

# Causal Mediation in Natural Experiments

## Abstract

Natural experiments provide settings for estimating causal effects, but give little indication of the mechanisms involved. My paper develops a Causal Mediation (CM) method that accounts for individuals' choices of a mediator mechanism — such as whether to use healthcare or attend college — using instrumental variation in mediator costs. Applying it to the Oregon Health Insurance Experiment (OHIE) shows that the effect of access to socialised healthcare effect on well-being operates through increased healthcare use, with notable direct effects.

## Research Question

- How can we identify mechanisms in natural experiments — when individuals freely choose a mediating mechanism?  
*Conventional CM breaks down when mediator choice is unconstrained, giving biased inference.*
- Can we model the system to deliver unbiased CM estimates?  
*I develop a Marginal Treatment Effect (MTE) approach, treating a mediator as a choice shaped by incentives, not assuming it is random.*
- What mechanisms explain the effects of access to socialised healthcare in the Oregon Health Insurance Experiment?  
*I compare conventional CM to my MTE approach estimating the role of increased healthcare take-up in the effect of new access to socialised health insurance.*

## Contribution & Literature

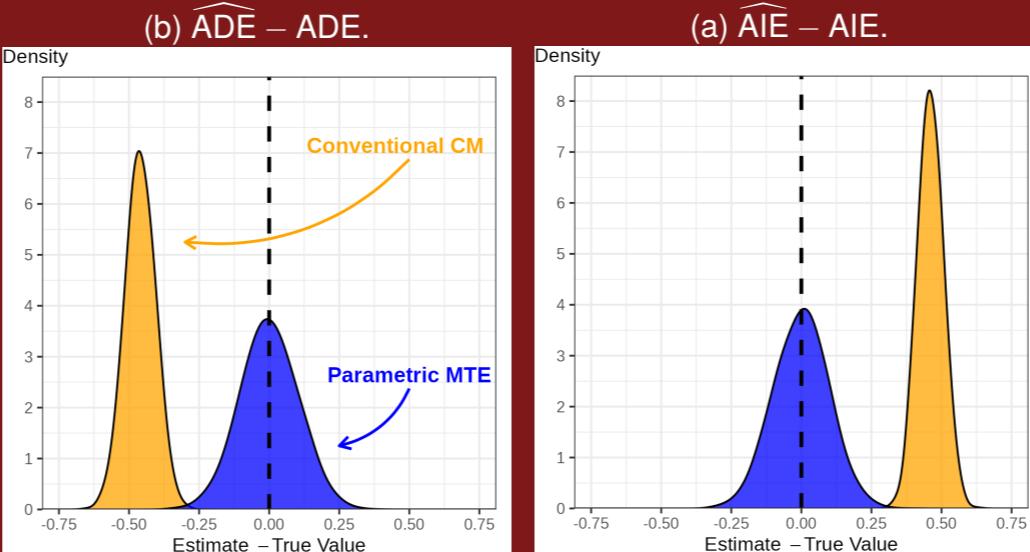
I show that conventional CM methods, break down in economic settings where mediators are chosen rather than randomly assigned. I formalise the resulting selection biases on the average direct and indirect effects, then develop a CM framework consistent with economic models of selection — linking CM to the MTE literature. This bridges the practice of suggestive evidence for mechanisms to a rigorous identification strategy for mechanism effects under endogenous mediator choice.

## Oregon Health Insurance Experiment (OHIE)

The OHIE offered access to socialised health insurance by a wait-list lottery, leading to increased healthcare take-up and benefits in subjective health. Standard practice interprets this as evidence that healthcare use mediates benefits from socialised health insurance effects — but this inference is so far only suggestive, and omits direct benefits such as psychological gains from no longer being uninsured. My method estimates these CM effects, showing that increased healthcare use explains much of the well-being gain, while direct effects remain substantial. This illustrates how accounting for endogenous mediator choice changes conclusions in a natural experiment setting.

# Conventional CM assumes away choice. My MTE approach puts choice back into the equation.

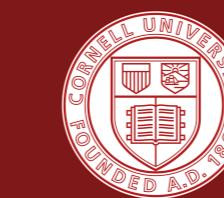
**Figure 1:** The MTE Approach Addresses Persistent Bias in Conventional CM Estimates of the Average Direct and Indirect Effects (ADE and AIE).



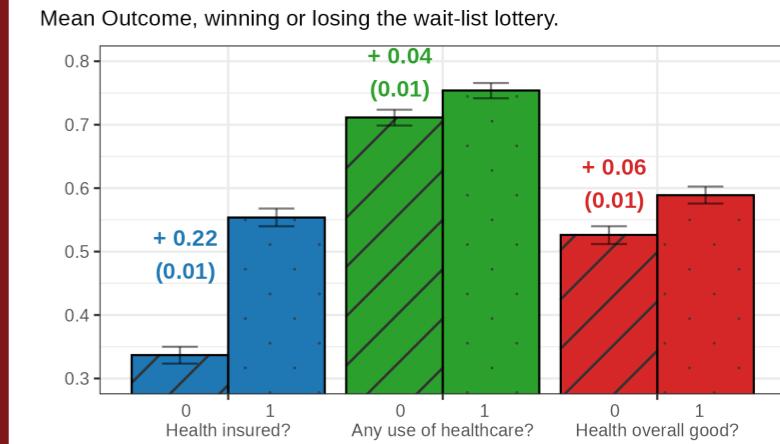
10,000 simulations show that if a mediator mechanism is decided by rational choice, then selection bias contaminates conventional CM. My MTE model addresses these biases.



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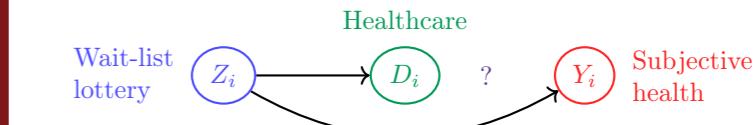


**Figure 2:** Total Effects of the OHIE.



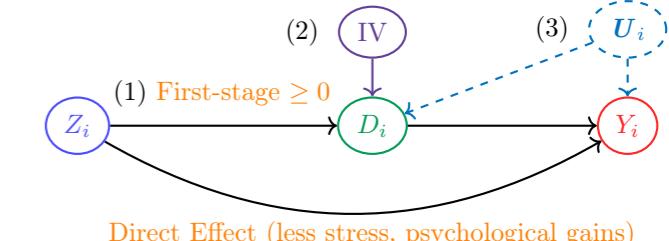
In 2008, Oregon gave access to socialised health insurance by wait-list lottery, increasing healthcare take-up and improving subjective health one year later (Finkelstein+, 2012).

## Causal Model: Suggestive Evidence.



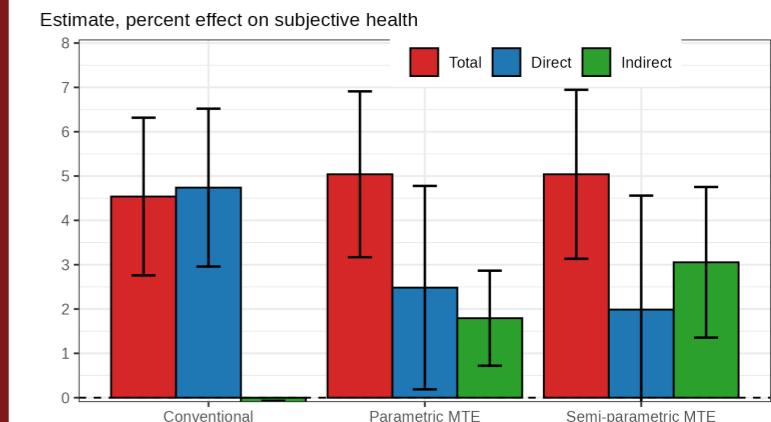
Investigate mechanisms with suggestive evidence  $\Rightarrow$  necessary (not sufficient) evidence on healthcare as mediating mechanism.

## Causal Model: MTE Approach.



MTE model with assumptions (1) mediator monotonicity, (2) cost-shift IV, (3) relevant selection  $\Rightarrow$  sufficient evidence.

**Figure 3:** CM Analyses of Healthcare Take-up in the OHIE.



- Conventional CM  $\rightarrow$  healthcare mediates  $\approx 0\%$
- MTE-based CM  $\rightarrow$  healthcare mediates  $\approx 20\text{--}80\%$ .

