

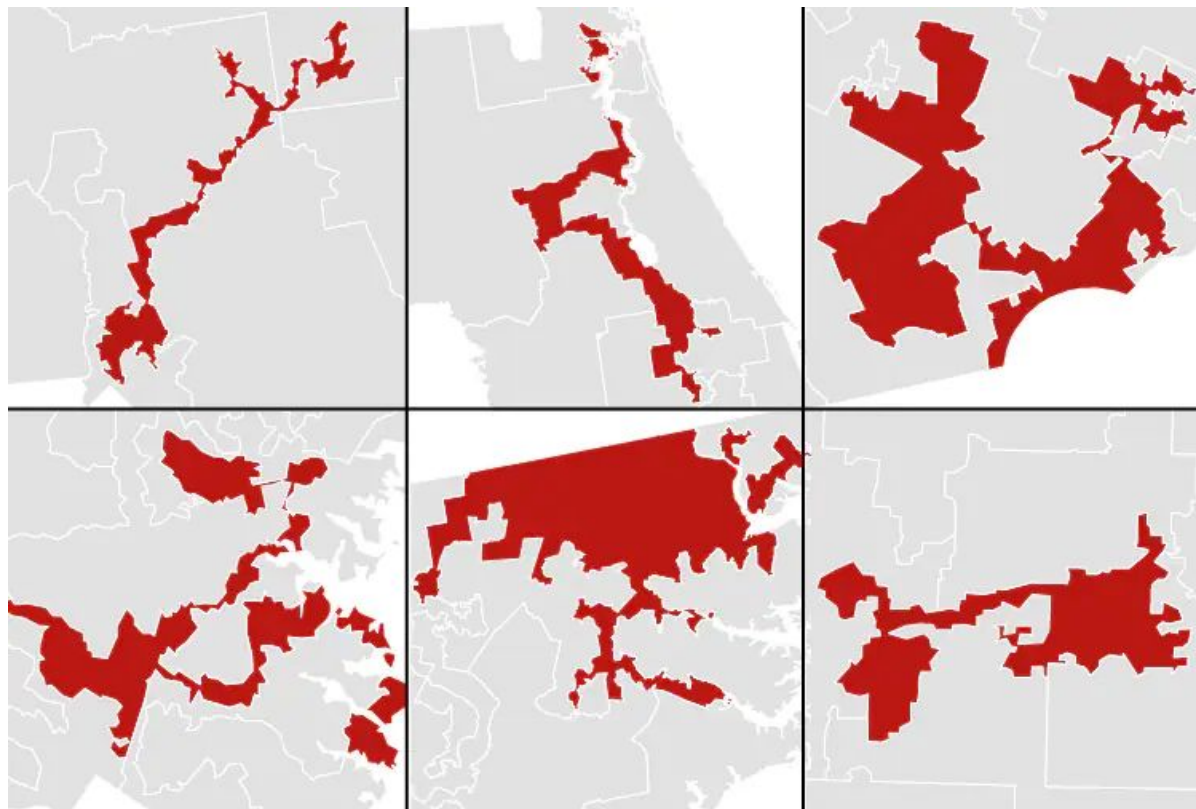
Compactness Effects on Partisan Outcomes in Redistricting

Broderik Craig, William Terry, Tyler Jarvis

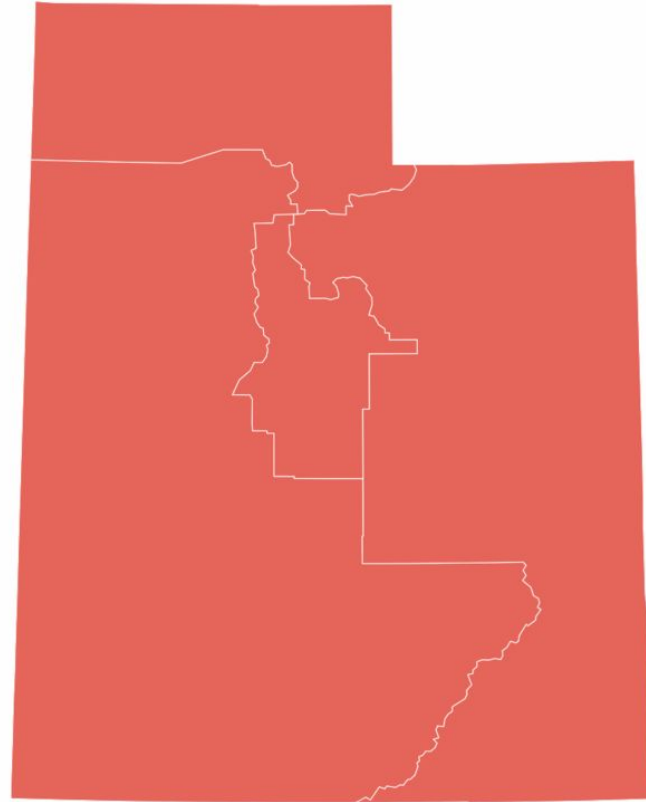
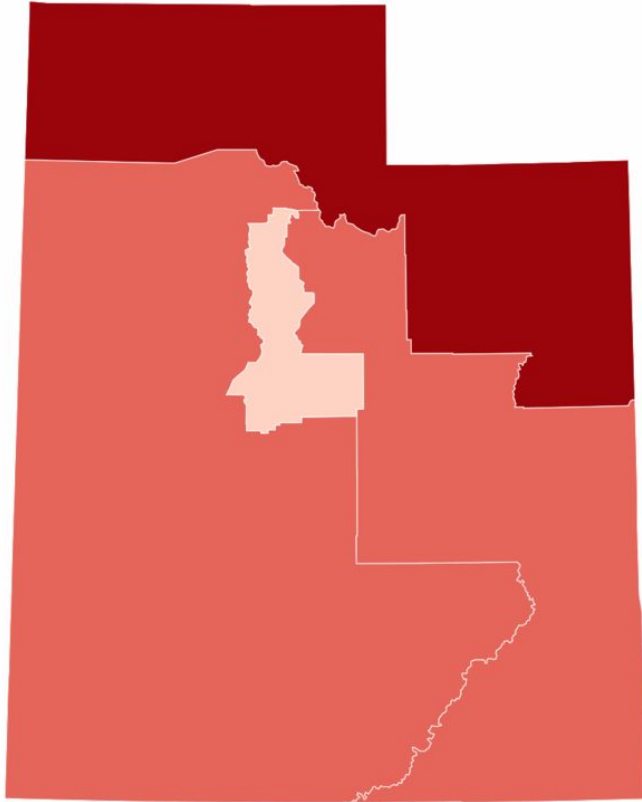
Gerrymander



Gerrymandered districts?

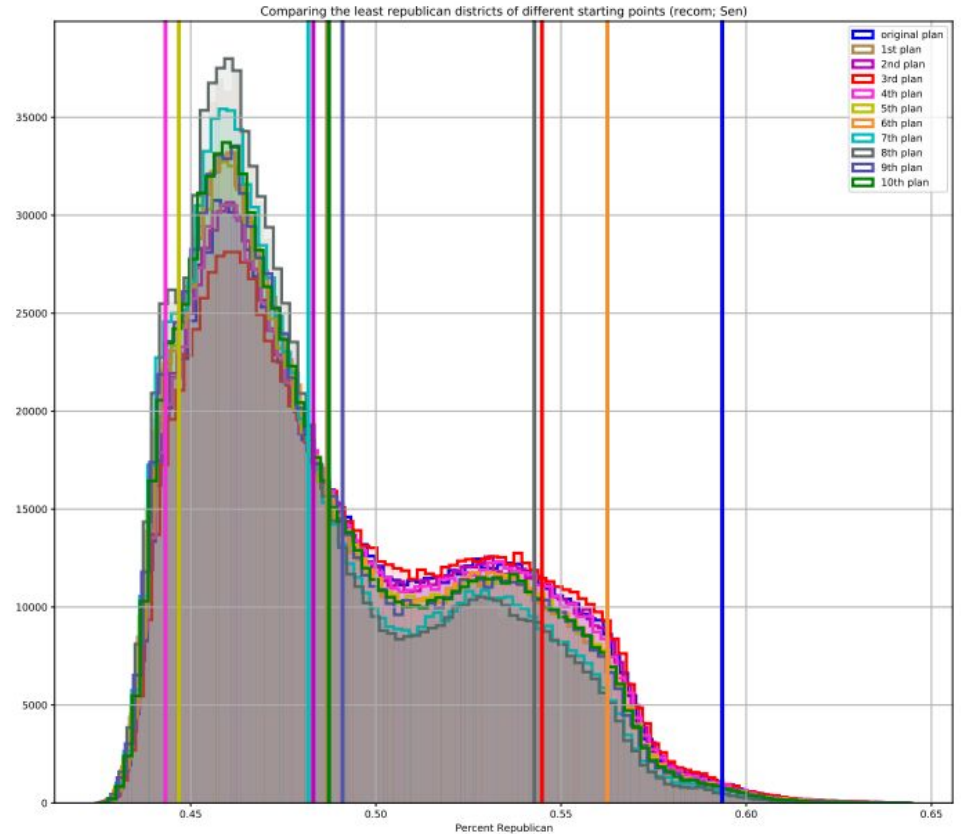


Does compact mean fair?



MGGG ReCom Metropolis-Hastings Algorithm

1. Start with a seed plan
2. Recombine two districts
3. Split the districts into two using minimum spanning trees
4. Accept or reject new plan with certain probability
5. Repeat steps 2-4



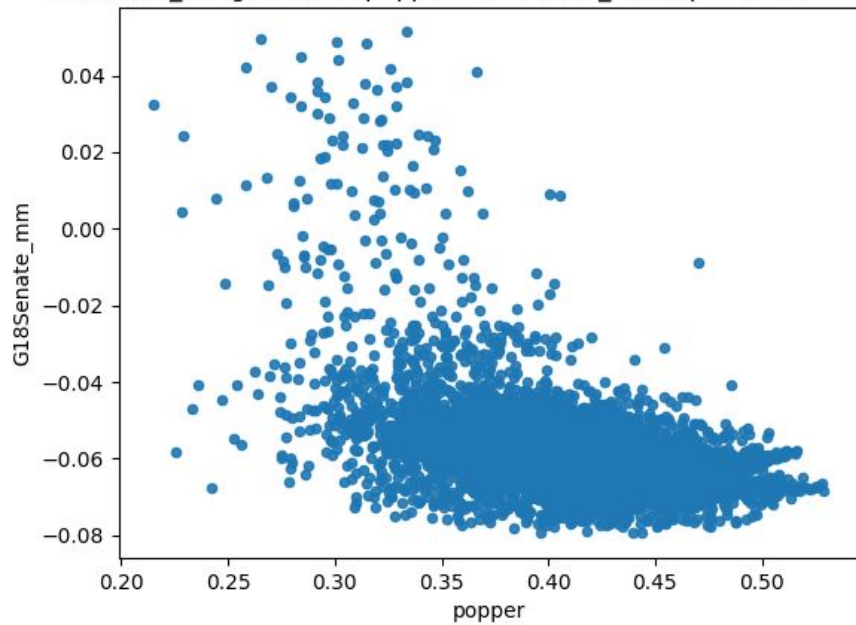
Compactness Metrics

- **Polsby-Popper and Schwartzberg**
 - $PP = 4\pi A/P^2$
 - $S = 1/\sqrt{PP}$
- **Reock**
 - Divide area of district by the area of the minimum bounding circle
- **Convex Hull**
 - Divide area of district by the area of its convex hull
- **Cut edges**
 - Number of edges “cut” to create the district
- **Border vs. Whole**
 - Density of border precincts against density of the district
- **K3**
 - Corresponds to how people perceive compactness

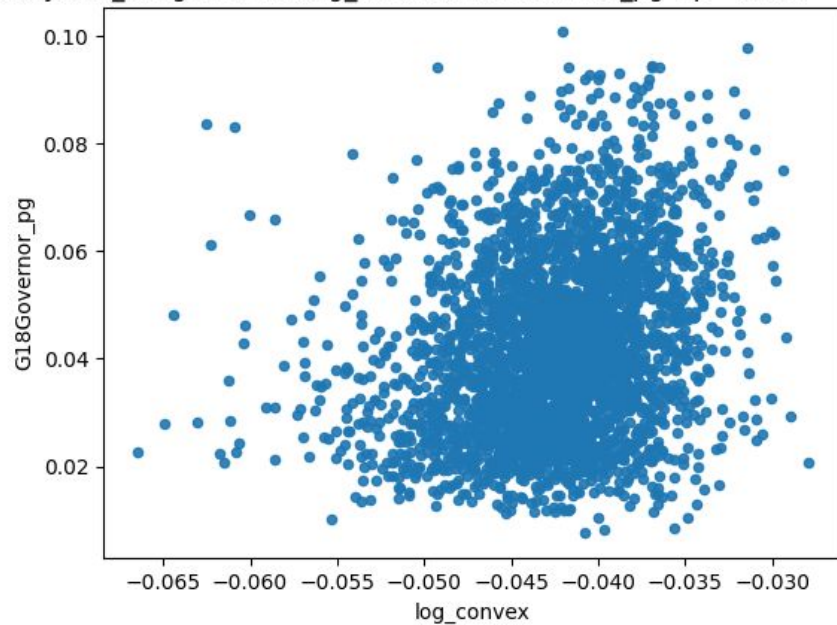
Partisan Fairness Metrics

- **Least Republican Vote Share (LRVS)**
 - The share of Republican voters in the least Republican district
- **Partisan Bias**
 - How many seats would a party win if it had 50% vote share
- **Partisan Gini**
 - TBD
- **Mean-Median**
 - Party's median vote share minus its mean vote share
- **Efficiency Gap**
 - Any vote more than 50% is “wasted”.
 - Take difference between two parties' wasted votes divided by total number of votes
- **Percentage of Seats vs Vote Share**
 - Difference between seat share and vote share
- **Competitive Seats**
 - Number of seats with party vote share between 44% and 56%

Nebraska_Congressional popper G18Senate_mm 1 $\rho = -0.48$ $r^2 = -90.3$

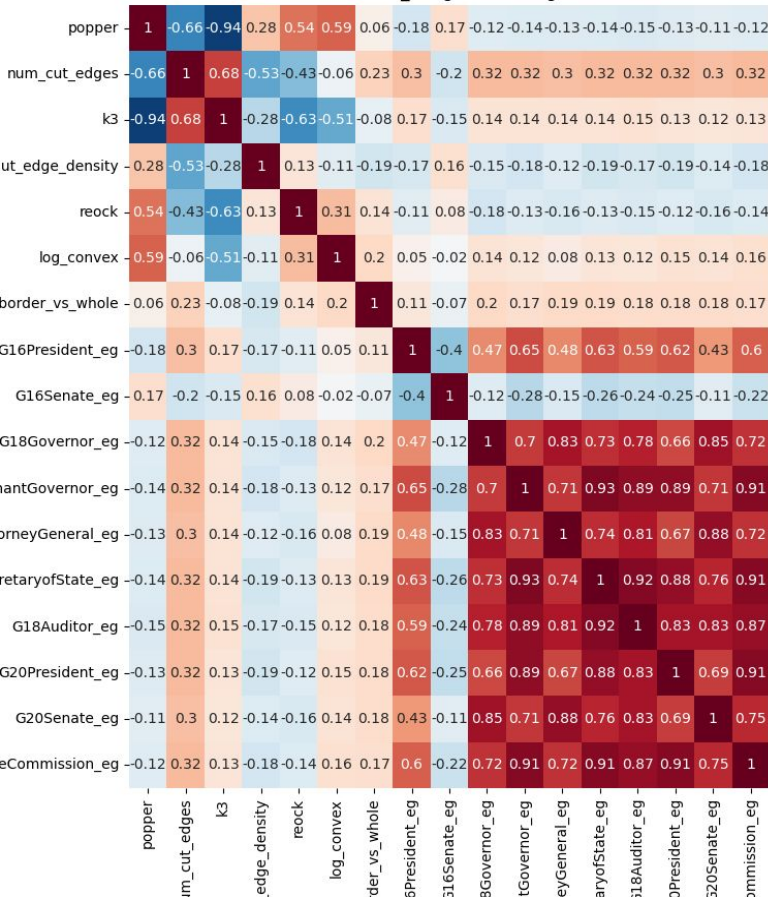


Maryland_Congressional log_convex G18Governor_pg 1 $\rho = 0.25$ $r^2 = -320.8$

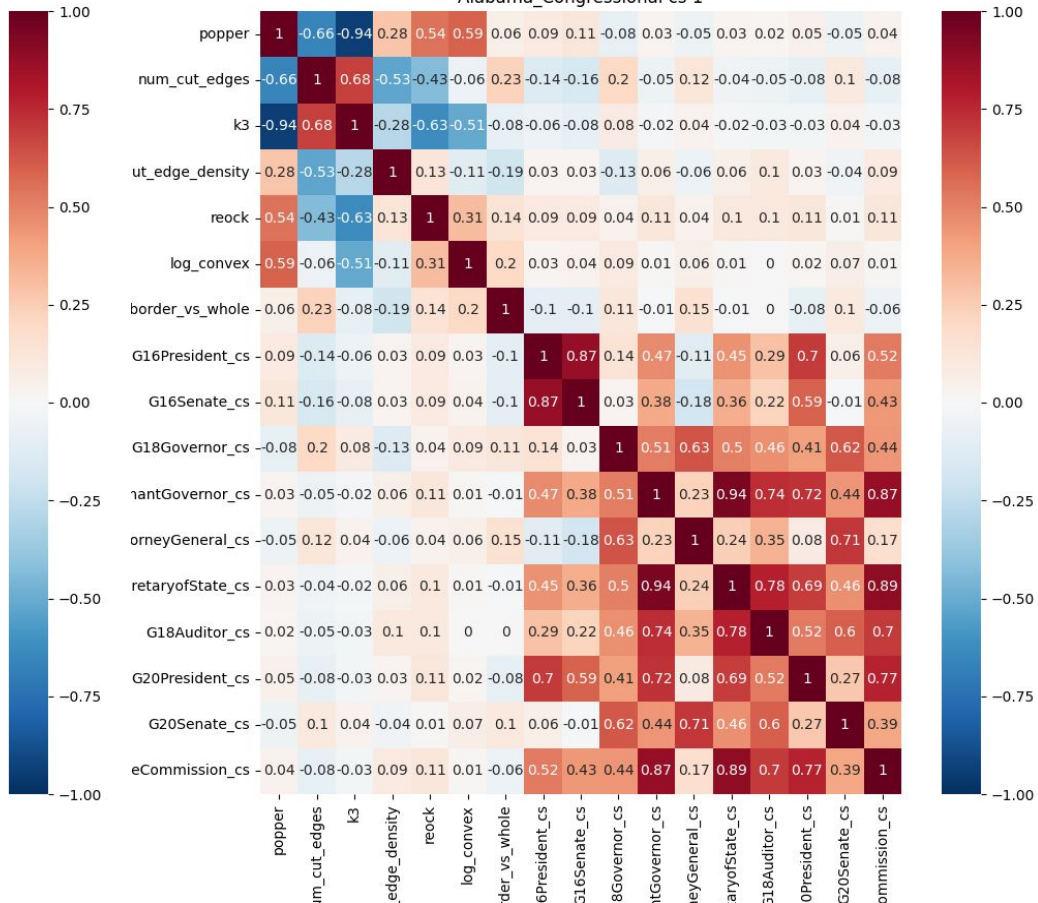


Results

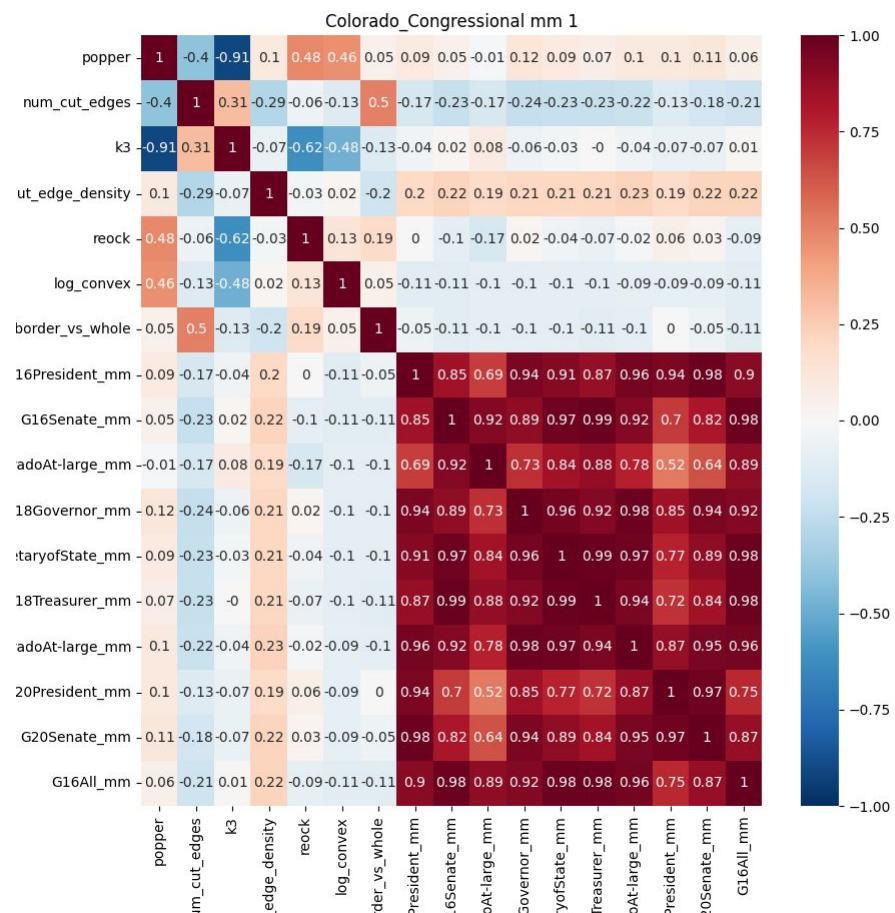
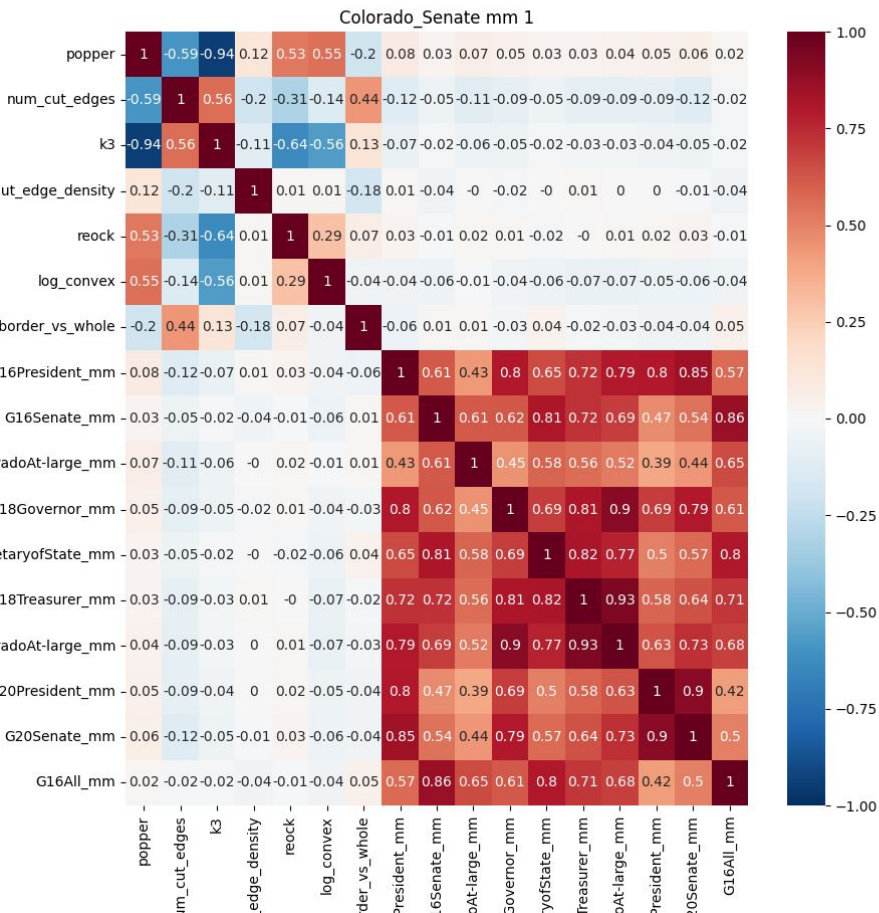
Alabama_Congressional eg 1



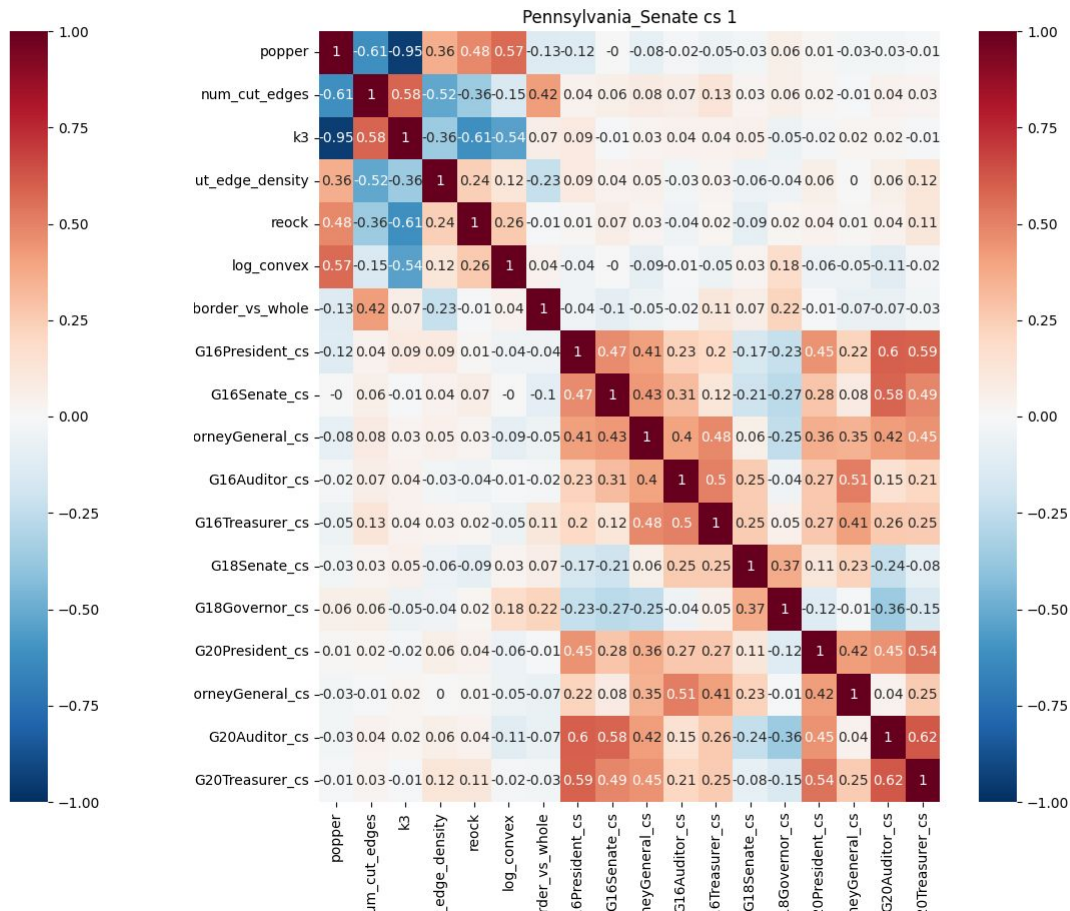
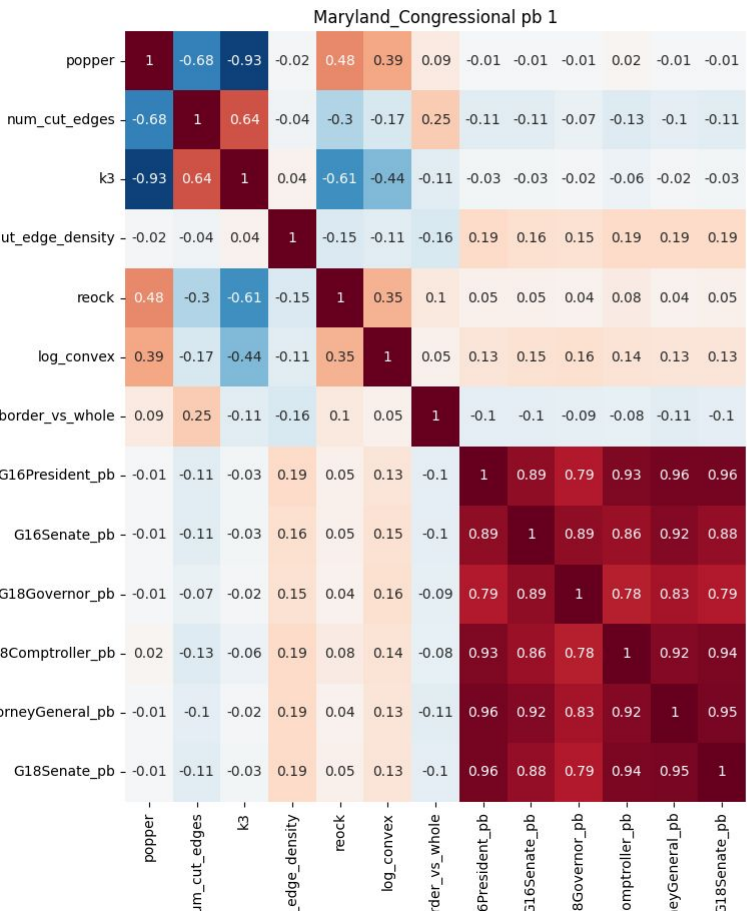
Alabama_Congressional cs 1



Results

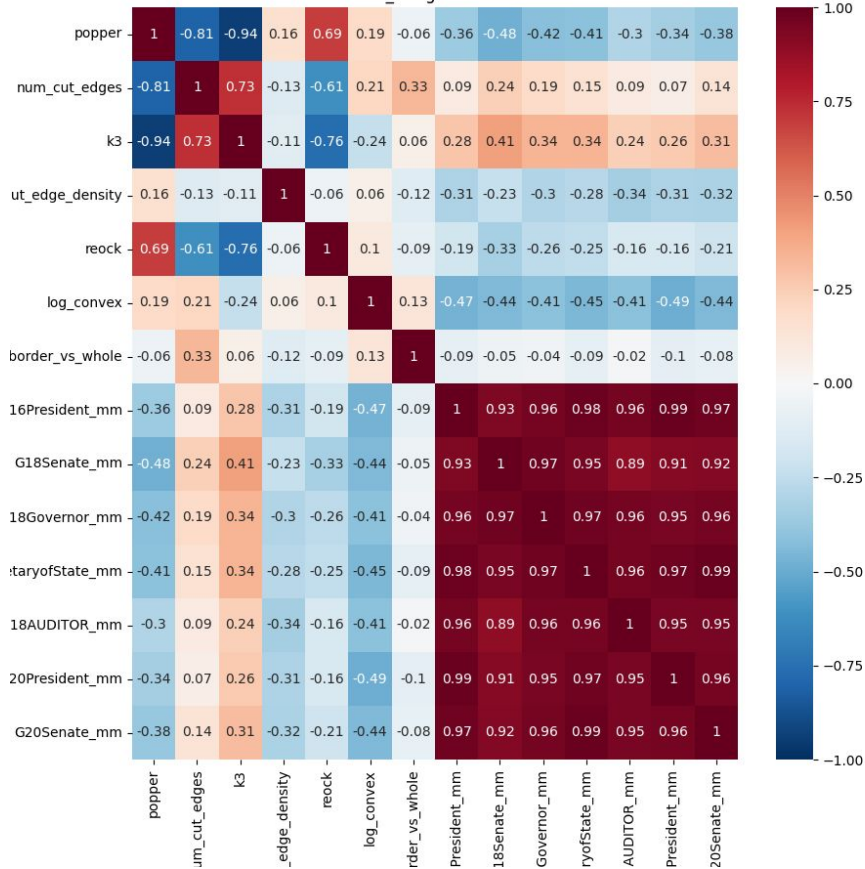


Results

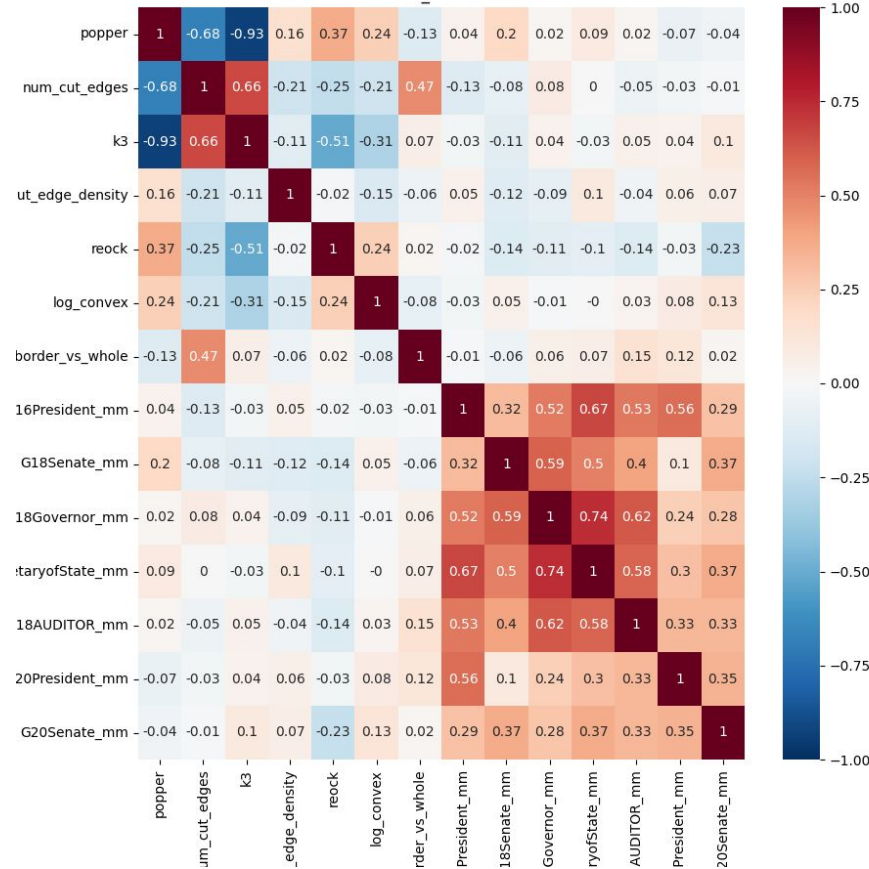


Results

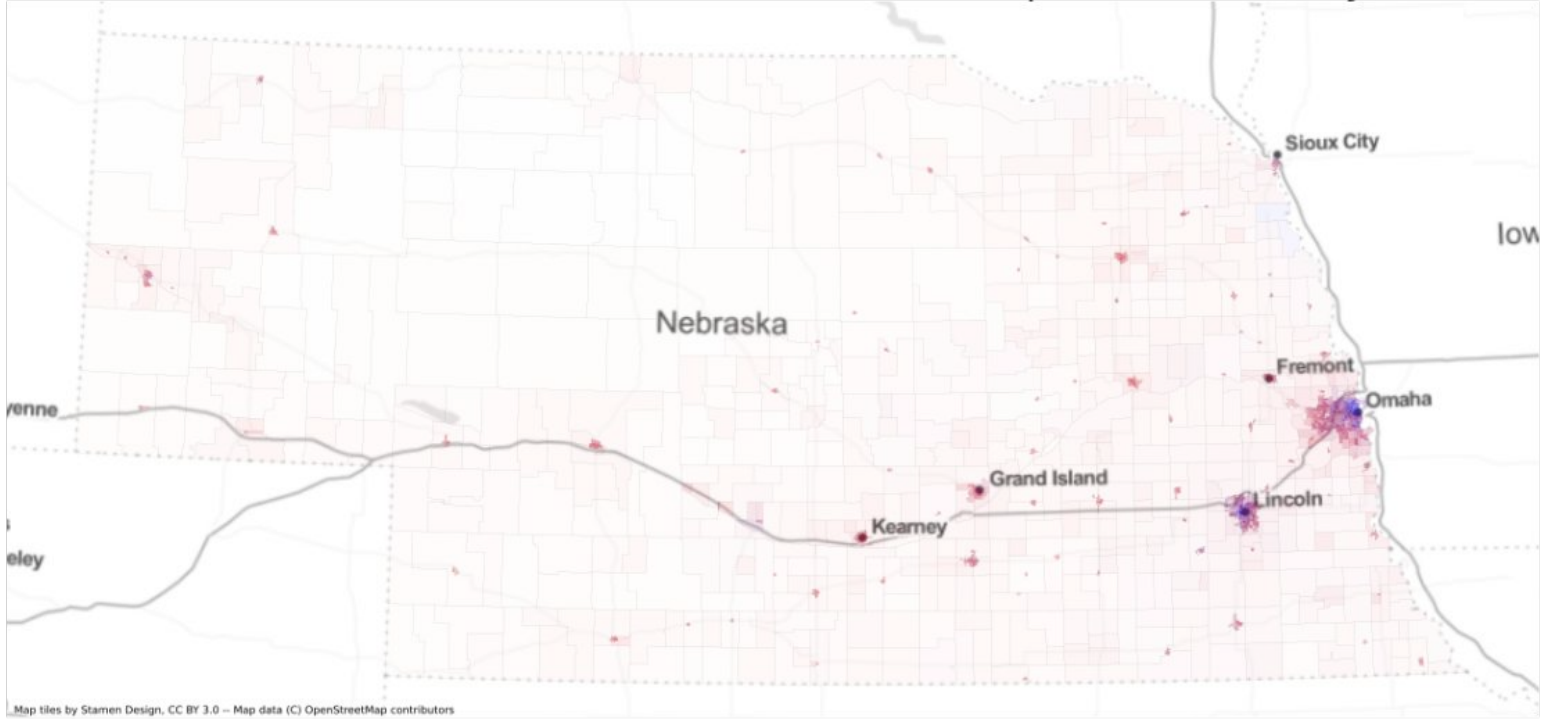
Nebraska_Congressional mm 1



Nebraska_Senate mm 1



Nebraska Vote Distribution Scaled for Population Density



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Why Compactness Still Matters

- Ease of travel
- Neighbors vote together
- Regional issues

