MT4113 - Report

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I confirm that the following report and associated code is my own work, except where clearly indicated.

Abstract

More than 17 million people voted to leave the EU in 2016 Referendum in the UK. This statistical report investigated the difference of approval rates of Brexit in England and the rest of the UK by carrying out both parametric and non-parametric tests. Particularly, Monte Carlo simulation is conducted on the referendum dataset by regions, to research the properties of those statistical tests under a range of different scenarios. *add a bit summary of result*

1   Motivation

Hundreds of thousands of people marched to London's Parliament Square for a referendum on the final Brexit deal in late October(BBC News, 2018). In the EU referendum in 2016, approximately 52%, or more than 17 million people in the UK, voted to leave the European Union (Becker, Fetzer & Novy, 2017). To investigate what voters in different nations of the UK vote for, the dataset of EU referendum results by regions(Electoral Commission, 2016) are statistically analysed and tested in this report. The dateset contains numerous variates regarding the referendum outcome, yet only *Region* and *Percent Leave* are concerned in terms of our research objectives.
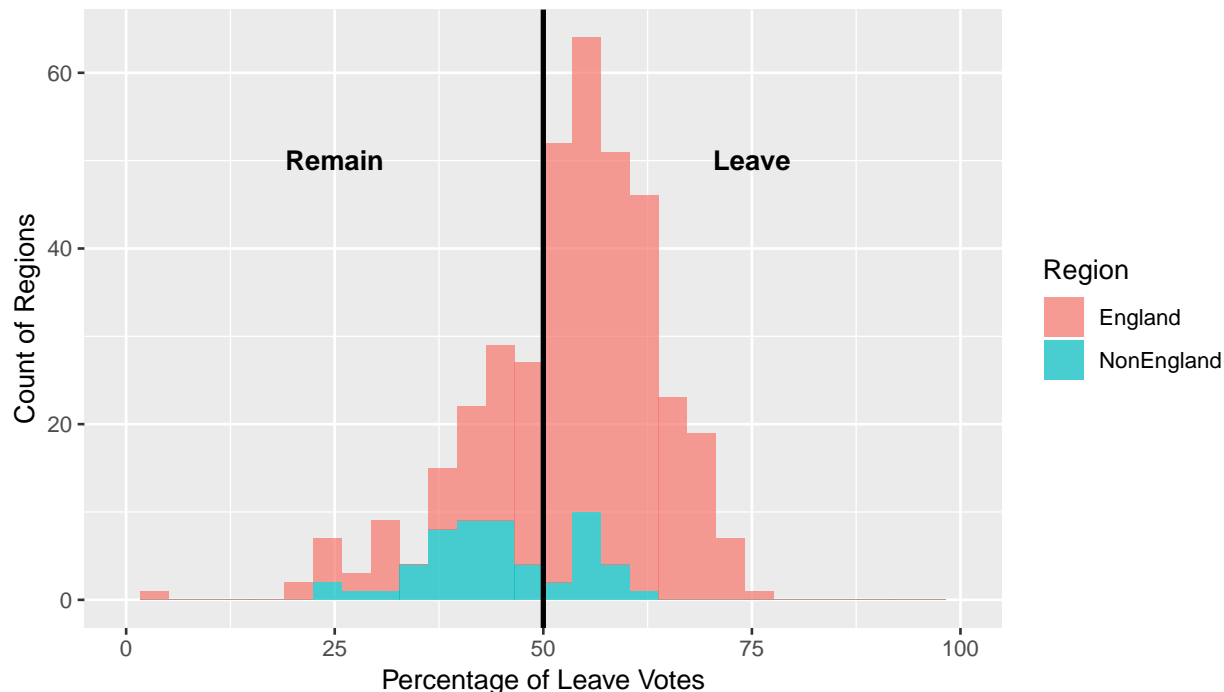

Figure 1: Leave Votes in England and Non-England Regions

According to the histogram of leave vote, it seems that England regions tend to be more supportive of Brexit than other regions. Hence, The research question is proposed as that

- *Were approval rates of Brexit greater in England or rest of the UK in 2016 referendum?*

On the basis of our research question, regions are categorized as England or Non-England, thus, Student's T test and Mann-Whitney U test are chosen to be conduct to compare the difference of mean approval rates of Brexit. Moreover, 1000-iteration Monte Carlo simulations are carried out under a range of scenarios in order to investigate power and size of these tests.

Table 1: Size of Student's T Test

Sample Size	SD Difference					SD Difference(record round to 0)				
	0	3	5	8	10	0	3	5	8	10
10	0	0.017	0.025	0.032	0.032	0	0.014	0.025	0.033	0.035
50	0	0.009	0.022	0.031	0.034	0	0.011	0.017	0.033	0.035
100	0	0.012	0.020	0.023	0.023	0	0.014	0.020	0.023	0.024
150	0	0.019	0.027	0.027	0.031	0	0.019	0.026	0.029	0.030
200	0	0.009	0.021	0.024	0.025	0	0.010	0.017	0.022	0.028
300	0	0.010	0.022	0.031	0.034	0	0.011	0.025	0.033	0.036
400	0	0.019	0.029	0.036	0.038	0	0.018	0.030	0.040	0.041
500	0	0.016	0.025	0.034	0.039	0	0.015	0.025	0.031	0.038
700	0	0.013	0.022	0.029	0.034	0	0.013	0.020	0.031	0.033
1000	0	0.015	0.029	0.033	0.036	0	0.013	0.028	0.034	0.036

Table 2: Size of Mann-Whitney U Test

Sample Size	SD Difference					SD Difference(record round to 0)				
	0	3	5	8	10	0	3	5	8	10
10	0	0.029	0.041	0.049	0.049	0	0.031	0.047	0.054	0.057
50	0	0.028	0.046	0.054	0.057	0	0.031	0.047	0.056	0.058
100	0	0.028	0.048	0.063	0.065	0	0.029	0.045	0.062	0.070
150	0	0.033	0.049	0.057	0.057	0	0.032	0.045	0.059	0.057
200	0	0.026	0.045	0.056	0.061	0	0.028	0.047	0.055	0.061
300	0	0.036	0.051	0.066	0.071	0	0.034	0.056	0.067	0.075
400	0	0.043	0.064	0.074	0.080	0	0.044	0.064	0.076	0.080
500	0	0.034	0.051	0.064	0.066	0	0.027	0.051	0.063	0.069
700	0	0.029	0.048	0.054	0.057	0	0.034	0.050	0.058	0.062
1000	0	0.038	0.054	0.065	0.071	0	0.037	0.056	0.063	0.070

2 Methodology

3 Result and Discussion

4 Conclusion

5 Reference

Appendix

BBC News (2018) *People's Vote march: Hundreds of thousands attend London protest.* [Online]. Available from: https://www.bbc.co.uk/news/uk-45925542.

Becker, S.O., Fetzer, T. & Novy, D. (2017) Who voted for Brexit? A comprehensive district-level analysis. *Economic Policy.* [Online] Available from: doi:10.1093/epolic/eix012.

Electoral Commission (2016) *2016 EU Referendum in the United Kingdom.* [Online]. Available from: https://www.kaggle.com/electoralcommission/brexit-results.