Problem Set 8
Econ 312, Spring 2019
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Due May 30th, 2019
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1. [30 pts] Answer all of the questions in the posted handout "*Causality in Econometrics and Statistics: Structural Models are Causal Models.*"

2. [20 pts] Answer all the questions in the posted handout "*The Principles Underlying Evaluation Estimators.*"

3. [10 pts] Compare ITT with TOT and PRTE. Consider two versions of ITT; conditional on $D = 1$ and unconditional on D.

4. [20 pts] Answer all of the questions in the posted handout "*The Roy Model and the Generalized Roy Model.*" Specifically, how can the price of one skill rise but the wage associated with the skill decline if person i,

$$\text{(wages) } i = \underset{\substack{\uparrow \\ \text{price of} \\ \text{skill}}}{\pi} \quad \underset{\substack{\uparrow \\ \text{quantity} \\ \text{of skill}}}{\text{(skill) } i} \qquad ?$$

(Skill prices are uniform across people)

5. [20 pts] Read the posted handout "*LATE and the Generalized Roy Model: Some Relationships.*"

   (a) Answer the questions embedded throughout the handout.

   (b) Compare LATE and MTE for an instrument Z.

(c) What is the role of $Pr(D = 1|X, Z)$ in (i) LATE, (ii) MTE, (iii) selection bias models, and (iv) in propensity score matching estimators? Relate the parameters if you can.

(d) How does $Pr(D = 1|X, Z)$ naturally emerge as a key variable in LATE and MTE?

6. Continuation of 5. **Bonus – 20 pts**: Under what conditions is the Generalized Roy model identified nonparametrically?

7. [**Bonus: 30 pts**] Read the posted handout "Simultaneous Causality." Consider equations (2a) and (2b). Suppose that

   $(X_1, X_2) \perp\!\!\!\perp (U_1, U_2)$

   $U_1 \not\perp\!\!\!\perp U_2$

   $\gamma_{12} \neq 0$ $\gamma_{21} \neq 0$

   (a) Define the causal effect of Y_2 on Y_1; of Y_1 on Y_2.

   (b) Are these causal effects identified?

   (c) Suppose now that $\beta_{12} = 0$ and $\beta_{21} = 0$; are they identified?

   (d) Suppose instead of (c) that $U_1 \perp\!\!\!\perp U_2$. Are the effects identified? Why or why not?

   (e) Suppose $U_1 = U_2 = 0$, but $\beta_{12} \neq 0$, $\beta_{21} \neq 0$. Is the model identified?