Econ 312 Part B, Spring 2022
Problem Set 2
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1. Answer the questions embedded in the econometric causality model hand-outs based on Heckman (2008).

2. Answer the questions embedded in the "Classical Discrete Choice Theory" handout.

3. For the model $Y = X_1\beta_1 + X_2\beta_2 + U$,

$$E(U \mid X_1, X_2) = 0$$

$$\sum_{X_1,X_2} \text{ full rank,}$$

   discuss and compare the properties of the three estimators:

   (a) OLS β_1.

   (b) $\hat{\beta}_1$ from a regression of Y on X_1 alone.

   (c) $\hat{\beta}_1 = \begin{cases} \beta_1 \text{ OLS,} & \text{if } t_{\hat{\beta}_1} \geq 2 \\ \hat{\beta}_1, & \text{otherwise (from a regression of } Y \text{ on } X_1 \text{ alone).} \end{cases}$

4. Answer the questions embedded in the "Hypothesis Testing: Part I" handout.

5. Answer the questions embedded in the "How to Correct for Sampling Biases" handout.

6. Answer the questions embedded in the "Roy Models of Policy Evalua-
   tion" handout.

7. Answer the questions embedded in the "Notes on Identification of the
   Roy Model and the Generalized Roy Model" handout.

8. Access the data set at `https://cehd.uchicago.edu/wp-content/uploads/`
   `2022/05/Q8.zip`. Apply the Generalized Roy model to analyze each
   data set. In particular, consider

$$Y_1 = \mu_1(X) + U_1$$

$$Y_0 = \mu_0(X) + U_0$$

$$C = \phi(Z) + U_c$$

and

$$D = \mathbb{1}\left(Y_1 - Y_0 - C > 0\right)$$

$Y = DY_1 + (1 - D)Y_0 \ (X, Z) \perp\!\!\!\perp (U_1, U_0, U_c). \ (U_1, U_0, U_c) \sim \mathcal{N}(0, \Sigma).$

Assume the specification:

$$\mu_1(X) = \beta_1 X + U_1$$

$$\mu_0(X) = \beta_0 X + U_0$$

$$C = \beta_C Z + U_c$$

(a) Estimate, for a given X, $\Pr(D = 1)$ for each data set and graph the

estimate as a function of Z. What is the subjective treatment effects for each data set? Define the graph for each data set.

(b) Use the normal selection correction model to estimate β_1 and β_0. Using your estimates, identify:

    (i) ATE

    (ii) TT

    (iii) TUT

    (iv) PRTE (for policy change Z): Consider the policy changes Z to Z' where $Z = 0.5$ and $Z' = 1$ as well as for $Z' = -0.5$.

    (v) MTE

    (vi) LATE

(This asks you to use the selection corrected estimates to identify each parameter.)

(c) Use the instrument Z to identify the same parameters as in 8(b) (i.e., define LATE and address what it identifies). Compare your estimates. Interpret LATE in terms of the MTE.

(d) Does LATE identify subjective treatment effects?

(e) Using your estimates from 8(b) and 8(c), compute the gain (or loss) surplus from changing Z to Z' where $Z = 0.5$ and $Z' = 1$ as well as for $Z' = -0.5$. Write out the formula and compute.