Foundations of Econometrics - Final Exam Pt. II

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You have 75 min to complete the exam and can achieve a maximum of 100 points + 5 bonus points. To receive partial credit show your work and explain your thought process. Keep your answers brief and solve easy questions first.

1 Randomized Controlled Trials

(20 points) You are asked to design a randomized experiment for Airbnb to evaluate the effect of taking professional photos on sales (booking rates). The idea is to help Airbnb decide whether it is profitable to offer hosts the free service of having pictures of the accommodation taken by professional photographers.

1. (10 points) Describe briefly how you would implement the experiment. Discuss on which level you think the randomization should be (country, city, accomodation)? Are you worried about take-up and why?
2. (5 points) Give the formulas for the ATE and ATT, how would you estimate them?
3. (5 points) How could you check if treatment and control groups are truly random?

2 Matching

(20 points) You want to study the effect of soft drink consumption on obesity. You have cross-sectional data on high school pupils' soft drink consumption (an indicator), weight and gender.

The table below shows the joint distribution of gender and soft drink consumption (all entries sum up to one.)

X_i/D_i	0	1
F	0.1	0.35
M	0.15	0.4

And you also have mean weight (in kg) for girls and boys that do and do not consume soft drinks.

X_i/D_i	0	1
F	50	53
M	60	65

1. (12 points) Calculate the ATE and ATT using direct matching. Simply insert the relevant numbers into the formula, no need to solve for the final number.

2. (8 points) Which assumption on potential outcomes and treatment is needed for matching? What about assumptions on $P(D = 1|X)$?

3 Instrumental Variables

(20 points) You would like to study the effect of treatment D on outcome Y but are worried that there was some self-selection into treatment. You are considering using an instrument Z to address this issue.

(a) (10 points) Which conditions must Z satisfy?

(b) (10 points) Assume that treatment effects are heterogeneous, i.e. not all individuals respond to the treatment in the same way. What type of treatment effect can you compute with your instrument? Are there individuals for whom you cannot compute an effect? State the formula of the treatment effect.

4 Regression Discontinuity

(10 points) State the two conditions for Y and D around cut-off z_0 that are necessary for RD. State the regression equation that you would estimate for a sharp design, assuming equal slopes to the right and left of the cut-off.

5 Difference-in-Difference

(10 points) You would like to assess the effect of a treatment on an outcome of interest. There is data for locations A and B over time periods $T = \{0, 1\}$, only location A has been treated in period 1. Graphically illustrate how Diff-in-Diff works on the $Y - T$ plane (replicate the graph from class). In particular, graphically show the effect that is being estimated, making use of the parallel-trends assumption.

6 Applications From Class

(20 + 5 points) Write down the title of your presentation in class. Answer the questions below **for presentations other than your own**.

(a) (10 points) Briefly state the research question, data and findings for a presentations that used a regression discontinuity design. What are variables Y, D and Z and what is the crucial cutoff z_0? Is the design sharp or fuzzy?

(b) (10 points) Briefly state the research question, data, method and findings for one presentation that used difference-in-difference, experiments or matching. Which were the control and treatment groups?

(c) (Bonus 5 points) For one of the above papers write a short critique of a few sentences, stating whether you found the analysis convincing and why. For instance, you can discuss the assumptions, quality of data used, robustness checks performed if any etc.