

## Group Assignment 2 – “Difference-in-Differences – Bazaar.com”

### MSBA 6440

#### Instructions:

Prepare and submit a written report to management that documents your analysis and findings (a PDF file, compiled output from R Markdown), along with the actual R Markdown file, which documents your findings and responses to the questions detailed below, as related to the Columbia Business School case entitled “Measuring RoI on Sponsored Search Ads.”

#### *Assignment Description:*

Frequently, conducting a randomized experiment is not feasible. This might be because there is no reliable way to “target” units of observation with a treatment, or simply because an experimental intervention is not legal, ethical or cost effective. In these situations, one must adapt, bringing to bear alternative techniques that can help to establish causality in observational settings (absent intervention).

One technique, which is simple, yet powerful, is known as Difference-in-Differences estimation. Faced with a setting in which multiple units of study can be observed over a period of time, where one unit (or cohort) is treated in a believably “random” manner and a second unit is (or cohort) not, we can recover a reliable estimate of the causal effect of the treatment. For example, we might estimate the causal effect of an operating policy change if the policy was instituted (or removed) at some company locations, yet not at others, by comparing outcomes associated with each location, over time. The “others” ultimately serve as a control group (similar to an experiment), such that they enable us to recover a plausible counterfactual for what *would* have happened in the treated location had treatment never happened.

Your report will document your application of this technique in the context of sponsored search advertisement at Bazaar.com, where a natural experiment has just occurred (the temporary stoppage of sponsored search advertisements on *one* search engine).

#### *Deliverable:*

Your ultimate goal is to report an accurate estimate of the Return on Investment associated with Sponsored Search advertising being run by Bazaar.com, based on the natural experiment. You need to address the following set of questions as part of your report:

- (a) **What is Wrong with Bob's RoI Calculation?** Explain in words what is problematic with Bob's approach to calculating the RoI associated with sponsored search ads? Hint: think about what visitors might do instead, in the absence of sponsored ads from Bazaar.com when they run a Google search. *Note: this is a conceptual question, which depends on your understanding of the business context.*
- (b) **Define the Treatment and Control.** What is the unit of observation here? Define the treatment. Which unit(s) are treated and which is / are control?
- (c) **Consider a First Difference Estimate.** One approach we might take (if we could only observe the treated unit) would be to calculate the first difference (that is, the % change in web traffic arriving from Google; (after – before) / before). This estimate is the pre-post difference in the treated cohort. Estimate this value using a regression (what is the estimated treatment effect from this simple post estimator?). Explain why it would not be a good idea to solely rely on this number as our estimate of the causal effect of the treatment.
- (d) **Calculate the Difference-in-Differences.** Now calculate the difference in differences estimate of the treatment effect (estimate a difference-in-differences regression). What is the new treatment effect estimate? How does it compare with the pre-post estimate, and what does this say about problems with relying on the post estimator?
- (e) **Given Your Treatment Effect Estimate, Fix Bob's RoI Calculation.** Throw out Bob's RoI calculation. Come up with your own, alternative calculation, based on your estimated treatment effect.