Experimental Design (27 Questions)

Question 1

As Prof. Duflo explained, two stage least squares (2SLS) is a two step procedure. What is the regressor in the second stage?

- ◯ The estimated effect of your instrument on the regressor of interest in the first stage.
- ◯ The outcome of interest
- ◉ The "fitted" values of the outcome variable in the first stage.
- ◯ The instrumented for variable
- ◯ The "fitted" values of the regressor of interest from the first stage.

✔

Explanation
In the 2SLS procedure, in the first stage: you estimate your first stage equation, in which you regress your instrumented variable on the instrument (same first stage as the Wald estimate). The key difference is that in 2SLS you regress your outcome variable on the saved fitted values from the first stage, rather than the variable itself. The fitted values capture the variation in the instrumented for variable that are a result of variation in the instrument.

Question 2

What is one advantage of two stage least squares relative to a Wald estimate?

- ◉ The instrument (and the variable that it is instrumented for) does not need to be a dummy
- ◯ You do not need to ensure random assignment
- ◯ You do not need to satisfy the exclusion restriction

✔

Explanation
Since a regression is used rather than a ratio, the instrument does not need to be a dummy. You still need to satisfy the restrictions of instrumental variables.

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Question 1

Which of the following is true of the number of required instruments? (Select all that apply)

- [ ] One can use one instrument for two different endogenous explanatory variables in the same regression
- [x] One can use two instruments for two different endogenous explanatory variables in the same regression ✔
- [x] One can use more than two instruments for two different endogenous explanatory variables in the same regression ✔

Explanation
You must have at least as many instruments as you have endogenous explanatory variables (this is referred to as the "rank condition.")

Question 2

Select all that apply: Performing two stage least squares in two steps rather than one will

- [x] Give the correct point estimates
- [ ] Give the correct standard errors
- [ ] Give the incorrect point estimates
- [x] Give the incorrect standard errors

✔

Explanation
The point estimates will be correct because the calculations are the same, but the standard errors will be incorrect because running the second step separately ignores the additional error from estimating the first stage rather than using the observed values.

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Question 3

Which of the following represents the 2SLS estimator that is equivalent to your Wald estimator if your instrument is binary?

- ◯ The coefficient on your explanatory variable in the first stage.
- ◯ The ratio of the coefficients on your explanatory variable in the second stage divided by the coefficient on your explanatory variable in the first stage.
- ◉ The coefficient on the "fitted" explanatory variable in the second stage.
- ◯ The ratio of the coefficients on your explanatory variable in the first stage divided by the coefficient on your explanatory variable in the second stage.

✔

Explanation
If your instrument is binary, then as you saw, your Wald estimator is given by:

$$\frac{\textbf{Reduced Form coefficient on instrumental variable}}{\textbf{First stage coefficient on instrumental variable}}$$

Your 2SLS estimator is just the coefficient on the "fitted" explanatory variable in the second stage. Refer to the slides to see this equivalence mathematically.

Question 1

What variables are included in the Z matrix (the instrument matrix used in the first stage)? (Select all that apply)

- [ ] Outcome variables
- [ ] Instrumented for variables
- [x] Instrumental variables
- [x] Control variables

✔

Explanation
The Z matrix must contain all the exogenous regressors that are part of your first stage, i.e. the instrumental variables and the control variables.

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Question 2

Here is the syntax for the R command to run a 2SLS procedure from the AER package:

```
ivreg(formula, instruments, data, subset, na.action, weights, offset,
contrasts = NULL, model = TRUE, x = FALSE, ...)
```

You want to look at the impact of charter school attendance on test scores. Luckily, you find that a lottery is used to decide which students are selected to attend. So you decide to use the lottery as an instrument for charter school attendance in order to identify your impact. You also have some other data on demographic characteristics that you want to control for.

Which of the following variable(s) do you need to enter in the “instruments” field in the command above to obtain the correct estimates? Select all that apply.

- [x] The lottery outcome variable ✔
- [ ] Charter school attendance
- [x] The demographic characteristics ✔
- [ ] Your test scores variable

Explanation
The “instruments” field here corresponds to your matrix Z from question 1. In this case, your instrument is the lottery outcome, and your controls are the demographic characteristics. So you need to include both these variables in this field.

Question 1

In randomized experiments, we randomize _________.

- (●) Whether the intervention is received
- ( ) Outcomes
- ( ) Strata
- ( ) Individual characteristics

✔

Explanation
It is randomized whether or not someone/something receives an intervention.

Experimental Design (27 Questions)

Question 1

What does it mean to use stratification in randomization?

- ◯ Dropping observations that do not take up the intervention
- ◯ Adding controls for individual characteristics into your regression
- ◯ Focusing on the individuals the intervention affected the most
- ◉ Randomizing among groups that are similar ex-ante (for pre-specified characteristics)

✔

Explanation
Stratification means you randomize among groups that are similar ex-ante. For example, you could split your sample by gender and then randomize only among females and only among males to insure that the treatment and control group had the same number of females and males.

Question 2

Why would you use stratification?

- ◯ Randomizing without strata is not possible
- ◯ Reduce spillover effects
- ◉ Help power by reducing variance in the outcome variable
- ◯ To target your intervention to the neediest

✔

Explanation
Since stratification makes the treatment and control group similar ex-ante, there should be less random variation in the outcome variable (to the extent the variable we used to stratify to predict the outcome). With less random variation, the regressions will have more power to identify the variation caused by the intervention. So stratifying will increase your power by reducing variance for any given sample size.

Targeting your intervention to the neediest is incorrect because randomization is a tool which you can use to assign a sample of individuals to different groups (although you could then decide to also change the probability of treatment within each strata). Reducing spillover effects is incorrect because if there are spillovers between your units of randomization, whether or not you randomized people within strata will not change whether or not there are spillovers. You always can randomize without strata, but you often should include strata because of the power benefits. Another benefit is that it signals ex-ante that these are potentially group of interest. In medicine stratifying ex-ante is a condition for reporting sub-group analysis.

Experimental Design (27 Questions)

Question 1

What does clustered randomization means?

- ◯ Repeating randomization until the control and the treatment are similar
- ◯ Randomizing within each region rather than within your entire sample
- ◯ Randomizing across individuals and not groups
- ◉ Randomizing across groups of units instead of individuals units

✔

Explanation
Clustering means to randomize across groups instead of individuals. For example, one might randomize the treatment across entire schools rather than to individuals within the school.

Question 2

True or False: Any randomized experiment for which your assignment occurs at a group level other than the individual level is a clustered randomized experiment.

Hint: this includes experiments where the unit of analysis is the group

- ◯ True
- ◉ False

✔

Explanation
If the unit of observation for your outcomes is the same unit across which you randomize, that is just a simple RCT where you have a different unit of interest. A clustered randomized experiment is one in which treatment is assigned at a more aggregate level than the observation unit for your outcomes.

Experimental Design (27 Questions)

Question 3

Why would you want to randomize clusters? Select all that apply.

- [ ] Helps power by reducing variance
- [x] When there are significant externalities within the cluster from treating individuals in the cluster ✔
- [x] When it is not practical to randomize at the individual level ✔
- [x] When the cluster is the natural unit of randomization ✔

Explanation
Clustering does not help power and in fact, it reduces power. However, if there are significant externalities ("spillovers"), then clustering may be necessary to ensure that treated individuals do not affect your control individuals. For example if you deworm at the individual level, the externality across kids within the same classroom will bias your estimates downwards.

Sometimes, it will be impractical to give an intervention to individuals within a cluster without giving the intervention to the whole cluster (for example if you give tablets to some kids within a class you may need to give them to all of them). The intervention you are interested in randomizing, might be at the cluster level (for example, if your intervention in a teacher training program, all the children in the classes taught by this teacher will be affected), in which case your cluster might be the natural unit of randomization.

Question 1

If an NGO says they cannot contact individuals without ever providing them the intervention, then a _________ approach could allow for randomization:

- (●) Phase-in
- ( ) Clustering
- ( ) Stratification
- ( ) You cannot randomize if you are going to treat everybody eventually

✔

Explanation
The phase-in approach creates random variation in the timing of the intervention, while ensuring that all individuals will receive the intervention eventually. So it would enable you to promise that everyone will get treated, whilst still allowing you to use randomization to estimate the causal impact of your treatment.

Experimental Design (27 Questions)

Question 2

What are the problems with phase-in randomization relative to simple randomization? (Select all that apply)

- [ ] Spillover effects
- [x] Long-run effects are more difficult to measure ✔
- [x] Anticipation of receiving treatment may change the behavior of the control group (during the implementation of the experiment) ✔
- [ ] Attrition bias

Explanation
Long-run effects are more difficult to measure, because the control group receives the treatment in the long-run. For anticipation, the control group often knows it will receive the treatment soon, which may change their behavior. Spillover effects and attrition bias should not be any worse than in simple randomization.

Question 1

Which of the following is true about randomization in a "bubble" (around a cutoff)? Select all that apply.

- [ ] Everyone above the cutoff must be included in the randomization
- [x] You only randomize among the people just above and below a cutoff ✔
- [ ] The people above and below the cutoff must have the same probability of being assigned to the treatment group.
- [ ] Everyone below the cutoff must be included in the randomization

Explanation
Randomization in a "bubble" means you randomize just above and below a cutoff, which can be useful with organizations that do not want to significantly vary their inclusion criteria. You do not include everyone above the cutoff in the randomization, because the organization will want to treat those far above the cutoff. You do not need to assign the same probability of being treated to people above and below the cutoff as long as you are randomizing within the just below and the just above the cutoff groups. You do not include everyone below the cutoff because the organization will not want to treat those far below the cutoff.

Experimental Design (27 Questions)

Question 2

Which of the following is true about encouragement design? Select all that apply.

- [x] The intervention is used as an instrument for the effect of the program ✔
- [x] The Ghana scholarship intervention is an example ✔
- [ ] All the treated individuals must take up the program
- [x] The intervention should not directly affect the outcomes of interest ✔

Explanation
Since encouragement designs only change the probability that one is treated, participation offer is often used as an instrument for the effect of the program. In this case, your intervention is just to offer individuals to participate in a given program (not the program itself). The scholarship in the Ghana example encouraged individuals enroll in secondary high school. To be an effective instrument, the encouragement only needs to create some variation in take-up between the treatment and the control, so it does not need all treated individuals to take up the program. Since the intervention is used as an instrument, it should not directly affect the outcome because of the exclusion restriction.

Question 1

What does the evidence that workers assigned to active labor market interventions do better than a control group within the same town suggest about the effects of active labor market policies?

- ○ High search costs prevent firms from filling vacancies
- ○ They suffer from displacement effects
- ◉ They help the treated, compared to others in the same market
- ○ They reduce unemployment

✔

Explanation
This evidence can only tell us that active labor market policies help those who are treated, but cannot tell us what the general equilibrium effects are. It is possible that the intervention reduces unemployment by reducing search costs for firms, but it is also possible that the intervention is simply giving jobs to the treated by displacing the control group from those jobs, creating no net benefit.

Experimental Design (27 Questions)

Question 2

What approach could estimate the general equilibrium effects?

- ◯ Clustering
- ◉ Two-step randomized control trial ✔
- ◯ Stratification
- ◯ Phase-in

Explanation
In the two-step RCT, you can randomly assign the proportion of treated to areas and then randomly assigns treatment status to individuals in these areas. By varying the proportion of treated in each area, one can test the general equilibrium effects of the program.

Question 1

Comparing the group assigned to control to the group assigned to super control (0% assignment areas) estimates the [displacement effect] ✔ **Answer:** displacement effect and comparing the group assigned to treatment to the group assigned to super control (0% assignment areas) estimates the [effect on the treated] ✔

Answer: effect on the treated

Explanation
The difference between these groups is that the control must compete for jobs with treated individuals. The effect of this competition will be the displacement effect of treated individuals taking jobs that control individuals would have gotten. One of them received the treatment, which means that comparing them will estimate the effect on the treated. Comparing treatment to control is not sufficient, because the control suffers from displacement effects as well as the effect of not being treated.

Question 1

What is the main question of interest in the Indonesia rice experiment?

- ◯ Does common knowledge facilitate collective action?
- ◯ Is there corruption in the Raskin rice program?
- ◉ Will program transparency increase the amount of subsidy eligible households receive?
- ◯ Does the Raskin rice program improve nutrition among poor households?

✔

Explanation
By providing information cards to eligible households, the experiment is testing whether more transparency from the cards leads to eligible households receiving more subsidies. They do not test nutrition outcomes. They do not directly test the degree of corruption. The common knowledge question is a possible mechanism through which program transparency increases subsidies received.

Question 2

What possible mechanism did the coupon sub-treatment test?

- (x) Whether implied checking-in on the part of the government changed the results
- ( ) Whether the physical card mattered in bargaining
- ( ) Whether the information on the card mattered
- ( ) Whether common knowledge facilitated collective action

✔

Explanation
The coupons were meant to imply that the government would check whether the correct amount of rice was distributed. This implied accountability could make the distributors of the rice less corrupt. The other options were mechanisms tested by the other sub-treatments.

Question 1

What should your sample size ideally be when you have many sub-treatments? (Select all that apply)

- [ ] Sample size is irrelevant
- [x] Large enough sample size to test treatment vs. control ✔
- [x] Large enough sample size to test the effect of each sub-treatment separately with respect to the control ✔
- [x] Large enough sample size to test interactions ✔

Explanation
One needs more power to test the sub-treatments than one would need to simply do a treatment vs. control comparison, so ensuring that your sample size is large enough to test each separately compared to the control. Ideally, you can also power the experiment to compare all treatment groups to each other (interactions).

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Question 2

If you have enough power to test the effect of each sub-treatment, which of the following are also guaranteed to be true? (Select all that apply)

- [x] You are powered to test treatment vs. control
- [ ] You are powered to test interactions
- [ ] You are powered to test some interactions

✔

Explanation
Since testing the effect of each sub-treatment requires more power than testing treatment vs. control, they will also have enough power to test treatment vs. control. Testing interactions requires more power and being able to test the effect of each sub-treatment doesn't guarantee it.

Question 1

The main result is that

- ○ The card has no effect
- ○ The card improved nutritional outcomes
- ○ The coupons made it more likely for eligible households to get rice
- ◉ The card increased the rice subsidies received by eligible households

✔

Explanation
The treatment group received 25% more rice subsidies than the control group which suggests that the card increased the rice subsidies received by eligible households. Nutritional outcomes were not tested. Coupons did not have an effect.

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Question 2

What does the non-effect of coupons suggest about the mechanism through which the card increased rice subsidies?

- ◯ It does not tell us anything
- ◯ Accountability effects drive the increased rice subsidies
- ◯ The information on the card does not drive the increased rice subsidies
- ◉ Accountability effects do not drive the increase in rice subsidies

✔

Explanation
The coupons tested accountability effects, so the fact that they had no effect suggests that accountability effects did not drive the increase in rice subsidies.