Institutional Control of Redistricting and the Geography of Representation*

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Abstract

A number of states have empowered independent redistricting commissions (IRCs) to redraw congressional district boundaries each decade following the Census. IRCs, which have binding authority and political independence, are seen as a solution to gerrymandering state legislatures. With less incentive to protect incumbents and partisans, what principles guide the work of IRCs? Do they adhere more closely to traditional principles such as drawing compact districts, maintaining continuity, and respecting political subdivisions? We are conducting this research to determine whether IRCs adhere to traditional redistricting principles more than state legislatures or courts do. We examine several decades of congressional district maps and find that IRCs tend to draw more compact districts and split fewer counties, but fare poorly on district continuity measures.

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**Introduction**

Independent redistricting commissions (IRCs) are a relatively recent attempt to solve the old problem of gerrymandering. A number of states have taken redistricting authority away from state legislatures and delegated binding authority for redistricting to independent commissions. We have the opportunity to evaluate whether districts created by IRCs differ in meaningful ways from districts created by state legislatures. In particular, we examine whether congressional districts created by IRCs adhere more closely to traditional, geographic principles than districts created by state legislatures.

Traditional redistricting principles are important for a number of reasons. We organize our representation systems primarily in terms of geographic areas, such as states, counties, and cities. Congressional districts are unique because their boundaries are mostly artificial and subject to periodic revision. Many states require mapmakers to adhere to traditional, geographic principles, such as compactness, respecting political subdivisions, and continuity. These principles help protect the model of representation embodied by the House of Representatives.

In this article, we analyze thousands of congressional districts. Over the past several decades, most congressional districts have been drawn by state legislatures, but many have been drawn by courts and a growing percentage are the product of different types of commissions. Here we are largely focused on IRCs. Our research design allows us to compare the districts created by these varied institutions and determine whether IRCs do a better job adhering to traditional redistricting principles than other institutions do. We find that IRC-created district rate highly with respect to compactness and respect for political subdivisions, but relatively poorly with respect to continuity. We discuss the issue of continuity, along with some possible limitations of this analysis, before concluding with suggestions for future research.
Political Representation and Traditional Redistricting Principles

Political representation in the United States is largely based on geography. The people who live in state, county, city, or other jurisdiction elect leaders to represent them in the corresponding level of government. Gerrymandering occurs when state legislatures draw district boundaries to advance the interests of legislators rather than the interests of constituents. Gerrymandering threatens this basic model of representation by allowing leaders to pick their constituents, instead of allowing the people to pick their representatives in fair elections.¹

Traditional redistricting principles include compactness, respecting political subdivisions, and continuity.² These principles are reflected in many state constitutions (National Conference of State Legislatures, 2009). Even in states where adherence to all of these principles is not required, courts nevertheless use these principles to judge redistricting plans.³

One of the virtues of traditional redistricting principles is limiting the extent to which legislators can shape districts to serve their own interests (McDonald, 1996). In his concurring opinion in *Karcher v. Daggett* (1983), Justice Stevens observed, “Drastic departures from compactness are a signal that something may be amiss.”⁴ The principle of respecting political subdivisions, such as counties, can also help limit the amount of gerrymandering in the creation

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¹ If one party controls the state legislature, it may attempt a partisan gerrymander to preserve or tighten its grip on power. If two parties share control of the legislature, they may settle on a bipartisan gerrymander that protects incumbents of both parties. In either case, the legislature frustrates the voters’ ability to select their representatives.

² Other traditional redistricting principles are contiguity, respecting communities of interest, and protecting incumbents. Contiguity means someone could go from one end of the district to the other without leaving the district (Bullock, 2010, p. 88). There are only a few non-contiguous districts, such as the district encompassing the upper peninsula of Michigan, so contiguity is not a good criterion for comparing districts. Respecting communities of interest and protecting incumbents are not geographic considerations, so we will focus instead on the related considerations of respecting political subdivisions and maintaining continuity. Sometimes complying with Sections 2 or 5 of the Voting Rights Act is presented as a traditional redistricting principle (National Conference of State Legislatures, 2009, p. 106), but the Voting Rights Act is a federal law not a traditional principle per se.

³ Courts have evaluated district compactness as a traditional principle in the absence of provision in state constitution or state statutes. See *Larios v. Cox*, 314 F. Supp. 2d 1357 (N.D. Ga. 2004) (ideal compactness for Georgia congressional districts described in geometric terms), *In re Senate Joint Resolution of Legislative Apportionment 2-B*, 89 So. 3d 872 (Fla. 2012) (district compactness evaluated on impressions of odd shapes or protruding appendages). Similarly, Oregon also does not require compactness but Oregon courts have evaluated the compactness of districts using a functionalist approach.

⁴ 462 U.S. 725, 758.
of new districts (Forgette & Platt, 2005; Winburn, 2008). Some scholars argue that one of the best ways to distinguish lawful from unlawful gerrymandering is to consider how well the districts conform to preexisting boundaries. Stephanopoulos (2012, p. 1379), for example, maintains that “districts ought to be upheld when they coincide with such communities, but struck down when they unnecessarily disrupt them.”

Compact districts serve a number of purposes (Bullock, 2010, pp. 90-91). Those who live in compact districts are more likely to know each other and have similar interests. Compactness reduces the costs of campaigning; this is particularly true for over-the-air broadcasting radiating from a particular location. The more compact the district, the easier it is for its representative to visit his or her constituents in a visit to the district. Voters may be more likely to recognize their representative as they are less likely to see advertisements for other districts’ representatives in their media. As Justice Stevens argued, compactness “facilitates political organization, electoral campaigning, and constitutional representation.”

Recent empirical work supports the proposition that compact districts improve political representation. Bowen (2014) seeks to test the relationship between district compactness and representation through survey responses in the 2008 CCES. Using quantitative measures of district compactness for the 110th Congress, he finds that those in “compact and coterminous districts are more likely to report being ideologically similar to their House member” as well as more familiar and satisfied with the work that representative has done (Bowen, 2014, p. 883).

Given the requirement for population equality among congressional districts, some county splitting is inevitable in states with more than one congressional district. After the 2012 redistricting, the only states with more than one congressional district that avoided splitting

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counties in any districts were Arkansas and Iowa. However, by taking county lines into consideration, mapmakers are more likely to create more homogeneous districts (Winburn & Wagner, 2010). This allows the politicians in those districts to more effectively represent their constituents, while also keeping them from alienating—or altogether ignoring—the needs of any minority that exists there, whether they are racial, economic, political, religious, or otherwise (Butler & Cain, 1992). Counties are particularly important because they are the most common political subdivision in the United States. Some states have many counties; other states have very few. While the amount of political authority delegated to counties varies, county governments play a large role in education, public safety, and social services, often in coordination with federal regulations and grant programs.

Furthermore, respecting political subdivisions improves representation by reducing the burden of obtaining information for both the congressperson and his or her constituency. For representatives, disseminating information is much easier when their respective districts are not broken up across a variety of counties given the structure of communication within counties (Jewell, 1982; Niemi, Powell, & Bicknell, 1986). Specifically, local news outlets generally focus their coverage on the representative in that district as opposed to the entirety of Congress (Clarke & Evans, 1983; Vinson, 2003). Local media markets tend to conform to county lines while congressional districts do not, which in turn creates disparities in the coverage some members

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6 In Iowa, mapmakers are forbidden from splitting counties across congressional districts. This process was designed to be as impartial as possible with mapmakers unable to consider previous electoral margins or voter demographics as well as disallowing any politicians to provide input. As such, this has led some observers to tout Iowa’s plan as “a model of equity” (Jan, 2013).

7 This is especially important given the results presented in other recent works, which demonstrate that drawing more competitive districts do not necessarily improve the quality of representation in those districts. Buchler (2005, p. 431) shows that “non-competitive districts lead to smaller ideological differences between the positions of district median voters and their representatives.” Similarly, Brunell (2010) argues that instead of trying to design more competitive districts, mapmakers should create districts with overwhelming similar voters (namely partisans) in order to decrease the number of those who are unsatisfied with the outcome of any given election.

8 Forty-eight states have counties; Louisiana has parishes and Alaska has boroughs. Determining the number of counties is further complicated by the fact that some independent cities are viewed as county equivalents.
receive (Schaffner, 2001; Schaffner & Sellers, 2003). Related to this, “voters living in a small sliver of a county that has been carved into more than one congressional district are different from voters who have a congressperson representing the lion’s share of the voters’ natural community of interest” (Winburn & Wagner, 2010, p. 381).\(^9\) Therefore, preserving existing political boundaries and drawing compact districts is at least—if not more so—important as fostering electoral competition in order to increase the quality of representation provided by members of the House.

Continuity serves different objectives than compactness and respecting political subdivisions.\(^10\) Preserving the core of old districts is a way to honor the results of prior elections and to preserve the relationships cultivated between representatives and their constituents (Crespin and Edwards 2016) and sometimes continuity is used as political cover for incumbent protection plans.

One potential drawback to the traditional principles of compactness and preserving political subdivision is weakening the political influence of minority voters. Unless minorities are concentrated in a particular area, it would be difficult to create a district that met both majority-minority and compactness standards (Altman, 1998). By examining numerous different redistricting principles from the 2001-2002 redistricting process, Barabas and Jerit (2004, p. 429) find “the compactness standard reduces minority representation, leading to fewer majority-minority districts and fewer minority influence districts.”\(^11\) Evaluating the redistricting process in Alabama during the 1990s, Webster (2000, p. 159) argues that “the use of ‘traditional’

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\(^9\) Another argument for respecting political subdivisions is minimizing voter confusion and making election administration easier. In a given election, voters may vote on local, county-level races in addition to voting in congressional elections and state-level contests. If the county is divided among districts, its residents will vote in different legislative elections. A single precinct may will require several different ballots.

\(^10\) See Crespin (2005) for ways to measure district continuity.

\(^11\) Klarner (2007) replicates this analysis after dropping states with an insufficient minority population to create a majority-minority district or too few districts to create one. Though the Barabas and Jerit results are shown to be relatively robust, Klarner finds no evidence of a relationship between compactness and minority representation.
districting criteria will almost certainly have negative ramifications for levels of minority representation."\(^{12}\) Of course, the practice of drawing majority-minority districts remains controversial.\(^{13}\)

**Hypotheses**

Our hypotheses are straightforward with respect to compactness and preserving political subdivisions.

(_H1_) *Districts created by IRCs will be more compact compared to districts created by state legislatures.*

(_H2_) *Districts created by IRCs will divide fewer counties compared to districts created by state legislatures.*

Our expectations with respect to district continuity are more complicated. On the one hand, we would expect IRCs to respect continuity as a traditional redistricting principle more than a state legislature primarily concerned with its political future. On the other hand, states have delegated redistricting authority to IRCs to reform politics. If we view IRCs as agents-of-change, we would expect less continuity in districts they create. Because both of these expectations seem reasonable, we test two competing hypotheses with respect to district continuity.

(_H3_) *Districts created by IRCs will preserve more of the core of old districts compared to districts created by state legislatures.*

\(^{12}\) In a follow-up work, Webster (2013, p. 12) contends “all eight traditional redistricting criteria evaluated have the potential to act as constraints to facilitating increases in social justice.”

\(^{13}\) Some point out that creating majority minority districts may increase the conservatism of the adjacent districts (Bullock, 1995), and mapmakers should therefore focus their efforts on creating “minority influence districts” (Lublin, 1997). Others see this “bleaching” process as a net positive in that it increases descriptive representation (Davidson, 1992).
(H4) Districts created by IRCs will preserve less of the core of old districts compared to districts created by state legislatures.

Measuring Adherence to Traditional Redistricting Principles

The traditional redistricting principles of respecting political subdivisions and maintaining continuity are not too difficult to measure (and we discuss our data in the next section). Drawing compact districts, in contrast, may seem like a simple goal, but measuring compactness turns out to be a complex and controversial matter. In this section, we discuss some of the issues related to measuring district compactness.

The first issue to consider is whether compactness is a geographic term that refers to the shape of a district on a map or a practical issue that requires courts to take into account where people actually live, the ease of travel within a district, and the ability of those who inhabit a district to communicate with one another. For example, a circular district divided by a mountain range or a body of water may be geographically compact but present practical problems for communication and travel. An oblong district that tracks an interstate corridor may rate poorly in terms of geographic compactness but may facilitate communication and travel within the district. A number of states appear to endorse a functional approach to compactness that emphasizes convenient travel and communication. While there may be some merit to this approach, there is no clear, efficient way of measuring this conception of compactness.14

Quantitative measures of compactness that focus on geometric shapes proceed from a common frame of reference: “For any given two dimensional area the most compact shape is a circle” (Schwartzberg, 1965, p. 444). Early efforts focused on the size of districts (Harris, 1964),

14 One might invent a measure of functional compactness by estimating travel time between points within districts, for example, but courts and legislatures have not consistently adopted any specific metric. Few courts have struck down district maps for non-compactness using such a practical, nuanced measure of compactness. It also seems to overlap with the redistricting concern for communities of interest.
but subsequent works have refined this approach.\textsuperscript{15} Over the past several decades, scholars have developed numerous ways to quantify the compactness of districts (Altman, 1998; Chou, Kimbrough, Murphy, Sullivan-Fedock, & Woodard, 2014; Fan, Li, Wolf, & Myint, 2015; Li, Chen, Wentz, & Fan, 2014; Li, Goodchild, & Church, 2013; McDonald, 1996; Niemi, Grofman, Carlucci, & Hofeller, 1990; Polsby & Popper, 1991; Reock, 1961; Schwartzberg, 1965; Young, 1988).

According to Bullock (2010), since the Supreme Court’s 1993 decision in \textit{Shaw v. Reno},\textsuperscript{16} courts have focused on three quantitative measures of district compactness. Examples of these measures are provided in Figure 1:

- **Dispersion/Reock Scores.** Calculated by dividing the area of the district by the area of the smallest circle that would fully contain the district (Reock, 1961).\textsuperscript{17}

- **Perimeter Ratios/Polsy-Popper Scores.** Calculated by “dividing the area of the shape by the area of a circle with a perimeter of equal length” (Polsby & Popper, 1991, pp. 348-349).\textsuperscript{18}

- **Population Ratio/Convex Hull Ratio.** Calculated by dividing the population of the district population by the population encompassed by a convex hull surrounding the district (like a rubber band around the district).\textsuperscript{19}

\textsuperscript{15} Though these are widely considered superior to measurements using size, measures of the dispersion of a district are sensitive to even small projections and therefore not ideal.
\textsuperscript{16} 509 U.S. 630 (1993).
\textsuperscript{17} Higher values mean more compactness. A dispersion score of 1.0 means the district is a circle, the most compact shape possible.
\textsuperscript{18} This compactness measure also contains values between 0.00 and 1.00 with higher values representing increased compactness. This measure is sensitive to map makers weaving district lines around neighbors rather than drawing the shortest possible lines from one point to the next. However, these scores are less sensitive to changes in a district’s shape than Reock Scores.
\textsuperscript{19} This measure is sensitive to map makers taking certain populations out of a district and accounts for the fact that some areas are more densely populated than other areas. A score of 1.0 is the most compact district. Many differently shaped districts could achieve 1.0 population ratios as long as they lack concave boundaries.
Figure 1 – Examples of Compactness Measures

California 23rd (2002)
Reock (.046)

Indiana 3rd (2002)
Reock (.642)

Convex Hull (.226)

Convex Hull (.928)

Polsby-Popper (.027)

Polsby-Popper (.531)
States follow a number of different approaches to quantify the compactness of districts. Some states constitutions specify how to measure district compactness. In other states, the method for measuring compactness is detailed in state statutes. Alaska, for example, has adopted the Perimeter Ratio approach while Michigan has specifically adopted Dispersion Scores (with adjustments for some natural features like the Great Lakes). More often, however, states that require compactness do not explicitly adopt a functionalist or geographic interpretation of the term, nor any specific metric, leaving courts to adjudicate among varied approaches to measuring compactness in redistricting litigation, often aided by expert witness testimony. Because there are multiple widely accepted measures of compactness, experts often produce inconsistent and conflicting evaluation of compactness.

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20 Some states that have explicitly adopted compactness as a redistricting principle have only one congressional district. How states like Alaska and Montana operationalize compactness is relevant to the issue of how states measure compactness. The difference in litigation over state, as opposed to congressional district compactness, would be the degree of non-compactness permitted rather than the method of measuring compactness. Courts will generally hold state legislative districts to a higher standard of compactness because states have greater leeway with respect to equalizing state legislative district populations compared to the populations of congressional districts.

21 When courts consider multiple measures of compactness, they are likely to decide that the analysis is inconclusive because maps may fare well on some measures, but worse on others.

22 Indeed, we could extend our enumeration of methods of measuring compactness significantly. According to Barabas and Jerit (2004), the “usual” and “classic” measure of compactness of geometric shapes with a long history of usage is $p^2/a$ (perimeter-squared divided by area). The most sophisticated approaches to measuring compactness utilize moment of inertia methods (MI), which were first introduced into shape analysis by Weaver and Hess (1963). Though this offered an improvement over other methods, it measures size as well as compactness, which in turn punishes large, often rural, districts with less compact scores. Therefore, Li et al. (2013) developed a measure of the moment of inertia (NMI) to compensate for this shortcoming. By calculating the ratio of the moment of inertia of a district relative to the moment of inertia of a circle of the same area, these researchers provided a standardized metric. Li et al. (2014) then improved the measure even further by proposing the NMMI, which incorporated the underlying distribution of some characteristic, such as race, on a shape when measuring compactness. For an application of this technique, see Fan et al. (2015). Given the variety of metrics, it would be interesting to assess the correlation among measures. Generally, an average of several measures is more reliable than a single measure, but calculating and communicating a composite score would be challenging.
Table 1 - How States Measure District Compactness

<table>
<thead>
<tr>
<th>Compact Districts Required</th>
<th>Geographic</th>
<th>Approach Undefined</th>
<th>No Compactness Requirement</th>
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<tbody>
<tr>
<td>Functionalist</td>
<td>Geographic</td>
<td></td>
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</tr>
<tr>
<td>ME, MO, RI, SC, VT, WI</td>
<td>AL, AZ, CA, HI, ID, IA, NJ, VA, WV</td>
<td>IL, KS, MD, MN, NE, NV, NJ, NM, NY, ND, OH, OK, PA, SD, UT, WA, WY</td>
<td>AR, CT, DE, FL, GA, IN, KY, LA, MA, NH, NC, OR, TN, TX</td>
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<tr>
<td>Specific Measures:</td>
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<tr>
<td>AK (perimeter-to-area ratio)</td>
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<tr>
<td>CO (minimize perimeters)</td>
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</tr>
<tr>
<td>IA (length-width difference, minimize perimeters)</td>
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</tr>
<tr>
<td>MI (Reock Scores)</td>
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<tr>
<td>MT (length-width difference)</td>
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</table>


These approaches to measuring compactness are not without their own shortcomings though. Districts with naturally irregular boundaries, such as coastal states, will have lower compactness scores. Some non-compactness will result from state boundaries that mapmakers cannot change. Others may object to the use of a circle as the ideal shape because, as Niemi et al. (1990, p. 1163) point out, “no conceivable set of districts could be perfect by this standard because non-overlapping circles cannot fill an entire area.”

Therefore, in the absence of the possibility of a perfectly compact district, a certain degree of non-compactness is expected. While expert testimony emphasizing quantitative measures of compactness is frequently considered, courts also appear willing to consider lay testimony and their own impressions of district shapes. If state law does not require a specific compactness metric, judges may evaluate district shapes on impressionistic grounds as if judging works of art. In these cases, districts that are merely “odd” or “irregular” are permissible, but districts that seem “tortured” or “grotesque” are struck down (unless necessary to equalize district populations or comply with the Voting

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23 However, these authors dispel the notion that squares or hexagons are superior alternatives by pointing out that states could not be divided evenly into these shapes either, especially if population equality is also considered.
Rights Act).\textsuperscript{24} Regardless of how one evaluates compactness, there is still no threshold for what constitutes a compact versus a non-compact district aside from subjective, post hoc evaluations.\textsuperscript{25} There is not some objectively defined range of permissible shapes.\textsuperscript{26} However, our analysis does not require us to identify the lower boundary of compactness. We are simply comparing districts drawn by one type of institution to districts drawn by other types of institutions. If the alternatives are the same on other dimensions, the more compact map may be preferable to the less compact map.

**Data and Methods**

In order to test our hypotheses, we examine congressional districts created after reappointments in 1970, 1980, 1990, 2000, and 2010 (for congressional elections in 1972, 1982, 1992, 2002, and 2012). Building on the work of Carson and Crespin (2004) and Carson, Crespin, and Williamson (2014), we specify whether a state legislature, court, or commission created each congressional district. As discussed above, no state uses its court system as its primary mechanism for redistricting, but courts are often forced to create maps when state legislatures cannot produce satisfactory maps in time for an election. We utilize the typology of redistricting commissions found in Edwards, Sanchez, Yeargain, Crespin, and Hayden (2016), to further distinguish independent redistricting commissions (IRCs) from redistricting commissions that

\textsuperscript{24} Or as Polsby and Popper (1993) stated, is the district “ugly” or not.

\textsuperscript{25} Some recent scholarship has attempted to establish an objective measure of compactness by establishing a baseline for comparison. For examples, see Chou et al. (2014) and Ansolabehere and Palmer (2015).

\textsuperscript{26} The compactness measures of states as shapes is an interesting prospect for establishing a “natural” baseline of compactness. State boundaries were not drawn for gerrymandering, but instead reflect history, geography, and other considerations. The compactness scores of states as geographic spaces might tell us what kind of boundaries we might expect in the absence of gerrymandering.
either play an advisor role or seat elected officials as commissioners. Here we code Arizona, California, Idaho, and Washington as IRC states in the appropriate years.

We use three of the most popular methods of quantifying how well congressional districts adhere to the traditional redistricting principle of compactness: Reock Scores, Polsby-Popper Scores, and Convex Hull Ratios. We calculate the geographic compactness of congressional districts using a GIS program and shape files for congressional districts, a method detailed in Ansolabehere and Palmer (2015). As discussed above, these measures have their relative merits and have used by courts to evaluate redistricting plans. Each of these compactness measures ranges between 0.00 and 1.00 with higher values corresponding to more compact districts. These measures are available for each of the redistricting cycles in the post Wesberry era.27

To estimate how well each district respects political subdivisions, we use the Missouri Census Data Center’s Geographic Correspondence Engine.28 This outstanding resource allows us to assess the correspondence of congressional district maps used in 1992, 2002, and 2012 elections and county boundaries throughout the United States. For each district, we are able to determine the number of counties within the district’s boundaries.29

The Geographic Correspondence Engine is also useful for comparing maps of congressional districts before and after redistricting. For each congressional district in 1992, 2002, and 2012, we identify the district’s correspondence with districts used before redistricting (in 1990, 2000, and 2010). We then encode the district’s highest correspondence with a prior

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27 Ansolabehere and Palmer (2015) created these measures for all districts from the first congress through the 2012 redistricting cycle.
29 The Geographic Correspondence Engine offers some options for measuring how much of the county is split (i.e. whether one measures the area or population of the county split into each district). We simply count the number of counties split by each district.
district as a measure of district continuity.30 For example, the redistricting process creates a new
district from parts of the areas of three prior districts such that 0.80 of the new district
 corresponds to one prior district, 0.15 to another, and 0.05 to the third, we assign the new district
 a 0.80 score for keeping a significant core of the old district intact.31 As an additional measure of
 continuity, we count the number of old districts used, in whole or in part, to create the new
district. Sticking with our example, the number of old districts used to make the new district
 equals three.

 As the discussion of majority-minority districts above suggests, it is important to control
 for the influence of the Voting Rights Act on redistricting. The Act compelled certain states with
 histories of racial discrimination in their election laws to pre-clear new congressional district
 maps with the federal government before holding elections. We identify the states covered by
 Section 5 of the Voting Rights Act. These states were compelled to create majority-minority
districts, often by drawing minority communities in different counties into a single district, to
 provide minority voters with fair opportunities to elect their preferred candidates to Congress.
We expect Section 5 jurisdictions to create districts that are less compact and split more counties
 in order to comply with the Act, regardless of what redistricting method they used.

 Additional control variables include the number of congressional districts and counties in
each state as well as the change in the number of districts due to reapportionment. We believe
these variables may help explain how well mapmakers are able to draw districts that respect
county lines and preserve the core of prior districts.

30 Our continuity measure focuses on the extent to which new maps preserve the core of prior districts. If a prior
district is fully encompassed within a new district, which happens most frequently when a state loses a seat in
Congress due to reapportionment, there is significant continuity, even if some area is joined to create the new district.
31 This is approach is a slight variation on the % new measure used in Crespin and Edwards (2016) who matched old
and new districts based on where incumbent members ran for re-election after redistricting. Because candidates must
reside in their districts, it is possible that an incumbent’s new district contains a slight amount of his or her old
district (where the member lives) but is mostly new area for that member.
Results

In order to evaluate our expectations regarding districting methods and outcomes, we first examine some descriptive data before turning to a series of regression models. In both cases, we look at three redistricting principles, continuity, splitting communities of interest, and district compactness. For each of the principles, we consider four redistricting methods, independent commissions, other commissions, court drawn plans, and finally traditional legislative drawn plans. “Other commissions” is meant to be inclusive of any method that takes place largely outside of the normal legislative process but is not considered independent. This type includes methods like Iowa where the legislature gets a vote and New Jersey where partisans are appointed to a commission with an “Independent” tiebreaker.

Table 2 provides the mean values for our measures for each of the redistricting types. We also provide a graphical depiction of the means in Figure 1. We perform simple t-tests treating each type as a dichotomous variable. For the first principle, continuity, we find an average district is about 75 percent the same after a redistricting. Both types of commissions tend to respect continuity significantly less compared to legislative drawn districts but not by a large amount. The difference is likely because commissions were intended to achieve outcomes other than incumbent protection plans. When courts are involved we do not see a statistically significance difference.

A different way to look at continuity is to examine the number of old districts that now make up the new district. This is a much rougher cut at the question, but we include it as a point of comparison. In this case, we find court drawn districts are made up of slightly more old districts than traditional legislative drawn districts but not by a large amount. The difference is likely because commissions were intended to achieve outcomes other than incumbent protection plans. When courts are involved we do not see a statistically significance difference.

32 Due to data constraints, we only examine the first two principles for 1992, 2002, and 2012. The compactness measures cover all redistricting cycles from 1972-2012.
districts compared to other methods. There is no difference for commissions or legislative drawn plans.

For the next principle, dividing communities of interest, we examine the number of counties that are split by each congressional district. While there are some important caveats to this measure, the most important being counties vary in both geographic size and population, it is
still a good indicator of a community of interest.\textsuperscript{33} When independent commissions draw districts, they are much less likely to split counties. The average independent commission district splits just under two counties while legislative districts split almost three. Since the average district is composed of 7.2 counties, this is a substantive difference as well. Courts and other commission fall somewhere in between but still split fewer districts. One reason commissions do well on this measure is they are frequently specifically tasked with keeping counties intact.

For the final principle, compactness, we rely on several different measures that capture different aspects of compactness. As we discussed above there is no one perfect measure of compactness so we hope the preponderance of the evidence points in one direction or another. Recall higher numbers correspond to more compact districts. When it comes to independent commission districts, they are more compact on two of the three measures (Convex Hull Ratio and Reock) but not the third measure, Polsby Popper. Court plans are always more compact on average. Other commissions, however, are no more or less compact compared to the other methods. Finally, legislative drawn districts are always less compact compared to districts drawn outside of the regular legislation process. In sum, the evidence across all three principles points in the direction that independent commission drawn districts are less likely to respect continuity, but more likely to retain communities and interest and be more compact. Legislative drawn districts, in contrast, tend to do worse on these measures.

\textsuperscript{33} The importance of counties as communities of interest likely varies across the country as well. Rhode Island and Connecticut do not have any county governments, and Massachusetts only has county governments in some of its counties. Los Angeles County (CA) has a population of 10,000,000 while most are much smaller.
Table 2 – Mean Values for Redistricting Measures

<table>
<thead>
<tr>
<th></th>
<th>Independent Commissions</th>
<th>Other Commissions</th>
<th>Court Plans</th>
<th>State Legislators</th>
<th>All Districts</th>
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<tbody>
<tr>
<td><strong>Continuity</strong></td>
<td></td>
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</tr>
<tr>
<td>Proportion prior district retained</td>
<td>.70*</td>
<td>.72*</td>
<td>.74</td>
<td>.76*</td>
<td>.75</td>
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<tr>
<td>Number of Districts</td>
<td>3.6</td>
<td>3.4</td>
<td>3.6*</td>
<td>3.4</td>
<td>3.5</td>
</tr>
<tr>
<td><strong>Community of Interest</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of Counties Split</td>
<td>1.94*</td>
<td>2.31*</td>
<td>2.35*</td>
<td>2.8*</td>
<td>2.59</td>
</tr>
<tr>
<td><strong>Compactness</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Polsby Popper</td>
<td>.25</td>
<td>.24</td>
<td>.27*</td>
<td>.22*</td>
<td>.24</td>
</tr>
<tr>
<td>Convex Hull Ratio</td>
<td>.74*</td>
<td>.70</td>
<td>.72*</td>
<td>.70*</td>
<td>.71</td>
</tr>
<tr>
<td>Reock</td>
<td>.41*</td>
<td>.37</td>
<td>.39*</td>
<td>.37*</td>
<td>.38</td>
</tr>
</tbody>
</table>

* Denotes p<.05 for t-test

In order to perform a more systematic test of our hypotheses, we perform a series of regressions where our dependent variables are the same as the measures examined above. Our main independent variables of interest are once again the types of redistricting methods, independent commissions, other commission, and court plans. Legislative drawn districts are the reference category. When the dependent variable is a proportion, we estimate a generalized linear model (GLM) with a logit link and the binomial family and OLS otherwise.\(^{34}\)

We also include a few control variables. The first is a dichotomous variable coded one if the state is covered under Section 5 of the Voting Rights Act.\(^{35}\) Since Section 5 states know they must face the preclearance requirement, they may be constrained in the types of districts they draw. We also include variables that indicate the number of districts in a state and how many districts a state gained or lost in the most recent reapportionment.\(^{36}\) When states have many districts, or gained or lost a seat, they are more likely to make larger changes to districts and this

\(^{34}\) The GLM is more appropriate when the dependent variable is a proportion so predicted values do not fall outside of the zero to one range. Results are similar using OLS.

\(^{35}\) Section 5 is the preclearance requirement. In *Shelby County v. Holder* (U.S. 2013). The U.S. Supreme Court held that the coverage formula, but not the requirement, is unconstitutional (Edwards, 2013).

\(^{36}\) Single district states are not included in any of our analyses.
can influence our dependent variable. We present the results from our models visually in Figure 2 and supply additional information in Table 3. For ease of comparison, we depict regression coefficients in Figure 3, but report the more accurate GLM coefficients where appropriate in Table 3.

**Figure 3- Regression Coefficients with 95% Confidence Intervals**
<table>
<thead>
<tr>
<th>Variables</th>
<th>Continuity</th>
<th>Communities of Interest</th>
<th>Compactness</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Proportion Retained (GLM)</td>
<td>Num. Prior Districts (OLS)</td>
<td>Num. Split Counties (OLS)</td>
</tr>
<tr>
<td>Ind. Commission</td>
<td>-0.194 (0.103)</td>
<td>-0.152 (0.136)</td>
<td>-0.721* (0.165)</td>
</tr>
<tr>
<td>Other Commission</td>
<td>0.111 (0.091)</td>
<td>-0.223* (0.113)</td>
<td>-0.394* (0.163)</td>
</tr>
<tr>
<td>Court</td>
<td>0.071 (0.073)</td>
<td>0.009 (0.103)</td>
<td>-0.543* (0.141)</td>
</tr>
<tr>
<td>Sec. 5</td>
<td>0.086 (0.073)</td>
<td>0.002 (0.092)</td>
<td>0.974* (0.260)</td>
</tr>
<tr>
<td>Seat Change (abs)</td>
<td>-0.108* (0.022)</td>
<td>0.045 (0.032)</td>
<td>0.044 (0.039)</td>
</tr>
<tr>
<td>Num. of Districts</td>
<td>-0.012* (0.002)</td>
<td>0.022* (0.003)</td>
<td>-0.013* (0.003)</td>
</tr>
<tr>
<td>Num. of Counties</td>
<td>-0.002 (0.002)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>1.447* (0.048)</td>
<td>3.009* (0.059)</td>
<td>3.017* (0.127)</td>
</tr>
<tr>
<td>Observations</td>
<td>1,284</td>
<td>1,284</td>
<td>1,284</td>
</tr>
<tr>
<td>AIC</td>
<td>0.82</td>
<td>0.82</td>
<td>0.82</td>
</tr>
<tr>
<td>Adjusted R-squared</td>
<td>0.078</td>
<td>0.048</td>
<td></td>
</tr>
</tbody>
</table>

Robust standard errors in parentheses
*p<0.05
Once again, we focus on three redistricting principles, continuity, communities of interest, and compactness. In contrast to our comparison of means above, we find limited influence of redistricting type on district continuity once we include control variables. The only exception is other commission districts are made up of fewer prior districts. The null results are not too surprising as the consequences of continuity are not so straightforward. If districts do not change, it is likely an indicator of an incumbent protection plan – the type of districts commissions were supposed to move away from. However, too much change makes representation more difficult as constituents might not even know the name of their representative.

Moving on to the principle of dividing communities of interest, non-legislative drawn districts perform how we expected and are less likely to split counties. While the coefficient for independent commissions is the greatest at about three-fourths of a county, it is not significantly different from the two other methods. For the final principle, compactness, independent redistricting commissions and court drawn districts are both significantly more compact on all three measures. Other commissions are no different compared to legislative drawn plans.

In order to test the robustness of our findings, we perform an additional set of estimations where we take our set of IRC states, and compare their compactness with other plans in the 1972 and 1982 redistricting cycles – the years prior to the start of IRCs. If these states show significant differences in compactness prior to using IRCs, then it is unlikely that the adoption of IRCs contributed to the increases in compactness scores. We present the results in Table 4. Briefly, the coefficient on the IRC variable fails to achieve statistical significance in any of the three models.

37 We include a control for the number of counties in a state in this model only.
38 We provide results from additional models using other compactness measures in the appendix. Results are similar.
In fact, the coefficient from the Polsby Popper model is almost significant in the opposite
direction (p = .057) suggesting these states were less compact.³⁹ These additional findings give
additional evidence that it was the adoption of the IRC that contributed to changes in
compactness scores.

Table 4 – Compactness Pre-test Results (1972 and 1982)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Polsby/Popper (GLM)</th>
<th>Reock (GLM)</th>
<th>Convex Hull (GLM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ind. Commission States</td>
<td>-0.169</td>
<td>0.014</td>
<td>0.026</td>
</tr>
<tr>
<td></td>
<td>(0.089)</td>
<td>(0.052)</td>
<td>(0.056)</td>
</tr>
<tr>
<td>Other Commission</td>
<td>-0.534*</td>
<td>0.027</td>
<td>-0.141</td>
</tr>
<tr>
<td></td>
<td>(0.197)</td>
<td>(0.093)</td>
<td>(0.112)</td>
</tr>
<tr>
<td>Court</td>
<td>0.136*</td>
<td>0.082*</td>
<td>0.083*</td>
</tr>
<tr>
<td></td>
<td>(0.058)</td>
<td>(0.034)</td>
<td>(0.040)</td>
</tr>
<tr>
<td>Sec. 5</td>
<td>-0.198*</td>
<td>0.031</td>
<td>0.053</td>
</tr>
<tr>
<td></td>
<td>(0.062)</td>
<td>(0.036)</td>
<td>(0.041)</td>
</tr>
<tr>
<td>Seat Change (abs)</td>
<td>-0.071*</td>
<td>0.005</td>
<td>0.017</td>
</tr>
<tr>
<td></td>
<td>(0.024)</td>
<td>(0.015)</td>
<td>(0.017)</td>
</tr>
<tr>
<td>Num. of Districts</td>
<td>-0.004</td>
<td>-0.006*</td>
<td>-0.011*</td>
</tr>
<tr>
<td></td>
<td>(0.003)</td>
<td>(0.002)</td>
<td>(0.002)</td>
</tr>
<tr>
<td>Constant</td>
<td>-0.933*</td>
<td>-0.371*</td>
<td>1.144*</td>
</tr>
<tr>
<td></td>
<td>(0.050)</td>
<td>(0.030)</td>
<td>(0.036)</td>
</tr>
<tr>
<td>Observations</td>
<td>858</td>
<td>858</td>
<td>858</td>
</tr>
<tr>
<td>AIC</td>
<td>0.79</td>
<td>0.91</td>
<td>0.82</td>
</tr>
</tbody>
</table>

Robust standard errors in parentheses
* p<0.05

Discussion and Conclusion

We are limited to several elections cycles and are only analyzing congressional districts.

There are many election cycles prior to the time period we study here, but IRCs are a relatively
recently innovation.

³⁹ In a simple t-test similar to the results presented in Table 2, IRC states are significantly less compact across all
three of the compactness measures.
Our findings with respect to continuity are interesting. Given that IRCs are reform measures, it makes sense that they would alter the cores of prior districts in order to draw new maps, but we might expect continuity to increase as IRCs revisit maps they created (as opposed to maps they inherited from state legislatures).

As discussed, there are alternative ways of operationalizing traditional redistricting principles. There is, for example, a suite of compactness measures (of which we have focused on the most significant metrics). There are political subdivisions other than counties (some of which may be more politically significant to voters, such as local school districts). In some ways, the effective representation of cities and school districts is more important than the representation of counties. Analyzing political subdivisions below the county level is complicated by the fact that the name and function of smaller political subdivisions varies so much from one state to the next. There are also other ways to operationalize district continuity and this principle has not been so widely studied that researchers agree on how to measure it. We suspect these alternative metrics would correlate highly with the ones we use here, but the correlation among alternative measures is an empirical matter that might be addressed in future research.

Some refinement to our empirical models may be in order. We might control for incumbents seeking re-election. Protecting incumbents (in order to respect the choices voters have made in the past) is often used as an excuse for irregularly shaped districts more than a positive principle embodied in state constitutions to guide map makers. Additionally, we might

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40 The communities of interest criteria recognizes that race/ethnicity and political boundaries are only part of what defines local communities. For example, there are ethnic neighborhoods that are not minority communities protected by the Voting Rights Act. There are also communities with shared religious beliefs. Some communities of interest are defined in socioeconomic terms, like historic areas and coastal communities. These varied types of communities are difficult to quantify and are beyond the scope of our research, but we would surmise that an institution that draws districts that respect political subdivisions would also display greater regard for varied communities of interest compared to state legislatures.

41 There is some issue of how to code whether a district has an incumbent. One might simply code whether a member of Congress ran in that district in the election following redistricting. One might also take a more nuanced
use spatial regression methods to account for the influence that one district’s design has on its neighbors. Finally, an area for future research would be state legislative districts. They are more numerous, but subject to different legal standards, especially with respect to population equality among districts.

approach, for example, by tracing whether the incumbent formerly represented the district that makes up the bulk of the new district. Further complicating the issue of incumbency is whether the incumbent belongs to the same party as the party that controlled the redistricting process.
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## Appendix

### Table 1A – Additional Compactness Measures

<table>
<thead>
<tr>
<th>Variables</th>
<th>Reock Adj. (GLM)</th>
<th>Convex Hull Adj. (GLM)</th>
<th>Schwartzberg (OLS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ind. Commission</td>
<td>0.219* (0.063)</td>
<td>0.356* (0.068)</td>
<td>-0.409* (0.092)</td>
</tr>
<tr>
<td>Other Commission</td>
<td>0.016 (0.050)</td>
<td>-0.006 (0.057)</td>
<td>0.087 (0.135)</td>
</tr>
<tr>
<td>Court</td>
<td>0.035 (0.032)</td>
<td>0.099* (0.036)</td>
<td>-0.375* (0.064)</td>
</tr>
<tr>
<td>Sec. 5</td>
<td>-0.073* (0.031)</td>
<td>-0.079* (0.036)</td>
<td>0.456* (0.107)</td>
</tr>
<tr>
<td>Seat Change (abs)</td>
<td>0.019 (0.011)</td>
<td>0.029* (0.013)</td>
<td>0.011 (0.028)</td>
</tr>
<tr>
<td>Num. of Districts</td>
<td>-0.014* (0.001)</td>
<td>-0.011* (0.001)</td>
<td>0.003 (0.002)</td>
</tr>
<tr>
<td>Constant</td>
<td>0.189* (0.025)</td>
<td>1.254* (0.026)</td>
<td>2.382* (0.045)</td>
</tr>
<tr>
<td>Observations</td>
<td>2,129</td>
<td>2,129</td>
<td>2,129</td>
</tr>
<tr>
<td>AIC</td>
<td>0.95</td>
<td>0.79</td>
<td>0.026</td>
</tr>
</tbody>
</table>

Robust standard errors in parentheses  
*p<0.05

### Table 2A – Compactness Scores for IRC States (1972 and 1982)

<table>
<thead>
<tr>
<th>Compactness</th>
<th>Independent Commissions</th>
<th>All Districts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polsby Popper</td>
<td>.19</td>
<td>.24</td>
</tr>
<tr>
<td>Convex Hull Ratio</td>
<td>.70</td>
<td>.73</td>
</tr>
<tr>
<td>Reock</td>
<td>.37</td>
<td>.39</td>
</tr>
</tbody>
</table>