GB 740: Experiments and Causal Methods for Business Insights
Prof. Sacks

Homework 2: Heterogeneous Treatment Effects (Rocket Fuel Case)

Rocket Fuel Analysis (upload a pdf of your R markdown file showing both your code and results):

Overview: This homework asks you to analyze results from the "rocket fuel" experiment. Please read the case carefully. In the experiment, individuals were targeted different number of times (tot_impr). For the analysis we are going to break down results by sub-groups depending on the number of times the individual was targeted for ads (tot_impr). I have created a data set called rocketfuel_deciles that you can use for this purpose. This simply takes the original rocketfuel data and adds a column labeling people into deciles (i.e., 10% groups) by tot_impr. If you prefer, you can take the raw data and create deciles yourself for practice.

You should start with the HW2_templat.Rmd. Write your code and answers in the indicated places.

1. **Check for balance:** In a table, compare the shares of individuals by treatment status, and the means and standard deviations of pre-experiment variables. Comment in your markdown file on your findings.

2. **Plot outcome:** Plot the means and confidence intervals of the main outcome "converted," treatment status. In your markdown, file, interpret the result (mean and confidence intervals, noting width).

3. **Find ATE:** Estimate of the Average Treatment Effect (ATE) of the ads for treatment relative to control, the associated standard error, and the 95% confidence interval on the Average Treatment Effects. You can do this by hand or with regression (but be careful about standard errors).

4. **Subgroup analysis:** Create a summary table showing the sample size, the mean and the standard deviation of variables in the data set for both treatment and control group over the 10 deciles of total impressions. Organize your table so that it's easy to see treatment effects for each decile. Comment about your findings in the file.

5. **Subgroup plots – means + CI: C**reate a graph that shows the mean and 95% CI on "converted" separately for treatment and control plotted over the 10 deciles of total impressions. Briefly interpret the plot in your market down file. (Bonus: make a graph of the treatment effects and 95% CIs by decile.)

6. **Value of advertising:** Based on the overall treatment effect (question 3), what do you estimate is the increased profit per individual from running these ads? You should use information from the case to determine costs and benefits. Explain how you calculate costs and benefits.

7. **Targeting:** Now suppose you could target ads, serving only based on deciles of impression (so you can control which decile is included in the campaign, but the total impression and costs will differ by decile). Based on your heterogeneous treatment effect estimates, and with a calculation analogous to the one for (6), which decile would you want to target?

8. **Value of targeting:** Discuss what your results imply about the value of selectively targeting ads

Deliverable: "Knit" your answers to html, then **export the HTML as a pdf** and submit both the pdf output and the .rmd file in the upload for this assignment. (I am not asking you for a separate "business memo" here.)