

Instrumental Variables

UNDERSTANDING IV



Roadmap

Where do (Good) Instruments Come From?

- True Lotteries

- Natural Experiments

- Panel Data

2SLS Mechanics

- Just-Identified IV

- Overidentification

Weak and Many Instruments

- Weak IV

- Many IVs

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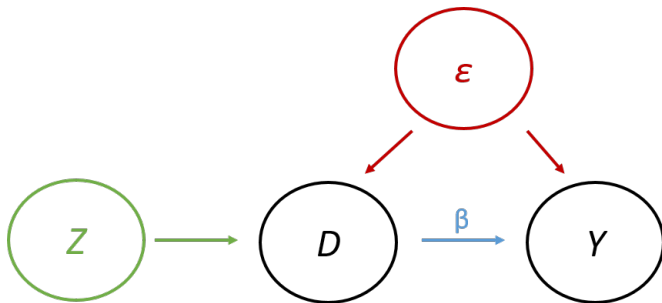
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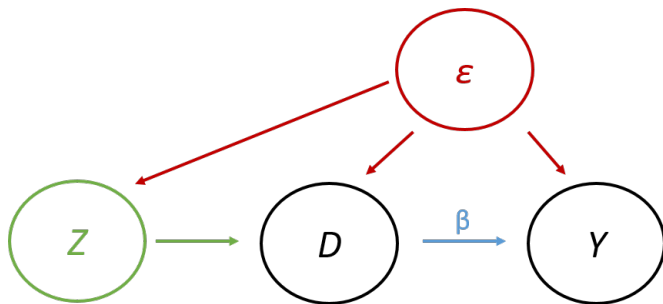
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 - More modern IV texts take care to distinguish between these two conceptually distinct requirements...

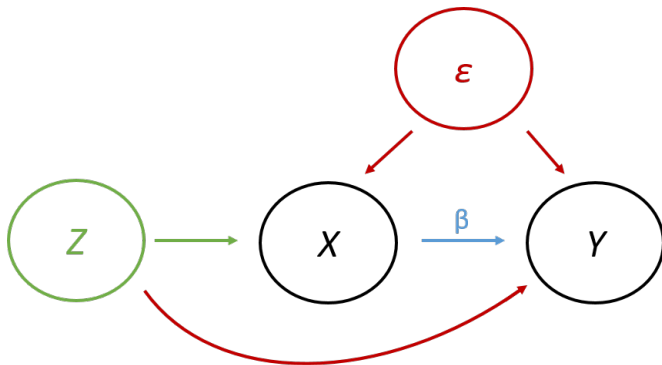
A Valid Instrument



A Violation of As-Good-As-Random Assignment



A Violation of Exclusion



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- “Gold standard” IV: a randomized offer to participate in a program, with X_i recording program participation
 - Exclusion restriction likely to hold for any Y_i , by construction
 - Relevance almost guaranteed (provided people want the program!)

Example: Charter School Lotteries

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 - When more kids want to enroll than there are seats, admission offers $Z_i \in \{0, 1\}$ are effectively drawn from a hat
 - Offers plausibly only affect later test scores Y_i by changing charter enrollment $D_i \in \{0, 1\}$, so are plausibly valid instruments
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- We study a particular charter (UP Academy), which is “takeover”
 - Two offer IVs: “immediate” (on lottery night) and from a waitlist

Lottery IV Estimates of UP Test Score Effects

TABLE 8—LOTTERY IV ESTIMATES OF UP EFFECTS

		2SLS				
		Comparison group mean (1)	OLS (2)	First stage		Enrollment effect (5)
				Immediate offer (3)	Waitlist offer (4)	
<i>Panel A. All grades</i>						
(Sixth through eighth)	Math (N = 2,202)	0.059	0.301 (0.022)	0.760 (0.063)	0.562 (0.067)	0.270 (0.056)
	ELA (N = 2,205)	0.103	0.148 (0.020)	0.759 (0.063)	0.562 (0.067)	0.118 (0.051)

Natural Experiments

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 - Fixed school start dates mean students who drop out at 16 get more or less schooling depending on their birth date
 - Quarter-of-birth seems quasi-randomly assigned... is it excludable? Some evidence that older students learn more in each grade...

Exclusion

Stuff about Exclusion

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Stuff about just-identified IV

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