

Quantitative Methods in Economics

Causality and treatment effects

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4) Robustness, Sensitivity, Falsification

Assessing the Confounding Effect of Unobserved Factors

- ▶ The selection on observables assumption implies that $Y_1, Y_0 \perp\!\!\!\perp D | X$, ruling out the possibility of hidden bias
- ▶ While this assumption is not directly testable, we can use a variety of robustness checks, falsification tests and sensitivity analyses to assess its plausibility
- ▶ Robustness checks: Are results sensitive to alternative ways to measure the treatment (e.g., dose-response analysis), or to the use of alternative control groups?
- ▶ Falsifications tests: Do we find “placebo” effects on outcomes that are known to be unaffected by the treatment (e.g., outcomes measured before the treatment)?
- ▶ Sensitivity Analysis: How important do unobservables need to be in order to eliminate or sufficiently change the estimated treatment effect?

Robustness

Robustness checks: Are results sensitive to alternative ways to measure the treatment (e.g., dose-response analysis), or to the use of alternative control groups?

- ▶ Alternative measures of treatment: Average number of cigarettes (Doll and Hill, 1966)
- ▶ Alternative control groups: CPS and PSID controls for the NSW program (Dehejia and Wahba, 1999)

Sensitivity

Sensitivity analysis: How important do unobservables need to be in order to eliminate or sufficiently change the estimated treatment effect?

“if cigarette smokers have 9 times the risk of nonsmokers for developing lung cancer, and this is not because cigarette smoke is a casual agent, but only because cigarette smokers produce hormone X, then the proportion of hormone X producers among cigarette smokers must be at least 9 times greater than among nonsmokers.”(Cornfield et al., 1959).

Rosenbaum and Rubin (1983, JRSS), Rosenbaum (2002), and Imbens (2003, AER) provide formal models of sensitivity analysis.

Falsification

Falsifications tests: Do we find “placebo” effects on outcomes that are known to be unaffected by the treatment (e.g., outcomes measured before the treatment)?

- ▶ Becker and Murphy's (1988) find empirical support for a theory of rational addiction using data on tobacco and alcohol consumption. Auld and Grootendorst (2004, JHE) replicate the exact same models obtaining similar result using data on milk, eggs, oranges, and apples.
- ▶ Several studies found significant networks effects on outcomes such as obesity or smoking. Cohen-Cole and Fletcher (2008, BMJ) use similar models and data and find network effects for acne, height, and headaches.