Randomization & Pseudo-Randomization Part I

Lecture 4 – Part 1

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Exp Class Lectures

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- Another way to think of the variable or set of variables in relationship to P_j is that they are redundant in the determination of the potential choices given information levels.
- If we could find such a variable, then maybe we could use it as a substitute for information and avoid or sidestep the problem of confounding that occurs when we use information.

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- Although in political science these two methods are often considered separately, the theoretical basis underlying the two approaches when based on an RCM model of causality is identical, as a growing body of literature in statistics and econometrics has established.
- In the literature on measuring causality through experiments, the assignment to treatment is used in the same way as an instrumental variable is used in observational data without experimental manipulation.

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- That is, usually explanations of IV approaches begin with particular models of the data generating process and the assumptions about functional forms and correlations between variables that allow for IV estimation given those models.
- Instead we begin abstractly, independent of a particular functional form of the data generating process or estimation procedure, and focus on the properties of an ideal IV.

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- **Condition (No Missing Data);** We can perfectly observe the choices made by those affected by M. That is, define P^{OBS} as the choices observed by the researcher and P^{ACT} as the actual choices made by the units of study. When there is no missing data then $P^{OBS} = P^{ACT}$, for all units.

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- ATE $=$ ATE $= E\left(P|M=1\right) - E\left(P|M=0\right)$

Definition (Ideal Instrumental Variable)

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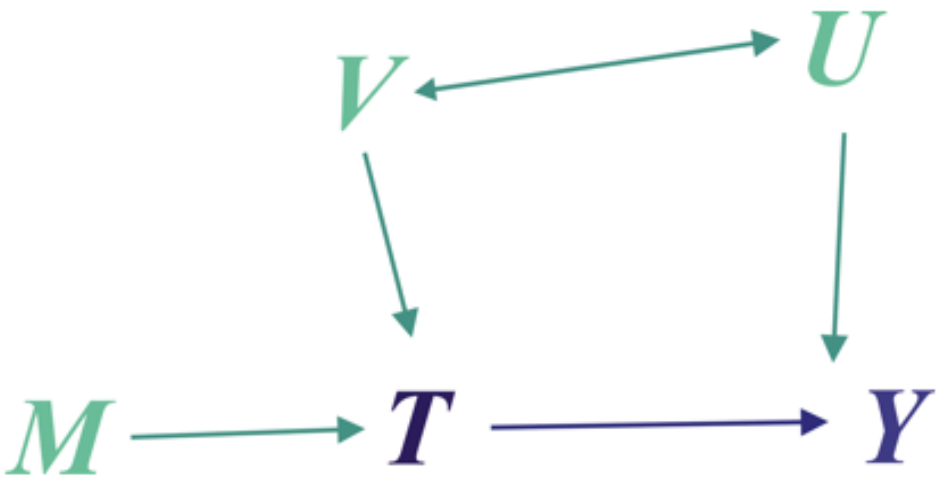

Figure: The Ideal Instrumental Variable

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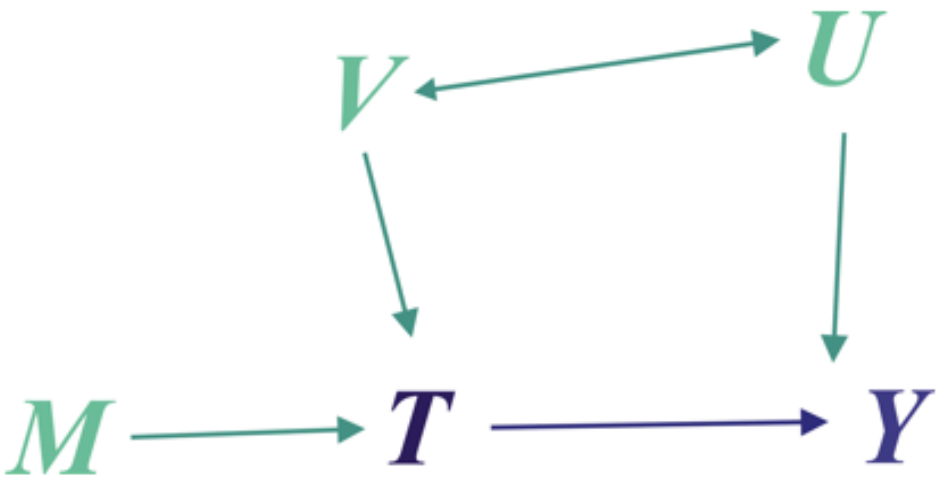

Figure: The Ideal Instrumental Variable

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- But since V and U are correlated, we cannot use control functions since ignorability of treatment does not hold.

Is Random Assignment of Manipulations in Experiments an Ideal IV?

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- Consider each condition separately.
- Begin with Independence.

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- Subjects who participate on Monday morning might be differently affected by manipulations than those who participate on Thursday evening.
- Subjects who participate in the summer one year might also be differently affected than those who participate several years later in the winter.

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How Random Assignment is Operationalized in the Field & Timing Issues

- Field experiments are also usually conducted over a period of time, sometimes in waves.
- If a field experiment is conducted over a period of time it is important that the manipulations be randomized within given time periods.
- Nevertheless, within a given time period some subjects may be manipulated on a Monday morning while others might be manipulated on a Thursday afternoon.

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Assignment of Other Manipulated Variables

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- Maintaining independence of manipulations is also important in field experiments that evaluate more than one treatment effect or a complexity of treatment effects.
- If the assignments are correlated, then independence of the manipulations can be violated.

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  - If having more children is related to potential outcomes of interest, then a violation of independence.

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- Have independence within educational categories, but not across educational categories.

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- If there is a relationship between living in a particular city district & potential outcomes studied, then there is a violation of independence.

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- Michelson and Nickerson (2009) points out that in some mobilization experiments randomization is done at the precinct level or some other aggregate level in order to avoid other problems in implementing the randomization such as mobilizers contacting subjects who were designated not to be contacted see for example Arceneaux 2005, Imai King and Nall 2009, King et al 2007.

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- If residence in these aggregate groups is related to potential outcomes, then independence is violated.

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- Material provides factual information about candidates (only way to get information.

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- Thus potential choices are affected by M (assuming information is not available to subjects independent of mailing).

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- We might have violation of independence between M and both P_0 & P_1.
- AIR and Heckman (1997) discuss problems with using draft lottery numbers as an IV for enlisting in military.
- Men with low lottery numbers, who expect to be drafted may get more education as a way of avoiding service through deferment & men with high numbers might have received more on-the-job training by employers who were more confident that they would not be leaving their jobs.

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- In Wantchekon candidates were experimentally induced to vary their messages to voters across election districts.
- Since variation could be observed by other candidates & parties as well as other elites–behavior with respect to the voters may have been affected.
- Did happen in some of districts where some candidates used experimental strategies & others did not–Wantchekon excludes from analysis.

Using Experimental Design to Solve Independence Problems

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- Principal methodological advantage of using undergraduate students as subjects in experiments; it increases ability to compare effects of different manipulations carried out over time.
- Also possible to build a nonstudent subject pool, as did Mutz, that is arguably homogenous on observables over time.

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- If there is sufficient variation within each time period, confounding unobservables that vary over time can be controlled for *ex post* by using regression control methods.

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- If interested in individual effects, avoid randomizing at group levels if possible.

Using Experimental Design to Solve Independence Problems

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- r send mailings that are reported to come from a partisan source (although there may be difficulties in the ethics of doing so because of potential harms to the political parties).
- Can use design to determine whether source of mailing interferes with independence of random assignment of information on potential choices.

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Using Experimental Design to Solve Independence Problems

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- But of course can lead to ethical concerns, however, as discussed later.

When an IV or Assignment is not a Perfect Substitute for Treatment

Potential Problems of Substitutability in Random Assignment: What is Noncompliance?

Definition (Pre-Treated Subject)

Subject who has experienced the desired manipulation prior to his or her random assignment.

Definition (Always-Taker)

Subject who chooses an assigned manipulation independent of his or her random assignment.

Definition (Never-Taker)

Subject who chooses against an assigned manipulation independent of his or her random assignment.

Definition (Defier)

Subject who chooses the opposite of the manipulation assigned to him or

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Noncompliance in the Laboratory

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- Used images of candidates in actual 2006 U.S. elections as manipulations in order to determine how differences in images can affect subjects' evaluations of the candidates.
- If subjects had already been exposed to candidates, then would be pre-treated.
- Problems of always-taking, never-taking, or defying–may occur in lab if subjects fail to pay attention during instructions in the sense that they fail to read something they are told to read, or fail to listen when told to listen.

Problems with Substitutability

Noncompliance in the Laboratory: Repetition & Information Control

- In some game theoretic experiments form of noncompliance occurs when subjects interact repeatedly & subjects can make inferences based on previous behavior which can influence their behavior in later periods.

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- Point might be study effects of repetition in such a situation & whether such inferences occur & affect behavior.
- But if not true, data gathered from later periods may be suspect.

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- But if not, then need to be concerned about the possible effects of communication on information levels.

Definition (Sequential Experiment)

In which subjects participate in manipulations conducted either over time or at separate time intervals.

- Druckman & Nelson (2003) contact subjects 10 days after an experiment in a survey to determine whether framing effects observed in the original experiment diminish over time & Chong & Druckman (2009) have subjects participate in 2 sessions 3 weeks apart.

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Noncompliance in the Laboratory: Drop-Off in Sequential Experiments

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- In both cases some subjects failed to come to the second round.

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- A subject who only chose to subscribe to newspaper or purchase it daily when it was not assigned but chose to refuse to accept newspaper when assigned would be a defyer.

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- However, it can be difficult to convey to nonacademics value of following a strict randomization strategy which can lead to instances of noncompliance.
- Michelson & Nickerson (2009) highlight a number of situations that can occur–such as mobilizers enthusiastically contacting voters who were designated not to be contacted because of their desire to increase voter participation, having difficulty identifying subjects by names from lists, failing to locate subjects' addresses, etc.

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- Green, Gerber, and Nickerson (2003) estimate an increase of 5.7 % for noncontacted household members among households of younger voters.

Using Experimental Design to Solve Substitutability Problems

Dealing with Pre-Treated Subjects in the Laboratory

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- Also collected familiarity ratings in an attempt to verify that none had been pre-treated.

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- In either case, recommendation is for researchers to attempt to measure when subjects have been pre-treated & to consider data from these subjects separately than those who have not been pre-treated.

Dealing with Other Types of Noncompliance

In the Laboratory: Using Randomization to Reduce Cross-Effects When Subjects Engage in Repeated Games

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- One solution is to only conduct one-shot games, however, there may be good reasons to allow subjects to play the games more than once to facilitate possible learning as explained later.

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- Important issue is to carefully consider how allowing less controlled communication may interfere with other manipulations investigating when designing experiment.

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- Discuss motivating subjects further later.

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- Chong & Druckman informed subjects at beginning that there would be a second session 3 weeks later & sent reminders to subjects every 3 days, up to a total of 3 reminders.

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- If a subject made highest bid, he or she was forced to pay for object.

Dealing with Other Types of Noncompliance

In the Laboratory: Using Financial Incentives & Other Motivation Techniques & Sequential Experiments

- Casari, Ham, & Kagel (2007) report on a sequential experiment on effects of different incentive mechanisms on possible selection bias
- They also compared design method to traditional post experimental statistical analysis to control for selection bias.
- Subjects participated in a series of auctions–bid on value of unknown objects.
- Before each auction each received a private signal about value of object.
- If a subject made highest bid, he or she was forced to pay for object.
- Earlier research shows subjects often overbid such that winner ends up paying more for object than it is worth in terms of payoffs.

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- Ignoring these implications & overbidding by bidding one's signal has been labeled the "winner's curse" result.