# Problem Set #5

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## Problem 1: Experiments on Amazon Mechanical Turk

**(a).** Experiment Title: 'A survey about your thoughts'. The description mentions that it is an experiment about understanding people's perceptions. See Figure 1 (Appendix) for the screenshot of the experiment.

**(b).** A total reward of $0.30 is given for completing the survey.

**(c).** Qualifications required were: (1) location in the US and (2) HIT approval rate of at least 95%. There were no mentions about the education levels/age of the survey taker or restrictions on the number of times the survey can be taken by a user.

**(d).** The survey takes ∼10 mins for completion. Thus, implied hourly rate is:

$$r_h = \$0.30/10 * 60 = \$1.80/hour$$

**(e).** The job expires on 11/13/18.

**(f).** Cost for 1 million survey observations = $0.30 * 1,000,000 = $300,000.

## Problem 2: Costa and Kahn (2013)

In this paper, Costa and Kahn extend the electricity market study by Schultz et al. They focus on the research question: *'How does the political ideology of a household affect its response to the Home Energy Report (HER) electricity feedback?'*

The authors rely on two separate data sources to answer their question. One is an electricity utility company. This source provided two datasets. The first was a billing dataset containing residential billing information from 01/2017 to 10/2009. It included data about the total kWh bought by each household, the number of days in the billing cycle, type of heating in the house (electric or other), and if the household purchased renewable energy from the company. The second dataset from the company was a 2009 survey containing feedback about the HER reports from 1,061 households. The other data source was a third-party aggregator website, www.aristotle.com. That data contained information about the party affiliation of the people named in the electricity bills, their donation history towards environmental causes, and the share of college educated people in the block. The authors link data from these sources to a treatment-control dataset that contains information about the timeline of receipt of

HER, size (in sq. ft), heating type, and age of building for each household.

After linking all the data sources, the study uses 81,772 households as the total subjects for the experiment. The control group contains 48,058 households. Of the remaining 33,664 households in the treatment group, 24,028 received monthly HERs and 9,636 received quarterly HERs as treatment. Although the control and treatment groups were more-or-less representative of all the homeowners in the country, the experiment homes consumed more electricity; had richer, more educated and older occupants; and were more likely to have electric heating. Between the two treatment groups, the households in the group receiving the quarterly report were more likely to be liberals. Thus, the authors hypothesize that conservatives were on average treated more intensely and hence if the political ideology did not matter, they would be more responsive in changing their electricity consumption pattern after the study.

With this experiment, this study tries to understand how results from the Schultz et. al study would vary between households grouped based on ideology. To study this hypothesis, new variables such as party affiliation, donation to environmental causes, enrollment in alternate energy plans, and political composition of neighborhoods are introduced. Additional control variables such as age of head, total income, footage, heating type, age, family size, and education levels in the neighborhood for each household are also included to single out the treatment effect.

The study finds that households that had 'politically liberal' characteristics (i.e. are affiliated to a liberal party, enrolled renewable energy plans, have donated to environmental causes, and are located in a predominantly liberal neighborhood) were more likely to cut down on electricity usage more drastically following the receipt of HER reports. On the other hand, households in the diametrically opposite end of the spectrum (i.e. with conservative beliefs, no donation for environmental causes etc.) were more likely to opt-out of, to dislike and to discredit the reports.

**Problem 3: Analytical Exercise**

**(a).**

A smaller number of clinics would be more preferable in the cases when:

1. *A large treatment group is required or when the same group has to be treated multiple times.* Since the budget is limited, choosing less number of clinics would give the researchers more money to be alloted for the purpose of sending text messages.

2. *Researchers prefer logistic ease.* Picking lower number of clinics would mean that there would be less effort needed for coordination.

A larger number of clinics would be more preferable in the cases when:

1. *There is a risk of 'spillover effect'.* If there is a higher likelihood of interaction between patients of the same clinic, there could be a 'spillover' of the treatment.

That is, the information passed to a treatment group patient can find its way to a control group patient through their interactions. This would make it difficult to isolate the effect of the treatment. In this case, choosing clinics that are farther away geographically might be a solution.

2. *Stronger argument for generalization.* When patients from multiple clinics participate in the study, they would be more representative of the general population as compared to a sample drawn from a lower number of clinics (unless there exists no significant difference between various clinics and their patients). Hence, the results using more clinics would be more applicable to the wider population.

**(b).** Two factors that will decide the smallest effect size that can be reliably detected with the given budget are:

1. *Sample Size*: Larger the sample size, more the precision, and hence lower the error. This makes it possible to detect smaller effect sizes. However, the budget is fixed, and this fixed budget needs to be split between the number of participating clinics, the number of people in the treatment group and the intensity of treatment (i.e. no. of text messages per person). If the sample size of people participating in the experiment has to increase, both the number of clinics and the treatment intensity has to decrease. So, while increasing the sample size, consideration has to be given for the experiment design and the spillover effect.

2. *Estimator Choice*: The difference in difference estimator has (i) less standard deviation, (ii) can control for change in outcome caused by factors other than the treatment, and (iii) is independent of the starting points of the outcomes of the two groups (because only the change in values is calculated) as compared to the difference in average estimator. Hence the difference in difference estimator is more adept at handling smaller size effects.

# Appendix

## Figure 1: Mechanical Turk Experiment