Chapter 6
Treatment Effects: Outline

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6.1 Introduction

The 'old school' conceptual framework intended for causal inference in econometrics: structural equation modeling. The 'new school' framework: treatment effects.

6.2 The structural equation paradigm (1940s-1980s)

6.2.1 Origins and achievements

- Haavelmo (1943, 1944) as the conceptual architect of probabilistic modeling in economics. Koopmans (1949, 1950) and the formalization of identification theory. Identification as a technical matrix-invertibility problem (rank and order conditions): switching between the reduced form and the structural form
- Emphasis on systems of equations, linearity, and constant parameters. Estimation and testing methods tailored to linear simultaneous equations.
- Practical applications to macroeconomic forecasting and policy analysis.

6.2.2 Why it did not age well

- It served applied microeconomics poorly: heterogeneity, selection, nonlinearity are not easy to incorporate. Lack of transparency about the meaning of identifying assumptions.

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- It served applied macroeconomics poorly. Lucas (1976): the invariance problem and lack of structural stability. Sims (1980, 1982): advocacy of VARs and skepticism about exclusion restrictions.

Macro turned toward (structural) VARs, DSGE models. Micro turned toward the statistical literature on causal inference.

6.3 The statistical roots of the potential outcomes framework (1920s-1980s)

6.3.1 Early statistical foundations

- Neyman (1923) on repeated-sampling inference and the notion of potential outcomes in randomized experiments.
- Rubin (1974): formal articulation of the Rubin Causal Model (RCM) — counterfactuals, stable unit treatment value assumption (SUTVA), and assignment mechanisms
- Rosenbaum and Rubin (1983): unconfoundedness and propensity score methods
- The language of 'treatment effects' rooted in clinical trials and biostats(?)
- Remained a niche area within statistics for a long time. Statistics' focus on prediction, estimation, and experimental design
- Limited interaction between econometricians and statisticians until the 1990s

6.3.2 Why it aged well

- Clear conceptual framework that transcends field boundaries
- Makes assumptions very explicit and clear
- Separates conceptual assumptions from functional form assumptions
- Clearly connects individual and aggregate effects

6.4 The migration of potential outcomes and treatment effects into econometrics (1990s–2000s)

6.4.1 Developments in theoretical econometrics

- Imbens and Angrist (1994), Angrist, Imbens, and Rubin (1996): reformulation of the traditional IV estimator in the potential outcome framework. The Local Average Treatment Effects (LATE).

- Heckman's parallel contributions: selection models, missing data, and structural interpretations of treatment effects.
- Clarifying concepts: ATE, ATT, LATE, MTE, etc.

6.4.2 Developments in applied econometrics: the 'credibility revolution'

- Angrist and Krueger (1991), Card (1990), etc.
- Emphasis on transparent designs and identification: differences-in-differences, regression discontinuity, instrumental variables, and natural experiments
- Replacement of technical identification arguments with design-based identification arguments. The potential outcome framework is very well suited to formalizing these arguments

6.5 Taking stock: why potential outcomes dominate causal inference today

6.5.1 Framework advantages

- Reduced reliance on functional-form assumptions
- Transparency of identifying assumptions; focusing on what matters. (What must be true for the estimator to mean what we claim.)
- Focus on single equations and policy-relevant parameters
- Natural accommodation of treatment effect heterogeneity
- Compatibility with machine learning through the decomposition of causal identification into prediction and identification steps

6.5.2 Disadvantages and critiques

- Critique from structural econometricians: lack of focus on economic mechanisms and behavioral grounding
- External validity and transportability concerns
- Design-based inference may not address equilibrium phenomena or counterfactual policy simulations
- 'Reduced-form hegemony' and concerns that treatment-effects methods encourage atheoretical empiricism

6.6 New directions in treatment effects

6.6.1 Heterogeneous treatment effects in modern econometrics

- Nonparametric and semiparametric identification of heterogeneous effects.
- Machine learning estimators: causal forests, orthogonal moments, and double/debiased ML.

6.6.2 Panel data and event-study methods

- Goodman-Bacon (2021) on staggered adoption
- Sun and Abraham (2020), Callaway and Sant'Anna (2020): modern difference-in-differences identification
- Interpretation of the two way fixed effects model with individual heterogeneity and staggered adoption

6.6.3 Policy-Focused Innovations

- Synthetic controls (Abadie et al.)
- Transporting and extrapolating treatment effects across settings (external validity research).

6.6.4 Multiple treatments and interactions

- Violations of SUTVA

6.7 The place for structural econometrics today

- Counterfactual policy evaluation
- Markets, equilibrium, dynamics, expectations, and welfare analysis.
- The growing field of structural microeconometrics (industrial organization, labor, development)
- Macro has its own developent path

6.8 Conclusion

- How treatment effects reshaped empirical practice
- Enduring tensions: identification versus explanation, design versus model, internal versus external validity
- Reflection on how econometrics continues to evolve in response to theoretical, computational, and empirical challenges
- Treatment effects as a bridge between different intellectual traditions rather than a replacement

References