

Redistricting out Representation: Democratic Harms in Splitting Zip Codes

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Abstract

Redistricting poses a potential harm to American voters in limiting choice and accountability at the polls. Although voters still technically retain their right to contact their Congressional representatives in order to seek redress for their concerns, we argue that the confusion created when redistricting divides ZIP Codes confounds the constituent-representative link and leaves a substantive minority of voters in representational limbo. ZIP Codes perform a functional role by organizing groups of residents into easily accessible blocs for mail service. However, Congressional districts split the ZIP Codes of over 100 million Americans. Splitting ZIP Codes across multiple Congressional districts leads to constituents being confused about who their member is and greater inefficiencies for representatives to mail to their constituents. Additionally, several members of Congress actively ignore out-of-district mail. We posit that constituents from ZIP Codes split by multiple Congressional districts will be less likely to recognize, contact, or ideologically identify with their representative. We conducted a population overlap analysis between ZIP Codes and Congressional districts to determine the impact of splitting ZIP Codes on a battery of items on the CCES from 2008 – 2016. Our analysis provides evidence that splitting ZIP Codes across multiple Congressional districts impairs the constituent-representative link. Finally, we demonstrate the preservation of ZIP Codes in redistricting is feasible and produces a substantive reduction in partisan bias.

“[T]he parties have not shown us, and I have not been able to discover, helpful discussions on the principles of fair districting discussed in the annals of parliamentary or legislative bodies. Our attention has not been drawn to statements of principled, well-accepted rules of fairness that should govern districting, or to helpful formulations of the legislator’s duty in drawing district lines.” – *Vieth v. Jubelirer*, 541 US 267 at 308 (2004)

Thirty two years following the landmark attempt to define an unconstitutional partisan gerrymander in *Davis v. Bandemer* (1986),¹ America remains without a national standard to detect and adjudicate gerrymanders. Further, the Supreme Court’s decision that plaintiffs lacked standing to sue in *Gill v. Whitford* (2018) suggests that the Supreme Court is unlikely to accept measures based on statewide partisan outcomes alone. Chief Justice John Roberts wrote in the majority opinion, “We need not doubt the plaintiffs’ math. 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.”² The Court’s rejection of the efficiency standard advanced in *Gill v. Whitford* is the most recent of several attempts at advancing statewide mathematical measures (Calidas, 2008; McGann et al., 2016). Chief Justice John Roberts and former Justice Anthony Kennedy make clear that they are interested in the direct and individual harm done to citizens when legislators violate their duty in an attempt to achieve partisan gain.

If we are to focus on a more duty based approach to gerrymandering, we must look beyond the utilitarianism of outcome based measures, such as the symmetry and efficiency standards as advanced by Gelman and King (1994b) and Stephanopoulos and McGhee (2015). The reservations raised by Justice Kennedy echo the concerns raised in *Davis v. Bandemer*, where justices feared dictating political outcomes.³ Redistricting reform needs “historical guidance” and demonstrable evidence of a burden on representation.⁴

¹478 U.S. 109

²*Gill v. Whitford* 585 U.S. 2018

³*Davis v. Bandemer* (1986), 78 U.S. 109 at 131

⁴*Vieth v. Jubelirer* concurring opinion, 541 U.S. 267 (2004)

We may find a more palatable solution by using a process based measure (Cox, 2006) of how districts are drawn. Particularly promising are Traditional Districting Principles (TDPs), standards adopted by states to guide redistricting, such as avoiding irregular shapes and following county and town lines when drawing district lines (Niemi et al., 1990). Justice Kennedy expressed strong sympathy for TDPs and noted they are “important not because they are constitutionally required ... but [because] they are objective factors that may serve to defeat a claim that a district has been gerrymandered.”⁵

We argue that to earn the Supreme Court’s favor on judicial intervention of gerrymandering, we need to focus on *what* has been violated in the attempt to achieve political gain. Given the court’s hostility to measures based on the idea of proportional representation as fair representation, we look to what makes district based representation unique: the exclusive relationship between a geographically constrained set of constituents and their representative. To determine what amounts to a violation of the constituent-representative link, we look to American historical conceptions of fair representation with self evident justification. In applying fair redistricting to preserve the constituent-representative link, we must develop a standard no more complex to apply than one person, one vote. Individual burdens to representation via violation of the constituent-representative link must be made evident and directly affect individual citizens.

We propose that the modern day incarnation of the original intent behind redistricting principles takes the form of preserving ZIP Codes. The founding fathers articulated an ideal district as one that was compact in order to preserve natural political communities, as institutionalized through the functional design of towns and counties. Although the standards used in 1789 can no longer be directly applied to modern day redistricting, the form, function, and rules behind creating ZIP Codes creates a modern day analogue to the ideal district where citizens know and have the opportunity to engage with their representative. When Congressional districts divide ZIP Codes, they break the constituent-representative link both during and after elections, which harms republican accountability. The resulting confusion burdens fair and effective representation in violation

⁵*Vieth v. Jubelirer* (2004) 541 U.S. 127, 335, cited by (Freyer and Holden, 2011, 497–8)

of the first and fourteenth amendments.

We demonstrate the suitability of preserving ZIP Codes as a procedural constraint for redistricting in five steps. We first make evident that a political outcome definition alone will not pass the scrutiny of the Supreme Court. This is made clear in their expressed desire for a theory driven definition rooted in the Constitution that can be consistently applied and ruling in *Gill v. Whitford*. We next explore and deduce how states and the founding fathers interpreted the purpose of a legislative district, and the standards by which to legislate their ideals into law. We follow up by demonstrating that due to the changes in population and construction of local jurisdictional boundaries, ZIP Codes are the closest fit to the original early American ideal. We then use mass survey evidence from the Cooperative Congressional Election Survey (CCES) from 2008 to 2016 to demonstrate that when Congressional districts split ZIP Codes, constituents are less likely to remember and contact their representative, and perceive greater alienation from their representative. We finally run redistricting simulations of North Carolina while preserving ZIP Codes to demonstrate the feasibility of ZIP Code based redistricting and the benefits in reducing partisan bias. Through our theoretical and empirical analysis, we propose a zero tolerance standard for ZIP Code splits that courts can easily implement according to federal and state law. Our work complements the rigorous research on political outcome standards while also presenting a theory driven and intuitive approach.

I Standards and Struggles with Gerrymanders

Social scientists, political scientists, economists, mathematicians, and lawyers tried and failed to date to develop a standard for partisan gerrymandering since *Davis v. Bandemer*. Although the Supreme Court accepts equal population as a strict criterion in redistricting, the traditionally more conservative justices thus far remain cautious in accepting any of the major developments made in measuring and defining partisan gerrymanders. The court has stated that such a definition must demonstrate burdens to representation by citizens due to “their association with a political party, or

their expression of political views.”⁶ The Supreme Court’s ruling in *Davis v. Bandemer* (1986) best demonstrates the origins and continued skepticism of the need for courts to involve themselves in adjudicating partisan gerrymanders.

“An individual or group of individuals who votes for a losing candidate is usually deemed to be adequately represented by the winning candidate and to have as much opportunity to influence that candidate as other voters in the district. We cannot presume in such a situation, without actual proof to the contrary, that the candidate elected will entirely ignore the interests of those voters.”⁷

Most analyses and amicus briefs adopt the symmetry standard to answer the court’s request to demonstrate harm to representation in elections. The symmetry standard assesses a state’s Congressional or legislative map as unfair based on whether the parties win the same proportion of seats for the same proportion of the statewide vote (Gelman and King, 1994*b,a*; King et al., 2005; McDonald and Best, 2015). A situation where Democrats need 55 percent of the vote to win 51 percent of seats, while the GOP might need only 47 percent to do the same, would be considered asymmetrical and thus a partisan gerrymander. The right for a majority to govern has been fairly uncontroversial since western political thought embraced the political theory of John Locke (McGann et al., 2016). Therefore, it seems fair that a majority of a state’s electorate should receive a majority of the seats in a state’s legislature and Congressional delegation. The symmetry standard coupled with computer simulations of hypothetical maps adhering to TDPs present clear evidence of maps designed to advance partisan interests (Chen and Rodden, 2013, 2015; McDonald and Best, 2015). However, the conservative wing of the court has not been receptive to these measures. The Supreme Court discounts research measuring gerrymanders due to a desire for theory driven work, and concern over future application of the law in highly politicized and uncertain contexts.

⁶*Vieth v. Jubelirer*, 541 U.S. at 9 (opinion of Kennedy, J.), cited by Chen and Rodden (2015)

⁷*Davis v. Bandemer*, 478 U.S. at 132, 106 S.Ct. 2797 (1986)

The Conservative Critique

There is a legitimate fear by legal scholars of deviating from a violation of good law. Former swing vote, Justice Anthony Kennedy, desired law free from spurious decisions driven by partisan and personal motives (Kelso and Kelso, 2014).⁸ Just law must be known and comprehensible by all, and have consistent application across cases (Fuller, 1969). He and the Conservative wing of the court sympathize with the original intent and meaning of the U.S. Constitution, as inferred from historical records and practices, as a means to determine how to adjudicate.

The issue of comprehensible and consistent application becomes a central concern when adjudicating standards founded and built upon statistics. A mostly mathematical approach to redistricting is not easily understandable to those without a strong background in statistics, and inconsequential to those who are primarily interested in original intent. To date, the judicially imposed constraint of one person, one vote, rests upon the belief that everyone should be equally represented. The means to achieve this is through the equal population of districts. Overall, one person, one vote is intuitive and easy to adjudicate. Any deviation from perfect equal population is enough to reject a map. The Supreme Court demonstrated its strong commitment to equal population in *Vieth v. Jubelirer* when it upheld the ruling that a population deviation of 19 people was too much after it was made evident that the deviation could not be justified (Engstrom, 2005b).⁹

Given the stringency in which the court will apply any such gerrymandering standard, outcome measures by themselves pose a serious problem. As Chen and Rodden (2015) note when it comes to symmetry standards or redistricting simulations, there is “no magic number” (344). Stephanopoulos and McGhee (2015) similarly note that the efficiency gap’s standard of a shift in two Congressional districts is a somewhat arbitrary threshold in large part based on expected

⁸Such a world view is consistent with natural law theory, which Justice Kennedy appears to subscribe to.

⁹A one percent population is permitted by the Supreme Court for redistricting Congressional districts. A state district map with a population deviation above might still be permitted, though it is incumbent upon the defendant to demonstrate that some other legitimate state concern is advanced by the population deviation, such as the preservation of TDPs (Levitt, 2010). The Supreme Court in *Mahan v. Howell* (1973) 410 U.S. 315 permits population deviations of up to 16.4 percent for state legislative districts if it can be demonstrated that TDPs are preserved by such a deviation. It is when the plaintiff demonstrates that non-perfect population deviation arises from concerns other than TDPs that a court may rule against the defendant and declare a population deviation numbering in the ones of people as too much (Engstrom, 2002).

changes in the efficiency gap over time (5). McGann et al. (2016) also point out that the efficiency gap itself is not “linked to any constitutionally protected right, apart from the general fairness argument,” and that the measure itself can be interpreted a number of different ways (296). McDonald and Best (2015) formulate their alternative on symmetry upon “neutral standards” though do not elaborate on how and why the constraints they use are neutral or theoretically fair (317).

Chief Justice Roberts cites former Justice Sandra Day O’Connor to state that it is inappropriate to reject “plans on the basis of their [political scientist] prognostications as to the outcome of future elections or future apportionments...which neither judges nor anyone else can have any confidence.”¹⁰ Roberts makes clear that the issue is not one of better math, but rather of using statistical forecasts to guide the full power of the Supreme Court in adjudicating gerrymanders.

We point out the lack of a clear objective standard within these great advances in measuring gerrymanders to highlight how they might be misapplied. If the Supreme Court rules affirmatively on an outcome standard, then federal and state judges will be empowered to strictly apply outcome based measures as they see fit. Should judges in individual cases not understand confidence intervals, they might attempt to reduce perceived partisan bias or efficiency gaps even when such outcomes are explained by chance alone.¹¹ If the Supreme Court rules affirmatively on a standard for gerrymandering and are unclear in their decision or get it wrong, they will bind courts to what was once the domain of state legislatures in a very political and subjective field of legislation.

The threat of inconsistent and subjective decisions remains a threat so long as any gerrymandering measure is outcome based, mostly founded in statistics, and adopts a negative approach to gerrymandering. What is needed is a clear and positive idea of what a district should be, how this directly relates to individual rights, and is intuitive and self evident.

¹⁰*Gill v. Whitford* 585 U.S. 10 (2018)

¹¹The Florida Supreme Court all but threw out the evidence Jonathan Rodden presented based on simulated neutral maps when the defendant pointed out a dozen out of the thousands of simulated maps that adhered to the GOP Congressional maps. See Appellant’s Reply Brief, *The League of Women Voters of Florida et. al. v. Ken Detzner et. al.* SC14-1905, http://www.floridasupremecourt.org/pub_info/summaries/briefs/14/14-1905/Filed_01-09-2015_Appellant's_Reply_Answer_Brief_Cross_Appeal.pdf

Towards A Positive Theory of Gerrymandering

As former Justice Kennedy writes, what is needed in order to adjudicate gerrymanders are “[C]omprehensive and neutral principles for drawing electoral boundaries” and “[R]ules to limit and confine judicial intervention.”¹² The courts already accept that politics are an integral part of redistricting and thus will be unlikely to reject a map simply because politics were involved in a map’s construction. Rather, what is desired is an achievable ideal before the worst of partisan excesses took over redistricting, as preferably demonstrated in historical record and original intent of the founding fathers. Procedural standards of this nature have been defined as compactness, contiguity, and preservation of local political boundaries and natural communities (Freyer and Holden, 2011). Justice Kennedy demonstrates much stronger support of using a TDP standard in place of symmetry in calling TDPs “objective.”¹³ Justice David Souter similarly adheres to violations of TDPs as a measure of gerrymanders (Chen and Rodden, 2015, 316). The Supreme Court also strongly relies on how weirdly shaped districts are in their decisions on racial gerrymanders, such as in *Shaw v. Reno* (1993).¹⁴ However, Justice Kennedy notes that as of *Vieth v. Jubelirer*, TDPs had yet to be applied in a way that moves beyond correlates of gerrymanders that might still be manipulated by parties.¹⁵ Strangely shaped districts by themselves offer no direct evidence of representational harm.

In essence, the concern of Justice Kennedy is what fair districting principles are violated when maps become very asymmetrical, and political scientists have so far failed to explain why violating these principles matter. Early work on TDPs largely frame matters such as compactness as deviations from what might be expected under random conditions (Niemi et al., 1990; Stern, 1974; Polsby and Popper, 1991). Chen and Rodden (2015) in particular address how asymmetric maps might be due to natural and self chosen distributions of clustered Democratic voters without noting why courts might want to preserve these naturally occurring clusters (334).

¹²541 U.S. at 267

¹³*Vieth v. Jubelirer* (2004) 541 U.S. 127, 335, cited by (Freyer and Holden, 2011, 497–8)

¹⁴509 U.S. 630

¹⁵Political science research confirms Justice Kennedy’s concerns over TDPs, as most courts tend to treat compactness free of mathematical measures (Engstrom, 2002), Democrats suffer from a natural gerrymander given that they cluster into cities (Chen and Rodden, 2013), and the order in which one prioritizes TDPs in simulations heavily changes the distribution of maps (Chen and Rodden, 2015; Altman and McDonald, 2011).

We answer that the core to understanding harms to representation amounts to what is unique to district based representation as opposed to proportional representation: the relationship between a subset of constituents and their representative. States originally sought to enshrine the constituent-representative link through the preservation and representation of functional and natural communities. Functional natural communities permit agreement and cooperation amongst members, even when political views conflict, and ease of contact between constituents and their representative. The TDPs of compactness and preservation of local boundaries originally preserved communities, which is why they became a traditional standard in districting. When America was founded, only political communities as sympathetic cohesive social groups warranted representation. State governments secured the representation of political communities by apportioning representatives to counties and towns, purposefully designed to be compact so as to ensure citizens could reach the seat of local government and participate in deliberative democracy. Although the original conception of representation of political communities via towns and counties is no longer possible due to population constraints, the preservation of ZIP Codes is the modern day equivalent of the early American ideal. Further, as we show empirically, it is the violation of ZIP Codes that breaks the sympathy between representatives and constituents in a way that unconstitutionally burdens the influence of voters on the political process.

II Early American Institutionalization of Representation

Traditional Districting Principles matter insofar as they represent functional natural political communities—a people who could come together and agree to a common government. Early American political theorists agreed for the need for some type of cohesion in order for a government, especially democracies and republics, to operate. In a republican system of government, James Madison in *Federalist 56* noted “It is sound and important principle that the representative ought to be acquainted with the interests and circumstances of his constituents.”¹⁶ Madison did not ex-

¹⁶(Hamilton, Madison and Jay, 1788, 275)

press his personal beliefs, but rather stated the widely accepted conception of representation across the states. States already represented “the people” within the lower house of the state’s legislature. In nearly every state, governments represented the people through the apportionment of representatives to counties or townships (Kromkowski, 2002).

It is from the representation of counties and townships that the TDP of respect for local political boundaries arises. The importance of towns and counties extends beyond tradition. Counties and townships were purposefully created with the intent to designate an existing political community as worthy of their own representative capable of partaking in the deliberative process to advance particular interests and consent to the public good. Even the more anti-local Federalists saw the use in localities as the smallest functional governing unit to ensure order (Rehfeld, 2008, 95).

Governments initially drew counties so that every counties’ center was no further than one day away by wagon to the neighboring county, a practice generally adhered to throughout colonial and early American history (Stephan, 1971; Billings, 1974). Each county was defined by a county court at its center, from which citizens could seek to address their concerns and interact with government in their daily lives.¹⁷ As Madison stated, “[T]he natural limit of a democracy is that distance from the central point which will just permit the most remote citizens to assemble as often as public functions demand.”¹⁸ County seats or township halls were in turn at the center of the county or township respectively. Therefore, both were institutionalized via their boundaries so as to ensure deliberative government by the people.¹⁹

Given that equal distance to the center of government was the primary concern by which to create local boundaries, local boundaries by definition had to be compact. Compactness as concerning early America meant compactness by travel times as opposed to shape (Niemi et al., 1990). Deviations from regular polygons arose insofar as counties and townships built roads to the periphery of counties so as to ensure that all could reach the center (Stephan, 1971; Billings, 1974;

¹⁷*The Federal Farmer, October 9, 1787.*

¹⁸*Federalist No. 14* (Hamilton, Madison and Jay, 1788, 62)

¹⁹States like New Hampshire did this so well that the state assembly had very little to legislate given that the towns could govern almost entirely independently; state representatives were merely delegates to perform rare jobs that the towns could not (Daniell, 1970; Kromkowski, 2002, 94).

Kromkowski, 2002). It was the need to connect all parts of the county to the county seat that led county governments to be responsible for the construction of roads (Bryce, 1888, 536).

The infrastructure and design of towns and counties to enable all citizens to reach the center enabled the direct relationship between constituents and their representatives. This is best demonstrated in how, until the first half of the eighteenth century, most state district constituents signed contracts with, and paid, their representatives (Porritt, 1903; Pole, 1966; Kromkowski, 2002, 79; 353). Therefore, the purpose of counties and towns was to ensure functional governance, represent political communities, and form the basis of political representation. Only when Democratic-Republicans changed two counties to be non-compact in the original gerrymander that the purpose of counties was violated (Monmonier, 2001).²⁰

The founding fathers also had in mind geographic based accountability between constituents and their representatives in conceptualizing the manipulation of districts. Hamilton in *Federalist 61* justifies the U.S. Constitution's Article 1, section 4 provision to regulate the place and time of elections on the basis that states might try to shut out voters via long distances from residencies to the place of an election. Hamilton writes such manipulation is present "[W]hen the place of an election is at an inconvenient distance from the elector ... whether the distance be twenty miles or twenty thousand miles"²¹

From this historical evidence we find that TDPs were once all part of a greater whole used to represent political communities and connect constituents to their representatives. Upon legislative recess, a representative could conveniently hear from their constituents by heading to their county or town seat. In the event that they represented several counties due to the population of each county not warranting their own representative,²² then it would merely be a day's travel from county seat to county seat (Stephan, 1971), an easy enough task given the long legislative recesses.

²⁰It was after the 1812 gerrymander that states began to write TDPs into their state constitutions. These States include Mississippi (1817), Missouri (1821), Tennessee (1835), Michigan (1837), Iowa (1846), New York (1848), Wisconsin (1848), Kentucky (1850), California (1850), Indiana (1851), Ohio (1851), Massachusetts (1857), Minnesota (1859) (Kromkowski, 2002, 352–351). The practice of writing TDPs into state constitutions further continued after the Apportionment Act of 1842 shrunk the size of the U.S. House of Representatives, making it all but impossible to represent single counties in the U.S. House (Kromkowski, 2002, 351–3).

²¹(Hamilton, Madison and Jay, 1788, 299)

²²Such was the case for the more rural and western parts of most states in 1789.

In the modern day, this concept of convenient travel distance is known as functional compactness, whereby districts are drawn to minimize travel times between all parts of a district (Freyer and Holden, 2011; Monmonier, 2001). Although such a measure is superior to shape based compactness when attempting to adhere to the founding intent of TDPs, it alone does not preserve the constituent-representative link. Further, Bowen (2014) and Engstrom (2005*b*) find that neither compactness nor preserving local boundaries affects the knowledge of constituents in regards to their representatives. Additionally, counties and towns must be routinely split in order to preserve equal population. Counties in urban areas, numbering in the millions, must be split. Therefore, in updating how we use TDPs to determine violations of political communities and the constituent-representative linkage, we need a unit that captures functional compactness, local boundaries and community in the way that counties originally did at the nation's founding.

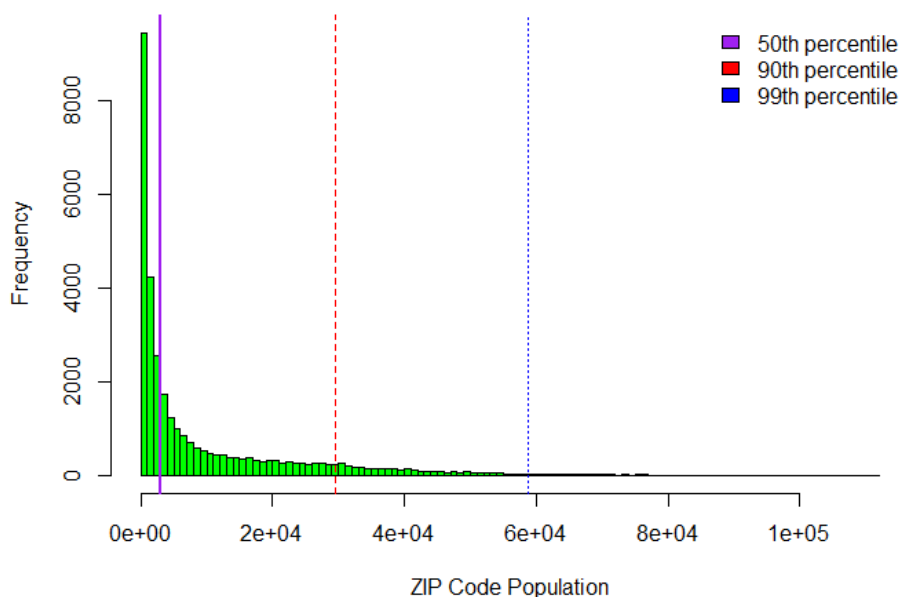
ZIP Codes and the Constituent-Representative Link

ZIP Codes serve the same functional purpose as counties did in 1789. The U.S. Postal Service established ZIP Codes following the rise of bulk mail enabled by the creation of national highways and bulk business mail that overwhelmed the old pure address system.²³ The USPS designs ZIP Codes centered around postal offices and draws boundaries to maximize the efficiency of mail delivery. The need to efficiently deliver mail constrains ZIP Codes by geography and population, with the median at 2,960 people, three quarters under 15,000, and only 10 exceeding a little over 100,000.²⁴ Figure 1 demonstrates the population distribution for ZIP Codes in 2010. As can be seen, there is no ZIP Code that rises above the population of a Congressional district, and the median ZIP Code falls within a 0.05 percent population deviation for the average Congressional district population. Therefore, ZIP Codes adhere to functional compactness and constrained population in order to achieve ease of communication.

²³ZIPboundary.com. 2016. "ZIP Code FAQs." *TTG Incorporated*. http://www.zipboundary.com/zipcode_faqs.html (accessed January 16, 2018)

²⁴ZIP Code Tabulation Areas. U.S. Census Bureau, February 9, 2015, <https://www.census.gov/geo/reference/zctas.html> (accessed January 14, 2018)

Figure 1: ZIP Code Population Distribution, 2010



ZIP Codes furthermore often adhere to county boundaries, crossing county lines only when mail efficiency necessitates keeping houses within a convenient distance of a post office.²⁵ The boundaries of ZIP Codes themselves are updated as new houses are built, with the Census GIS information provided for ZIP Code boundaries known as ZIP Code Tabulation Areas (ZCTAs).²⁶ In regards to compactness, ZIP Codes essentially follow the method designed by counties to keep people within a sufficient distance of the county seat, though with postal offices instead. We posit that violating ZIP Codes alienates individuals from their Congressional representative. Dividing ZIP Codes across districts robs constituents of the knowledge of their representative necessary to vote wisely in elections.

Splitting ZIP Codes erodes the connection between Congressional incumbents and their constituencies through structural mailing inefficiencies. The common method by which representatives can reach out to all of their constituents is through mass bulk mail via their franking priv-

²⁵ZIPboundary.com. 2016. "ZIP Code FAQs." *TTG Incorporated*.

²⁶"ZIP Code Tabulation Areas (ZCTAs)," United States Census Bureau, February 2015. <https://www2.census.gov/geo/pdfs/education/brochures/ZCTAs.pdf> (accessed January 15, 2018)

ileges.²⁷ However, bulk mail requires that mail be pre-sorted by ZIP Code. In the event that a ZIP Code is split, representatives have four options. First, representatives can spend extra time pre-sorting and carefully categorizing mail. However, they do this knowing that there will still likely be some errors, and their staff might have been assigned to more productive work. Second, representatives could choose not to pre-sort the mail and spend approximately 50 percent more on mailing costs to pay the post office to sort everything. Third, representatives could send mail to all houses within any ZIP Codes that are at least partially covered by their Congressional district. Although a representative's staff spends less time sorting mail, the expenses are higher, and many citizens receive unnecessary mail. Finally, a representative could choose not to send mail to any constituents within split ZIP Codes, which would necessarily lead to informational inequalities between constituents within split ZIP Codes, and those in wholly preserved ZIP Codes. These same dilemmas arise for Congressional challengers, who often lack the resources of a Congressional representative. Because each of the options for reaching constituents in split ZIP Codes is financially inefficient, challengers must ultimately spend more to reach fewer constituents, making it relatively more costly to challenge incumbents where ZIP Codes are split.²⁸

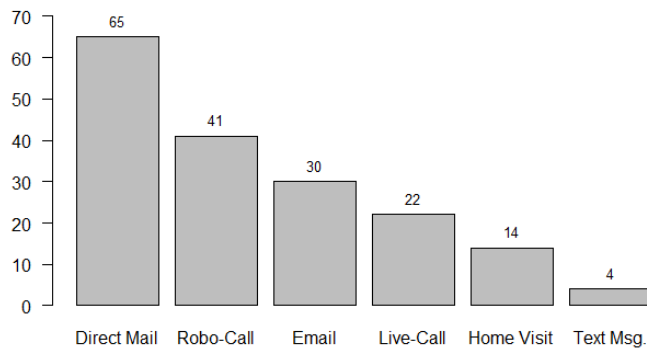
The importance of mailing and canvassing remains strong even with the rise of the internet given the lack of a database of all constituents within a geographic area with their email addresses and cell phone numbers. Further, Figure 2 shows that mail is still the most popular method of contacting voters by Congressional incumbents and challengers. Direct mail remains by far the most common method at 65 percent. These results make sense given that if a representative were to contact a constituent by email or text message, they would have to either purchase such data from a third party or from a constituent directly.

Districts splitting ZIP Code cause further problems when constituents attempt to reach out to their representative. Likely beset by competing information from different Congressional repre-

²⁷Chairman Greg Harper. 2018. "House Administration: Franking FAQ." *Franking Commission*, <https://cha.house.gov/franking-commission/franking-faq> (accessed February 19, 2018)

²⁸A poorly funded challenger might make up for the lopsided campaign spending by engaging in direct mail and/or canvassing, shown to be quite effective in getting out the vote (Gerber and Green, 2000; Green, 2004). However, as mentioned above, mailing becomes more costly amidst split ZIP Codes, and canvassing becomes inefficient as split ZIP Codes result in numerous houses outside of the district of interest when campaigning.

Figure 2: Congressional Campaign Contact Methods, 2012



Data: Survey by Pew Research Center for the People & the Press. Methodology: Conducted by Princeton Survey Research Associates International, November 8 – November 11, 2012 and based on 1,206 interviews. Sample: National adult voters.

sentatives, a constituent living in a ZIP Code split between multiple districts will be uncertain as who to contact. Searching their representative by ZIP Code will result in several potential representatives. In the event that they contact the wrong representative, they will likely not receive a response. We searched the Congressional websites of members of the 115th Congress and found 28 explicitly stating on their website that although there are some ZIP Codes split by their district, they will only respond to their own constituents.²⁹ For example, Democrat Representative Sheila Jackson Lee states on her website, “There are multiple Representatives who share the same 5-digit zip code which was entered. Due to the large volume of US mail, emails, and faxes I receive, I am only able to accept messages from residents of the 18th Congressional District of Texas.”³⁰ Although Representative Lee represents the urban area of Houston, which as a city must be split, Houston’s ZIP Codes are small enough to easily fit in a Congressional district of around 700,000 people. For example, the split ZIP Code of 77003 in Representative Lee’s district only has around 12,000 people.³¹ Note also that she represents a district within a state commonly considered gerrymandered by the symmetry method (McGann et al., 2016). It is also important to remember that

²⁹The list of representatives and their website links are listed in the appendix.

³⁰Representative Sheila Jackson, “Zip Code Split Between Multiple Districts.” Congressional Website of Representative Sheila Jackson Lee, TX-18, <https://jacksonlee.house.gov/contact-me/zip-code-split>

³¹ZIP Code Tabulation Areas. U.S. Census Bureau, February 9, 2015

the 28 Congressional representatives found are those who explicitly mentioned it on their website. It is possible that many representatives simply throw out mail from out-of-district without reporting it on their website, making the problem far more prevalent.

Problems in reaching voters within split ZIP Codes in turn causes representational harm to voters. Constituents cannot easily search for and find their representatives based on ZIP Codes, and either receive mail from too many representatives and challengers from other districts or no mail at all. Further, neighbors conversing on politics or partaking in neighborhood political meetings within a split ZIP Code might incorrectly assume that their representative is the same as their neighbor's. For example, politically involved organizations might have their local members write their perceived common representative when in reality their ZIP Code is shared between multiple representatives. While it is still possible to search by residential address, we know that no fewer than 28 Congressional representatives are beset by enough out-of-district mail due to split ZIP Codes that they feel the need to report it on their websites.

Given the expected confusion in who one's representative is arising from split ZIP Codes, we expect the following:

Hypothesis 1: As the number of Congressional districts splitting a ZIP Code increases, the less likely a constituent will be to recognize their representative.

Hypothesis 2: As the number of Congressional districts splitting a ZIP Code increases, the less likely a constituent will be to contact their representative.

For those constituents who choose to contact a member of Congress, they might contact a member who is not their representative. Congressional representatives who receive out of district mail would either give it a low priority response, if any. Given the that we know at least 28 representatives receive and ignore out-of-district mail, we expect:

Hypothesis 3: As the number of Congressional districts splitting a ZIP Code increases, the less satisfied a constituent will be with the outcome of their contact.

Given the functional purpose of ZIP Codes to communication, we expect their violation to lead directly to confusion amongst voters in ways that would not be present in violating county lines

and compactness (Cain, 1985; Butler and Cain, 1992; Morrill, 1987; Bowen, 2014).

Shared sympathies and communication are two necessary conditions for a strong constituent-representative link (Bowen and Clark, 2014). Shared sympathies might consist of partisanship, policy preferences, and racial identity (Bowen and Clark, 2014; Lublin, 1997; Swain, 1993; Griffin and Flavin, 2011). Today shared sympathies between constituents and representatives can be explained largely by partisanship (Abramowitz, 2011; Fiorina, Abrams and Pope, 2010) and racial identity (Bowen and Clark, 2014; Gay, 2002). However, constituents also tend to trust and relate more to representatives that they know and contact (Parker and Parker, 1993). Communication between constituents and representatives permits representatives to better understand their constituents. Even when disagreements arise, constant communication leads to the belief by constituents that their representatives still have the district's interests in mind (Bowen and Clark, 2014; Parker and Parker, 1993; Box-Steffensmeier et al., 2003). When neither shared sympathies nor communication can be maintained, the constituent-representative link breaks and republican governance falls apart.

Given the role that knowledge and communication exerts in maintaining mutual sympathies between constituents and representatives, we expect:

Hypothesis 4: As the number of Congressional districts splitting a ZIP Code increases, the greater the alienation a constituent will perceive between themselves and their representative.

By confirming these hypotheses, we would demonstrate direct representational harm to voters, thus meriting the consideration of ZIP Code violations as a means to measure and adjudicate gerrymanders.

III Data and Methods

We employ data from the Congressional Cooperative Election Study (CCES) from 2008–2016 to determine how splitting ZIP Codes affects the constituent-representative link. The CCES has a battery of items that prove useful in testing our four hypotheses. Our four dependent variables consist

of (1) a respondent's ability to recognize the name and party of their member of Congress, (2) whether a respondent contacts their representative and (3) satisfaction with their contact, and (4) their perception of ideological distance from their representative. We pool together the CCES data where applicable and run multilevel models with random intercepts for ZIP Code, and Congressional district for a given year, with state and year fixed effects, coupled with the CCES sampling weights. The CCES is a mass survey with tens of thousands of respondents, with multiple respondents from every Congressional district in the nation, with respondent's ZIP Codes provided (Ansolabehere and Schaffner, 2018). Therefore, the CCES provides the necessary data to test the constituent-representative link.

Measuring the Constituent-Representative Link

The CCES data used in this analysis is taken from the 2008–2016 data for every year that features a general election or a Congressional mid-term election. The CCES stratifies samples of individual respondents so as to approximate a representative sample each year.

We measure representation on the dimensions of communication and sympathy as best captured in the CCES. Bowen (2014) and Bowen and Clark (2014) similarly use the CCES to measure policy responsiveness, and we employ their methods. We first use the question asked across all years of the CCES, whether a respondent recognizes the name of their representative and can correctly name their party affiliation. The question asks respondents whether they recognize the name of one of their representatives on a list of names,³² and if they can identify the party of the representative. A respondent is measured as having successfully recognized their representative if they affirm that they recognize the name and state the party correctly. The recognition variable is coded as 1 if they recognize and successfully report their representative's party, and 0 otherwise. We employ a multilevel logit model in order to determine the effect of multiple districts splitting ZIP Codes on recognition of Congressional representatives.

The 2008 CCES alone asks whether a respondent contacted their member of Congress, and

³²These office holders consist of their Congressional representative, senators, and governor.

if so, how satisfied they were with the contact. We therefore run a multilevel model to measure whether a respondent contacted their representative, coded as 1, or 0 otherwise. From there, the CCES asks how satisfied respondents were with the response from their contact, where 1 is very satisfied, 2 somewhat satisfied, 3 not very satisfied, and 4 not satisfied at all. We use an ordered logit model for satisfaction of contact, where positive coefficients equate to less favorable responses, and lower values as more favorable responses.

Finally, we make use of the CCES question on ideological distance between respondents and their representatives. Respondents are asked to rank themselves and their representative on a seven point ideological scale, ranging from 1 for very liberal to 7 for very conservative. We take the absolute value of the difference between a respondent's self reported ideology and that of their Congressional representative. We then employ an ordered logit model to measure the perceived distance between a respondent and their member of Congress, where positive values equate to greater distance. We must note that the CCES ideology question does not perfectly measure the general sense of alienation between a constituent and their representative. However, as Buttice and Stone (2012) note, the general question of seven point ideology also captures valence issues such as integrity and trust, beyond just preference for more or less government intervention. Further, the question as asked should bias any results against our hypotheses. If respondents answer and perceive ideology entirely on the dimension of government intervention (Poole and Rosenthal, 2001), then there would be null results for hypothesis four. Therefore, if we find results where ZIP Code splits lead to greater perceived ideological distance, this would suggest alienation on a valence dimension, which would strongly support our hypothesis and theory.

Given the large number of respondents to the CCES across time, we also make use of training and testing sets for the recognition and ideological distance analyses.³³ For name recognition, we make use of 40 percent of the data as a training set and 60 percent for the testing set. For ideology, fewer people responded, so we make use of a 50 percent sample for the training set and 50 percent for the testing set. For the contact model, only responses from 2008 are available, so we do not

³³By testing our model on a subset of the data, we can demonstrate that we are not over fitting the model to the data and producing false positive results, a type 1 error.

employ a testing and training set. We then determine the accuracy of the models based on whether the most likely predicted probability fits the actual responses of the respondents.

Measuring ZIP Code Violations

Our explanatory variable of interest is the extent to which Congressional districts split and violate ZIP Codes. We measure this through two variables, the number of Congressional districts splitting a given ZIP Code, and the share of ZIP Code's population with its largest Congressional district. The data within the CCES takes the form of ZIP Code-Congressional district dyads.

These data were created using a self made python toolbox for ArcGIS to calculate the population overlap between a given ZIP Code and Congressional district. We draw upon Congressional District shapefiles from the Congress Boundaries UCLA dataset by Lewis et al. (2013), and the ZIP Code Tabulation Area data from the U.S. Census Bureau.³⁴ The U.S. Postal Service categorizes addresses by ZIP Code relative to their postal route and distance from a postal office, and stores this information in a national database. The U.S. Census creates close approximations of ZIP Code areas based on the proportion of people within a Census block with a given ZIP Code.³⁵ Census blocks vary in size, though have an average population of approximately 30 people, with a minimum of zero and max of 700.³⁶

To calculate the overlap between ZIP Codes and Congressional districts, our script first merged Census ZCTAs with Census Block Groups (CBGs), the smallest level of geography with demographic information and made up of approximately 40 Census blocks. When there was not perfect overlap between either a Congressional district or ZCTA and CBG, we weighted the population by geographic overlap, as is standard in spatial methods (Alam, 2010; Carson et al., 2011; Rao, 2003). We then used the three way intersection between Congressional districts, ZCTAs and CBGs to cal-

³⁴“ZIP Code Tabulation Areas (ZCTAs),” United States Census Bureau, February 2015. <https://www.census.gov/geo/reference/zctas.html> (accessed September 15, 2017)

³⁵“ZIP Code Tabulation Areas (ZCTAs),” United States Census Bureau, February 2015. <https://www2.census.gov/geo/pdfs/education/brochures/ZCTAs.pdf> (accessed January 15, 2018)

³⁶2010 Census Tallies of Census Tracts, Block Groups & Blocks. U.S. Census Bureau (last updated February 28 2015), <https://www.census.gov/geo/maps-data/data/tallies/tractblock.html> (accessed January 19, 2018)

culate the given population of a ZCTA within a Congressional district and vice versa. Given the over 220,000 CBGs, 43,000 ZCTAs and 435 Congressional districts, the script took approximately 80 minutes to run per Congress.

We employ two self created independent variables to measure the violation of ZIP Codes. The first is the number of Congressional districts that overlap and intersect a ZIP Code. We expect that the greater the number, the greater the expected confusion a respondent will have as to their representative. The second variable is the proportion of the ZIP Code's population within the Congressional district with the most overlap.

Figure 3: Congressional District-ZIP Code Overlap Example

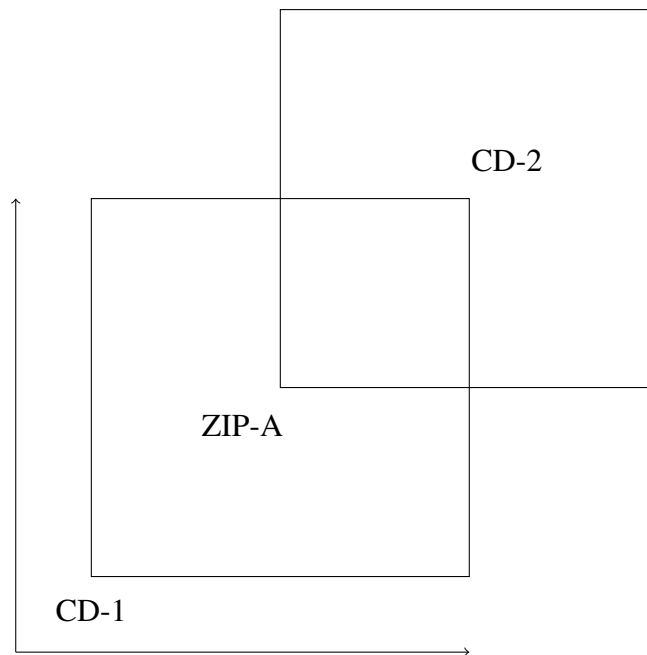
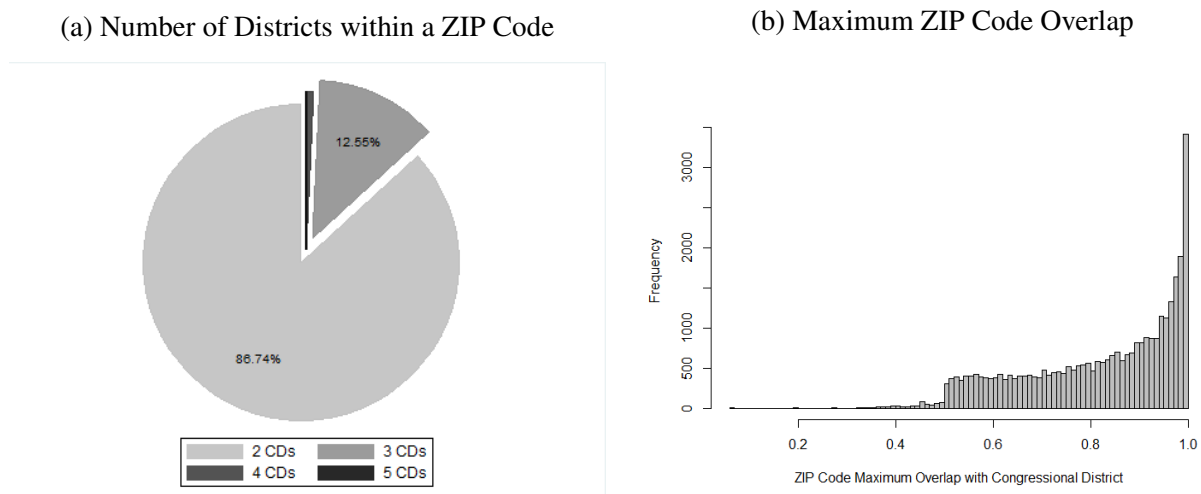


Figure 3 demonstrates a ZIP Code split between two Congressional districts, CD-1 and CD-2. The population is uniformly distributed across ZIP-A. CD-1 covers 75 percent of ZIP-A, and CD-2 covers 25 percent of the population. Therefore, we would measure such a ZIP Code as having a split of two, and maximum overlap of .75. The maximum population overlap is of theoretical interest as the larger the share of the population that the largest Congressional district has within a ZIP Code, the more likely that a voter might correctly find out who their representative is by asking their neighbors or looking at yard signs. When one Congressional district all but entirely encom-

passes a ZIP Code, then competing information from other Congressional districts should also dissipate. As the number of Congressional districts splitting ZIP Codes increases and maximum overlap decreases, we expect for more confusion to arise amongst voters.

Within the data, ZIP Codes range from being completely within a single Congressional district to being shared by five Congressional districts. Approximately 82 percent of U.S. ZIP Codes, between the years 2000 and 2016, are completely within a single Congressional district. Two or more Congressional districts share the remaining 18 percent of ZIP Codes. When we merge the ZIP Code data with the CCES data, not all ZIP Codes are present, and some are more sampled than others. Of the ZIP Codes present in the data, we find that 65.69 percent of respondents are from ZIP Codes within a single Congressional district, and the remaining 34.31 percent are from ZIP Codes shared between 2 or more Congressional districts.

Figure 4: ZIP Code Violation Variables



Note: Data for figures are for ZIP Codes shared between 2 or more Congressional Districts.

Figure 4a illustrates the subset of ZIP Codes within the merged data shared across two or more Congressional districts. We find that the vast majority of ZIP Codes are shared between two Congressional districts, comprising 86.74 percent of the data. Only 12.55 percent of ZIP Codes are shared between three Congressional districts, and the remaining 0.71 percent of ZIP Codes are shared between four or five Congressional districts. Figure 4b demonstrates the distribution of ZIP Code-Congressional district overlap values. Because most ZIP Codes are completely within

a single Congressional district, the mode is approximately one. For the 18 percent of ZIP Codes that are intersected by multiple Congressional districts, this variable ranges from a minimum of 6.4 percent overlap to nearly 100 percent overlap.

Controls

We also include a number of controls that are theoretically relevant to an individual's political knowledge and engagement. We follow the set of controls used by Bowen (2014) and Bowen and Clark (2014) in their analysis of CCES data and the effect of district design and descriptive representation on policy responsiveness. We control for whether respondents are of the same party as their representative, coded 1 if yes and 0 otherwise. We also control for whether respondents are of the same race as their representative, 1 if yes and 0 otherwise.³⁷ For respondent specific variables, we include the respondent's age (measured in years), education (number of years), income (measured in \$5,000 increments), and race/ethnicity. We further control for the length of time a respondent lived at their residence, as respondents who have lived longer at their residence tend to be more involved in politics (Ansolabehere, Brady and Fiorina, 1992; Crespin, 2005; Bowen and Greene, 2014). We expect increased age, education, income, and being of the same party and race to lead to a stronger constituent-representative link (Bowen, 2014; Bowen and Clark, 2014).

Several ZIP Code level variables are controlled for as well, as they have been demonstrated to impact political activities and behavior (Ansolabehere, Brady and Fiorina, 1992; Cain, Ferejohn and Fiorina, 1987; Bowen and Clark, 2014). These data include the population per square mile, median age, the homeowner percent of the population, and the non-white percentage of the population. We acquired these data from the U.S. Census Bureau.

Congressional district level effects consist of the seniority of a representative and their two-party vote percentage from their previous election. Longer serving members of Congress should be more well known (Cain, Ferejohn and Fiorina, 1987; Bowen and Clark, 2014), and more com-

³⁷We found out the race of Congressional representatives through a combination of data from the *Congressional Quarterly* Voting and Elections Collection, and the Legislative Effectiveness data set by Volden and Wiseman (2014).

petitive elections should increase the interest and knowledge of a representative (Ansolabehere, Brady and Fiorina, 1992; Bowen and Clark, 2014).³⁸

IV Results

Table 1 presents the results of the correct recognition of one's current representative. The model has 37,770 observations, which is 40 percent of the total number of observations within the CCES data from 2008-2016. We find that the model correctly predicts the test set 78.48 percent of the time compared to the baseline model of 67.01 percent.³⁹

In regards to hypothesis one, respondents were expected to be less likely to correctly recognize their member of Congress as the number of Congressional districts intersecting their ZIP Codes increases.

Table 1 confirms these expectations, as both the extent to which districts split ZIP Codes and its maximum overlap with a Congressional district reaches statistical significance ($p < 0.01$). Additionally, both variables go in the expected direction. The extent to which a ZIP Code is split between Congressional districts decreases recognition of representatives, and as the overlap between a ZIP Code and the largest Congressional district within its boundaries increases, so does the recognition of one's member of Congress. It is worth noting that the combined effect of the two ZIP Code variables exceeds that of same party and race.

In order to interpret the effects of ZIP Code violation on name and party recognition of one's Congressional representative, we plot the predicted recognition in Figure 5 by number of districts splitting ZIP Codes and maximum overlap. All controls are held to their means, medians, or modes where appropriate, and respondents are coded as the same party and race as their representative. All else equal, when respondents are of the same race and party as their representative, and no ZIP Code violations exist, the predicted name and party recognition is about 89 percent. However, each

³⁸We found the Congressional district level information from the same sources as described above.

³⁹The baseline model consists of scoring everyone as having recalled their representative, which would be true in the data 67.01 percent of the time.

Table 1: Correct Recognition of House Member

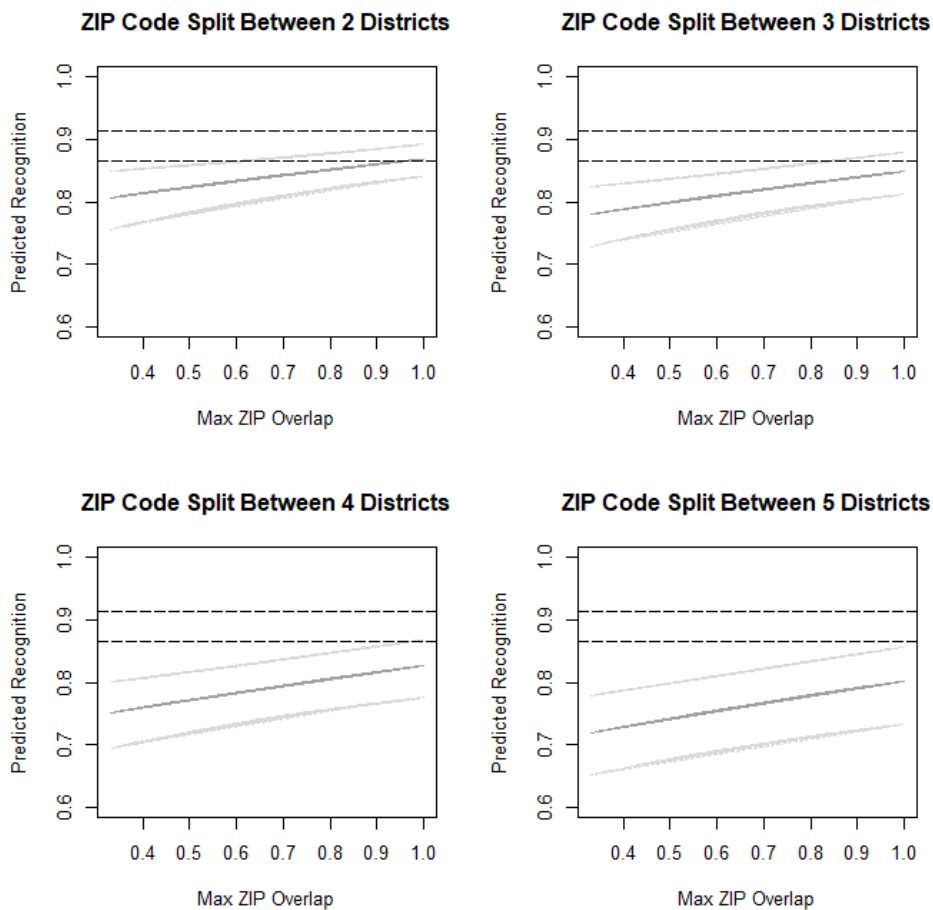
	<i>Dependent variable:</i>	
	Correct Recognition	
	β	St. Error
Individual Level Variables:		
Splits In ZIP Code	-0.162***	(0.04)
Max Overlap	0.680***	(0.20)
Same Party	0.577***	(0.05)
Same Race	0.394***	(0.06)
Age	0.050***	(0.00)
Education	0.420***	(0.01)
Income	0.115***	(0.01)
Mobility	0.317***	(0.01)
Black	0.078	(0.07)
Asian	-0.088	(0.08)
Latino/a	-0.735***	(0.14)
Other Racial Groups	0.365***	(0.10)
ZIP Code Level Variables:		
Pop. per sq. mile	0.000	(0.00)
Median Age	0.003	(0.00)
% Non-White	0.574***	(0.13)
% Homeowner	-0.232	(0.14)
Incumbent Level Variables:		
Inc. Vote Share	-0.004***	(0.00)
Inc. Seniority	0.013***	(0.00)
AIC	69,665.181	
N	67,468	

Note: *p<0.1; **p<0.05; ***p<0.01

Coefficients produced using a logit model, where the dependent variable is the respondent's correct recognition of their representative's name and party affiliation.

additional district that splits a ZIP Code reduces recognition by several percentage points. When a ZIP Code is shared between two Congressional districts, maximum overlap between a ZIP Code and district beneath 60 percent leads to a significant drop. However, when three districts share a ZIP Code, the maximum overlap must be 80 percent, and at four or more districts recognition of one's representative is always significantly lower. The predicted drop in recall is about 20 percentage points for the most violated ZIP Codes.

Figure 5: Predicted Probability of Recognizing Current Congressional Representative Over ZIP Code Violations



95 percent confidence intervals reported.

It must be stressed that these predicted results are for those of the same party and race as their representative. Therefore, for those not of the same party and race, predicted recognition will drop well below 50 percent. These results suggest substantive and significant drops to name and party

recognition when Congressional districts split ZIP Codes.

Table 2 presents the results for whether a respondent contacted their representative, and if so, their satisfaction with their contact. We found the model accurately predicted data 59.21 percent of the time relative to the baseline of 35.01 percent.

We find that although the number of districts splitting ZIP Codes does not significantly impact whether one decides to contact their representative, the overlap between a ZIP Code and its largest Congressional district does. Neither explanatory variable significantly impacts the ensuing satisfaction one has from their contact.

Table 2: Reported Contact with Representative and Satisfaction From Contact

	Contact	Satisfaction
Individual Level Variables:		
Splits In ZIP Code	-0.067 (0.04)	0.030 (0.06)
Max Overlap	0.900*** (0.21)	0.056 (0.27)
Same Party	0.326*** (0.04)	-1.183*** (0.06)
Same Race	0.111 (0.08)	-0.256** (0.10)
Age	0.009*** (0.00)	-0.007*** (0.00)
Education	0.137*** (0.01)	0.028 (0.02)
Income	0.030*** (0.01)	0.016** (0.01)
Mobility	0.113*** (0.02)	-0.010 (0.02)
Black	-0.524*** (0.11)	-0.467*** (0.13)
Asian	-0.324*** (0.10)	-0.293** (0.14)
Latino/a	-0.603*** (0.18)	-0.744*** (0.23)
Other Racial Groups	0.362*** (0.11)	-0.091 (0.15)
ZIP Code Level Variables:		
Pop. per sq. mile	-0.000 (0.00)	0.000 (0.00)
Median Age	-0.003 (0.00)	-0.011* (0.01)
% Non-White	-0.382*** (0.12)	0.042 (0.16)
% Homeowner	-0.358** (0.14)	0.171 (0.18)
Incumbent Level Variables:		
Inc. Vote Share	0.002 (0.00)	-0.007*** (0.00)
Inc. Seniority	0.016*** (0.00)	-0.003 (0.00)
AIC	24,983.482	19,212.986
N	24,925.000	9,257.000

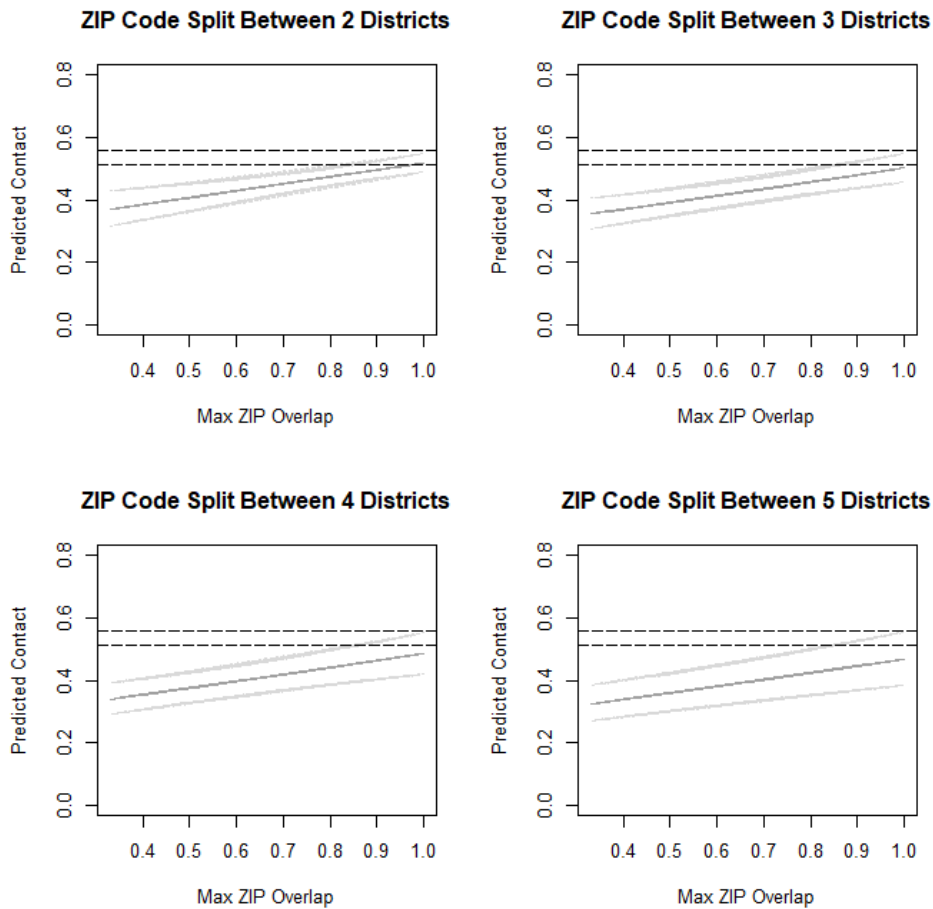
Note:

*p<0.1; **p<0.05; ***p<0.01

Standard errors in parentheses. Coefficients for the contact model are produced by a logit model, where the dependent variable is whether a respondent reported contacting their representative. The satisfaction model coefficients are produced by an ordered logit model, where greater values reflect more dissatisfaction with outcome of contact.

We again present the predicted probabilities of whether one decides to contact their representative. We hold the other variables at their respective means, medians, and modes, and respondents as the same party and race as their representative. Figure 6 presents the results by maximum overlap and ZIP Code splits. For a ZIP Code nested entirely within a Congressional district, the predicted contact is 53.48 percent. For ZIP Codes shared between multiple Congressional districts, the predicted contact is significantly lower when the maximum ZIP Code Congressional district overlap is beneath 80 percent. For example, where the largest Congressional district comprises only 50 percent of a ZIP Code, the predicted contact drops to about 40 percent, a drop of about 13 percentage points. These results strongly support hypothesis two.

Figure 6: Predicted Probability of Contacting Congressional Representative Over ZIP Code Violations



The satisfaction model we do not predict results for, as neither explanatory variable reaches

significance, rejecting hypothesis three. It must be noted the greater values reflect greater dissatisfaction. Therefore, it is unsurprising that variables such as same party and same race lead to more satisfaction with contacting one's representative.

We finally analyze hypothesis four with the results from Table 3. The ordered logit model measures the perceived ideological distance between a respondent and their representative, which we argue poses a difficult test for hypothesis four, the perceived sense of alienation. The model correctly predicts ideological distance 35.09 percent of the time, compared to a baseline model of 19 percent. We find that ZIP Code splits reaches statistical significance ($p < 0.01$) in support of hypothesis four, though overlap does not exert a significant impact. Unsurprisingly, the most substantive and significant effect is whether one is in the same party as their representative.

In order to determine the exact effect of ZIP Codes on ideological distance, we bootstrap the predicted probabilities, holding the other variables constant, and as the same race and party as their representative. For simplicity, we present the results as little ideological distance (0-1) and moderate difference (2-4).⁴⁰ We simulate and bootstrap the data to represent the 95 percent confidence intervals. Figure 7 presents the results. We find that at three shared districts, the predicted probabilities between little and moderate ideological difference diverge. Whereas at one or two districts sharing a ZIP Code a respondent is as likely to rate themselves as differing little or moderately ideologically, at 5 districts there is a 20 percentage point difference. These results therefore do confirm hypothesis four. It is again important to note that these predicted results are for those within the same party as their representative. Where being of the same race as one's representative does not exert a significant effect, the impact of splitting ZIP Codes between several districts is both significant and substantive. That we see sizable effects for ZIP Code violations across the board attests to its importance in maintaining knowledge, communication, and shared sympathies between constituents and their representatives.

⁴⁰Given that we are predicting the results based on same party and race, the predicted probabilities for great ideological distance (5-7) are effectively zero, and therefore excluded.

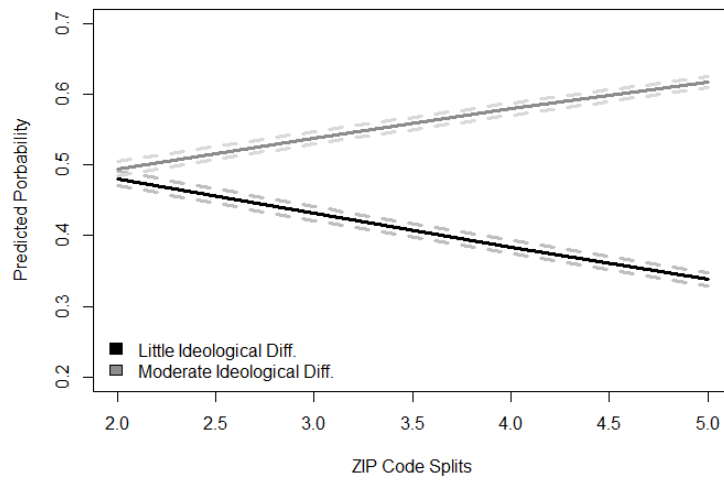
Table 3: Reported Perceived Ideological Difference

	β	St. Error
Individual Level Variables:		
Splits in ZIP Codes	0.199***	(0.07)
Max Overlap	0.532	(0.35)
Same Party	-1.018***	(0.11)
Same Race	0.198	(0.14)
Age	-0.012***	(0.00)
Education	0.165***	(0.03)
Income	-0.003	(0.01)
Mobility	-0.067**	(0.03)
Black	0.255	(0.16)
Asian	0.267	(0.20)
Latino/a	0.129	(0.28)
Other Racial Groups	0.311	(0.23)
ZIP Code Level Variables:		
Pop. per sq. mile	0.000***	(0.00)
Median Age	0.006	(0.01)
% Non-White	0.022	(0.20)
% Homeowner	-1.176***	(0.24)
Incumbent Level Variables:		
Inc. Vote Share	-0.000	(0.00)
Inc. Seniority	0.010***	(0.00)
AIC	52,490.037	
N	12,952.000	

Note: *p<0.1; **p<0.05; ***p<0.01

Coefficients produced by ordered logit model. Dependent variable is a respondent's perceived distance between themselves and their representative, where greater values reflect greater ideological distance.

Figure 7: Predicted Ideological Distance Over Number of ZIP Code Splits



Confidence intervals bootstrapped for 95 percent confidence intervals. Great ideological distance left off as the predicted probabilities were essentially zero, given that the results were predicted for constituents within the same party as their representative.

V The Impact on Electoral Outcomes by Preserving ZIP Codes

The final question is what the potential impact a ZIP Code standard would have on gerrymandering. To work, the preservation of ZIP Codes must maintain equal population, adherence to the Voting Rights Act, and reduce the partisan bias of district maps.

We decided to redistrict North Carolina as a critical test for the ZIP Code standard for several reasons. First, the state earned thirteen Congressional districts as of the 2010 Census. Its population of over 9 million people makes it the tenth largest state in the nation. Therefore, North Carolina is a non-trivial state to analyze. Secondly, North Carolina was partially covered by the Voting Rights Act and is required to have two majority-minority districts and/or a minority-influence district. Thus, it is not sufficient to simulate 13 districts with population equality. We must also ensure two of these districts have a minority proportion of 35 percent and can elect their candidate of choice to Congress (Grose, 2011). Most importantly, parties perennially battle over North Carolina's redistricting in Court ever since the 1990s in *Shaw v Reno* (1993), with North Carolina's partisan balance nearly at a 50-50 split. The 113th Congress in particular saw the North Carolina GOP benefit from a 25 point efficiency gap, where the GOP won 10 out of 13 districts despite making up only about half of the population. More specifically, North Carolina's districts in 2013 produced four of the top 30 worst violations of ZIP Codes by Congressional District. Common Cause also filed suit against North Carolina's Congressional map in *Rucho v. Common Cause* (2018). Defenders of North Carolina's districts claim that the odd shapes, and by extension ZIP Code violations, are the only way to ensure compliance with the VRA and population equality (Monmonier, 2001). Therefore, if North Carolina can be redistricted preserving whole ZIP codes while maintaining population equality, ensuring at least two minority-influence districts and a smaller efficiency gap, then the feasibility and benefits of preserving ZIP Codes will be evident in redistricting.

Steps to Simulating North Carolina Districts with ZIP Codes

We employed the R “redist” package in order to conduct our simulations, created by Fifield et al. (2016). We used ZIP Codes as our smallest geographic unit, with information on partisanship drawn from North Carolina’s Democratic Presidential vote share at the precinct level. Unlike determining the population overlap between ZIP Codes and Congressional Districts, the estimates for partisanship were prone to errors due to the size of precincts. Most precincts are about on par with ZIP Codes in regards to population size, and most precincts are not drawn to overlay or be nested within ZIP Codes. Therefore we took the mean percent of Democratic presidential vote share of the precincts⁴¹ within the ZIP Codes, weighted by rough population overlap.

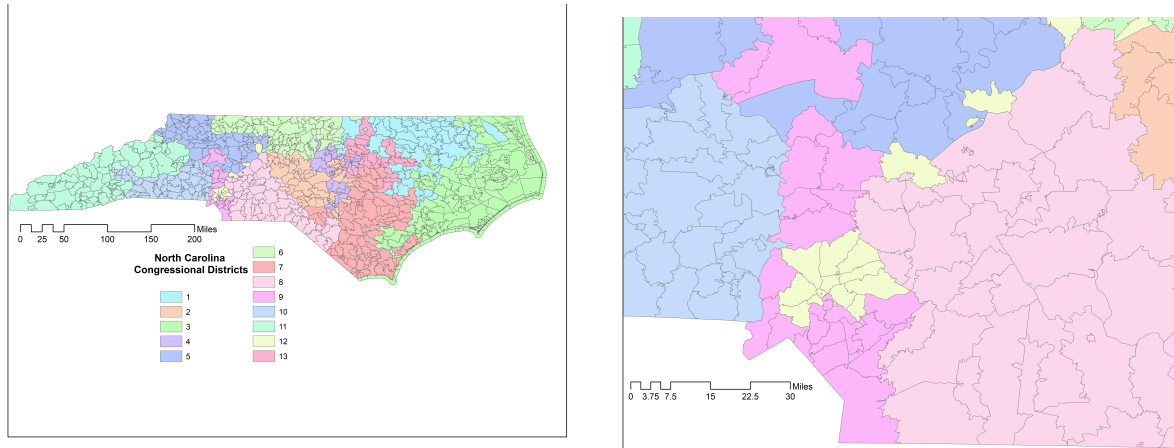
We next set the seed for the simulations as ZIP Codes roughly approximate to the Congressional District design for the 113th Congress. We set the seed as we seek a critical test of the ZIP Code standard. If ZIP Codes are to succeed in regards to reducing the efficiency gap and partisan nature of gerrymanders, then it should be the case that it would be nearly impossible to attain the level of partisan bias even with the most partisan of intents in redistricting. Past simulation research of redistricting suggests that it is all but impossible to expect partisan outcomes to match what is observed when starting from a what amounts to a blank map (Chen and Rodden, 2013; Fifield et al., 2016; Magleby and Mosesson, 2018). If ZIP Codes are a serious constraint, then ZIP Code based districting from the outlines of the 113th Congressional North Carolina districts should be at least marginally better in regards to the efficiency gap.

When creating the 113th North Carolina Congressional districts via ZIP Code, we found it necessary to create dummy ZIP Codes for ocean and coastal areas, as ZIP Codes do not include water areas. Failure to include dummy ZIP Codes leads the redist package to abort. We also had to create the base map by hand. Figure 8a demonstrates North Carolina’s Congressional Districts when we assign ZIP Codes to districts that they have the most population overlap with. The districts with the most ZIP Code violations, especially the districts surrounding North Carolina’s Twelfth,

⁴¹Auto-Redistrict: ESRI Shapefiles of Results, ftp://autoredistrict.org/pub/shapefiles_2010_vtd/, (accessed July 1, 2018)

are not contiguous. Further, there is extreme population inequality, with the smallest districts at around 200,000 residents, and the largest at well over 1.2 million.

Figure 8: North Carolina’s 113th Congressional Districts’ Contiguity by ZIP Code



(a) North Carolina’s 113th Congress Assigning ZIP Codes to Districts

(b) Charlotte, North Carolina Area

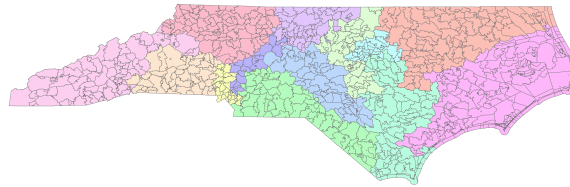
The state of the Charlotte area is particularly poor in regards to contiguity, as seen in Figure 8b. Note that the entire stretch of what was the twelfth district is split between the eighth, ninth, and twelfth districts. More non-contiguous districts exist around the first district as well.

Figure 9 presents our base map. We created the map to be within five percent population deviation, a standard we kept for the simulations.⁴² Note that the districts appear for more compact in shape, though that was not our primary concern. We instead focused first on redrawing NC-12 and NC-01 to fit within the accepted population range, and then moved onto the other districts. We

⁴²We note that the Supreme Court mandates strict population equality, and thus it might be the case that a five percent deviation is too much. We go with a five percent deviation for two reasons. First, the ZIP Code populations are estimates produced from overlap with Census Block Groups. Although we have a high degree of confidence within our overlap script, there will still be some errors. A five percent deviation is standard for simulation purposes (Fifield et al., 2016; Magleby and Mosesson, 2018). Further, the Supreme Court does permit greater population deviation if it can be demonstrated that the state is attempting to preserve some Traditional Districting Principle (TDP) or similar state interest (Levitt and McDonald, 2007). Although a five percent deviation is greater than the standard one percent that the Supreme Court usually grants, it is important to note that the Supreme Court respects TDPs out of tradition as opposed to any constitutional grounds. If the ZIP Code standard were accepted as a necessary constraint for redistricting on par with equal population, then it is more than likely that the Court would permit a population deviation within five percent. After all, the court did permit population deviations of up to 17 percent in *Mahan v. Howell* (410 U.S. 315 at 329-330 (1973)) at the state legislative district level in order to adhere to TDPs. Finally, even if a five percent deviation is not permitted, it is possible to split a ZIP Code no more than once between two Congressional districts and still maintain a relatively close constituent-representative link. It is when a ZIP Code is split between three or more Congressional Districts that the constituent-representative link becomes seriously strained.

then use this base map in order to conduct the random swapping method as employed by Fifield et al. (2016). We conduct 10,000 simulations with only the population constraint and analyze the partisan and racial outcomes. We decide to forgo constraints such as segregation and compactness in order to thoroughly test the limits of the ZIP Code standard. We are interested in the worst possible externalities of the ZIP Code standard, and how much creativity parties might need in redistricting if the only standards they had to follow were population equality, preservation of ZIP Codes, and contiguity.⁴³

Figure 9: North Carolina ZIP Code Transformed Base Map

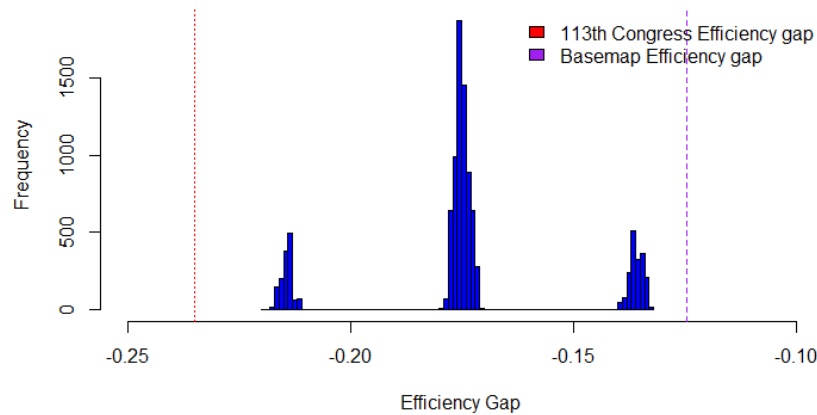


Simulation Outcomes

We find that upon running the simulations that not only is it feasible to preserve ZIP Codes, but that it consistently reduces the partisan efficiency gap relative to the actual map adopted by North Carolina for the 113th Congress. Figure 10 demonstrates the efficiency gap of the simulated districts relative to the actual efficiency gap for North Carolina and the base map. As can be seen, there are three major clusters within the simulation. However, each cluster significantly reduces the efficiency gap relative to what North Carolina saw in the 113th Congress. The Republican gerrymander in 2013 approached an efficiency gap of 24 percent, above the 20 percent standard argued to count as an unconstitutional gerrymander amongst legal and political science scholars (McGann et al., 2016; Chin, 2017). Further, the base map attains an efficiency gap of only approximately 12 percent in favor of the Republican Party. These results suggest that even with the placement of the districts in ways to maximize the loss of Democratic votes, the ZIP Code standard substantially reduces the extent of partisan gerrymandering.

⁴³Contiguity by water counts as contiguity.

Figure 10: Distribution of the Efficiency Gap from District Simulations

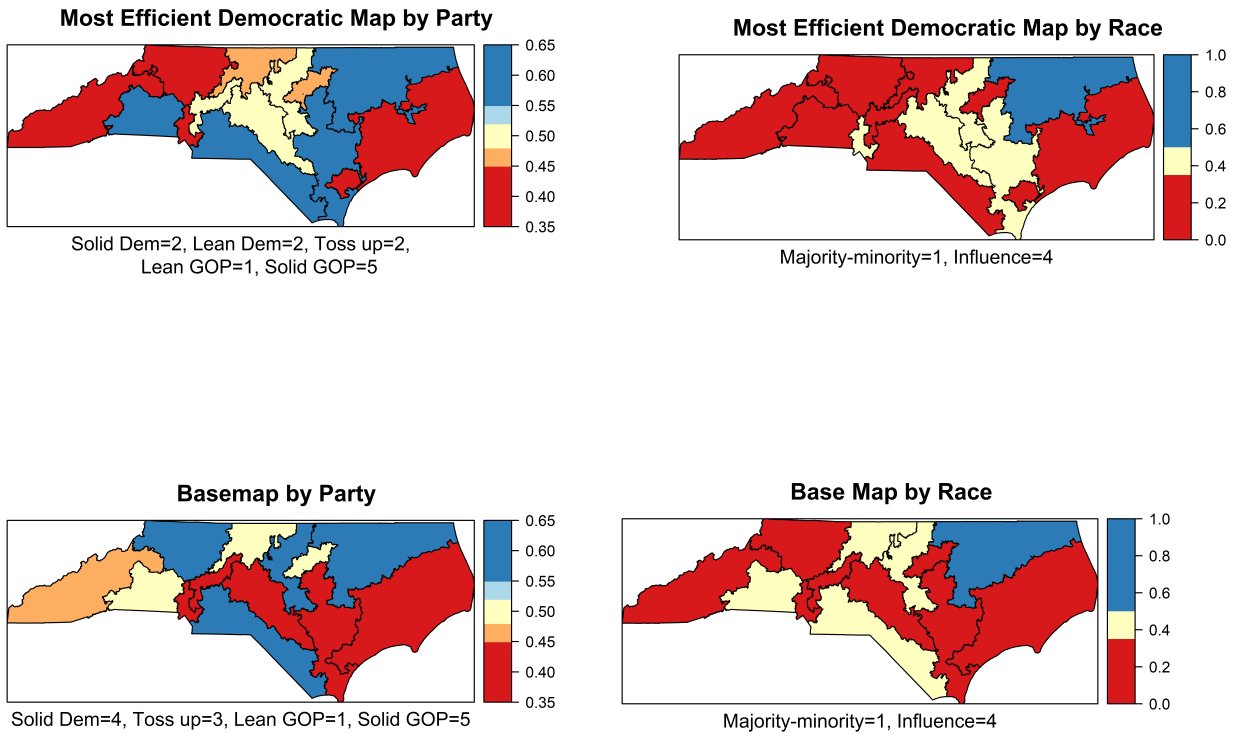


We next look into whether it is possible to attain majority-minority or minority-influence districts within North Carolina while reducing the efficiency gap and preserving ZIP Codes. We find that it is possible to ensure racial minorities receive representation. Figure 11 demonstrates the base map and the most efficient simulated map by race and party. We present these maps as it is routinely argued that gains in efficiency for the Democratic Party almost always comes at the expense of representation for minorities (Grose, 2011; Lublin, 1997). North Carolina Democrats in *Shaw v. Reno* (1993) argued that they had to draw the notorious North Carolina Twelfth in the manner that they did as it was the only way to ensure compliance with the U.S. Justice Department’s edict for two majority-minority districts (Monmonier, 2001). Therefore, one would likely expect it impossible to ensure minority representation when maximizing efficiency. Figure 11 demonstrates that this is not the case. Instead, the base map and most efficient simulated map produce a majority-minority district and four minority-influence districts. Further, in each map the Democrats earn another seat to Congress, with several competitive districts as well.⁴⁴

We further note that the minority-influence districts tend to overlap with solidly Democratic districts as well. Therefore, if minorities turnout for Democratic primaries, it is all but certain that they will elect a racial minority member to Congress (Grose, 2011). Compared to North Car-

⁴⁴We define a district as solidly within one party if the vote for the respective party exceeds 55 percent, leaning towards a party if the vote is less than 55 percent but greater than 52 percent, and as toss up if the vote is between 52 and 48 percent.

Figure 11: North Carolina Districts by Partisanship and Race



olina 113th Congressional map, the preservation of ZIP Codes performs better by every measure. Therefore, we find through these simulations that it is possible to redistrict in a way that preserves ZIP Codes and achieves relative equal population. Just as important, the partisan efficiency gap is substantially reduced while at the same time leading to racial minority representation in Congress.

VI Discussion

Our results strongly support the theory that ZIP Codes act as the modern day geographic unit to preserve the constituent-representative link that counties performed in early America. ZIP Codes, like early counties, are designed to be functionally compact so as to ensure ease of communication between residents. Although members of Congress may not reach out to voters by holding town

halls at post offices, they do communicate to their constituents through direct mail via ZIP Codes. As demonstrated by our results, the violation of ZIP Codes leads to confusion amongst constituents as to who their representative is. ZIP Code violations lead to less citizen initiated contact between constituents and their representatives. Finally, Congressional district violation of ZIP Codes lead to greater perceived alienation between constituents and their legislators. Like the original gerrymander of 1812, the splitting and violation of ZIP Codes between Congressional districts impairs the connection between constituents and their representatives.

We must also stress that these results arise even when controlling for important concerns like party and race. Constituents as the same party affiliation and race of their representative should be among those best represented by their representatives, and those who members of Congress respond to the most (Bowen and Clark, 2014). The damage that the violation of ZIP Codes does to the constituent-representative link meets the criteria set in 1986 by *Davis v. Bandemer*, as constituents are not represented well following elections. Further, the results of the redistricting simulations suggest that not only is redistricting by ZIP Codes feasible, but that it will lead to better more fair outcomes as well.

Since we find evidence that splitting ZIP Codes poses direct representational harm to individuals, there is no legitimate reason to split ZIP Codes given that their population is always smaller than a Congressional district. Preserving ZIP Codes is superior in effect and practicality than the preservation of county lines. Counties frequently exceed the average size of Congressional districts – like Cook County in Chicago with over 2 million residents – and have not been demonstrated to impact the constituent-representative link (Bowen, 2014). The preservation of county lines is certainly impossible in urban areas, but these urban areas pose no real problem when districts are required to preserve ZIP Codes.

In order to constrain gerrymandering and maintain the connection between constituents and their representatives, we propose the following guidelines for redistricting:

Congressional Districts

Considering the ZIP Code Tabulation Area within a state's borders,

1. No ZIP Code may be split across multiple congressional districts
2. Rule 1 may be violated if it can be demonstrated that no map of preserving ZIP Codes can be achieved while keeping the population deviation of districts within one percent
 - a If it can be demonstrated that ZIP Codes must be split to achieve equal population, a map will be judged as fair insofar as it minimizes the number of split ZIP Codes
 - b Further, no more than two Congressional districts can share a single ZIP Code

Legislative Districts

Considering the ZIP Codes within a state's borders,

1. No ZIP Code may be split across multiple state legislative districts
2. Rule 1 may be violated if it can be demonstrated that no map of preserving ZIP Codes can be achieved while keeping the population deviation of districts within ten percent, or the permitted deviation allowed under state law
 - a If it can be demonstrated that ZIP Codes must be split to achieve equal population, a map will be judged as fair insofar as it minimizes the number of split ZIP Codes
 - b Further, no more than two legislative districts can share a single ZIP Code
3. If legislative districts are smaller than the ZIP Code population, ZIP Codes can be split across multiple legislative districts only insofar as all legislative districts are completely nested within a ZIP Code.
 - a Maps in these cases shall be judged on the basis of fewest ZIP Codes split in order to achieve population deviation, with only as many splits permitted as to nest legislative districts into a ZIP Code

These guidelines can be easily applied across the states. Further, the ZIP Code standard can be used to constrain redistricting regardless of the partisan, incumbent or racial outcome. If a legislature violated ZIP Codes with the intent to create and incumbent or racial gerrymander, all that the plaintiffs would need to do is demonstrate a map where ZIP Codes are preserved in order to undue the damage. Such a standard is already present with equal population. The Supreme Court upheld in *Vieth v. Jubelirer* that the Republican legislature malapportioned districts when Democrats offered a map that provided for a population deviation fewer than 19 people (Engstrom, 2005a).⁴⁵ Therefore, the ZIP Code standard would take advantage of the existing competition between parties to preserve ZIP Codes as best as possible, and therefore also preserve the constituent-representative link.

We must note that our method was drawn using estimated ZIP Code characteristics from Census data. Should the U.S. Supreme Court determine that ZIP Codes are the primary means by which to adjudicate gerrymanders, then it will be necessary for the U.S. Census Bureau to release all demographic information by ZCTA. However, this will not be difficult, as the Census Bureau already has this information; they would just need to make it public.

The Supreme Court made very clear the importance of standing. The ZIP Code standard is well suited to demonstrate individual harm in court given its basis in the constituent-representative link. Anyone who runs for office in a district that splits multiple ZIP Codes will face increased costs in mailing or canvassing, and would therefore be able to demonstrate an unnecessary barrier to their first amendment right to association and free speech. The same can also be said of any organized interest that seeks to engage in mass mailing campaigns in districts splitting many ZIP Codes; if their members are less likely to contact their representatives, or instead contact the wrong member, then a barrier similarly exists to freedom of speech and association. Further, the ZIP Code standard works in heavily partisan states. Even if a state's populace is overwhelmingly affiliated with a single party, and thus unlikely to elect the minority party to majority status, it would still be possible to demonstrate harm in single districts because the effects of splitting ZIP Codes procedurally is

⁴⁵The Supreme Court made such a ruling even though by 2005, redistricting to achieve equal population on data from 2000 would have been just as likely to malapportion voters as the existing plan.

not dependent on the minority having a chance to elect a majority. Barriers caused by splitting ZIP Codes to those who seek to wage a primary challenge against an incumbent of their own party would have standing under the ZIP Code standard that is not captured by outcome based measures. If a representative can overcome the costs of reaching out to voters in split ZIP Codes while the primary challenger cannot, individual harm would be demonstrated. Therefore, the ZIP Code standard demonstrates direct harm across a variety of situations that is not true of statewide outcome measures alone.

When adhering to the ZIP Code standard, we must note that ZIP Code boundaries do change with population. Therefore, redistricting mid or late decade might lead to some ZIP Code discrepancies when using dated Census data. However, such changes already afflict the equal population standard, yet the Supreme Court ruled it to be fine to adhere to perfectly equal population using dated Census data. Further, there are some cases where ZIP Codes are not contiguous. These arise due to the layout of roads in an area. When these arise, a district must simply be certain to include the ZIP Code separating the parts of the non-contiguous ZIP Code. Finally, not all parts of the nation have a ZIP Code. In these situations, non-ZIP Code yet populated areas can be treated like frontier areas of states in early America, and be placed into districts with the discretion of legislatures. They can be used to connect parts of a district, similar to how states already use non-populated areas and bodies of water to adhere to contiguity when redistricting.

We must assume that the political parties will not remain idle and will seek to work around the ZIP Code standard. We must first note that the U.S. Postal service draws ZIP Codes, with input from citizens. This means that state legislatures will not be able to manipulate ZIP Codes as they already do with legislative districts. Therefore any corruption of the ZIP Code standard must come from the U.S. Congress.

Congress might seek to first overcome the obstacle of the imprecision of ZIP Codes; it is more difficult to draw snaking narrow districts in order for them to attach disparate parts of the state. In order to correct for this, the U.S. Congress might order and fund the construction of more post offices, which would enable numerous small ZIP Codes. We do not see this as much of a problem,

as a more well funded post office system would lead to more efficient communication. Further, it is ZIP Code preservation, not a district's shape, that matters.

Congress and the President might also work together to appoint trusted partisans to gerrymander ZIP Codes. We believe this unlikely given that the post office employs the standard civil service test. It is possible to repeal, though we predict much uproar.

Congress might finally take away the power of the USPS to draw ZIP Codes. Congress could then draw ZIP Codes themselves. Again, we expect such a scenario unlikely given the certain backlash that they would face from citizens and businesses alike. If Congress managed to push through such a change, the problem would not lie in the ZIP Code standard, but in the strength of parties to completely undermine government institutions for their own partisan goals. At that point, we predict little hope for the future of the country and that America would have realized the worst fears George Washington had regarding parties.

Ultimately, we assert that we answer Justice Kennedy's call to develop a theory of gerrymandering in line with historical precedent and theories of representation. ZIP Codes act as the amalgamation of Traditional Districting Principles with the purpose to link citizens together and constituents with their representatives. We find both direct evidence from Congressional representatives themselves, and from survey evidence of the importance of ZIP Codes in maintaining the constituent-representative link. The constituent-representative link rests upon shared sympathies and communication between constituents and their representatives. When redistricting splits ZIP Codes in order to achieve partisan gain, then our theory and results demonstrates that the constituent-representative link breaks. Therefore, if one uses our ZIP Code standard to measure the harm to individuals as a procedural standard, coupled with an outcome standard like partisan symmetry, the Supreme Court will be able to consistently, and fairly, adjudicate gerrymanders.

Appendix Table A: Congressional Representatives with Website Messages of ZIP Code Split Confusion

Name	District	Party	URL
Gary Palmer	AL06	R	https://palmer.house.gov/contact/email/zip-code-split-between-multiple-districts
Terri Sewell	AL07	D	https://sewell.house.gov/contact/email-me/zip-code-split-between-multiple-districts
Ted Lieu	CA33	D	https://lieu.house.gov/contact/email/zip-code-split-between-multiple-districts
Mimi Walters	CA45	R	https://walters.house.gov/contact/email/zip-code-split-between-multiple-districts
Dana Rohrabacher	CA48	R	https://rohrabacher.house.gov/contact-me/zip-code-split
Ileana Ros-Lehtinen	FL27	R	https://ros-lehtinen.house.gov/contact-me/zip-code-split
Steve King	IA04	R	https://steveking.house.gov/contact/email-me/zip-code-split-between-multiple-districts
Darin LaHood	IL18	R	https://lahood.house.gov/contact/email/zip-code-split-between-multiple-districts
Cedric Richmond	LA02	D	https://richmond.house.gov/contact-cedric/email-me/zip-code-split-between-multiple-districts
Joseph Kennedy	MA04	D	https://kennedy.house.gov/contact/email-me/zip-code-split-between-multiple-districts
Stephen Lynch	MA08	D	https://lynch.house.gov/contact-me/zip-code-split
David Trott	MI11	R	https://trott.house.gov/contact/email/zip-code-split-between-multiple-districts
Brenda Lawrence	MI14	D	https://lawrence.house.gov/contact/email/zip-code-split-between-multiple-districts
Keith Ellison	MN05	D	https://ellison.house.gov/contact/email-me/zip-code-split-between-multiple-districts
Vicky Hartzler	MO04	R	https://hartzler.house.gov/contact/email/zip-code-split-between-multiple-districts
Sam Graves	MO06	R	https://graves.house.gov/contact/email-me/zip-code-split-between-multiple-districts
Mark Meadows	NC11	R	https://meadows.house.gov/contact/email-me/zip-code-split-between-multiple-districts
Adrian Smith	NE03	R	https://adriansmith.house.gov/contact-me/zip-code-split
Donald Norcross	NJ01	D	https://norcross.house.gov/contact/email-me/zip-code-split-between-multiple-districts
Carolyn Maloney	NY12	D	https://maloney.house.gov/contact/email-me/zip-code-split-between-multiple-districts
Elise Stefanik	NY21	R	https://stefanik.house.gov/contact/email/zip-code-split-between-multiple-districts
Tim Ryan	OH13	D	https://timryan.house.gov/contact-me/zip-code-split
Glenn Thompson	PA05	R	https://thompson.house.gov/contact-me/zip-code-split
Tom Marino	PA10	R	https://marino.house.gov/contact/email/zip-code-split-between-multiple-districts
Al Green	TX09	D	https://algreen.house.gov/contact-me/zip-code-split
Sheila Jackson Lee	TX18	D	https://jacksonlee.house.gov/contact-me/zip-code-split
Dan Newhouse	WA04	R	https://newhouse.house.gov/contact/email/zip-code-split-between-multiple-districts
Sean Duffy	WI07	R	https://duffy.house.gov/contact-me/zip-code-split

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