Analysis of Proposed Illinois Congressional Districts
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The proposed 2021 congressional plan for Illinois was released on Friday, October 15, 2021 (available at https://ilhousedems.com/redistricting/). We used Quantum Geographic Information System (QGIS) software to establish which census blocks are assigned to which congressional districts. With these block assignments, we determined basic properties of the proposed plan, scoring it according to voting-based fairness metrics. To calculate values for these metrics, we disaggregate and average precinct-level voting data from the 2016, 2018, and 2020 elections for the President, the United States Senate, and the governor to the census block level.

Key Observations:

The proposed congressional districts have nearly equal populations, with an approximate difference of 463 people between the most populated and least populated districts. The maximum deviation from the ideal (average) district population is approximately 0.038%.

The proposed plan has five majority-minority districts, to satisfy the Voting Rights Act of 1965: three with Black/African American majorities or pluralities, one with a Latino/Hispanic majority, and one with a non-Hispanic white plurality. The specific composition of each majority-minority district is listed in the table below. The currently enacted congressional plan has four majority-minority districts (https://ballotpedia.org/Redistricting_in_Illinois).

| Majority-Minority District	Percent non-Hispanic white	Percent Black/African American	Percent Latino/Hispanic
1	34.50%	50.88%	12.67%
2	34.77%	49.16%	15.04%
4	29.59%	4.30%	68.71%
7	29.40%	42.66%	19.91%
8	49.79%	4.68%	28.07%

Many of the proposed districts have irregular shapes, such as districts 4, 13, and 15 (shown below). We measure the compactness of this plan as the sum of all district perimeters; a smaller sum indicates more compact districts, while a larger sum indicates more convoluted districts. The proposed plan has a compactness score of approximately 10,985 miles; for comparison a congressional plan for Illinois with very compact districts would have a score below 6,000 miles. Irregular district shapes do not automatically imply extreme partisan bias, but they do warrant further investigation into the partisan qualities of the proposed plan.

District 4   District 13   District 15
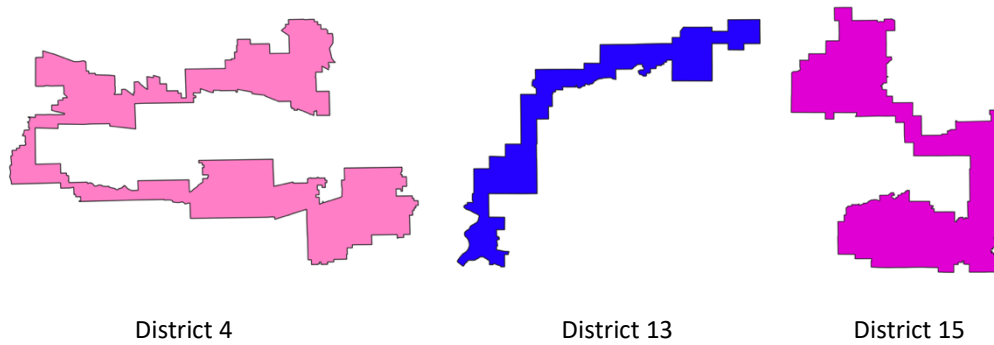
Partisan Bias:

Using the previously mentioned election data, Illinois is approximately 58.5% Democrat and 41.5% Republican. In a congressional district plan that follows traditional proportionality (i.e., a party wins seats at the same rate that it wins votes), one would expect Democrats and Republicans to win approximately 10 and 7 seats, respectively (out of 17). In a congressional plan that follows a "winner's bonus" version of proportionality (i.e., a party wins seats at twice the rate that it wins votes), one would expect Democrats and Republicans to win approximately 12 and 5 seats, respectively.

In the proposed congressional plan, Democrats and Republicans are expected to win 14 and 3 seats, respectively. From the expected vote-shares in each district (shown below), Republicans appear packed in three districts and cracked in four districts (the four districts that could be considered competitive all lean Democrat); hence, Republicans are expected to waste a significant portion of their votes by narrowly losing districts or winning them by large margins.
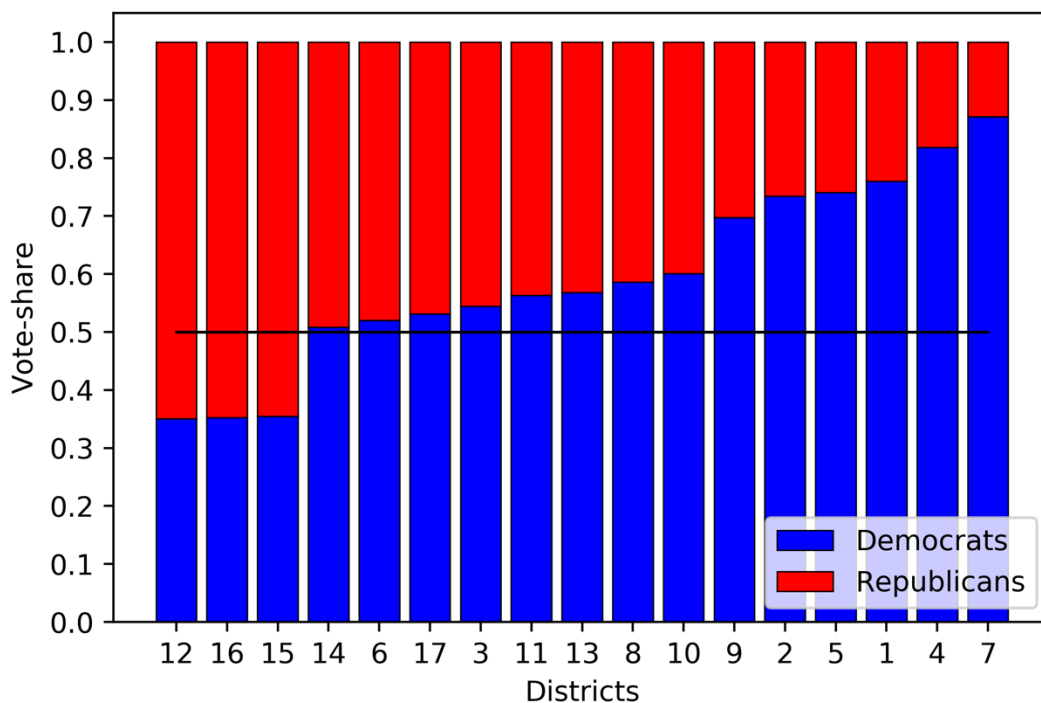
Fairness Metrics:

Efficiency Gap is a fairness metric that reports the difference in wasted votes between Democrats and Republicans as a percentage of the total votes cast. The Efficiency Gap for the proposed congressional plan is –13.81%, which confirms that Republicans waste a significantly larger portion of their votes than Democrats do.

The creators of the Efficiency Gap (Stephanopoulos & McGhee, 2015) suggest that a state legislative plan could be considered reasonable if its Efficiency Gap value is within $\pm 8\%$; a congressional plan could be considered reasonable if it has less than a two-seat deviation from "winner's bonus" proportionality. The proposed Illinois plan exceeds both recommended thresholds, which indicates a clear Democratic advantage.

Partisan Asymmetry is a fairness metric that compares how many seats Democrats and Republicans are expected to win if statewide voter preference shifts in favor of either party (Grofman,1983). The Partisan Asymmetry value is close to zero (e.g., below 0.01) when both parties win/lose seats symmetrically as voter preference shifts; the value is higher (e.g., above 0.07) when the distribution of district vote-shares is extremely skewed. The proposed Illinois plan has an average Partisan Asymmetry value of 0.047. Although the distribution of district vote-shares is slightly skewed from the three packed Republican districts, it is not extremely skewed. Therefore, Partisan Asymmetry does not show a clear advantage for either party as voter preference shifts.

Disclaimer: The commentary reported here is based on a non-partisan analysis of the proposed 2021 Illinois Congressional map available at the Illinois legislative redistricting website.

References

Grofman, B. (1983). Measures of Bias and Proportionality in Seats-Votes Relationships. *Political Methodology*, 9(3), 295-327.

Stephanopoulos, N. O. & McGhee, E. M. (2015). Partisan Gerrymandering and the Efficiency Gap. *University of Chicago Law Review*, 82(2), 831-900.