EC428/528: Problem Set 1
Due in class on Wednesday, April 13th

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1 Theory (40 points)

Consider a consumer whose income is \$100. Her utility function is given by:

$$U(X, Y, c) = ln(X) + Y.$$

$ln(\cdot)$ is the natural logarithm. The derivative of the natural logarithm is $dln(X)/dX = 1/X$.

1.1. Standard Utility Maximization (10 points)

1.1.1. The price of both X and Y is 1 but X is taxed at 10%. What is the consumer's budget constraint?

1.1.2. How much of X and Y does the consumer buy?

1.1.3. $U(X, Y) = ln(X) + Y$ is called a quasi-linear utility function. Often, it is used when good Y is money an X is a product (like tacos or t-shirts). What property of this utility function makes it a good one to use when one of the goods is money?

1.2. Utility Maximization with Limited Attention (25 points)

Now, suppose the consumer's utility function is given by:

$$U(X, Y, c) = ln(X) + Y - \nu c.$$

where c equals 0 if the consumer does not pay attention to the sales tax (assumes price is 1 when it is actually 1.1) and 1 if the consumer does pay attention (correctly assumes price is 1.1). Therefore, νc is the psychic cost of paying attention.

1.2.1. Suppose the consumer pays attention to the tax ($c = 1$). How much X and Y should the consumer purchase?

1.2.2. What is the consumer's utility (this will depend on ν)?

1.2.3. Suppose the consumer does not pay attention to the tax ($c = 0$). Solve for the optimal consumption choices in two steps. First, calculate the optimal relationship between X and Y assuming the prices are both 1. Second, use this derived relationship and the actual budget constraint to solve for the quantities. What is the consumer's utility?

1.2.4. For what values of ν is it optimal for the consumer to pay attention to taxes?

1.3. Who pays for a sales tax (the consumer, the store, or someone else)? (5 points)

2 Evidence (25 points)

This question will be about the paper "Salience and Taxation: Theory and Evidence" by Raj Chetty, Adam Looney, and Kory Kroft. You can find this paper on Canvas under "Course Readings." You are **not** expected to read and understand the whole paper.

2.1. What is their research question? Why is it interesting? (5 points)

2.2. Describe their experiment. Why is an experiment necessary? (10 points)

2.3. Interpret the coefficient (-13.12) and standard error (4.89) in Table 4, Column 2. What does this teach us? (10 points)

3 Standard Errors (25 points)

You can use whatever computer program you would like for this exercise, but I recommend using R and will give tips on how to do it in R throughout. (R can be downloaded for free from `https://www.r-project.org/`.)

We are going to explore what standard errors are using a simulation.

1. Draw 10 random variables which are normally distributed with a mean of 5 and a standard deviation of 5. In R, you can use the *rnorm* function for this. Type "?rnorm" to read the help file.

2. Calculate the mean of the 10 random variables you just drew. How does it compare to the true population mean. In R, you can use the *mean* function for this.

3. The formula for the standard error of a mean is $\hat{SE} = \frac{\hat{\sigma}}{sqrtN}$ where $\hat{\sigma}$ is the standard deviation of the data and N is the number of observations. What is $\hat{SE}$ based on the data you drew in step 1.

4. Repeat steps 1 and 2 $1,000$ times, save the results, and plot a histogram of the mean across the $1,000$ iterations. In R, you can do this with the following code: *results<-vector(length=1000); for (i in 1:1000) {; results[i]<-mean(rnorm(10,mean=5,sd=5)); }; hist(results).*

5. What is the standard deviation of means across the 1,000 simulations? In R, you can use the "sd" command for this.

6. How do your answers to parts 3 and 5 compare?

4 Applications (10 points)

4.1. Comment on the following statement: "I was at dinner with a bunch of economists. All of us ordered dessert, but I was the only one who finished it. A colleague looked at my finished plate and said it was very likely that I ate more or less than the amount of food I wanted."