



Instrumental Variables

Philosophy of Economics

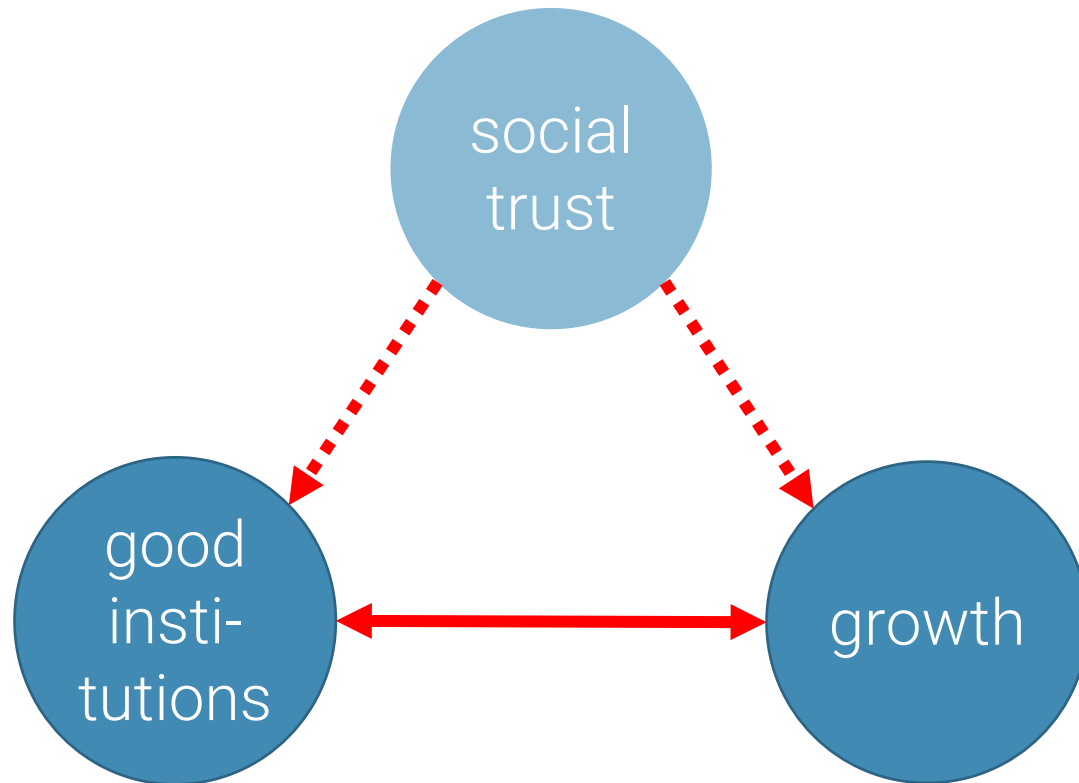
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- 1. Instrumental Variables**
2. Acemoglu et al.
3. Natural Experiments
4. Discussion

Causal Puzzles

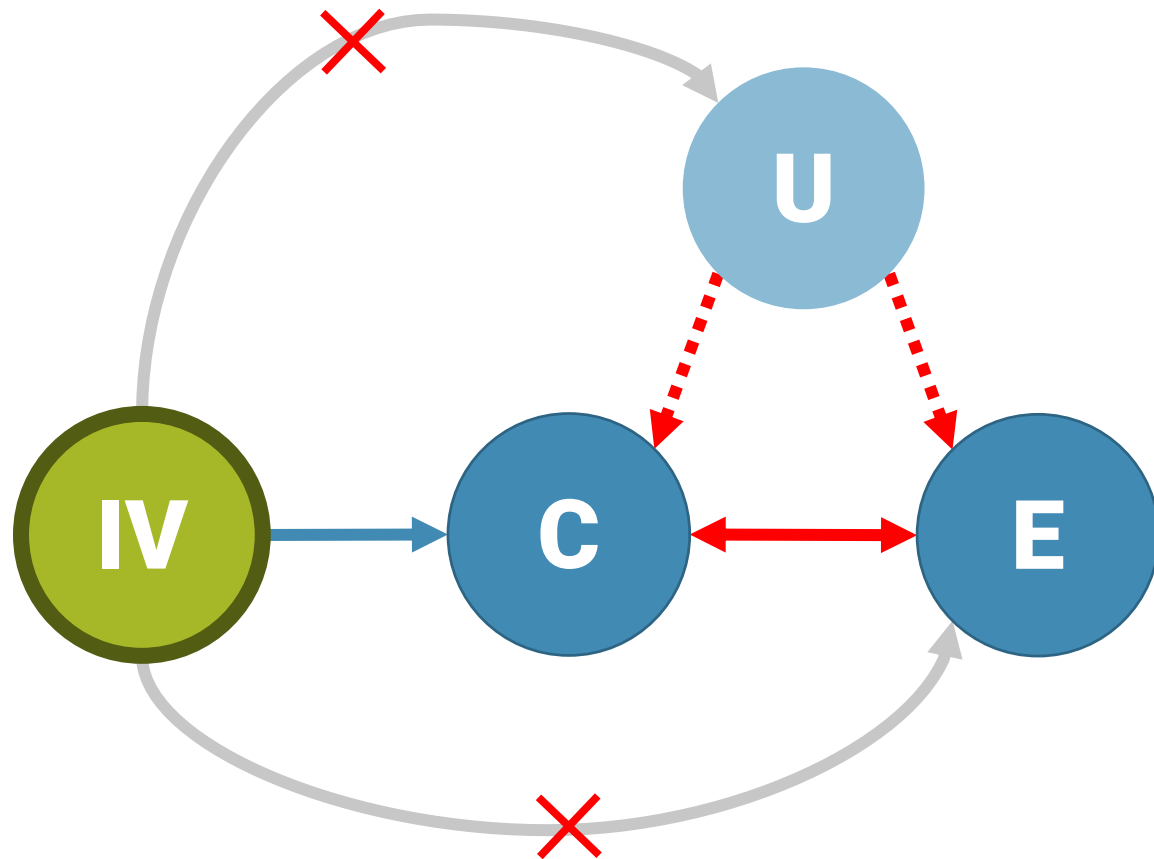


Imagine you want to test whether **good institutions** → **growth**

Problems

- Growth might also cause democracy (*inverted causality*)
- There might be *unmeasured confounders* (e.g., social trust) which cause both
- Our measurement of good institutions might be *biased* towards rich countries

Instrumental Variables



Imagine you want to test whether **good institutions** → **growth**

Solution: use an instrumental variable (IV). Simplifying, two conditions:

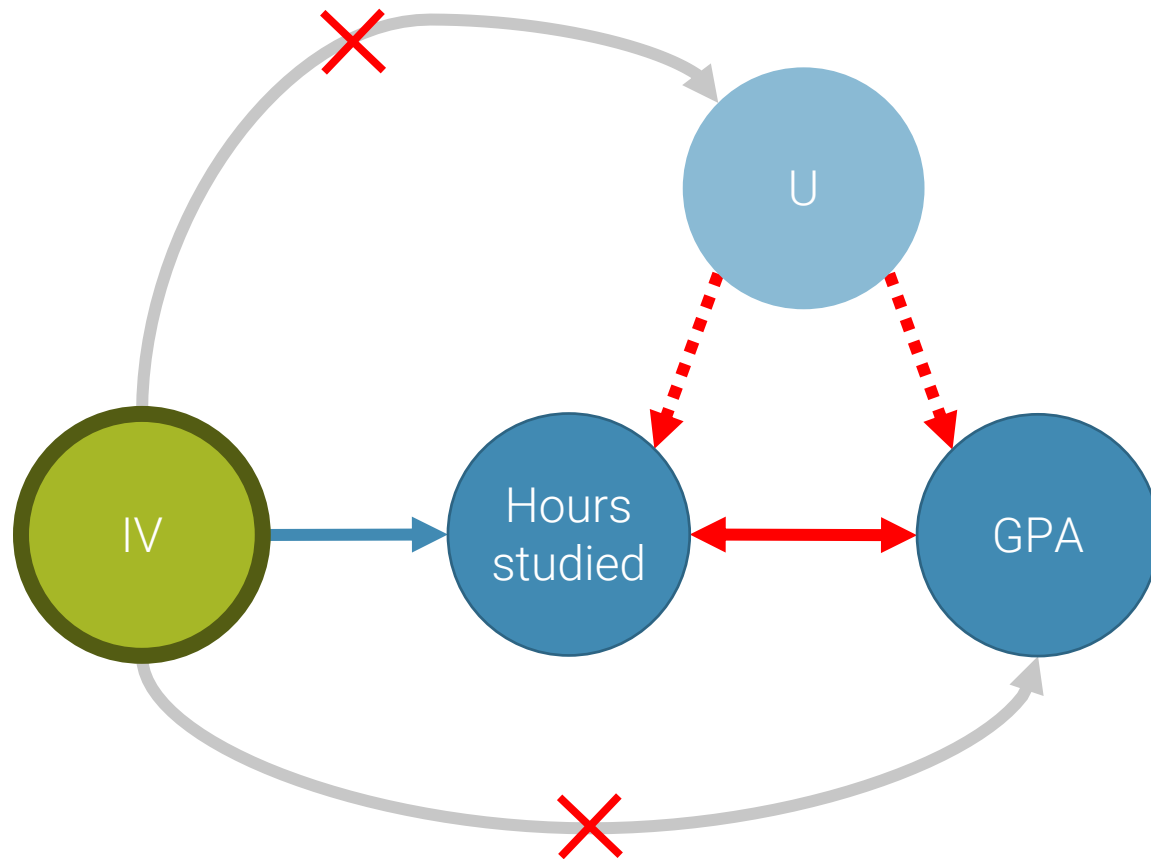
- **Relevance:** IV must be correlated with C
- **Exclusion:** (1) IV cannot have a direct effect on E, except through C, (2) IV cannot have an effect on, or be correlated with, any U

Exercise

For the *Philosophy of Economics* course, you have a dataset (for each student) of (i) hours studied (self-reported), and of (ii) end-of-term GPA achieved. Your research question is whether more hours studied cause a higher GPA.

1. What might possible unmeasured variables be which confound the relationship?
2. What might possible biases in measurement be?
3. Is there any possible backwards causation between GPA and hours studied?
4. Can you find an instrumental variable which could help you decide the question?

An Example



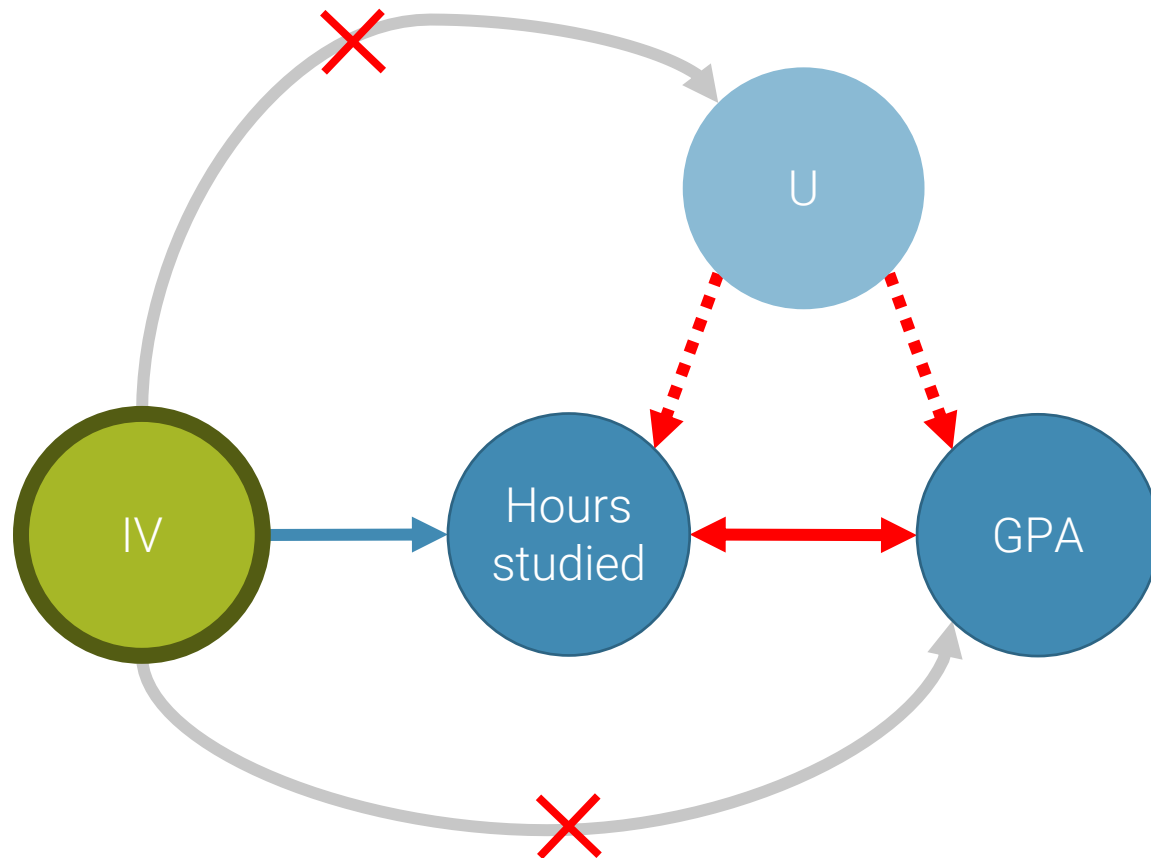
Possible **Confounders**:

- Motivation/Interest in Topic
- Ability/Time Use Efficiency

Possible **Measurement Errors/Inverse Causality**:

- Biased memory (“I did well... I must have worked hard!”)
- Bad/Good Grade Shock (“My midterms were bad... I’ll stop trying.”)
- Bad Grade Anticipation (“I won’t do well... so why put in the work?”)

An Example



Are the following good IVs?

1. Number of other classes taken
2. Hours studied for other classes
3. Amount of extracurricular activities
4. Change in relationship status
5. Unexpected illnesses/family emergencies/jury duty/etc.
6. Whether roommate brought a computer game to campus
7. Number of hours studied by roommate

Crohn/O'Connor 2005, 4

The measured effect of student effort on performance in economics courses found in past studies has been mixed. In an informative survey of research on economic education, Siegfried and Fels (1979) **concluded that student effort did not seem to be related to performance on standardized tests** (see also Becker 1997) but that class attendance seemed to be important for performance on locally constructed tests. More recent studies involving a variety of courses support the conclusion that class attendance positively affects student performance (Schmidt 1983—introductory macroeconomics; Lumsden and Scott 1987—introductory economics; Park and Kerr 1990—money and banking; Romer 1993—intermediate macroeconomics; Douglas and Sulock 1995—financial economics; Didia and Hasnat 1998—introductory finance). **The effect of study time on performance was mixed.** Schmidt (1983) and Douglas and Sulock (1995) **found study time to be positively related to student performance.** Borg, Mason, and Shapiro (1989) found study time to be insignificant overall among introductory macroeconomics students but positive for above average students and negative for below average students. On the other hand, Lumsden and Scott (1987), Gleason and Walstad (1988), and Park and Kerr (1990) found study time to be unrelated to student performance, and Didia and Hasnat (1998) **found study time to be negatively related to performance.**

Stinebrickner/Stinebrickner 2007

First, specific questions in the data allow us to construct the instrument that we use to divide students into two groups that are identical at the time of college entrance: students who have a randomly assigned roommate who brought a video game to school at the beginning of the year and students who have a randomly assigned roommate who did not bring a video game to school at the beginning of the year.

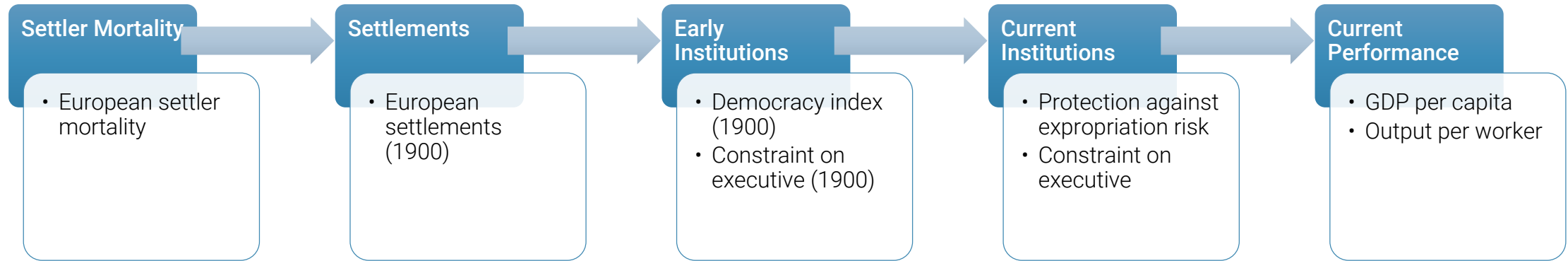
Second, time-use diaries that were collected at multiple times during the year allow us to document that the assignment of a roommate with a video game causes students in the former group to study significantly less per day, on average, than students in the latter group. [...]

We have access to two other potential instruments: how much a student's randomly assigned roommate studied in high school and how much this roommate expects (at the time of college entrance) to study in college. [...] [R]oommates interact very little on specific academic matters and [...] peer effects between roommates are most likely to arise through students influencing the time-use of each other.

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Main Variables



Main idea: use settler mortality as an instrument for current institutions

Relevance: established statistically

Exclusion: established through a variety of arguments (which?)

The Main Steps

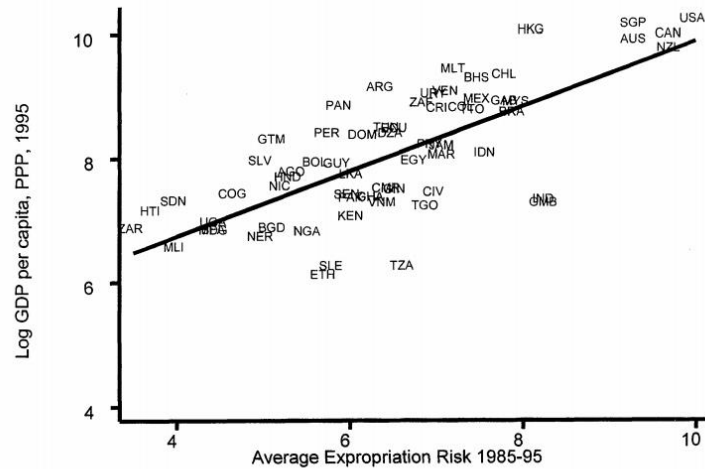


FIGURE 2. OLS RELATIONSHIP BETWEEN EXPROPRIATION RISK AND INCOME

Step 1.

Current Institutions & Current Performance: correlated, but really causal?

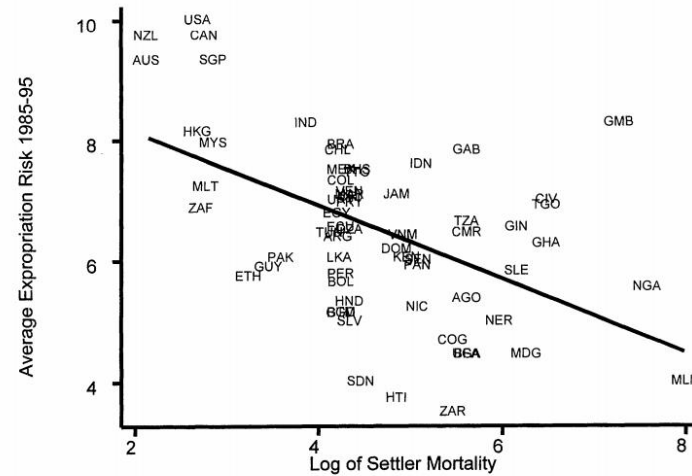


FIGURE 3. FIRST-STAGE RELATIONSHIP BETWEEN SETTLER MORTALITY AND EXPROPRIATION RISK

Step 2.

Settler Mortality & Current Institutions: correlated, and a decent instrument.
(Much more background argument here!)

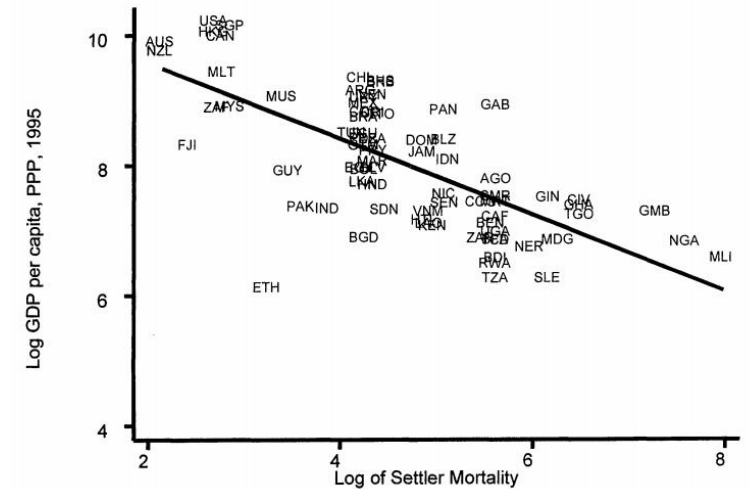


FIGURE 1. REDUCED-FORM RELATIONSHIP BETWEEN INCOME AND SETTLER MORTALITY

Step 3.

Settler Mortality & Current Performance: replace the potentially tainted cause with the instrument—real causality?

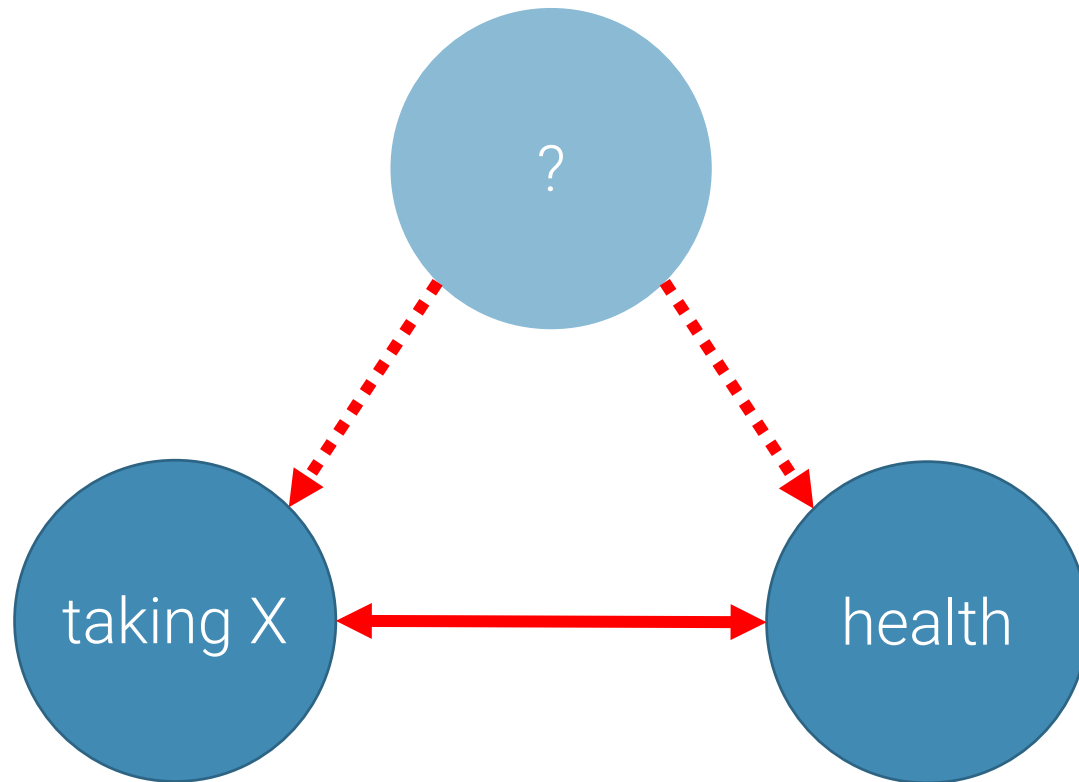
Questions

1. How do Acemoglu et al. establish that settler mortality is a good IV?
2. In particular, how do they establish Exclusion?
3. What is their objection to alternative IVs (see p. 1373)?
4. What role does historical/non-economic evidence play in their argument?

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A Comparison to Experiments

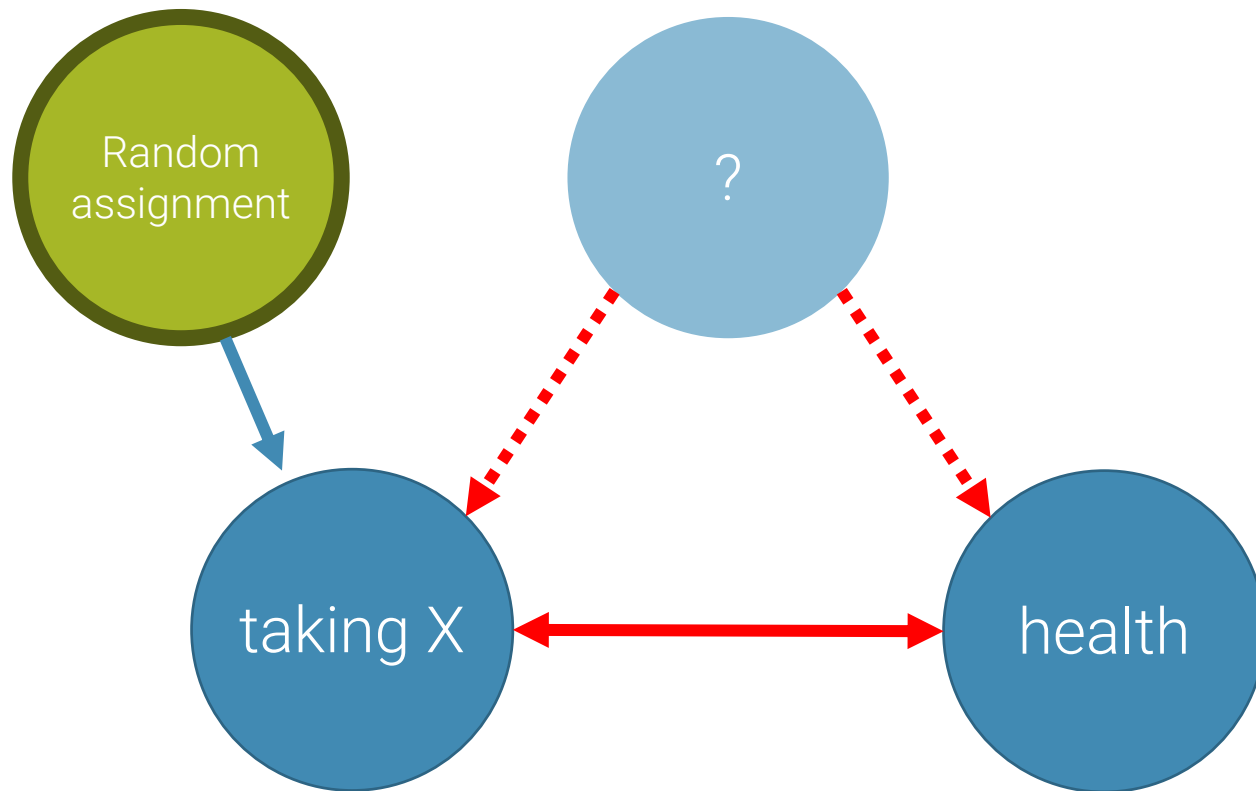


Imagine you want to test whether **taking nutritional supplement X** → **better health**

Problems

- The people who take nutritional supplements might be more health-conscious, and more healthy to begin with
- Other self-selection effects (older people take more supplements, and they are less healthy)

A Comparison to Experiments

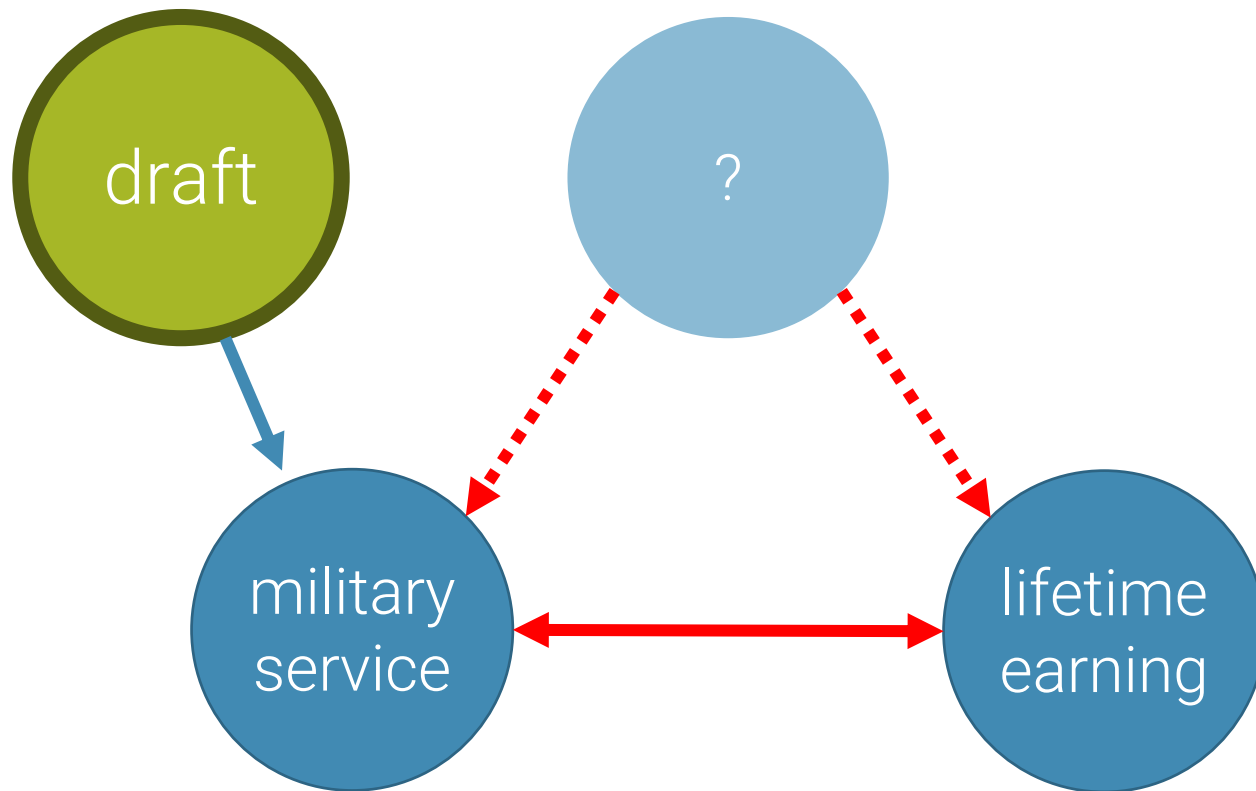


Imagine you want to test whether **taking nutritional supplement X** → **better health**

Solution: assign people randomly to treatment group (variable “treatment”)

If done correctly, treatment should be independent from potential third factors

Natural Experiments



Imagine you want to test whether **serving in the military** → **higher/lower wages as civilian**

Solution: observe a “natural” experiment: the Vietnam-era draft

Other examples...

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Problems

- There are few instrumental variables which fulfil both Relevance and Exclusion
- Genuine instrumental variables are often weak (i.e., weakly correlated) which makes the statistical results unreliable
- More sophisticated statistical techniques need to be brought when IVs are used
- Instrumental variables rely on previous causal knowledge

Further Reading

Acemoglu/Robinson,
Why Nations Fail

Pearl/Mackenzie,
The Book of Why