

PSC4375: Introduction to Causality

Week 1: Lecture 1

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Villanova University

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What is causal effect?

Factual vs. **Counterfactual**

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Factual vs. Counterfactual

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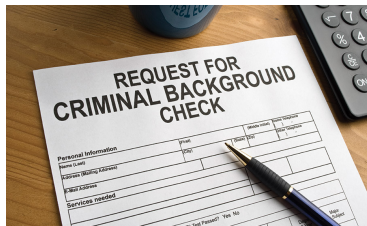
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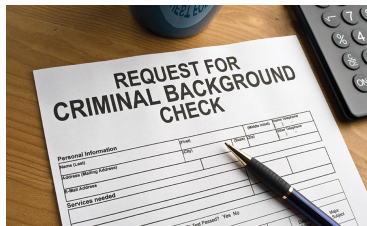
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- **Fundamental problem of causal inference:**
 - Can never observe counterfactuals, must be inferred.

Criminal record experiment

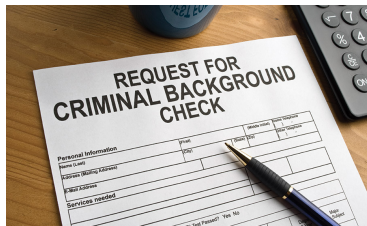


Criminal record experiment



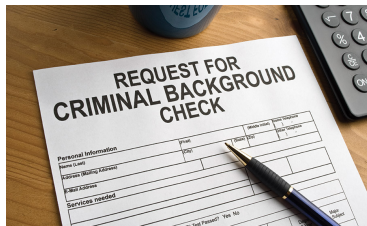
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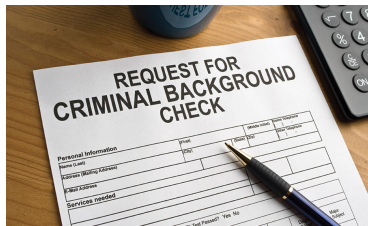
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- Outcome of interest: receiving a callback from a potential employer.

A tale of two applications

	Criminal Record	Callback?
Applicant 1	Ex-felon	No
Applicant 2	No criminal record	Yes

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- Did the first applicant not get a callback **because** they had a criminal record?

Notation and Jargon

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- **Outcome variable** Y_i : callback

	T_i (ex-felon)	Y_i (callback)
Ex-felon applicant	1	0
Non-ex-felon applicant	0	1

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Potential Outcomes

	T_i (ex-felon)	Y_i (callback)	$Y_i(1)$	$Y_i(0)$
Ex-felon applicant	1	0	0	???
Non-ex-felon applicant	0	1	???	1

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 - Observe $Y_i = Y_i(1)$ if $T_i = 1$ or $Y_i = Y_i(0)$ if $T_i = 0$
- To infer causal effect, we need to infer the missing counterfactuals!

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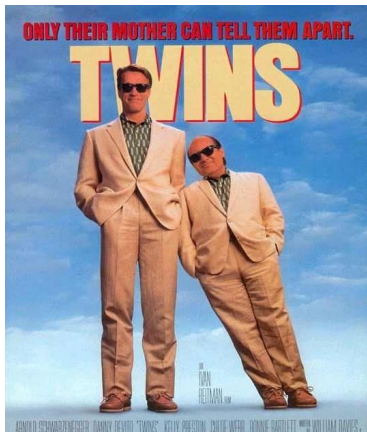
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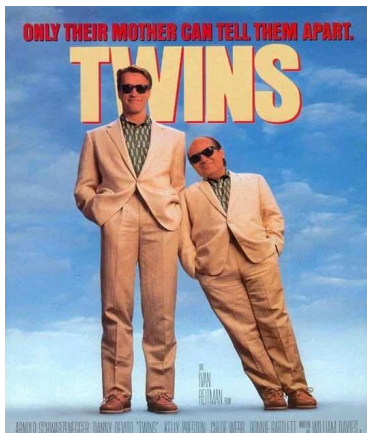


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 - \rightsquigarrow find a state similar to NJ that didn't increase minimum wage.

Imperfect matches

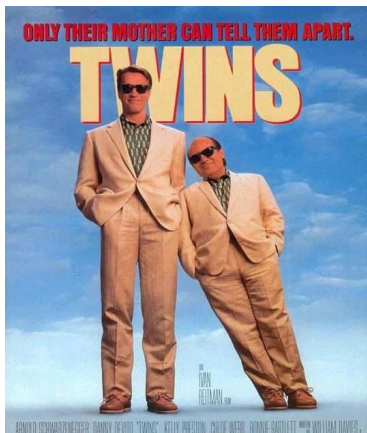


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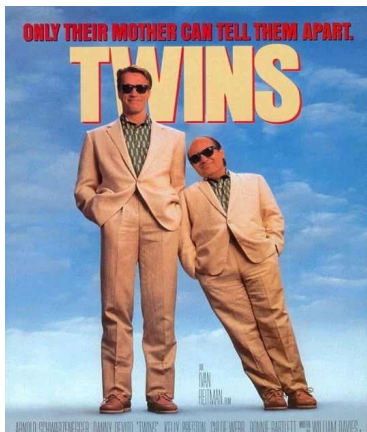
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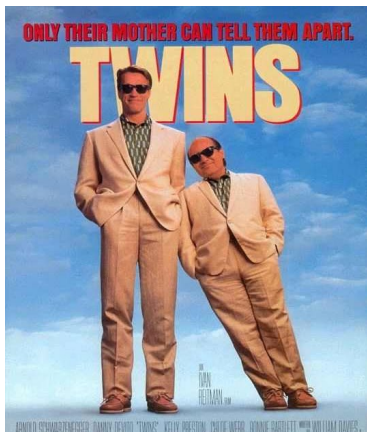
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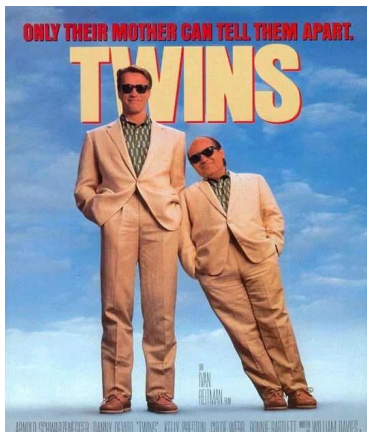
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- Those who take treatment may be different than those who take control.
- How can we correct for that?

Assignments this week:

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- **This Friday:**
 - Lecture on randomized control trials
 - Problem set 1 posted on Github, due next Friday