Evaluating the 2021 Enacted General Assembly Redistricting Plan: House

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1 Overview

We compare the enacted SL 2021-175 house general assembly redistricting plan in North Carolina to two collections of maps that are representative of two types of policies for non-partisan redistricting. Our collections of maps and the criteria used to generate them are presented in our previous analysis [1]. Our distributions favors plans with compact districts and keeps counties intact. One of the distributions prioritizes keeping municipalities whole.

2 Results

Figure 1 gives the *Collected Seat Histograms* for the ensemble sampled from the distribution which does not consider preserving Municipalities (MCDs). Figure 2 gives the *Collected Seat Histograms* but for the ensemble sampled from the distribution which does consider preserving Municipalities (MCDs).[1] In addition to looking at a collection of historic votes, it is also useful to examine how the ensemble shifts under changes to the statewide vote fraction on a particular set of votes. This may be accomplished, for example, by using a uniform swing analysis. We omit such investigation in this work, but such studies may be achieved with the provided data and we plan to implement this in future analysis.

Without reference to a particular set of votes, the primary message of this plot is that the enacted SL 2021-175 plan heavily and consistently favors the Republican party when compared to either collection of maps.

We generated this ensemble of maps from a distribution on redistricting which was set before the General Assembly released its maps. Hence our distribution was informed by the nonpartisan criteria they laid out but not by how those criteria were implemented in the selected maps.

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[1]One can find the shapefiles, election data, and the voting data on our ensembles at our online archive: `https://git.math.duke.edu/gitlab/gjh/redistricting2020results.git`
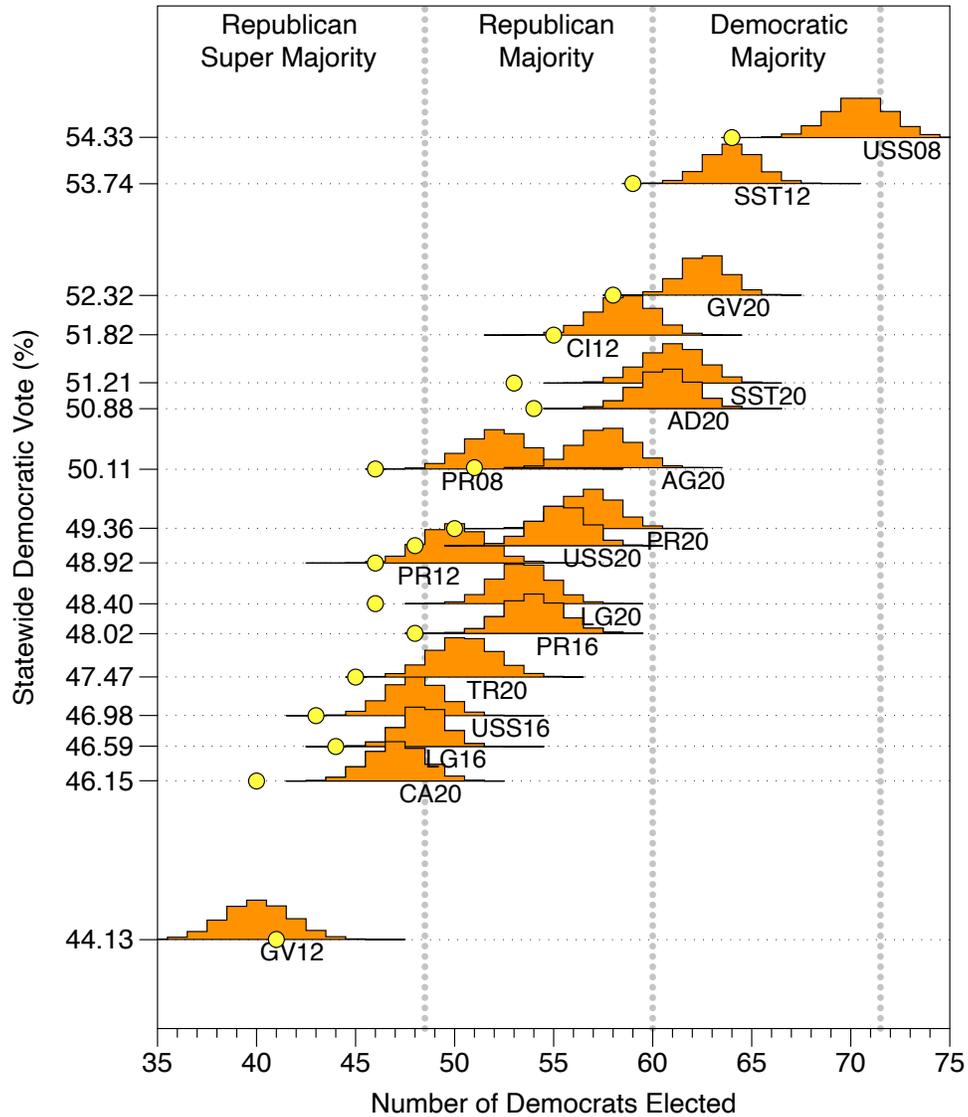
Figure 1: Each orange distribution represents the range of possible Democratic seats won in the ensemble of plans which do not consider Municipalities under a given set of historic votes; the height is the relative probability of observing the result. We only include a selection of the historic vote counts for clarity. Abbreviations contain the year in the last two characters and the race in the first few characters: AG for Attorney General, USS for United States House, CI for Commissioner of Insurance, GV for Governor, LG for Lieutenant Governor, and PR for United States President. On the left axis, we provide selected Democratic statewide vote percentages. The yellow dots compare the ensemble with the SL 2021-175 proposed plan.
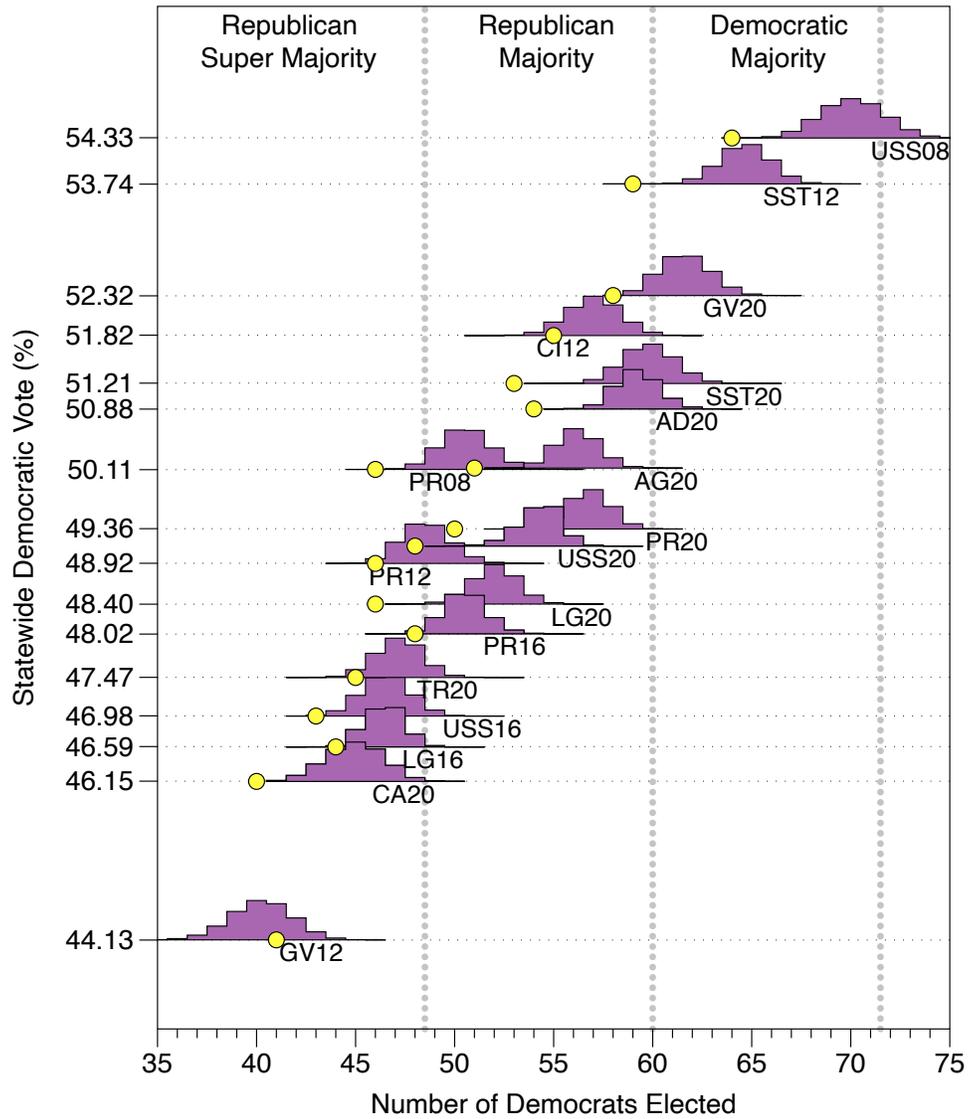
Figure 2: The same as Figure fig:HouseCEAH except the ensemble used is concentrated on plans that also respect the boundaries of municipalities. The yellow dots compare the ensemble with the SL 2021-175 proposed plan.
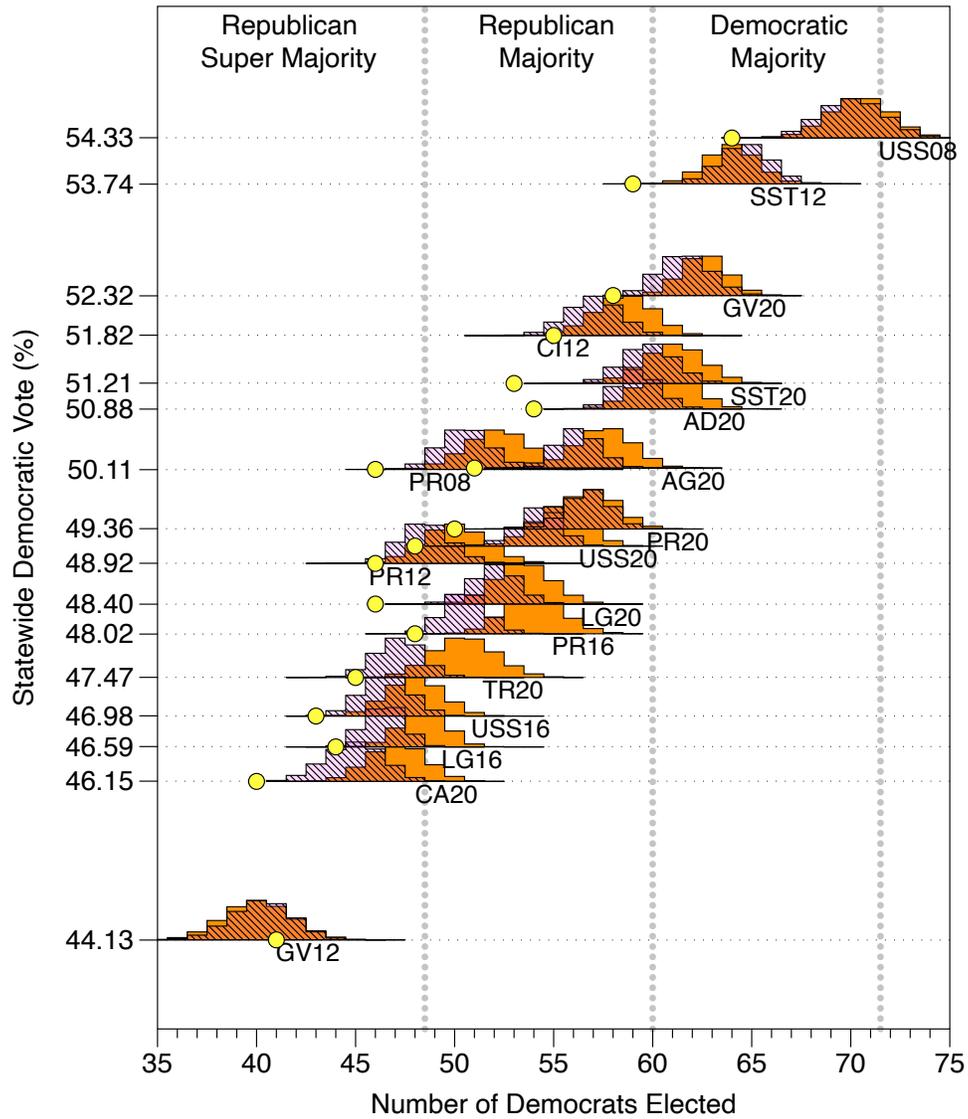
Figure 3: This figure combines Figure 1 and Figure 2 so that they can be compared. The yellow dots compare the ensemble with the SL 2021-175 proposed plan.

3 Ranked Ordered Marginal Boxplots

The following figures plot the typical range of the most Republican district to most Democratic district. Ranges are represented by box-plots. In these box-plots, 50% of all plans have corresponding ranked district that lies within the box; the median is given by the line within the box; the ticks mark the 2.5%, 10%, 90% and 97.5% quartiles; the extent of the lines outside of the boxes represent the range of results observed in the ensemble. There are 120 seats; any box that lies above the 50% line on the vertical axis will elect (or typically elect) a Democrat; any box that lies below the 50% line will elect (or typically elect) a Republican.

Figures **??-??** give the box-plots of the marginal vote fraction distribution under a representative collection of elections. The elections used were chosen the span the range of statewide vote fractions seen in Figure 1.

We can take a proposed plan with a set of votes and plot the ordered district returns over the box plots. If the districts of an enacted plan lie either far above or far below the ensemble at a particular ranking, this can indicate that the district was either packed or cracked to provide an atypical result. We chose these elections to give some variety in year, type of race and statewide partisen vote fraction.

We examine a variety of elections and consistently find that the two most Democratic districts contain significantly more Democratic voters than are seen in the ensemble. We also see that two most Republican districts contain significantly fewer Republicans than we see in the ensemble. Finally, we see that districts in the middle have fewer Democrats than is expected from the ensemble. This suggests that Democrats have been removed from these middle districts to have been packed in the most Democratic districts and that Republicans have been removed from the most Republican districts and placed into the middle, more competitive districts.
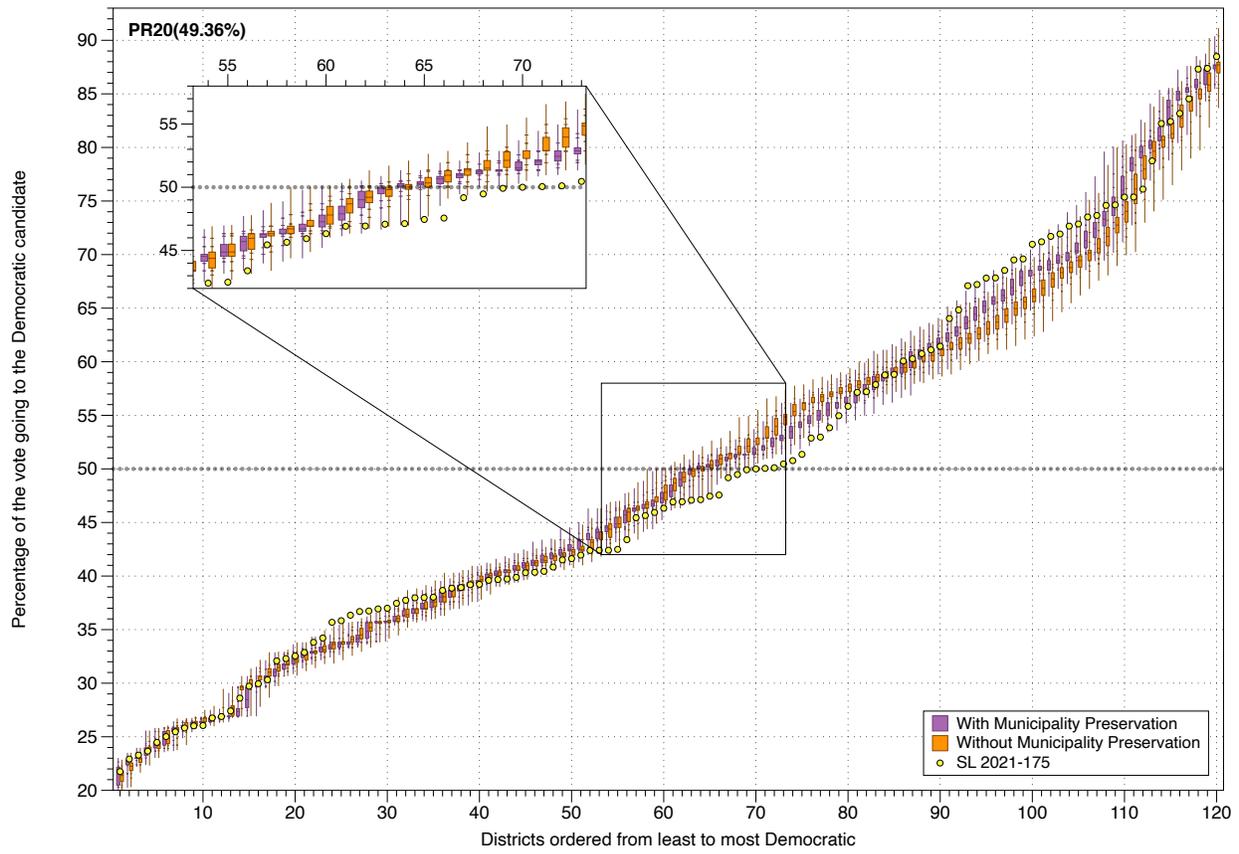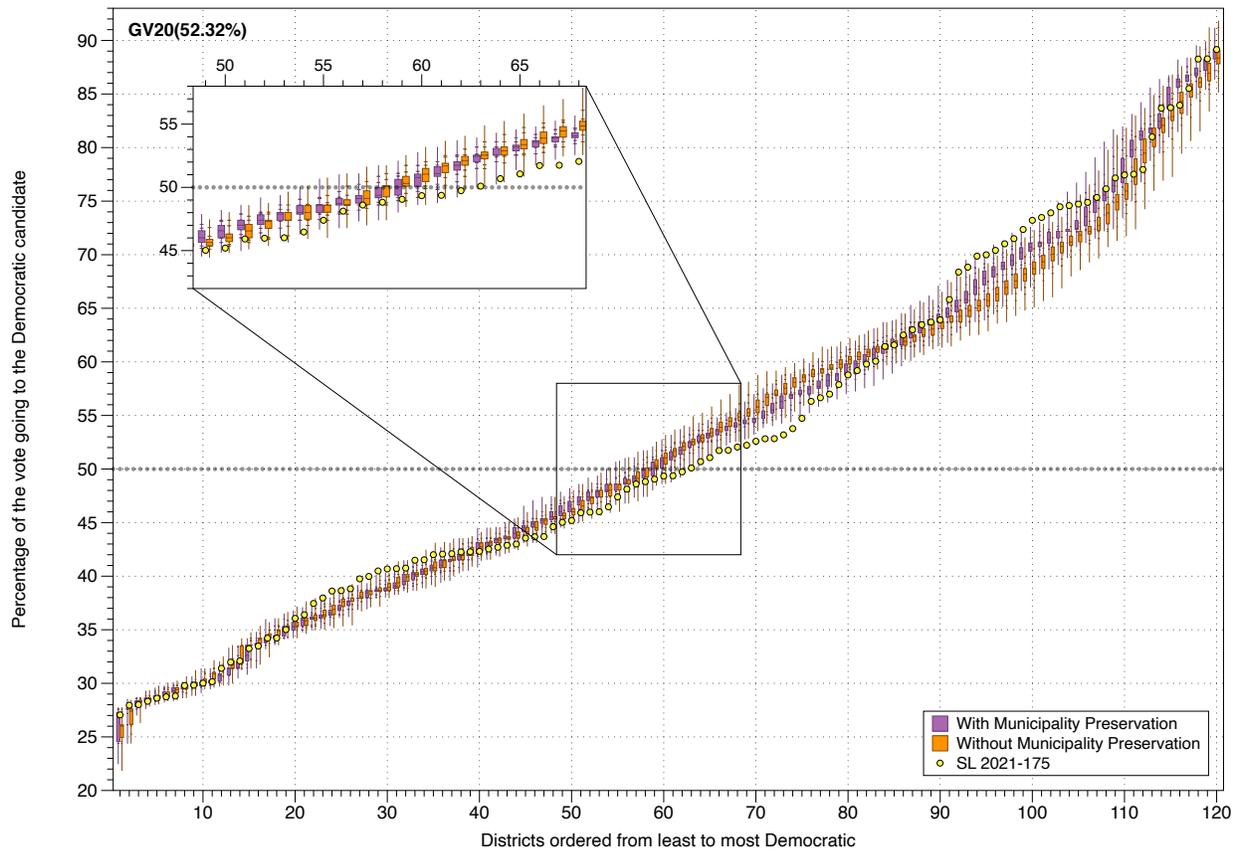
Figure 4: Ranked Ordered Marginal Boxplots considering MCD and using Governor 2020 votes and President 2020 votes.
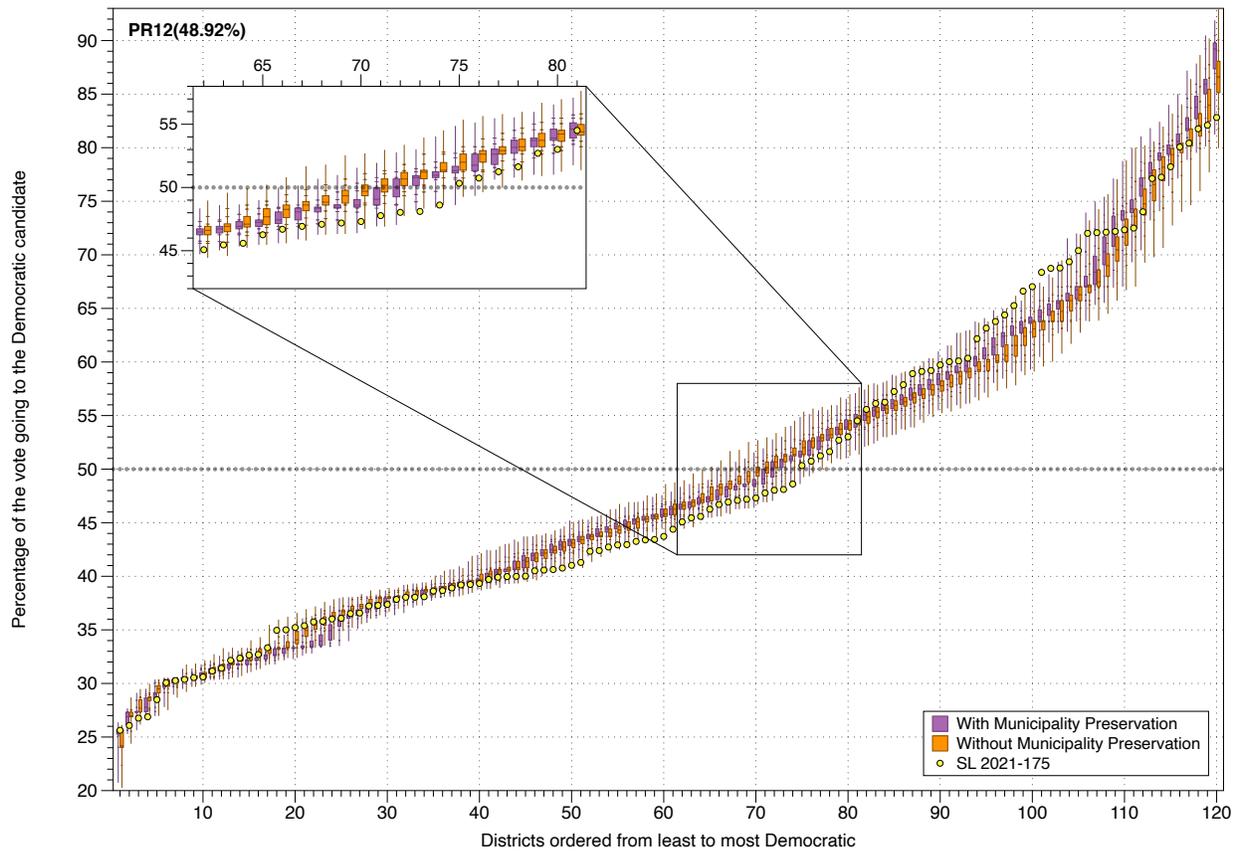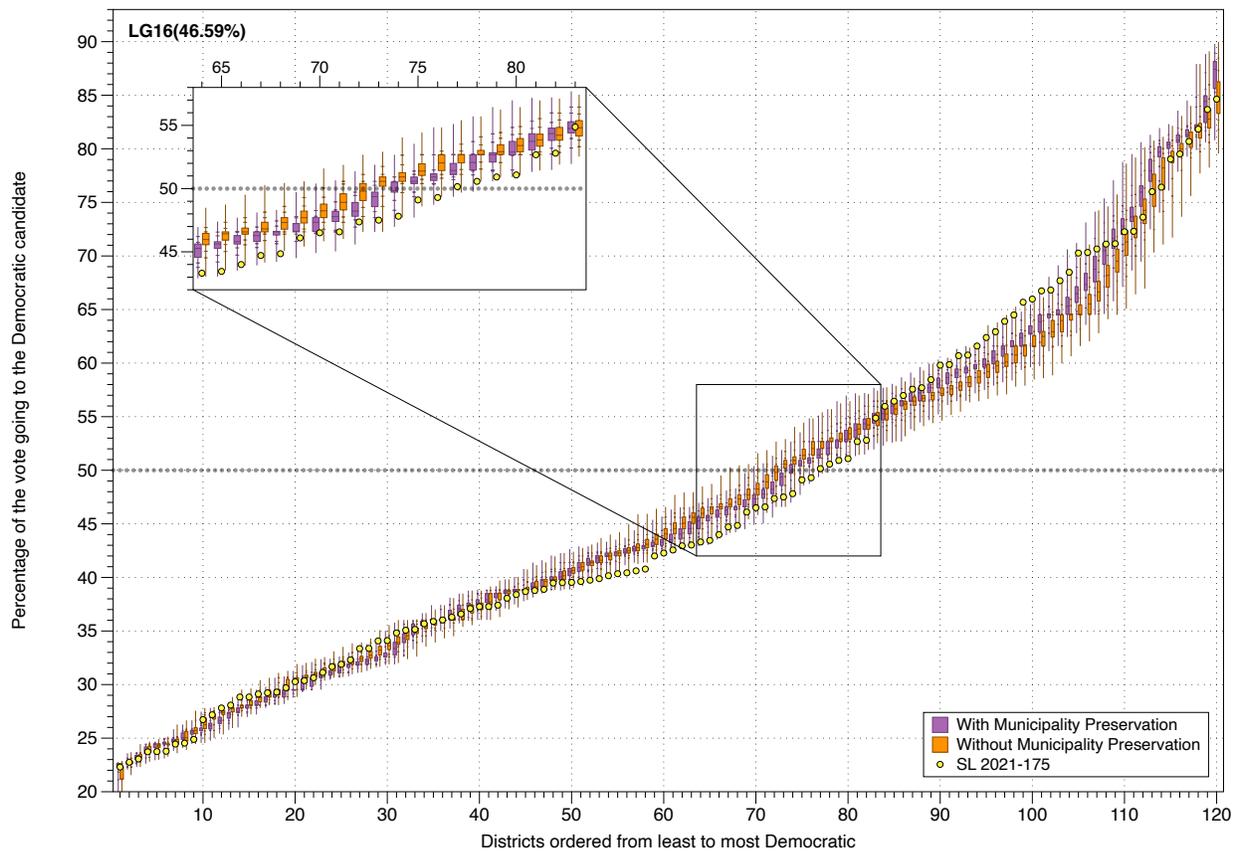
Figure 5: Ranked Ordered Marginal Boxplot distribution considering MCD and using Secretary of State 2012 votes an President 2008 Votes.
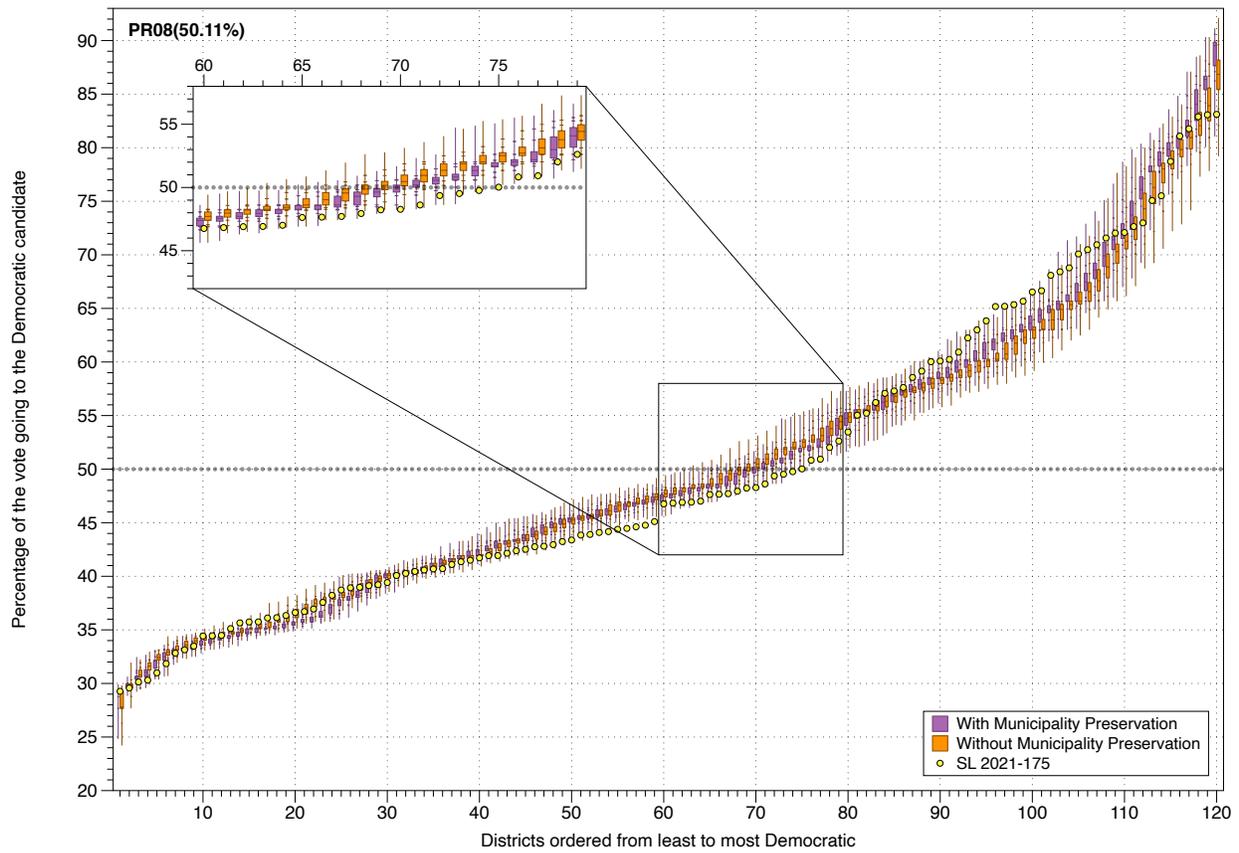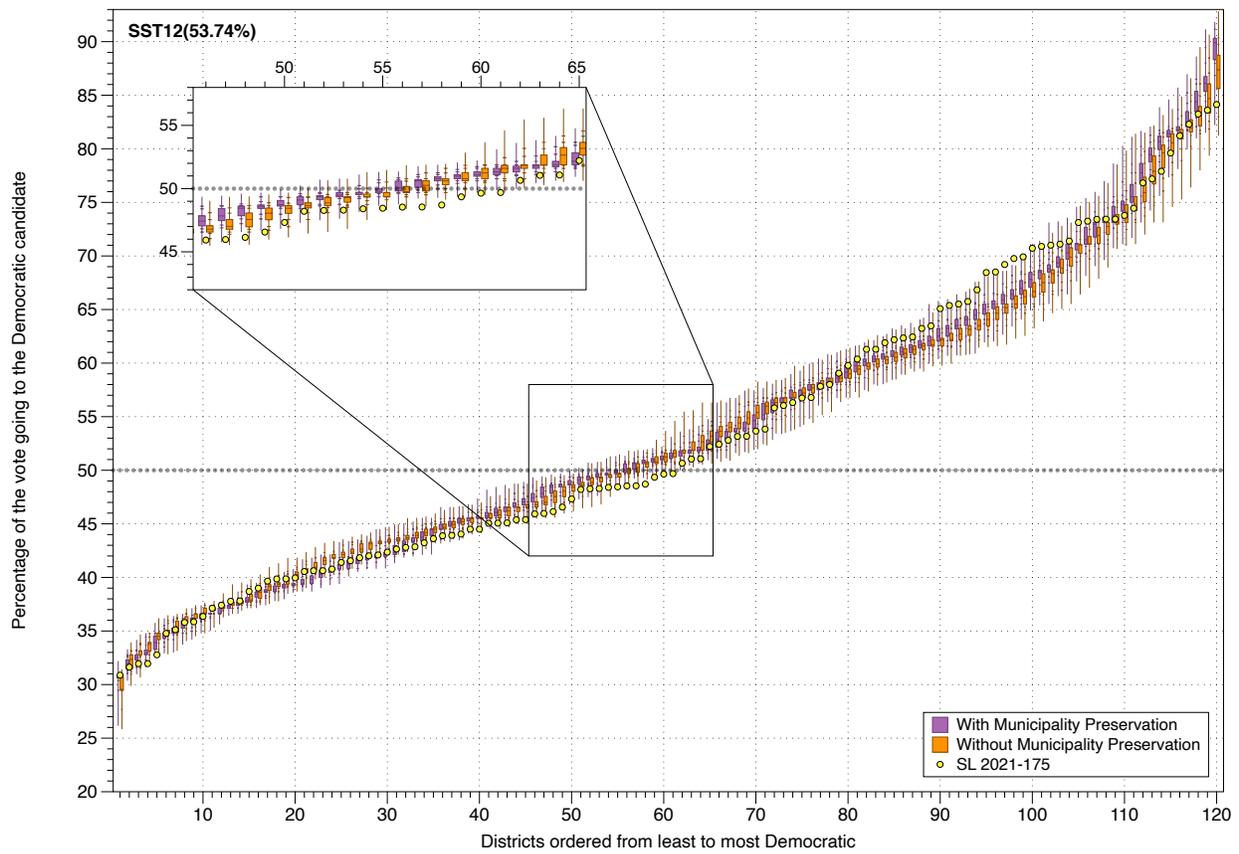
Figure 6: Ranked Ordered Marginal Boxplot distribution considering MCD and using Secretary of State 2012 votes an President 2008 Votes.
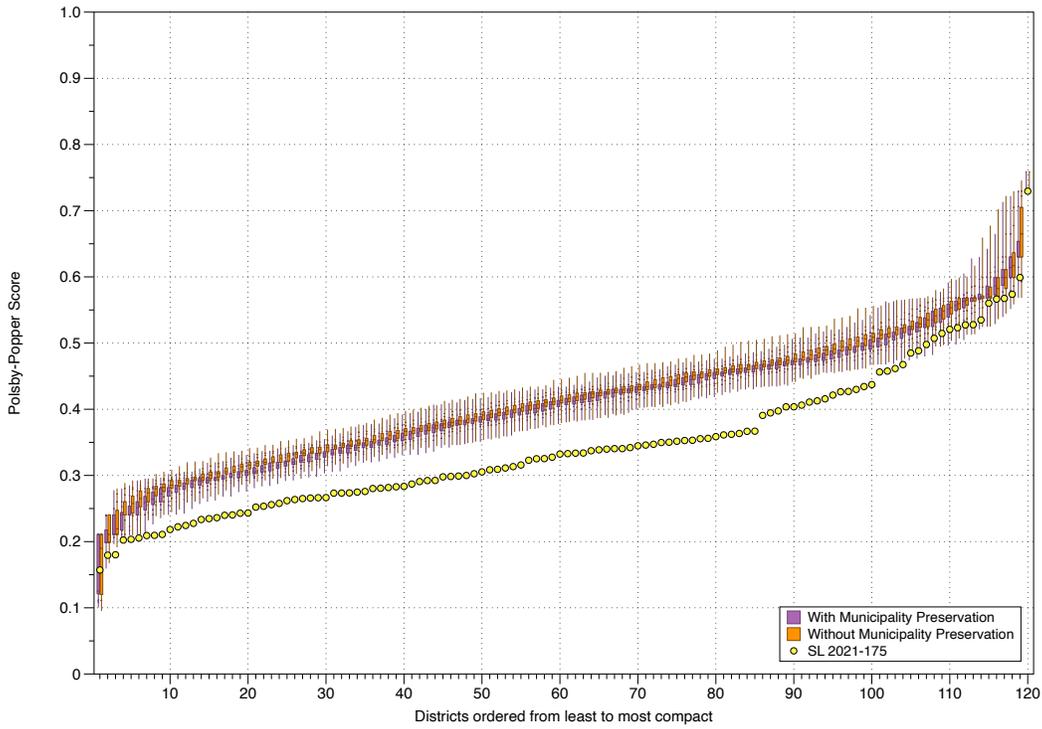
Figure 7: The yellow dots display the ordered Polsby-Popper score of the 120 districts in the SL 2021-175 plan.

4 Distribution of Compactness

In Figure 7, we give the box-plots for the ranked ordered marginal distribution for the compactness score, namely the Polsby-Popper score (see companion methods document). We compare the ensemble of plans with the SL 2021-175 plan.

References

[1] The geopolitical landscape of the north carolina general assembly. [Online]. Available: https://sites.duke.edu/quantifyinggerrymandering/2021/10/26/the-geopolitical-landscape-of-the-north-carolina-general-assembly/