Applied Economics
Difference-in-differences Estimators

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

Card and Krueger, AER(1994)

Motivation

- What is the effect of increasing the minimum wage on employment?

- Minimum wage is effective only in certain jobs: low-skilled.

- How much does an increase in the minimum wage reduce demand for low-skilled workers?

- Economic theory for competitive markets predicts a cut in employment if there is an increase in wages.

The Story

- On April 1, 1992, New Jersey's minimum wage rose from 4.25 to 5.05 per hour.

- The minimum wage in neighboring Pennsylvania stayed constant.

- Card and Krueger collected data on employment at fast-food restaurants before and after the wage increase in the two states.

- The treatment is the increase in the minimum wage, the treated group is New Jersey fast-food restaurants and the control group Pennsylvania fast-food restaurants.

The Idea

- Why Pennsylvania?
  - New Jersey is a small state, closely linked to nearby states and likely affected by common unobservable shocks.

  - Pennsylvania presumably affected by the same unobservable shocks, but did not increase minimum wage.
- Why Fast-food restaurants?
  - Fast-food restaurants are major employers of low-wage workers.

  - A few number of chains, all very careful to strictly comply with legislation.

  - Homogeneous industry across states (and within states) in terms of job requirements and product characteristics.

  - Data not difficult to gather.

Timing of Reform and Data Gathering

- First Wave: Feb/March 1992: 331 restaurants in New Jersey (91% response rate) and 79 in Pennsylvania (73%).

- Reform takes place in April 1992.

- Second Wave: Nov/Dec 1992: 321 in New Jersey (5 closed, 1 reformed, 4 temporarily closed) and 78 in Pennsylvania (1 closed).

- $NJ = 1$ denotes a store in New Jersey (treatment group) and $NJ = 0$ in Pennsylvania (control group).

- $after = 1$ if data from Nov 92 (after the policy change), $after = 0$ if data from Feb 92.

- Outcome Variable: $Y = FTE$ (Full time employment).

Two Potential Measures

- First: employment difference between New Jersey and Pennsylvania after the policy change (in Nov 92).

$$FTE = \delta_0 + \delta_1 NJ + \varepsilon, \text{ only for } after = 1$$

$$\widehat{FTE} = 21.17 - 0.14 \text{ NJ}$$
$$\underset{(0.94)}{} \quad \underset{(1.07)}{}$$

Problem:...

- Second: employment change in New Jersey before and after the policy change.

$$FTE = \gamma_0 + \gamma_1 after + \varepsilon, \text{ only for } NJ = 1$$

$$\widehat{FTE} = 20.44 + 0.59 \text{ after}$$
$$\underset{(0.51)}{} \quad \underset{(0.47)}{}$$

Problem:...

Difference-in-differences estimator

- Average change in New Jersey employment relative to average change in Pennsylvania employment:

$$DD = [E\left(FTE_1(1)|NJ=1\right) - E\left(FTE_0(0)|NJ=1\right)] - [E\left(FTE_0(1)|NJ=0\right) - E\left(FTE_0(0)|NJ=0\right)]$$

- The DD estimator can be obtained from the following regression:

$$FTE = \beta_0 + \beta_1 NJ + \beta_2 after + \beta_3 NJ * after + u_i$$

- β_3 measures the difference between the average employment change in New Jersey and the average employment change in Pennsylvania.

Results 1/2

TABLE 5.2.1
Average employment in fast food restaurants before and after the
New Jersey minimum wage increase

Variable	PA (i)	NJ (ii)	Difference, NJ − PA (iii)
1. FTE employment before, all available observations	23.33 (1.35)	20.44 (.51)	−2.89 (1.44)
2. FTE employment after, all available observations	21.17 (.94)	21.03 (.52)	−.14 (1.07)
3. Change in mean FTE employment	−2.16 (1.25)	.59 (.54)	2.76 (1.36)

Notes: Adapted from Card and Krueger (1994), table 3.

- Full time employment actually decreased slightly in Pennsylvania (by 2.16) while it remained quite stable in New Jersey (0.59 increase)

Results 2/2

- How convincing is this evidence against the standard labor-demand story?
- Key assumption: temporal effect in the two states is the same in the absence of the policy change.
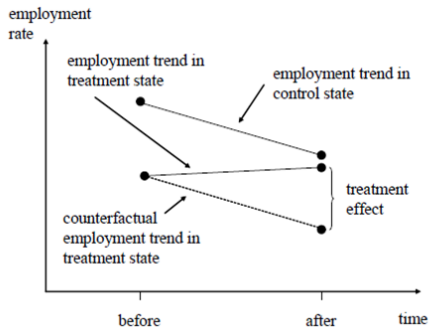
Potential problems

- they only look at stores already in place in first wave (no entry effects)

- differences in response rates may be a small source of bias in the comparison because of unobservable heterogeneity

- legislation may have been endogenous

- employment may have been measured with error as data was obtained from telephone surveys

Update 1/2

- Neumark and Wascher (AER 2000) argue that using different data the minimum wage can be shown to reduce employment

- In response to this criticism, Card and Krueger published a reply in the AER in 2000.

- They update their analysis using payroll tax records for fast-food restaurants in New Jersey and two selections of Pennsylvania counties for a number of years.

- The next figure, taken from Card and Krueger (2000) summarizes the new findings.

Update 2/2

The first two vertical lines indicate the dates when their original surveys were conducted, and the third vertical line denotes the increase in the federal minimum wage to $4.75 in October 1996, that took place in Pennsylvania only.
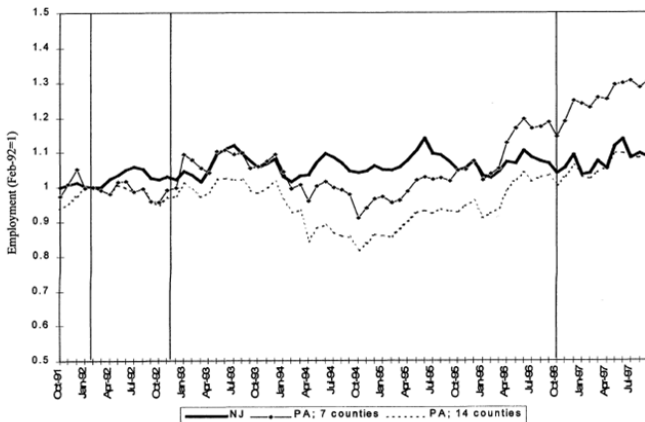
Replication in `gretl`

1. Describe wages in both states, before and after the reform. Is the minimum wage increase visible in the data?
2. Calculate the average employment at fast food restaurants in New Jersey and Pennsylvania before and after the change in the New Jersey minimum wage. Describe the evolution of employment for the restaurants located in New Jersey and in Pennsylvania.
3. What is the difference-in differences estimator?