**ECO220Y: Homework 17**

**<u>Note:</u>** Do all calculations *without* software. Instead, *use the statistical tables from our course website*. Use approximation based on these tables when necessary.

**Required Exercises:** <u>Chapter 14</u>: 1, 3, 7, 9, 11, 13, 15, 23, 35, 37, 39, 41, 63

**Required Problems:**

**(1)** Recall Karlan and List (2007) "Does Price Matter in Charitable Giving? Evidence from a Large-Scale Natural Field Experiment" first discussed in Lecture 12. For people in the control group (those offered no match) who gave money to the charity in response to the solicitation, we obtain this STATA summary of the amount donated (in dollars).

```
. summarize amount if (gave==1 & control==1), detail

                           amount
-------------------------------------------------------------
      Percentiles      Smallest
 1%            3              2
 5%           10              2
10%           10              3       Obs                 298
25%           20              5       Sum of Wgt.         298

50%           25                      Mean           45.54027
                        Largest       Std. Dev.      41.37982
75%           55            150
90%          100            160       Variance        1712.29
95%          125            250       Skewness       1.906669
99%          160            300       Kurtosis       8.734306
```

For people in the treatment groups (those offered a 1:1, 2:1 or 3:1 match) who gave money to the charity in response to the solicitation, we obtain these STATA summaries of the amount donated.

```
. summarize amount if (gave==1 & ratio==1), detail

                           amount
-------------------------------------------------------------
      Percentiles      Smallest
 1%            5              3
 5%           10              3
10%           10              5       Obs                 231
25%           20              5       Sum of Wgt.         231

50%           25                      Mean           45.14286
                        Largest       Std. Dev.      47.09741
75%           50            200
90%          100            250       Variance       2218.166
95%          125            250       Skewness       3.243264
99%          250            400       Kurtosis       19.01166
```

```
. summarize amount if (gave==1 & ratio==2), detail

                            amount
-------------------------------------------------------------
      Percentiles      Smallest
 1%            3              1
 5%           10              2
10%           10              3       Obs                 252
25%           20              5       Sum of Wgt.         252

50%           25                      Mean            45.3373
                        Largest       Std. Dev.      43.26304
75%           50            160
90%          100            200       Variance       1871.691
95%          125            300       Skewness       2.375049
99%          200            300       Kurtosis       11.64395

. summarize amount if (gave==1 & ratio==3), detail

                            amount
-------------------------------------------------------------
      Percentiles      Smallest
 1%            2              1
 5%          7.5              1
10%           10              2       Obs                 253
25%           20              2       Sum of Wgt.         253

50%           25                      Mean           41.25178
                        Largest       Std. Dev.      35.35036
75%           50            125
90%          100            150       Variance       1249.648
95%          100            200       Skewness       1.663551
99%          150            200       Kurtosis       5.794014
```

**(a)** Conditional on giving money, did offering a 1-to-1 match versus no match increase the amount donated? Similarly, did a 2-to-1 match increase the amount compared to no match? Similarly, did a 3-to-1 match increase the amount compared to no match? Write out the formal hypotheses in each case. Do you need to do formal hypothesis tests to determine the answers? If you did those tests, what kind of P-values would you obtain? (Be as specific as possible without actually calculating them.)

**(b)** Given what you found in part **(a)**, which part of the abstract (reproduced below) is potentially misleading?

> **ABSTRACT:** We conducted a natural field experiment to further our understanding of the economics of charity. Using direct mail solicitations to over 50,000 prior donors of a nonprofit organization, we tested the effectiveness of a matching grant on charitable giving. We find that the match offer increases both the revenue per solicitation and the response rate. Larger match ratios (i.e., \$3:\$1 and \$2:\$1) relative to a smaller match ratio (\$1:\$1) had no additional impact, however. The results provide avenues for future empirical and theoretical work on charitable giving, cost-benefit analysis, and the private provision of public goods.

**(c)** Suppose that someone in the 3:1 match group gave $10,000 instead of $200 to yield this STATA summary.

```
. summarize amount if (gave==1 & ratio==3), detail

                           amount
-------------------------------------------------------------
      Percentiles      Smallest
 1%            2              1
 5%          7.5              1
10%           10              2       Obs                 253
25%           20              2       Sum of Wgt.         253

50%           25                      Mean           79.98696
                        Largest       Std. Dev.      627.0578
75%           50            125
90%          100            150       Variance       393201.5
95%          100            200       Skewness       15.74193
99%          150          10000       Kurtosis       249.5389
```

Suppose you did not check this detailed summary, but instead just looked at the mean and standard deviation. In this particular case, should the mean and s.d. ($79.99 and $627.06) have alerted you to the presence of an outlier (or outliers)? If you made the mistake of going ahead with the analysis, would you conclude that there is a statistically significant difference in the amount donated comparing a 3:1 match with a 2:1 match? An economically significant difference? A significant difference?

**(2)** For 1,200 credit card customers the amount spent (on that credit card) each month for four months (December 2012, January 2013, February 2013, March 2013, and April 2013) is recorded in the raw data ("credit_spending.xlsx") on our course site right next to this homework. Here is an excerpt of those data:

| customer_name | dec12 | jan13 | feb13 | mar13 | apr13 |
|---:|---:|---:|---:|---:|---:|
| Abdul, Qiting | 185.86 | 49.09 | 35 | 0.61 | 320 |
| Abraham, Mikail | 2380.32 | 979.05 | 2244.96 | 1227.3 | 1599.4 |
| Abramyan, Yi | 12.06 | 6.03 | 4.46 | 573.86 | 273.9 |
| … | | | | | |
| Zou, Sui | 889.6 | 256.8 | 685.19 | 1664.19 | 65 |
| Zou, Yu | 0 | 136.14 | 196.12 | 84.98 | 43.99 |

You can look at those raw data and do calculations in Excel to check your work, however, for this question please answer as if you were writing a test (i.e. without a computer) and using the summary statistics below.

```
. correlate dec12 jan13 feb13 mar13 apr13
(obs=1200)

             |    dec12    jan13    feb13    mar13    apr13
-------------+---------------------------------------------
       dec12 |   1.0000
       jan13 |   0.5298   1.0000
       feb13 |   0.4862   0.4843   1.0000
       mar13 |   0.5075   0.4555   0.4985   1.0000
       apr13 |   0.3961   0.3853   0.3442   0.4852   1.0000
```

```
. summarize dec12, detail

                            dec12
-------------------------------------------------------------
      Percentiles      Smallest
 1%            0        -176.17
 5%        21.11        -155.13
10%       47.215           -135       Obs                1200
25%       155.16        -128.21       Sum of Wgt.        1200

50%      546.355                      Mean            728.182
                        Largest       Std. Dev.      644.6249
75%      1186.98        2440.43
90%     1734.625        2467.01       Variance       415541.3
95%       1970.7        2469.91       Skewness       .7670922
99%      2365.02        2497.54       Kurtosis       2.541951

. summarize jan13, detail

                            jan13
-------------------------------------------------------------
      Percentiles      Smallest
 1%      -23.965         -496.2
 5%        15.73        -412.38
10%       35.845         -299.8       Obs                1200
25%       115.23        -242.62       Sum of Wgt.        1200

50%      377.925                      Mean           564.9852
                        Largest       Std. Dev.       565.011
75%      895.015        2402.17
90%      1404.61        2416.42       Variance       319237.4
95%      1779.61         2434.3       Skewness       1.185705
99%      2307.63        2471.73       Kurtosis       3.785926

. summarize feb13, detail

                            feb13
-------------------------------------------------------------
      Percentiles      Smallest
 1%            0        -123.29
 5%         16.8         -76.77
10%        35.69         -56.32       Obs                1200
25%       115.89            -29       Sum of Wgt.        1200

50%       380.48                      Mean            565.605
                        Largest       Std. Dev.      563.3056
75%       852.64        2402.01
90%     1411.115        2403.03       Variance       317313.2
95%     1788.985        2407.01       Skewness       1.235567
99%     2284.775        2445.65       Kurtosis       3.877813
```

```
. summarize mar13, detail

                            mar13
-------------------------------------------------------------
      Percentiles      Smallest
 1%          -30        -519.49
 5%        10.15        -230.04
10%       30.035        -214.27       Obs                1200
25%       113.54        -159.26       Sum of Wgt.        1200

50%      402.225                      Mean            602.761
                        Largest       Std. Dev.      602.0878
75%       949.64        2451.13
90%      1500.75        2487.55       Variance       362509.8
95%     1901.625         2488.5       Skewness       1.105214
99%      2321.98        2497.49       Kurtosis       3.453496

. summarize apr13, detail

                            apr13
-------------------------------------------------------------
      Percentiles      Smallest
 1%      -35.095        -256.19
 5%            0        -216.95
10%       14.105        -170.63       Obs                1200
25%       78.665        -143.36       Sum of Wgt.        1200

50%       296.59                      Mean           479.0528
                        Largest       Std. Dev.      525.2633
75%      695.755        2402.62
90%      1251.29        2427.66       Variance       275901.5
95%     1641.305        2442.92       Skewness       1.466265
99%      2140.23        2467.93       Kurtosis        4.76434
```

**(a)** Comparing December versus January, January versus February, and January versus March, for a total of three comparisons, are there statistically significant differences in mean spending by month? How strong is the evidence of a difference in each case?

**(b)** Again considering those three comparisons of months, how large are any differences in mean spending? (Hint: Make sure to make an inference about all customers, not just reporting on your sample of 1,200, and make sure to include a margin of error for your inferences.)

**(c)** If in answering the previous two parts you made the serious error of failing to recognize that these data are paired, what effect would you expect that to have on your answers to parts **(a)** and **(b)**? (Note: This is a conceptual question and it is not asking you to re-do all the calculations above using an incorrect method.)

**(3)** A researcher wishes to make an inference about the difference between the average price in monopolized markets and competitive markets for retail gasoline. There are two research questions: (Q1) Do the data provide sufficient statistical support for the claim from basic microeconomic theory that less competition means higher prices for consumers? and (Q2) How big of a price premium do monopolists charge? The following data are available.

4 monopolized retail gasoline markets: 1.88 1.90 1.86 1.84
mean: $1.87 per gallon; sd: $0.026 per gallon

8 comparable but competitive markets: 1.79 1.69 1.87 1.86 1.66 1.86 1.91 1.76
mean: $1.80 per gallon; sd: $0.091 per gallon

**(a)** Which general method of statistical inference is most appropriate to address Q1? How about Q2? Explain in words. [This is a qualitative question not a quantitative one.]

**(b)** What kind of data are these? (cross-sectional, times series, panel) (observational, experimental, natural experiment) Explain.

**(c)** Draw a diagram like we did in Lecture 4 (with the boxes and arrows) for this example that illustrates the effect that we are interested in and any confounding (unobserved/lurking/omitted) variables.

**(d)** Using your diagram, explain why the presence or absence of a monopolist is an endogenous variable and how that will affect our inference regarding the research question.

**(e)** We choose "comparable" locations in an attempt to hold "other things equal" and hence to isolate the impact of monopolization. Explain how your answer to part (d) is related to the challenge of picking otherwise comparable locations when looking for monopolized and competitive markets to compare.

**(f)** Are prices higher, in a statistically significant way, in markets that are monopolized compared to competitive? Is this the same question as Q1?

**(g)** If we find that prices are significantly higher, can we conclude that monopolies cause higher prices? Carefully explain your answer.

**(4)** Consider this study about people claiming to have degrees (from institutions like U of T) that they have not actually earned: Attewell, P. and T. Dominab (2011) "Educational imposters and fake degrees" dx.doi.org/10.1016/j.rssm.2010.12.004. This study started with a well-known data set *The National Education Longitudinal Study*: a representative sample of U.S. 8th graders in 1988 & in 1994, 2000 (same people all 3 years) and conducted the *Postsecondary Education Transcript Study* where the researchers obtained the original higher education transcripts for those in NELS claiming higher ed. (~9,600 of ~12,100 participants). They "requested transcripts from 3,200 institutions… institutional response rate of approximately 88%." Of 3,343 claiming a BA (Bachelors of Arts), 185 were fake (5.53%). On pp. 61 & 68 the paper states:

> Our analyses hinge on the assumption that respondents who have misreported their credentials to NELS survey researchers on multiple occasions also misstate their credential to employers... Although we cannot directly test this assumption, the paper concludes with a comparison between fake and legitimate degree holders on earnings and wages. .. We found no significant wage differences between people with true and fake degrees.

**(a)** Reread the last sentence in the excerpt above. Write down the formal hypotheses and say which method – of all the methods you have learned in Chapters 11, 12, 13, and 14 – would be used in this test.

**(b)** Suppose the researchers wondered if those with fake degrees are more likely to be unemployed. Write down the formal hypotheses and say which method – of all the methods you have learned in Chapters 11, 12, 13, and 14 – would be used in this test.

**(c)** For Part (a), how would you find the point estimate of the difference? For Part (b), how would you find the point estimate of the difference?

**(d)** Again referring to the last sentence, what do the authors mean by "significant"? Be context specific.

**(e)** Should you conclude that getting a real degree has no value beyond giving you a credential on your resume?

**(5)** Recall the paper discussed in class: "Medicaid Increases Emergency-Department Use: Evidence from Oregon's Health Insurance Experiment" published in *Science* in January 2014. (DOI: 10.1126/science.1246183). Next, the paper's abstract, a description of a key table, and a copy of that table are reproduced.

***Abstract:*** In 2008, Oregon initiated a limited expansion of a Medicaid program for uninsured, low-income adults, drawing names from a waiting list by lottery. This lottery created a rare opportunity to study the effects of Medicaid coverage using a randomized controlled design. Using the randomization provided by the lottery and emergency department records from Portland-area hospitals, we study the emergency department use of about 25,000 lottery participants over approximately 18 months after the lottery. We find that Medicaid coverage significantly increases overall emergency use by 0.41 visits per person, or 40 percent relative to an average of 1.02 visits per person in the control group. We find increases in emergency-department visits across a broad range of types of visits, conditions, and subgroups, including increases in visits for conditions that may be most readily treatable in primary care settings.

***Excerpt (p. 265):*** We report the estimated effect of Medicaid on emergency department use over our study period (March 10, 2008 – September 30, 2009) in the entire sample and in subpopulations based on pre-randomization emergency department use. For each subpopulation, we report the sample size, the control mean of the dependent variable (with standard deviation for continuous outcomes in parentheses), the estimated effect of Medicaid coverage (with standard error in parentheses), and the p-value of the estimated effect. Sample consists of individuals in Portland-area zip codes (N=24,646) or specified subpopulation.

**Table 2. Emergency-department use**

| | | *Percent with any visits*[1] | | | *Number of visits*[2] | | |
|---|---|---|---|---|---|---|---|
| | N | Percent in Control Group | Effect of Medicaid Coverage | P-value | Mean Value in Control Group | Effect of Medicaid Coverage | P-value |
| **Panel A:** Overall | | | | | | | |
| All visits | 24,646 | 34.5 | 7.0 (2.4) | 0.003 | 1.022 (2.632) | 0.408 (0.116) | <0.001 |
| **Panel B:** By emergency department use in the pre-randomization period | | | | | | | |
| No visits | 16,930 | 22.5 | 6.7 (2.9) | 0.019 | 0.418 (1.103) | 0.261 (0.084) | 0.002 |
| One visit | 3,881 | 47.2 | 9.2 (6.0) | 0.127 | 1.115 (1.898) | 0.652 (0.254) | 0.010 |
| Two+ visits | 3,835 | 72.2 | 7.1 (5.6) | 0.206 | 3.484 (5.171) | 0.380 (0.648) | 0.557 |

[1] For the percent-with-any-visits measures, the estimated effects of Medicaid coverage are shown in percentage points.
[2] The number-of-visits measures are unconditional, including those with no visits.

**(a)** Looking at Panel B, why isn't the mean usage of the ED (emergency department) for those with "No visits" zero? Similarly, why isn't the mean visits of those with "One visit" one?

**(b)** Locate the P-value of 0.019 in Table 2. Show all the work to calculate it. (In other words, write down the hypotheses and do the test yourself using the relevant information in the table.)

**(c)** Locate the P-value of 0.002 in Table 2. Show all the work to calculate it. (In other words, write down the hypotheses and do the test yourself using the relevant information in the table.)

**(d)** The results are not statistically significant in the last row of Panel B. This lack of statistical significance is not that surprising compared to the statistically significant results in Panel A because that subsample (Two + visits) has a sample size of only 3,835 versus 24,646 in Panel A. (In other words, they broke the sample up into three sub-samples.) Because the sample size is much smaller, sampling error goes up and that increases the standard errors and P-values. But then why in the second to last row of Panel B (One visit), which also has a sample size less than 4,000, is there a small P-value for the difference in mean ED visits?