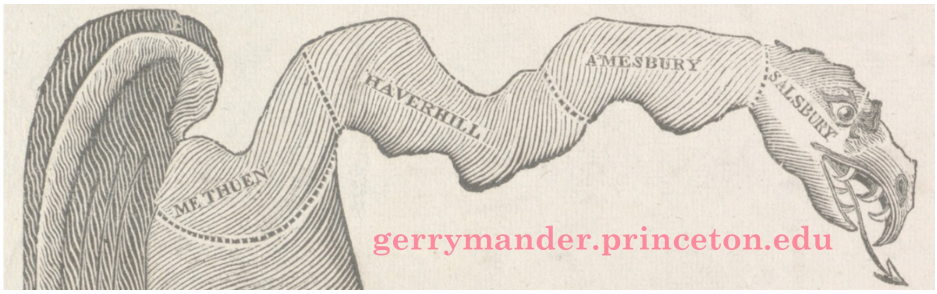


Gerrymandering analyzer from Prof. Sam Wang, Princeton University

Election to be analyzed: U.S. House election of 2014 in CA
Districts to be sampled for fantasy delegations: Random, partisan-symmetric districts.

The CA delegation has 53 seats, 39 Democratic/other and 14 Republican.
Uncontested races are assumed to have been won with 75% of the vote.
The average Democratic share of the two-party total vote was 60.7% (raw), 57.4% with imputation of uncontested races.

Analysis of Intents

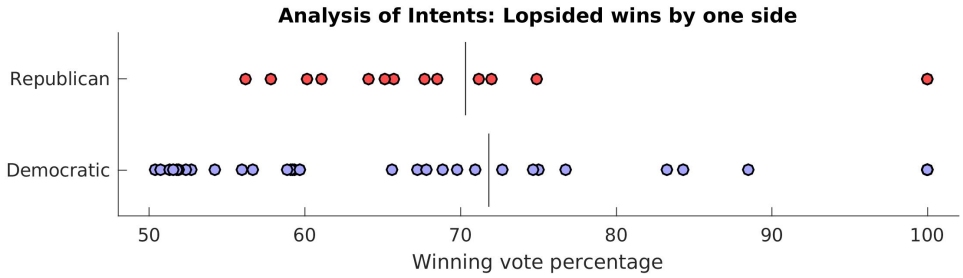
If a political party wishes to create for itself an advantage, it will pack its opponents to win overwhelmingly in a small number of districts, while distributing its own votes more thinly, but still to produce reliable wins.

Partisan gerrymandering arises not from single districts, but from patterns of outcomes. Thus a single lopsided district may not be an offense - indeed, single-district gerrymandering is permitted by Supreme Court precedent, and may be required for the construction of individual districts that comply with the Voting Rights Act. Rather, it is combinations of outcomes that confer undue advantage to one party or the other.

The following two tests provide a way of quantifying any such advantage in a set of election results.

First Test of Intents: Probing for lopsided win margins (the two-sample t-test): To test for a lopsided advantage, one can compare each party's winning margins and see if they are systematically different. This is done using the two-sample t-test. In this test, the party with the *smaller* set of winning margins has the advantage.

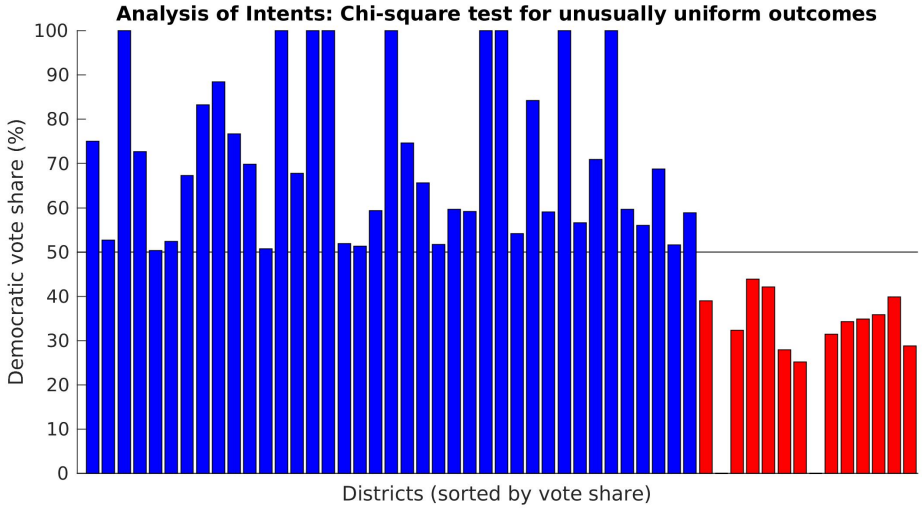
The difference between the two parties' win margins does not meet established standards for statistical significance. The probability that this difference or larger could have arisen by partisan-unbiased mechanisms is 0.78.



Second Test of Intents: Probing for asymmetric advantage for one party (mean-median difference and/or chi-square test): The choice of test depends on whether the parties are closely matched (mean-median difference) or one party is dominant (chi-square test of variance).

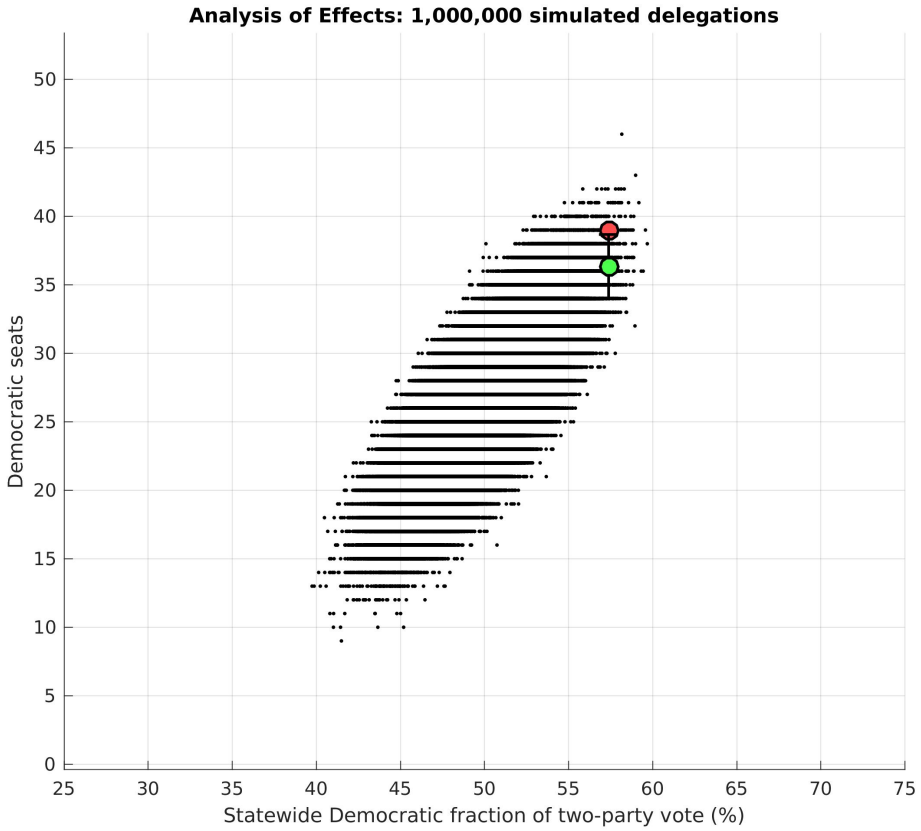
When one party is dominant statewide, it gains an overall advantage by spreading its strength as uniformly as possible across districts. The statistical test to detect an abnormally uniform pattern is the chi-square test, in which the vote share of the majority party-controlled seats are compared with nationwide patterns.

The standard deviation of the Democratic majority's winning vote share is 10.9%. At a national level, the standard deviation is 17.6%. This difference is statistically significant ($p<0.01$), and in a case of suspected gerrymandering is extremely unlikely to have arisen by chance.



Test of Effects: How many extra seats did either party gain relative to party-neutral sampling? (fantasy delegations): It is possible to estimate how the state's delegation would be composed if votes were distributed according to natural variations in districting. This is done by drawing districts at random from a large national sample, and then examining combinations whose vote totals are similar to the actual outcome.

In the following simulations, individual districts used to build "fantasy delegations" were flipped at random, thus generating a partisan-symmetric distribution. Consequently, these simulations ignore population clustering and show what would occur in a fully partisan-symmetric situation.



In this election, the average Democratic vote share across all districts was 57.4%, and Democrats won 39 seats. 76 fantasy delegations with the same vote share had an average of 36.4 Democratic seats (green symbol), with a standard deviation of 2.3 seats (see error bar). The actual outcome (red symbol) was therefore advantageous to Democrats. However, this advantage was not statistically significant.

The above calculations are based on Samuel S.-H. Wang, "Three Tests for Practical Evaluation of Partisan Gerrymandering," 68 Stan. L. Rev. XX (2016). For further information, contact sswang@princeton.edu.