

EXHIBIT A

Second declaration concerning Tennessee Congressional redistricting

Moon Duchin

June 30, 2026

1 Background and qualifications

I am a Professor of Data Science and Computer Science at the University of Chicago. I hold a Ph.D. from Chicago and an A.B. from Harvard University. I have provided reports and/or testimony in numerous redistricting matters.

My general research areas are discrete geometry and the applications of mathematics and computing to the study of democratic systems. My research has had major grant support from the National Science Foundation, including a CAREER grant from 2013–2018 and a Convergence Accelerator grant from 2019–2021 entitled "Network Science of Census Data." I was elected a Fellow of the American Mathematical Society in 2017 and was named both a Radcliffe Fellow and a Guggenheim Fellow in 2018. Case citations and further professional details are available on the CV that is included with this report.

2 Response

Dr. Michael Barber has provided two recent reports for Tennessee Congressional redistricting, Report A (undated, but filed May 27, 2026) and Report B (dated June 22 and filed June 23, 2026).¹ In Report A, he conducts his own ensemble analysis of the districts in the Memphis area, but this work has numerous problems that I will document below. In Report B, he offers an analysis of the ensemble work in my report dated June 8, 2026.

In my previous declaration, I compared two simple objective-seeking approaches to redistricting in Tennessee. I also presented the neutral baseline of maps that are blind to race and party. It is striking that Tennessee is one of the few states in the nation in which a race-blind, party-blind process would usually contain a majority-Black district. This is the only purpose of the fully neutral ensemble: to establish that baseline, from which the state departed in its use of partisan and/or racial objectives.

Dr. Barber is quite mistaken in thinking that graph algorithms *simulate* human map-making, as when he says that "what we would expect to see if millions of people were asked to produce a map from a relatively blank slate that followed some of the basic traditional redistricting criteria, without considering partisanship or race." Rather, they provide a sample of valid redistricting plans; the choice of a good algorithm allows the drawing of a representative sample of plans according to a distribution of weight on the plans. His own ensemble work falls well short of this standard.

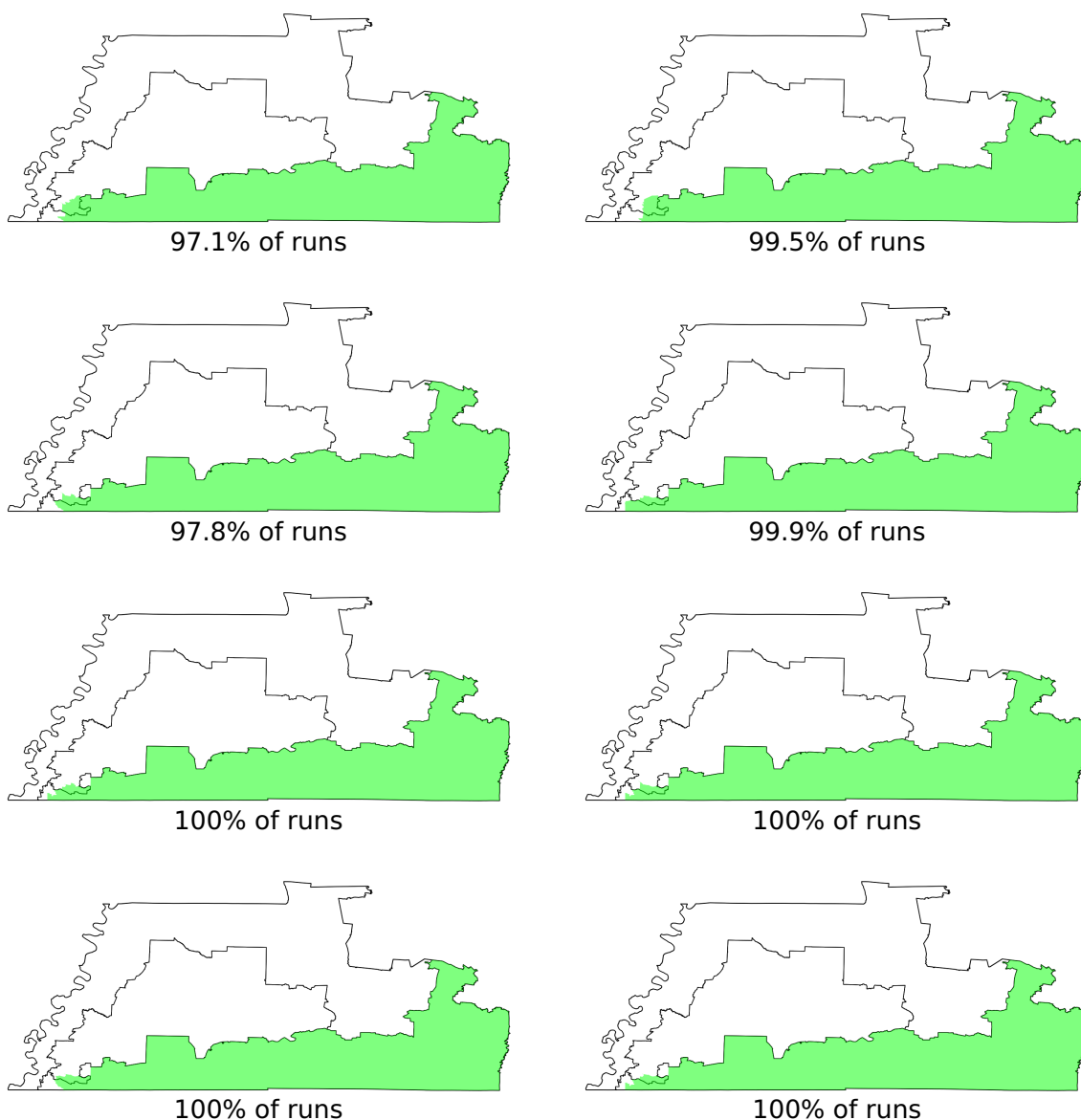
¹Report A is Case 3:26-cv-00616 Document 43-3; Report B is Case No. 3:26-cv-00638 Document 37-2.

2.1 Flaws in Barber methods and analysis

- **Faulty ensembles giving poor sample.** Dr. Barber's own ensemble work (Report A) fails to provide a representative sample because it is highly over-constrained: he has frozen 35 out of 36 counties in place, then varied lines within Shelby using coarse pieces and a narrow population range. This means that the three-way split of Shelby, with the population proportions found in the 2026 Plan, is forced rather than observed. This is not necessary to hit the partisanship target, as I will show below. While the method he employs is advertised to provide approximately independent samples, a replication run of Dr. Barber's code produces entire plans that appear identically as many as 4129 times in a batch of 20,000. Repeated runs find the same districts over and over, as shown in Figure 1. Statistical conclusions should not be drawn from such a constrained ensemble.
- **Use of flawed "election index."** Both Barber reports muddy the electoral landscape by blending six elections together into an "election index."² It is implausible that the State was pursuing an objective of partisan gerrymandering with respect to Dr. Barber's custom election blend. I focus on an individual contest (Section 2.2), then consider treating six elections individually (Section 2.3), and either way I find many ways to create maps with a comparable partisan advantage to what is observed in the 2026 Plan, but without the extreme racial distribution.
- **Misinterpretation of "race-targeted" ensembles.** In my previous declaration, I describe one of the ensemble variants as a "race-targeted run" in order to consider its partisan properties. Dr. Barber writes that "The simulation [sic] therefore uses racial targets directly." This is hardly surprising given my description. My race-targeted plans not only hit those targets (as expected), but also hit partisan targets just as well as when I used partisan data directly. This is not a circular argument, and the finding is not true in reverse: targeting partisanship does not lead to resemblance in racial statistics. In order to suggest that it does, Barber can rely only on the flawed ensemble work described above.
- **Clearly erroneous conclusion.** Dr. Barber writes that the 2026 Plan's "racial and electoral consequences" are "what one would expect from a statewide partisan plan designed to convert an eight-Republican-district map into a nine-Republican-district map." This is **false**. I have demonstrated with millions of examples that a map with nine Republican districts need not crack Black voters to under 32% in every district, and indeed I have shown that a race-neutral randomization process gave an expectation of a district with roughly 36% BVAP or more.

²This is a longstanding flaw in Dr. Barber's expert work. To the best of my understanding, he simply adds the votes across different contests, creating a Democratic total and a Republican total in each precinct, producing an opaquely weighted average that need not resemble any actual observed election. In a rebuttal report from 2022, I showed that his use of a faulty election index had the effect of flipping the result of a partisan gerrymandering test from one side of the state's bright line to the other (dropping the *efficiency gap* from .09 to .05).

Figure 1: Because Dr. Barber did not provide his districting plans, I had to re-generate plans by running his code. I ran 1000 replication runs of 20,000 plans each. Each of the districts shown in green is present in over 97% of replication runs using Dr. Barber's code. They are so visually similar that extreme zooming is needed to see the difference. Yet despite freezing so much terrain that the maps are forced to be a close geographical match for the 2026 Plan, this process gets all districts over 60% for Trump in Pres2024 less than one percent of the time.

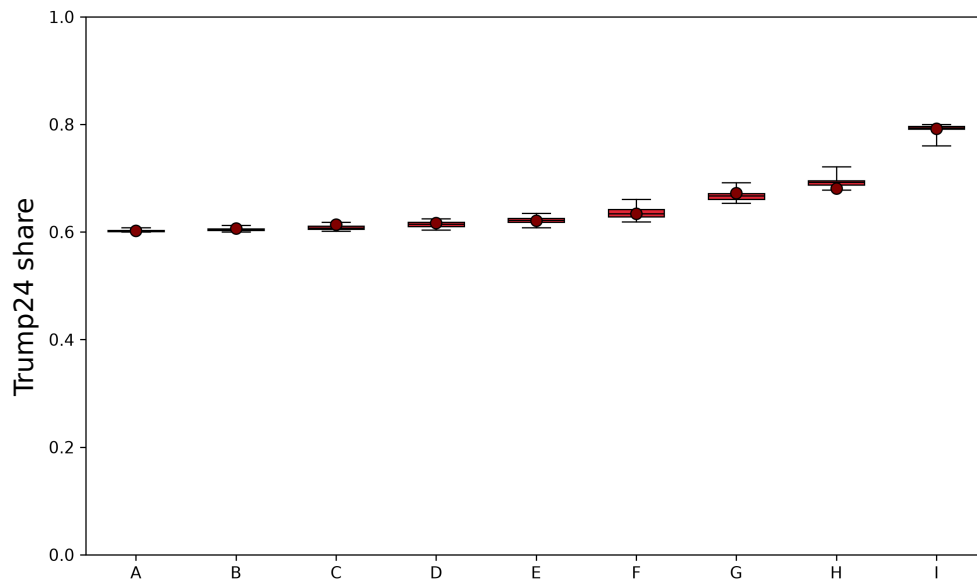


2.2 Specific partisan target: Margins in Pres2024

Dr. Barber writes that the ensembles in my earlier declaration "do not provide valid comparison maps because they do not reproduce the enacted map's partisan structure." It is impossible to hit the exact partisan totals in every contest without being identical to the map itself, and it is likewise impossible to guess which margins of victory in which set of elections were sought by the State. This is particularly true since I have been told that legislators deny the use of partisan data altogether.³

However, since Dr. Barber has emphasized the importance of resembling the Trump vote in Pres2024, in which the lowest district share was 60.2%, I have now provided an additional set of maps in which *every district has over 60% Trump share* in that contest.⁴ To generate these maps, I used a very simple process: first, find a single example hitting this 60% Trump threshold in all districts; then, vary it with the same neutral recombination moves as before, but this time rejecting any proposed change that drops the map below the 60% Trump line.⁵

Figure 2: The nine districts of Tennessee are ordered from lowest to highest vote share for Trump in the Pres2024 contest. The boxplot contains an ensemble of over 3.7 million distinct plans, but their statistical range squarely hits the 2026 Plans (shown with dots). Every plan in the ensemble has Trump share at over 60% of the major-party vote in each of the nine districts.



³I understand from counsel that no legislator ever articulated a particular margin of victory as a target, and furthermore that some indicated that only Census data was used in the mapmaking process.

⁴Dr. Barber writes that "None has all nine districts at least 60% Trump" and that it is "perplexing" not to have provided maps that are "truly comparable" to the enacted map in this sense. He does not mention that under 1% of his own ensemble from Report A hits this mark.

⁵To raise my confidence in the robustness of these findings, I also conducted shorter runs with alternative seeds and at the block level; the results are consonant with the findings and conclusions reported here.

Figure 3: That same ensemble is now plotted for its racial composition, with the 2026 Plan's BVAP shown with green dots. This time, it is not a match. Even with hyper-partisan plans as a comparator, having all districts under 32% BVAP is an extremely unlikely occurrence. (The whiskers are at the 1st-99th percentile marks.)

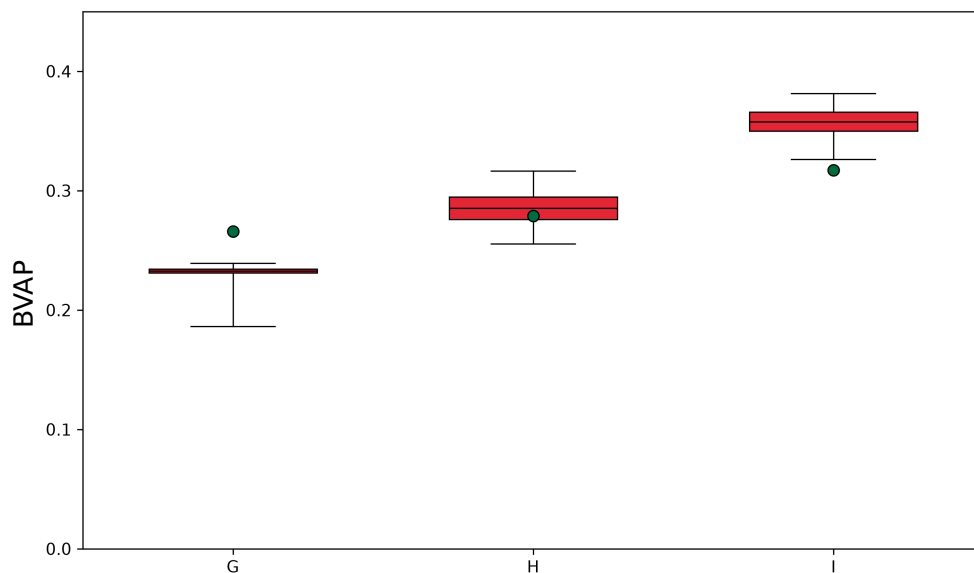
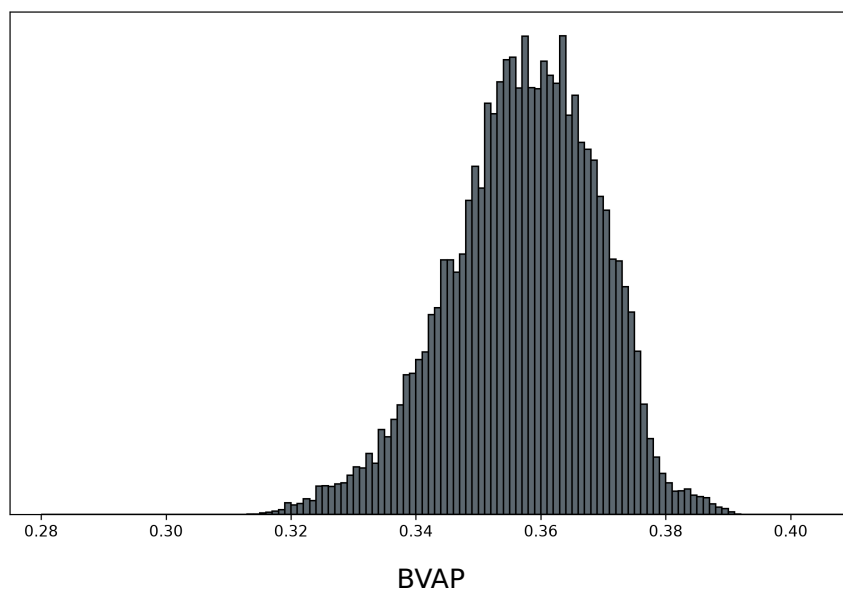


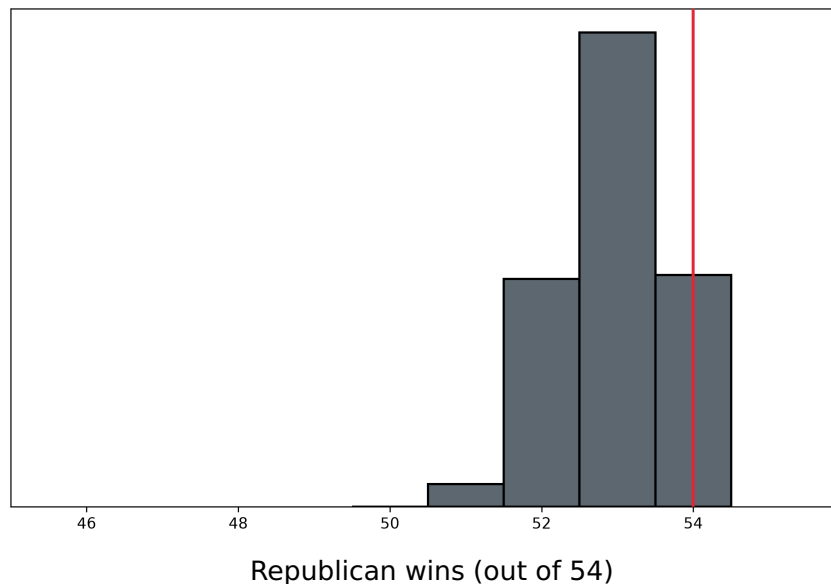
Figure 4: This histogram shows the highest BVAP in a district (District I in the previous plot) for this ensemble of hyper-partisan plans. The median for this ensemble is 35.8% BVAP, and more than half a million different examples have BVAP over 37%. The State's 2026 Plan has no district over 31.7% BVAP, which makes it an extreme outlier compared to this distribution.



2.3 Using data from six partisan elections

Instead of focusing on a specific margin in a specific contest, this plot takes all six contests that Dr. Barber considered and counts the district-level wins in each voting pattern. The 2026 Plan gives a Republican sweep of all districts in all contests, and so does a large share of the ensemble that is optimized to match the Pres2024 margins of victory. Yet the racial attributes of the 2026 Plan are still very extreme outliers, lowering the top district's BVAP to a level that occurs at a 0.00023 rate (or 0.02% of the ensemble).

Figure 5: In the 2026 Plan, all nine districts favor the Republican in all six contests, for a score of 54—a Republican sweep. More than 24% of the ensemble that is optimized for the Pres2024 contest shares this property.



3 Harm to Black voters

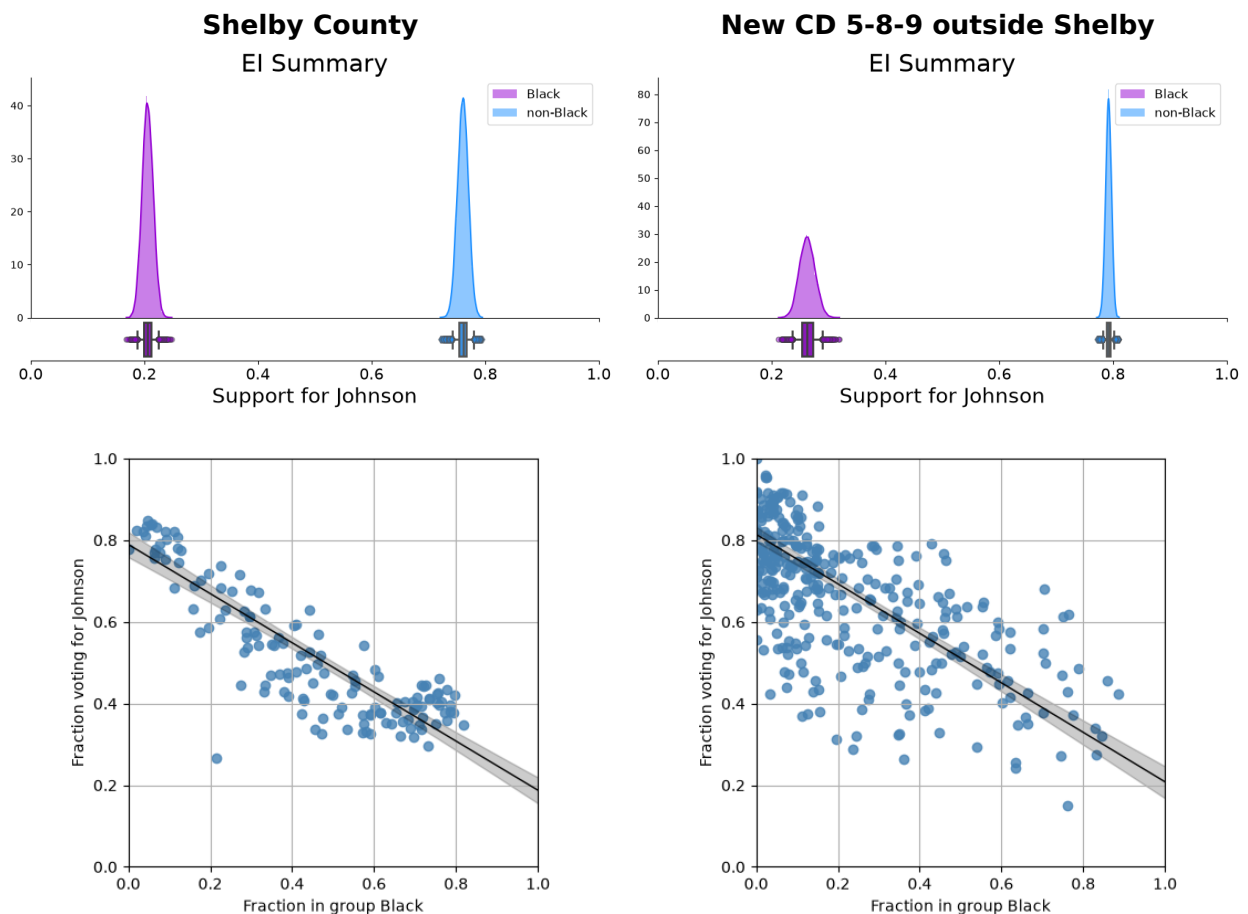
In this section, I demonstrate that there is likely to be a meaningful difference in terms of the opportunity of Black voters to impact electoral outcomes between a district with 37 or 38% Black voting age population and one with only 30-32% BVAP. To do this, I identify the "tipping point" where Black voters make up the majority of the Democratic primary electorate.

According to a voter registration file provided to me by counsel, the totality of area covered by CD 5-8-9 contained 25,785 Black voters in the Democratic primary in 2024, and 37,387 others (non-Black; mostly White). The BVAP count in that same geography was 504,108 and the (non-Hispanic) WVAP count was 1,082,047 out of a total VAP of 1,757,182. Thus, the voter file numbers put Democratic primary turnout for Black voters at just 5.11% of the adult population. Though White voters turn out at a higher rate for primary elections, most choose the Republican primary, so non-Black voters' participation in the Democratic primary was measured at just 2.98% of adults. This means that Black adults cast a vote in the Democratic primary at 1.71 times the rate of non-Black adults overall. We can use the symbol $r = 1.71$ to represent this participation ratio.

A simple algebraic calculation now tells us that a district BVAP of **36.9%** is the tipping point for Black voters to have majority control of the primary election.⁶

To cleanly separate race from party, we can look at the candidates of choice in Democratic primaries and find that there is often a wide difference in the preferences of Black and White voters. For example, Gloria Johnson, a White state legislator, ran for the U.S. Senate nomination in 2024 against Marquita Bradshaw, a community advocate who is Black. Johnson's support from White primary voters is estimated at roughly 80%, as shown in Figure 6, while her support from Black voters was close to 20%.⁷

Figure 6: Both within and outside Shelby County, EI (ecological inference) and ER (ecological regression) methods give consistent answers. With these methods, we estimate Black support for Gloria Johnson near 20% in the Democratic primary for U.S. Senate in 2024, while non-Black (mostly White) voters support her at near 80%.



⁶If there are B Black adults and W non-Black adults in a district, then the Democratic primary has a ratio of Black to non-Black voters of rB to W . The tipping point when Black voters make up half of the primary voters occurs when $rB = W$, which means that the Black share of the district must be $\frac{B}{B+W} = \frac{B}{(r+1)B} = \frac{1}{r+1}$. At $r = 1.71$, the tipping point Black share of the district is $1/2.71$, or 36.9%.

⁷Primary contests frequently feature appreciable racial polarization. In another recent contest, the 2022 Governor's race, Jason Martin (a White doctor) prevailed in the Democratic primary statewide despite roughly 15% estimated support from Black voters in Shelby County; Black voters overwhelmingly preferred a Black attorney named JB Smiley, Jr.

So having too low of a BVAP level will lead to insuperable advantage for White-preferred candidates in the primary, even in districts engineered for Republican advantage in the general election. Indeed, aggregating the 2024 election results in the new districting plan shows that Johnson exceeds 50% in all three Memphis-area districts: 61.4% in new CD 5, 54.7% in new CD 8, and 53.1% in new CD 9.⁸ Paring the Black share of voting age population back to near 30% in those districts clearly hurts the ability of Black voters to advance their preferred candidates to the general election.

4 Conclusion

There are a number of points in which I am in agreement with Dr. Barber, notably where he concedes the sacrifice of traditional districting principles in the construction of the 2026 Plan. According to his report (describing the expert work of Dr. Tony Fairfax), "The 2026 Plan divides Shelby County and Memphis across Districts 5, 8, and 9. It moves large numbers of Black residents and Black voting-age residents out of the former District 9. It creates three Shelby County districts with districtwide BVAP shares in the range of roughly 27% to 31%. It also performs worse than the 2022 Plan on compactness and several subdivision-split measures." We also agree that the 2026 Plan has very extreme partisan properties.

However, he is demonstrably not correct in asserting that the extreme levels of partisanship observed in the 2026 Plan explain—much less require—the shortcomings. In my previous declaration, I showed that extreme partisanship is as well achieved by setting a racial target (splitting up Black population) as by setting a partisan target directly. In this response, I go further and provide a rich supply of districting plans that hit the State's extreme target dead-on. Only when I set racial targets explicitly, or when Dr. Barber freezes nearly all of the geography of the State's plan (only allowing small changes within Shelby County that maintain a three-way split with the State's given proportions), do either of us get racial statistics anything like the 2026 Plan. Otherwise, its partisan properties can readily be replicated while maintaining meaningful influence for Black voters.

⁸Generally a candidate does not need 50% of the vote to advance in a primary contest because there may be more than two candidates; however, 50% of the vote is the level that ensures a win.

I reserve the right to modify, update, or supplement my analyses, findings, and any conclusions as additional information is made available to me or as I perform further analysis.

I declare under penalty of perjury under the laws of the United States of America that the foregoing is true and correct to the best of my knowledge and belief.

Executed on June 30, 2026 in Chicago, IL.

A handwritten signature in black ink that reads "Moon Duchin". The signature is written in a cursive, flowing style.

Dr. Moon Duchin