Introduction to Applied Research in Economics

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Training Course on Applied Econometric Analysis

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Why do we need applied economic research?

Introduction

- Excitement about applied economic research comes from the opportunity to learn about cause and effect in real world
- Economic theory suggests important relationships, often with policy implications, but virtually never provides quantitative magnitudes of causal effects
- Applied economics is more vulnerable than physical sciences to models whose validity never will be clear, because necessity for approximation is much stronger
- Nevertheless, economics has an important quantitative side, which cannot be escaped
- The important questions of the day are our questions

Introduction (cont.)

- Will loose monetary policy spark economic growth or just fan the fires of inflation?
- What is the effect of a 1 percentage point increase in broad money on inflation?
- What is the effect of a 1 percentage point increase in interest rates on output growth?
- Will mandatory health insurance really make people healthier?
- How does an additional year of education change earnings?
- What is the effect of farm size on agricultural productivity?
- How does agricultural diversity impact nutritional outcomes?

Introduction (cont.)

- Economists' use of data and tools to answer cause-and-effect questions constitutes the field of applied econometrics
- Tools of applied econometrics are disciplined data analysis combined with statistical inference
- We are after truth, but truth is not revealed in full, and messages the data transmit requires interpretation
  - Examples
- Comparisons made under ceteris paribus conditions may have a causal interpretation
- Ceteris paribus comparisons are difficult to engineer

Objectives of this course

- The main objective of the course is to strengthen the capacity of young researchers to conduct empirical research
- The emphasis of the course will be on empirical applications with a focus on detection of causality in data
- Ideally, we would like to have an experiment
- But most of the time we only have observational (non-experimental) data

In this course you will learn

- “Furious Five” of modern applied econometric research
  - Regression, RCT, Regression discontinuity, Instrumental variables, Difference-in-differences
- Other methods for estimating causal effects using observational data
  - Fixed effects, Propensity score matching, etc.
- Productive use of these techniques requires a solid conceptual foundation and a good understanding of the machinery of statistical inference
- Focus on applications – theory is used only as needed to understand the “why” of methods
- Learn to evaluate the empirical (regression) analysis of others – this means you will be able to read/understand empirical economics papers
- Get some hands-on experience with econometric analysis using real world data

Hypotheses in empirical research

- Construction of research hypotheses is an important step in applied economics research
- Hypotheses argue that one phenomenon or behavior causes or is associated with another phenomenon or behavior
  - These phenomena are called constructs
- Various sources of support routinely used to develop hypotheses
  - Theory and logical analysis (intuition)
  - Past studies: authority and consensus
  - Real life experiences and observations

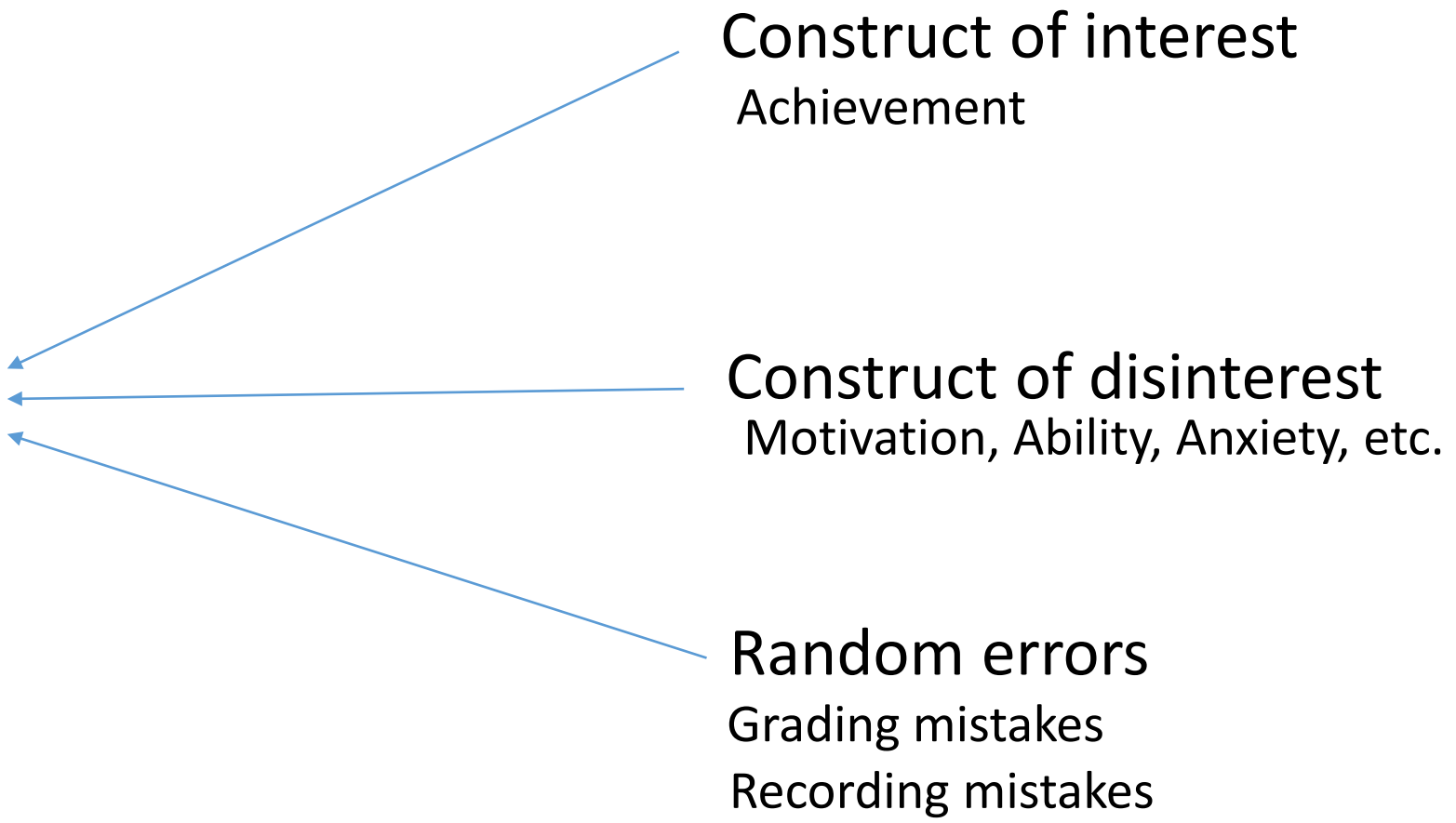
Framework for assessing empirical research

- Construct validity: to what extent are the constructs of interest successfully operationalized in the research?
- Internal validity
  - To what extent does the research design permit us to reach causal conclusions about the effect of the independent variable on the dependent variable?
- External validity
  - To what extent can we generalize from our sample and setting to the populations and settings specified in research hypothesis?

Maximizing construct validity

- Constructs are the abstractions and any one construct can be measured in different ways because there are a variety of concrete representations of any abstract idea
- Variables are partial representations of constructs, and we work with them because they are measurable
- Operational definitions specify how to measure a variable
- Reliability of a measure is defined as the extent to which it’s free from random error components
- Validity is defined as the extent to which the measure is free from systematic errors

Three components of variable



Stock, J. and M. Watson (2010)

Maximizing internal validity

- Threats to the internal validity of regression studies
  - Omitted variable basis
  - Misspecification or incorrect functional form
  - Measurement error
  - Sample selection bias
  - Simultaneous causality bias
  - Unobserved heterogeneity
- All of these imply that conditional mean independence assumption fails – in which case OLS is biased and inconsistent

Maximizing external validity

- A population is the aggregate of all of the cases that conform to some designated set of specifications
  - All the people residing in a given country, all households residing in a given state, etc.
- A stratum may be defined by one or more specifications that divide the population into mutually exclusive segments
- Nonprobability versus probability sampling
- Probability sampling
  - Simple random sampling gives each element in the population an equal chance of being selected
  - Stratified random sampling

Better research design helps to mitigate threats to validity

- Edward Leamer's (1983) reflection on the state of empirical work in economics: "take the con out of econometrics," "hardly anyone takes data analysis seriously"
- Empirical economics has experienced credibility revolution, with a consequent increase in policy relevance and scientific impact
- Randomized controlled trials (RCTs)
  - Treatment and comparison groups
- RCT designs
  - Randomized two-group design
  - Before-after two group design
  - Solomon four-group design
- Strengths and weaknesses of RCTs
  - Experimental artifacts
  - External validity issues

Quasi-experimental designs

- Difference-in-difference methods
  - Card and Krueger (2000) study the effects of minimum wages on employment
- Instrumental variables
  - Relevance
  - Exogeneity
- Regression discontinuity
  - Exploits precise knowledge of the rules determining treatment
  - Angrist and Lavy (1999) study of the effects of class size on achievement
- Matching methods

Data: sources and types

- Experimental versus observational data
- Cross-sectional data: data on different entities for a single period of time
- Time-series data: data on a single entity collected at multiple time periods
- Panel or longitudinal data: data for multiple entities in which each entity is observed at two or more time periods

Questions?

- What is the policy question?
- What is the causal relationship of interest?
- What is the dependent variable and how is it measured?
- What is (are) the key independent variable(s)?
- What is the data source?
- What is the identification strategy?
- What is the mode of statistical inference?
- What are the main findings?

Future readings

- Chetty, R. Yes, Economics Is a Science. New York Times, Oct. 20, 2013. http://www.nytimes.com/2013/10/21/opinion/yes-economics-is-a-science.html?_r=0
- Angrist, J. D. and J. S. Pischke. 2010. The Credibility Revolution in Empirical Economics: How Better Research Design is Taking the Con out of Econometrics. Journal of Economic Perspectives, vol. 24, No. 2, pp. 3-30.
- Angrist, J. D. and J. S. Pischke. 2009. Mostly Harmless Econometrics: An Empiricists's Companion. Princeton University Press. Chapter 1.
- Angrist, J. D. and J. S. Pischke. 2015. Mastering Metrics: The Path from Cause to Effect. Introduction

Thank you and good luck