Weak-necessity causal reasoning for evaluating counterfactual arguments in law and economics

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Motivation

- The American legal system is adversarial
- In disputes pertaining to economic matters (e.g. antitrust, discrimination), each side will hire an economist to offer scientific evidence for the claim
  - economic consulting is a large and lucrative industry
- The expert economist is evaluated using the same standards as experts in the natural sciences, e.g. forensic chemists, medical doctors

Problem 1 of 2

How is it so often the case that two independent economists can use the same dataset in pursuit of the answer to the same question and conjure up empirical evidence for two opposing conclusions?

- Let’s assume intellectual honesty on the part of the economists
- Assumption: Sometimes there really is more than one reasonable stance on how to model a situation

How does a non-expert judge evaluate the findings of two disagreeing experts?

Problem 2 of 2

Economist expert witnesses are challenged, and their testimonies removed from legal consideration by failing to meet standards of scientific reliability, more frequently than the expert witnesses of any other scientific discipline. Why?

- Knee-jerk: economics unscientific?
- A reputation problem for economics?
- Argument: this is a problem with the standards of evaluation for scientific evidence

Daubert standards for scientific evidence

1. Whether the technique or theory in question can be, and has been tested
2. Whether it has been subjected to publication and peer review
3. Its known or potential error rate
4. The existence and maintenance of standards controlling its operation
5. Whether it has attracted widespread acceptance within a relevant scientific community

(Daubert v. Merrell Dow Pharmaceuticals, 1993)

- If a judge determines that a testimony does not satisfy the Daubert standard, then the testimony must be excluded from legal consideration altogether.
- Note: Between 1993 and 2021, 103 of 286 economist expert testimonies were excluded from consideration in Daubert challenges (Peruzzi, 2024, p. 7)

Focus on antitrust

- Antitrust will be the focal point.

    1. It’s an area of law that frequently employs economists

    2. The arguments in antitrust often take on a particularly problematic structure: but-for causation (Hartnett, 2017)

But-for (strong necessity) causation

- A common strategy for explicitly evaluating causal claims: but-for test of causation
- Originally used in tort law, in cases in which plaintiffs allege that the defendant caused the plaintiff harm.
- Checks that the harm would not have occurred in the absence of (but for) some action or omission by the defendant (Abele et al., 2011, p. 849; David et al., 2005, p. 216).

But-for (strong necessity) causation

Applied to antitrust:

- No smoking gun evidence (e.g., security tapes, with audio, of a group of businessmen saying, “let’s cooperate to inflate prices in steps X, Y, and Z!”)

- Claim: *Firm A engaged in a set of allegedly anticompetitive behaviors, Σ, which together caused the actual outcome Y_A. In their absence, the outcome would have been the hypothetical Y_H. For the plaintiff, outcome Y_A is inferior to outcome Y_H, and thus the difference between outcomes, call this $r(Y_A, Y_H)$ for some metric r, is the harm done by firm A.*

- Economist must:

  - expose a causal relationship substantiated by data

  - develop a clear picture of what would have happened, absent a set of conditions, institutional arrangements, or habitual behaviors that did in fact hold, i.e., depict a but-for world

Problem with but-for: unclear counterfactual

Tort	Antitrust
Separating condition: vehicle runs a red light	**Separating condition**: collusion and price-fixing
Outcome: pedestrian is struck by vehicle and injured	**Outcome**: higher consumer prices
Counterfactual: vehicle does not run a red light	**Counterfactual**: Perfect competition? Oligopoly? Allegedly, lower prices—but how much lower?

Tort compares anomaly to typical reality; antitrust compares typical reality to anomalous ideal.

Alternative causal framework

1. Richard Wright's NESS test of causation
    - Similar to J.L. Mackie's INUS
2. Mackie's causal field

A cause is a necessary element of a sufficient set

- Suppose A and B independently and unbeknownst to each other enter the same home and set fire to it at the same time.
- If A hadn't, B's fire would have burned the house down; if B hadn't, A's fire would have burned the house down
- Neither A's fire nor B's fire is a necessary (but-for) condition for the fire
  - According to the but-for test, neither's actions *caused* the house to burn down
- But each is a member of a set of conditions sufficient for the outcome
  - For each X in {A,B}: We have a set of conditions which would have ensured the outcome. Party X lights the match; there is oxygen in the atmosphere to fuel the flame; nobody is home to put out the fire; the floors are made of wood and easy to burn.
  - According to the NESS test, A and B's actions are each considered to be causes for the outcome

Mackie's causal field

- We have a set of conditions that, taken together, are sufficient to produce an outcome.
    - For each X in {A,B}: We have a set of conditions which would have ensured the outcome. Party X lights the match; there is oxygen in the atmosphere to fuel the flame; nobody is home to put out the fire; the floors are made of wood and easy to burn.
- The court of law is not interested in holding atmospheric oxygen responsible for causing the fire, though it did play a causal role
- Let's relegate it to the causal field

Mackie's causal field

- The causal field can be understood as the background, or setting, of the specific causal relationship under scrutiny—often implicit
- Precisely stating the causal field can give *boundary conditions* for the number of possible counterfactual scenarios
    - Reduce from the hypothetical infinite counterfactuals to a finite number specified by fixed parameters, making the modeling problem tractable
- NESS conditions that can safely be shunted to the causal field are ones that are *reasonably invariant*

What belongs in the causal field?

- In many cases, the category in which a NESS condition should reside is unambiguous, e.g. atmospheric oxygen

- In some cases, there is room to debate whether a given condition is reasonably invariant, either as a factual or a normative matter.

What belongs in the causal field?

- Consider a sufficient set for harms to due alleged anticompetitive behavior:
  - the anticompetitive actions under scrutiny; the market share of the firm under scrutiny; *the long-standing economic institutions, conventions, and structures of the United States that both champion the ideal of competitive market conditions and consistently contain ways for the firms in its domain to capture large shares of the market and execute what are later construed as anticompetitive behaviors*
- Plaintiff's economist asserts that institutional structures that uphold competitive economic conditions ought to be considered the background and should be relegated to the causal field, while institutional structures that enable individual firms to capture large shares of the market have an active causal role
- Defendant's economist asserts the opposite: it is the circumstances that enabled the firm's allegedly anticompetitive actions that ought to be relegated to the causal field

What belongs in the causal field?

- The decision of what to seal into legal precedent is ultimately a normative problem left for the judge.

- Economists are responsible only for the prior analysis: providing an adequate account of actual causation and an appropriate model by which to demonstrate a plausible counterfactual.

Weak-necessity causal reasoning for evaluating counterfactual arguments

The plaintiff's expert economist is usually tasked with

1. proving actual causation (demonstrating that the separating condition is a NESS condition not in the causal field)

2. selecting a model by which to describe the events of a counterfactual world (choosing a model whose causal field is compatible with the causal field present in the target system)

The point: the weak-necessity account I have detailed offers a reasonable way for an economist to structure their analysis *and* for a non-expert judge to evaluate the evidence

What happens when evaluation does not focus on causal structure?

The plaintiffs' economic expert witness conducted a regression analysis that found, after correcting for other factors likely to influence prices of HFCS, that those prices were higher during the period of the alleged conspiracy than they were before or after. (More precisely, the independent variable that the expert labeled CONSPIRE, which took a value of 1 during the period of the alleged conspiracy and a value of 0 before and after that period, was found to have a positive and statistically significant effect on the dependent variable, which was price.) [. . .] The defendants presented a competing regression analysis done by one of their economic experts, who added a couple of variables to the analysis of the plaintiffs' expert and, presto, the CONSPIRE variable ceased to be statistically significant.

Judge Richard Posner

In re High Fructose Corn Syrup Antitrust Litigation (2002)

Problem for evaluation

- The judge is presented with a statistical argument about the nebulous “CONSPIRE” term

- No clear causal structure, and no clear next steps for weighing one economist’s testimony against another’s

Causal structure & regression models

- Regression models are often presented as one or more *structural* equations of a form resembling $E = \beta_0 + \beta_1 C_1 + \beta_2 C_2 + \varepsilon$ where β_i for $i = 1, 2$ measure the strength of causal connection between cause C_i and effect E and ε represents an error term capturing variation in E not explained by C

- Relies on regression model to have structural content—terms map to measurable quantities

Interpretation:

- Variables may be considered members of a set sufficient for the outcome

- In a well-specified regression, the error term is a good analog for part of the causal field, capturing causal determinants of the outcome not worth making explicit

It’s not all about regression… causal structure in theoretical models

- Many economic testimonies involve not regressions but theoretical economic models (or informal invocations of economic theory that could in principle be made formal and explicit)

- Not discussed in this presentation but present in the paper: a 2024 antitrust case involving the National Football League (NFL)

Thanks!

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