Advanced Econometrics

University of Warsaw

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Course information

- Prerequisites: probability, statistics, basic econometrics (regression analysis)
- Office hours: Tuesday 17.00-18.30 room 304 or online upon email request
- Requirements for passing the course:
  - written final exam
- Textbooks:
  - probability: B. Hansen (2022b). *Probability and Statistics for Economists*. Princeton University Press. ISBN: 9780691235943
  - econometrics: B. Hansen (2022a). *Econometrics*. Princeton University Press. ISBN: 9780691235899
  - Bayesian econometrics: G. Koop (2003). *Bayesian Econometrics*. Wiley. ISBN: 9780470845677
  - Data sets and codes for examples included in textbooks: `https://users.ssc.wisc.edu/~bhansen/econometrics/`

Econometric packages

- STATA:
  - not free, menu-driven, command-line, programming
  - available in computer labs and also you can obtain one year student license in the IT department
  - documentation with examples: `https://www.stata.com/bookstore/choice-models-reference-manual/`
  - video tutorials: `https://www.stata.com/links/video-tutorials/`
- Gretl
  - free, menu-driven
- R:
  - free, command line, programming
  - useful in spatial econometrics and in machine learning

Trends in economic research

TABLE 4
Percent Distributions of Methodology of Published Articles, 1963–2011 *

	Type of study				
Year	Theory	Theory with simulation	Empirical: borrowed data	Empirical: own data	Experiment
1963	50.7	1.5	39.1	8.7	0
1973	54.6	4.2	37.0	4.2	0
1983	57.6	4.0	35.2	2.4	0.8
1993	32.4	7.3	47.8	8.8	3.7
2003	28.9	11.1	38.5	17.8	3.7
2011	19.1	8.8	29.9	34.0	8.2

* A type could not be assigned to seventeen of the articles published in 1963.

Source: Hamermesh (2013)

Trends in economic research

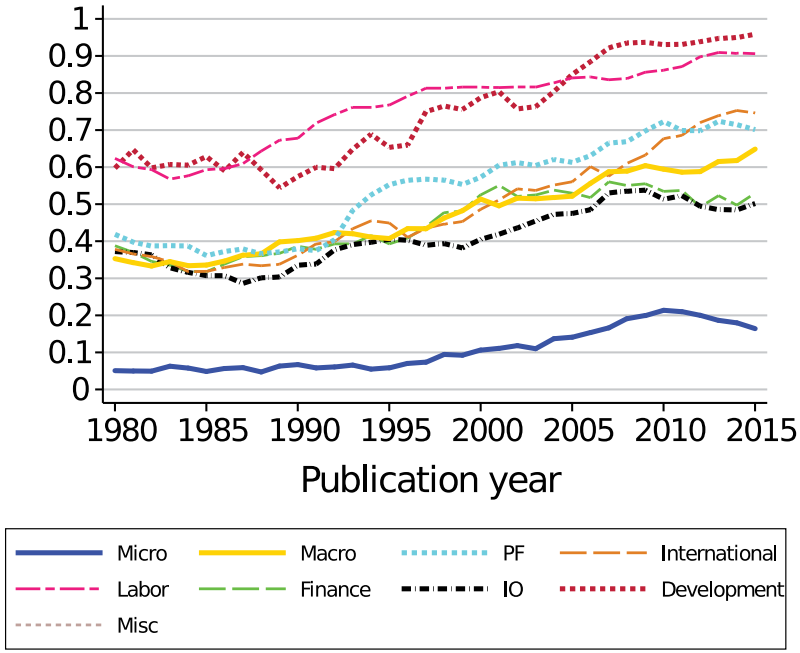


Figure 4. Weighted Fraction Empirical by Field

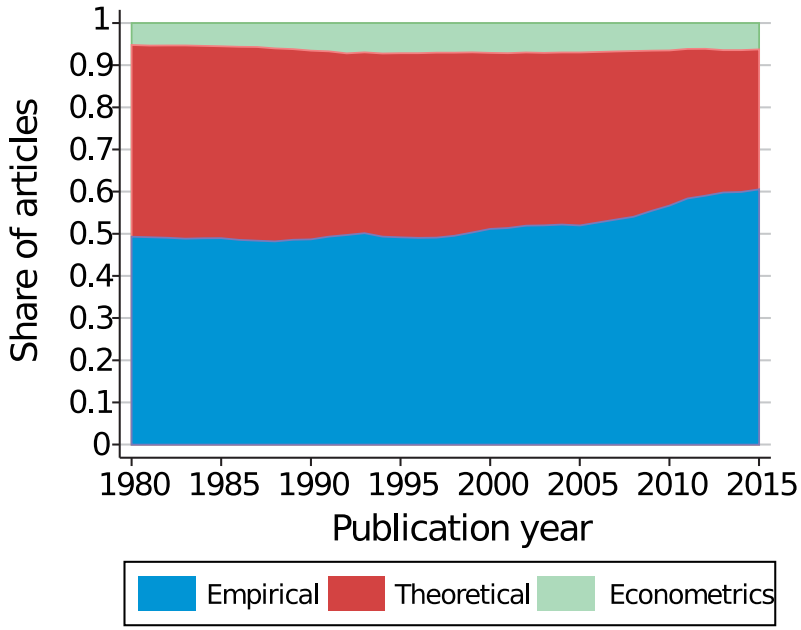


Figure 5. Publications by Style

Source: Angrist et al. (2017)

Trends in economic research

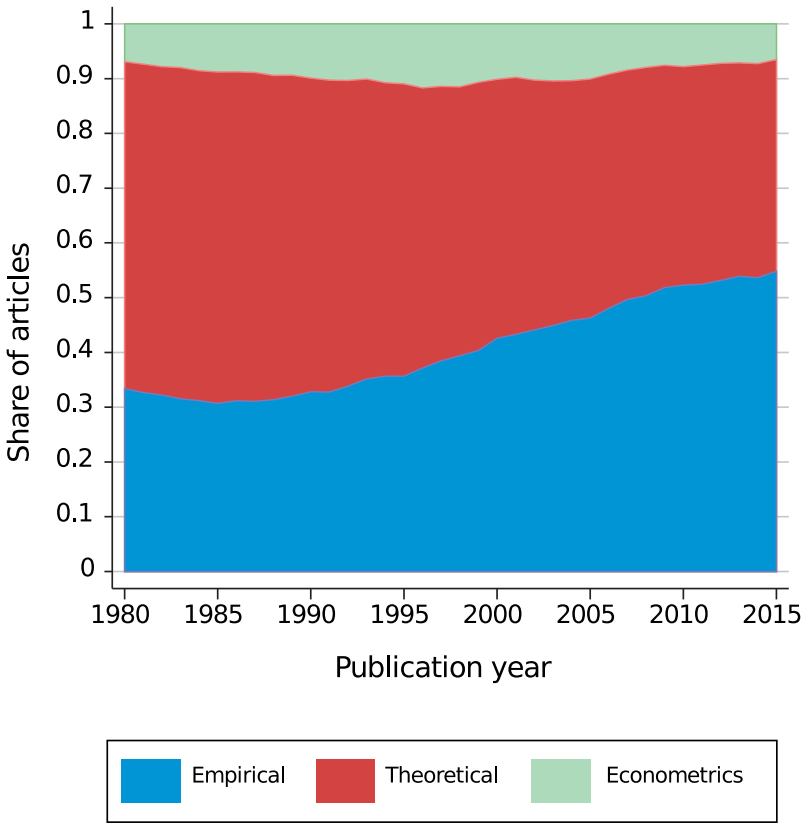


Figure 6. Weighted Publications by Style

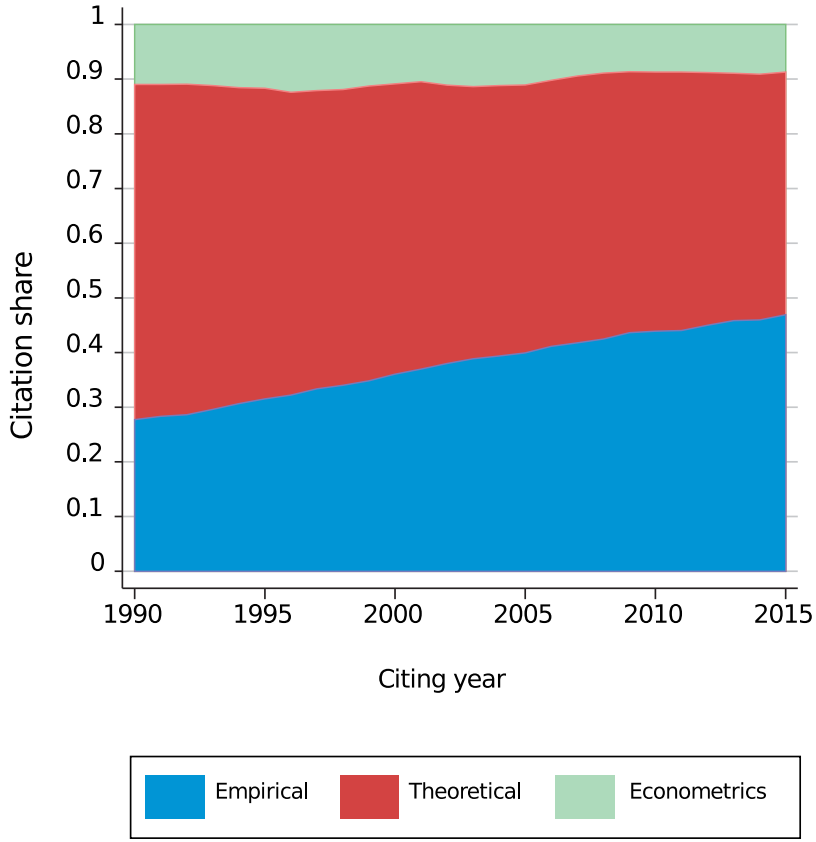


Figure 7. Weighted Citations by Style

Source:Angrist et al. (2017)

Objectives of empirical studies

- Why does modern economics rely so much on empirical research?
- Economic theory only provides qualitative guidance about the nature of relationships between variables.
- There are a number of cases where quantitative estimates are very important:
  - estimation of causal effect: policy analysis, evaluation studies
  - empirical verification of economic theory: statistical inference
  - forecasting

Examples of empirical questions

Example

What is the influence of the education on productivity?

Example

Is the supply of money money neutral in long-term?

Example

What will be the growth of GDP in the next quarter?

Causal relationship

- I_0 control group, Y_0 outcome if $i \in I_0$
- I_1 exposed group, Y_1 outcome if $i \in I_1$
- $D \in \{0, 1\}$
  - $D = 0$ unit is not exposed
  - $D = 1$ unit is exposed
- We observe Y

$$Y = DY_1 + (1 - D) Y_0$$

- Every unit has the observed effect and counterfactual effect

	I_0	I_1
$D = 0$	Y_0	Y_1
$D = 1$	Y_0	Y_1

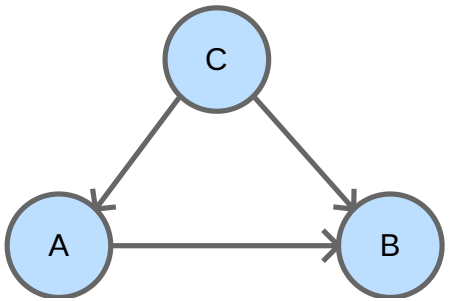
- We are interested in causal effect

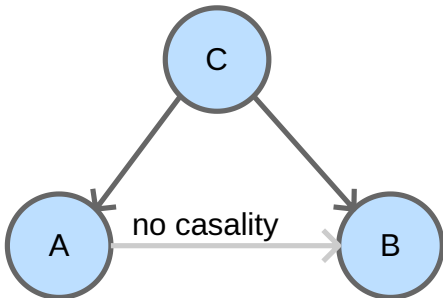
$$(Y_1 | D = 1) - (Y_1 | D = 0)$$

Causal relationship

- The outcome of the exposure for the control group $(Y_1|D=0)$ cannot be observed!
- Generally speaking $(Y_1|D=0) \neq (Y_0|D=0)$.
- Therefore it is never possible to observe causal effect directly!
- The value of $(Y_1|D=0)$ is known as counterfactual effect.
- Inferences about causal relationships are always indirect and based on a number of assumptions (so called hidden conditionals).
- Note, for example, that the way the analysis is carried out implies that we know a priori what is cause (D) and what is effect (Y)
- Standard interpretation of the causal effect assumes that exposure may be applied (D is manipulable).

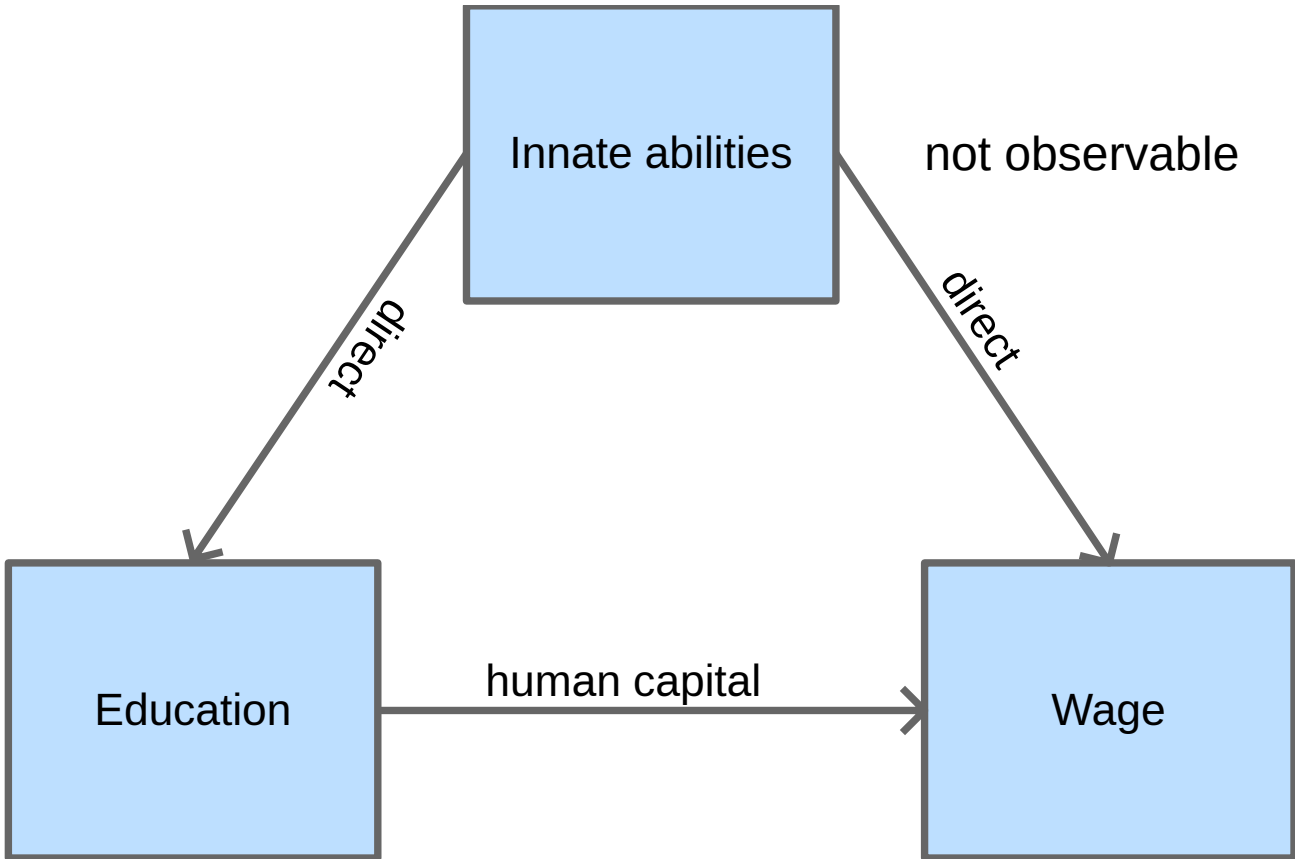
Confounding variables.



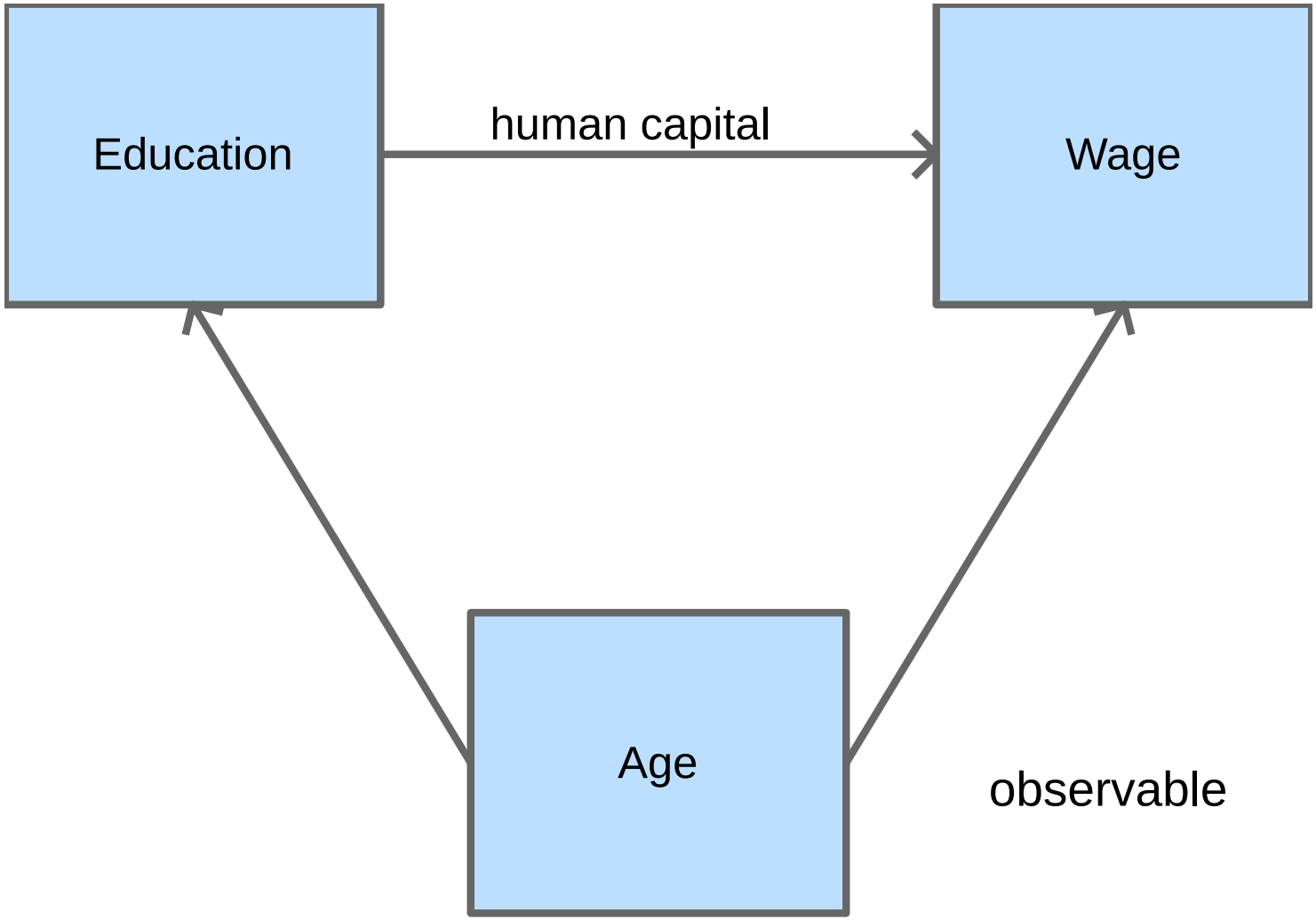


- A - causal variable (explanatory variable of interest)
- B - outcome (dependent variable)
- C - confounder: variable which influences both the causal variable and the outcome
- Notice that even if there is no causal relationship between A and B the influence of C can make them to co-move (A and B are correlated)
- Therefore correlation does not imply causality!

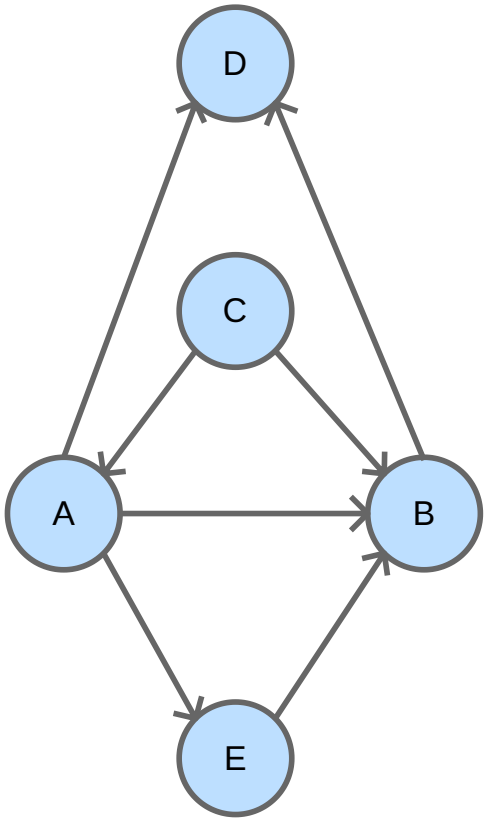
Confounding variables.



Control variables and ceteris paribus.



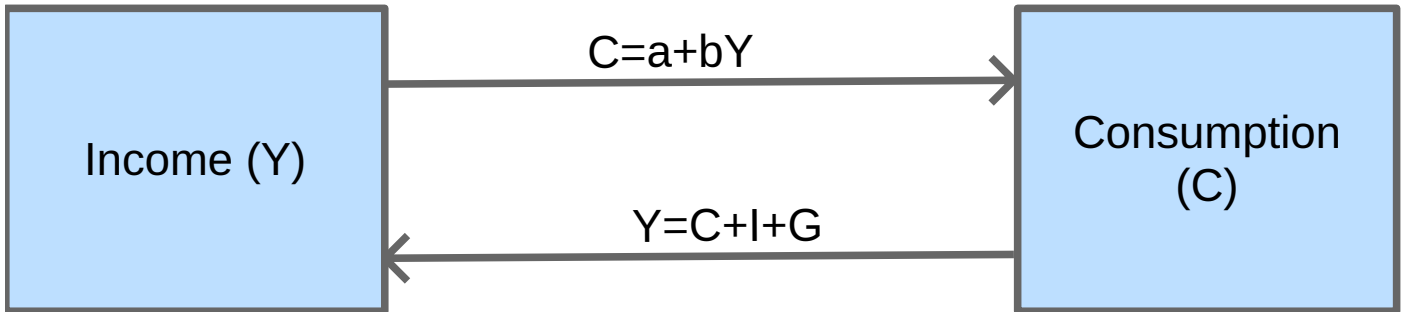
Mediators and colliders, Directed Acyclic Graph (DAG)



A: causal variable
B: outcome variable
C: confounder (causes A, causes B)
D: collider (caused by A and B)
E: mediator (caused by A, causes B)

- To correctly measure causal effect of A on B we have to take into account the influence C and E but D can be ignored
- Notice that this diagram is acyclic, you cannot find the path along arrows from A to other nodes and then back to A
- This property implies that we are not considering cases of bidirectional causality (A causes B, B causes A)

Simultaneity



- In the case of relationships between economic variables (especially macroeconomic) ones, bidirectional causality is not exceptional
- Notice that in the specific case of Keynesian the correlation between Y and C variables can be attributed partly explained by the way GDP is defined
- When explanatory causal variable depend on outcome variable we say that the simultaneity problem is present

Bibliography

- Angrist, Joshua et al. (May 2017). "Economic Research Evolves: Fields and Styles". In: *American Economic Review* 107.5, pp. 293–97. DOI: 10.1257/aer.p20171117. URL: https://www.aeaweb.org/articles?id=10.1257/aer.p20171117.
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