

External validity, causal interaction and randomised trials

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Overview

1 Motivation: RCTs in economics

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- 2 From necessity and sufficiency to causal interaction
- 3 Causal interaction and the failure of external validity
- 4 Reduction in class size and educational outcomes
- 5 Interpretation and implications

Caveats and notes

- Part of broader project: 1. Present work on RCTs; 2. Necessary & sufficient causes, econometrics & causal graphs; 3. Revisiting Suppes (1970) 'quantitative causality'
- Economist interested in philosophy rather than philosopher interested in economics
- Rejection does not imply acceptance

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Claim 1: INUS causality implies causal interaction

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- **Claim 2:** Interaction leads to failure of external validity

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- Interest is in $E[Y_{1i} - Y_{0i}]$
- Definition of external validity given binary 'location' variable D

$$E[Y_i(1) - Y_i(0)|D_i = 1] = E[Y_i(1) - Y_i(0)|D_i = 0] \quad (3)$$

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- If T interacts with D the result follows straightforwardly. Statistical logic known since at least Cook and Campbell (1979: 70-74): external validity 'in essence [an issue of] statistical interaction'
- But *also* in the philosophy literature: "Probably the most common reason for a capacity to fail to obtain in the new situation is causal interaction" (Cartwright, 1989: 163)

Back to RCTs (in brief)

- Interaction entirely neglected in standard guides to practice (e.g. Angrist and Pischke (2009) and Duflo, Glennerster, and Kremer (2006)).
 - Some allusion to the issue by critics - notably Ravallion (2008), Leamer (2010) and Keane (2010).
 - Key difference: above authors conflate issues of selection, models of agent behaviour and interaction.
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- **Claim 3:** Interaction - external validity issue not accounted for in current literature

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- Specifically cite the case of class size: “Across [the four cited] studies a ten-student reduction in class size produces about a 0.2 to 0.3 standard deviation increase in individual test scores” (Angrist and Pischke, 2010: 24)

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 - 1 It makes no sense to think of class size as primarily an independent causal factor: class size matters because of what happens in the classroom.
 - 2 Why would standard deviations in test scores relative to specific level changes be the correct measure?

Sibling (micro)econometrics paper(s)

- Focus on specific interaction: teacher quality and class size. Large, but orthogonal, literatures on both.
- Using *existing* data - *Project STAR* (RCT in Tennessee in 1980s) - but this presents various technical complications..
- Two other issues emerge naturally from less simplistic specification of causal relationship: student absence and teacher absence (also the subject of various studies)

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- The critical contribution of the philosophy is to give us a reason to believe in interactive causal structures, implying:
 - 1 Failure of external validity as the null hypothesis
 - 2 A limited role for RCTs (as argued for other reasons by Cartwright, Heckman and others)
 - 3 Little justification for the 'more experiments' mantra; if you don't know/measure the interactive factors what basis is there for terminating the replication process?

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How is this different from the preceding literature?

- Link between causal interaction and external validity is not made explicit (at least not that I have seen).
- Economist critics focus on how various maximising behaviours of economic agents might compromise inference from RCTs (through selection into samples, compensating behaviour, etc), but little independent justification for particular models.
- Not an attempt to construct a positive general theory for 'hunting causes'
- Present work: simple, plausible ontological assumptions about the nature of causal structures are enough to call into question the methodology of RCTs in economics. I do not commit myself to more than this.