MACS 3000: Perspectives on Computational Analysis
Problem Set 5

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1 Experiments on Amazon Mechanical Turk

Under the F1 visa I'm not allowed to apply for off-campus jobs [1]. For this reason I did not apply to Mechanical Turk.

I ask one of my classmates that is an American Citizen, Neta Grossfeld, she apply but got rejected. I wasn't able to complete this question. Here is the email she received from Amazon:

———- Forwarded message ———

From: Mechanical Turk ¡mturk-noreply@amazon.com¿

Date: Sat, Nov 10, 2018, 8:20 PM

Subject: Your Amazon Mechanical Turk Account Registration

To: Neta Grossfeld ¡neta.grossfeld@gmail.com¿

Greetings from Amazon Mechanical Turk, We have completed our review of your Amazon Mechanical Turk Worker Account. We regret to inform you that you will not be permitted to work on Mechanical Turk.

Our account review criteria are proprietary and we cannot disclose the reason why an invitation to complete registration has been denied. If our criteria for invitation changes, you may be invited to complete registration in the future.

Thank you for your interest in Mechanical Turk.

Sincerely,

Amazon Mechanical Turk

https://www.mturk.com

[1] https://www.uscis.gov/working-united-states/students-and-exchange-visitors/students-and-employment

2 Energy conservation "nudges" and environmentalist ideology, Costa and Kahn (2013)

The main research question of this paper is: Does the effectiveness of energy conservation "nudges" depends on an individual's ideology? Or in other words, are there different effects of conservations "nudges" depending on an individual ideology? The authors assess this question empirically using a randomized experiment. They show how individuals with different ideology have different responses in their behavior after receiving the same treatment of energy conservation "nudges."

The data that the authors used came from different sources. First, they use the residential billing data from January 2007 to October 2009, where they get information about the consumption of energy in the household. Particularly, kilowatt-hours purchased per billing cycle, the length of the billing cycle (measured in days), whether the house uses electric heat, and whether the household is enrolled in the electric utility's program to purchase energy from renewable sources. Secondly, the treatment and control data of the experiment that includes information about the timing of the treatment for each household, the square footage, the type of heat system, and the age of the house. Finally, for the ideology information, they use the individual voter registration and marketing data. In this dataset, they have the household's party affiliation, and whether the individual donates to environmental organizations.

The households that participate in the randomized experiment where selected from 85 census tracts with a high density of single-family homes. All of them had to have a current account with the electric utility (active for at least one year), not apartment buildings and a house with square footage between 250 and 99,998 square feet. From this sample, the households were grouped on "block batches" of five contiguous census blocks. If a block batch was assigned to the treatment group then a contiguous census block batch was assigned to the control group. They continue the random assignment process until they had 35,000 treatment and control households, the remaining households in the sample where assigned to the control group. The treatment households received with their electric utility bill was a Home Electricity Report. The Home Electricity Reports consists of two page of information about the household's electricity consumption. The first page compares the electricity consumption of the household with neighboring similar households and with the 20th percentile of electricity usage. The second page compares the usage of the household with its consumption the same month the year before. The HER report's experiment was already evaluated in previous studies, not only as an average treatment effect but also how its effectiveness varies by socio-economic characteristics. The extra layer of participant heterogeneity Costa and Kahn control for is the ideology of the individuals getting the nudges. In the paper, the ideology was measured in different ways: the registered political party, an indicator of living in a liberal or conservative community, if they are willing to pay for renewal resources energy and if they donate to environmental organizations.

Adding the ideology layer of heterogeneity, the authors find that the effectiveness of HER reports changes by ideology. Specifically, the treatment reduces the mean daily kWh consumption on 1.7% for a conservative household and 2.4%

for a liberal. Homes that purchase energy from renewal resources reduce their consumption 0.9% more than the ones who aren't. Similarly, those donating to environmental organizations reduce their 1.1% more compared to non-donors. In conclusion, energy conservation "nudges" are more effective on liberal and environmental households/communities.

3 Analytical Exercise

A new experiment aims to estimate the effect of receiving text message reminders on vaccination uptake. One hundred and fifty clinics, each with 600 eligible patients, are willing to participate. There is a fixed cost of $100 for each clinic you want to work with, and it costs $1 for each text message that you want to send. Further, any clinics that you are working with will measure the outcome (whether someone received a vaccination) for free. Assume that you have a budget of $\$1,000$.

(a) Under what conditions might it be better to focus your resources on a small number of clinics and under what conditions might it be better to spread them more widely?

There are two criteria to think about the trade-off between the number of clinics and the number of treated patients we are going to include in the experiment. First, we need to think about possible spillover effects (first part of SUTVA) of the treatment within patients in the same clinic. If we assume there are spillover effects, the vaccination uptake of patients in the control group is going to be affected by the text message reminders sent to treated patients. In this scenario, if we merely compare control and treated patients the average treatment effect is going to be biased. In this case, we will need to do the randomization at a cluster level, that in this case, it could be at clinic level or some other grouping inside a clinic that can assure that patients between groups are not going to influence each other's behavior. Doing the randomization at a cluster level will demand more clinics.

Secondly, we need to think about our targeted population and the external validity of our experiment. If the people that attend the same clinic is representative of the targeted population, we will want to focus our resources on a small number of clinics. If on the contrary, the people who attend a particular clinic is homogeneous in its socioeconomic characteristics, it is better to spread more widely across clinics to have a more representative population. In other words, depending on how we choose our targeted population we need to think about a trade-off between variance and bias.

(b) What factors would determine the smallest effect size that you will be able to reliably detect with your budget?

To see what factors would determine the smallest effect size that we will be able to detect with our budget is useful to think about the minimum detectable effect size (MDE). Assuming that we conducted the randomization at the patient level, for a given power κ and significance level α this is going to be:

$$MDE = (t_{1-\kappa} + t_{\alpha})SE(\hat{\beta})$$

$$MDE = (t_{1-\kappa}+t_{\alpha}) \left(\frac{1}{nJ-1} \left(\frac{PNVar(Y_i(0))}{(1-P)N} + \frac{(1-P)NVar(Y_i(1))}{PN} + 2Cov(Y_i(0), Y_i(1)) \right) \right)^{1/2}$$

where n is the number of patients in each clinic that for simplicity is going to be equal for all the clinics and J is the number of clinics. P is the proportion of treated patients. All of this variables determine the size of the minimum effect in a different manner depending on our assumptions and knowledge about the potential outcomes variance and covariance. If we assume homosckedasticity (as in Duflo, et.al, 2007) , $Var(Y_i(1)) = Var(Y_i(1)) = \sigma^2$ this expression can be written as:

$$MDE = (t_{1-\kappa} + t_{\alpha}) * \sqrt{\frac{\sigma^2}{nJP(1-P)}}$$

In this case, we will like to make N as large as possible and $P = 0.5$.

References:

- Duflo, E., Glennerster, R., & Kremer, M. (2007). Using randomization in development economics research: A toolkit. Handbook of development economics, 4, 3895-3962.