Economic Impacts of Gerrymandering

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Motivation / Introduction

What is the problem?

In the United States, legislative representation relies on the division of the population into voting districts. Through gerrymandering, districts can be drawn to give a political advantage to one group, thus unfairly determining the constituents for each representative. Legislative representation can become unequal and translate into public policy not reflective of the people's wishes. We seek to visualize and analyze the relationship between gerrymandering and poverty in congressional districts.

Why is it important?

Gerrymandering impacts fair representation in a democracy. Partisan gerrymandering has grown over the last few decades and enabled political parties to gain electoral advantages with wins in close races. Studying the relationship between gerrymandering and poverty clarifies how representation connects to societal issues.

Data Collection

Societal Data

Method of gathering: Collected via REST API of https://data.census.gov/ .

Characteristics: Data on race, income, poverty, and other variables comes from the American Community Survey (ACS). Used single year ACS dataset for each year from 2005 – 2019. Each single-year ACS data set has over 30,000 variables.

Geographic Data (Shapefile)

Method of gathering: Downloaded from http://cdmaps.polisci.ucla.edu/ (UCLA) and https://www.census.gov/geographies/mapping-files/time-series/geo/carto-boundary-file.html (Census.gov)

Characteristics: Each shapefile has 435 shapes, one for each congressional district. Shapefiles are 500 MB in size.

Voting Data

Method of gathering: Downloaded from MIT Election Data and Science Lab, https://dataverse.harvard.edu/dataverse/medsl_house

Characteristics: Results of all US House of Representatives elections by district from 1976-2018, including results for every candidate. For all years and elections, there are approximately 30,000 rows of data.

Approach and Methods

Approaches Used

Gerrymandering metrics: Polsby-Popper, Convex-Hull, Schwartzberg, Wasted Votes

Analysis Techniques: Linear Mixed Effect (LME) model

How they worked

Polsby-Popper, Convex Hull, Schwartzberg: Geometric metrics are calculated using shapefiles

Wasted Votes: Calculated from voting data

LME Model: Augments standard linear regression model by adding random effects that allows for longitudinal data, dependent observations, and nesting or grouping in the data.

Why they worked

Wasted Votes / Geometric measures: These are appropriate measures of gerrymandering in our study because they can be calculated for each district. Using both a geometric measure and a voting measure gives flexibility for our model experiments

LME Model: Our data observations (congressional districts) are not independent and instead represent multiple observations on similar units across time. There is correlation between districts in the same state due to similar voting laws and the redistricting process within each state. We used state as the random effect to account for the grouping in our data. LME random effects allow the model to add adjustments to the intercept and slope for each state.

Innovation / Novelty

We chose to study the proportion of people in poverty in relation to gerrymandering. Existing gerrymandering research focuses on partisan data and voting outcomes. Our approach is new in linking gerrymandering to a societal factor such as poverty. The LME model allows us to examine gerrymandering as a variable of interest in relation to poverty while accounting for the dependent nature of the observations and grouping states together.

Our visualization is novel in that it allows for exploration of various gerrymandering measures, instead of a single metric, across all districts in the US and includes information on redistricting process, race, poverty, and voting data.

Experiments and Results

Method of Evaluation

We used a significance threshold of 0.05 and used the lmerTest package in R for creating models and computing the inherently complicated p-values for LME. The MuMIn R package allowed us to evaluate models via a pseudo-R-squared for generalized mixed effects models and AIC value.

Results

Of the many models constructed and tested, two notable results were found.

Poverty ratio can be predicted by Wasted Votes ratio within each state. The positive coefficient for Wasted Votes ratio was significant and accounts for about 3% of the variation in poverty ratio.

Poverty ratio can be predicted by Wasted Votes ratio and the winning party within each state. Both coefficients were significant and together accounted for about 10% of the variation in poverty ratio.

Comparison

Our methods and results are similar to research by Akey, which determined an increase in irregular political boundaries leads to a decrease in consumer credit. Akey had R-squared values between 0.087 and 0.095, so our peak R-squared of 0.104 is comparable.

Visualization

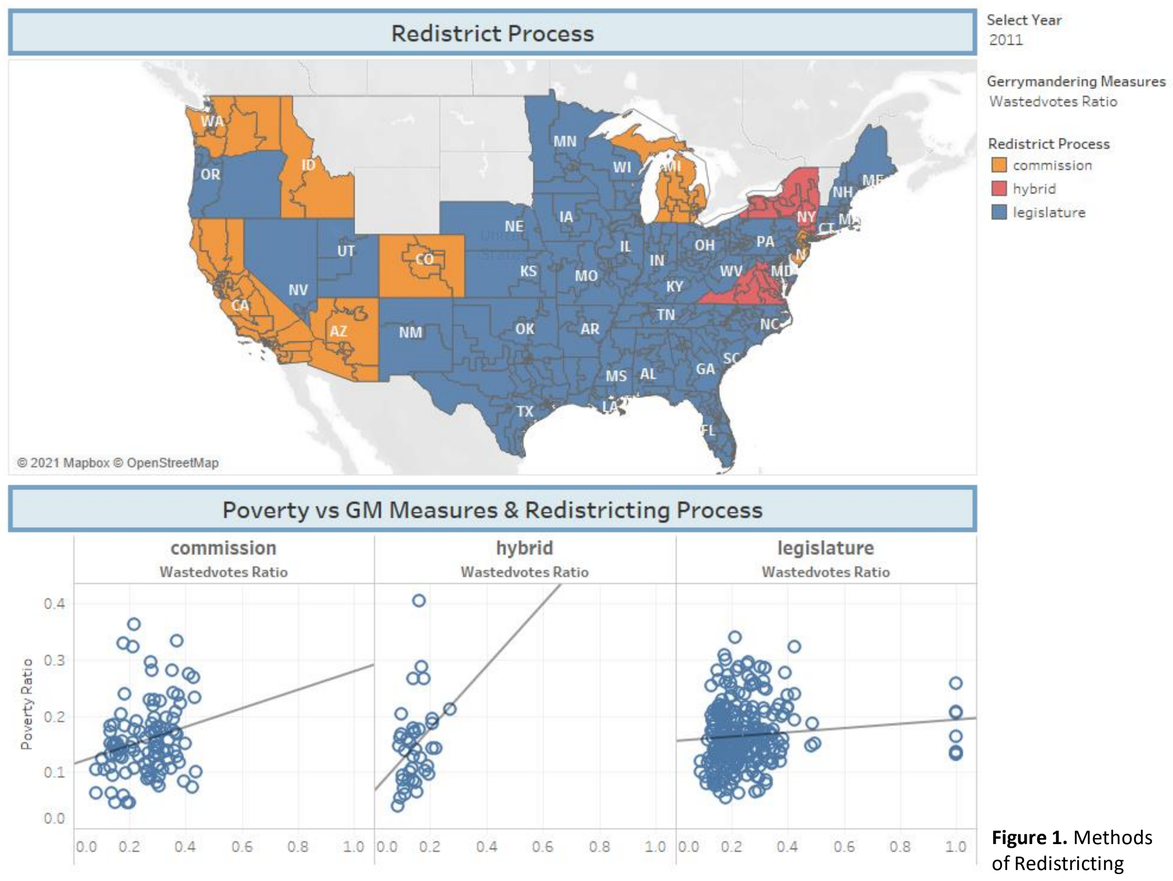

Figure 1. Methods of Redistricting

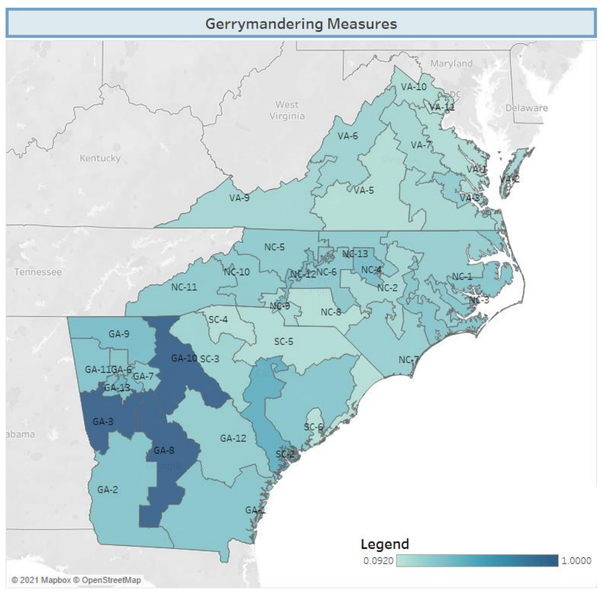

Figure 2. Gerrymandering Measures

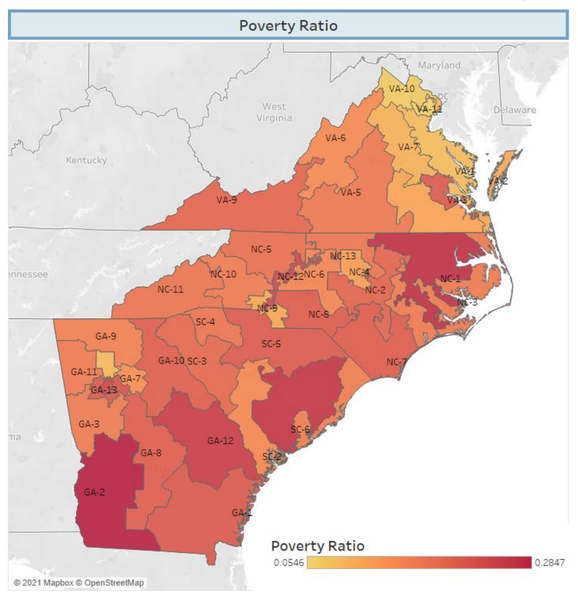

Figure 3. Poverty Ratio

Conclusion

Our findings indicate a relationship between increased gerrymandering in a congressional district and an increased proportion of people in poverty in that same district.

Gerrymandering and poverty are inherently complex topics. We believe our linear mixed effects model has determined a statistical relationship between gerrymandering, specifically wasted votes, and the proportion of citizens in a congressional district living in poverty. As the ratio of wasted votes increases in a congressional district, the poverty ratio tends to increase.