Gerrymandering and Legislator Efficiency

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The purposes of gerrymandering are to maximize the number of legislative seats that can be won by the political party in charge of redrawing the district boundaries, and to create "safe" seats for the party's incumbent legislators. My hypothesis is that US Representatives serving districts made safer by gerrymandering have less competitive incentive to capture federal appropriations for their districts than Representatives facing tougher reelection prospects in less safe districts.

Introduction

Gerrymandering involves the redrawing of election district boundaries to give an electoral advantage to a particular candidate or party. It has been recognized as an American political art form since 1812. The term derives from a redrawing of US Representative districts in Massachusetts before the 1812 elections, when Elbridge Gerry was governor. The story goes that two reporters were discussing the new map, and when one commented that the district north of Boston looked like a salamander, the other exclaimed, "No, a Gerry-mander!" (Figure 1).

Figure 1: Satire of the original 1812 "gerrymander"

Beyond the Constitutional principle that districts should have near-equal populations so that citizens are equally represented in the House of Representatives, there are several other generally-accepted principles in drawing "fair" boundaries. District boundaries should make sense to laypeople, preferably following naturally-occurring geographic features that define boundaries between communities. And as geography permits, they should each be comprised of single polygons with reasonable geometric compactness. But politicians are often willing to ignore these principles, and majority parties in the various state legislatures have been refining the art of gerrymandering ever since

the term was coined. US courts have generally been reluctant to intervene in these processes unless they involve overt civil rights issues, and in some cases have actually encouraged creative mappings that promote representation of racial minorities (e.g., Georgia's 13th district, shown in Figure 3 below).

While the US Constitution guarantees that how you vote is secret, the fact that you did or did not vote in an election is public record. Voter registration data typically include the name, address, phone number, sex, age, party registration and voting history of each registered voter. All of this is made available to parties and political candidates, and most of it is available to the public. These voter databases are now routinely geo-coded, and combined with Census block-level SF1 (short-form) data from the decennial Census, they can readily support high-precision gerrymandering in a geographic information system.

Theory of Gerrymandering

Gerrymandering depends on a heterogeneous geographic distribution of political interests, and only occurs in elections by district rather than at-large. In the schematic diagram below (Figure 2), representing a geographic area with evenly-dispersed population, suppose the people in the west (40% of the total population) all vote for Party A and the people in the east (60% of the total population) all vote for Party B. If the region is split into compact east and west sections of equal proportions, each party wins one seat. But if regional majority Party B controls the redistricting process, and splits the region into less compact north and south sections of equal proportions, it can win both seats and Party A is effectively unrepresented.

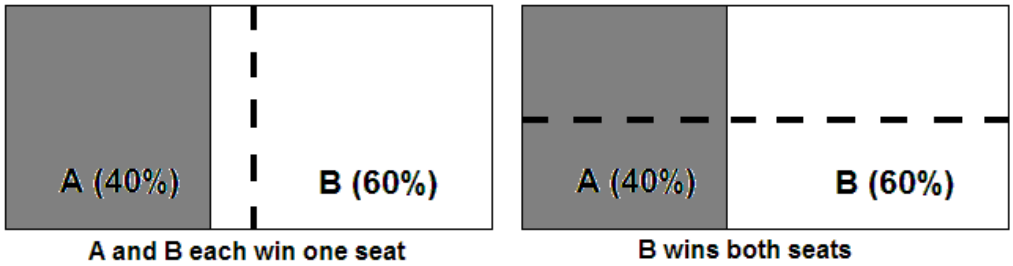


Figure 2: Gerrymandering Schematic

The problem can be generalized for multiple seats, parties and voting systems. At best, in the two-party case, as the number of districts gets large, a minority party with A% of total voters could win up to 2A% of seats (e.g., a 26% regional minority could eke out wins in up to 52 of 100 districts and gain political control); alternately, the majority party can win all the seats. With J equal-sized parties competing in K equal-sized districts, where district winners are determined by simple plurality, one party controlling redistricting could theoretically concede just one seat and sweep the remaining K-1 seats.

Gerrymandering targets specific voter groups that are "packed" into a few conceded districts where they have larger local majorities, and/or "cracked" into multiple contested districts where they are in the minority. Either strategy can marginalize and perhaps discourage these voters, although there is very little evidence that gerrymandering actually discourages voter turnout. Variations in voter turnout mostly depend on voter age, income, educational attainment, race and ethnicity. Since ballots include

multiple races for offices with various geographies, some of which may be closely-contested, one or two "foregone conclusions" on the ballot will not diminish voter interest in other races.

Looking past these equity concerns, the political efficiency of gerrymandered districts is unclear. Political economists typically assume that each legislator's primary incentive is to insure her own re-election, and the typical behaviors of legislators support this assumption. An "effective" legislator wins large government appropriations or other special advantages for the politically-connected constituents in her district, and she extracts substantial contributions to her re-election campaigns from these same constituents. She gets re-elected and gains seniority and more legislative clout to sustain her incumbency.

Political competition, like market competition, is supposed to yield efficiency. In hotly-contested districts, politicians competing to win the support of various constituent groups have to be highly responsive to those groups. In safe districts, well-entrenched legislators, like monopolists, can afford some laziness.

The question I discuss here is whether legislators in districts that are gerrymandered to be safe are in fact less "efficient" than other legislators in capturing federal dollars for their home districts, *ceteris paribus* (i.e., after accounting for accumulated legislative seniority).

Political Art

Modern-day redistricting is every bit as artful as the original gerrymander. Figures 3 through 6 below show the current boundaries of Georgia's 13th, Illinois' 11th , Georgia's 11th and Pennsylvania's 12 Districts. Some of these maps have extremely convoluted details not visible at the scales shown here.

In this analysis I used a GIS to analyze a shapefile of district boundaries for the 109th Congress obtained from the US Census Bureau website (http://www.census.gov/geo/www/cob/bdy_files.html). I calculated a simple scale-invariant, unit-free index of polygon compactness for each district, where compactness is based on the ratio of polygon area to perimeter squared. This ratio ranges from zero for any true fractal, to $1/(4\pi)$, or approximately 0.079577, for any circle.

State boundary polygons also vary in compactness, with some states having low compactness because of highly convoluted natural boundaries such as shorelines. Convoluted state boundaries naturally reduce the compactness of Congressional districts along those boundaries. As a rough correction, I normalized district compactness by state compactness to create a simple net ratio of Congressional district compactness that provides a somewhat better index of gerrymandering. Obviously states with one at-large Representative are naturally precluded from Congressional gerrymandering.

Out of the 435 Congressional districts (Figure 7), the four districts shown in Figures 3-6 have the highest net ratio boundary complexity. A simple kriging of this polygon complexity index for the continental US (Figure 8) reveals the states with the highest degrees of gerrymandering (Georgia, Pennsylvania, Alabama, Illinois and Arizona) as well as other gerrymandering hot spots (e.g., the Texas Gulf Coast, redistricted a second time in 2003 following a Republican takeover of the state legislature so that five US House seats went from Democrat to Republican).

A more precise index of gerrymandering would require (1) cracking district polygons into component boundary arcs, (2) distinguishing arcs following natural boundaries (shorelines, etc.) from arbitrarily-drawn boundary arcs, (3) substituting straight lines for the natural boundary arcs, and (4) analyzing district pseudo-polygons reconstructed from the straight lines and arbitrarily-drawn arcs … a tedious and time-consuming process that I did not pursue.

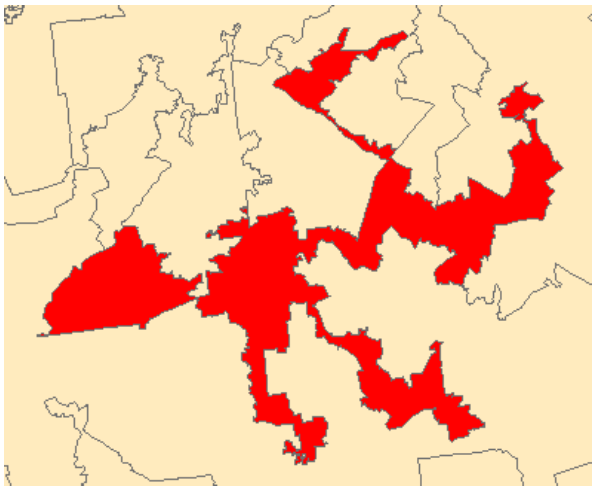


Figure 3: Georgia 13th—David Scott (D)
(roadkill poodle)

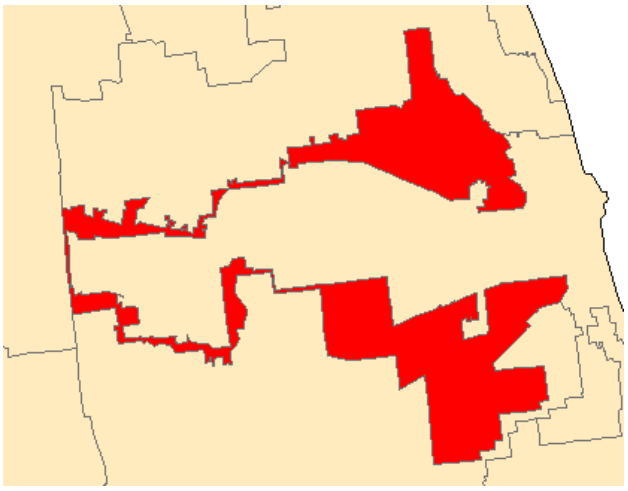


Figure 4: Illinois 11th—Debbie Halvorson (D)
(mutant lobster, or Chicago's earmuffs)

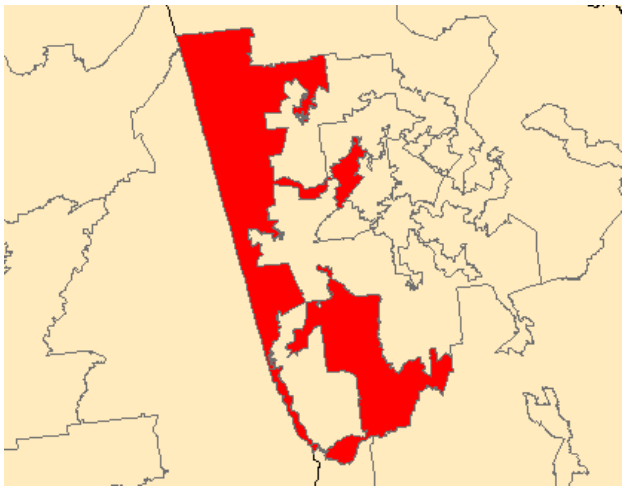


Figure 5: Georgia 11th—Phil Gingrey (R)
(profile of smoking farmer holding piglet)

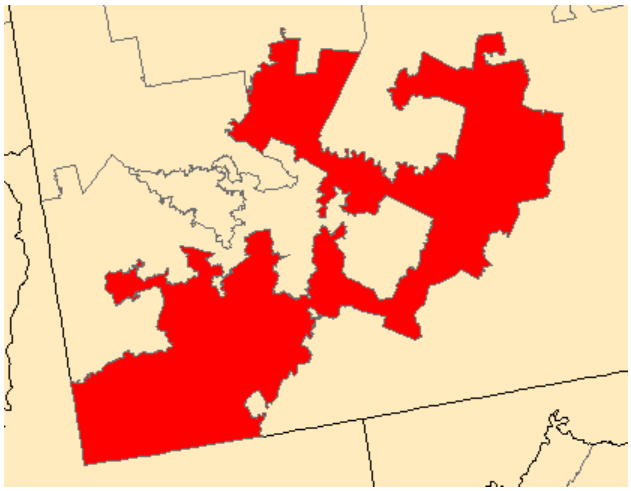
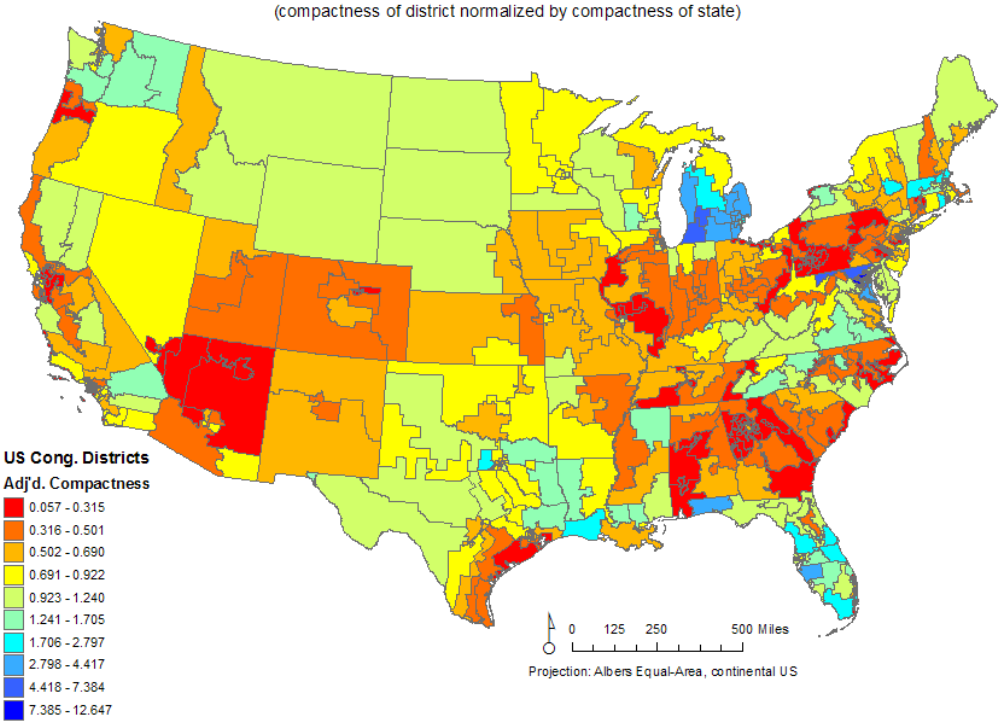


Figure 6: Pennsylvania 12th—John Murtha (D)
(profile of barfing lady)

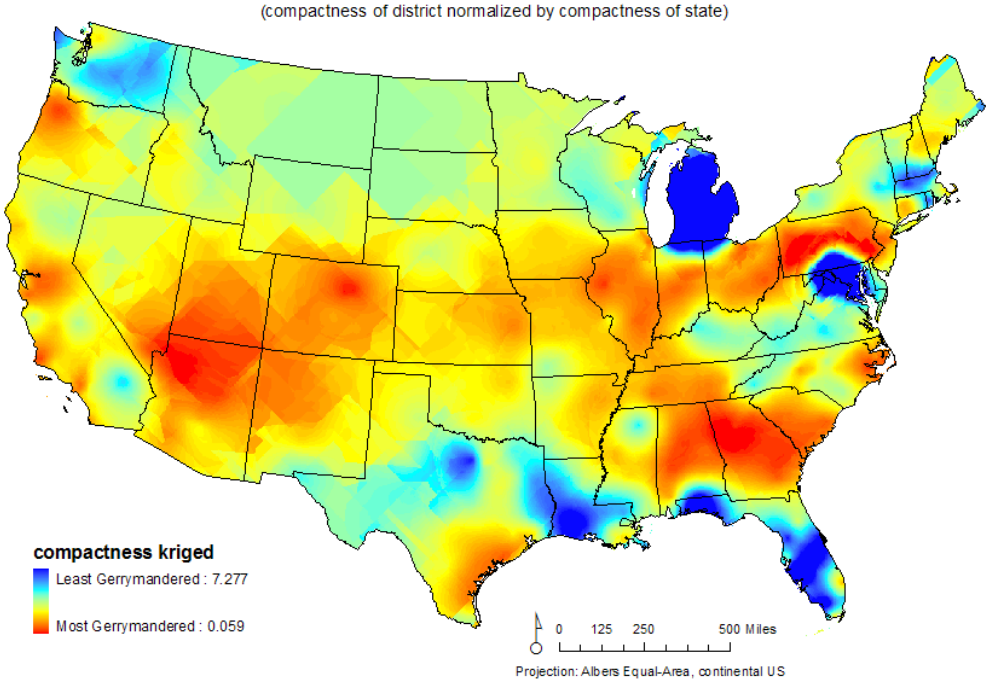
Representative District Compactness, 109th Congress

(compactness of district normalized by compactness of state)



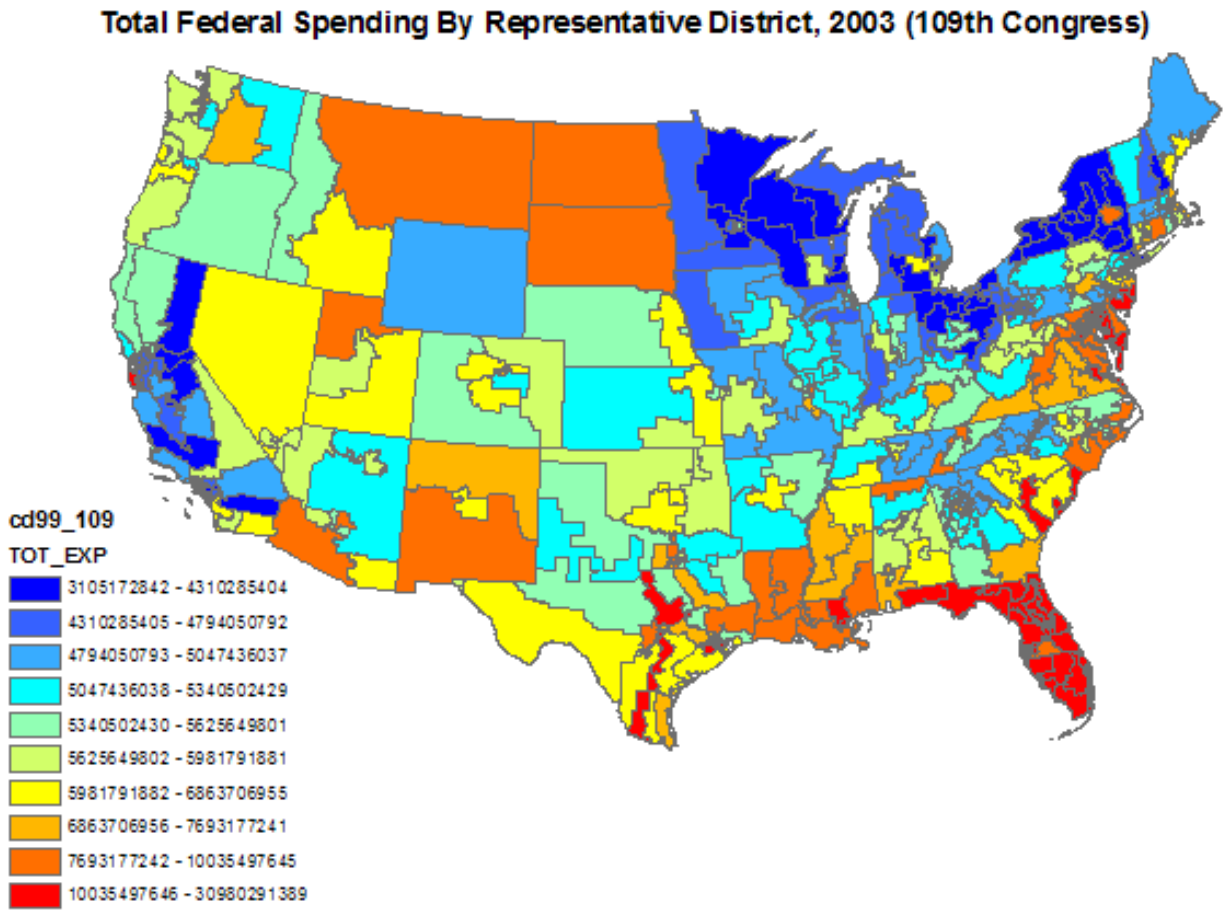
Kriging of Representative District Compactness, 109th Congress

(compactness of district normalized by compactness of state)



Tracking Legislative Appropriations

To obtain a crude measure of legislator "effectiveness," I aggregated 2003 Congressional appropriations data from the US Census Bureau's *Consolidated Federal Funds Report* by Representative district. Where appropriations were for multiple districts within a state, I apportioned the dollars equally among the districts. Aggregate federal spending by district is mapped below.



These spending figures include Social Security payments, which is why Florida stands out in this map.

The final two maps show Representative seniority (years in Congress) and the ratio of federal expenditures received versus total federal taxes paid in 2004, by Congressional district. Fortunately, Congressman are mortal, so even the safest seats see turnover.

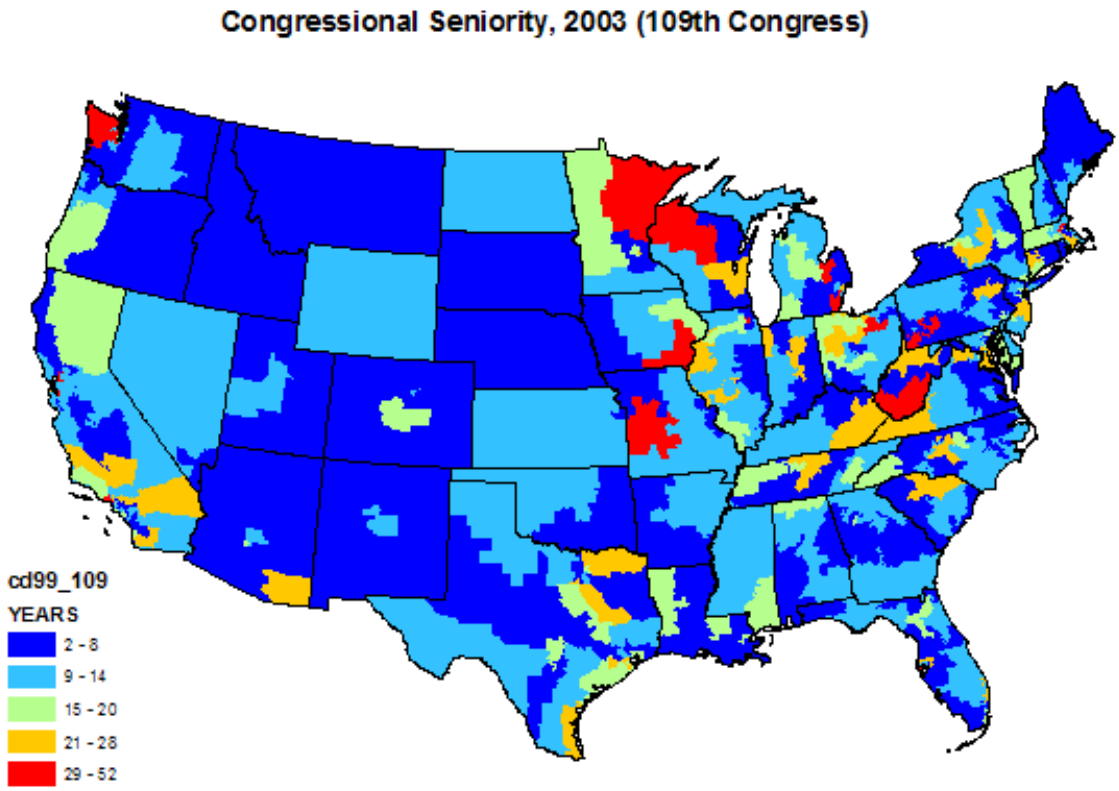
The tax data obtained from the Tax Foundation (www.taxfoundation.org) were calculated from IRS reports. In this map, the "winner" and "loser" districts in the federal money redistribution game are clearly identifiable.

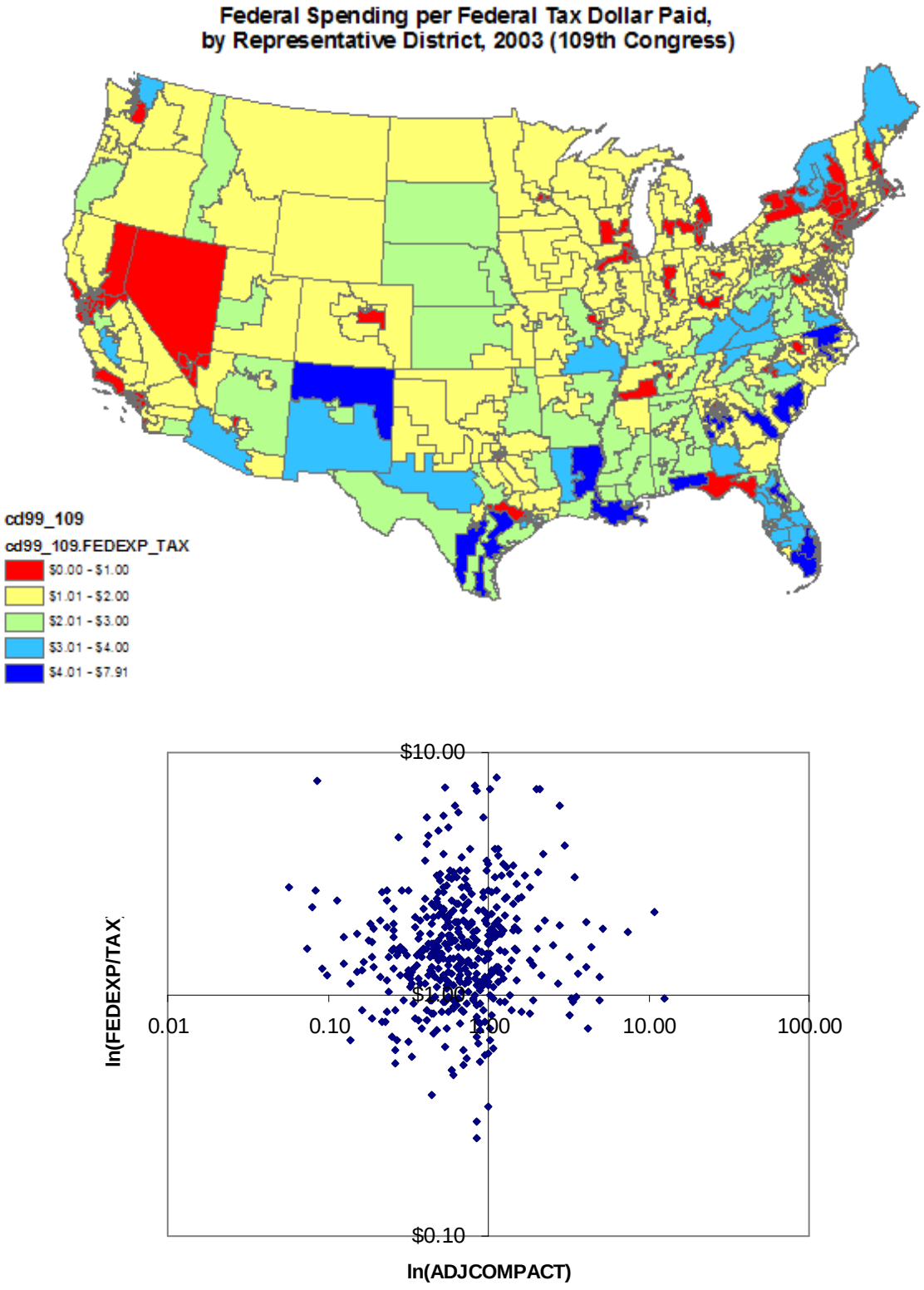
The final image below is a scatterplot of the logarithms of districts' compactness indices versus the logarithms of federal dollars received per dollar of federal taxes paid. As this scatterplot indicates, the data do not show any significant correlation between my informal gerrymandering index and the federal expenditure/tax ratios of Congressional districts. A trial regression of the expenditure/tax ratio against both district compactness and Representative seniority actually suggested that more *junior*

members of Congress from more *compact* districts may fare slightly better in delivering federal dollars to their home districts, but this model explained less than four percent of the total variation in federal appropriations.

These results are generally consistent with prior studies that show little or no relationship between legislative seniority, campaign fundraising, or victory margins in elections and federal appropriations. While gerrymandering may be decried as dirty politics, my analysis does not suggest that it reduces the effectiveness of US Representatives in capturing (or recapturing) federal dollars for their home districts. Indeed, given the complex political interdependencies between US Representatives and local and state-level officials, other members of their state's Congressional delegation from both parties, their various committee colleagues, and their caucuses, any individualistic modeling of the appropriations process may be naïve.

In a democracy, the voters get what they deserve. Legislators write their own rules, and incumbency gives them many advantages over prospective challengers. As political sport, redrawing district boundaries may distract a lot of politicians from more serious malfeasance.





Federal Dollars Received per Federal Tax Dollar Paid vs. Geometric Compactness Index of US Representative Districts, 109th Congress