Problem Set 1: Potential Outcome

GOV 2003

Due at 11:59 pm (ET) on Sept 15, 2021

Instruction

Before you begin, please read the following instructions **carefully**:

- **No late submission are allowed** without a prior approval from the instructors.
- **All answers should be typed up**. We recommend the use of `Rmarkdown`. An `Rmarkdown` template for this problem set is provided. Answers to analytical solutions should also be typed up.
- **A PDF copy of your answer** including your computer code should be uploaded to `Gradescope` before the deadline. **Do not submit the markdown file itself**.

Introduction

In this problem set, we investigate one of the three field experiments conducted by Kalla and Broockman (2020) which studies a strategy that is effective on reducing exclusionary attitudes — prejudice toward outgroups and opposition to policies that promote their well-being. In Experiment 1, the authors test whether the *non-judgemental exchange of narratives* is effective on reducing exclusionary attitudes[1]. You may read the section titled "Experiment 1: Does the non-judgemental exchange of narratives facilitate reducing exclusionary attitudes toward unauthorized immigrants? (Kalla and Broockman, 2020, pp. 414-418)" for more details about the design. While reading the section, try to think about how the causal question of interest can be expressed as the **potential outcome** notation rather than focusing on understanding all the details.

Setup

Let Y_i denote the support for inclusive policies for each voter i and T_i the canvassing with three categories — *placebo* conversation unrelated to immigration ($T_i = 0$), *full intervention* including non-judgemental exchange of narratives ($T_i = 1$), and *abbreviated intervention* similar to a traditional political canvass ($T_i = 2$). Note that the group receiving the placebo serve as the baseline, rather than rely upon a control group that does not receive any attempted canvassing. Here, we assume no interference between units (voters) and unit-level random assignment of the canvassing (i.e., ignore

[1]The authors define the non-judgemental exchange of narratives as a strategy where an individual attempts to persuade another person by providing to or eliciting from them nattarives about relevant personal experiences while non-judgementally listening to the views they express

the household-level random assignment from the original studies for simplicity). We only consider the individuals who open their doors and identify themselves before the intervention and placebo scripts diverge.

Question 1: Potential Outcome 1 (4 pts; 2 pts for each)

(a) For any given voter i, define the individual causal effect of the full intervention with non-judgemental exchange of narratives compared to the placebo conversation on increasing the support for inclusive policies.

(b) Similarly, for any given voter i, define the sample average treatment effect of the full intervention with non-judgemental exchange of narratives compared to the abbreviated conversation without those on increasing the support for inclusive policies.

Answer 1

(a) Let $Y_i(t)$ denote the potential outcome of voter i given the treatment (in this case, canvassing), $t \in \{0, 1, 2\}$. Then, the individual causal effect of the full intervention with non-judgemental exchange of narratives compared to the placebo conversation on increasing the support for inclusive policies is,

$$Y_i(1) - Y_i(0).$$

(b) Using the same notation as above, the sample average treatment effect of the full intervention with non-judgemental exchange of narratives compared to the abbreviated conversation without those on increasing the support for inclusive policies is,

$$\frac{1}{n}\sum_{i=1}^{n}[Y_i(1) - Y_i(2)].$$

where n is the total number of samples.

Question 2: Principal Stratification (3 pts)

Note that not all the individuals continue with the intervention. To incorporate the presence of individuals who did not receive the entire intervention, we introduce a new variable Z_i where $Z_i(t) = 1$ if the unit i complete the entire intervention (*either* full *or* abbreviated). Define the principal strata based on Z_i and the treatment (canvassing). Which stratum can be labeled as the compliers — voters received the intervention if they were assigned to either full or abbreviated intervention group and would not have received it were they in the placebo group? (We will cover noncompliance in randomized experiment in more depth around week 6.)

Hint: List all the possible principal strata defined by $(Z_i(0), Z_i(1), Z_i(2))$.

Answer 2

We have eight principal strata defined by $(Z_i(0), Z_i(1), Z_i(2))$: $(0,0,0)$, $(0,0,1)$, $(0,1,0)$, $(1,0,0)$, $(0,1,1)$, $(1,1,0)$, $(1,0,1)$, $(1,1,1)$ where $(0,1,1)$ indicates compliers.

Question 3: Potential Outcome 2 (3 pts)

Define the population average treatment effect of the full intervention compared to the placebo conversation on increasing the support for inclusive policies among the compliers.

Answer 3

The population average treatment effect of the full intervention compared to the placebo conversation on increasing the support for inclusive policies among compliers is,

$$\mathbb{E}[Y_i(1) - Y_i(0) \mid (Z_i(0), Z_i(1), Z_i(2)) = (0,1,1)].$$

Question 4: Science Table (5 pts)

In this question, you will be asked to create a science table (from lecture slides p.6) using the data (`KallaBrookman2020.RData`). This data set contains a subset of the observations for voters, who are given a unique ID (id). The table below describes the variables we will use.

Name	Description
id	a unique ID of voters
age	age of voters
gender	gender of voters, F/M
asian	= 1 if self-identified Asian
afam	= 1 if self-identified African American
latino	= 1 if self-identified Latino
canvass	canvassing with three categories (Placebo, Full Intervention, or Abbreviated Intervention)
compliance	= 1 if the individuals continues with either full or abbreviated intervention
factor	a pooled outcome index that captures the support for inclusive policies

Create the science table which includes the potential outcomes and the causal effects of the full intervention derived in Question 1 (a) (without considering the principal strata). Present the rows for id $\in \{23865, 25862, 62584, 81456, 134831, 156720, 179477, 179561, 183163, 185095\}$. Please make sure to include the code as part of your answers.

Hint: Make sure to include the following in your columns: the treatment (T_i), potential outcomes, and the individual causal effect. Note that some of the values are missing (*fundamental problem of causal inference*).

Answer 4

```
library(tidyverse)
```

```
## -- Attaching packages --------------------------------------- tidyverse 1.3.0 --
```

```
## v ggplot2 3.3.2     v purrr   0.3.4
## v tibble  3.0.4     v dplyr   1.0.2
## v tidyr   1.1.2     v stringr 1.4.0
## v readr   1.4.0     v forcats 0.5.0
```

```
## -- Conflicts ------------------------------------------ tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()
```

```
load("KallaBrookman2020.RData")
subdat %>%
  mutate(Ti = recode(canvass,
                     `Placebo` = 0, `Full Intervention` = 1, `Abbreviated Intervention` = 2)) %
  mutate(`Yi(0)` = ifelse(Ti == 0, factor, NA),
         `Yi(1)` = ifelse(Ti == 1, factor, NA),
         `Yi(2)` = ifelse(Ti == 2, factor, NA),
         `Yi(1)-Yi(0)` = NA) %>%
  filter(id %in% c(23865,25862,62584,81456,134831,156720,179477,179561,183163,185095)) %>%
  arrange(id)
```

```
##        id age gender asian afam latino                  canvass compliance
## 1   23865  74      M     0    0      0                  Placebo          0
## 2   25862  42      F     0    0      0                  Placebo          0
## 3   62584  59      M     0    0      0 Abbreviated Intervention          0
## 4   81456  69      F     0    0      0 Abbreviated Intervention          1
## 5  134831  54      M     0    0      0        Full Intervention          1
## 6  156720  62      F     0    0      0 Abbreviated Intervention          1
## 7  179477  53      F     1    0      0                  Placebo          0
## 8  179561  38      F     0    0      0        Full Intervention          1
## 9  183163  64      M     0    0      0        Full Intervention          1
## 10 185095  59      M     0    0      1        Full Intervention          0
##        factor Ti      Yi(0)      Yi(1)      Yi(2) Yi(1)-Yi(0)
## 1  -1.9613310  0 -1.9613310         NA         NA          NA
## 2   0.1944717  0  0.1944717         NA         NA          NA
## 3  -1.9788710  2         NA         NA -1.9788710          NA
## 4   0.5403311  2         NA         NA  0.5403311          NA
## 5  -1.0312840  1         NA -1.0312840         NA          NA
## 6   0.2088593  2         NA         NA  0.2088593          NA
## 7   1.1743180  0  1.1743180         NA         NA          NA
## 8   1.3337710  1         NA  1.3337710         NA          NA
## 9  -0.0977911  1         NA -0.0977911         NA          NA
## 10 -2.1269340  1         NA -2.1269340         NA          NA
```

References

Kalla, J. and Broockman, D. (2020). Reducing exclusionary attitudes through interpersonal conversation: Evidence from three field experiments. *American Political Science Review*, 114(2):410–425.