

Difference in difference

INFO/STSCI/ILRST 3900: Causal Inference

4 Nov 2025

Learning goals for today

At the end of class, you will be able to:

1. Study effects of policies in a spooky setting:
when there is no matching control unit

Logistics

- ▶ Quiz 4 today
- ▶ Project Groups and Part II instructions posted
- ▶ PSET 5 posted, due Nov 11

Card, D., & Krueger, A. B. (1994).

Minimum Wages and Employment: A Case Study of the Fast-Food Industry in New Jersey and Pennsylvania.

The American Economic Review, 84(4), 772-793.

Economic theory

When the minimum wage rises, how might employment change?

Economic theory

When the minimum wage rises, how might employment change?

- ▶ employees cost more

Economic theory

When the minimum wage rises, how might employment change?

- ▶ employees cost more
- ▶ employers might get by with fewer employees

The setting

The setting

- ▶ Federal minimum wage
 - ▶ \$3.80 on April 1, 1990
 - ▶ \$4.25 on April 1, 1991

The setting

- ▶ Federal minimum wage
 - ▶ \$3.80 on April 1, 1990
 - ▶ \$4.25 on April 1, 1991
- ▶ New Jersey minimum wage
 - ▶ \$5.05 on April 1, 1992

NJ introduces a high minimum wage.

How would you study the effect on employment?

Source: Wikimedia





Photo by James Loesch - <https://www.flickr.com/photos/jal33/49113053632/>
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New Jersey
Minimum Wage
Rose

Photo by James Loesch - <https://www.flickr.com/photos/jal33/49113053632/>
CC BY 2.0, <https://commons.wikimedia.org/w/index.php?curid=87207834>



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171 stores



80 stores



99 stores



60 stores



171 stores



80 stores



99 stores



Wendy's

60 stores

Phone interview: Feb-Mar 1992 before minimum wage rose
364 in NJ and 109 in PA

Nov-Dec 1992 after minimum wage rose
331 in NJ and 79 in PA



171 stores



80 stores



99 stores



60 stores

Phone interview: Feb-Mar 1992 before minimum wage rose
364 in NJ and 109 in PA

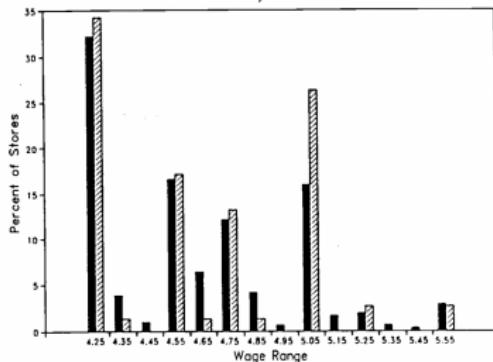
Nov-Dec 1992 after minimum wage rose
331 in NJ and 79 in PA

Recorded: How many full-time equivalent employees?

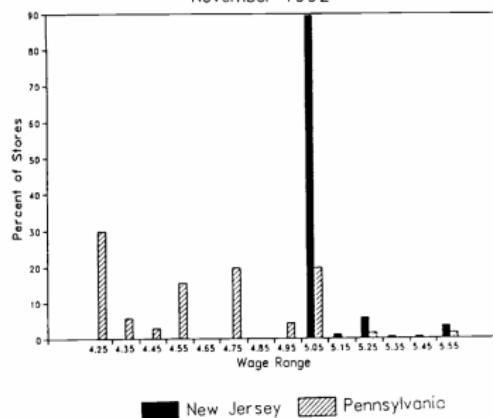
Did starting wages rise in NJ?

Figure 1
Distribution of Starting Wage Rates

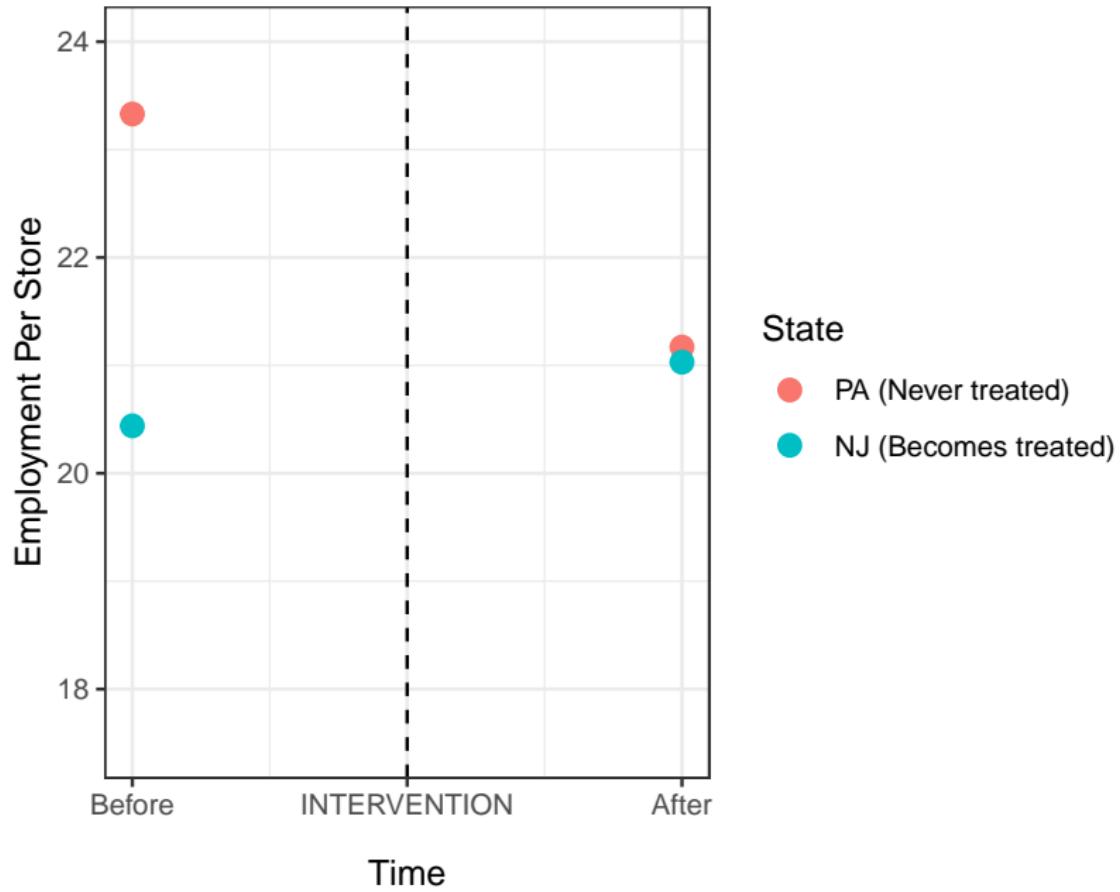
February 1992

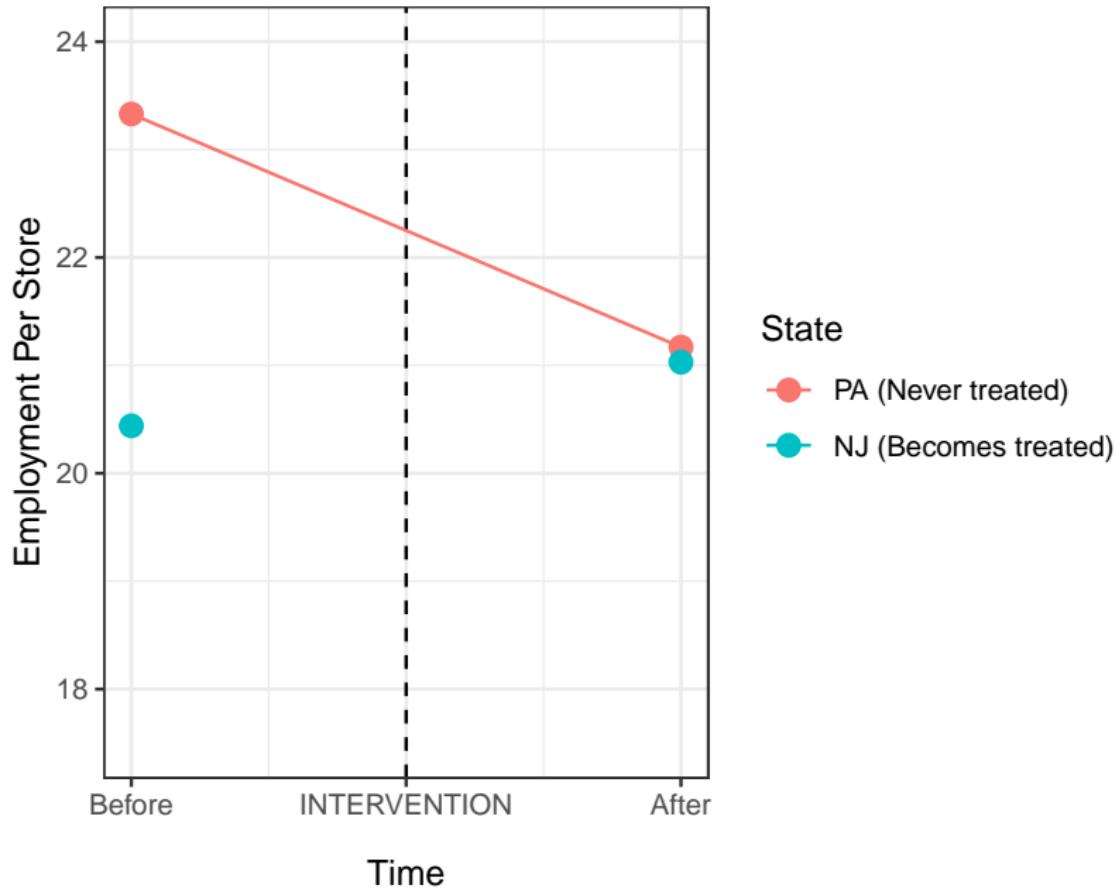


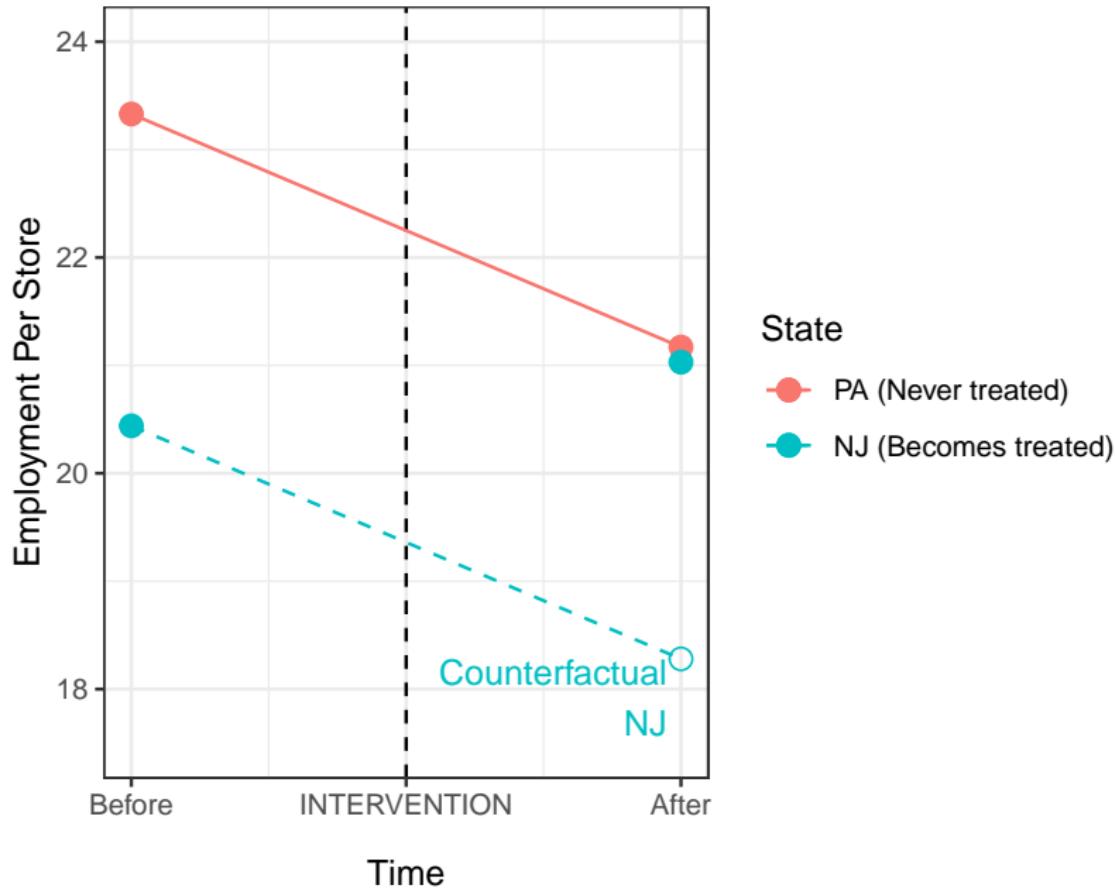
November 1992

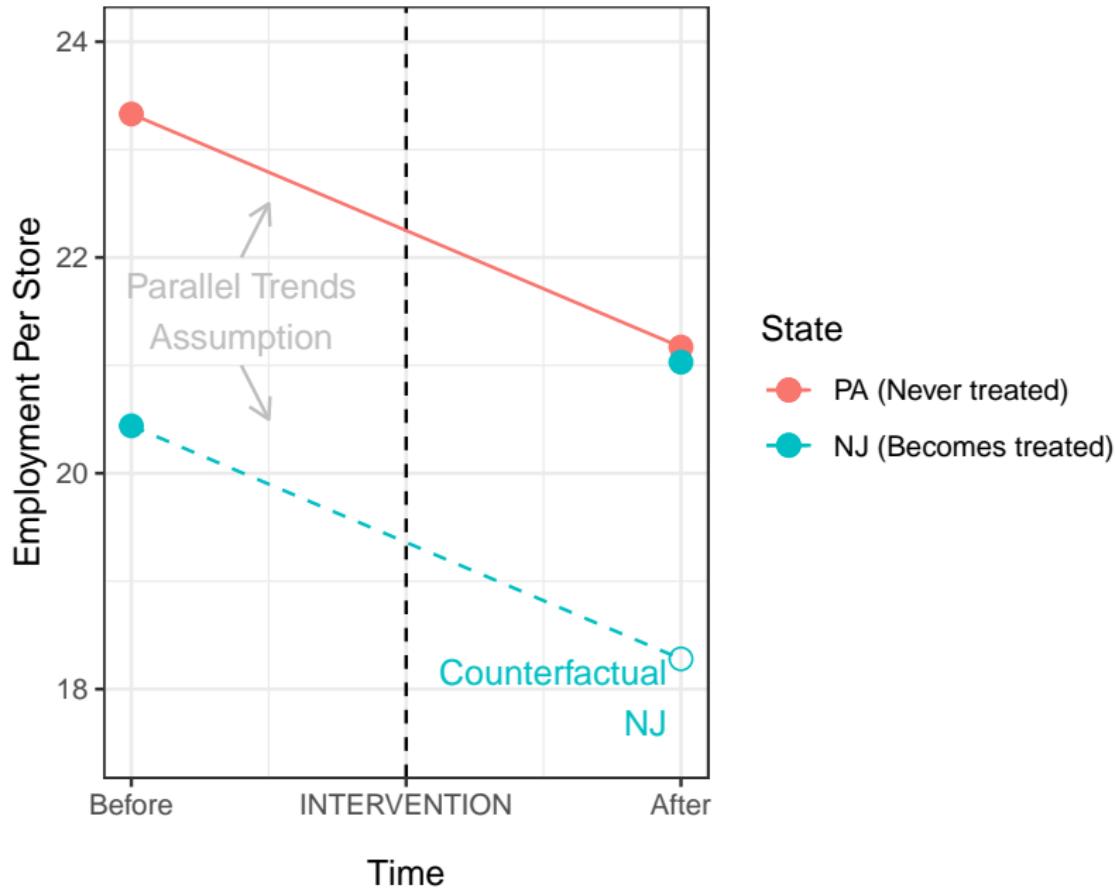


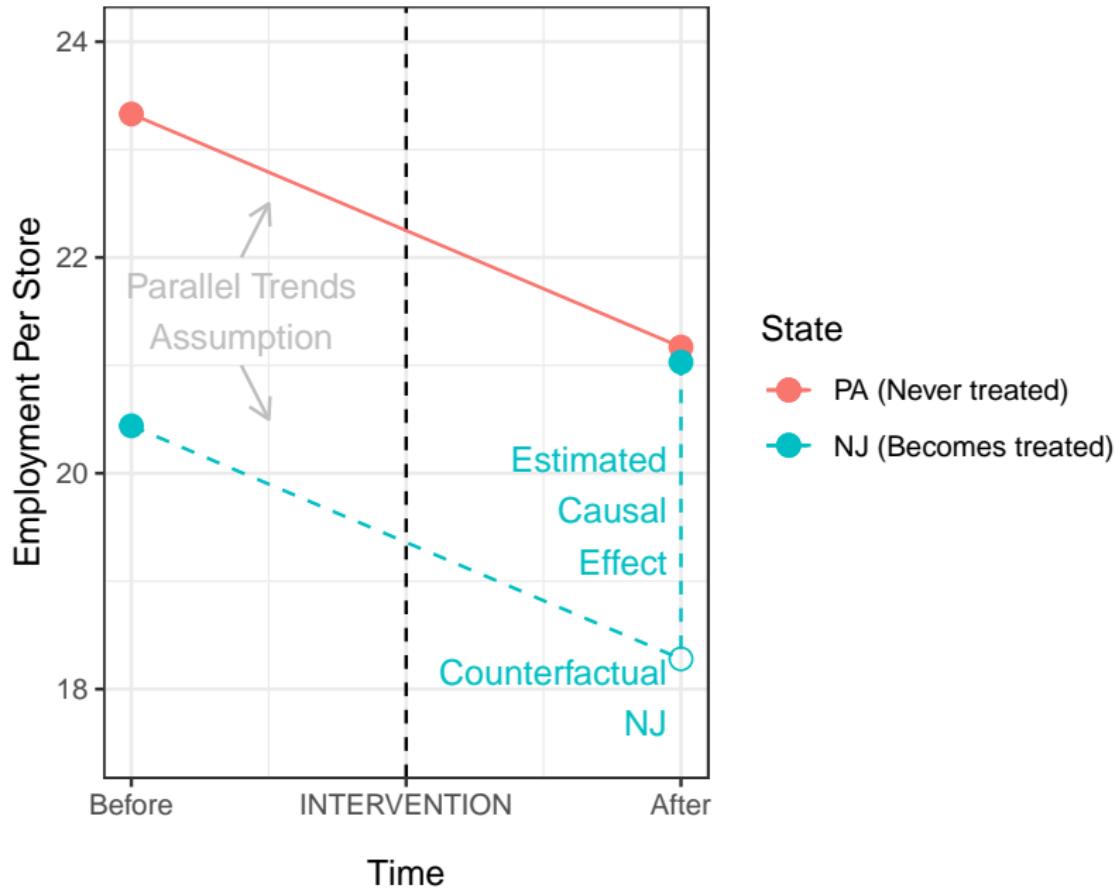
How did employment change?











Variable	Stores by state		
	PA (i)	NJ (ii)	Difference, NJ – PA (iii)
1. FTE employment before, all available observations	23.33 (1.35)	20.44 (0.51)	-2.89 (1.44)
2. FTE employment after, all available observations	21.17 (0.94)	21.03 (0.52)	-0.14 (1.07)
3. Change in mean FTE employment	-2.16 (1.25)	0.59 (0.54)	2.76 (1.36)

“Contrary to the central prediction of the textbook model of the minimum wage,...we find no evidence that the rise in New Jersey's minimum wage reduced employment at fast-food restaurants in the state.”

Card & Krueger 1994, p. 792

- ▶ simple study
- ▶ well-executed
- ▶ upended conventional wisdom

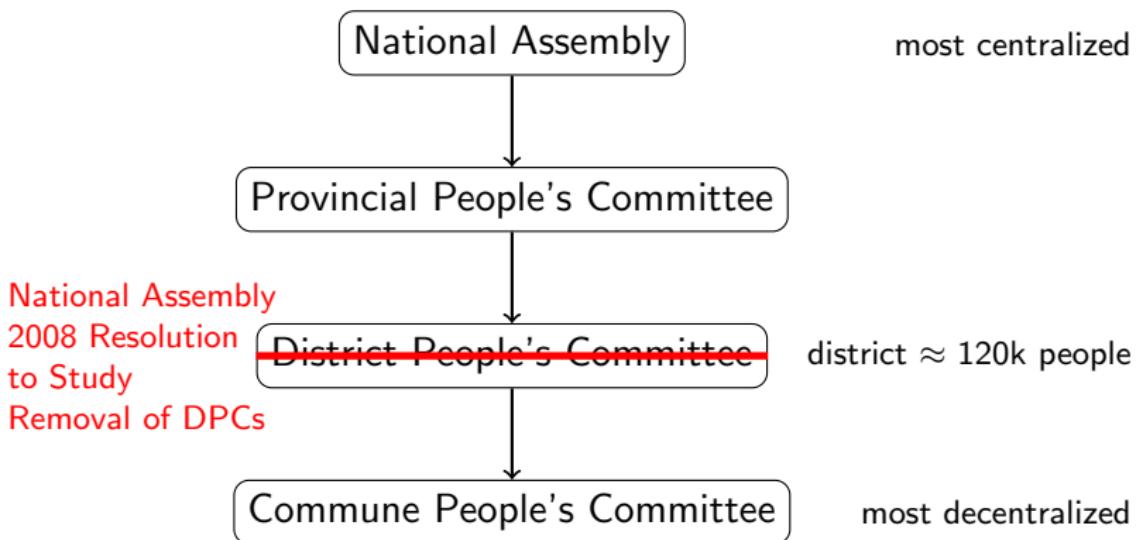
- ▶ simple study
- ▶ well-executed
- ▶ upended conventional wisdom

Decades of papers followed suit. Here is one.

Malesky, E. J., Nguyen, C. V., & Tran, A. (2014).
The impact of recentralization on public services:
A difference-in-differences analysis of the abolition of elected
councils in Vietnam.
American Political Science Review, 108(1), 144-168.

Does government work better when it is centralized or decentralized?

Vietnam setting: A study of recentralization



Vietnam setting: A study of recentralization

Input from social scientists

Vietnam setting: A study of recentralization

Input from social scientists

1. Enough treated units to study

Vietnam setting: A study of recentralization

Input from social scientists

1. Enough treated units to study
2. Sampling stratified by region

Vietnam setting: A study of recentralization

Input from social scientists

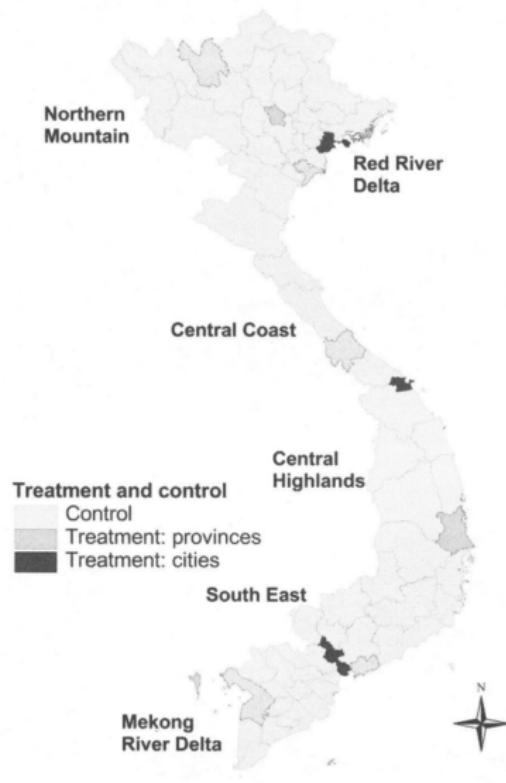
1. Enough treated units to study
2. Sampling stratified by region
3. Sampling stratified by
 - ▶ city versus rural
 - ▶ lowland versus highland
 - ▶ midland versus inter-nationally bordered land

Vietnam setting: A study of recentralization

Input from social scientists

1. Enough treated units to study
2. Sampling stratified by region
3. Sampling stratified by
 - ▶ city versus rural
 - ▶ lowland versus highland
 - ▶ midland versus inter-nationally bordered land
4. Sampling stratified by socioeconomic and public administration performance

FIGURE 2. Map of Treatment Provinces and National-Level Cities



Vietnam Household Living Standards Survey

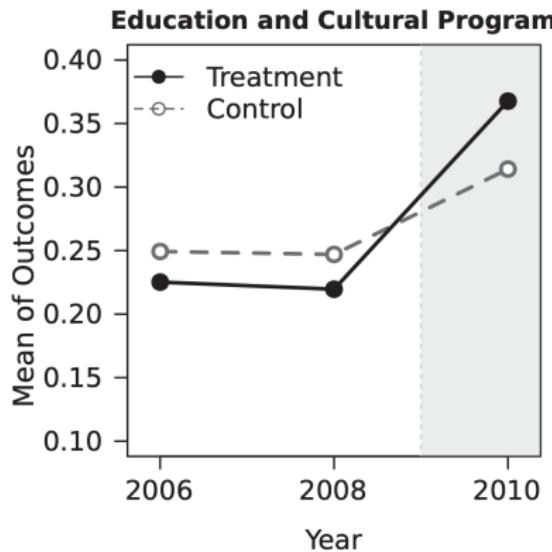
Reports by each local commune by commune leaders

- ▶ 2006 and 2008: Before DPC abolition
- ▶ 2010: After DPC abolition

One outcome we will examine:

Is there the following project in the commune?

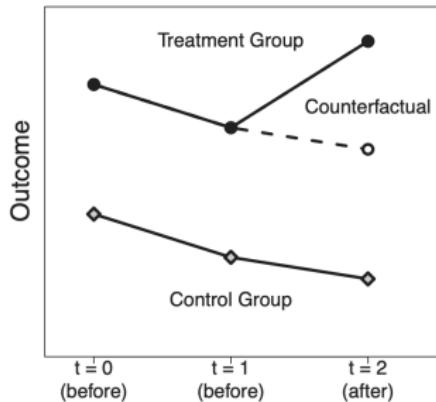
- ▶ Investment on culture and education



Screenshot of re-analysis by [Egami & Yamauchi 2023](#), Fig 3

Difference in difference

When no control unit is comparable to a treated unit, we might assume a control unit and treated unit share the same trend in the potential outcome under control



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