AREC 815: Experimental and Behavioral Economics

Problem Set 4

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Fall 2016

Problem Set 4 is due by the end of the day on December 2.

1. Consider the three-period model of addiction discussed in class. Within each period, consumption utility is given by:

$$u_t(a_t, k_t) = \begin{cases} x - \rho k_t & \text{if } a_t = 1 \\ 0 - (\rho + \sigma) k_t & \text{if } a_t = 0 \end{cases}$$

   Total utility is the sum of utility in the current period and discounted future utility:

$$U_1 = u_1 + \beta\delta u_2 + \beta\delta^2 u_3$$
$$U_2 = u_2 + \beta\delta u_3$$
$$U_3 = u_3$$

   Consider an individual who is already *addicted* at time $t = 1$.

   (a) Under what conditions would a time-consistent individual (with $\beta = 1$ and $\delta < 1$) quit at time $t = 1$?

   (b) Under what conditions would a sophisticated present-biased individual (with $\hat{\beta} = \beta < 1$ and $\delta < 1$) quit at time $t = 1$?

   (c) Under what conditions would a naive present-biased individual (with $\beta < 1$, $\hat{\beta} = 1$ and $\delta < 1$) quit at time $t = 1$?

2. You are attempting to replicate the Convex Time Budget (CTB) experiment described in Balakrishnan, Haushofer, and Jakiela (2015). You've run 4 pilot sessions, and you are hoping to use the data from the pilot sessions to do a power calculation and decide how many experimental sessions you'll need in total. The data set `arec815ps4data.dta` contains data on the CTB decisions of the 75 subjects who participated in your initial pilots.

   The do file `arec815ps4q2.do` replicates Columns 1 and 5 of Table 2 in the paper for the 75 subjects included in the pilot. Modify the code so that you also replicate Columns 2 and 6 from Table 2, and then present your output in a table (so, there should be 4 columns in your table). Summarize the findings from the pilot data.

3. We can reject the hypothesis that $\beta = 1$ in the NLS specification (in Column 1), but not in the Tobit (in Column 5). We'd like to conduct a power calculation to identify the approximate sample size we should need to have a power of 0.8 to detect an effect of the size that we

observe in the pilot data. In other words, how large would the sample need to be if we wanted to reject the hypothesis that $\beta = 1$ 80 percent of the time, given the magnitude of the deviations from exponential discounting that we observe in the pilot data?

Write a program that answers this question by going through the following steps:

(a) Expand the sample so that you have 8 copies of each observation (for a total of 600 observations). This will allow you to use the `bsample` command to draw bootstrapped samples from the pilot data (the `bsample` command will not draw a bootstrapped sample that is larger than the initial sample). The program `arec815ps4q3.do` does this.

(b) Generate any additional variables that you will need to estimate the specification reported in Column 5 of Table 1 in the original paper.

(c) Since Column 5 of Table 1 does not include any independent variables that differ across subjects, bootstrapping simply involves drawing a bootstrapped sample (i.e. a sample of size N that is drawn with replacement from the pilot sample) and running the relevant estimation code (to estimate the specification in Column 5 of Table 2 in the paper). Write a program that does this 20 times (for 20 different bootstrapped samples) at each possible N from 50 to 500 observations. At each iteration, record whether you reject the hypothesis that $\beta = 1$ or not (at the 95 percent confidence level).

(d) Plot your results: make a graph that plots the relationship between the sample size and the empirical probability of rejecting the hypothesis that $\beta = 1$.

(e) Based on your results, what sample size gives you a power of 0.8 to detect deviations from exponential discounting as large as those observed in the data?