, the simulation results show that within the enacted seven-member district plan, District 4 packs African-American population to an extent that is not possible under a race-neutral districting process that follows traditional districting criteria. The 54.3% Black share of District 4's population is a racial outcome that falls completely outside of the entire range of districts created by the computer simulation districting process, suggesting that race was a motivating factor in the drawing of this district. However, we wish to evaluate whether race was the *predominant* factor in the General Assembly' drawing of District 4. Thus, I conduct an additional simulation analysis that predicts how District 4 *would* have been drawn had the General Assembly been motivated primarily by a *non-racial* factor, such as a partisan desire to pack Democratic voters to achieve District 4's 19.2% Republican share of the electorate. The simulation results demonstrate that under such a *partisan-motivated* but *race-neutral* district-drawing process, District 4 would have emerged with 45% to 53% Black population. District 4's Black population of 54.3% is a statistical outlier falling completely outside of this simulated distribution, demonstrating that racial packing, not partisanship motivations, predominated in the General Assembly's drawing of District 4.

I begin with an explanation of the logic of the districting simulation approach, followed by an overview of the simulation technique. Next, I present the results of the simulations and demonstrate that the population deviations in the enacted districting plans are associated with a significantly more favorable distribution of seats in favor of Republican candidates. Finally, I analyze the predominance of race as a factor in the drawing of District 4.

The Logic of Redistricting Simulations

When an enacted districting plan is challenged in court, judges face a difficult challenge in assessing the intent of the map-drawers, especially regarding partisan and racial motivations. The central problem is that the mere presence of partisan bias or racially segregated districts may tell us very little about the intentions of those drawing the districts. Whenever political representation is based on winner-take-all districts, asymmetries between votes and seats can emerge merely because one party's supporters are more clustered in space than those of the other party. When this happens, the party with a more concentrated support base achieves a smaller seat share because it racks up large numbers of "surplus" votes in the districts it wins, while falling just short of the winning threshold in many of the districts it loses. This can happen quite naturally in cities due to such factors as racial segregation, housing and labor markets, transportation infrastructure, and residential sorting by income and lifestyle.

In order to make informed and precise inferences about the presence or absence of partisan and racial intent during the redistricting process, it is necessary to compare the General Assembly's enacted districting plans against a standard that is based on a non-partisan, race-neutral districting process following traditional redistricting criteria. The crucial question is whether, due to underlying patterns of political and racial geography, the political and racial outcomes distributions created by an enacted districting plan could have plausibly emerged from a non-partisan and race-neutral districting process.

By randomly drawing districting plans with a process designed to optimize on traditional districting criteria, the computer simulation process gives us a precise indication of the range of districting plans that plausibly and likely emerge when map-drawers are not motivated primarily by partisan and racial goals. By comparing the enacted plans against the range simulated plans with respect to partisan and racial measurements, we are able to precisely determine when, and to what extent, a map-drawer's deviation from traditional districting criteria, such as population equality, was motivated by partisan and racial goals.

In simulating districting plans for Wake County, the computer algorithm follows four traditional districting criteria:

1) *Population Equality:* Wake County's 2010 Census population was 900,993, so districts in the seven-member plan have an ideal population of 128,713, while each of the two super-districts has an ideal population of 450,497. The computer simulation algorithm is designed to draw 7-district plans such that every district is within 1% of the ideal district population, and 2-district simulated plans contain districts that are within 0.3% of the ideal population.

Throughout this report, I measure the overall population deviation of districting plans using the formula defined in *Daly v. Hunt* (4th Cir. 1996).[1] Using this formula, the simulated 7-

[1] "To determine compliance with the one person, one vote principle courts usually analyze the apportionment plan in terms of the maximum population deviation among the districts. Generally, to calculate maximum deviation, the court first constructs a hypothetical ideal district by dividing the total population of the political unit (e.g., state or county) by the total number of representatives who serve that population. Then, the court determines how much the

district plans in this report achieve an overall population deviation ranging from 0.5% to 2.0%, indicating that the difference between the most-populated and least-populated district in any simulated plan is never greater than 2% of the ideal district population. By comparison, the General Assembly's enacted 7-district plan has an overall population deviation of 7.11%, with districts ranging from 96.5% to 103.6% of the ideal district population.

The computer-simulated 2-district plans in this report achieve an overall population deviation ranging from 0.0% to 0.3%. In other words, the most and least-populated districts created by the simulations deviate from the ideal district population by no more than 0.3%. By comparison, the General Assembly enacted a two super-district plan in which district "A" is overpopulated by 4.9%, and district "B" is underpopulated by 4.9%, resulting in an overall population deviation of 9.8%.

Table 1: Municipalities Kept Intact in Enacted and Simulated Districting Plans

Municipalities Kept Intact in Enacted 7-district Plan (S.L. 2013-110 and 2015-4)	Municipalities Kept Intact in All Computer Simulations of 7-District Plans
Angier town (District 7)	Angier town
Wendell town (District 1)	Fuquay-Varina town
Zebulon town (District 1)	Knightdale town
	Morrisville town
	Rolesville town
	Wake Forest town
	Wendell town
	Zebulon town

Municipalities Kept Intact in Enacted 2 Super-District Plan (S.L. 2013-110 and 2015-4)	Municipalities Kept Intact in All Computer Simulations of 2-District Plans
Angier town (District B)	Angier town
Fuquay-Varina town (District B)	Apex town
Rolesville town (District B)	Fuquay-Varina town
Wendell town (District B)	Holly Springs town
Zebulon town (District B)	Knightdale town
	Morrisville town
	Rolesville town
	Wake Forest town
	Wendell town
	Zebulon town

actual population of each district varies from the population of the ideal district. This deviation is expressed as a percentage of the ideal population. Maximum deviation is the sum of the absolute value of the deviation of the district with the smallest population and that of the district with the largest population." Daly v. Hunt, 93 F.3d 1212, 1215 n.2 (4th Cir. 1996).

Table 2: Precincts Split into Two or More Districts
In Enacted and Simulated Districting Plans
(Analysis Performed Using November 2014 Precinct Boundaries and 2010 Census VTDs)

Split Precincts in Computer Simulations of 7-District Plans	Split Precincts in Enacted 7-district Plan (S.L. 2013-110 and 2015-4)	Split VTDs in Enacted 7-district Plan (S.L. 2013-110 and 2015-4)
(none)	Precinct 16-01 (Districts 1 and 4)	VTD 16-01 (Districts 1 and 4)
	Precinct 16-06 (Districts 1 and 4)	VTD 16-06 (Districts 1 and 4)
	Precinct 16-09 (Districts 1 and 4)	VTD 16-09 (Districts 1 and 4)
	Precinct 16-08 (Districts 1 and 4)	VTD 16-08 (Districts 1 and 4)
	Precinct 17-03 (Districts 1 and 4)	VTD 17-03 (Districts 1 and 4)
	Precinct 15-02 (Districts 6 and 7)	VTD 16-04 (Districts 1 and 4)
	Precinct 15-04 (Districts 1 and 7)	VTD 17-08 (Districts 1 and 4)
	Precinct 16-04 (Districts 1 and 4)	VTD 17-02 (Districts 1 and 4)
	Precinct 17-08 (Districts 1 and 4)	VTD 16-03 (Districts 1 and 4)
	Precinct 17-02 (Districts 1 and 4)	VTD 17-04 (Districts 1 and 4)
	Precinct 16-03 (Districts 1 and 4)	
	Precinct 17-04 (Districts 1 and 4)	
	Precinct 19-15 (Districts 1 and 2)	
	Precinct 07-03 (Districts 2 and 5)	
	Precinct 19-14 (Districts 1 and 2)	

Split Precincts in Computer Simulations of 2-District Plans	Split Precincts in Enacted 2 Super-District Plan (S.L. 2013-110 and 2015-4)	Split VTDs in Enacted 2 Super-District Plan (S.L. 2013-110 and 2015-4)
(none)	Precinct 01-30 (Districts A and B)	VTD 16-01
	Precinct 16-01 (Districts A and B)	VTD 16-06
	Precinct 16-06 (Districts A and B)	VTD 16-09
	Precinct 16-09 (Districts A and B)	VTD 16-08
	Precinct 16-08 (Districts A and B)	VTD 17-03
	Precinct 17-03 (Districts A and B)	VTD 01-18
	Precinct 01-18 (Districts A and B)	VTD 18-04
	Precinct 18-04 (Districts A and B)	VTD 13-05
	Precinct 20-12 (Districts A and B)	VTD 16-05 (Split involves an unpopulated area)
	Precinct 13-05 (Districts A and B)	
	Precinct 16-04 (Districts A and B)	VTD 16-04
	Precinct 17-08 (Districts A and B)	VTD 17-08
	Precinct 17-02 (Districts A and B)	VTD 17-02
	Precinct 19-17 (Districts A and B)	VTD 19-17
	Precinct 19-04 (Districts A and B)	VTD 19-04
	Precinct 09-01 (Districts A and B)	VTD 09-01
	Precinct 01-43 (Districts A and B)	VTD 01-43
	Precinct 16-03 (Districts A and B)	VTD 16-03
	Precinct 17-04 (Districts A and B)	VTD 17-04
	Precinct 10-04 (Districts A and B)	VTD 10-04
	Precinct 10-03 (Districts A and B)	VTD 10-03
	Precinct 10-02 (Districts A and B)	VTD 10-02

2) ***Holding Municipalities Intact***: Wake County contains, in part or in whole, 13 incorporated municipalities. The computer simulation process is designed to maximize the number of these municipalities that are kept intact and not split into two or more districts, so long as the population equality requirements are not violated. As detailed in Table 1, all of the seven-district plans simulated for this report successfully preserve intact eight municipalities: Angier, Fuquay-Varina, Knightdale, Morrisville, Rolesville, Wake Forest, Wendell, and Zebulon. Moreover, all of the simulations of two-district plans keep intact the boundaries of ten total municipalities: The originally listed eight municipalities, along with Apex and Holly Springs.

By comparison, as Table 1 illustrates, the General Assembly's enacted districting plans preserve a significantly smaller set of municipalities. The enacted seven-district plan keeps only Angier, Wendell, and Zebulon intact, while the enacted two super-district plan additionally preserves Fuquay-Varina and Rolesville intact.

3) ***Holding Precincts Intact***: As of November 2014, Wake County is divided into 200 voting precincts. The computer simulation algorithm uses these precincts as building blocks for constructing simulated districting plans. Therefore, in all simulated plans, each one of these 200 precincts is preserved intact and never split into multiple districts.

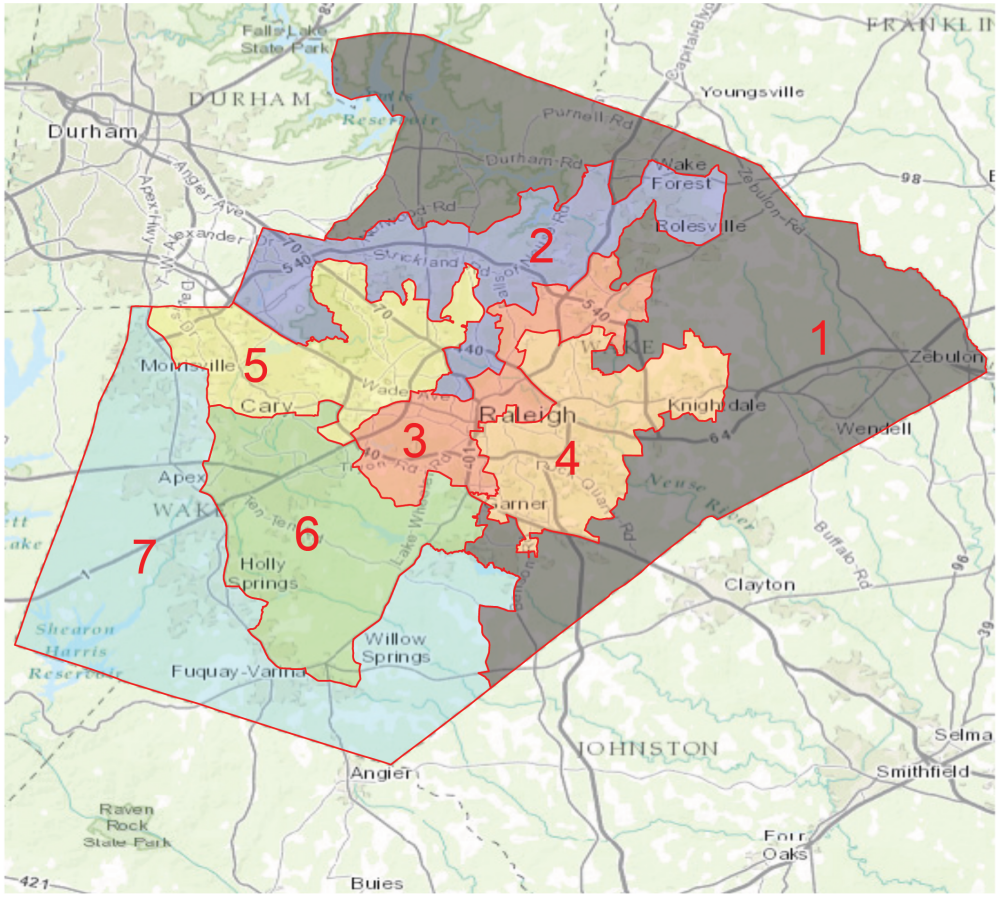
As Table 2 illustrates, the General Assembly's enacted districting plans split apart a significant number of precincts. The enacted seven-district plan splits apart 15 precincts, most of which are along the border between Districts 1 and 4, while the enacted two super-district plan splits apart 22 precincts. Even when analyzed using 2010 Census Voting Tabulation District (VTD) boundaries instead of 2014 precincts, the enacted seven-district plan splits apart 10 VTD's, while the two super-district plan splits apart 21 VTD's.

4) ***Geographic Compactness***: Beyond preserving precinct and municipal boundaries, the simulation algorithm prioritizes the drawing of geographically compact districts. To illustrate the contrast between the computer simulated and the General Assembly's enacted districting plans with respect to compactness, Figures 1 and 2 present maps showing examples of simulated districting plans. In Figure 1, the left map depicts the seven-district plan enacted by the General Assembly, while the map on the right is an example of a seven-district plan created by the computer simulations. In Figure 2, the left map shows the General Assembly's two super-district plan, while the map on the right displays and example of a computer simulated two-district plan.

The following section describes the simulation results and inferences about the motivations driving the General Assembly's population deviations in its districting plans.

Figure 1:

Enacted 7−District Plan:
(Session Laws 2013−110 and 2015−4)



Example of Computer−Simulated 7−District Plan:

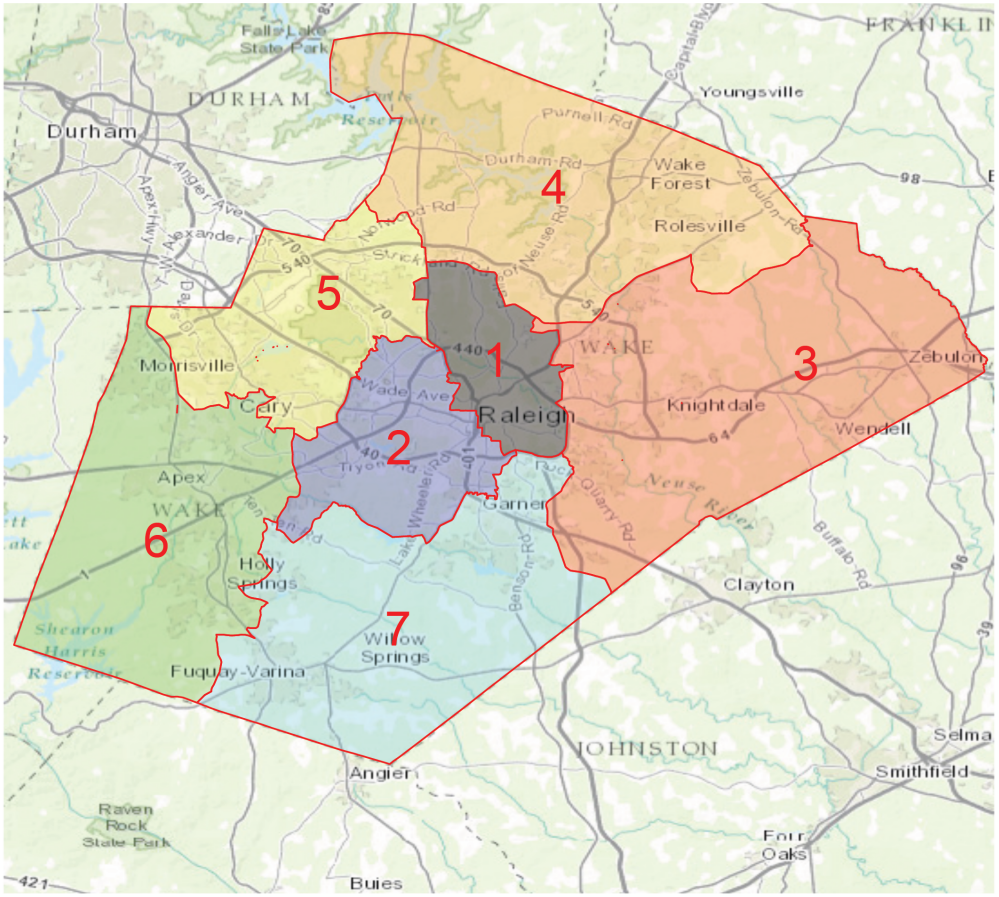
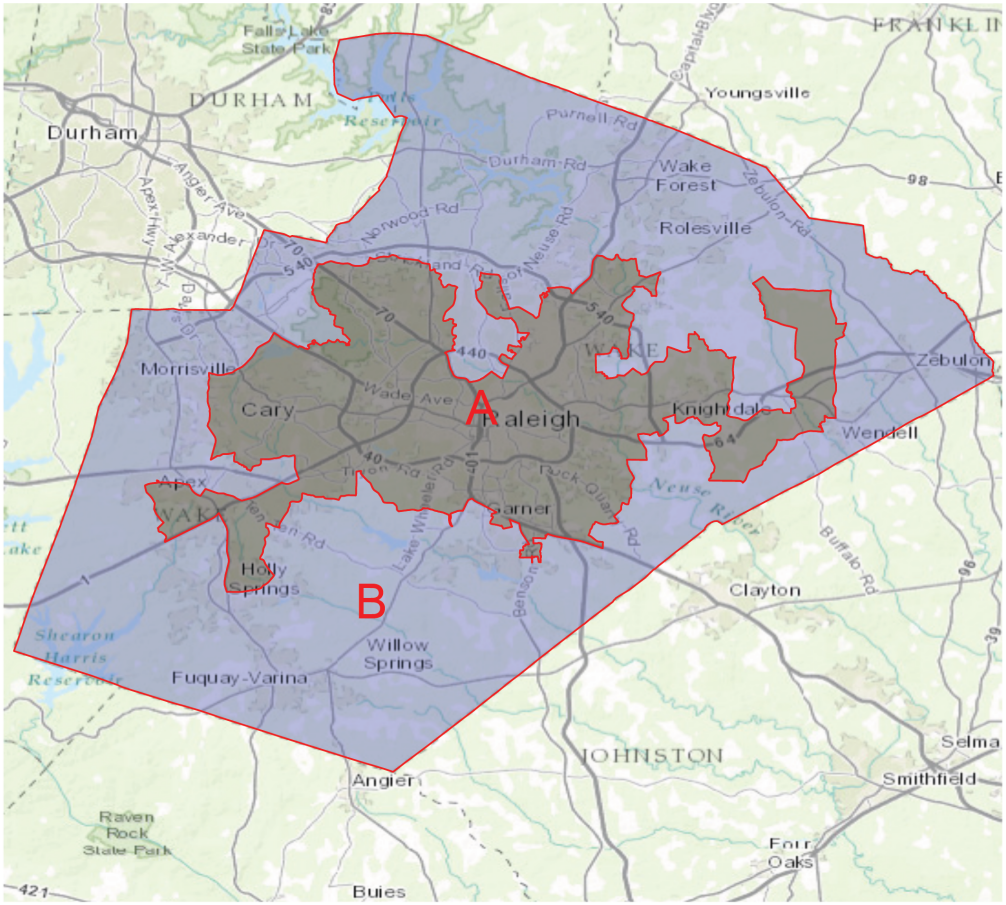
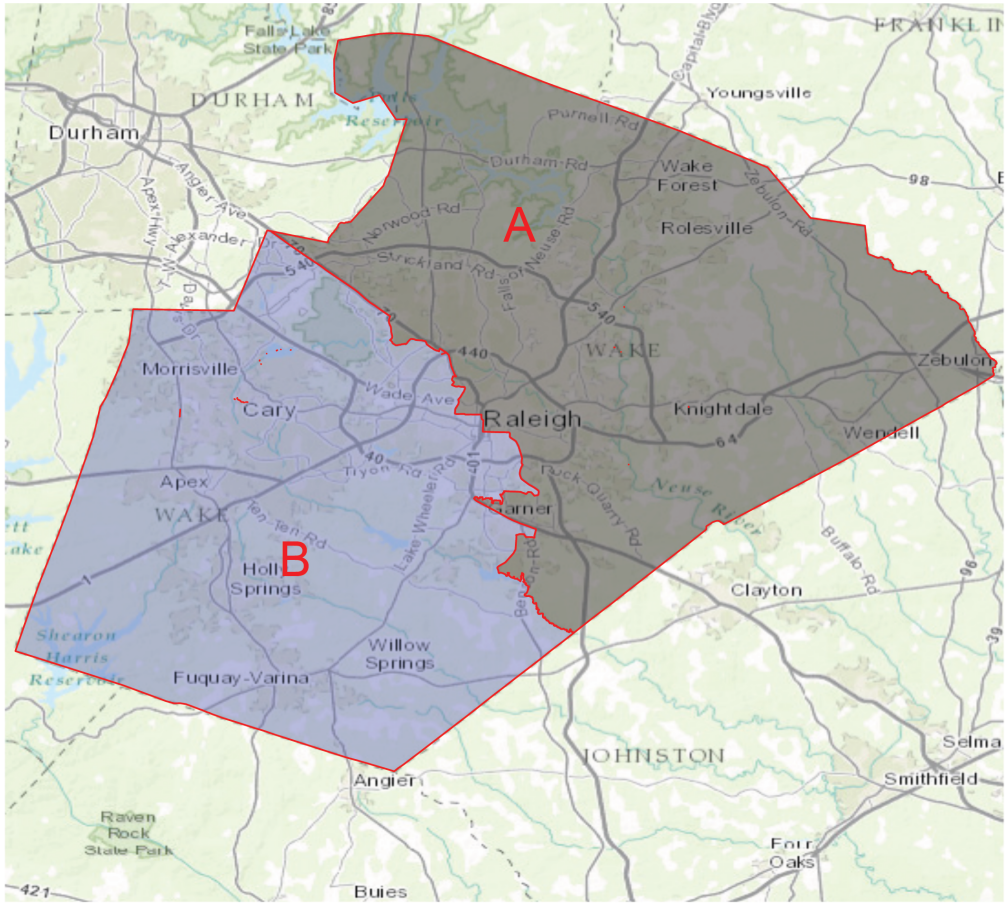


Figure 2:

Enacted 2 Super−District Plan:
(Session Laws 2013−110 and 2015−4)



Example of Computer−Simulated 2−District Plan:



Simulation Results

I conduct and report on two independent sets of simulations. First, I describe a set of 500 simulations, each dividing Wake County into two districts. A second set of 500 simulations draws plans dividing Wake County into seven equally-populated super-districts.

Simulations of Two-District Plans: To evaluate the General Assembly's enacted two super-district plan, I conduct 500 computer simulations of plans in which Wake County is divided into two districts. I then analyze the partisanship of each of these simulated districts by calculating the Republican candidates' share of 2-party votes in some recent elections. Specifically, I independently use three different sets of recent elections to measure the partisanship of the simulated districts: The 2014 Board of County Commissioners elections (choosing commissioners for Districts 1, 2, 3, and 7), the 2012 Board of County Commissioner elections (choosing commissioners for Districts 4 and 6), and the 2012 US Presidential Election. Although the 2012 County Commissioner elections also included a race for District 5's Commissioner, I exclude the results from the District 5 race because the winner, Democrat James West, ran uncontested.

Figure 3:

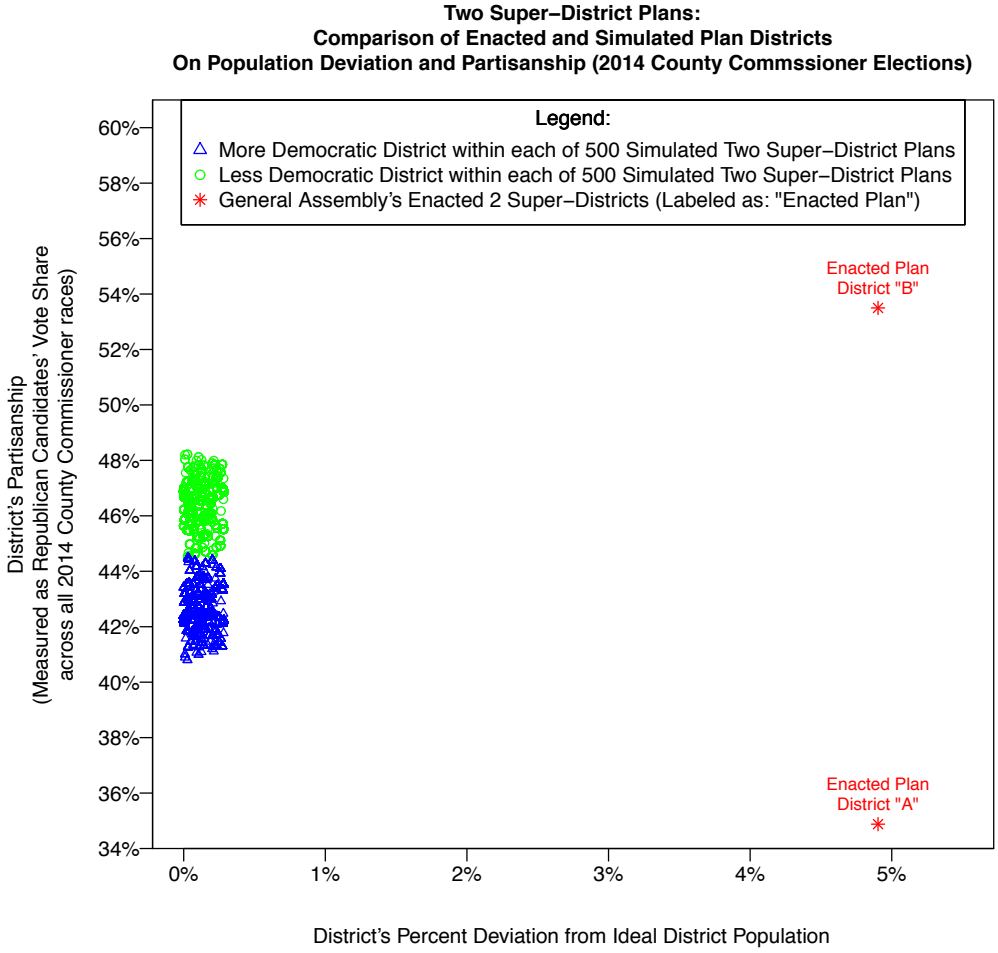


Figure 3 illustrates the simulation results when partisanship is measured using the 2014 Board of County Commissioners elections, during which Districts 1, 2, 3, and 7 had candidates running in county-wide races. The Figure 3 plot depicts both districts of each of 500 simulated two-district plans: The blue triangles represent the more Democratic-leaning district within each plan, while the green circles represent the less Democratic-leaning of each plan's districts. The two districts of the General Assembly's enacted two super-district plan are depicted with red stars. In Figure 3, the horizontal axis measures each district's percent deviation from the ideal district population of 450,497, while the vertical axis measures the partisanship of each district, defined as the Republican candidates' total share of election votes across the four County Commissioner races (Districts 1, 2, 3, and 7) in November 2014.

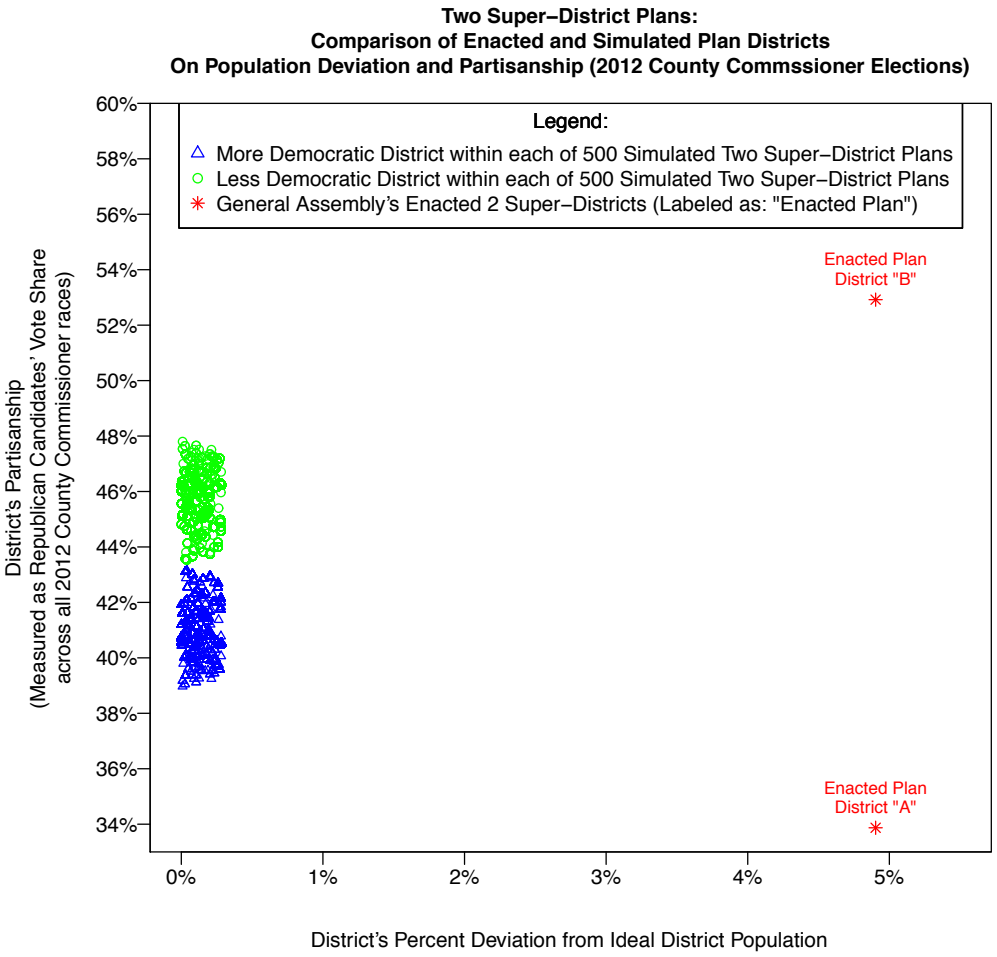
Two important findings are apparent in Figure 3. First, the General Assembly's two enacted super-districts are populated much more unequally than any of the simulated districts. The enacted districts "A" and "B" each have a population deviation of 4.9%, over 15 times greater than the population deviation observed in any of the 500 simulated districting plans.

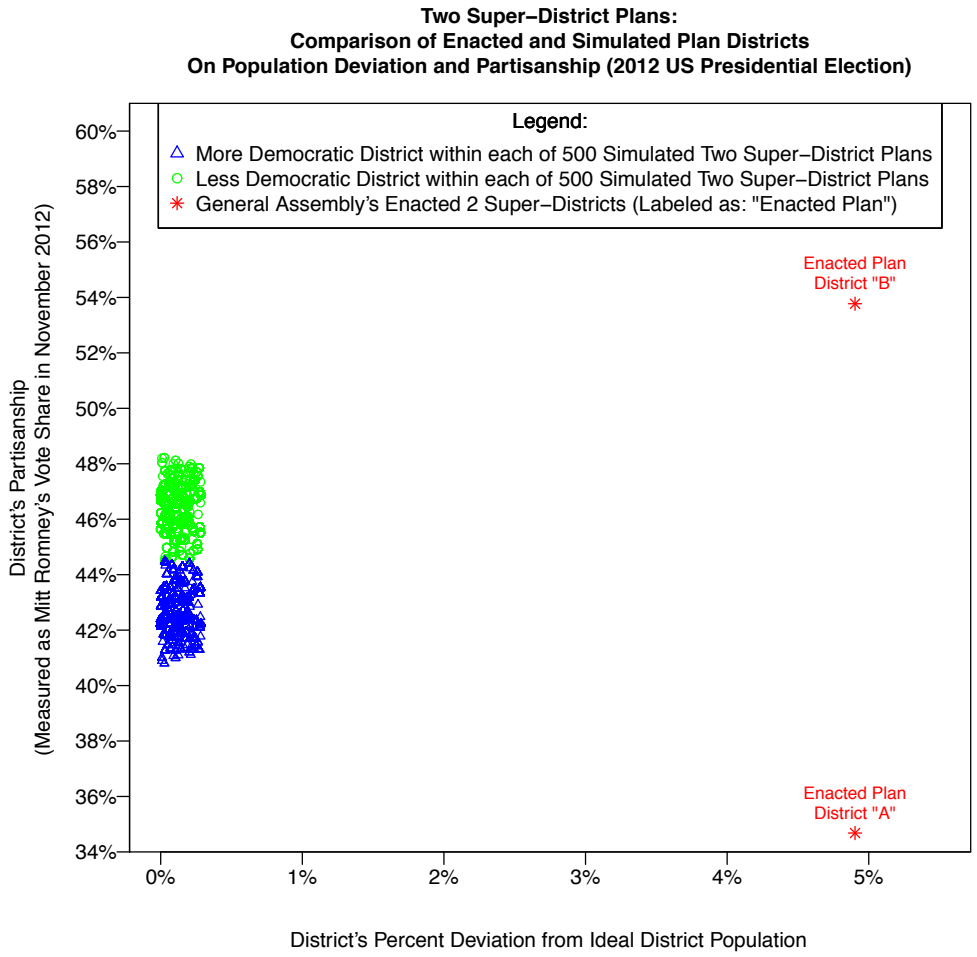
Second, these large deviations from equal population enable the enacted districting plan to achieve a partisan outcome that is entirely and very significantly outside of the range produced by the 500 simulated plans. Specifically, Figure 3 illustrates that every district in the 500 simulated two-district plans has a Republican vote share ranging from 40.8% to 48.2%. Compared against this baseline distribution of equally populated, non-partisan, race-neutral simulated plans, the General Assembly's plan creates two super-districts that are both extreme statistical outliers. The enacted plan's overpopulated District A, which has a 34.9% Republican vote share, and underpopulated District B, which has a 53.5% Republican vote share, are both over 9 standard deviations outside of the partisan distribution produced by the 500 districting simulations. Moreover, the electoral significance of District B's extreme deviation in the pro-Republican direction is apparent: Any non-partisan simulated two-district plan would have produced two moderately Democratic-leaning districts, but the General Assembly's efforts at under-populating and increasing the Republican share of District B allows a Republican candidate to win District B with some reliability.

Together, these results demonstrate with extremely high statistical confidence that the General Assembly's drawing of its unequally populated "A" and "B" Districts were motivated by an effort to achieve a particular partisan outcome in an underpopulated District B. The simulation results demonstrate that this partisan outcome in District B would not have been remotely possible had the districting plan been drawn using a non-partisan, compact map-drawing process with stricter adherence to population equality.

The plots in Figure 4 present similar analyses using the 2012 Board of County Commissioners elections (left plot) and the 2012 US Presidential election (right plot) to measure partisanship. Similar to Figure 3, these results illustrate that a partisan-neutral districting process that follows equal apportionment and other traditional districting criteria would have produced two districts, both with Republican vote shares under 48%. Hence, not a single one of the 500 simulations resulted in a two-district plan containing a Republican-leaning district, using any of the three elections as a measure of partisanship. Thus, these findings confirm and strengthen the original conclusion that the enacted two-district plan's significant deviations from population equality were motivated as part of an effort to achieve a partisan outcome that would have been statistically impossible under a non-partisan districting process adhering to population equality.

Figure 4


Two Super−District Plans:
Comparison of Enacted and Simulated Plan Districts
On Population Deviation and Partisanship (2012 County Commssioner Elections)
Legend:
More Democratic District within each of 500 Simulated Two Super−District Plans
Less Democratic District within each of 500 Simulated Two Super−District Plans
General Assembly's Enacted 2 Super−Districts (Labeled as: "Enacted Plan")
Enacted Plan District "B"
Enacted Plan District "A"
District's Partisanship (Measured as Republican Candidates' Vote Share across all 2012 County Commissioner races)
60%
58%
56%
54%
52%
50%
48%
46%
44%
42%
40%
38%
36%
34%
0%
1%
2%
3%
4%
5%
District's Percent Deviation from Ideal District Population


Two Super−District Plans:
Comparison of Enacted and Simulated Plan Districts
On Population Deviation and Partisanship (2012 US Presidential Election)
Legend:
More Democratic District within each of 500 Simulated Two Super−District Plans
Less Democratic District within each of 500 Simulated Two Super−District Plans
General Assembly's Enacted 2 Super−Districts (Labeled as: "Enacted Plan")
Enacted Plan District "B"
Enacted Plan District "A"
District's Partisanship (Measured as Mitt Romney's Vote Share in November 2012)
60%
58%
56%
54%
52%
50%
48%
46%
44%
42%
40%
38%
36%
34%
0%
1%
2%
3%
4%
5%
District's Percent Deviation from Ideal District Population

Simulations of Seven-District Plans: I conduct a separate set of 500 computer simulations of plans in which Wake County is divided into seven districts in order to evaluate the General Assembly's enacted seven-member district plan. As before, these simulations are constrained to producing districts within 1% of the ideal district population, keep intact the eight municipalities listed in Table 1, keep intact all precincts, and otherwise maximize geographic compactness. I analyze the partisanship of these 500 simulated plans' districts using the same three sets of election results as before: The 2014 and 2012 Board of County Commissioners elections and the 2012 US Presidential Election.

Figure 5:

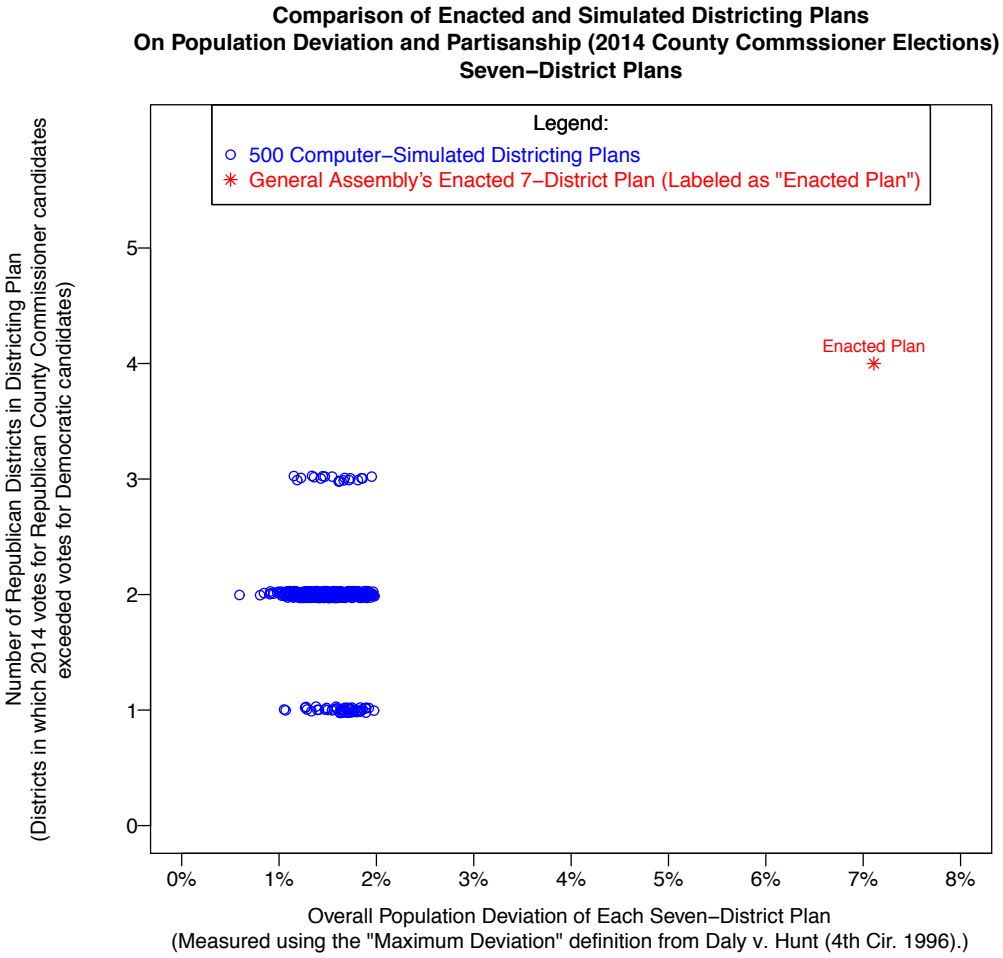


Figure 5 illustrates the simulation results when partisanship is measured using the 2014 Board of County Commissioners elections, during which Districts 1, 2, 3, and 7 had candidates running in county-wide races. To evaluate each 7-district simulated plan, I count up the number of districts within each plan in which votes for the four Republican candidates in these races exceeded votes for the four Democratic candidates.

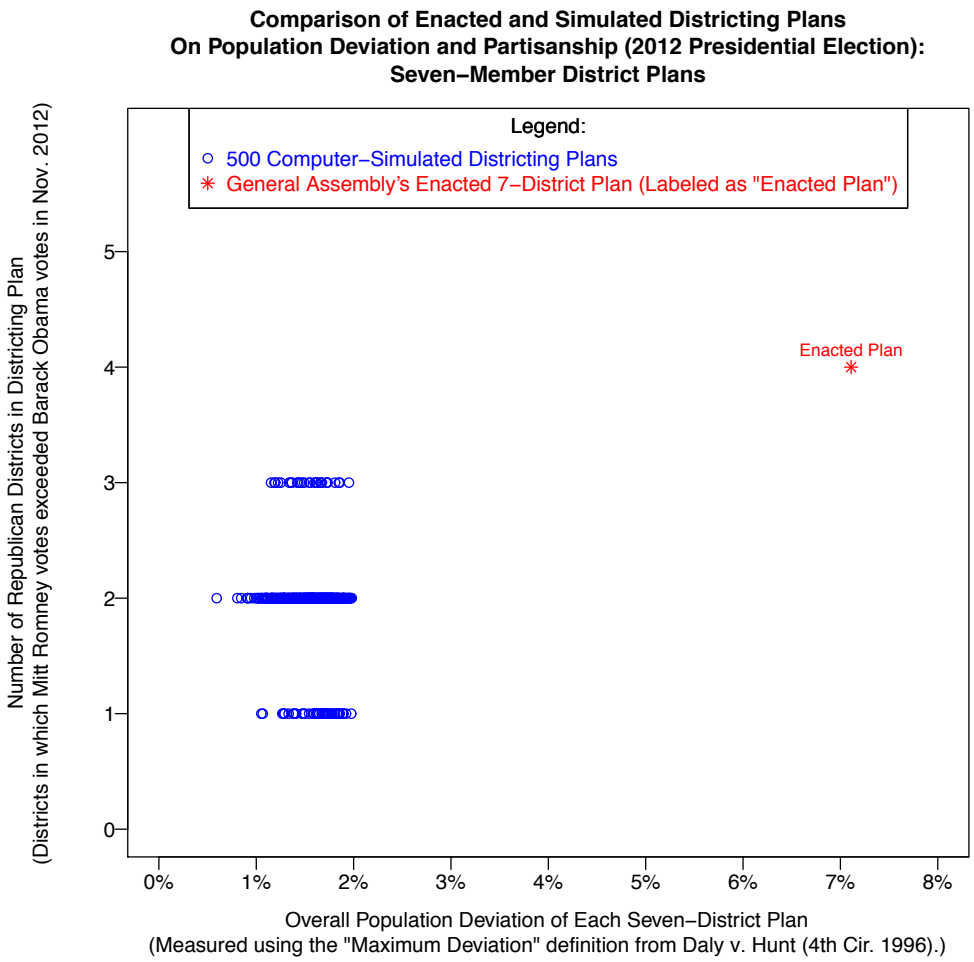
Each of the blue circles in Figure 1 represents a single simulated districting plan, and the red star represents the General Assembly's enacted seven-member districting plan. The vertical axis depicts the number of Republican-leaning districts created by each districting plan, while the

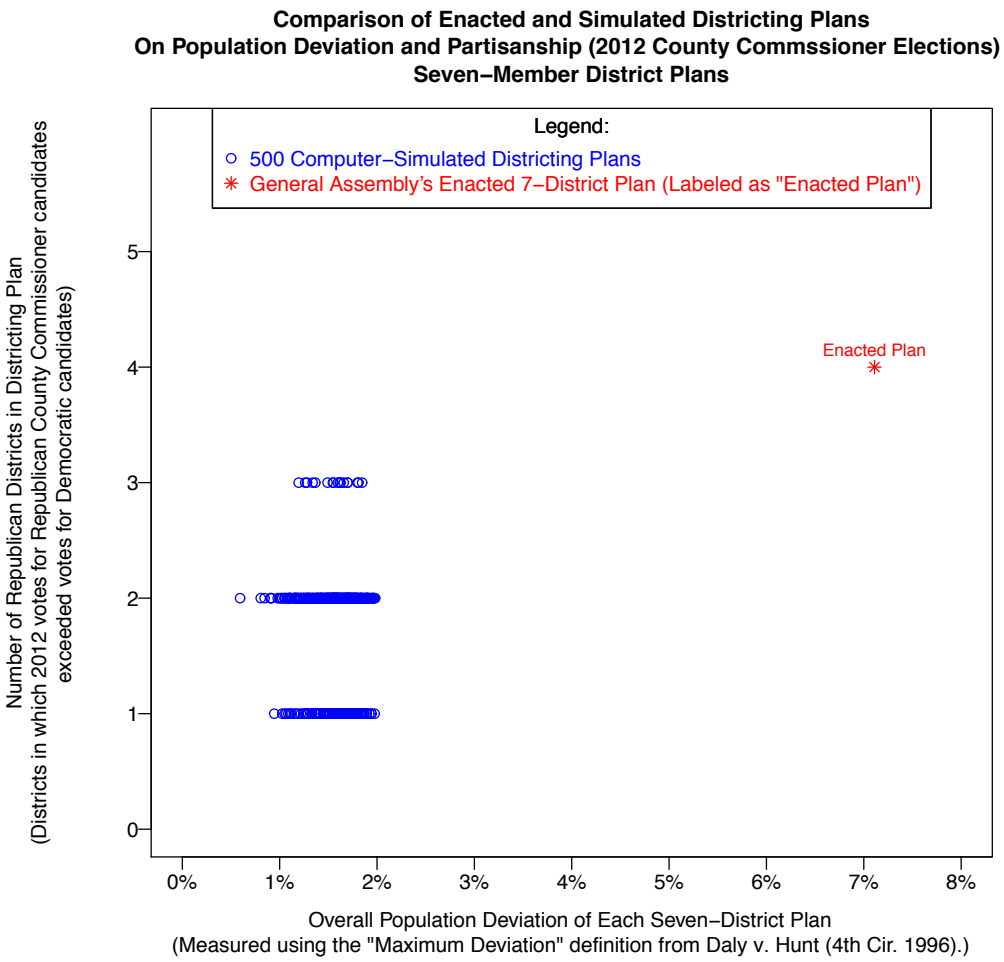
horizontal axis depicts the average population deviation across the seven districts in each plan. As Figure 1 illustrates, 430 of the 500 simulations create exactly two Republican-leaning districts. A small minority (50 of 500 simulations) create only one Republican district, and an even smaller fraction (20 of 500 simulations) create three Republican districts. Moreover, the blue circles illustrate that the simulated plans have an average population deviation ranging from approximately 0.25% to 0.75%. Hence, these results illustrate that a non-partisan districting process respecting equal apportionment and other traditional districting criteria will generally result in two Republican seats out of seven districts, although three Republican districts is occasionally possible as well.

In light of these simulation results, the red star in Figure 5 illustrates that the General Assembly's enacted seven-member districting plan is clearly a statistical outlier in two ways: First, the populations of the enacted plan's districts deviate much more significantly from the ideal district population, producing an overall population deviation of 7.11%. Second, as a result of these significantly higher population deviations, the enacted plan is able to produce a total of four Republican-leaning districts, an outcome which is completely outside of the partisan distribution produced by the simulated plans. Together, these statistical results demonstrate that the enacted plan's deviations from a stricter level of population equality were motivated by an effort to achieve an unusual level of Republican partisan control over four districts. This effort would not have been possible under a process that followed traditional districting criteria more strictly.

The plots in Figure 6 present similar analyses using the 2012 Board of County Commissioners elections (left plot) and the 2012 US Presidential election (right plot) to measure partisanship. Similar to Figure 5, these results illustrate that a partisan-neutral districting process that follows equal apportionment and other traditional districting criteria would have generally produced two Republican-leaning districts. The simulations occasionally produce as many as three Republican districts but never produce more than three. Together with the fact that the enacted seven-member plan creates four Republican districts using either of these elections as a measure of partisanship, these findings confirm and strengthen the conclusion that the enacted plan's deviations from population equality were motivated by an effort to produce a statistically extreme partisan distribution across districts that would not have been possible under a non-partisan districting process constrained by equally populated districts.

Figure 6:

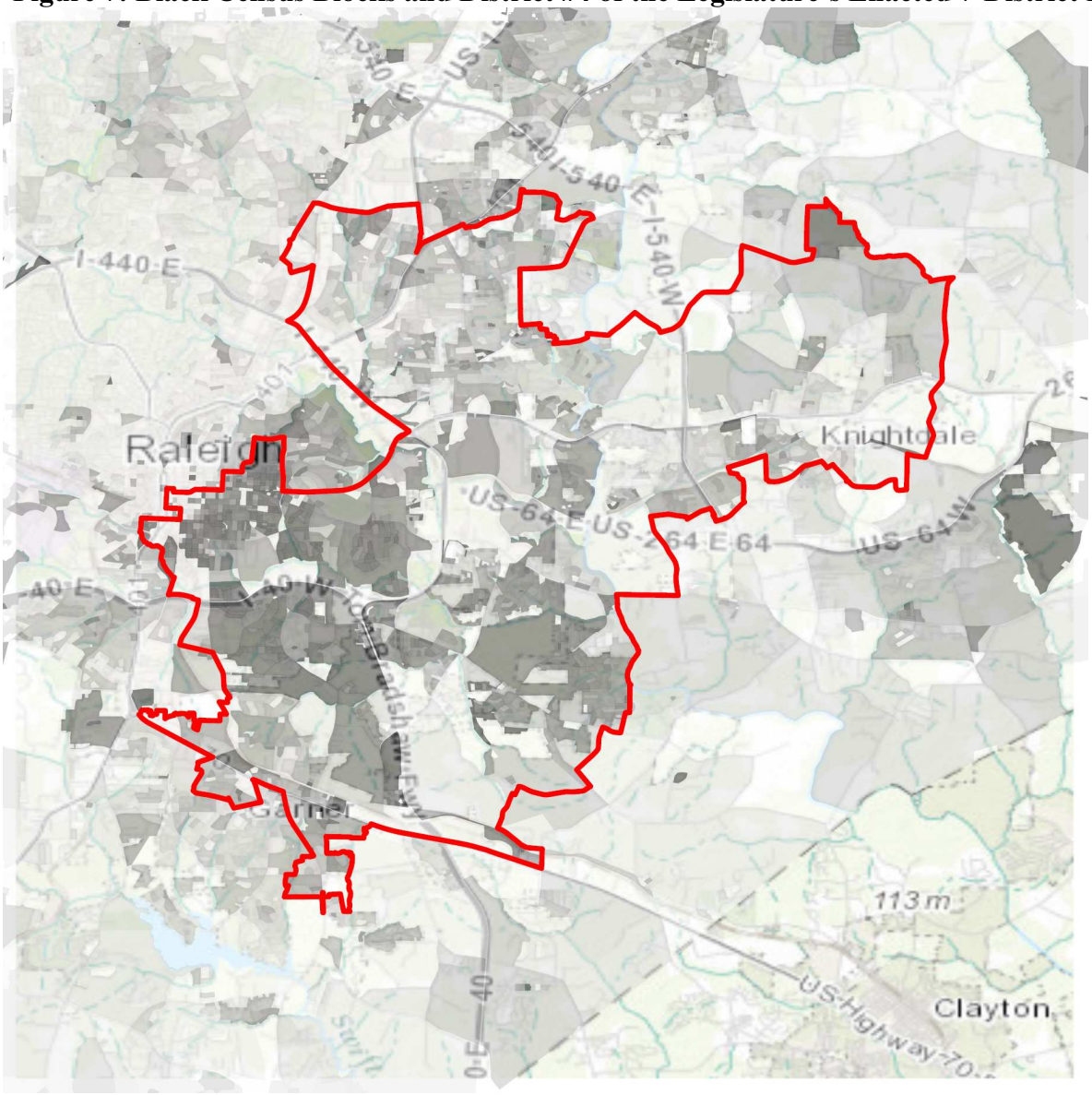

Comparison of Enacted and Simulated Districting Plans
On Population Deviation and Partisanship (2012 Presidential Election):
Seven−Member District Plans
Legend:
500 Computer−Simulated Districting Plans
General Assembly's Enacted 7−District Plan (Labeled as "Enacted Plan")
Enacted Plan
Number of Republican Districts in Districting Plan
(Districts in which Mitt Romney votes exceeded Barack Obama votes in Nov. 2012)
0
1
2
3
4
5
0%
1%
2%
3%
4%
5%
6%
7%
8%
Overall Population Deviation of Each Seven−District Plan
(Measured using the "Maximum Deviation" definition from Daly v. Hunt (4th Cir. 1996).)


Comparison of Enacted and Simulated Districting Plans
On Population Deviation and Partisanship (2012 County Commssioner Elections)
Seven−Member District Plans
Legend:
500 Computer−Simulated Districting Plans
General Assembly's Enacted 7−District Plan (Labeled as "Enacted Plan")
Enacted Plan
Number of Republican Districts in Districting Plan
(Districts in which 2012 votes for Republican County Commissioner candidates
exceeded votes for Democratic candidates)
0
1
2
3
4
5
0%
1%
2%
3%
4%
5%
6%
7%
8%
Overall Population Deviation of Each Seven−District Plan
(Measured using the "Maximum Deviation" definition from Daly v. Hunt (4th Cir. 1996).)

Racial Intent and District 4 of the Enacted Seven-District Plan

District 4 of the General Assembly's enacted seven-district plan has a black proportion of 54.3% and a Republican vote share of 19.2% (2012 County Commissioner elections). Among all of the districts in the enacted plan, District 4 is particularly noteworthy because of the nature of its statistical deviations from the 500 simulated districting plans described in this report. In analyzing the enacted seven-district plan, I visually inspected the borders of each district to evaluate how these district boundaries were drawn relative to the unique political and racial geography of Wake County. Unlike much of the borders throughout the remainder of the enacted plan, some of District 4's borders appear to follow along racial, rather than partisan, delineations.

Figure 7: Black Census Blocks and District #4 of the Legislature's Enacted 7-District Plan



Note: Red lines depict the boundaries of District #4. Census blocks are shaded in grayscale, such that darker areas depict census blocks with higher proportions of black population.

Figure 7 illustrates this pattern clearly. The map in Figure 7 depicts the racial geography of the area spanning from downtown Raleigh to Wendell and the eastern portion of Wake County. Census blocks are shaded on this map, with darker areas depicting blocks with higher black proportions and lighter-colored areas representing whiter populations. The boundaries of District 4 of the General Assembly's enacted plan are outlined in red.

Much like other industrialized US cities, Raleigh exhibits a typical pattern of urban racial segregation, with black residents concentrated in downtown and Southeast Raleigh, while Western and Northern Raleigh are composed of significantly whiter neighborhoods. The boundaries of District 4 closely follow the contours of neighborhoods with heavily black population, particularly in the northwestern portion of downtown Raleigh and along the outer edges of Southeast Raleigh. These patterns, combined with the moderately non-compact shape of District 4, are suggestive of a district drawing process that was cognizant of the racial geography of eastern Wake County, although they are certainly not conclusive evidence of any racial motivation.

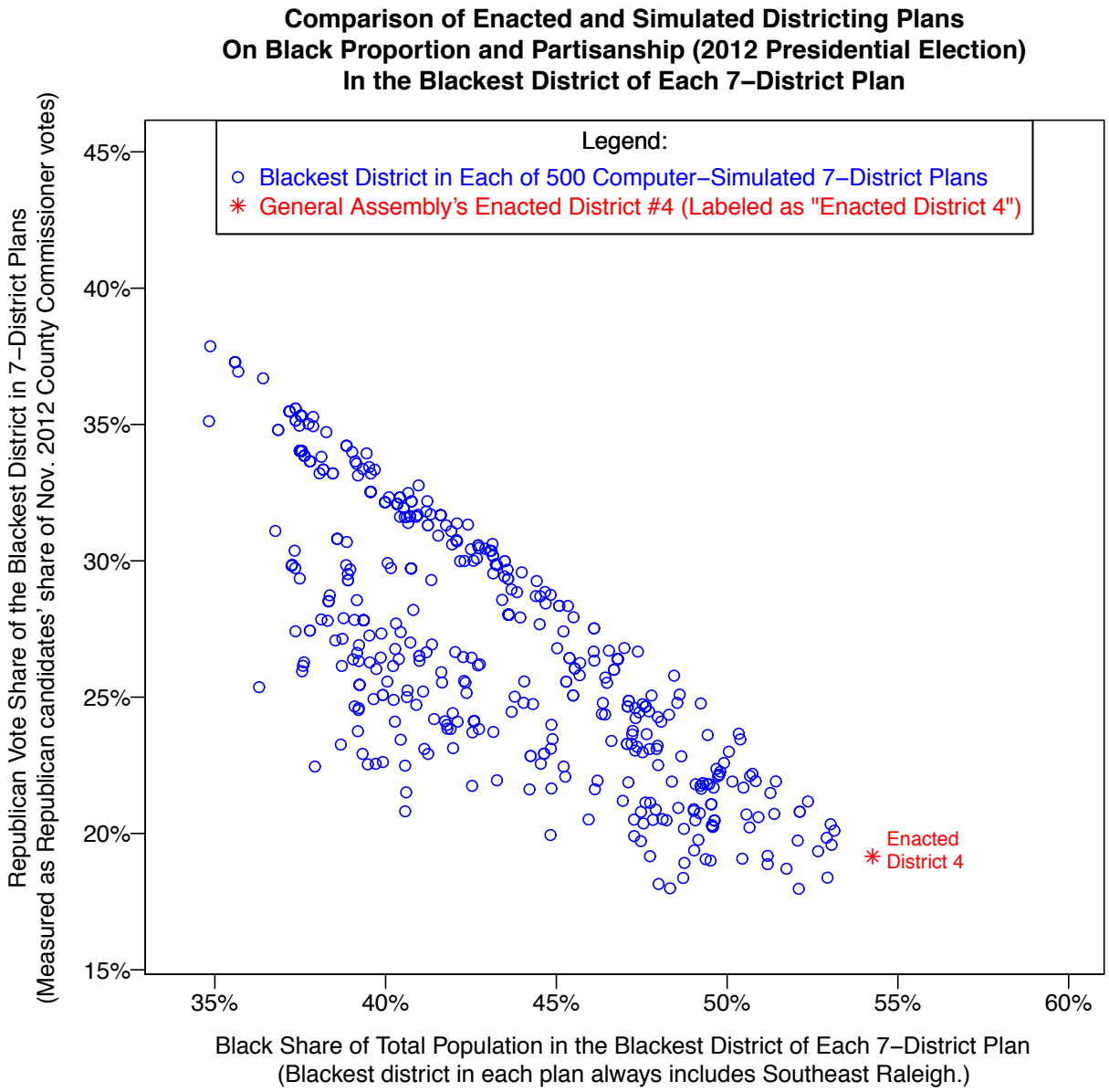
A more definitive evaluation the possible racial motivations behind the drawing of District 4 requires analyzing the following hypothetical: How might District 4 have been racially composed if the General Assembly had been motivated primarily by *non-racial* considerations, such as partisan goals, in the drawing of the district's boundaries? After determining the distribution of racial compositions for District 4 that could plausibly emerge under such a non-racial map-drawing process, I then evaluate whether the *actual* racial composition of District 4 falls within the normal range of this distribution. In other words, my approach is to determine whether the racial composition of District 4 is consistent with a district drawn by a non-racially motivated districting process. If it is not consistent, I then evaluate whether the statistical evidence significantly suggests a racial motivation in the drawing of the district.

To analyze District 4 in this manner, I begin with the same 500 simulations of seven-district plans presented previously in this report. Within each simulation, I identify the blackest district among the seven simulated districts, which generally covers the southeastern Raleigh area. These 500 blackest simulated districts represent alternative versions of how District 4 would have been drawn under a race-neutral, non-partisan districting process respecting traditional districting criteria. For each of these 500 blackest districts, I calculate the district's partisanship as the total Republican share of votes in the 2012 County Commissioner races.

The racial and partisan characteristics of these 500 blackest simulated districts are illustrated in Figure 8. This Figure demonstrates that the General Assembly's enacted District 4 is a clear statistical outlier in terms of racial composition: The simulated blackest districts have a black population share ranging from 34.8% to 53.1%. In the enacted District 4, blacks comprise 54.3% of the total population, a percentage completely outside of the range of the simulated distribution. This finding simply demonstrates with extremely high statistical confidence that District 4 was not drawn in a race-neutral manner.

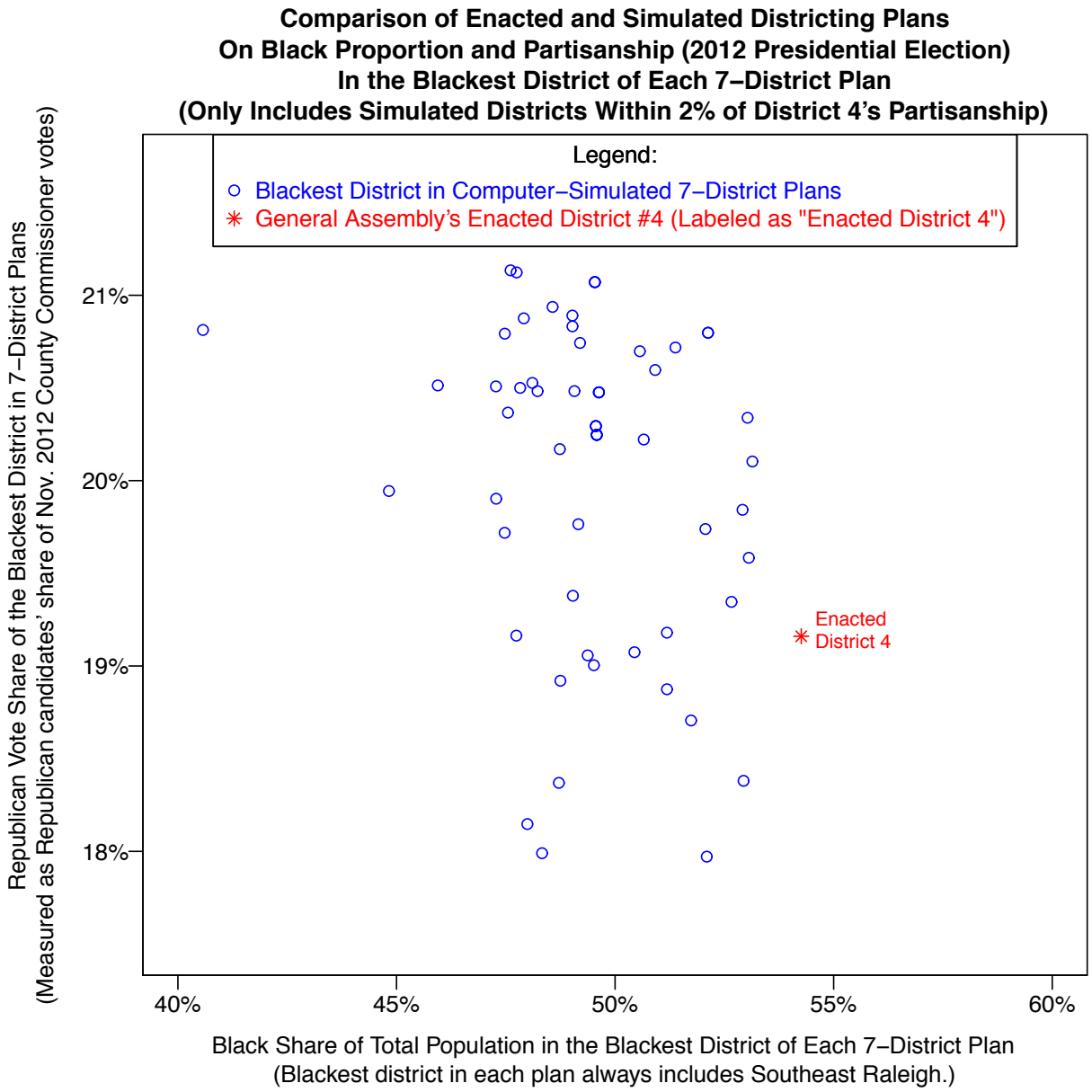
But my goal is not merely to determine whether race was a factor in the drawing of District 4. Instead, the important question I wish to answer is whether race was the predominant factor in the drawing of the district, or whether a partisan, non-racial motivation could have accounted for the statistically unusual racial composition of District 4. In other words, it is important to fully evaluate the possibility that the General Assembly was motivated primarily by partisan intent to create a district containing the particular partisan breakdown exhibited in District 4.

Figure 8:



To evaluate a possible partisan motivation for the drawing of District 4, we confine our attention to a subset of the 500 blackest simulated districts depicted in Figure 8. Specifically, we focus on only those blackest simulated districts from Figure 8 that have a partisan composition very similar to that of District 4's 19.2% Republican vote share, as measured by the 2012 County Commissioner elections. As depicted in Figure 9, there are 60 simulations in which the blackest district contained a partisan composition within 2% of the enacted District 4's 19.2% Republican partisanship. These 60 simulations thus represent the sorts of districts that would have emerged under a race-neutral districting process respecting traditional districting criteria, assuming that the General Assembly's partisan goal was to create 19.2% Republican district

Figure 9:

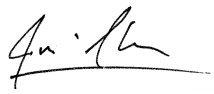


Having identified these 60 simulated districts in Figure 9 with a partisanship similar to District 4, we now consider the racial distribution produced by such a partisan-motivated but race-neutral districting process. As Figure 9 illustrates, these 60 simulated districts have a black population share ranging from 40.6% to 53.1%. By comparison, the General Assembly's District 4 has a black population share of 54.3%, which is completely outside of the distribution produced by the race-neutral but partisan-motivated simulation process. Hence, we can not only conclude with extremely high statistical confidence that the racial packing of black residents was the predominant factor in the drawing of District 4, but we can also rule out the possibility that a possible partisan goal might have caused the extreme racial composition of the district.

Conclusion

By randomly producing a large number of valid districting plans under a race-neutral, non-partisan map-drawing process following traditional districting criteria, we are able to discover not merely the ways in which an enacted districting plan deviates from traditional districting criteria, but also the motivations for such deviations. Using computer simulations to generate a large baseline sample of valid plans, this report demonstrates that the population deviations exhibited in the General Assembly's two-district and seven-district plans were motivated by an effort to achieve partisan control over a statistically unusual number of districts in the two enacted plans. Additionally, District 4 of the seven-district plan exhibits a racial composition that represents not an effort to manipulate the district's partisanship, but rather an intentional racial packing of black residents that went beyond what could be explained as a partisan effort. Instead, District 4's racial makeup can only be explained as an effort, motivated predominantly by racial considerations, to create a district with a statistically outlying racial composition.

The foregoing is true and correct to the best of my knowledge.



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