Research Design & Variable Measurement

- Different ways of doing p.s. research
- Basic laws for doing research
- Social science vs. Natural science/engineering
- Components of research design
  - Side trip to data
- Causality
  - Side trip to types of research designs
- Seven things to avoid
The Road Map

Theory
  Empirical
    Causal
    Descriptive
  Positive
    Normative
      Philosophy
Different Ways of Doing Empirical Research

• Interpretive
  – *Verstehen*

• Small-\(N\) case study
  – Haphazard
  – Structured

• Large-\(N\) statistical analysis

• Interactions among these ways
Basic Laws of Doing Empirical Social Science Research I

- No clear path between interesting & researchable questions
- Path paved with observable implications
- Any research work doing contributes to a body of knowledge
- Most of the low-hanging fruit has been picked
Basic Laws of Doing Empirical Social Science Research II

• But there are other orchards
• Never under-estimate the ease of replication
• Build upon scalable ambitions
Social Vs. Natural Science & Engineering

• Reductionism

• Degree of reductionism

• Implications
  – Measures of association weak
  – Aggregates often better predictors

• Why we have statistics
  – Probabilities
  – Expected values
Major Components of Research Design

- Research question
- Theory
- Data
Research Question

• Importance
  – Not too general
  – Not too specific
  – Just right

• Contribute to literature
  – www.webofscience.com
Theory

• Def: A general statement of a proposition that argues why events occur as they do and/or predicts future outcomes as a f(prior conditions).

• General/concrete trade-off
• Observable implications

• Falsification
  – Karl popper
• Parsimony
  – Occam’s razor
Data

• Terms
  – Cases
  – Observations
  – Variables
  – Units of analysis

• Mapping between the abstract and concrete
  – Measures
  – Indicators
Side Trip to Measurement

• From abstraction to measure
• Sources of error
• What to do about error
The Mapping
Mapping from Abstraction to Measure

• Very abstract
  – Alienation and suicide
  – Moral decay and crime

• Less abstract
  – Democracy and peace
  – Party identification and voting
  – Fear of defeat and fundraising
  – Polarization and responsiveness
Sources of Error

- Conceptual or design error
- Bad breaks in random sampling
- Survey question wording
- Non-random out-selection
- Transcription errors
- Calculation & mechanization errors
What to Do About Error

• Practice safe data
  – Know where your data come from
  – Watch for anomalies
  – Use multiple measurement techniques
  – Collect as much data as possible and disaggregate
Causality

- Definitions of causality
- Problems in causal research
- Side trip to Campbell and Stanley
Definitions of Causality

• Mechanical
• Logical
• Statistical
  – Experimental paradigm
  – Expected values
Problems in Causal Research

- Theory
  - Confounding effects

- Design
  - Experimentalism is an ideal
  - Observationalism
    - “natural experiments”
    - Control variables
Donald Campbell and Julian Stanley

Experimental and Quasi-Experimental Designs for Research (1963)
Research design types

- One-shot case study
- One-group pre-test/post-test
- Static group comparison
- Pre-test/post-test with control group
- Solomon four-group design
- Post-test only experiment
One-shot Case Study

• Summary:
  X  O

• Journalism
• Common sense
• “of no scientific value”
One-group Pre-test/post-test

• Summary:
  O   X   O

• Better than nothing
• Standard way of doing most research
Static group comparison

• Summary:

\[ \begin{array}{c|c|c}
X & O_1 \\
-----
O_2 \\
\end{array} \]

• Problems
  – Selection
  – Mutual causation

• This is most cross-sectional analysis
Pre-test/Post-test Control Group

• Summary:

\[
\begin{align*}
R & O^1_T 
\times 
O^2_T \\
\hline
R & O^1_C 
& O^2_C
\end{align*}
\]

• Effect of treatment:

\[
[O^2_T - O^1_T] - [O^2_C - O^1_C]
\]
Solomon Four-Group Design

• Summary:
  
  R  O  X  O
  R  O  O
  R  X  O
  R  O

• This allow you to control for the effect of the experiment itself
Post-test only experiment

• Summary:

  \[
  \begin{array}{ccc}
  R & X & O \\
  R & O \\
  R & O \\
  \end{array}
  \]

• No selection
• No prior observation
• Classical scientific and agricultural experimentalism
Last word: Things to Avoid

• Colinearity
• Sampling on the dependent variable
• Constant explanatory variables
• Constant dependent variables
• Measurement error
• Excluded variable bias
• Endogeneity