

Evaluating Gerrymandering Metrics in Utah

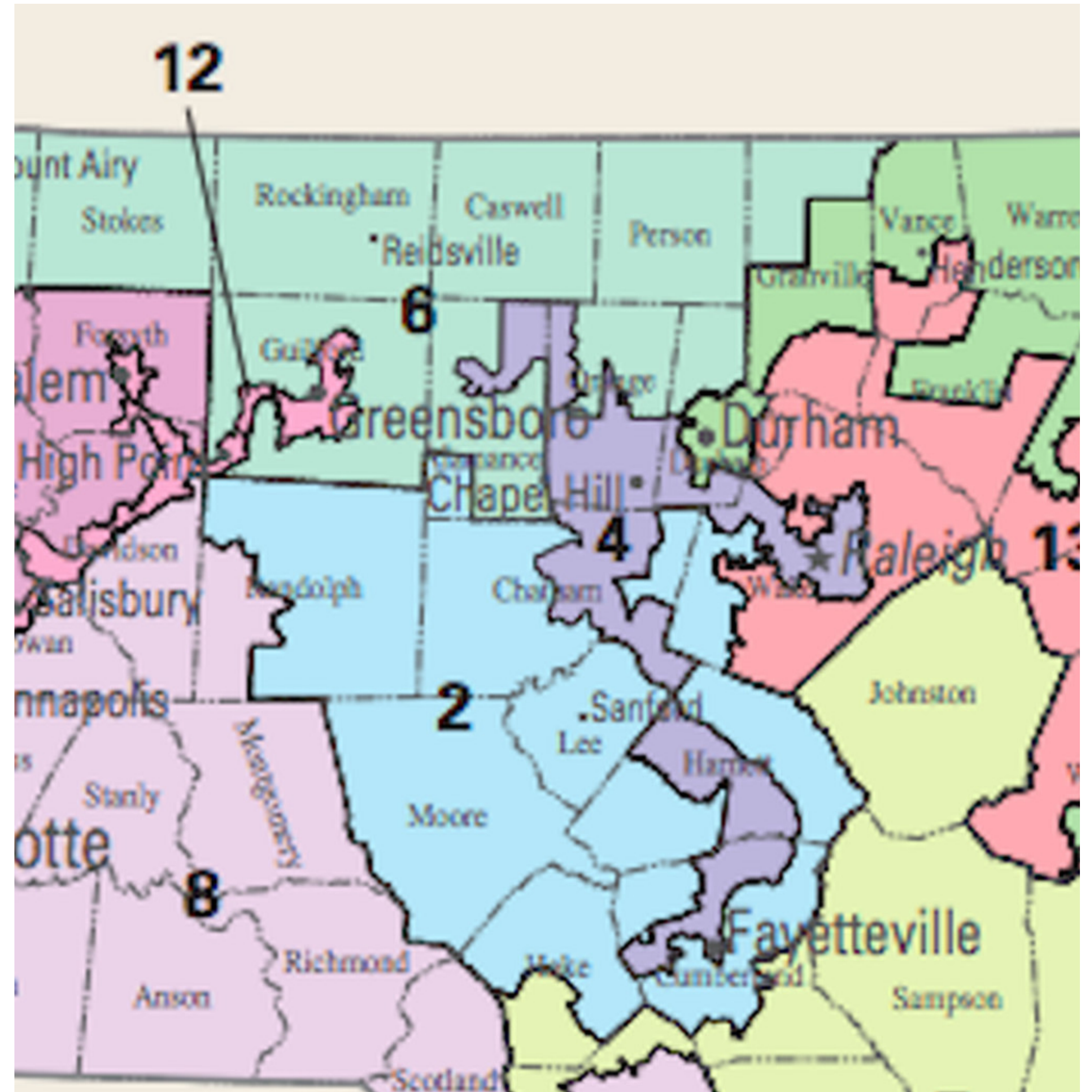
Brigham Young University Mathematics

Jacob Murri, Annika King, Jake Callahan, and Tyler Jarvis

Outlining the Problem

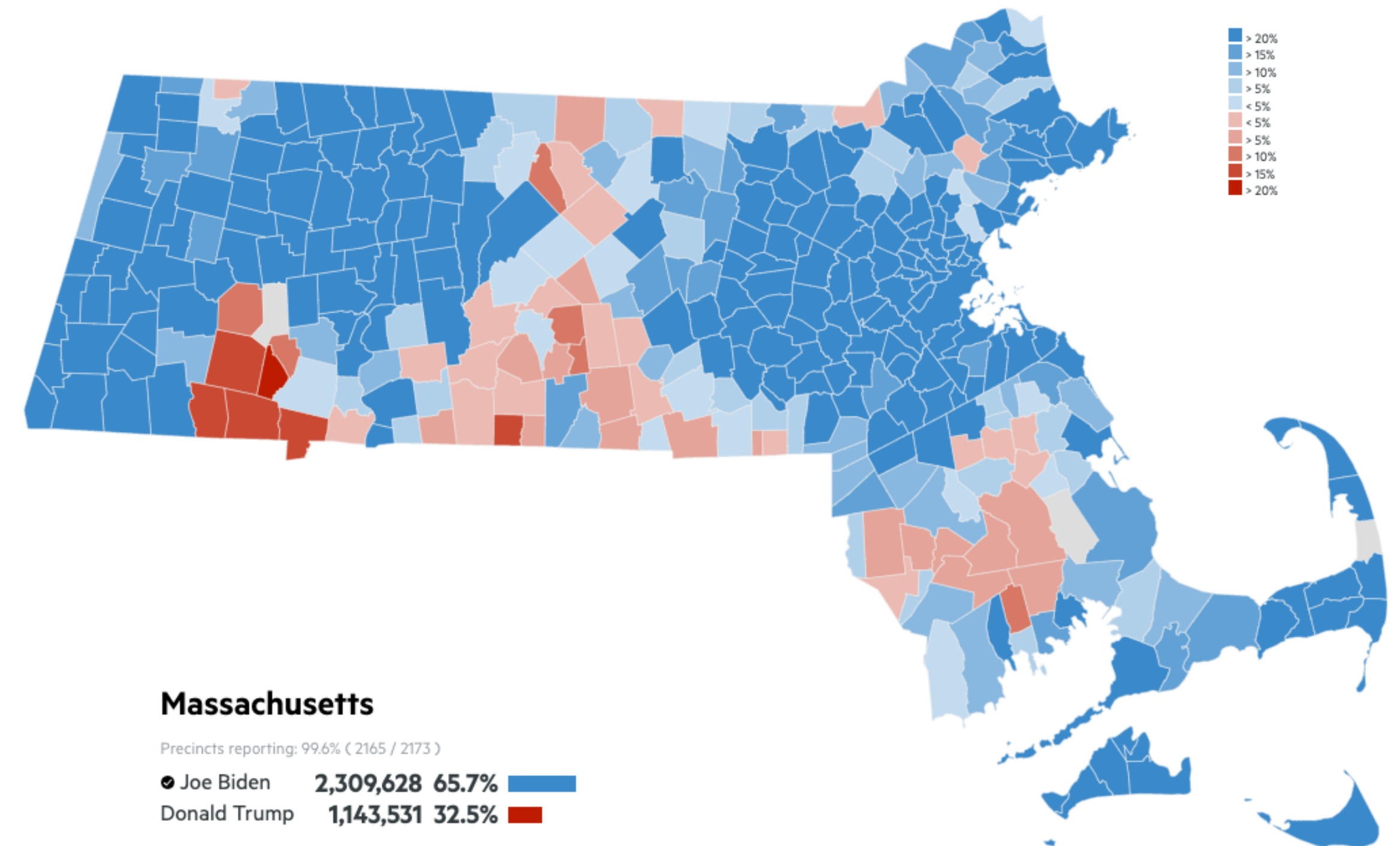
What is Gerrymandering?

- Manipulating the boundaries of an electoral constituency to influence the outcome
- Named for districts that look squiggly

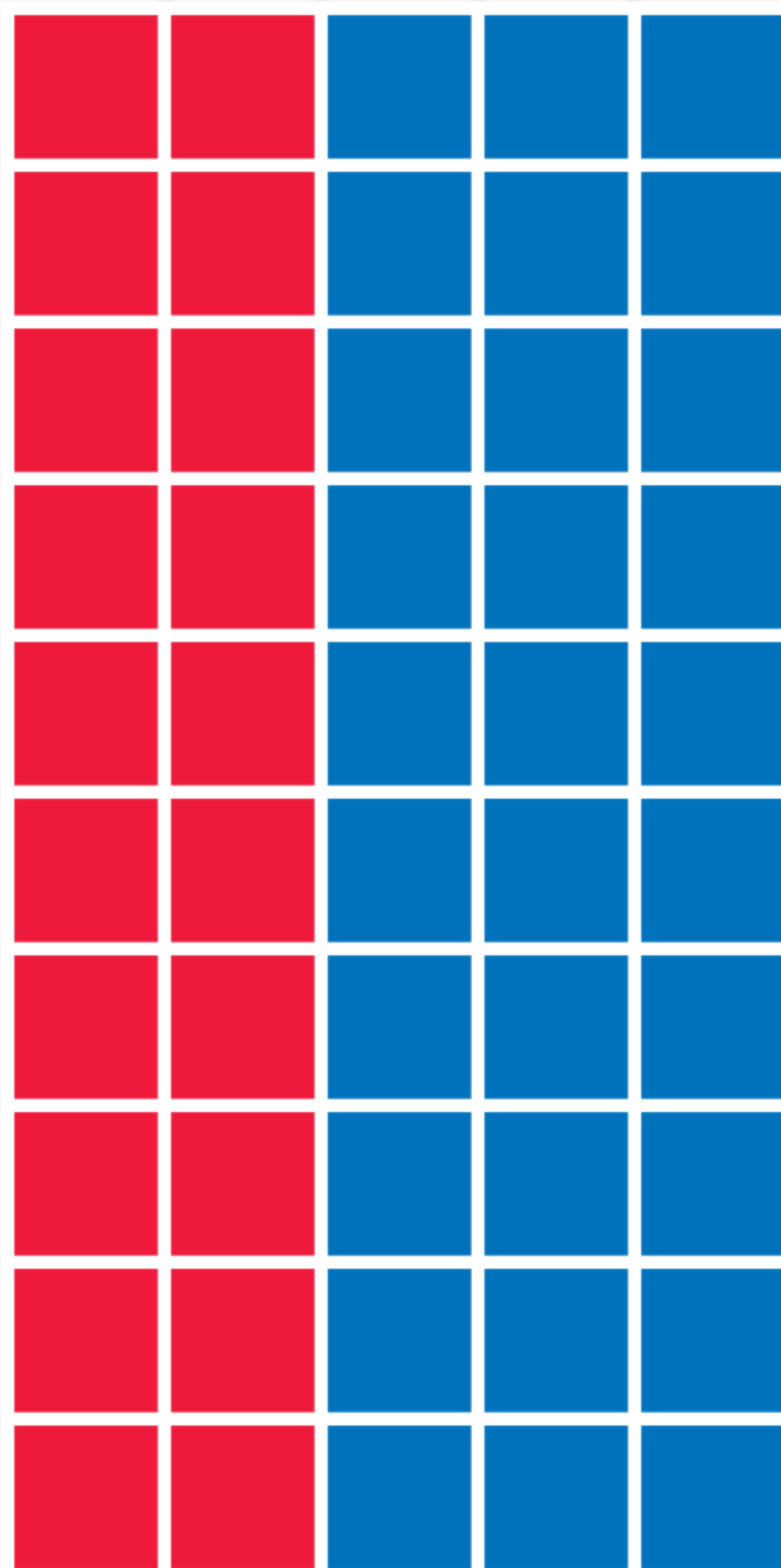


How do you measure gerrymandering?

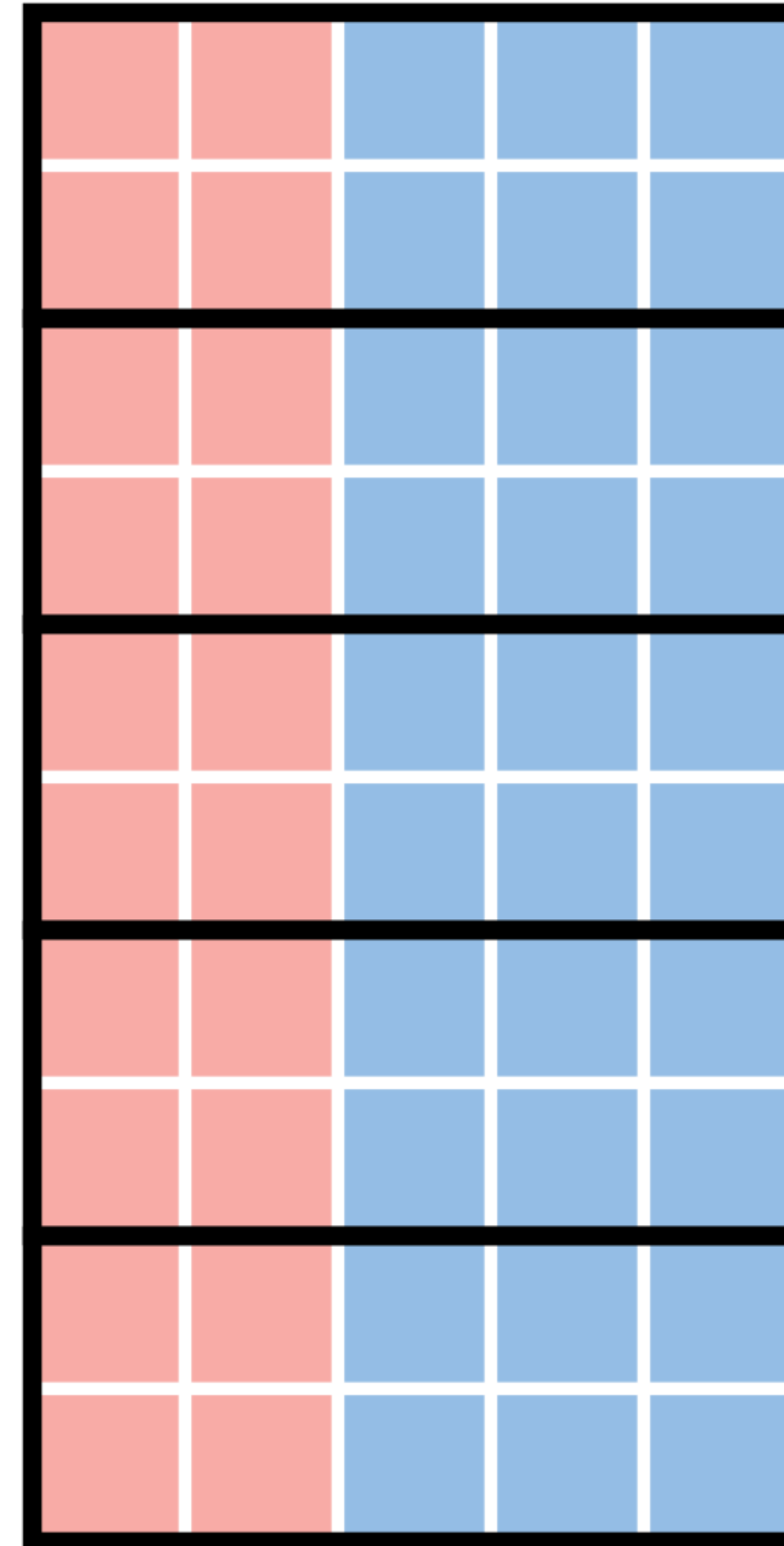
- Seems like it should be easy: discrepancy between vote share and seats won
- But: example of Massachusetts



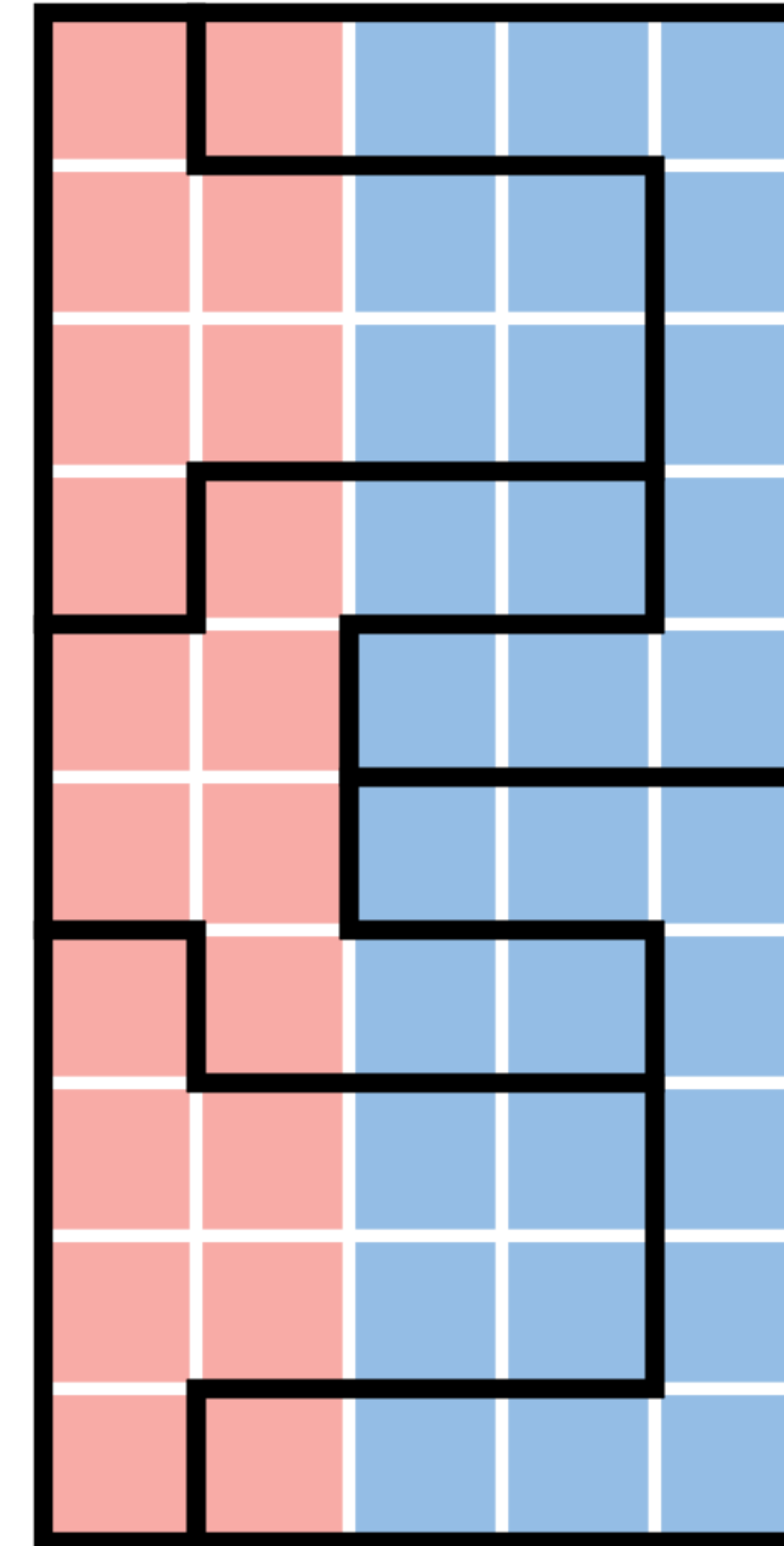
HOW TO STEAL AN ELECTION



50 PRECINCTS
60% BLUE
40% RED



5 DISTRICTS
5 BLUE
0 RED
BLUE WINS



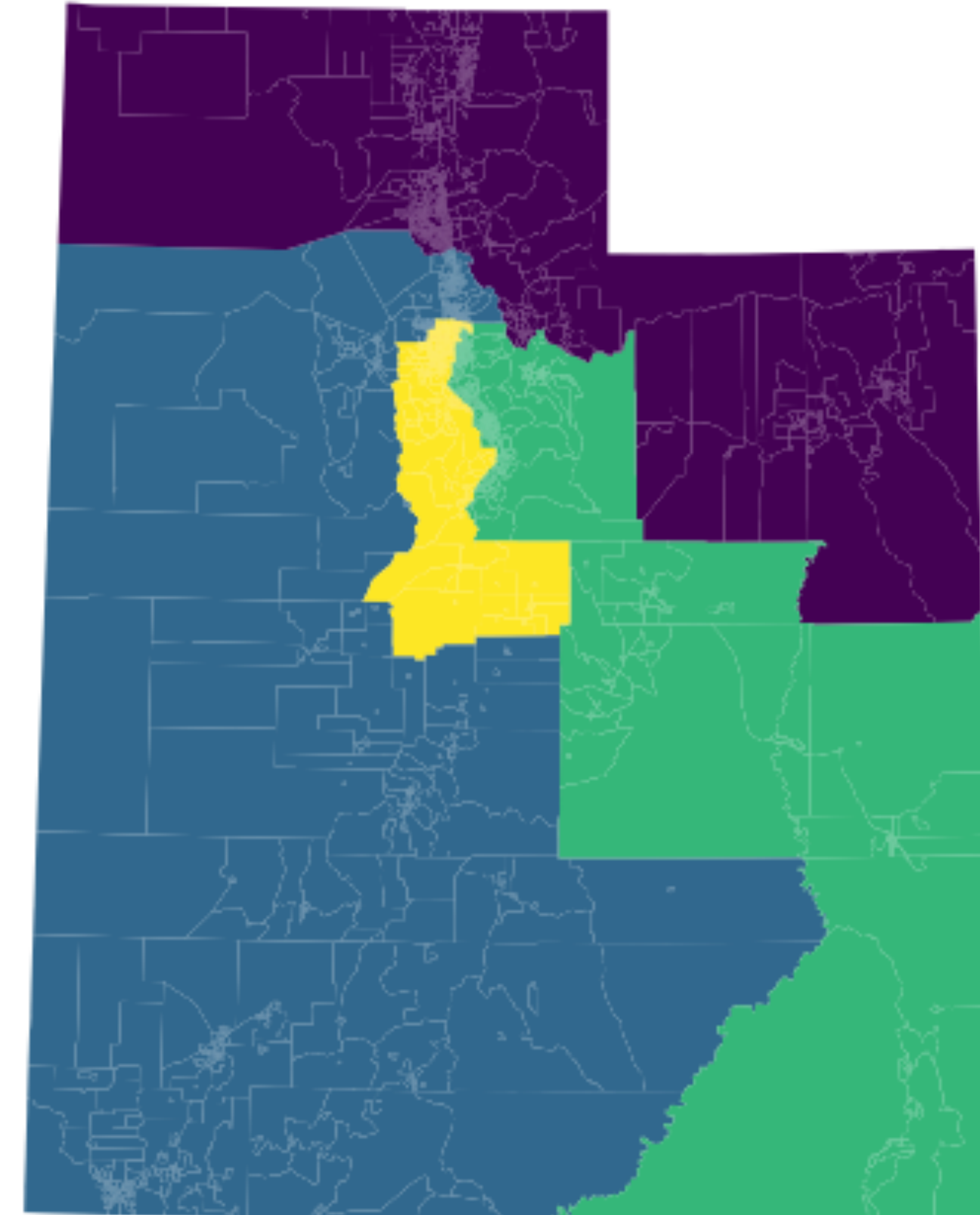
5 DISTRICTS
3 RED
2 BLUE
RED WINS

Metrics for Gerrymandering

- Partisan Bias
- Mean-Median
- Partisan Gini
 - Assumption: Uniform Partisan Swing
- Efficiency Gap
- Partisan Dislocation

Features of Utah

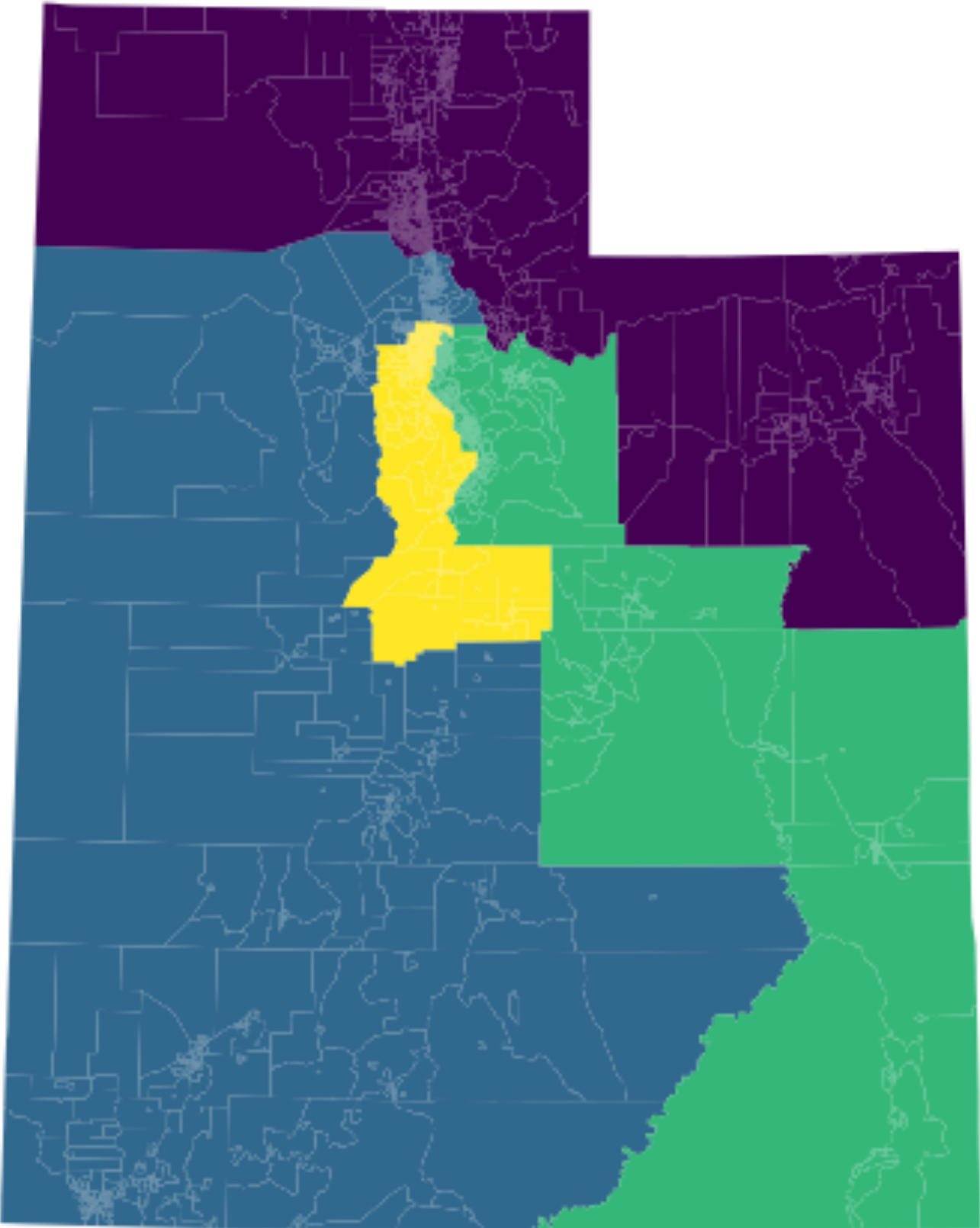
- Small state (only four districts)
- Most of the population is Republican
- Democrats can only win one district
- LRVS score



LRVS Score

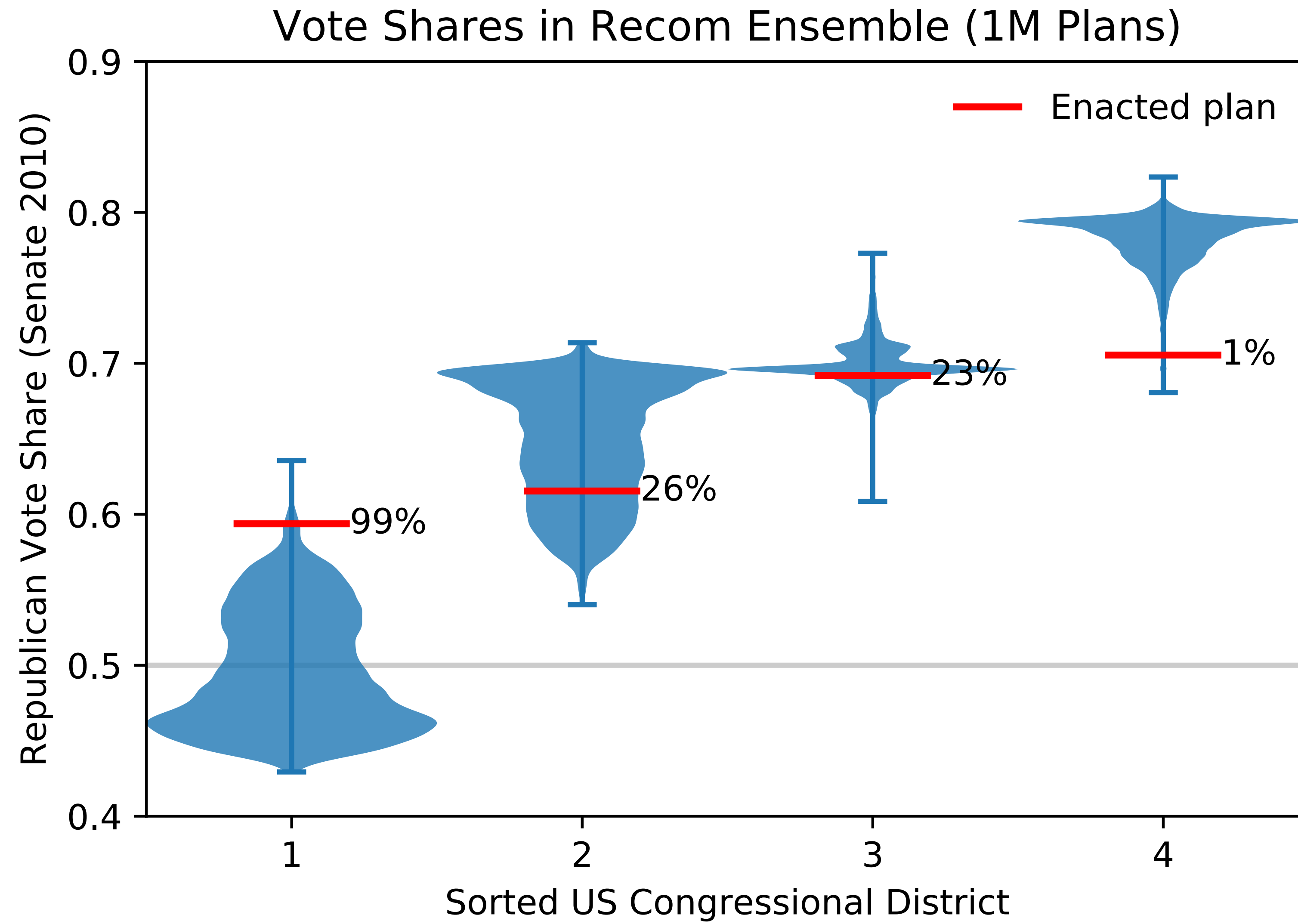
Example: Table of R Vote Shares

District 1	District 2	District 3	District 4	LRVS
80%	45%	60%	65%	45%
50%	60%	60%	80%	50%
70%	50%	65%	65%	50%



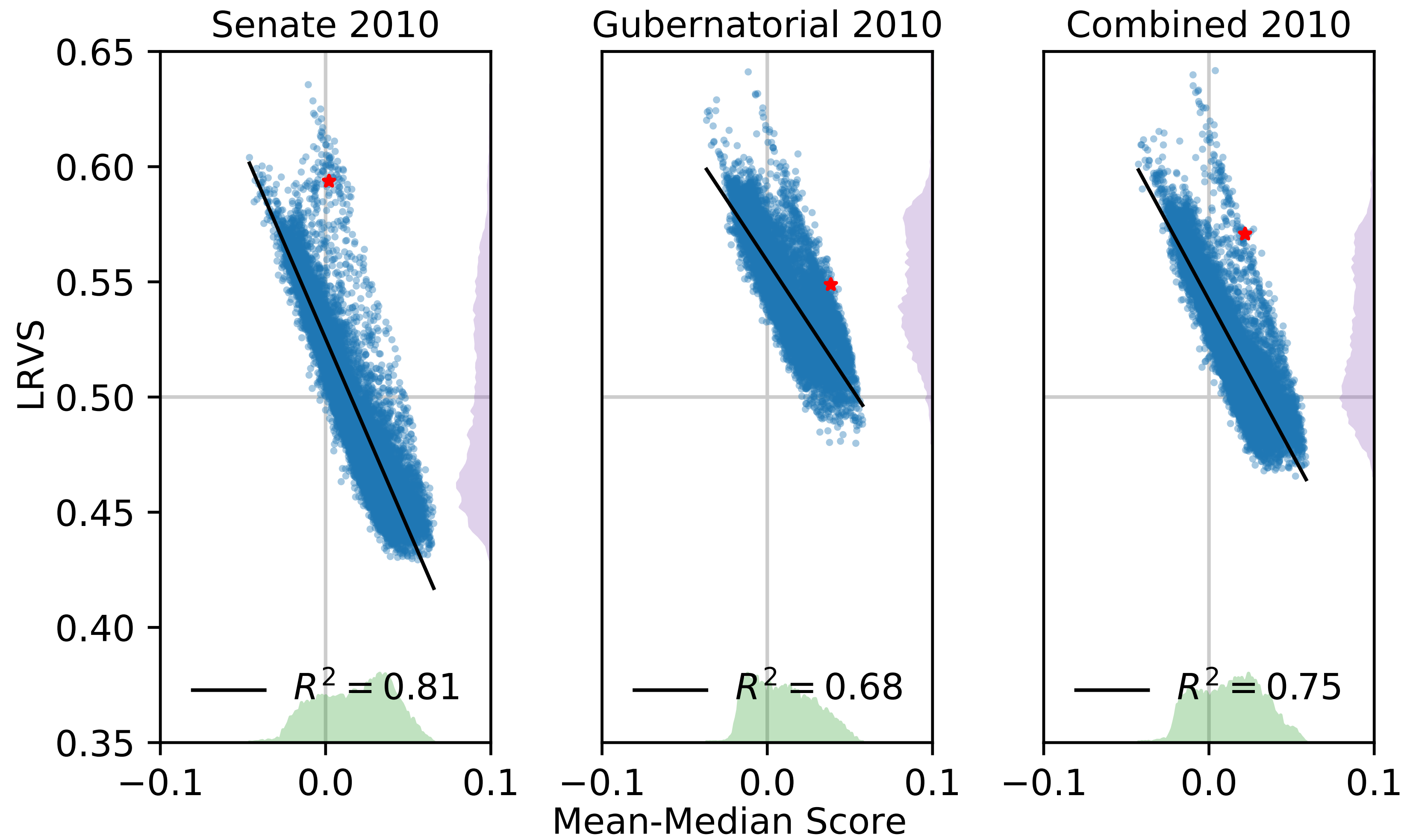
Ensemble Methods

- We need to understand the distribution of possible plans
- Use MCMC to sample from this distribution
- Allows use to use LRVS in Utah

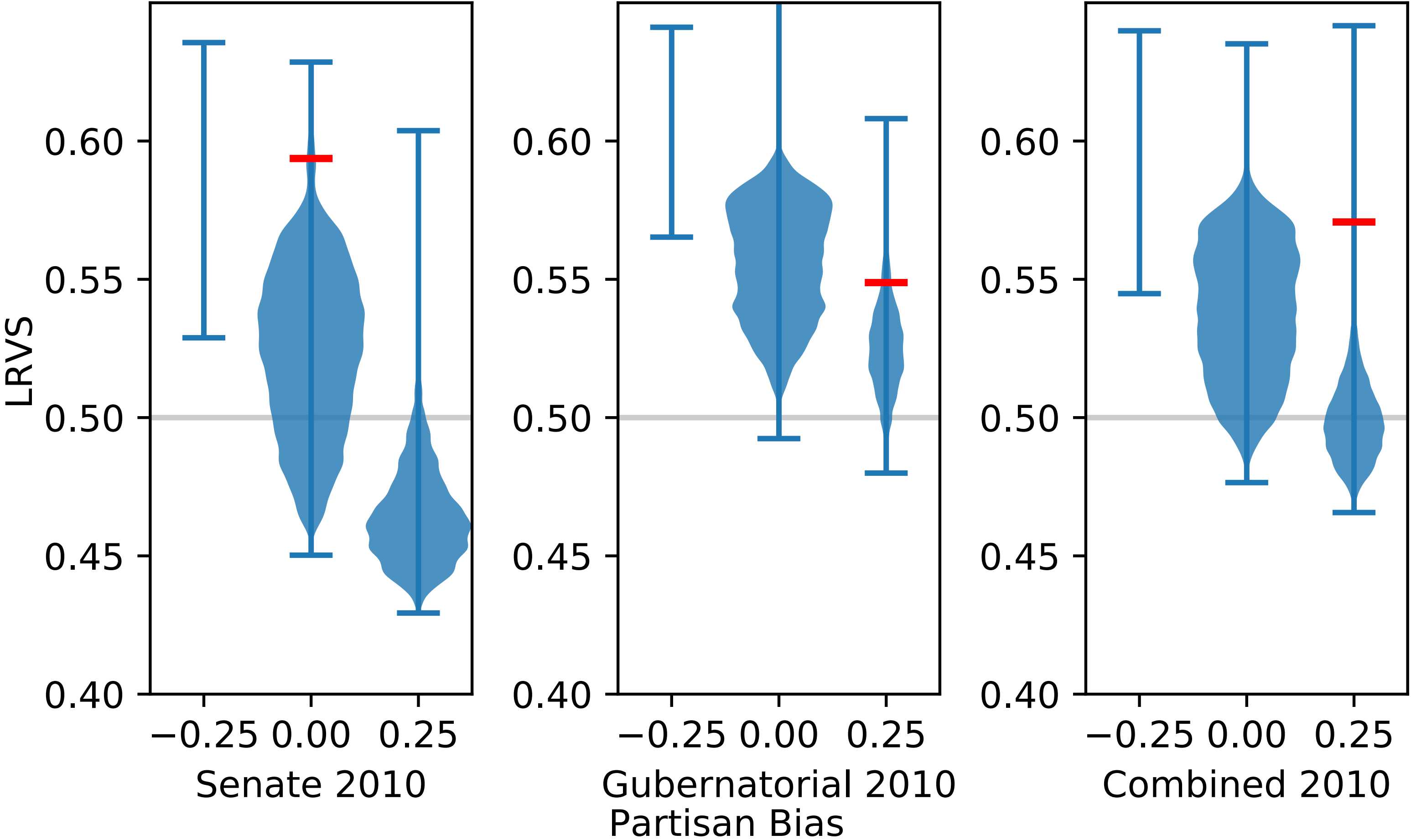


Results: Partisan Symmetry Measures

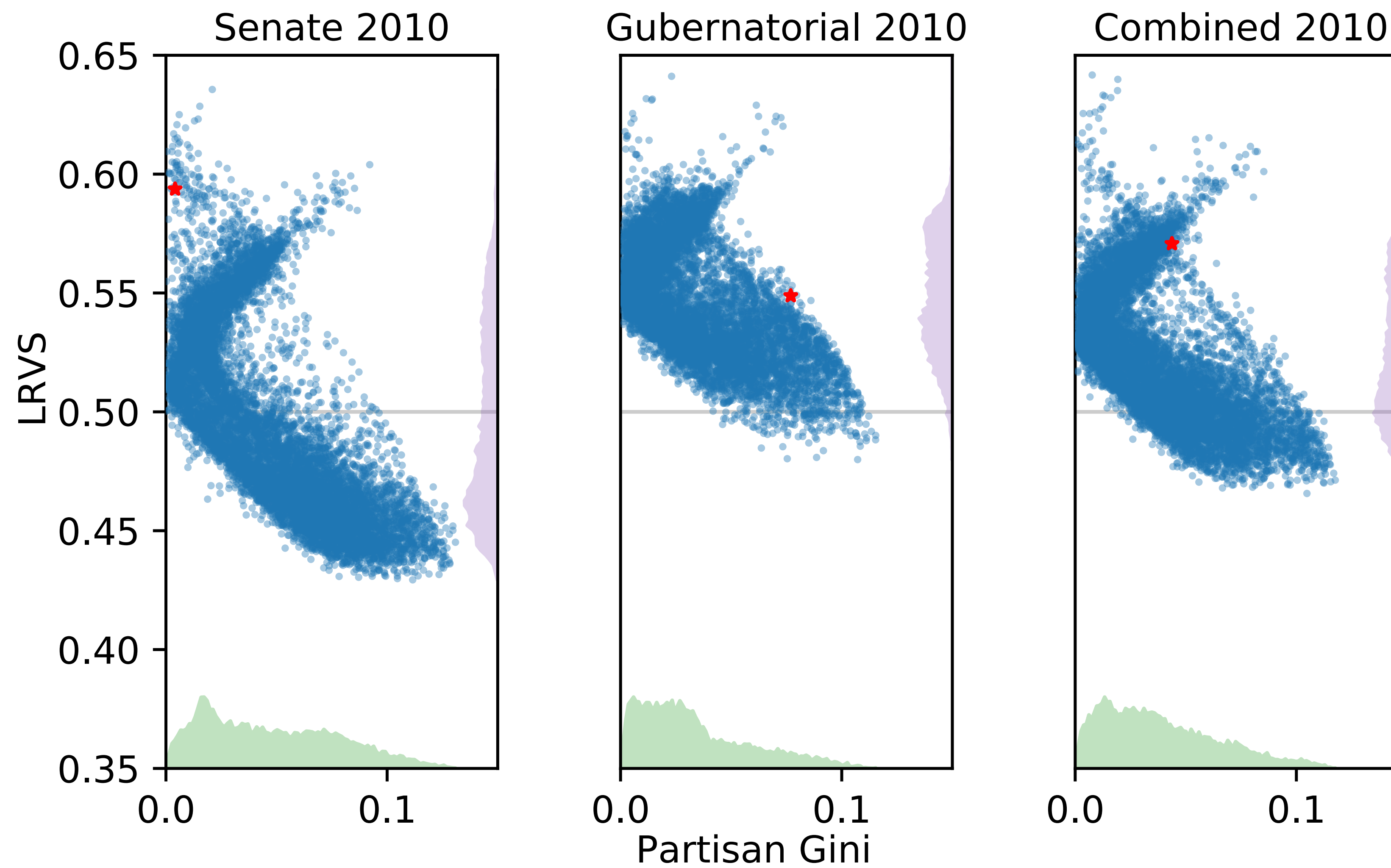
Mean-Median Score and LRVS in Recom Ensemble (1M Plans)



Partisan Bias and LRVS in Recom Ensemble (1M Plans)

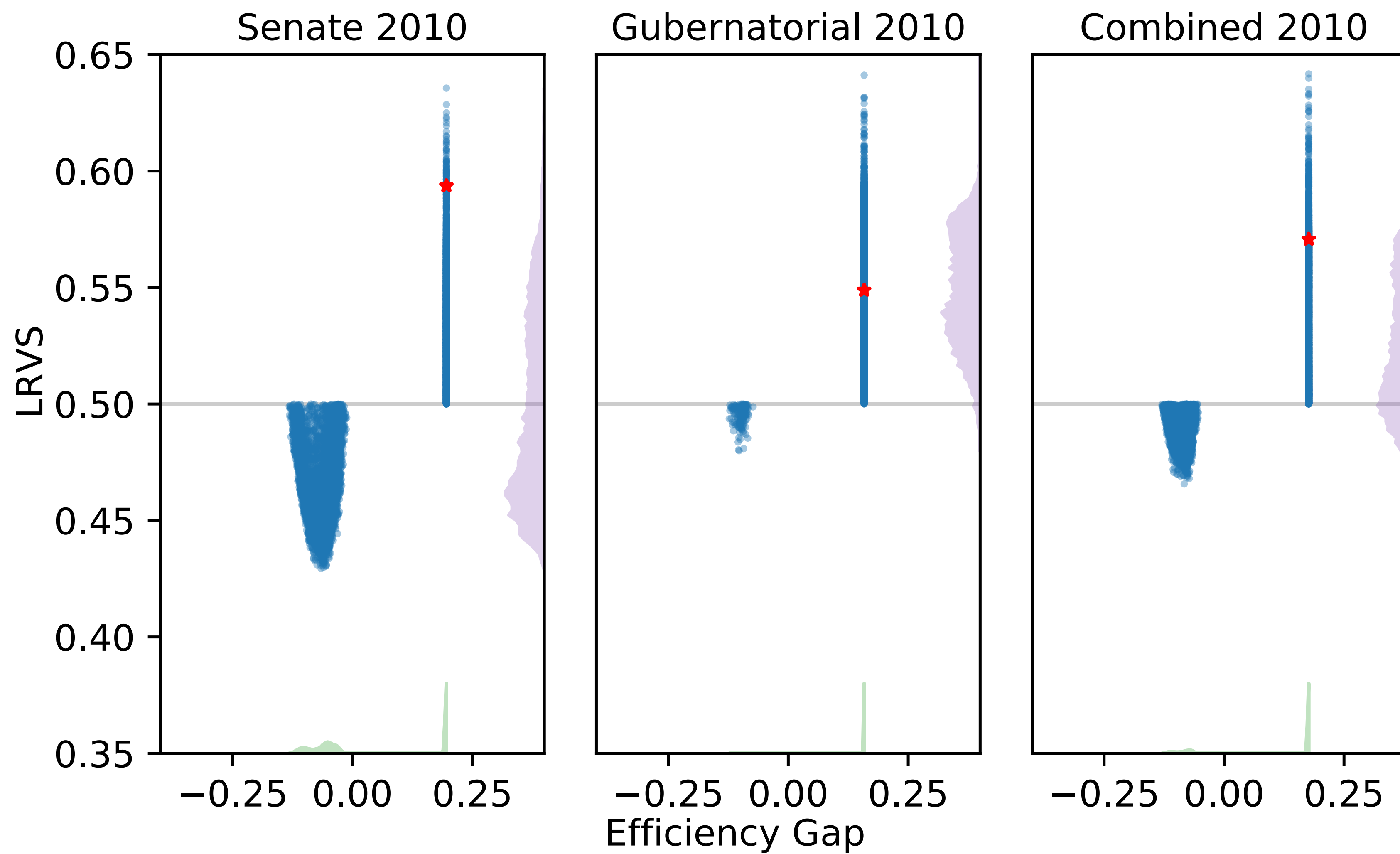


Partisan Gini and LRVS in Recom Ensemble (1M Plans)

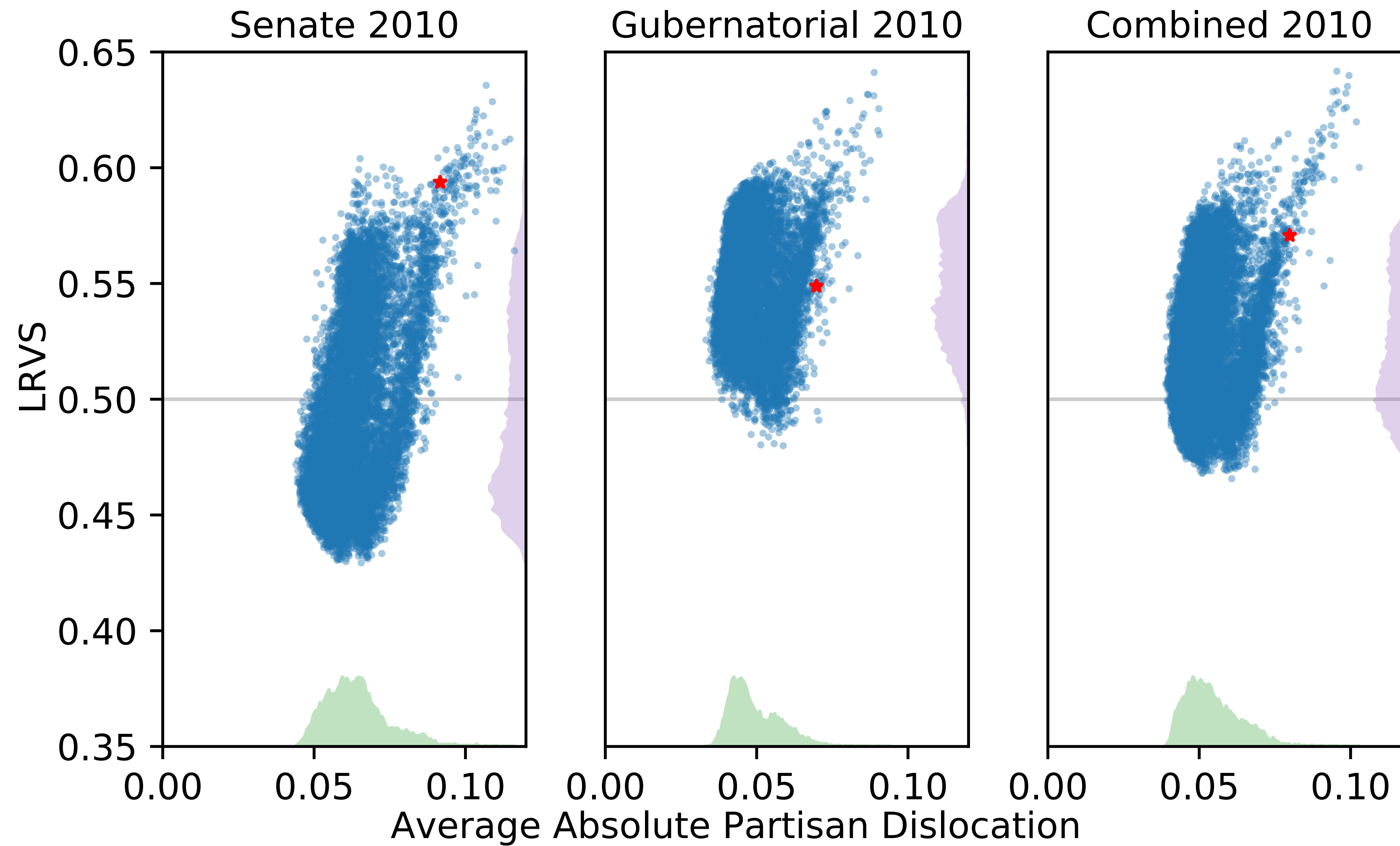


Results: Newer Metrics

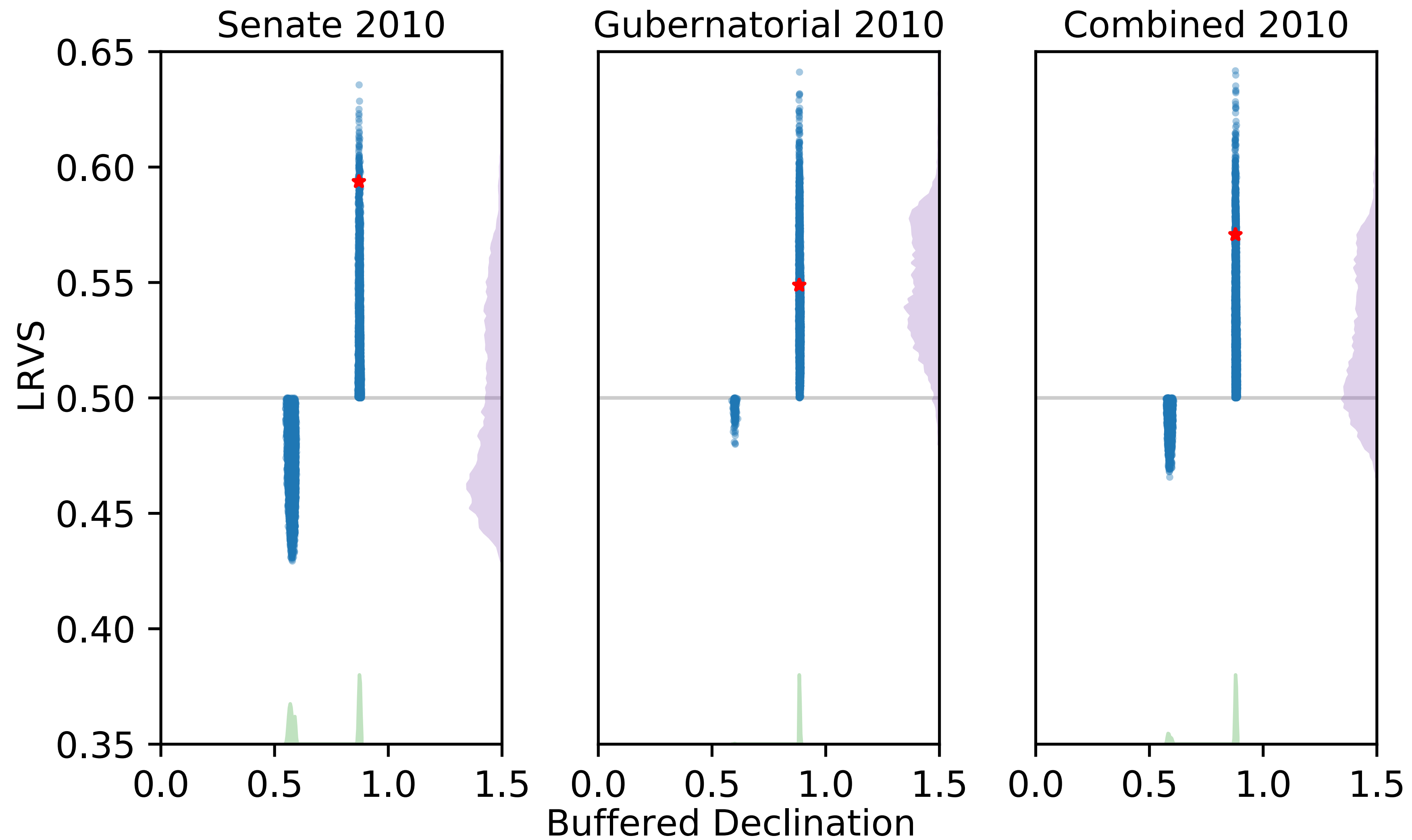
Efficiency Gap and LRVS in Recom Ensemble (1M Plans)



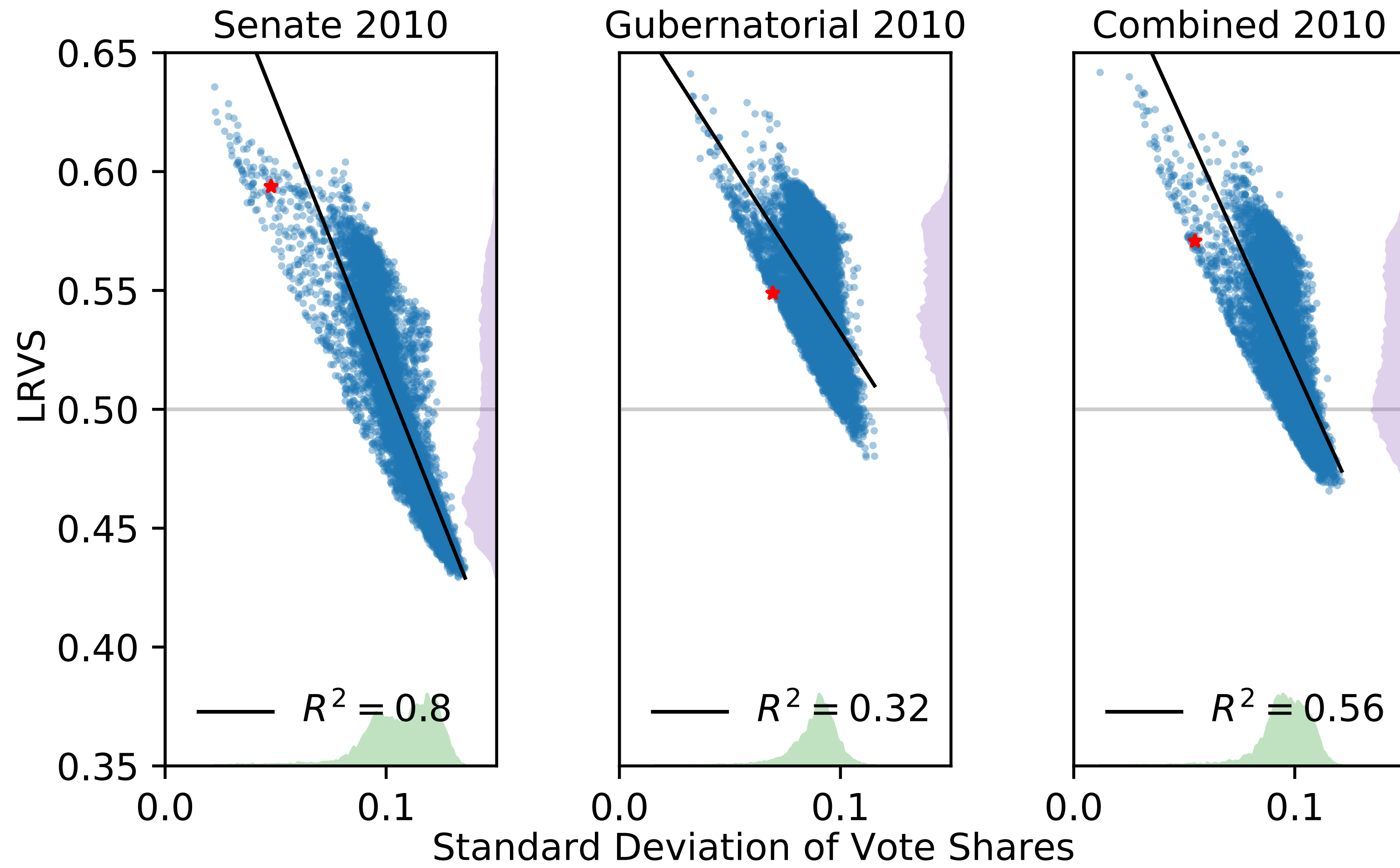
Avg Abs Partisan Dislocation and LRVS in Recom Ensemble (1M Plans)



Buffered Declination and LRVS in Recom Ensemble (1M Plans)



Standard Deviation of Vote Shares and LRVS in Recom Ensemble (1M Plans)



Conclusion

- Common measures are uninformative or misleading in Utah
- LRVS is most important for Utah
- Signed vs unsigned measures

Thank you!