Hastings Constitutional Law Quarterly

Volume 46
Number 2 *Winter 2019*

Article 3

Winter 2019

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Richard E. Finneran

Steven K. Luther

Filling the Gap in the Efficiency Gap: Measuring Partisan Gerrymandering on a Per-District Basis

by RICHARD E. FINNERAN & STEVEN K. LUTHER*

In Gill v. Whitford*, the Supreme Court dismissed a challenge to Wisconsin's state legislative map based upon a lack of standing. While the*

* Richard E. Finneran is an Adjunct Professor of Law at Washington University School of Law and partner at Bryan Cave Leighton Paisner LLP. Steven K. Luther is an Assistant United States Attorney for the Eastern District of Missouri. The views expressed in this Article are those of the authors and do not necessarily reflect the views or policies of the United States Department of Justice, the United States Attorney's Office for the Eastern District of Missouri, or Bryan Cave Leighton Paisner LLP. The authors give their sincerest thanks to Shontee Pant, J.D. '20, Washington University School of Law, who offered thorough research assistance in the preparation of this Article.

plaintiffs alleged that the statewide map violated the Equal Protection Clause of the Constitution by being gerrymandered to asymmetrically advantage one political party over the other, the Court held that such allegations were insufficient to state a personal, individualized injury under Article III's Case or Controversy Clause. Since the plaintiffs had not alleged that their voting power in their particular legislative districts had been diluted, the Court found that the plaintiffs' complaint stated only a "generalized grievance" incapable of giving them standing under Article III. The Supreme Court was likely correct to find the plaintiff's proof was incomplete, but that is only because the principal metric employed in the case—the much-celebrated "efficiency gap"—is by definition capable of identifying partisan bias only in a statewide map and not on a district-by-district basis. In this Article, we propose a methodology by which plaintiffs can plausibly demonstrate the impact of partisan bias on a district-by-district basis by calculating the district's "vote dilution index": the percentage of voters who could be drawn into competitive districts but who have instead been "cracked" or "packed" into a noncompetitive district by mapmakers. The application of that metric reveals not only that the prevalence of partisan gerrymandering is more significant and, in many districts, more extreme than previously known, but the precise degree to which each district has been skewed to promote the dominance of one of the major political parties at the expense of the power of individual voters. By permitting comparison of the degree of vote dilution between districts while simultaneously accounting for the limitations imposed by geographical clustering of voters, the "vote dilution index" opens the door to partisan gerrymandering claims that the Supreme Court left ajar in Whitford.

Introduction

The date was October 26, 2017, and the Supreme Court was set to hear oral arguments in *Gill v. Whitford*,[1] a case heralded as the best chance to have partisan gerrymandering declared unconstitutional in a generation, if not in the history of the Court.[2] The plaintiffs had persuaded a three-judge district court in Wisconsin to throw out the state's legislative map for failing a newly minted constitutional test, known as the "efficiency gap" test, which

1. 138 S. Ct. 1916 (2018).

2. *See, e.g.*, Michael Cooper, *Gerrymandering Case Echoes in Inkblot-Like Districts Across the U.S.*, N.Y. TIMES (June 19, 2017), https://www.nytimes.com/2017/06/19/us/gerrymandering-wisconsin-pennsylvania-maryland-supremecourt.html; Adam Liptak, *When Does Partisan Gerrymandering Cross a Constitutional Line?*, N.Y. TIMES (May 15, 2017), https://www.nytimes.com/2017/05/15/us/politics/when-does-political-gerrymandering-cross-a-constitutional-line.html.

measures partisan bias[3] by comparing the number of "wasted votes" each party receives in a given election on a statewide basis.[4] Since Wisconsin's map consistently and systematically made it far easier for Republicans to convert their supporters' votes into legislative seats, the district court had found the map violated the Equal Protection Clause. The questioning from the bench left Supreme-Court-vote-counters predicting that partisan gerrymandering would soon meet its demise under the force of Justice Anthony Kennedy's quill.[5]

And yet, almost as soon as the starting gun had gone off, the plaintiffs were called for a false start. In a surprisingly unanimous opinion written by Chief Justice John G. Roberts, the Court held that the plaintiffs lacked standing because they had failed to establish any individualized injury that they had suffered in their own voting districts.[6] The asserted injury of vote dilution, the Court held, "arises from the particular composition of the voter's own district, which causes his vote . . . to carry less weight than it would carry in another, hypothetical district."[7] Thus, plaintiffs who claim an injury to their preferred party's interests on a statewide basis fail to allege the sort of particularized harm that is required to have standing to bring a suit in federal court.[8] As the Court put it, "[a] plaintiff who complains of gerrymandering, but who does not live in a gerrymandered district, 'assert[s] only a generalized grievance against governmental conduct of which he or she does not approve.'"[9]

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3. Throughout this Article, we, joining the trend in the wider literature on the subject of gerrymandering, use the term "bias" to refer to statewide asymmetry between the percentage of votes won by a political party and the share of seats it earns in the resulting legislature. *See* Bernard Grofman & Gary King, *The Future of Partisan Symmetry as a Judicial Test for Partisan Gerrymandering after* LULAC v. Perry, 6 ELECTION L.J. 2, 10 (2006) (defining partisan bias as "the degree to which an electoral system deviates from partisan symmetry"); Gary King & Robert X. Browning, *Democratic Representation and Partisan Bias in Congressional Elections*, 81 AM. POL. SCI. REV. 1251 (1987). We should not, therefore, be misunderstood, through our use of the term, to be referring necessarily to *intentional* efforts to achieve partisan asymmetry, nor do we make any normative claims about the desirability of such asymmetry for purposes of our discussion.

4. Nicholas O. Stephanopoulos & Eric M. McGhee, *Partisan Gerrymandering and the Efficiency Gap*, 82 U. CHI. L. REV. 832 (2015). For the simplest and most intuitive explanation of the efficiency gap metric we have found, see Darla Cameron, *Here's How the Supreme Court Could Decide Whether Your Vote Will Count,* WASH. POST (Oct. 4, 2017), https://www.washingtonpost.com/graphics/2017/politics/courts-law/gerrymander/.

5. *See, e.g.*, Amy Howe, *Argument Analysis: Cautious Optimism for Challengers in Wisconsin Redistricting Case*?, SCOTUSBLOG (Oct. 3, 2017), http://www.scotusblog.com/2017/10/argument-analysis-cautious-optimism-challengers-wisconsin-redistricting-case/.

6. *Whitford*, 138 S. Ct. at 1930.

7. *Id.* at 1931.

8. *Id*.

9. *Id.* (quoting United States v. Hays, 515 U.S. 737, 745 (1995)).

What was needed, the Court said, was for the plaintiffs to point to an injury arising from their placement into a district where they had less voting power than they might otherwise have.[10] After all, the Court stated, it is not any statewide bias in a map, but "[t]he boundaries of the district" and "the composition of its voters," that "determine whether and to what extent a particular voter has been," in the parlance of the Supreme Court's redistricting jurisprudence, "packed" or "cracked" into noncompetitive districts.[11]

Taking our cue from Chief Justice Roberts, we set out in this Article to address the very question that the Court found the plaintiffs had left unanswered in *Whitford*: "whether and to what extent a particular voter" has been "packed or cracked" as a result of her placement on a legislative map.[12] We set forth the very sort of district-specific metric of vote dilution that the Court demanded (and found wanting) in *Whitford*, one which permits assessment of "the particular composition of the voter's own district" to determine whether the mapmaker's decisions have caused her vote "to carry less weight than it would carry in another, hypothetical district."[13] In so doing, we propose a method that permits a voter not merely to claim that she could have been placed in a district where her voting power would be increased, but to compare the degree of bias in her district to the other

10. *See Whitford*, 138 S. Ct. at 1930–31. In this Article, we address only the standing necessary to make a claim of constitutionally cognizable injury from vote dilution. Justice Kagan's concurrence in *Whitford* left open the possibility that a claim of statewide injury might formulate a proper basis for a claim rooted in theory of "associational injury" under the First Amendment. *See id.* at 1938 (Kagan, J., concurring); *infra* notes 90–93 and accompanying text. The majority opinion, which Kagan joined in full, characterized any such theory as "speculative" and reminded readers that "[t]he reasoning of this Court with respect to the disposition of this case is set forth in *this* opinion and none other." *Whitford*, 138 S. Ct. at 1931 (emphasis added). Whatever promise such a theory may have, we do not endeavor to analyze or critique it here.

11. *Whitford*, 138 S. Ct. at 1929. "Packing" refers to the practice of placing a number of voters of one group into a particular district in order to diminish their ability to influence the outcome of an election in another district. *Id.* at 1923. "Cracking" refers to the practice of distributing a single group of voters across multiple districts in order to diminish their ability to influence the outcome in any one district. *Id.*; *see also* Samuel S.H. Wang, *Three Practical Tests for Gerrymandering: Application to Maryland and Wisconsin*, 15 ELECTION L.J. 367, 371 (2016) ("State-level gerrymandering is more elaborate than single-district gerrymandering and relies on an elaborate strategy. First, map drawers cram voters likely to favor their opponents so that they are 'packed' into a few throwaway districts where the other side will win lopsided victories. Second, state-level gerrymanders have a distinctive feature: the remaining, more numerous districts are drawn with boundaries to yield more-narrowly won victories. For example, voters can be 'cracked' so that a bloc of votes is split across districts to dilute their impact and prevent them from contributing to a majority in any one district. In this process, the critical requirement is asymmetry: the opposing party's voters must be more tightly packed than one's own voters. The net result is an increased likelihood of unrepresentative outcomes.").

12. *Id*. at 1929.

13. *Id.* at 1931.

districts in her state and across the country.[14] We achieve this by comparing each state's current legislative map to a hypothetical map with the greatest possible number of competitive districts and calculating, for each existing district, the percentage of voters who could be placed in such a competitive district but have instead been placed in a "safe" (i.e., noncompetitive) district.[15] The resulting "vote dilution index" (or "VDI"), which captures both "packing" and "cracking" of voters, supplies the missing link the Court required in *Whitford* for plaintiffs to demonstrate a constitutionally redressable injury.[16]

Our discussion is divided into three principal parts. We begin by summarizing the Supreme Court's jurisprudence in the context of both partisan and racial gerrymandering from its genesis until *Whitford*.[17] Next, we offer an assessment of the "efficiency gap" and competing partisan asymmetry metrics as measures of partisan vote dilution and identify which of their shortcomings must be corrected in order to surmount the hurdle of *Whitford*.[18] We then introduce, illustrate, and ultimately apply the vote dilution index in order to ascertain the degree of gerrymandering in each of the country's 435 federal Congressional districts, pointing up the promise of the "vote dilution index" as a superior measure of vote dilution after *Whitford*.[19]

I. The Emerging Jurisprudence of Partisan Gerrymandering

In order to justify the validity of the "vote dilution index" as a proper district-specific measure of partisan gerrymandering, we first undertake a brief review of the jurisprudential constraints imposed on any such metric by the Supreme Court's redistricting case law. First, we summarize the Court's racial gerrymandering jurisprudence and assess how the elements of successful racial gerrymandering claims inform the analysis of partisan gerrymandering claims.[20] We then review the Court's few partisan gerrymandering cases, focusing on the limitations the Court has placed on these claims and identifying the common pitfalls of pursuing a claim of gerrymandering based upon partisan bias.[21] Finally, we examine the Court's holding in *Whitford* itself, paying special attention to the requirements the

14. *See infra* Part III.
15. *See infra* Part III.A.
16. *See infra* Part I.C.
17. *See infra* Part I.
18. *See infra* Part II.
19. *See infra* Part III.
20. *See infra* Part I.A.
21. *See infra* Part I.B.

Court imposed for establishing standing for a plaintiff who asserts an injury from partisan gerrymandering.[22]

A. Lessons from the Racial Gerrymandering Cases

So far, the only context in which the Supreme Court has recognized a constitutionally redressable injury from gerrymandering is in the area of racially conscious map-drawing.[23] As the court's racial gerrymandering cases demonstrate, race-based vote dilution can occur in one of two ways: first, by "packing," whereby voters of a single racial group are crowded into a single district in order to reduce their ability to influence elections outside of the district,[24] and second, by "cracking," whereby voters of a single racial group are split among several districts in order to reduce their ability to influence the outcome of any single election.[25] In either case, where racial gerrymandering is done intentionally, the Court has found that it may violate the Equal Protection Clause of the Constitution.[26] The Court has further held that a plaintiff advancing a racial gerrymandering claim must establish "individualized harm," either by showing that she resides in a racially gerrymandered district or by providing specific evidence tending to show that she was personally subjected to a racial classification.[27]

Under the standard that has emerged in racial gerrymandering cases, a plaintiff can succeed if she demonstrates that "race was the predominant factor motivating the legislature's decision to place a significant number of voters within or without" the district in which she resides.[28] If the plaintiff makes that showing, the burden shifts to the state to establish that it meets strict scrutiny, i.e., that it has a compelling interest in considering race and

22. *See infra* Part I.C.

23. *See, e.g.*, Cooper v. Harris, 137 S. Ct. 1455 (2017); Ala. Legis. Black Caucus v. Alabama, 135 S. Ct. 1257 (2015); Georgia v. Ashcroft, 539 U.S. 461 (2003); Bush v. Vera, 517 U.S. 952 (1996); Miller v. Johnson, 515 U.S. 900 (1995); Shaw v. Reno, 509 U.S. 630 (1993); Wright v. Rockefeller, 376 U.S. 52 (1964).

24. *See, e.g.*, *Ashcroft*, 539 U.S. at 471.

25. *See, e.g.*, *Wright*, 376 U.S. at 53–54; Wang, *supra* note 11.

26. *Cooper*, 137 S. Ct. at 1463. While intent has been an obvious indicator of unconstitutionality in racial gerrymandering cases, its application in partisan gerrymandering cases is more problematic, as the Court has suggested that *some* partisan consideration in redistricting is acceptable. *See* Gaffney v. Cummings, 412 U.S. 735, 752 (1973); *see also infra* Part I.B.

27. United States v. Hays, 515 U.S. 737, 744–45 (1995). Justice O'Connor's majority opinion in *Hays* states that the racial composition of a district, without more, is insufficient to establish a racial gerrymandering claim. *Id.* at 746; *see also* Sinkfield v. Kelley, 531 U.S. 28, 30 (2000) (noting that existence of an adjacent majority-minority district did not provide standing sufficient to advance a claim of racial gerrymandering).

28. *Miller*, 515 U.S. at 919; *see also Ala. Legis. Black Caucus*, 135 S. Ct. at 1265 (requiring district-specific challenges in racial gerrymandering cases).

that the approach taken is narrowly tailored to achieve that compelling interest.[29]

One interest that the Court has "long assumed" is compelling is the state's need to comply with the federal Voting Rights Act of 1965 ("VRA").[30] Section 2 of the VRA prohibits any practice that "results in the denial or abridgement of the right to vote on account of race."[31] As interpreted by the Supreme Court, that provision prevents a legislature from pursuing a policy of vote dilution based upon race.[32] If a redistricting plan can be shown to have done that, it potentially violates the VRA. To shift the burden of justifying the use of race in drawing maps under VRA to the state, a plaintiff must show that she is a member of a "politically cohesive" minority group that is "sufficiently large and geographically compact to constitute a majority in some reasonably configured legislative district"[33] and that the white majority of the district "votes sufficiently as a bloc" to defeat a minority candidate in the ordinary case.[34]

The Supreme Court's racial gerrymandering cases provide several important lessons for those who would seek to establish standing to challenge partisan gerrymandering as unconstitutional.[35] First, the cases illustrate that a plaintiff whose voting power has been diminished as a result of the manner in which her district's lines have been drawn suffers a cognizable injury-in-fact.[36] Second, they teach us that, even if such a plaintiff may have been injured, a gerrymandering claim cannot succeed if a particular group has no realistic hope of electing the representative of its choice—i.e., if it is either not cohesive or not numerous enough to constitute a majority in an alternative district.[37] And third, as the Court reminded us in *Whitford*, an injury claimed under the Equal Protection Clause of the

29. *Cooper*, 137 S. Ct. at 1464.

30. *Id*. at 1461.

31. 52 U.S.C. § 10301(a) (1982).

32. *See, e.g.*, Thornburg v. Gingles, 478 U.S. 30, 46 n.11 (1986).

33. *Cooper*, 137 S. Ct. at 1470 (quoting *Thornburg*, 478 U.S. at 50–51) (internal quotations omitted).

34. *Thornburg*, 478 U.S. at 50.

35. Indeed, the *Whitford* Court expressly pointed to several principles developed in its racial gerrymandering jurisprudence in its effort to explain the requirements of Article III standing. *See infra* notes 46–47, 57, 81 and accompanying text.

36. United States v. Hays, 515 U.S. 737, 744–45 (1995); *see also* Ala. Legis. Black Caucus v. Alabama, 135 S. Ct. 1257, 1265 (requiring district-specific challenges in racial gerrymandering cases). Whether an injury-in-fact had been established was not expressly considered in any of the partisan gerrymandering cases prior to *Whitford*, as those cases were disposed of on other grounds. *See infra* Part I.B.

37. *Cooper*, 137 S. Ct. at 1470. Although the Court has treated this as a merits question, it might plausibly be viewed as a question of redressability. *See infra* note 128 and accompanying text.

Constitution must rest on the premise that dilution has occurred with respect to the plaintiff's power to affect electoral outcomes in her own district, not a political group's ability to compete on a statewide basis.[38]

B. Pre-*Whitford* Partisan Gerrymandering Law

Whereas racial gerrymandering cases have provided fertile ground for those seeking redress under the Equal Protection Clause, partisan gerrymandering cases have largely been fruitless. As Chief Justice Roberts expressed at the outset of his opinion in *Whitford*, the Supreme Court's previous attempts to determine what constitutes partisan gerrymandering have "left few clear landmarks for addressing the question."[39] The initial guidepost remains the first case in which the Supreme Court took up the issue of partisan gerrymandering, *Gaffney v. Cummings*.[40] Ironically, the issue in *Gaffney* was the precise opposite of the one raised by the plaintiffs in *Whitford*: the statewide legislative map had been consciously drawn to favor neither the Democratic nor Republican party, but instead to provide a rough measure of electoral balance between the two.[41] Justice White, writing for the majority, believed the mere presence of political motivations to be constitutionally unproblematic: "[i]t would be idle," he said, "to contend that any political consideration taken into account in fashioning a reapportionment plan is sufficient to invalidate it."[42]

While the *Gaffney* Court acknowledged that political gerrymandering could run afoul of the Fourteenth Amendment if "political groups have been fenced out of the political process and their voting strength invidiously minimized," it concluded that removal of politics from the redistricting process was an "impossible task," with the implication that it was not one for courts to undertake.[43] In other words, although the *Gaffney* Court suggested that partisan gerrymandering could reach such a level that it would be unconstitutional, it offered little guidance on how to assess or identify any such violation.

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38. *Cooper*, 137 S. Ct. at 1470.

39. *Whitford*, 138 S. Ct. at 1926.

40. Gaffney v. Cummings, 412 U.S. 735 (1973). A key holding in *Gaffney* was that the principle of "one man one vote," which applied to federal congressional redistricting, did not extend to state legislative redistricting. *Id.* at 741–42. Thus, whereas the federal rule required strict adherence to grossly proportional representation, state legislative redistricting could diverge from strict proportionality, so long as the divergence was "based on legitimate considerations incident to the effectuation of a rational state policy." *Id*. at 742 (citing Reynolds v. Sims, 377 U.S. 533, 579 (1964)).

41. *Id*. at 752.

42. *Id.*

43. *Id.* at 754.

The Court's next foray into partisan gerrymandering came thirteen years later in *Davis v. Bandemer*, the first (and so far the only) case in which the Court has recognized the justiciability of a claim based upon partisan gerrymandering.[44] The case arose from a claim by Indiana Democrats that the state Republican party had purposefully redistricted the statewide map to disadvantage the Democratic party.[45] The Court reversed the three-judge panel that had agreed with the Democrats and found an Equal Protection Clause violation, but it was sharply divided in its analysis of the claims.

The threshold issue in the case was justiciability. A majority of Justices agreed the case was justiciable, relying on the rationale from racial gerrymandering cases[46] that, when an identifiable group "had an insufficient chance to elect a representative of its choice," it could seek redress in court.[47] Three Justices, concurring in the judgment, strongly disagreed, arguing that partisan gerrymandering claims by political parties should be precluded under the political question doctrine.[48] The Court fractured further on whether an Equal Protection Clause violation existed. A plurality found it did not because insufficient proof was offered to show that the partisan gerrymander had "consistently degrade[d] a voter's or a group of voters' influence on the political process as a whole."[49] The two remaining Justices who found the case justiciable proposed a complex balancing test, while the three Justices concurring in the judgment would not have even reached the issue.[50] *Bandemer* thus provides tentative support for two propositions: (1) that partisan gerrymandering cases are indeed justiciable; and (2) that proving an Equal Protection Clause violation requires evidence that the "electoral system substantially disadvantages certain voters in their opportunity to influence the political process effectively."[51]

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44. Davis v. Bandemer, 478 U.S. 109 (1986).

45. As in *Gaffney*, the challenge was to the statewide map in its entirety. *Cf. Gaffney*, 412 U.S. at 754. The Indiana Democratic Party presented evidence that in the statewide races for the Indiana House of Representatives, the Democrats had received 51.9 percent of the vote, but only won 43 of 100 available seats. *See Bandemer*, 478 U.S. at 115. The lower court's ruling invalidating the statewide map was based upon multiple issues with the map itself, as opposed to a claim of vote dilution in any particular district. *Id.* at 116–17.

46. *See supra* Part I.A.

47. *Bandemer*, 478 U.S. at 124.

48. *Id*. at 162 (O'Connor, J., concurring). Justice O'Connor was joined by Chief Justice Warren E. Burger and Justice William Rehnquist.

49. *Id*. at 132.

50. *Id.* at 144, 173.

51. *Id.* at 133. How to determine whether "certain voters" are disadvantaged was left open by the Court. The type of statistical analysis employed in *Whitford* and proposed herein was not considered by the *Bandemer* Court. *See id.* at 116 n.3 ("A multitude of conflicting statistical evidence was also introduced at the trial. The District Court, however, specifically declined to

Those principles were called into question in *Vieth v. Jubelirer*,[52] a case in which Pennsylvania Democrats challenged a map allegedly favoring Republicans at the expense of "traditional redistricting criteria."[53] A plurality of the Court voted to overrule *Bandemer* as wrongly decided, as "no judicially discernible and manageable standards for adjudicating political gerrymandering claims ha[d] emerged" in the eighteen years since *Bandemer* was handed down.[54] However, Justice Kennedy's opinion concurring in the judgment preserved *Bandemer*, even though he agreed with the plurality that no workable standard had yet been advanced to adjudicate partisan gerrymandering claims.[55] Justice Kennedy refused to foreclose the possibility that a workable standard could be developed:

> [N]ew technologies may produce new methods of analysis that make more evident the precise nature of the burdens gerrymanders impose on the representational rights of voters and parties. That would facilitate court efforts to identify and remedy the burdens, with judicial intervention limited by the derived standards.[56]

The dissenters in *Vieth*, on the other hand, all would have upheld *Bandemer*, though each proposed different standards for judicial management of partisan gerrymandering claims. One standard would permit a claim that a particular district had been drawn in such a way as to unduly burden the claimant's participation in elections,[57] whereas another would have permitted a claim when the plaintiff could show "unjustified use of

credit any of this evidence, noting that it did not 'wish to choose which statistician is more credible or less credible.'" (internal citation omitted)).

52. Vieth v. Jubelirer, 541 U.S. 267 (2004).

53. *Id.* at 272.

54. *Id*. at 281. The plurality also engaged in a historical analysis, first finding that the Framers had vested in Congress, not the courts, the power to override state legislative maps, *see* U.S. CONST. art. I, § 4, and then determining that *Bandemer* must be incorrect because the lower courts had been incapable of fashioning a workable standard for adjudicating political gerrymandering claims. *See Vieth*, 541 U.S. at 274–81. The professed absence of a judicially manageable standard, however, seems to be the primary justification for the plurality's holding that *Bandemer* should be overturned.

55. *Vieth*, 541 U.S. at 312, 314 (Kennedy, J., concurring). Justice Kennedy agreed with *Bandemer*'s conclusion that the Fourteenth Amendment provided the basis for a claim of partisan gerrymandering, but further noted that a "subsidiary standard" would likely be necessary to establish any such claim. *Id.* at 314. Justice Kennedy posited that such a standard would need to show "how an otherwise permissible classification, as applied, burdens representational rights . . . ." *Id*.

56. *Id.* at 312–13 (Kennedy, J., concurring).

57. *Id*. at 330–31 (Stevens, J., dissenting). Justice Stevens drew primarily from the Court's racial gerrymandering jurisprudence, *see supra* Part I.A, in crafting this standard.

political factors to entrench a minority in power."[58] Unlike *Gaffney* and *Bandemer*, the proposed standards required showing harm by an individual claimant on a district-specific level, rather than a more generalized harm arising from a statewide map, in order to establish a violation of the Equal Protection Clause.

The Court's final partisan gerrymandering decision prior to *Whitford* was *League of United Latin American Citizens (LULAC) v. Perry*.[59] After setting aside the justiciability of partisan gerrymandering cases,[60] the Court turned once again to whether a judicially manageable standard had been established. The Court specifically took up an argument from an amicus brief, which had proposed a "symmetry standard" that measured the bias inherent in a map based upon "the extent to which a majority party would fare better than the minority party, should their respective shares of the vote reverse."[61] In other words, if the Democratic Party were to receive 55 percent of the vote and 70 percent of the legislative seats, this result would reflect partisan bias only if the Republican party would obtain more or less than 70 percent of the seats when receiving 55 percent of the vote.[62] The Court rejected this standard, finding it too speculative and reliant on counterfactuals, and holding that any workable standard must be rooted in actual harm to particular voters or voting groups.[63] The Court stressed that the partisan symmetry standard failed to answer the fundamental question of "how much partisan dominance is too much."[64] As a result, it found the plaintiffs had established "no legally impermissible use of political classifications" in the redistricting at issue.[65]

The pre-*Whitford* jurisprudence, muddled as it is, sheds light on how the Court is likely to evaluate partisan gerrymandering claims going forward. First, although the Court has held these claims justiciable, the Court will be unlikely to grant relief until it is able to articulate a judicially manageable

58. *Vieth*, 541 U.S. at 360–61 (Breyer, J., dissenting).

59. League of United Latin Am. Citizens v. Perry, 548 U.S. 399 (2006) [hereinafter *LULAC*].

60. *Id.* at 413–14. Chief Justice Roberts and Justice Alito joined the Court's disposition on the issue of justiciability because it had not been argued in the instant case, potentially leaving the door open to a justiciability challenge in the future. *Whitford* did not reach the issue. *See* Gill v. Whitford, 138 S. Ct. 1916, 1931 (2018).

61. *LULAC*, 548 U.S. at 419–20.

62. *See* Brief for Gary King, et al., as Amici Curiae Supporting Neither Party, at 5, *LULAC,* 548 U.S. 399 (2006), https://www.brennancenter.org/sites/default/files/legalwork/Brief_Amici_Curiae_Professors_King_Grofman_Gelman_Katz.pdf.

63. *LULAC*, 548 U.S. at 420. The Court specifically noted that it was "wary of adopting a constitutional standard that invalidates a map based on unfair results that would occur in a hypothetical state of affairs." *Id.*

64. *Id.*

65. *Id.* at 423.

standard for assessing claims of partisan gerrymandering. Second, any such proposed standard would need to establish a significant burden on representational rights, and do so in a manner that courts could readily administer. Finally, since a showing of actual harm is required, a standard that employs speculative counterfactual analyses is likely too attenuated from actual harm to provide a workable standard.

C. *Whitford* and the Supreme Court Debut of the Efficiency Gap

Nearly as soon as it was published,[66] the efficiency gap metric[67] proposed by Professor Nicholas Stephanopoulos and his colleague Eric McGhee was the subject of great academic and popular interest.[68] The authors claimed to have solved the puzzle posed by Justice Kennedy in his concurrence in *Vieth*: the enigma of developing a judicially manageable standard for measuring partisan gerrymandering.[69] The efficiency gap was heralded as the answer to Justice Kennedy's call, and to the prayers of the opponents of partisan gerrymandering. The *New York Times*' Adam Liptak declared that Stephanopoulos and McGhee "may have found [the] holy grail" in the quest to stop partisan gerrymandering.[70] Or so the story went.

The logic of the efficiency gap was intuitive. Since political parties achieve asymmetric dominance by "packing" some of their opponents' voters into safe districts and "cracking" others across multiple districts, the efficiency gap was designed to calculate the degree to which such "packing" and "cracking" had enabled either party to more "efficiently" convert its votes into legislative seats.[71] It did this by comparing the number of votes each party "wasted" across a statewide election, either by casting votes for a losing candidate, or by casting more votes than were needed for a winning candidate.[72] By "boiling down" partisan gerrymandering claims into a "single tidy number,"[73] the efficiency gap permitted its creators to propose a

66. *See generally* Stephanopoulos & McGhee, *supra* note 4. For the simplest and most intuitive explanation of the efficiency gap metric we have been able to find, see Cameron, *supra* note 4.

67. *See infra* Part II.B (detailing the calculation and operation of the efficiency gap metric).

68. *See, e.g.*, Radiolab, *Who's Gerry and Why Is He So Bad at Drawing Maps?*, NPR (Oct. 2, 2017), https://www.wnycstudios.org/story/whos-gerry-and-why-he-so-bad-drawing-maps.

69. Vieth v. Jubelirer, 541 U.S. 267, 312–13 (2004) (Kennedy, J., concurring).

70. Liptak, *supra* note 2.

71. Stephanopoulos & McGhee, *supra* note 4, at 834.

72. *Id.*

73. *See* Sam Kean, *The Flaw in America's "Holy Grail" Against Gerrymandering*, THE ATLANTIC (Jan 26. 2018), https://www.theatlantic.com/science/archive/2018/01/efficiency-gap-gerrymandering/551492/ ("It's intuitive and easy to calculate, requiring little more than arithmetic. . . . Perhaps best of all, it boils gerrymandering—an unholy mix of geometry and demographics—down to a 'single tidy number' . . . .").

presumptive threshold beyond which partisan gerrymandering could be assumed to be unconstitutional.[74]

Adding the efficiency gap to their quiver, plaintiffs in Wisconsin brought a case challenging the state legislative map as being an unconstitutional partisan gerrymander, with the efficiency gap squarely at the center of the case as the plaintiffs' best evidence. The trial, we are told, was something of a referendum on the efficiency gap, with dueling experts sparring over its reliability and workability.[75] Ultimately, the three-judge district court was persuaded to find Wisconsin's statewide map to be an unconstitutional partisan gerrymander, and the case went to the Supreme Court on direct appeal.[76]

Chief Justice Roberts delivered the opinion of a unanimous court, finding that the plaintiffs had failed to establish standing to challenge Wisconsin's map.[77] The Chief Justice noted that, while the case had focused on whether metrics like the efficiency gap provided manageable standards to permit judicial review, the plaintiffs had overlooked the need to first establish a personal stake in the outcome of the controversy before the court.[78] Reminding the plaintiffs that "[a] federal court is not a forum for generalized grievances,"[79] the Chief Justice wrote that "a plaintiff who complains of gerrymandering, but who does not live in a gerrymandered district, asserts only a generalized grievance against governmental conduct of which he or she does not approve."[80] The Chief Justice said that the right to vote, being "individual and personal in nature," requires a voter to allege a "disadvantage to the voter as an individual" resulting "from the boundaries of the particular district in which he resides."[81]

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74. Stephanopoulos & McGhee, *supra* note 4, at 896.

75. Whitford v. Gill, 218 F. Supp. 3d 837, 859–62 (W.D. Wisc. 2016) (summarizing testimony of four experts who presented evidence of possible partisan bias in Wisconsin's state legislative map); *see* Wang, *supra* note 11, at 382 ("In *Whitford*, the districting plan was evaluated using a recently developed measure of asymmetry, the efficiency gap. Expert witness Prof. Simon Jackman established the statistical properties of the efficiency gap in a presentation that included 36 figures. This report was challenged by the state's expert witness, who focused on the question of how much asymmetry came from population clustering; that expert was, in turn, counter-challenged.").

76. Cases involving redistricting are among the limited set of cases for which the Supreme Court has direct, mandatory appellate jurisdiction by statute. 28 U.S.C. § 1253 (2018).

77. Gill v. Whitford, 138 S. Ct. 1916, 1930 (2018).

78. *Id.* at 1932 (noting that, while some plaintiffs had alleged personal injuries-in-fact, "[a]s the proceedings in the District Court progressed to trial, the plaintiffs failed to meaningfully pursue their allegations of individual harm").

79. *Id.* at 1929 (internal quotations and citations omitted).

80. *Id.* at 1930.

81. *Id.* at 1929–30 (internal quotations, emendations, and citations omitted). This holding echoes the rationale employed by the Court in its analysis of standing in racial gerrymandering

Thus, the Court held, any claim of partisan vote dilution must be alleged on a per-district basis.[82] The Chief Justice drew an analogy to the Court's racial gerrymandering cases, in which a plaintiff has standing "to assert only that his own district has been . . . gerrymandered,"[83] and in which complaints therefore "must proceed district-by-district" rather than on a statewide basis.[84] Likewise, the Chief Justice said partisan gerrymandering claims must be based on an assertion that "the particular composition of the voter's own district [has caused] his vote—having been packed or cracked—to carry less weight than it would carry in another, hypothetical district."[85] Because the Court found the plaintiffs had failed to demonstrate an injury of this sort, it left "for another day consideration of other possible theories of harm . . . and whether those theories might present justiciable claims giving rise to statewide remedies."[86]

The Chief Justice also took the time to point to the deficiencies of the efficiency gap as a method of detecting the sort of district-specific injury required by the Court's standing jurisprudence. Putting aside technical objections to the metric's utility,[87] the Chief Justice succinctly summarized the limitations of the efficiency gap and other measures of partisan asymmetry as evidence of individualized harm:

> The difficulty for standing purposes is that these calculations are an average measure. They do not address the effect that a gerrymander has on the votes of particular citizens. Partisan-asymmetry metrics such as the efficiency gap measure something else entirely: the effect that a gerrymander has on the fortunes of political parties.
>
> Consider the situation of Professor Whitford, who lives in District 76, where, defendants contend, Democrats are "naturally" packed due to their geographic concentration, with

cases. *See supra* Part I.A; United States v. Hays, 515 U.S. 737, 744–45 (1995); Sinkfield v. Kelley, 531 U.S. 28, 30 (2000).

82. *Whitford*, 138 S. Ct. at 1930 ("To the extent the plaintiffs' alleged harm is the dilution of their votes, that injury is district specific. An individual voter in Wisconsin is placed in a single district. He votes for a single representative. The boundaries of the district, and the composition of its voters, determine whether and to what extent a particular voter is packed or cracked.").

83. *Id.*

84. *Id.*

85. *Id.* at 1931; *cf. id.* at 1935 (Kagan, J., concurring) ("The harm of vote dilution . . . arises when an election practice—most commonly, the drawing of district lines—devalues one citizen's vote as compared to others.").

86. *Id.* at 1931.

87. *See infra* Part II.B.

> that of plaintiff Mary Lynne Donohue, who lives in Assembly District 26 in Sheboygan, where Democrats like her have allegedly been deliberately cracked. By all accounts, Act 43 has not affected Whitford's individual vote for his Assembly representative—even plaintiffs' own demonstration map resulted in a virtually identical district for him. Donohue, on the other hand, alleges that Act 43 burdened her individual vote. Yet neither the efficiency gap nor the other measures of partisan asymmetry offered by the plaintiffs are capable of telling the difference between what Act 43 did to Whitford and what it did to Donohue. The single statewide measure of partisan advantage delivered by the efficiency gap treats Whitford and Donohue as indistinguishable, even though their individual situations are quite different.[88]

The Court declined to enter judgment for the defendants, electing, in light of the unclarity of the record before it, to remand for further proceedings in which the plaintiffs could seek to demonstrate district-specific harms to their individual rights to vote.[89]

Justice Elena Kagan concurred in order to elaborate on what would be required for plaintiffs to establish an injury under the Court's standing doctrine.[90] As Justice Kagan explained, a plaintiff claiming vote dilution must show that, because she lives in a "packed" or "cracked" district, her vote "carries less weight—has less consequence—than it would under a neutrally drawn map."[91] If, Justice Kagan posited, a plaintiff were able to show that, on a map drawn according to nonpartisan criteria, she would reside in a substantially more competitive district, such evidence would be adequate for her to establish the sort of injury necessary for her to have

88. *Whitford*, 138 S. Ct. at 1933. We dare say that the metric we propose solves precisely the problem the Chief Justice identified in *Whitford*. *See infra* Part III.

89. *Id.* at 1934, 1941. Justice Clarence Thomas, joined by Justice Neil M. Gorsuch, concurred in the entirety of the Court's opinion, except its decision to remand the case rather than dismiss it.

90. *Id.* at 1934 (Kagan, J., concurring).

91. *Id.* at 1936.

standing.[92] Justices Breyer, Ginsburg, and Sotomayor concurred, leaving them one vote shy of a majority.[93]

Although it portrays itself as a straightforward application of the Supreme Court's standing doctrine (and it is), *Whitford* reveals a deep chasm of difference between the approaches taken heretofore by social scientists, which, like the efficiency gap, aim to detect systemic partisan bias,[94] and the approach evidently preferred by a unanimous Supreme Court. *Whitford* reminds us that the injury the Court might plausibly remedy in a gerrymandering case is not a mere imbalance in statewide partisan efficiency, but rather the *cause* of that imbalance: the dilution of individual votes.[95] While that change in focus may not make evidence of statewide partisan asymmetry totally irrelevant, after *Whitford*, it is not dispositive, nor perhaps even necessary. As we explain below, substantial vote dilution often occurs in systems with modest or no partisan asymmetry, as where the major parties conspire to draw maps that minimize the number of contests in which they will have to compete against each other to win, and the efficiency gap is therefore markedly underinclusive as a measure of vote dilution.[96] After *Whitford*, these "balanced" but noncompetitive maps too are up for grabs.

II. Meeting the Demands of *Whitford*

Whitford reminds us that, regardless of the potential merit of the efficiency gap as a method of measuring the overall partisan bias in a statewide map, it is definitionally incapable of identifying a district-specific injury.[97] It is therefore necessary to develop some method of articulating a district-specific injury from partisan gerrymandering that is at least sufficient to show an "injury-in-fact" that would allow plaintiffs to get in the courthouse door.[98] Once such an injury is identified, the efficiency gap and

92. *Whitford*, 138 S. Ct. at 1936 ("For example, a Democratic plaintiff living in a 75%-Democratic district could prove she was packed by presenting a different map, drawn without a focus on partisan advantage, that would place her in a 60%-Democratic district. Or conversely, a Democratic plaintiff residing in a 35%-Democratic district could prove she was cracked by offering an alternative, neutrally drawn map putting her in a 50-50 district. The precise numbers are of no import. The point is that the plaintiff can show, through drawing alternative district lines, that partisan-based packing or cracking diluted her vote.").

93. *Id.* at 1934.

94. *See* Grofman & King, *supra* note 3, at 6 ("Social scientists have long recognized *partisan symmetry* as the appropriate way to define partisan fairness in the American system of plurality-based elections, and for many years such a view has been virtually a consensus position of the scholarly community.").

95. *Whitford*, 138 S. Ct. at 1930.

96. *See infra* note 104 and accompanying text.

97. *See Whitford*, 138 S. Ct. at 1930.

98. *Id.*

other metrics may be utilized to meet the burden of showing a constitutional violation on the merits, but establishing a plaintiff's standing is an ineluctable first step.[99]

This Part begins by summarizing the demands that *Whitford* and the Court's standing doctrine in general will place upon plaintiffs who seek to have a map declared to have been unconstitutionally gerrymandered.[100] We then turn our microscope on the efficiency gap and competing measures of partisan asymmetry, exploring their strengths and their deficits, both as a means of establishing partisan asymmetry and as a tool for demonstrating a personalized injury arising from an allegedly unconstitutional map.[101]

A. Criteria for an Acceptable Measure of Standing After *Whitford*

Any metric that would seek to establish standing for a plaintiff must, after *Whitford*, measure a district-specific injury.[102] In other words, it must show that a plaintiff has personally suffered vote dilution as a result of the manner in which the legislature has chosen to the draw the legislative map.[103] A metric that, like the efficiency gap, merely identifies a statewide imbalance in voting power between the political parties will therefore fail to surpass that bar.[104]

Whitford's rule rests upon well-settled principles of the Court's standing jurisprudence.[105] Those principles tell us that, in order for a case to present a "case or controversy" under Article III of the Constitution, a plaintiff must show an "injury-in-fact" that is traceable to the conduct of the defendants and which could be redressed by a favorable judicial decision.[106]

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99. *See* Stephanopoulos & McGhee, *supra* note 4, at 856 (comparing the efficiency gap to partisan bias, a competing measure of partisan asymmetry).

100. *See infra* Part II.A.

101. *See infra* Part II.B.

102. *See Whitford*, 138 S. Ct. at 1930.

103. *See id*. at 1930 (requiring a plaintiff to demonstrate a "disadvantage to the voter as an individual" resulting from "the boundaries of the particular district in which he resides").

104. *See id.* at 1930–31. The efficiency gap is not alone in its emphasis on statewide partisan asymmetry, an analytical focus that is nearly uniform in academic literature on the subject of partisan gerrymandering. *See* Grofman & King, *supra* note 3, at 6 ("Social scientists have long recognized *partisan symmetry* as the appropriate way to define partisan fairness in the American system of plurality-based elections, and for many years such a view has been virtually a consensus position of the scholarly community."). For the same reason, many other proposed methods that seek to measure gerrymandering as a function of statewide partisan asymmetry will likely be deemed constitutionally insufficient measures of vote dilution after *Whitford*.

105. *See* Lujan v. Defenders of Wildlife, 504 U.S. 555, 560–61 (1992).

106. *Id.* at 560–61 ("[O]ur cases have established that the irreducible constitutional minimum of standing contains three elements. First, the plaintiff must have suffered an injury in fact—an invasion of a legally protected interest which is (a) concrete and particularized and (b) actual or imminent, not conjectural or hypothetical. Second, there must be a causal connection between the

To establish an injury, a plaintiff must point to an alleged harm that is personal to him and which is therefore, in the language of the Court, more than a mere "generalized grievance."[107] The injury must also be "concrete and particularized," a qualification designed to exclude claims that are based upon abstract harms that are not readily susceptible to judicial redress.[108]

An adequate measure of district-specific vote dilution, therefore, cannot be based simply on the fact that a voter finds herself in a political minority in any particular legislative district. If, because the constraints imposed by geography and population distribution patterns, the voter cannot be drawn into a district where she would have a realistic chance of electing the representative of her choice, then her "injury" can neither be said to be traceable to the conduct of the mapmaker nor redressable by a court.[109] If she is harmed at all, her harm arises because of the location in which she resides and not because of any action taken by any putative defendant.[110]

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injury and the conduct complained of—the injury has to be fairly traceable to the challenged action of the defendant, and not the result of the independent action of some third party not before the court. Third, it must be likely, as opposed to merely speculative, that the injury will be redressed by a favorable decision." (internal quotations and emendations omitted)).

107. *See* United States v. Richardson, 418 U.S. 166, 179–80 (1974) (restating the "basic principle" that "to invoke judicial power the claimant must have a 'personal stake in the outcome,' or a 'particular, concrete injury,' or 'a direct injury'; in short, something more than 'generalized grievances'" (internal citations omitted)).

108. *See* Warth v. Seiden, 422 U.S. 490, 508 (1975) ("Absent the necessary allegations of demonstrable, particularized injury, there can be no confidence of a real need to exercise the power of judicial review or that relief can be framed no broader than required by the precise facts to which the court's ruling would be applied." (internal quotations and citations omitted)).

109. *See Whitford*, 138 S. Ct. at 1932 (noting that the lead plaintiff, even under the plaintiffs' proposed alternative map, would still reside in a district with an overwhelming Democratic majority); *see also* Bruce E. Cain et al., *A Reasonable Bias Approach to Gerrymandering: Using Automated Plan Generation to Evaluate Redistricting Proposals*, 59 WM. & MARY L. REV. 1521, 1531–32 (2018) ("While the Court could take the view that a constitutional partisan gerrymandering doctrine ought to correct for imbalances in the way partisans are distributed across space, it is more likely that the Court will find that natural gerrymanders are a permissible price of redistricting regime . . . . [A] high-functioning measure of partisan effect must be able not only to parse out natural gerrymanders from unnatural ones, but also to *quantify* the effects of each."); *cf. infra* Part III (proposing a metric that would quantify the effects of partisan gerrymanders while accounting for geographic limitations).

110. *See Whitford*, 138 S. Ct. at 1933 ("Consider the situation of Professor Whitford, who lives in District 76, where, defendants contend, Democrats are 'naturally' packed due to their geographic concentration . . . . By all accounts, Act 43 has not affected Whitford's individual vote for his Assembly representative—even plaintiffs' own demonstration map resulted in a virtually identical district for him."). The inability to account for the challenges presented by an uneven geographic distribution of partisan preference is an endemic problem among most existing measures of partisan asymmetry. *See, e.g.*, Wang, *supra* note 11, at 381–82 (noting that two of the author's proposed tests "are oriented towards the outcomes of elections rather than the specifics of map boundaries" and "do not rely on geographically oriented approaches which require normative assumptions of what constitutes good districting procedure").

A proper measure of district-specific vote dilution must instead permit a plaintiff to claim that, if not for the partisan effect resulting from her district's specific lines, her voting power would be increased, *i.e.*, that under a more competitive map, she would have a substantially greater chance of her vote impacting electoral outcomes.[111] Ideally, such a metric would also permit comparison not only between the *status quo* and other possible maps, but between districts, thereby allowing a determination of how large an impact the partisan bias of a particular map has had on the voting power of individuals within any particular district relative to other districts, and relative to the whole.[112]

B. The Promise—and Shortcomings—of the Efficiency Gap

The efficiency gap is defined by its originators as representing "the difference between the parties' respective wasted votes in an election—where a vote is wasted if it is cast (1) for a losing candidate, or (2) for a winning candidate but in excess of what she needed to prevail."[113] The "wasted" votes for each party are added together on a statewide basis, and the difference between the two is then divided by the total number of votes cast, resulting in a percentage representing the efficiency gap.[114] Although the efficiency gap is calculated on a per-election basis, it may be tracked over time to determine the degree to which any partisan bias is a structural, as opposed to merely incidental, consequence of a particular map.[115]

The efficiency gap presents two major advantages that make it a leading candidate as a measure of partisan bias. First, as its originators point out, it "avoids the need to estimate hypothetical election results"; rather, "[t]he parties' respective wasted votes are calculated using actual election

111. *See Whitford*, 138 S. Ct. at 1931 (noting that claims of vote dilution rest on the claim that "the particular composition of the voter's own district . . . causes his vote—having been packed or cracked—to carry less weight than it would carry in another, hypothetical district"); *id.* at 1932 (illustrating how, even under plaintiffs' proposed map, Professor Whitford would still be located in a "safe" Democratic district).

112. Cain, *supra* note 109, at 1531–32 (2018) ("[A] high-functioning measure of partisan effect must be able not only to parse out natural gerrymanders from unnatural ones, but also to *quantify* the effects of each."); *cf. infra* Part III (proposing a metric that would quantify the effects of partisan gerrymanders while accounting for geographic limitations).

113. Stephanopoulos & McGhee, *supra* note 4, at 834.

114. *Id.*

115. *Id.* The efficiency gap itself does not distinguish between packed and cracked districts, but dissecting the "wasted votes" that serve as its inputs may offer some clues. *See also* Mira Bernstein & Moon Duchin, *A Formula Goes to Court: Partisan Gerrymandering and the Efficiency Gap*, 64 NOTICES OF THE AM. MATHEMATICAL SOC'Y 1020, 1021 (2017) ("If (nearly) all the wasted votes belong to the winning side, it's a packed district. If (nearly) all the wasted votes belong to the losing side, it's a competitive district. And if there are several adjacent districts where most of the wasted votes are on the losing side, then it may be a cracked plan.").

outcomes."[116] Thus, it does not require analysts to make counterfactual assumptions about how elections would have turned out had the map been drawn differently.[117] Instead, it is analytically focused on measuring a single number: the degree to which a party is able "to convert its votes into seats more efficiently than its adversary—even if the edge would vanish under different electoral conditions."[118] And, since it looks directly at the results of past elections, it "can therefore provide evidence of real harm"[119] (albeit on a statewide, as opposed to a district-by-district, basis).

Another characteristic of the efficiency gap that recommends it as a judicially manageable standard is that it requires only very basic arithmetic.[120] A fifth grader with a pencil and a calculator could easily calculate the efficiency gap for even the most complex map.[121] It therefore

116. Stephanopoulos & McGhee, *supra* note 4, at 896.

117. *Id.* at 855.

118. *Id.* at 859.

119. Kean, *supra* note 73.

120. *Id.* ("It's intuitive and easy to calculate, requiring little more than arithmetic . . . . Perhaps best of all, it boils gerrymandering—an unholy mix of geometry and demographics—down to a 'single tidy number' . . . ."); Garrett Epps, *The Supreme Court's Choice on Partisan Gerrymandering*, THE ATLANTIC (Mar., 28, 2018), https://www.theatlantic.com/politics/archive/2018/03/the-supreme-courts-choice-on-partisan-gerrymandering/556661/ ("[W]ith a modicum of effort, even a J.D. could understand it."); Sam Wang & Brian Remlinger, *How to Spot an Unconstitutionally Partisan Gerrymander, Explained*, VOX (Jan. 17, 2018) ("Far from being gobbledygook, as Chief Justice John Roberts memorably put it, the simplest statistical methods are more than a century old, invented for real-world needs like beer quality control. And if brewers can harness the power of statistical reasoning, surely judges and reformers can too . . . . Some of the most promising statistical measures of gerrymandering can be understood by a high schooler or even a grade school student."); Nate Cohn & Quoctrung Bui, *How the New Math of Gerrymandering Works*, N.Y. TIMES (Oct. 3, 2017), https://www.nytimes.com/interactive/2017/10/03/upshot/how-the-new-math-of-gerrymandering-works-supreme-court.html ("Over all, it's a simple measure that elegantly follows the logic of partisan gerrymandering."). *But see* Bernstein & Duchin, *supra* note 115, at 1024 ("Legal scholars believe that [the efficiency gap] will appeal to the courts because of its simple, one-shot construction with no technical machinery. As we have seen, the simplicity is actually illusory: a lot of care, including further statistical testing and modeling, is required to use [it] responsibly."); Transcript of Oral Argument at 37, Gill v. Whitford, 138 S. Ct. 1916 (2018) (No. 16-1161) (remarks of Roberts, C.J.) ("[I]f you're the intelligent man on the street and the Court issues a decision, and let's say the Democrats win, and that person will say: Well, why did the Democrats win? And the answer is going to be because EG was greater than 7 percent, where EG is the sigma of party X wasted votes minus the sigma of party Y wasted votes over the sigma of party X votes plus party Y votes. And the intelligent man on the street is going to say that's a bunch of baloney. It must be because the Supreme Court preferred the Democrats over the Republicans. And that's going to come out one case after another as these cases are brought in every state.").

121. *See* Gill v. Whitford, 138 S. Ct. 1916, 1933 (2018) (reciting plaintiffs' contention that "the efficiency gap and similar measures of partisan asymmetry will allow the federal courts—armed with just 'a pencil and paper or a hand calculator'—to finally solve the problem of partisan gerrymandering"); Brief for Bipartisan Group of 65 Current and Former State Legislators as Amici Curiae at 6, 25, Gill v. Whitford, 138 S. Ct. 1916 (2018) (No. 16-1161); Christopher Chambers et

reduces the need for experts to explain complex algorithmic processes to jurists who ordinarily are not, by training, experts in statistics, let alone map-drawing, and promises to tamp down courtroom battles between experts over which among the possible maps best complies with traditional redistricting criteria.[122] As its originators suggest, that means that the efficiency gap "could be straightforwardly converted into doctrine."[123]

As *Whitford* itself revealed, however, the efficiency gap has limitations which make it an imperfect (or at least an incomplete) measure of partisan bias.[124] First, as *Whitford* notes, even a finding of an extreme efficiency gap between the two parties does not, on its own, provide an account of how any such gap causes a concrete and particularized injury to a voter within the state.[125] In other words, while (on its best day) the efficiency gap tells an analyst that a map is biased in favor of one party, it does not tell the analyst in which district (or districts) that bias originates.[126] As *Whitford* holds, this means that, even if an efficiency gap is evidence of partisan gerrymandering, that does not on its own bestow standing on a plaintiff to challenge the map; it allows her merely to state a "generalized grievance" that is by definition incapable of supplying jurisdiction to a court.[127]

While the *Whitford* Court identified this problem as one of injury, it might just as well be viewed as a problem of redressability.[128] The efficiency gap tells an analyst that there is a problem, but it does not tell her how to

al., *Flaws in the Efficiency Gap*, 33 J. LAW & POL. 1, 2 (2017) ("The formula is simple and easy to compute: in its simplified form, it can be calculated on the basis of two numbers, the proportions of votes and seats won by a party.").

122. *But see* Whitford v. Gill, 218 F. Supp. 3d 837, 859–62 (W.D. Wisc. 2016) (summarizing testimony of four experts who presented evidence of possible partisan bias in Wisconsin's state legislative map); Wang, *supra* note 11, at 382 ("In *Whitford*, the districting plan was evaluated using a recently developed measure of asymmetry, the efficiency gap. Expert witness Prof. Simon Jackman established the statistical properties of the efficiency gap in a presentation that included 36 figures. This report was challenged by the state's expert witness, who focused on the question of how much asymmetry came from population clustering; that expert was, in turn, counter-challenged.").

123. Stephanopoulos & McGhee, *supra* note 4, at 837.

124. *See* Bernstein & Duchin, *supra* note 115, at 1022 (identifying numerous failings of the efficiency gap, including that it "penalizes proportionality," produces false positives in cases where a party's dominance exceeds 75 percent, and ultimately serves merely as a measure of deviation from a principle of double-proportionality whose desirability the authors question). Professors Chambers, Miller, and Sobel likewise point to several curiosities and contradictions internal to the efficiency gap, which we do not endeavor to catalogue here, but which are worthy of our readers' consideration. *See generally* Chambers et al., *supra* note 121.

125. *Whitford*, 138 S. Ct. at 1930–31.

126. *See id.* at 1933.

127. *Id.* at 1931.

128. *See id.* at 1932 (noting that the lead plaintiff would remain in a noncompetitive district on even the plaintiffs' proposed map).

solve it. Indeed, it does not even tell her whether any observed efficiency gap is a function of intentional gerrymandering or an unavoidable consequence of population distributions and partisan clustering.[129] It is possible, in other words, that in some states, a large efficiency gap may be an incurable ill—and those without a remedy do not have standing, much less a chance of prevailing on the merits.[130]

The efficiency gap also produces a result that might be considered anomalous by a Supreme Court that is evidently concerned with identifying a district-specific injury arising from vote dilution.[131] Because the efficiency gap, by its very nature, involves offsetting one party's wasted votes against the other's, it permits a significant partisan advantage in one district to be compensated for by a significant partisan advantage in another district for the other party.[132] Thus, in a ten-district state where half of the voters are Republicans and the other half are Democrats, the efficiency gap is essentially agnostic as between a plan that would create ten competitive

129. "With geographically defined districts, the number of legislative seats that a party wins is going to depend not only on the number of votes it receives but also on where its voters live. . . . A measure like the [e]fficiency [g]ap, which implicitly dictates a particular relationship between votes and seats, is therefore guaranteed to erroneously detect 'gerrymandering' under some circumstances." Pam Frost Gorder, *You Can't Tell a Gerrymandered District by Its Shape,* OHIO STATE NEWS (Oct. 25, 2017), https://news.osu.edu/you-cant-tell-a-gerrymandered-district-by-its-shape/ (quote attributed to Mira Bernstein, founding member of the Metric Geometry and Gerrymandering Group at Tufts University); *see also* Cain, *supra* note 109, at 1533 ("Knowing that plan *A* has a higher or lower efficiency gap score than plan *B* does not inform whether the score in either plan is more likely to be produced by impermissible partisan gerrymandering. Without knowing about the natural level of bias in any given geographic area, the scores are unreliable as even a comparative measure of partisan bias."); *see also* Kean, *supra* note 73; Sam Wang, *The Great Gerrymander of 2012*, N.Y. TIMES (Feb. 2, 2013), https://www.nytimes.com/2013/02/03/opinion/sunday/the-great-gerrymander-of-2012.html ("Concentration of voters in urban areas can, for example, limit how districts are drawn, creating a natural packing effect."); Cohn & Bui, *supra* note 120 ("Gerrymandering isn't the only reason one party might 'waste' many more votes than the other. Parties can naturally 'pack' or 'crack' themselves, simply because of how their voters are distributed geographically. The efficiency gap doesn't distinguish between votes wasted by gerrymandering or by natural causes. That's probably the biggest practical limitation of the measure."). This failing is one common to most every measure of partisan asymmetry proposed in the academic literature. *See, e.g.*, Grofman & King, *supra* note 3, at 7 ("The key to the symmetry definition of fairness is that it evaluates the electoral system *as a whole* by evaluating how voter preferences s*tatewide* are translated into the division of legislative seats between the parties." (emphasis added)); *cf. Whitford*, 138 S. Ct. at 1931 ("The difficulty for standing purposes is that these calculations are an average measure. They do not address the effect that a gerrymander has on the votes of particular citizens. Partisan-asymmetry metrics such as the efficiency gap measure something else entirely: the effect that a gerrymander has on the fortunes of political parties.").

130. *See Whitford*, 138 S. Ct. at 1931.

131. *See id.* at 1930.

132. *See* Chambers et al., *supra* note 121, at 3 ("[The efficiency gap] ignores political heterogeneity within political parties and its application can strengthen extremists at the expense of moderates. It can increase political polarization, and can make the weaker party—which the efficiency gap attempts to protect—worse off.").

districts and one which would create five solidly blue and five solidly red districts.[133] That these two situations could be treated identically by the purportedly talismanic test of partisan gerrymandering is more than a little challenging to square with any claim of constitutional injury premised on a principle of vote dilution, as the Court called for in *Whitford*.[134]

There are still other senses in which the efficiency gap's purported strengths betray yet greater weaknesses. Because it looks only at actual votes in elections, the efficiency gap is slow to catch up to partisan bias. At a bare minimum, the metric requires two election cycles to produce enough data to make reliable claims about any map's bias.[135] As subsequent research has also demonstrated, the efficiency gap is prone to serious swings from election to election, which further diminishes its utility as a speedy assessor of partisan bias.[136] In addition, its focus on actual votes fails to take account of the effect of gerrymandering on suppressing voter turnout.[137] To the extent, therefore, that the efficiency gap is understood to make predictive claims about the outcome of future elections (i.e., that they too will involve similar inefficiencies as elections past), it requires one to make the assumption that party loyalty is relatively inelastic, an assumption that, while

133. *See Whitford*, 138 S. Ct. at 1931.

134. *See id.* This feature of the efficiency gap is not merely an academic problem; it ignores the fact that voters in districts where there is insignificant inter-party competition will often be left to choose in a party primary between highly partisan candidates who do not represent the majority of the district, merely a majority (or perhaps only a plurality) of the majority caucus. *See* Chambers, *supra* note 121, at 23–24 ("[T]he efficiency gap does not contemplate that political parties may be heterogenous. This is a problem because gerrymandering can affect not only which parties are elected, but also the specific political opinions of the representatives that comprise the legislature. . . . [T]he measure can favor plans that make it easier for political extremists to be elected, and which would naturally increase the level of political polarization in legislatures. More importantly, in spite of its proposed application in adjudicating Equal Protection cases, the use of the efficiency gap can actually harm the minority party.").

135. *See* Stephanopoulos & McGhee, *supra* note 4, at 887 ("[P]lans' efficiency gaps vary markedly from election to election. It thus is futile to insist on a gap of zero at any particular moment, because in all likelihood the gap will have assumed a non-zero value by the time of the next election."); *id.* at 836 ("In many cases, in fact, a plan whose average gap favors one party will feature a gap favoring the other party at some point during the decade.").

136. *See* Cohn & Bui, *supra* note 120 ("The difference between the presidential election results and congressional election results hints at another problem: The efficiency gap is very noisy. It can shift back and forth from cycle to cycle. That's mainly because the efficiency gap emphasizes the difference between winning and losing a district. If you win by one vote, all of your opponents' votes are wasted, and just one of yours; lose by one vote and the opposite is true. As a result, the courts would probably need to look across many elections to assess whether a map is in violation.").

137. *Cf.* Cohn & Bui, *supra* note 120 ("The efficiency gap isn't great at measuring the one big Democratic geography advantage: Hispanic districts. Here, the Democrats' advantage is that they can translate votes to seats at an efficient rate, thanks to the extremely low turnout-to-population ratio of Hispanic areas, which, for good measure, are not always overwhelmingly Democratic. The efficiency gap, if anything, gets this backward. It's measuring wasted votes, after all, and the low turnout of these districts means that the Republicans waste very few in Hispanic districts.").

it may be true today,[138] has been too infrequently true historically to make it a plausible constitutional norm.[139] As its originators admit, an efficiency gap in any single election is not enough to make an assumption of inherent partisan bias, and thus they include a series of caveats which one must employ before determining its usefulness.[140]

While the efficiency gap may still have promise as a tool for demonstrating the effects of enduring partisan bias and entrenchment, *Whitford* makes it clear that it is inadequate, standing on its own, to sustain a claim of unconstitutional partisan gerrymandering.[141] In the next section, we propose an alternative, district-focused approach that would provide a court an adequate basis to find an individualized injury-in-fact to a particular voter, as well as permit the sort of apples-to-apples comparisons that made the efficiency gap an attractive metric to begin with.[142]

III. Measuring Per-District Vote Dilution

This section introduces and explains the metric we propose to answer the challenge, set down in *Whitford*, of demonstrating a district-specific injury from partisan gerrymandering: the "vote dilution index." It begins by setting forth a formula for calculating the index, which is equal to the percentage of voters in a given district who, on a maximally competitive map, could be drawn into a competitive district but have instead been drawn into a district where there is a vanishingly small chance of their votes affecting the outcome.[143] Next, we illustrate the function and attributes of the index using a simplified hypothetical state whose population is both evenly distributed geographically and closely divided along partisan lines.[144] We then put theory into practice by calculating the vote dilution index for each of the country's 435 Congressional districts and reporting our findings.[145] Finally, we discuss the advantages of the vote dilution index over existing measures of partisan bias, with a focus on its unique ability to isolate and identify the effects of partisan gerrymandering on individual

138. *See* Micah Altman, *Modeling the Effect of Mandatory District Compactness on Partisan Gerrymanders*, 17 POL. GEOGRAPHY 989, 1000 (1998).

139. *See* Cain, *supra* note 109, at 1525 ("While it is a straightforward calculation to identify seats-votes gaps at the end of a decade, it is more problematic to project them with a high degree of certainty into the future when the districts lines have just been drawn.").

140. *See* Stephanopoulos & McGhee*, supra* note 4, at 847.

141. Gill v. Whitford, 138 S. Ct. 1916, 1932 (2018).

142. *See id.* at 1935 (Kagan, J., concurring) ("The harm of vote dilution . . . arises when an election practice—most commonly, the drawing of district lines—devalues one citizen's vote as compared to others.").

143. *See infra* Part III.A.

144. *See infra* Part III.B.

145. *See infra* Part III.C.

legislative districts, all while fully accounting for the potential distorting effects of geographic clustering.[146]

A. The Vote Dilution Index

To meet the demands of *Whitford*, we propose a new metric, which we call the "vote dilution index," that would permit plaintiffs to credibly claim, and courts to properly find, a district-specific injury based upon partisan vote dilution. Our metric answers the call of *Whitford* by providing a method of assessing partisan gerrymandering not on a statewide basis, but on a district-by-district basis, and in a manner that accounts for the limitations imposed by geographic clustering of members of one party.[147] And, because it can be calculated for any district, the vote dilution index also permits comparison among districts and among maps.[148]

Although we explain our method in greater detail below, it will be helpful for us to offer a definition of the vote dilution index at the outset. The vote dilution index is expressed as the percentage of the voters[149] in a

146. *See infra* Part III.D.

147. *See* Whitford v. Gill, 218 F. Supp. 3d 837, 862 (2016) (noting that defense expert in district court proceeding could not "determine exactly how much of the [efficiency gap] was attributable to geography.").

148. *See infra* Part III.C and III.D.

149. In our application below, *see infra* Part III.C, we generally utilize the voting-age population of a district as the best and most readily available approximation of the number of registered and active voters in a particular district. Since the vote dilution index is expressed as a percentage, however, its formula should produce similar results if other segments are studied, such as total population or registered voter population, provided that those populations are as evenly distributed in a given jurisdiction. Indeed, in our analysis below, where precinct-level voting age population figures were not readily available, we have utilized total population to calculate the vote dilution index. This was the case for the six states that have redistricted since the 2012 presidential election: Arizona, California, Florida, North Carolina, Pennsylvania, and Virginia. In order to include those districts in our population totals below, *see infra* Part III.C, we multiplied the vote dilution index by the total voting-age population of the district in order to approximate the number of voting-age individuals in each district whose voting power has been diminished as a result of decisions by mapmakers.

presently noncompetitive district[150] that, on a maximally competitive map,[151] would instead reside in a competitive district,[152] or, more mathematically:

$$I = \frac{P_{lost}}{P_{total}}$$

where P_{lost} is the number of voters in each "safe" district who, on a maximally competitive map, would be situated in a competitive district (the district's

150. We do not endeavor here to set in stone a definitive dividing line between of "competitive" or "noncompetitive," although we believe any reasonable definition of competitiveness, at least in the context of federal Congressional elections, must give each major party something close to a one-in-five chance of winning an election, since there will only be five Congressional elections in the decade-long life of a map. In our application below, we utilize the definition of competitiveness adopted in the models developed by FiveThirtyEight, which requires that the minority party have at least an 18 percent chance of gaining control of the district over time. *See infra* note 184 and accompanying text.

In setting a proper threshold for "competitiveness," one must select a definition that separates genuinely competitive races from realistically noncompetitive ones. A district in which there is a 95 percent chance of a party maintaining control is not practically different from a district in which there is a 98 or 99 percent chance of the same result, at least for a map that will only endure for five elections. For that reason, we do not propose a measure that would simply ask whether voters could have been drawn into *more* or *less* competitive districts, but whether they can be drawn into districts that meet a reasonable threshold of competitiveness. *Cf.* Grofman & King, *supra* note 3, at 23 ("It somehow seems more heinous to prevent a majority from exercising its mandate, then [*sic*] merely to exaggerate the size of a majority. Moreover, exaggerating the size of a majority is virtually inevitable under plurality-based legislative elections because of electoral responsiveness values above one (the bonus effect).").

151. As with settling on a definition of competitiveness, *see supra* note 150, creating a "maximally competitive map" is both a necessary first step in our methodology and an area where reasonable minds may differ as to what constitutes such a map. As we explain below, *infra* note 187, we believe that the threshold selected by FiveThirtyEight (Cook PVI +5 for either party) is as reasonable a definition of competitiveness as any other. But regardless, once the mapmaker selects a threshold for separating competitive districts from noncompetitive districts, then the criteria for creating such a map are clear. A map is "maximally competitive" under our definition if, for each given state, it is not possible to create any more competitive districts than appear on the map while adhering to presumptively mandatory traditional redistricting criteria such as contiguity and equal population. *See* Reynolds v. Sims, 377 U.S. 533, 577–78 (1964) (requiring roughly equal population among state legislative districts and recognizing contiguity as an acceptable principle); Baker v. Carr, 369 U.S. 186, 237 (1962) (requiring equal population among federal Congressional districts). Thus, assuming, as we do in our application of the methodology below, that a district must have an approximately one-in-five chance of changing party control in order to be considered competitive, then the maker of our "maximally" competitive must draw the districts' lines in order to maximize the number of districts that are at least that competitive. Because it satisfies this criterion, FiveThirtyEight's "highly competitive" map meets the definition of a "maximally competitive map" and is therefore used in our application of our method below. *See infra* note 187.

152. *See supra* note 150 (discussing criteria for a proper measure of competitiveness).

"population lost" to competitive districts), and P_{total} is the total number of voters in the district.[153]

Thus, a district which is already competitive will have a vote dilution index of zero.[154] Similarly, a district which, though it is a safe district, has no

153. We acknowledge that our methodology bears some resemblance to the "precinct swapping" arguments made by the plaintiffs in *Easley v. Cromartie*, 532 U.S. 234 (2001), a racial gerrymandering case, although it has some significant differences. In *Cromartie*, the plaintiffs, who had challenged a single district as being racially gerrymandered, presented the district court with numerous examples of precincts in their district which could be swapped with precincts in another district in order to promote racial balance while maintaining a similar degree of partisan symmetry. *Id.* at 255–57. The district court did not address the plaintiffs' "precinct swapping" arguments, but found a racial gerrymander on other grounds. *Id.* at 255. The Supreme Court, in reversing the district court, evaluated the plaintiffs' precinct-swapping arguments as a possible alternative basis to uphold the factual findings of the district court, which it had found to be clearly erroneous. *Id.* at 257.

In each case, the Court found that the mapmakers (there, the legislature) could satisfactorily have based each of their decisions not to swap precincts on traditional redistricting criteria, and therefore, the Court said, there was not a sufficient basis to conclude that the decisions were made based upon racial considerations. *Id.* at 255–56. Ultimately, the Court said, "a showing that the legislature might have 'swapped' a handful of precincts out of a total of 154 precincts, involving a population of a few hundred out of a total population of about half a million, cannot significantly strengthen appellees' case." *Id.* at 256–57.

As an initial matter, it is important to note that the *Cromartie* Court did not reject a "precinct swapping" approach out-of-hand as an improper method for assessing vote dilution; instead, it found that such an approach was not convincing under the specific facts of the case. Critically, in reaching that conclusion, it pointed to the relatively negligible proportion of voters who would have been affected (a number evidently less than two-tenths of one percent of the total population of the district) as one of the major factors diminishing the persuasive power of such an approach.

Thus, while a certain kind of "precinct swapping" occurs in the calculation of the vote dilution index (in that it determines the degree of vote dilution by determining the number of voters in each precinct who could, on a maximally competitive map, be "swapped" into a competitive district), we believe that it is a substantially more powerful metric than a mere "precinct swapping" approach. A "precinct swapping" approach may provide some evidence of purposeful gerrymandering at a particular time and place, but the vote dilution index permits comparison of the degree of vote dilution across districts and across time. It also has the advantage of using, as a baseline, not a slightly rejiggered neighboring district, but a statewide map that has been designed to maximize competitiveness. Thus, the vote dilution index allows us to determine not merely how many voters in a district could be redrawn into an already-existing neighboring district, but how many of those voters could be drawn into competitive districts overall. As a result, the vote dilution index permits a court to readily distinguish the sort of *de minimis* effects observed in *Cromartie* from the far more significant gerrymanders detected in our analysis below. *See infra* Part III.C.

154. That is true, because in our formula P_{lost} is defined to include only voters who are currently situated in safe districts but could be situated in competitive districts on a maximally competitive map. Since voters in a competitive district are not currently situated in a safe district, P_{lost} is zero and the vote dilution index is likewise zero as a result. This result is consistent with the objectives of our methodology, because a voter who already lives in a competitive district has not, by definition, been "packed" or "cracked" into a district where his voting power has been substantially reduced as a result of decisions by the mapmakers. *But see infra* note 169 (discussing the utility of ascertaining a "negative" vote dilution index for voters who reside in a competitive district on the

precincts that would be drawn into a competitive district on a maximally competitive map likewise has a vote dilution index of zero.[155] A district, meanwhile, where all of the precincts could be, but are not, drawn into a competitive district, would have a vote dilution index of 100.[156] A vote dilution index between zero and 100 reflects that some, but not all, of the voters in that district could be drawn into a competitive district but have not been.

Our method is based upon a comparison of two maps: (1) the current map; and (2) an alternative map that has been drawn to maximize the number of competitive contests.[157] In our application of the methodology below, we have used a map developed by Nate Silver and his colleagues at FiveThirtyEight to maximize the number of competitive Congressional districts,[158] but our method can be applied using any alternative map

current map but who would be situated in a noncompetitive district on a maximally competitive map). On the most recent national Congressional map, there are 72 such districts. *See infra* note 201 and accompanying text.

155. That is true for similar reasons as in the case of a competitive district. *See supra* note 154. If a district is such that, even when a state map is drawn to maximize the number of competitive districts, every voter in the district would still reside in a noncompetitive district, then P_{lost} is zero because there are no voters in the district who would be situated in a competitive district even on a maximally competitive map, and the resulting vote dilution index is therefore zero. Again, this fits with the objectives of the metric, since it can be reasonably assumed that the voters residing in such a district reside in a noncompetitive district as a result of geography and not as a result of any "packing" or "cracking" by mapmakers. On the most recent national Congressional map, there are 53 such districts, seven of which are in single-district states. *See infra* note 202 and accompanying text.

156. That result once again follows from a straightforward application of the formula we present above. If literally ever voter residing in a presently noncompetitive district could, on a maximally competitive map, be drawn into a competitive district, then each and every one of those voters has a plausible basis to claim that the resulting diminishment in her voting power is traceable to the decisions of the mapmakers. That showing is enough to satisfy the first two prongs of the standing inquiry, and the fact that a maximally competitive map exists satisfies the third. *See* Gill v. Whitford, 138 S. Ct. 1916, 1936 (2018) (Kagan, J., concurring). On the most recent national Congressional map, there are 49 such districts. *See infra* notes 189–91 and accompanying text.

157. *See supra* notes 150–51 (discussing possible methodologies for developing such a map).

158. *See infra* Part II.C. Professor Cain and his colleagues question the wisdom of seeking to identify a "single-but-elusive counterfactual" map that can be drawn according to any combination of neutral (i.e., nonpartisan) criteria. *See* Cain, *supra* note 109, at 1536 ("Instead . . . the spectrum of viable maps better constitutes the baselines or natural set of maps against which to compare the observed map."). While that critique may have force in the context of determining what degree of partisan gerrymandering goes "too far," we do not believe it is fatal to an approach like ours, which seeks merely to identify the circumstances in which a plaintiff has standing to raise such a claim. As the Court tells us in *Whitford*, to demonstrate standing in the context of a partisan vote dilution case, a plaintiff must merely claim a diminution in voting power that is traceable to the decisions of the mapmakers and which could be redressed by a hypothetical map. Given those requirements, a maximally competitive map sets the best possible baseline to measure and compare the effects of the mapmakers' decisions in each existing district.

designed to maximize the number of competitive contests.[159] This "maximally competitive map" is used in our method as a baseline to assess the degree to which voters in each district are "cracked" or "packed" into noncompetitive districts as a result of choices made by mapmakers.[160]

Our method next classifies the districts in each state as being either "competitive" or "safe" (i.e., noncompetitive), based upon an assessment of the likelihood that the district will change partisan control over time.[161]

159. *See supra* notes 150–51 (discussing possible methodologies for developing such a map). It is important to note that our analysis necessitates no claim that a maximally competitive map is constitutionally required, or even desirable. Courts might well determine that something well short of maximum competitiveness is required under the Constitution, and anti-gerrymandering advocates on all sides may take different views of what goals should be achieved in an optimal map. While our metric would also permit the current maps to be compared to those alternative maps, our purpose in using a map that maximizes the number of competitive districts is to provide a baseline for assessing the size of the voting population that is "cracked" or "packed" into noncompetitive districts as a result of the choices that have been made by mapmakers.

160. We believe that a maximally competitive map provides the proper baseline by which to measure partisan gerrymandering, for several reasons. First, unlike metrics that look merely at the degree of partisan advantage in a particular district as compared to a statewide average, drawing a maximally competitive map requires plaintiffs to take account of the limitations imposed by the fact of geographic clustering. Studies show that such clustering has dramatically increased over the course of the last several decades, and as a result it will literally be impossible in some regions to produce a competitive district. *See, e.g.*, Aaron Bycoffe et al., *West Virginia - The Atlas of Redistricting*, FIVETHIRTYEIGHT (Jan. 25, 2018), https://projects.fivethirtyeight.com/redistricting-maps/west-virginia/#Competitive (demonstrating that it is impossible to draw a competitive Congressional district in the state of West Virginia). By using a maximally competitive map as the baseline, analysts resist the temptation to ignore the geographical (and really, geometrical) limitations imposed by the independent residential choices of voters.

Other might argue that the use of a maximally competitive map is an improper baseline since such a map is highly unlikely to exist in reality, but such an argument badly misses the point. As we note above*, supra* note 159, our methodology does not presume that a maximally competitive map is even desirable, much less constitutionally required. But what a maximally competitive map does is set the outward bound for how "unpacked" and "uncracked" a map can possibly be, and thus it provides a proper starting point to assess how great a variation from that baseline is reflected on a per-district basis.

Finally, it might be claimed that our metric is flawed in that there will not always be *one* maximally competitive map, but rather multiple maps that may produce the same number of competitive districts and thus, as a measure of vote dilution, it is too dependent on the particular "maximally competitive map" that an analyst might draw. As an initial matter, we doubt that will be the case very often as a result of the geographic clustering of voters. But even in a case where that might be true, we do not believe the existence of an alternative "maximally competitive map" would undermine a plaintiff's showing of standing (although we grant that it might weaken the plaintiff's case on the merits). If a plaintiff residing in a safe district can show that it is possible to draw even *one* maximally competitive map in which she would reside in a competitive district, then she has shown both a plausible claim of injury traceable to the decisions of the mapmakers and a possibility of redress. If it shown that she has not been the victim of unconstitutional partisan gerrymandering because, for example, the map nonetheless complies with traditional redistricting criteria, that may mean she will not prevail, but it does not mean she lacks standing.

161. As described above, different analysts may adopt different thresholds, but so long as the threshold adopted remains consistent through calculation of the vote dilution index, it will still

Again, in our application below, we have defined "competitive" in the same way as FiveThirtyEight's methodology uses the term—i.e., to reflect a district in which each party has at least a roughly one-in-five chance of winning control over the district, and thus where, on average, partisan control would be expected to shift at least once during the decade-long life of the map—but different applications of our method could use different thresholds to distinguish "safe" districts from "competitive" ones.[162] What is important is that the method used to draw the alternative map use the same definition of competitiveness that is then used to calculate each district's vote dilution index.[163]

Our next step is to determine, on each map, and for each voting precinct, whether the precinct is in a safe district or a competitive one. If the precinct is in a safe district on the current map and would likewise be in a safe district on the maximally competitive map, it is discounted from the rest of the analysis.[164] This is because the voters in that precinct would not, even on the most competitive possible map, be in a competitive district, and therefore it cannot be said that they have been "cracked" or "packed" into a noncompetitive district.[165] Likewise, precincts that are already in competitive districts are discounted, because they by definition have not been placed in a safe district by the mapmakers.[166]

What is left, then, are precincts that experience a change in position under the maximally competitive map, relative to the current map, e.g., precincts that are drawn into safe districts under the current map but which, on the maximally competitive map, would instead be situated in a competitive district.[167] The sum of the voter populations of these precincts forms the numerator for our formula, and, once divided by the total voter population of the district, produces the district's vote dilution index, i.e., the percentage of voters in the district who have been drawn into a noncompetitive district but who could, on a maximally competitive map, be drawn into a competitive district instead. So long as the vote dilution index is greater than zero, then there are at least some voters in the district who could be drawn into a competitive district while increasing (in fact, maximizing) the competitiveness of the state map overall, and who may

produce results that permit useful comparison among districts and among maps. *See supra* note 150.

162. *See infra* note 187 and accompanying text.

163. Since voting results are a reported on a precinct-by-precinct basis, it is the smallest available data point that would permit assessment of the partisan voting patterns of any particular geographic area. We therefore use precinct data as our unit of analysis.

164. *See supra* notes 149–53 and accompanying text.

165. *See supra* note 11 and accompanying text.

166. *See supra* notes 149–53 and accompanying text.

167. *See supra* notes 149–53 and accompanying text.

therefore plausibly assert a redressable injury that is traceable to the conduct of the mapmakers.[168]

While the greatest benefit of the vote dilution index is that it permits evaluation and comparison of vote dilution on a per-district basis, the index can also be calculated on a statewide basis. To do so, one simply sums the numerators of the formula for each district (i.e. the total number of voters on a statewide basis who, were the map drawn to maximize competitiveness, would be moved from "safe" districts to competitive ones) and divides that sum by the total number of voters in the state.[169] Performing such an analysis allows one to consider the extent to which each district contributes to vote dilution on a statewide basis, as well as to compare the degree of statewide vote dilution to the state's efficiency gap or other statewide measures of partisan asymmetry.[170]

B. Illustrating the Metric

To demonstrate the utility of the vote dilution index, let us proceed through a simplified illustration of its application. Let us assume that there is a district, which we shall call "District 1," that contains four voting precincts, which we will call Precincts A, B, C, and D.

168. We do not claim, however, that a high vote dilution index necessarily reflects an invidious intent on the part of the mapmakers to disempower voters generally, or to disadvantage partisans of either political party in particular. Rather, the vote dilution index merely measures the *effect* of the mapmakers' decisions; it does not, standing alone, permit definitive conclusions about the mapmakers' purpose or intent (although it may be strong evidence thereof). Nor, as *Whitford* holds, is such an inference necessary for plaintiffs to have standing to assert claims based on partisan gerrymandering. *See* Gill v. Whitford, 138 S. Ct. 1916, 1932 (2018) ("[T]he question at this point is whether the plaintiffs have established injury in fact. That turns on effect, not intent . . . .").

169. In order to account for shifts in the opposite direction, one may also calculate the "negative" vote dilution index by determining the number of voters who are currently situated in competitive districts but would be moved into safe districts on a maximally competitive map. Although some such shifts are inevitable in any redrawn map, they are negligible relative to the number of voters that would move from safe to competitive districts. *See infra* note 183. Were one to then subtract the negative vote dilution index for the state from the state's vote dilution index, she will then produce a "net" vote dilution index, which will reflect the net number of voters who would see an increase in their voting power on a maximally competitive map.

170. *See supra* notes 71–74 and accompanying text.

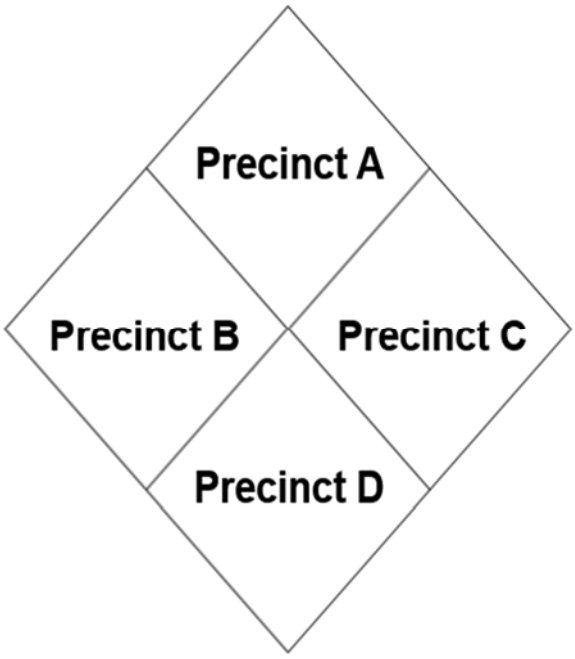

Figure 1. A hypothetical four-precinct district.

Let us assume that there are two dominant political parties in the state, which we will call the "White" party and the "Gray" party. Let us further assume that the district is presently a noncompetitive district that favors the "White" party, and, for the purpose of illustration only, that each of the precincts has an equal voter population. Let us also assume that the maximally competitive map for the state in which District 1 is situated would include two more competitive districts than currently exist.

To determine the vote dilution index for District 1, we must determine how many voters in the district would be drawn into a competitive district on a maximally competitive map. To do this, we simply perform a precinct-by-precinct comparison between the two maps. Let us assume that, on a maximally competitive map, Precinct A is situated in a New District 1, which would remain a "safe" district for the White party; that Precinct B is situated in a New District 2, which would become a "safe" district for the Gray party; that Precinct C is situated in a New District 3, which would become a competitive district; and that Precinct D is situated in a New District 4, which would likewise become a competitive district.

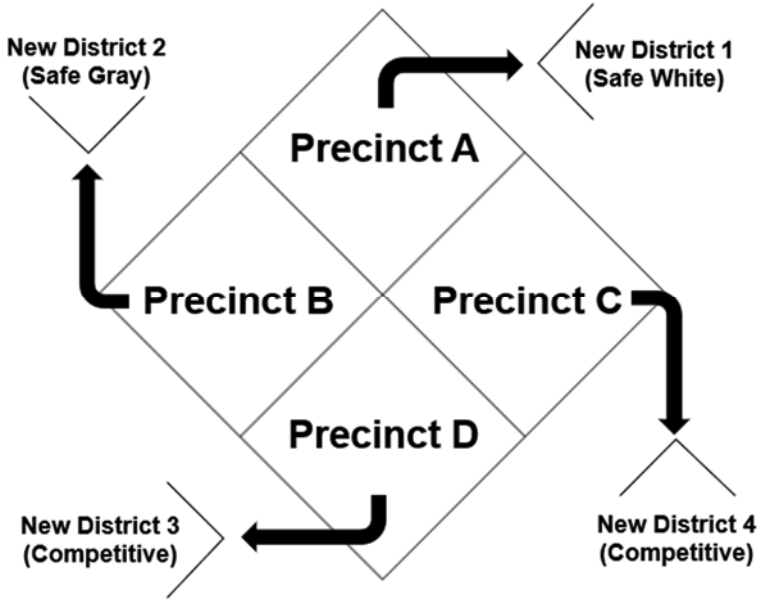

Figure 2. An illustration of the districts into which our hypothetical precincts would be drawn on a maximally competitive map.

We now have all of the information we need in order to determine the vote dilution index for District 1. Because Precinct A would remain in a district that is "safe" for the White party on the maximally competitive map, no voters in that precinct are added to the numerator of the formula.[171] Likewise, the voters of Precinct B do not count towards the vote dilution index, because even on a maximally competitive map, they will remain in a safe district, albeit a district that is safe for the opposing party.[172] The voters of Precinct C and D, however, could, on a maximally competitive map, be situated in competitive districts, and their numbers therefore do count towards the vote dilution index.[173] Given that each of the precincts has an equal voter population, we can say that half of the voters in District 1 could be drawn into a competitive district on a maximally competitive map, and the vote dilution index of District 1 is therefore 50.[174]

An observant reader will note that the foregoing illustration in fact included more information than was needed in order to determine the vote

171. *See supra* notes 164–65 and accompanying text.
172. *See supra* notes 164–65 and accompanying text.
173. *See supra* notes 167–68 and accompanying text.
174. *See supra* notes 167–68 and accompanying text.

dilution index for our hypothetical district. That is because we identified the direction of the partisan advantage (i.e., towards the White party or the Gray party) for each district in question. As far as the vote dilution index is concerned, that fact is irrelevant.[175] All that matters to the calculation is whether the relevant districts are competitive or noncompetitive, not which party is favored. This reflects the reality that vote dilution can occur either by "cracking" or "packing," and that each may produce a similar dilutive effect.[176]

The example of Precinct B above is therefore illustrative, in that the voters of Precinct B, even though they reside in a safe White district and would reside on a safe Gray district on a maximally competitive map and thus would experience a change in which party controlled their Congressional district, they do not count towards the vote dilution index because their voting power would not increase on the maximally competitive map: they are still fated to elect a politician from the dominant political party in their district. While they may currently be "packed" into a safe White district and would, on a maximally competitive map, be "cracked" into a safe "Gray" district, in either case they lack any substantial power to affect the outcome of an election in their district.[177]

Now let us provide a slightly more complex explanation by illustrating the vote dilution index in the context of a hypothetical state redistricting plan. Take a state that has been divided into five Congressional districts.[178] Let us assume that each district contains four precincts with voter populations of 125,000 apiece, which we depict below as squares, and that the population is evenly distributed throughout the state.[179] Let us further assume that, on the current Congressional map, two of the districts are "safe" districts for the White party; two are "safe" for the Gray party; and one is a competitive district. In the figure below, the color of each square reflects the fact that the corresponding party enjoys a dominant advantage in each such region.

175. *See supra* notes 148–53 and accompanying text.

176. *See supra* note 11 and accompanying text.

177. *See supra* notes 148–53 and accompanying text.

178. While we have chosen a round number to simplify the illustration, it is not far from the true voting age population of the average Congressional district in the United States, which hovers around 540,000. The average voting age population of a Congressional district in South Carolina, in fact, is almost exactly 500,000.

179. This is of course a highly unrealistic assumption, but we make it nonetheless for the purpose of illustration. *See* Cain et al., *supra* note 109, at 1530 ("Partisans are not randomly dispersed across geography. Rather they cluster in nonrandom ways, causing redistricting to produce natural partisan bias.").

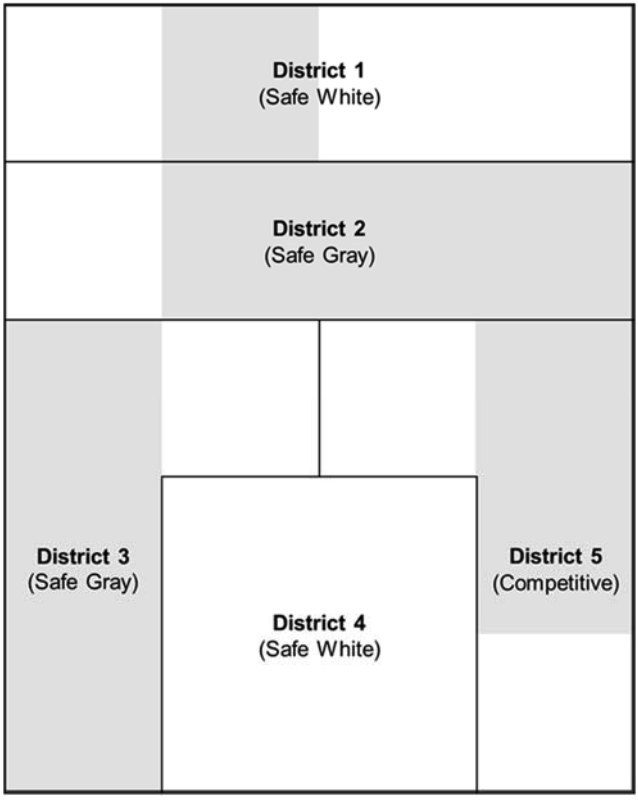

Figure 3. A hypothetical state composed of five districts. Regions shaded in gray are dominated by the Gray party.

Now let us further assume that, if one were to redraw the map to maximize the number of competitive districts, it would be possible to create four competitive districts and one safe White district, like so:

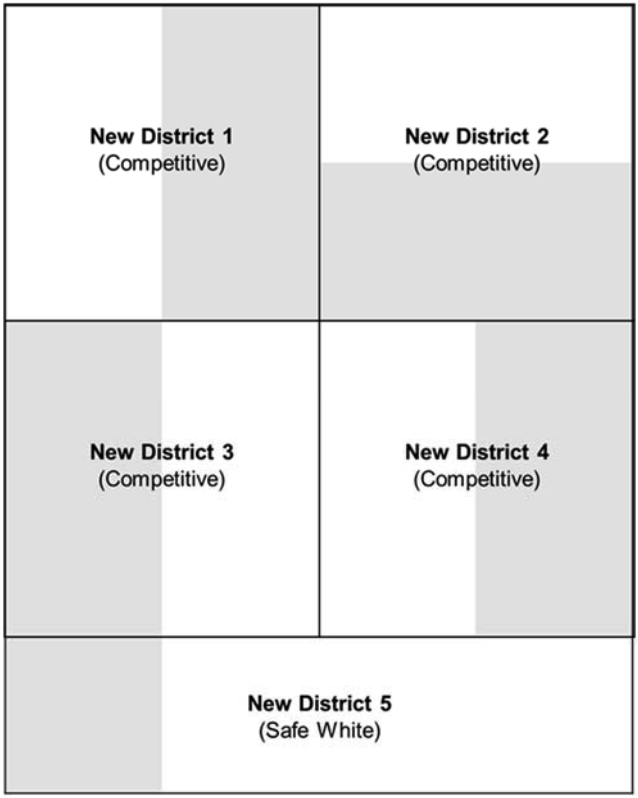

Figure 4. A maximally competitive map drawn on the same territory shown in Figure 3.

We now have all the information we need in order to be able to determine the vote dilution index for each of the existing Congressional districts. Let us begin by examining Districts 1 and 2. Districts 1 and 2 are districts that are "safe" districts for White and Gray, respectively. On the maximally competitive map, however, the entire population of each district would instead reside in a competitive district. Thus, the vote dilution index for both District 1 and District 2 is 100.[180]

180. The fact that, in our illustration, both District 1 and District 2 have vote dilution indices of 100, despite being controlled by different parties, points up the fact that the vote dilution index is focused on the degree of competitiveness and exhibits no preference towards producing maps that favor one party over another.

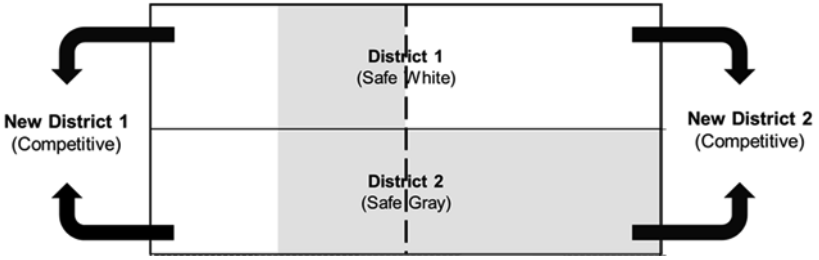

Figure 5. A figure reflecting that the entire population of both District 1 and District 2 could be situated in a competitive district on a maximally competitive map.

In the case of District 3, however, it is not possible to situate its entire population in a competitive district on a maximally competitive map. Although three quarters of the population is situated in a competitive district (New District 3) on the maximally competitive map, one quarter of the population is situated in a District 5 on the maximally competitive map, a district that is safe for White. Thus, since only three quarters of the population of District 3 would be situated in a competitive district on a maximally competitive map, the vote dilution index of District 3 is 75.[181]

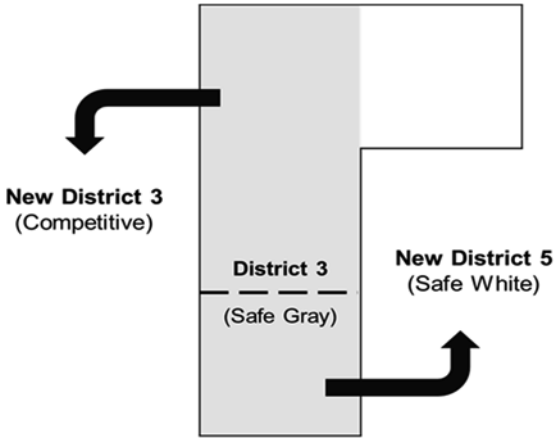

Figure 6. A figure reflecting that only three quarters of the population of District 3 would be in a competitive district on a maximally competitive map.

181. Note that it is irrelevant to the calculation of the vote dilution index that the quarter of voters who are in noncompetitive districts on both maps are in a district that is "safe" for Gray on the existing map, but would be in a district that is "safe" for White on the maximally competitive map. That is because, in either case, their votes do not stand a realistic chance of affecting the outcome of the election, and therefore it cannot be said that their voting power has been measurably diminished by the decisions of mapmakers.

A similar analysis applies in the case of District 4, which is a safe district for White on the current map. On a maximally competitive map, half of the population of District 4 would be resituated into either New District 3 or New District 4, each of which is a competitive district. The remaining half of its population, however, would be situated in New District 5, which is a safe district for White. Thus, since only half of the population of District 4 would be situated in a competitive district on a maximally competitive map, the vote dilution index of District 4 is 50.

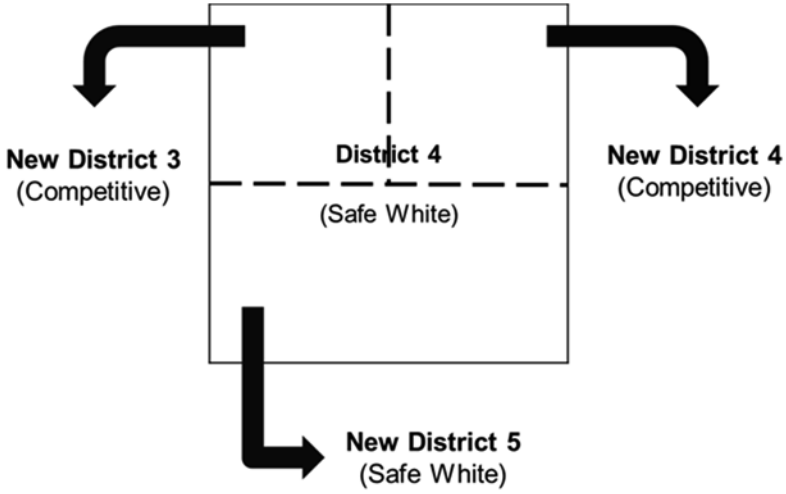

Figure 7. A figure demonstrating that only half the population of District 4 would be situated in a competitive district on a maximally competitive map.

Finally, let us examine the case of District 5. On a maximally competitive map, three quarters of the population of District 5 would be situated in a competitive district, New District 4. One quarter of the population would move to New District 5, which is a safe district for White. Since, however, District 5 is already a competitive district on the current map, its vote dilution index is 0 because there are no voters in District 5 who are currently situated in a noncompetitive district.[182]

182. At first blush, it may seem surprising that the vote dilution index does not pick up that a quarter of the population of District 5, which is competitive on the current map, would be moved into a safe White district on a maximally competitive map, and thus, the voters in District 5 would in fact receive a diminution in voting power if the map were drawn to maximize competition. As counterintuitive as it may seem, we believe this outcome is appropriate. The vote dilution index is our attempt to identify the number of voters in a given district whose voting power has been substantially diminished as a result of decisions by the mapmakers. Since, in an already-

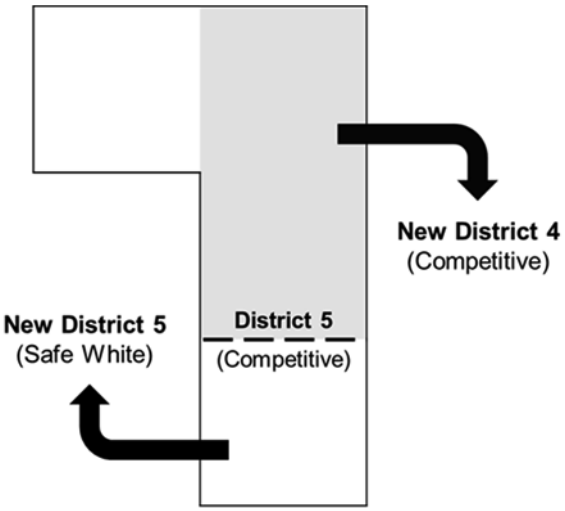

Figure 8. A figure demonstrating that one quarter of the population of District 5 would be situated in a safe district on a maximally competitive map.

Looking at the entire state map, we are also able to calculate the statewide vote dilution index by calculating the percentage of the total population of the state that is situated in a safe district but would be situated in a competitive district on a maximally competitive map. Forty percent of the state's voter population lives in Districts 1 and 2, which both have a vote dilution index of 100. Three-quarters of the population of District 3 (a safe district) would likewise be situated in a competitive district on a maximally competitive map, and those voters make up 15 percent of the state's total

competitive district, there are no such voters, it makes sense that the vote dilution index should be zero for such districts.

If, however, one wished to use a similar method to measure the impact that drawing a particular map to be more competitive would have on an already-competitive district, our method could be easily adapted to that end. One would simply calculate the total voting age population in each competitive district that, on a maximally competitive map, would be situated in a safe district or districts. We believe that, for the sake of clarity, this number should be expressed as a negative. Thus, in the example above, District 5 would have a vote dilution index of -25.

We did in fact calculate these numbers in order to net them out of our statewide calculations of the vote dilution index. *See infra* notes 207–15 and accompanying text. As discussed therein, however, only 41 Congressional districts have negative vote dilution indices under this calculus, and on a statewide basis, most states experience only a negligible decrease in their vote dilution indices when their negative vote dilution indices are factored in. In other words, in all states where negative vote dilution indices were observed, there are significantly more voters who could be placed into competitive districts who have instead been drawn into safe districts, than there are voters who would be shifted of competitive districts into safe ones on a maximally competitive map.

voter population. Likewise, half of the population of District 4 would be situated in a competitive district on a maximally competitive map, and those voters constitute an additional 10 percent of the state's total population. Thus, since slightly less than two-thirds of the state's population could have been drawn into a competitive district but has instead been drawn into a safe district for either White or Gray, the statewide vote dilution index is 65.[183]

Although this illustration involves a number of simplifying assumptions for the sake of demonstration, it highlights the intuitiveness and practicality of our proposed metric. Simply by determining the percentage of the voter population of a given district that, on a maximally competitive map, could instead be located in a competitive district, one can produce a single metric that permits comparison of districts both to each other and to the maximally competitive map.[184] As the illustration further demonstrates, a district's vote dilution index can be decreased either by "unpacking" the district—i.e., by moving majority voters in one district into a more competitive district—or by "uncracking" it—i.e., by doing the same for minority voters in that same district.[185] Again, the point is not that a maximally competitive map is necessarily ideal, but rather that, by comparing any given map to the maximally competitive map, we can assess the degree to which the lack of competitiveness in any particular district is a function of decisions made by mapmakers (and not merely a function of geography).[186]

C. Applying the Metric

We have calculated the vote dilution index for each of the United States' 435 Congressional districts using the methodology set forth above, using data culled from U.S. Census Bureau data and FiveThirtyEight's

183. As we explain above, see *supra* note 182 and accompanying text, we have also developed metrics that we call the "negative" and "net" vote dilution indices, which account for the number of voters in competitive districts who would be drawn into noncompetitive districts if the maximally competitive map were adopted. Since, in the illustration above, one quarter of the population of District 5 (a competitive district) would be placed in a noncompetitive district on the maximally competitive map and that population represents five percent of the total population of the state, the "negative" vote dilution index of the maximally competitive map is -5 and the "net" vote dilution index is therefore 60.

184. *See infra* Part III.C.

185. *See* Gill v. Whitford, 138 S. Ct. 1916, 1931 (2018) ("Remedying the individual voter's harm . . . does not necessarily require restructuring all of the State's legislative districts. It requires revising only such districts as are necessary to reshape the voter's district—so that the voter may be unpacked or uncracked, as the case may be.").

186. *See supra* note 159 and accompanying text.

publicly accessible data set.[187] The results of that analysis are depicted in the Appendix hereto.[188] A few of the more salient findings are reported here.

Forty-nine Congressional districts yielded a vote dilution index of 100. That means that, in 49 of the 435 Congressional districts, literally every voter in the district could be drawn into a competitive district if the state's map were drawn to maximize the number of competitive districts.[189] These 49 districts comprehend approximately 27 million voting-age individuals, more than 11 percent of the total voting-age population of the United States.[190] Twenty-seven such districts have been drawn to favor Democrats; 22 to favor Republicans.[191]

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187. In utilizing FiveThirtyEight's model, we adopt, for purposes of our analysis, FiveThirtyEight's definition of competitiveness, which requires that each major party have at least an 18 percent of gaining the seat over time, an assessment reached by reference to the Cook Partisan Voter Index (PVI) for the district. *See* Aaron Bycoffe et al., *We Drew 2,568 Congressional Districts by Hand. Here's How.,* FIVETHIRTYEIGHT (Jan. 25, 2018), https://fivethirtyeight.com/features/we-drew-2568-congressional-districts-by-hand-heres-how/ ("The probabilities of electing a Democrat or Republican are based on how often seats with a given Cook PVI elected members of each party between 2006 and 2016. They reflect a seat's expected performance over the long run, across a variety of political conditions. They are not predictions for the 2018 election, specifically."). To express that concept in the more traditional frame of the Cook Partisan Voter Index (PVI), a noncompetitive district is one where the PVI is greater than +5 for either party. Bycoffe et al., *supra*; David Wasserman & Ally Flinn, *The Cook Partisan Voting Index for the 115th Congress*, COOK POLITICAL REPORT (2017), https://adobeindd.com/view/publications/76a932db-5c64-472a-b201-6534a25a6d03/1/publication-web-resources/pdf/PVI_Doc.pdf ("[T]he Cook PVI measures how each district performs at the presidential level compared to the nation as a whole. . . . A Partisan Voting Index score of D+2, for example, means that in the 2012 and 2016 presidential elections, that district performed an average of two points more Democratic than the nation did as a whole, while an R+4 means the district performed four points more Republican than the national average. If a district performed within half a point of the national average in either direction, we assign it a score of EVEN.").

We believe this a fair threshold for distinguishing competitive from noncompetitive districts, although we might prefer a probability closer to 20 percent, to mirror the number of Congressional elections to be held over the life of the map. *See supra* notes 150–51. Were that or a different threshold for competitiveness set, it is possible that the voter dilution index would produce different raw numbers. But once an analyst sets such a threshold and creates a map that maximizes the number of competitive districts under her definition, the methodology described above will still be available to permit that analyst to compare the degree of vote dilution across all districts on the current map. *See supra* notes 150–51 (presenting criteria for creation of maximally competitive map). Because FiveThirtyEight's "promote competitive elections" map is designed to maximize the number of districts that are competitive under the foregoing definition, it meets our definition of a "maximally competitive map." *See supra* note 151.

188. *See infra* app. tbl.1 (Nonzero Vote Dilution Indices of U.S. Congressional Districts, Ranked).

189. *See supra* note 156 and accompanying text.

190. Based upon data from the U.S. Census Bureau. *See* UNITED STATES CENSUS BUREAU, https://www.census.gov/ (last visited Oct. 5, 2018) [hereinafter U.S. CENSUS BUREAU].

191. *See infra* app. tbl.1 (Nonzero Vote Dilution Indices of U.S. Congressional Districts, Ranked).

An additional 261 Congressional districts have nonzero vote dilution indices less than 100, meaning that at least some (but not all) voters in the district have been drawn into "safe" districts, where they would instead be situated in a competitive district on a maximally competitive map.[192] Republicans are favored in 138 of these districts; Democrats in 123.[193] The total voting-age population of these districts is approximately 140 million people, approximately half of whom would reside in a competitive district on their state's most competitive possible map.[194] When combined with the voting-age population of the Congressional districts with vote dilution indices of 100, that produces a total of 97 million voting-age individuals who are living in safe districts but who could instead be living in competitive districts, a number representing almost exactly a third of the voting-age population of the United States.[195]

Vote dilution indices higher than 50 occurred in 126 of the 261 districts with nonzero vote dilution indices less than 100.[196] That means that, in 175 of the 435 Congressional districts in the United States, more than half the voting-age population could be drawn into a competitive district but has instead has been drawn into a "safe" district.[197] More than 77 million voting-age individuals residing in those districts could be drawn into competitive

192. *See infra* app. tbl.1 (Nonzero Vote Dilution Indices of U.S. Congressional Districts, Ranked).

193. One should not misread these and similar findings to suggest that partisan gerrymandering necessarily favors one party over the other. A district may be safely Republican because the Republicans have successfully cracked Democratic clusters into multiple districts—but it may also be the case that the Democrats successfully packed the district with Republican voters in order to reduce their ability to influence elections in other districts. Indeed, what the vote dilution index may show most powerfully is that the parties have sometimes conspired to draw both safe Republican districts and safe Democratic districts where competitive districts are possible, with a resulting loss of voting power for voters in "safe" districts, regardless of the party who claims the advantage in any one of them. *See* Christopher Ingraham, *America's Most Gerrymandered Districts*, WASH. POST (May 15, 2014), https://www.washingtonpost.com/news/wonk/wp/2014/05/15/americas-most-gerrymandered-congressional-districts ("Contrary to one popular misconception about the practice, the point of gerrymandering isn't to draw yourself a collection of overwhelmingly safe seats. Rather, it's to give your opponents a small number of safe seats, while drawing yourself a larger number of seats that are not quite as safe, but that you can expect to win comfortably. . . . [T]he point of gerrymandering isn't to draw yourself a safe seat but to put your opponents in safe seats by cramming all of their supporters into a small number of districts. This lets you spread your own supporters over a larger number of districts.").

194. U.S. CENSUS BUREAU, *supra* note 190.

195. *supraId.*

196. *See infra* app. tbl.1 (Nonzero Vote Dilution Indices of U.S. Congressional Districts, Ranked); *see also supra* note 193 (discussing implications of such partisan analysis).

197. *See infra* app. tbl.1 (Nonzero Vote Dilution Indices of U.S. Congressional Districts, Ranked).

districts.[198] One hundred and three of the 174 districts in this category have been drawn to favor Republicans; 71 to favor Democrats.[199]

In only 115 of the 435 Congressional districts was the vote dilution index found to be zero.[200] Seventy-two of those districts had a vote dilution index of zero because they were already deemed competitive under FiveThirtyEight's model.[201] The remaining 43 districts achieved a vote dilution index of 0 because they are geographically situated in such a way that, even if their state's map were redrawn to maximize competitiveness, none of the voters in that district would find themselves in a competitive district.[202] Seven of those districts are the at-large districts of Alaska, Delaware, Montana, North Dakota, South Dakota, Vermont, and Wyoming, each of which is represented in Congress by a single representative whose district covers the whole state.

Among the districts with positive vote dilution indices under 100, the degree of vote dilution showed little clustering, with a more-or-less straight-line relationship between the vote dilution index of a district and its rank among the districts.[203] Likewise, there appears to be only minimal correlation between which party controls a given district and the degree of vote dilution present in the district. Among districts with vote dilution indices above 80, the number of safe Democratic districts is nearly equal to the number of safe Republican districts.[204] For those with nonzero vote dilution indices below 80, Democratic districts tend to have lower vote dilution indices than Republican districts, and there are fewer such Democratic districts overall.[205] As noted above, however, there are five more Democratic districts that have vote dilutions indices of 100 than Republican districts, but there are many more Republican districts than Democratic districts whose vote dilution indices are less than 100 and more than zero.[206]

198. U.S. CENSUS BUREAU, *supra* note 190.

199. *See infra* app. tbl.1 (Nonzero Vote Dilution Indices of U.S. Congressional Districts, Ranked).

200. *See infra* app. tbl.2 (Vote Dilution Indices of U.S. Congressional Districts by Rank).

201. *See* Aaron Bycoffe et al., *The Atlas of Redistricting*, FIVETHIRTYEIGHT (Jan. 25, 2018), https://projects.fivethirtyeight.com/redistricting-maps/.

202. *See supra* note 155 and accompanying text.

203. *See infra* app. tbl.2 (Vote Dilution Indices of U.S. Congressional Districts by Rank); app. tbls. 4–7 (Vote Dilution Indices of U.S. Congressional Districts, Ranks 1–300).

204. *See infra* app. tbls.3–4 (Vote Dilution Indices of U.S. Congressional Districts, Ranks 1–150).

205. *See infra* app. tbls.4–7 (Vote Dilution Indices of U.S. Congressional Districts, Ranks 51–300); *see also supra* note 193 (discussing implications of such partisan analysis).

206. *See supra* notes 191, 199 and accompanying text; *see also supra* note 193 (discussing implications of such partisan analysis).

We also calculated the vote dilution index for each state.[207] In addition to the seven single-district states (whose vote dilution index is zero by definition),[208] five other states achieved vote dilution indices of zero: Hawaii, Iowa, Idaho, New Hampshire and West Virginia.[209] Nebraska's vote dilution index was only slightly worse, at 1.8.[210] Of the remaining 37 states, 35 have vote dilution indices of 20 or more, meaning that, in those 35 states, fully one-fifth of the voters in the state have been drawn into noncompetitive districts who could instead be drawn into competitive districts.[211] The highest vote dilution index by far belongs to North Carolina, whose vote dilution index of 77.3 is more than 11 points higher than the next closest contender.[212] Fifteen states have vote dilution indices of 50 or more, and the median vote dilution index across all multi-district states is 35.9.[213]

Notably, on a nationwide basis, redrawing the maps to maximize the number of competitive districts would not result in *any* voters being moved from competitive districts into safe ones in 21 of the 38 states whose maps can be made more competitive, and on a nationwide basis the percentage of voters who would suffer such a fate is only 1.1 percent.[214] On a nationwide basis, if one were to implement the maximally competitive map, approximately 94 million voters who live today in safe districts would live in competitive ones, whereas only approximately 2.4 million voters would be moved in the other direction.[215]

According to FiveThirtyEight's model, approximately 82 percent of the American public live in "safe" Congressional districts—districts where it is unlikely that party control of the district will change over the decade-long life of the map.[216] Thanks to the vote dilution index, we can not only say that it is possible to draw nearly half of these voters into competitive districts, but also, for each existing district, exactly how many voters could be so drawn.[217] We believe that this analysis provides the clearest picture available of the degree to which the decisions of mapmakers have diluted the power

207. *See infra* app. tbl.8 (Vote Dilution Index by State, Ranked).

208. These states are Alaska, Delaware, Montana, North Dakota, South Dakota, Vermont, and Wyoming. *See supra* note 155 and accompanying text.

209. *See infra* app. tbl.8 (Vote Dilution Index by State, Ranked).

210. *See infra* app. tbl.8 (Vote Dilution Index by State, Ranked).

211. *See infra* app. tbl.8 (Vote Dilution Index by State, Ranked).

212. *See infra* app. tbl.8 (Vote Dilution Index by State, Ranked).

213. *See infra* app. tbl.8 (Vote Dilution Index by State, Ranked).

214. *See infra* app. tbl.8 (Vote Dilution Index by State, Ranked).

215. U.S. CENSUS BUREAU, *supra* note 190.

216. *Id*.

217. *See infra* app. tbl.1 (Nonzero Vote Dilution Indices of U.S. Congressional Districts, Ranked); *supra* notes 190, 194 and accompanying text.

of voters to select their representatives, the very proof the *Whitford* Court required for a partisan gerrymandering case to go forward.[218]

D. The Advantages of the Vote Dilution Index

Unlike the efficiency gap, the vote dilution index allows a plaintiff to make a district-specific prima facie showing of partisan vote dilution that should be adequate to survive a motion for summary judgment on standing grounds.[219] Our metric drives directly at the alleged injury that underlies a vote dilution claim: that an individual voter, by virtue of her placement in a particular legislative district, has significantly less power to affect the outcome of elections than she would if the map had been drawn to make the districts more competitive.[220] Importantly, our metric does not seek simply to compare her voting power to the voting power of a voter elsewhere in the state, since even a map that is drawn to maximize competitiveness will not create totally equal voting power among all voters due to the geographic clustering of voters of either party.[221] Likewise, our method does not entail a claim that it is constitutionally necessary that a map be drawn to maximize the voting power of any particular voter; instead, it simply provides a baseline to judge whether or not a particular voter would see an increase in her voting power if the district been drawn to make its elections more competitive.[222] As such, the vote dilution index does something that no

218. *See* Gill v. Whitford, 138 S. Ct. 1916, 1930 (2018).

219. *See supra* Part II.A.

220. *See Whitford*, 138 S. Ct. at 1931 (noting that vote dilution claims arise "from the particular composition of the voter's own district, which causes his vote . . . to carry less weight than it would carry in another, hypothetical district"); Davis v. Bandemer, 478 U.S. 109, 133 (1986) (finding constitutionally suspect an "electoral system [that] substantially disadvantages certain voters in their opportunity to influence the political process effectively").

221. *Whitford*, 138 S. Ct. at 1925 (reciting testimony of experts that "efficiency gaps alone are unreliable measures of durable partisan advantage, and that the political geography of Wisconsin currently favors Republicans because Democrats—who tend to be clustered in large cities—are inefficiently distributed in many parts of Wisconsin for purposes of winning elections"); *see also* Stephanopoulos & McGhee, *supra* note 4, at 859 (acknowledging that "the geographic distributions of the parties' supporters are highly heterogeneous"); *id.* at 894 ("[I]n many urbanized states, Democrats are highly clustered in dense central city areas, while Republicans are scattered more evenly through the suburban, exurban, and rural periphery." (quoting Jowei Chen & Jonathan Rodden, *Unintentional Gerrymandering: Political Geography and Electoral Bias in Legislatures*, 8 Q.J. POL. SCI. 239, 241 (2013)); *id.* at 884–85 (suggesting that, to solve this problem, "states whose plans have efficiency gaps above [the authors' desired] thresholds would have the chance to show that the gaps . . . were inevitable due to the states' underlying political geography" and acknowledging that, if "plans with gaps below the thresholds . . . could not be drawn at all, then there would be no constitutional violation"); *see also* Clemens Puppe & Atilla Tasnádi, *Optimal Redistricting Under Geographical Constraints: Why "Pack and Crack" Does Not Work*, 105 ECON. LETTERS 93 (2009).

222. *See supra* note 159 and accompanying text.

previously developed metric has been capable of doing: it permits a plaintiff to assert a personal injury arising from a legislature's decision to draw her into a less competitive district than she could otherwise have been placed, while accounting for the geographical limitations arising from the requirement of contiguity and the pervasiveness of partisan clustering.[223]

While we believe these features of the vote dilution index are sufficient to solve the problem identified by the Court in *Whitford*,[224] our metric has other salient advantages as well. First, unlike the efficiency gap, our metric does not allow a voter's diminution in voting power to be compensated for by another voter's corresponding change in voting power elsewhere in the state.[225] Instead, the vote dilution index compares a voter's present district on the map with the district she would be in if the map had been drawn to maximize the number of competitive districts in the state—i.e., to minimize gerrymandering.[226]

An additional (and we believe positive) feature of our methodology is that it permits a voter to assert a personal injury even if the party with which she identifies controls the district into which she has been drawn, or even if she does not identify with any party at all.[227] That is because the injury she asserts is not merely that her party is unable to gain control of the district in which she resides (a claim that would not be available in any "packed" district), but that her own power to affect that outcome has been diminished to a greater degree than it would be if the map had been drawn to increase (and indeed, to maximize) its competitiveness—in other words, that her power to change which party she votes for (i.e., her right to vote) has been rendered inconsequential by the decisions of the mapmakers.[228] Thus, the

223. *See infra* note 239 and accompanying text. *See, e.g.*, Ingraham, *supra* note 193; *see also* Aaron Blake, *Name That District Contest Winner: 'Goofy Kicking Donald Duck'*, WASH. POST (Dec. 29, 2011), https://www.washingtonpost.com/blogs/the-fix/post/name-that-district-contest-winner-goofy-kicking-donald-duck/2011/12/29/gIQA2Fa2OP_blog.html (awarding a free T-shirt to a reader who dubbed Pennsylvania's Seventh Congressional District "Goofy Kicking Donald Duck"); *see also* Trip Gabriel, *In Comically Drawn Pennsylvania District, the Voters Are Not Amused*, N.Y. TIMES (Jan. 26, 2018), https://www.nytimes.com/2018/01/26/us/pennsylvania-gerrymander-goofy- district.html.

224. *See Whitford*, 138 S. Ct. at 1921 ("A plaintiff who complains of gerrymandering, but who does not live in a gerrymandered district, 'assert[s] only a generalized grievance against governmental conduct of which he or she does not approve.'" (quoting United States v. Hays, 515 U.S. 737, 745 (1995))).

225. *See supra* note 133 and accompanying text; Bernstein & Duchin, *supra* note 115, at 1021 (noting that "a lot of packing and cracking . . . is not penalized by [the efficiency gap if] it happens symmetrically to voters of both parties.").

226. *See supra* notes 148–53 and accompanying text.

227. *Cf. Hays*, 515 U.S. at 745 (holding that a plaintiff must reside in an allegedly gerrymandered district in order to bring a racial gerrymandering claim).

228. *See supra* notes 148–53 and accompanying text; *see also* Transcript of Oral Argument at 24–25, Gill v. Whitford, 138 S. Ct. 1916 (2018) (remarks of Ginsburg, J.) ("[I]f you can stack a

vote dilution index allows a plaintiff to assert a personal injury that results either from "cracking," in which a voter has been placed into a district where she is a member of a hopelessly weak minority, or from "packing," in which a voter has been placed into a district where she is part of a thoroughly entrenched majority.[229]

Our metric also serves the useful function of helping to readily disqualify claims by plaintiffs who live in districts that are already competitive, as well as those who, regardless of how the map is drawn, will not be situated in a competitive district (since those districts will have a vote dilution index of zero).[230] As such, it limits the class of plaintiffs who might plausibly seek relief to those for whom there is not only an injury-in-fact, but a possibility that their injuries can be redressed, which is a separate and distinct element of the standing inquiry.[231] In addition, although the vote dilution index does not, on its own terms, admit of any necessary dividing line between what makes for a cognizable injury (or for unconstitutional gerrymandering) and what does not, it produces a full spectrum of results that permits comparison of the degree of gerrymandering to whatever threshold a court might set as being within permitted tolerance.[232] Similarly,

legislature in this way, what incentive is there for a voter to exercise his vote? Whether it's a Democratic district or a Republican district, . . . using this map, the result is preordained in most of the districts. . . . [W]hat becomes of the precious right to vote? Would we have that result when the individual citizen says: I have no choice, I'm in this district, and we know how this district is going to come out? . . . [T]hat's something that this society should be concerned about.").

229. *See supra* note 11 and accompanying text.

230. *See Whitford*, 138 S. Ct. at 1921 ("A plaintiff who complains of gerrymandering, but who does not live in a gerrymandered district, 'assert[s] only a generalized grievance against governmental conduct of which he or she does not approve.'" (quoting *Hays*, 515 U.S. at 745)); *see also id.* at 1935 (Kagan, J., concurring) ("To have standing to bring a partisan gerrymandering claim based on vote dilution, . . . a plaintiff must prove that the value of her own vote has been 'contract[ed].'" (quoting Wesberry v. Sanders, 376 U.S. 1, 7 (1964))).

231. *See* Spokeo, Inc. v. Robins, 136 S. Ct. 1540, 1547 (2016) (requiring a plaintiff to show that she (1) suffered an injury in fact, (2) that is fairly traceable to the challenged conduct of the defendant, and (3) that is likely to be redressed by a favorable judicial decision).

232. If, for example, a court were to hold that no cognizable injury arises where a partisan advantage is only "incidental," then it could set a minimum vote dilution index of 10, or 15, or 20 that must be demonstrated before it would recognize a claim. We do not, however, believe such an approach would be advisable, at least with respect to the question of Article III standing. In our view, as long as a voter can demonstrate (1) that she votes in a precinct that, on a maximally competitive map, would be situated in a competitive district and (2) that her current district is not competitive, she has demonstrated both a plausible injury-in-fact traceable to the conduct of the mapmakers and a possibility of redress that is adequate to convey Article III standing. *See Whitford*, 138 S. Ct. at 1936 (Kagan, J., concurring). The vote dilution index, however, serves to meet the requirement of *Whitford* that the injury asserted must be district-specific, as well as to measure the degree to which the district has been systematically drawn to decrease inter-party competition. *See* Wang, *supra* note 11, at 369–70 ("In gerrymandered districts, the noncompetitive nature of the general election leaves the primary election as the only avenue for voters to affect their representation. . . . Since partisan gerrymandering creates noncompetitive districts for both

it permits comparison of vote dilution in one district to vote dilution in other districts, both within a state and elsewhere in the country, thereby permitting courts to assess how great an outlier the degree of vote dilution may be in any particular district.[233]

We acknowledge that, as the origin of its name suggests, "gerrymandering" ordinarily refers to the drawing of oddly shaped districts for the purpose of creating partisan advantage.[234] Our approach, we must admit, assigns no value to the regularity or irregularity of the shape of a district in geographical terms, and thus it may assign even relatively regular, compact districts a high vote dilution index,[235] and likewise may give an oddly shaped district a vote dilution index that is low or even zero.[236] But we believe this outcome is appropriate, for several reasons.

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parties, voters on both sides may potentially feel the chill."); *Whitford*, 138 S. Ct. at 1940 (Kagan, J., concurring) (noting the view of a group of state legislators that partisan gerrymandering has "sounded the death-knell of bipartisanship" (citing Brief for Bipartisan Group of 65 Current and Former State Legislators as Amici Curiae, Gill v. Whitford, 138 S. Ct. 1916 (2018) (No. 16-1161))).

233. *See Whitford*, 138 S. Ct. at 1935 (Kagan, J., concurring) ("The harm of vote dilution . . . arises when an election practice—most commonly, the drawing of district lines—devalues one citizen's vote as compared to others.").

234. *See* Nic Cavell, *Gerrymandering Is Even More Infuriating When You Can Actually See It*, WIRED (Jan. 28, 2016), https://www.wired.com/2016/01/gerrymandering-is-even-more-infuriating-when-you-can-actually-see-it/.

235. The statewide map of Indiana helps to illustrate the point. Indiana, whose statewide vote dilution index is the ninth-worst in the country at 55.6, has been drawn to create two reliably Democratic districts surrounding Gary and Indianapolis, with the remaining seven districts being reliably Republican. *See* Aaron Bycoffe, et al., *Indiana - The Atlas of Redistricting*, FIVETHIRTYEIGHT (Jan. 25, 2018), https://projects.fivethirtyeight.com/redistricting-maps/indiana/ /redistricting-maps/indiana/. A maximally competitive map for Indiana, however, would contain only four safe Republican districts, leaving the remaining five districts competitive. In order to produce such an outcome, the entire population of the First Congressional District, which contains Gary, would be placed in a competitive district, as would 97.1 percent of the population of the Seventh Congressional District, which contains Indianapolis. Thus, despite their compactness and regular shape, the First and Seventh Congressional Districts have vote dilution indices of 100 and 97.1, respectively.

236. Consider, for example, West Virginia's Third Congressional District, which spans nearly the length of the state and has a relatively contorted shape. It nonetheless has a vote dilution index of zero because there is no conceivable map of West Virginia that would produce even a single competitive district, and thus the map cannot be said to have caused any meaningful degree of vote dilution. *See* Aaron Bycoffe et al., *West Virginia - The Atlas of Redistricting*, FIVETHIRTYEIGHT (Jan. 25, 2018), https://projects.fivethirtyeight.com/redistricting-maps/west-virginia/. Likewise, a district like Illinois's Sixth Congressional District, whose shape may look bizarre, has a vote dilution index of zero because its shape produces a highly competitive district in which Republicans have a nearly 40 percent chance of prevailing. *See* Aaron Bycoffe et al., *Illinois - The Atlas of Redistricting*, FIVETHIRTYEIGHT (Jan. 25, 2018), https://projects.fivethirtyeight.com/redistricting-maps/illinois/; *see also* Tim Jones & Patrick Judge, *Illinois' Political Map Rigging Takes Back Seat to Wisconsin, Others*, CRAIN'S CHICAGO BUSINESS (Aug. 29, 2017), https://www.chicagobusiness.com/article/20170829/NEWS02/170829860/wisconsin-gerrymandering-case-offers-little-hope-for-illinois-gop.

First, mapmakers do not draw districts shaped like salamanders, or praying mantises, or "Goofy kicking Donald Duck"[237] for the hell of it; in most cases, they do so in order to produce anticompetitive effects either within the district or across the state as a whole.[238] Using simple geography as a method of identifying the competitiveness of any particular district is therefore too facile an approach: it is *political* geography (i.e., the geographical distribution of partisan preference across a population) that determines whether or not a particular district map has an anticompetitive purpose or effect.[239]

But more importantly, vote dilution is often achieved by maximizing the compactness of a particular district, and a proper metric should therefore capture vote dilution in regularly and irregularly shaped districts alike.[240] We see no reason why, at least as far as her standing is concerned, a voter may not claim a traceable injury just as well from her vote being diluted as a result of her having been "packed" into a compact but noncompetitive district as she might from her having been "cracked" into a noncompetitive district whose lines resemble a plate of spaghetti.[241]

Conclusion

The vote dilution index is designed to permit a district-specific assessment of the degree to which the decisions of mapmakers have diminished the voting power of voters within a district, and we dare say it

237. *See* Ingraham, *supra* note 193.

238. In other cases, the lines may have been drawn to promote minority representation under the Voting Rights Act, a goal which, while laudable, may have the same anticompetitive effect on a statewide map as methods designed to affirmatively diminish the voting power of minorities within particular districts. *See* Clyde Haberman, *The Odd Political Alliance Behind Today's Gerrymandering*, N.Y. TIMES (May 28, 2018), https://www.nytimes.com/2018/05/28/us/30retro-gerrymandering-districts.html.

239. Cohn & Bui, *supra* note 120.

240. *See* Gill v. Whitford, 138 S. Ct. 1916, 1930 (2018); Vieth v. Jubelirer, 541 U.S. 267, 298 (2004) (plurality opinion) ("[P]acking and cracking, whether intentional or no, are quite consistent with adherence to compactness and respect for political subdivision lines."); Grofman & King, *supra* note 3, at 28 ("Criteria such as compactness and respect for existing political boundaries are often used as proxies for partisan gerrymandering, but they are typically not very good proxies. . . . The fundamental issue in partisan gerrymandering cases in terms of effects is whether a districting plan unfairly burdens the representational rights of a particular political group, not whether or not districts look pretty."); *see also* Boris Alexeev & Dustin G. Mixon, *An Impossibility Theorem for Gerrymandering*, ARXIV (Oct. 26, 2017), https://arxiv.org/pdf/1710.04193.pdf (demonstrating that it is mathematically impossible to achieve both optimal compactness and optimal efficiency while maintaining equal population in any redistricting scheme).

241. *See Whitford*, 138 S. Ct. at 1930; *see also* Beckett Mufson, *'Spawn of Gerrymander' Illustrates the Grotesque Shapes of US Congressional Districts*, VICE (Nov. 3, 2014), https://creators.vice.com/en_us/article/z4qmyj/spawn-of-gerrymander-illustrates-the-grotesque-shapes-of-us-congressional-districts.

does just that.[242] But the results demonstrate just how profound an impact partisan gerrymandering has on the power of voters in the United States today. Were maps across the country drawn to maximize the competitiveness of elections, then 117 million more people would live in competitive Congressional districts than do today.[243] Those voters reside in 310 of the nation's 435 Congressional districts.

That is not to say, of course, that all 310 of those districts have been drawn intentionally to disenfranchise voters.[244] Nor does it mean that maximal competitiveness is a constitutionally mandated norm, or that the degree of gerrymandering in those 310 districts has reached a constitutionally unacceptable level. Rather, it serves to illustrate just how important it is that plaintiffs who would seek to challenge partisan gerrymandering have the tools they need to establish standing so that they may raise such challenges. Although we are not so bold to claim that the vote dilution index, standing alone, provides a complete standard for declaring any particular gerrymander unconstitutional, it does allow plaintiffs to demonstrate both the degree to which their diminished voting power is traceable to the decisions of mapmakers and how that injury can be redressed.[245] As the Court reminded us in *Whitford*, that is a necessary first step before partisan gerrymandering can truly have its day in court.[246]

242. *See supra* Part III.C.

243. *See supra* notes 190, 199 and accompanying text.

244. *See supra* note 3.

245. *See supra* Part II.A.

246. *See Whitford*, 138 S. Ct. at 1930.

Appendix

Table 1. Nonzero Vote Dilution Indices of U.S. Congressional District, Ranked[247]

Rank	State	Dist.	Favored Party	VDI
1	NC	9	*Rep.*	100
2	NC	4	*Dem.*	100
3	CA	22	*Rep.*	100
4	CA	4	*Rep.*	100
5	CA	8	*Rep.*	100
6	MO	1	*Dem.*	100
7	VA	3	*Dem.*	100
8	MO	2	*Rep.*	100
9	CO	2	*Dem.*	100
10	NY	22	*Rep.*	100
11	NY	26	*Dem.*	100
12	NY	20	*Dem.*	100
13	KY	6	*Rep.*	100
14	NY	23	*Rep.*	100
15	NJ	12	*Dem.*	100
16	MD	1	*Rep.*	100
17	NY	27	*Rep.*	100
18	PA	18	*Dem.*	100
19	PA	9	*Rep.*	100
20	NC	6	*Rep.*	100
21	KY	3	*Dem.*	100
22	NY	25	*Dem.*	100
23	VA	7	*Rep.*	100
24	CO	3	*Rep.*	100
25	OH	9	*Dem.*	100
26	NJ	4	*Rep.*	100
27	CA	1	*Rep.*	100

247 Where two districts have the same vote dilution index, we have assigned a higher rank to the district with the higher absolute number of voters who could have been drawn into a competitive district on a maximally competitive map.

Rank	State	Dist.	Favored Party	VDI
28	MI	12	*Dem.*	100
29	IN	1	*Dem.*	100
30	MI	7	*Rep.*	100
31	NC	2	*Rep.*	100
32	NC	12	*Dem.*	100
33	CO	7	*Dem.*	100
34	IN	7	*Dem.*	100
35	FL	10	*Dem.*	100
36	ME	1	*Dem.*	100
37	WI	4	*Dem.*	100
38	CA	6	*Dem.*	100
39	GA	2	*Dem.*	100
40	NV	2	*Rep.*	100
41	CA	23	*Rep.*	100
42	TX	7	*Rep.*	100
43	CA	16	*Dem.*	100
44	IL	11	*Dem.*	100
45	IL	14	*Rep.*	100
46	NV	1	*Dem.*	100
47	TX	9	*Dem.*	100
48	TX	18	*Dem.*	100
49	TX	29	*Dem.*	100
50	FL	14	*Dem.*	99.9
51	WI	5	*Rep.*	99.9
52	FL	26	*Dem.*	99.9
53	VA	1	*Rep.*	99.9
54	VA	4	*Dem.*	99.9
55	NM	2	*Rep.*	99.8
56	TX	22	*Rep.*	99.7
57	PA	4	*Dem.*	99.5
58	CA	50	*Rep.*	99.3
59	CA	42	*Rep.*	98.8
60	TN	5	*Dem.*	98.6

Rank	State	Dist.	Favored Party	VDI
61	MN	6	*Rep.*	98.5
62	PA	14	*Rep.*	97.7
63	TX	21	*Rep.*	96.3
64	TX	32	*Rep.*	96.0
65	FL	6	*Rep.*	95.9
66	MN	1	*Rep.*	95.4
67	NM	3	*Dem.*	93.9
68	TX	14	*Rep.*	93.4
69	GA	6	*Rep.*	92.8
70	OH	14	*Rep.*	92.7
71	PA	12	*Rep.*	92.4
72	NC	7	*Rep.*	92.1
73	TX	6	*Rep.*	92.0
74	PA	5	*Dem.*	91.6
75	FL	5	*Dem.*	91.5
76	OH	16	*Rep.*	91.4
77	IL	8	*Dem.*	90.1
78	TX	20	*Dem.*	90.1
79	CA	9	*Dem.*	90.0
80	NJ	6	*Dem.*	89.6
81	FL	15	*Rep.*	89.5
82	MO	5	*Dem.*	89.4
83	IL	16	*Rep.*	89.3
84	NC	1	*Dem.*	88.8
85	TX	2	*Rep.*	88.8
86	WI	1	*Rep.*	88.6
87	VA	5	*Rep.*	88.5
88	NC	8	*Rep.*	88.2
89	MD	2	*Dem.*	87.8
90	VA	6	*Rep.*	86.5
91	OH	15	*Rep.*	86.2
92	VA	11	*Dem.*	86.2
93	LA	2	*Dem.*	86.1

Rank	State	Dist.	Favored Party	VDI
94	MI	5	*Dem.*	85.8
95	TX	31	*Rep.*	85.6
96	PA	10	*Rep.*	85.6
97	CA	31	*Dem.*	84.8
98	NY	17	*Dem.*	83.5
99	TX	28	*Dem.*	82.0
100	IN	4	*Rep.*	81.5
101	MD	6	*Dem.*	80.8
102	IL	12	*Rep.*	80.6
103	TX	34	*Dem.*	80.2
104	OR	1	*Dem.*	79.7
105	WA	5	*Rep.*	79.6
106	CT	4	*Dem.*	79.0
107	WA	6	*Dem.*	78.9
108	IN	2	*Rep.*	77.8
109	GA	12	*Rep.*	77.5
110	RI	2	*Dem.*	76.2
111	OK	5	*Rep.*	75.3
112	MA	6	*Dem.*	74.5
113	PA	11	*Rep.*	74.2
114	MO	3	*Rep.*	74.1
115	OH	6	*Rep.*	73.9
116	TX	12	*Rep.*	73.8
117	NC	5	*Rep.*	73.8
118	TX	27	*Rep.*	73.0
119	IL	3	*Dem.*	72.5
120	OH	4	*Rep.*	72.5
121	TX	24	*Rep.*	72.4
122	MI	3	*Rep.*	72.0
123	GA	7	*Rep.*	71.0
124	FL	16	*Rep.*	70.5
125	TX	30	*Dem.*	70.1
126	CA	24	*Dem.*	70.1

Rank	State	Dist.	Favored Party	VDI
127	IN	5	*Rep.*	70.0
128	FL	12	*Rep.*	69.2
129	MA	4	*Dem.*	68.9
130	FL	22	*Dem.*	68.8
131	FL	2	*Rep.*	68.1
132	PA	3	*Dem.*	67.7
133	MD	5	*Dem.*	67.2
134	WI	6	*Rep.*	66.7
135	OH	7	*Rep.*	66.5
136	FL	3	*Rep.*	65.4
137	WI	7	*Rep.*	64.9
138	AL	7	*Dem.*	64.9
139	IL	10	*Dem.*	64.3
140	WI	8	*Rep.*	64.3
141	GA	1	*Rep.*	64.3
142	MD	3	*Dem.*	63.0
143	MI	4	*Rep.*	62.7
144	NC	13	*Rep.*	62.5
145	FL	11	*Rep.*	61.5
146	MS	3	*Rep.*	61.5
147	NC	10	*Rep.*	61.4
148	AZ	6	*Rep.*	61.2
149	TX	17	*Rep.*	61.1
150	GA	10	*Rep.*	61.0
151	LA	1	*Rep.*	60.6
152	KS	4	*Rep.*	60.0
153	SC	2	*Rep.*	59.7
154	AL	6	*Rep.*	59.5
155	TX	5	*Rep.*	59.4
156	PA	15	*Rep.*	59.4
157	TX	10	*Rep.*	58.7
158	GA	8	*Rep.*	58.6
159	MN	4	*Dem.*	58.3

Rank	State	Dist.	Favored Party	VDI
160	CO	4	*Rep.*	57.8
161	CA	47	*Dem.*	56.9
162	GA	11	*Rep.*	56.5
163	WA	2	*Dem.*	56.5
164	SC	6	*Dem.*	55.1
165	MO	6	*Rep.*	54.0
166	SC	1	*Rep.*	53.7
167	TN	8	*Rep.*	53.5
168	CA	52	*Dem.*	53.4
169	UT	4	*Rep.*	52.5
170	AR	2	*Rep.*	52.3
171	TX	36	*Rep.*	52.0
172	IL	18	*Rep.*	51.2
173	TX	25	*Rep.*	50.2
174	OH	3	*Dem.*	50.1
175	MI	2	*Rep.*	49.6
176	CA	26	*Dem.*	49.6
177	FL	4	*Rep.*	49.4
178	TX	3	*Rep.*	48.7
179	TN	9	*Dem.*	48.3
180	TX	35	*Dem.*	47.9
181	AL	3	*Rep.*	47.9
182	IN	9	*Rep.*	47.7
183	MO	4	*Rep.*	45.6
184	CA	53	*Dem.*	45.3
185	MI	10	*Rep.*	44.8
186	MA	2	*Dem.*	44.6
187	CA	38	*Dem.*	44.5
188	GA	3	*Rep.*	44.2
189	CO	5	*Rep.*	44.0
190	OH	5	*Rep.*	44.0
191	TX	33	*Dem.*	42.6
192	TN	4	*Rep.*	42.6

Rank	State	Dist.	Favored Party	VDI
193	MN	5	*Dem.*	42.3
194	CA	2	*Dem.*	42.0
195	MA	3	*Dem.*	41.6
196	UT	2	*Rep.*	40.2
197	WA	1	*Dem.*	39.6
198	CA	33	*Dem.*	37.7
199	KS	2	*Rep.*	37.4
200	CA	41	*Dem.*	37.1
201	WA	10	*Dem.*	36.9
202	AR	1	*Rep.*	36.6
203	MO	7	*Rep.*	36.3
204	FL	17	*Rep.*	36.0
205	MA	8	*Dem.*	35.4
206	MD	7	*Dem.*	35.2
207	LA	3	*Rep.*	33.4
208	CA	27	*Dem.*	33.4
209	NY	10	*Dem.*	33.1
210	MD	8	*Dem.*	32.0
211	MD	4	*Dem.*	31.9
212	TX	26	*Rep.*	31.9
213	FL	21	*Dem.*	31.4
214	OH	12	*Rep.*	30.9
215	WA	4	*Rep.*	30.7
216	OH	13	*Dem.*	28.9
217	OH	11	*Dem.*	28.2
218	PA	2	*Dem.*	27.8
219	AL	2	*Rep.*	27.6
220	GA	5	*Dem.*	27.5
221	SC	5	*Rep.*	27.1
222	CT	1	*Dem.*	26.8
223	GA	4	*Dem.*	26.3
224	OK	4	*Rep.*	26.1
225	TN	7	*Rep.*	26.1

Rank	State	Dist.	Favored Party	VDI
226	MI	14	*Dem.*	25.8
227	IN	6	*Rep.*	24.8
228	GA	13	*Dem.*	24.5
229	RI	1	*Dem.*	24.5
230	TX	15	*Dem.*	24.5
231	NY	8	*Dem.*	24.2
232	NY	9	*Dem.*	24.1
233	IL	2	*Dem.*	23.9
234	CA	28	*Dem.*	23.6
235	CA	5	*Dem.*	23.4
236	OH	8	*Rep.*	22.8
237	CA	15	*Dem.*	22.8
238	IL	1	*Dem.*	22.6
239	CA	35	*Dem.*	22.5
240	OH	2	*Rep.*	22.4
241	CT	3	*Dem.*	22.3
242	TN	3	*Rep.*	21.5
243	CA	32	*Dem.*	21.4
244	LA	6	*Rep.*	21.4
245	AZ	7	*Dem.*	21.1
246	VA	9	*Rep.*	20.6
247	FL	20	*Dem.*	20.1
248	MA	1	*Dem.*	20.1
249	OR	3	*Dem.*	19.6
250	NC	3	*Rep.*	19.4
251	NC	11	*Rep.*	19.0
252	MS	2	*Dem.*	18.8
253	TX	11	*Rep.*	18.6
254	NY	16	*Dem.*	16.1
255	CA	46	*Dem.*	15.4
256	CO	1	*Dem.*	15.3
257	FL	19	*Rep.*	15.2
258	CA	43	*Dem.*	14.6

Rank	State	Dist.	Favored Party	VDI
259	WI	2	*Dem.*	14.6
260	UT	3	*Rep.*	14.5
261	CA	11	*Dem.*	14.4
262	NY	7	*Dem.*	14.2
263	MS	1	*Rep.*	13.9
264	IL	9	*Dem.*	13.8
265	MN	7	*Rep.*	13.2
266	CA	19	*Dem.*	12.9
267	MA	5	*Dem.*	12.6
268	NJ	1	*Dem.*	12.0
269	VA	8	*Dem.*	12.0
270	TX	4	*Rep.*	11.9
271	MI	13	*Dem.*	11.1
272	NJ	9	*Dem.*	10.9
273	PA	13	*Rep.*	10.9
274	TN	6	*Rep.*	10.3
275	AR	4	*Rep.*	10.2
276	IL	5	*Dem.*	9.1
277	NM	1	*Dem.*	8.8
278	IL	15	*Rep.*	8.0
279	AZ	8	*Rep.*	8.0
280	TX	16	*Dem.*	7.6
281	NJ	10	*Dem.*	7.6
282	SC	7	*Rep.*	7.3
283	AZ	3	*Dem.*	6.8
284	TX	8	*Rep.*	6.8
285	MS	4	*Rep.*	5.9
286	AZ	5	*Rep.*	5.7
287	AZ	4	*Rep.*	5.6
288	FL	24	*Dem.*	5.6
289	NE	1	*Rep.*	5.2
290	KS	1	*Rep.*	5.2
291	NJ	8	*Dem.*	4.9

Rank	State	Dist.	Favored Party	VDI
292	IL	4	*Dem.*	4.3
293	NY	6	*Dem.*	3.7
294	PA	16	*Rep.*	3.4
295	CA	20	*Dem.*	2.8
296	CA	44	*Dem.*	2.3
297	GA	9	*Rep.*	2.3
298	NY	5	*Dem.*	2.2
299	AL	4	*Rep.*	1.3
300	FL	23	*Dem.*	1.0
301	MO	8	*Rep.*	0.5
302	CA	29	*Dem.*	0.4
303	CA	51	*Dem.*	0.4
304	FL	1	*Rep.*	0.3
305	CA	30	*Dem.*	0.3
306	LA	5	*Rep.*	0.3
307	CA	18	*Dem.*	0.2
308	CA	17	*Dem.*	0.1
309	WA	9	*Dem.*	0.1
310	FL	8	*Rep.*	0.1

Table 2. Vote Dilution Indices of U.S. Congressional Districts, Ranked

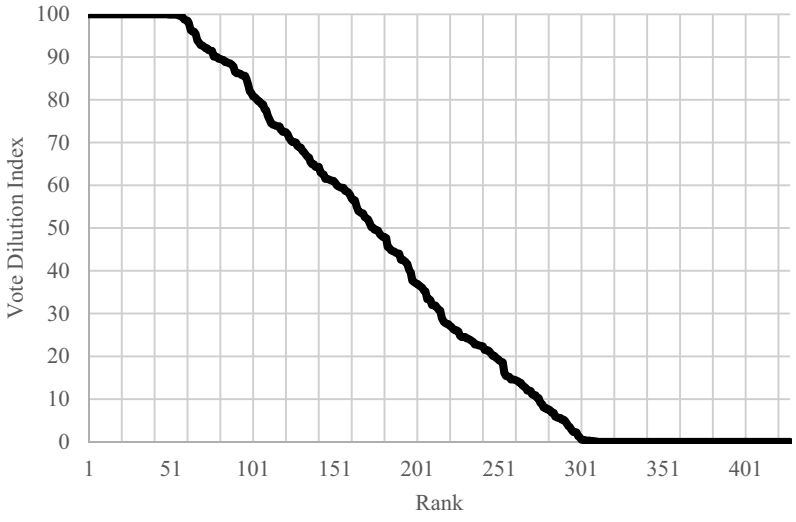


Table 3. Nonzero Vote Dilution Indices of U.S. Congressional Districts, Ranked by Party

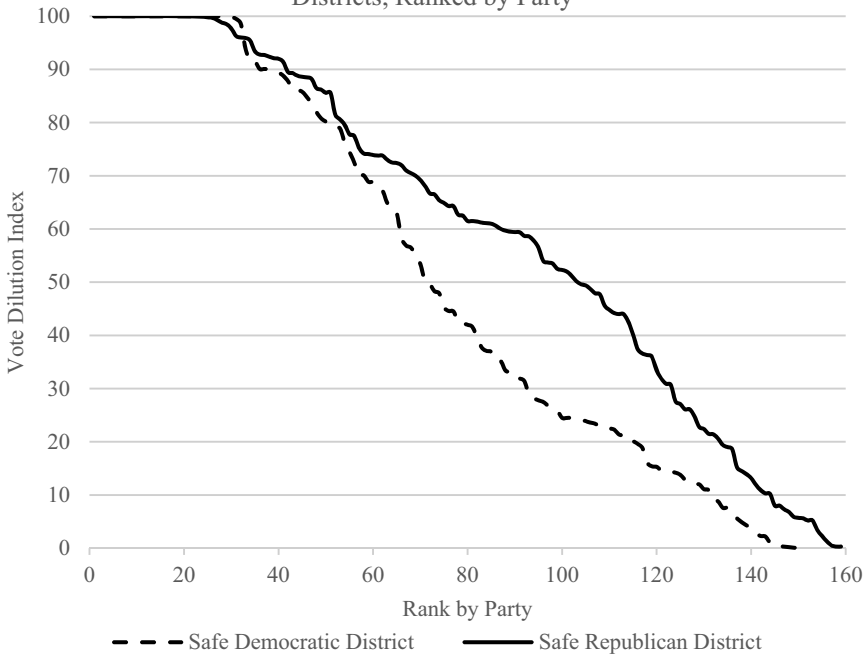


Table 4. Vote Dilution Indices of U.S. Congressional Districts, Ranks 1−75

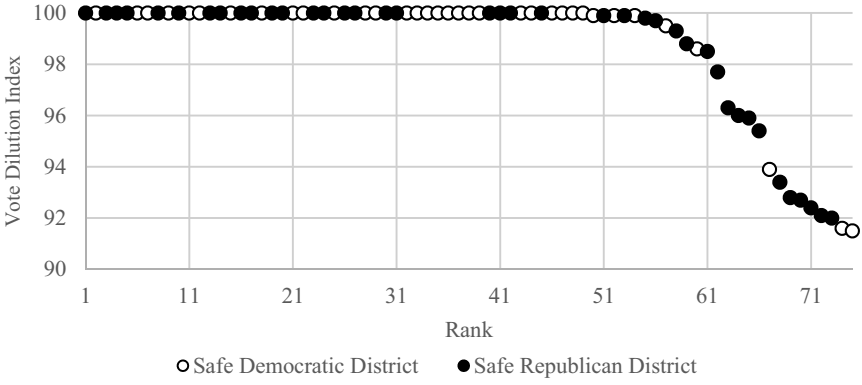
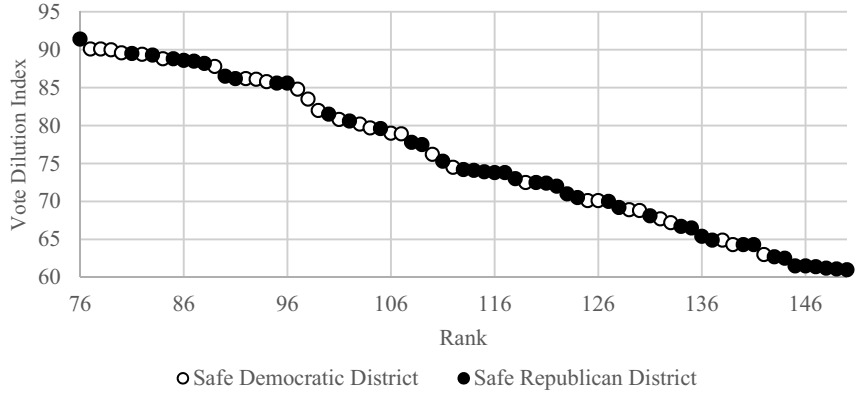
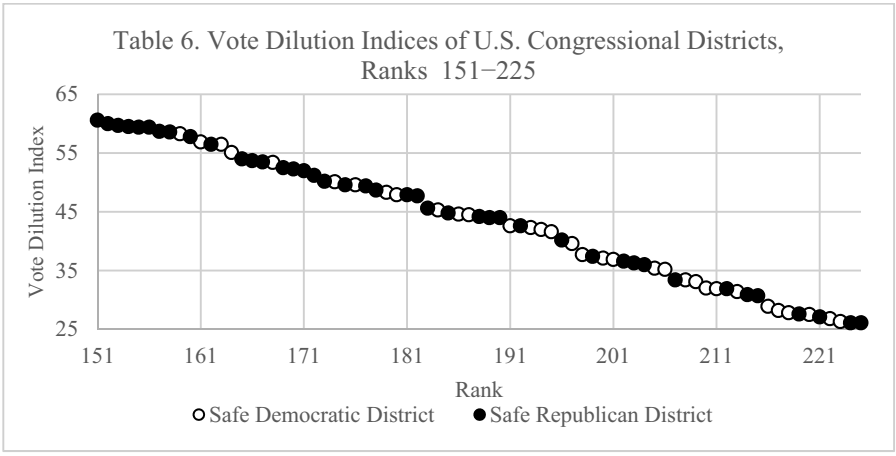


Table 5. Vote Dilution Indices of U.S. Congressional Districts, Ranks 76−150





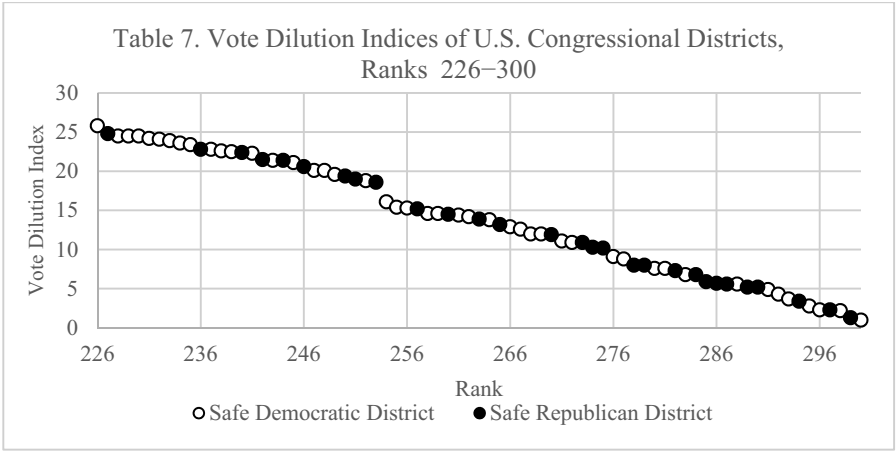


Table 8. Vote Dilution Index by State, Ranked

Rank	State	VDI	Neg. VDI[248]	Net VDI[249]
1	NC	77.3	-	77.3
2	NM	66.1	-	66.1
3	VA	63.3	-	63.3
4	MO	62.5	-	62.5
5	MD	62.2	-	62.2
6	WI	62.0	-	62.0

[248] *See supra* notes 169, 182, 187.
[249] *See supra* notes 169, 182, 187.

Rank	State	VDI	Neg. VDI[250]	Net VDI[251]
7	CO	60.0	2.1	58.0
8	TX	58.7	-	58.4
9	IN	55.6	-	55.6
10	OH	50.8	2.0	48.7
11	PA	50.5	6.3	44.2
12	GA	50.5	-	50.5
13	RI	50.4	-	50.4
14	NV	50.2	-	50.2
15	ME	50.0	-	50.0
16	FL	42.2	1.3	40.9
17	IL	40.0	1.7	38.3
18	MI	39.3	3.8	35.5
19	MN	38.2	1.0	37.2
20	KY	33.7	-	33.7
21	LA	33.7	-	33.7
22	TN	33.3	-	33.3
23	MA	32.7	-	32.7
24	CA	32.5	-	31.9
25	WA	32.3	2.3	30.0
26	NY	29.7	0.2	29.5
27	SC	28.9	-	28.9
28	AL	28.8	-	28.8
29	NJ	27.0	2.1	24.9
30	UT	26.8	-	26.8
31	KS	25.6	0.4	25.2
32	CT	25.2	5.9	19.3
33	MS	25.0	-	25.0
34	AR	24.9	-	24.9
35	OK	20.2	-	20.2
36	OR	19.5	0.2	19.3
37	AZ	12.1	1.9	10.2

[250] *See supra* notes 169, 182, 187.
[251] *See supra* notes 169, 182, 187.

Rank	State	VDI	Neg. VDI[252]	Net VDI[253]
38	NE	1.8	1.6	0.2
39	HI	-	-	0
39	IA	-	-	0
39	ID	-	-	0
39	NH	-	-	0
39	WV	-	-	0
39	AK	-	-	0
39	DE	-	-	0
39	MT	-	-	0
39	ND	-	-	0
39	SD	-	-	0
39	WY	-	-	0
39	VT	-	-	0

[252] *See supra* notes 169, 182, 187.
[253] *See supra* notes 169, 182, 187.

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