Presentation of PS 2

Replication: Minimum Wages and Employment: A Case Study of the Fast-Food Industry in New Jersey and Pennsylvania (Data collected by Card & Krueger)

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Labour Economics

Paper Set-up

- The dataset `minwage.dta` contains data collected by David Card and Alan Krueger on fast-food restaurants in New Jersey (NJ) and eastern Pennsylvania (PA)
- Two survey waves were conducted:
  - February / March 1992 (first wave)
  - November / December 1992 (second wave)
- On April 1, 1992, New Jersey increased its minimum wage from $4.25 to $5.05.
- Pennsylvania had no reform on minimum wages
- The goal is to analyze how the minimum wage increase in NJ affected employment and wages in the fast-food industry

1 - Average wages

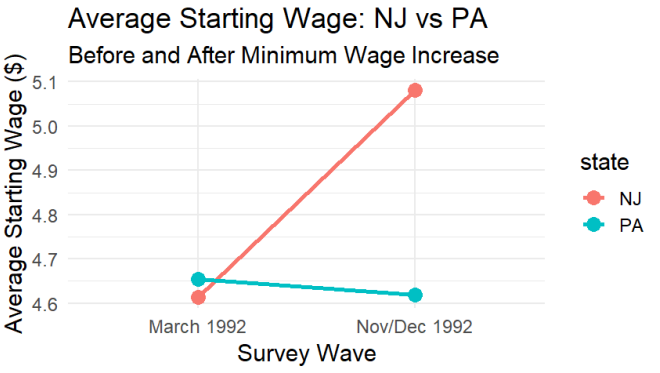

Figure 1: Wage

2 - Average employment

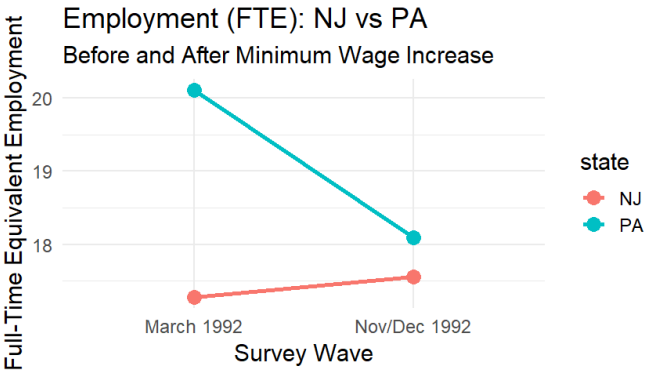

Figure 2: Employment

3.1 Diff-in-Diff regression

$$Y_{ist} = \beta\ TREAT_{is} + \gamma\ POST_t + \delta_{rDD}(TREAT_{is} \cdot POST_t) + e_{ist}$$

$$\begin{aligned}
\text{For March}(t = 1, POST_1 = 0) : Y_{is1} &= \beta\ TREAT_{is} + e_{is1} \\
\text{For Dec}(t = 2, POST_2 = 1) : Y_{is2} &= \beta\ TREAT_{is} + \gamma + \delta_{rDD}\ TREAT_{is} + e_{is2} \\
\Rightarrow Y_{is2} - Y_{is1} &= \gamma + \delta_{rDD}\ TREAT_{is} + e_{is2} - e_{is1}
\end{aligned}$$

- γ: regression constant reflecting general changes of wages or employment
- δ_{rDD}: coefficient of interest reflects the differential changes in NJ
- $e_{is2} - e_{is1}$: new regression residual

3.2 - Diff-in-Diff regression estimates on wages

	Estimate	Std. Error	t value	$\Pr(>\|t\|)$
(Intercept)	-0.03485	0.04287	-0.813	0.417
state	0.50401	0.04757	10.595	$< 2 \times 10^{-16}$ ***

Table 1: Regression results for model *dw* $\sim$ *state*

- Intercept: average wage change in PA
- The change in wages in the control state is almost zero on average (p-value)
- The wage rate in NJ increases on average more than in PA

3.3 - Diff-in-Diff regression estimates on employment

	Estimate	Std. Error	t value	Pr($>\|t\|$)
(Intercept)	-2.015	1.052	-1.916	0.0562
state	2.302	1.167	1.972	0.0494*

Table 2: Regression results for model *dfte* $\sim$ *state*

- Intercept: average change in employment in PA (control state)
- Intercept is decreasing
- MW did not lead to losses in employment in NJ

3.4 - Regression with dummy on wages

	Estimate	Std. Error	t value	Pr($>\|t\|$)
(Intercept)	0.04497	0.04744	0.948	0.34379
state	0.50366	0.04693	10.731	$< 2 \times 10^{-16}$ ***
co_owned	-0.03676	0.04308	-0.853	0.39413
as.factor(chain)2	-0.04665	0.05084	-0.918	0.35945
as.factor(chain)3	-0.15112	0.05180	-2.917	0.00376 **
as.factor(chain)4	-0.15024	0.05846	-2.570	0.01060 *

Table 3: Regression results for model $dw \sim state + co\_owned + as.factor(chain)$

- Wages in NJ rise more sharply on average than in PA, even when we control for restaurant characteristics
- Most control variables are not significant, with the exception of Chain 3 (and Chain 4), which have slightly lower wages than the reference chain

3.5 - Regression with dummy on employment

	Estimate	Std. Error	t value	Pr($>|t|$)
(Intercept)	-1.6073	1.1867	-1.354	0.1765
state	2.2973	1.1741	1.957	0.0512
co_owned	0.3394	1.0777	0.315	0.7530
as.factor(chain)2	0.2949	1.2719	0.235	0.8143
as.factor(chain)3	-1.9637	1.2960	-1.515	0.1306
as.factor(chain)4	-0.7816	1.4626	-0.534	0.5934

Table 4: Regression results for model $dfte \sim state + co\_owned + as.factor(chain)$

Multiple R-squared: 0.0207, Adjusted R-squared: 0.006506
F-statistic: 1.458 on 5 and 345 DF, p-value: 0.2029

- observe positive employment effect exists, it is statistically weak

4.1 - Within NJ estimates on wages

	Estimate	Std. Error	t value	Pr($>\|t\|$)
(Intercept)	-0.00409	0.02672	-0.153	0.878
low_wage	0.61587	0.03048	20.206	$< 2 \times 10^{-16}$ ***

Table 5: Regression results for model *dw* $\sim$ *low_wage* (Data: NJ)

- low-wage earning restaurants in NJ have risen more than in high-wage earning restaurants in NJ

4.2 - Within NJ estimates on employment

	Estimate	Std. Error	t value	Pr($>|t|$)
(Intercept)	-2.2500	0.9472	-2.375	0.01820 *
low_wage	3.3014	1.0806	3.055	0.00246 **

Table 6: Regression results for model *dfte* $\sim$ *low_wage* (Data: NJ)

- employment rate (on average) rises in low-wage earning restaurants in NJ
- theory implies that as the minimum wages arises the employment rate should decrease

Within NJ comparison vs NJ-PA comparison

- Restaurants within NJ face similar regional economic conditions
- Comparing low-wage and high-wage restaurants may satisfy the parallel trends assumption
- Problem of different time trends does not remain

5.1 - New Regression Diff-in-Diff estimates on wages just for PA

	Estimate	Std. Error	t value	Pr(> |t|)
(Intercept)	-0.26522	0.07318	-3.624	0.000575 ***
low_wage	0.35359	0.09066	3.900	0.000233 ***

Residual standard error: 0.3509 on 64 degrees of freedom
Multiple R-squared: 0.192, Adjusted R-squared: 0.1794
F-statistic: 15.21 on 1 and 64 DF, p-value: 0.0002331

Table 7: Regression results for model *dw* $\sim$ *low_wage* (Data: PA)

- Restaurants that paid less than $5 before the minimum wage increased show an average wage increase

5.2 - New Regression Diff-in-Diff estimates on employment just for PA

	Estimate	Std. Error	t value	Pr(> |t|)
(Intercept)	-3.848	2.340	-1.644	0.105
low_wage	2.813	2.899	0.970	0.336

Residual standard error: 11.22 on 64 degrees of freedom
Multiple R-squared: 0.01449, Adjusted R-squared: -0.0009036
F-statistic: 0.9413 on 1 and 64 DF, p-value: 0.3356

Table 8: Regression results for model *dfte* $\sim$ *low_wage* (Data: PA)

- indicator low-wage can not explain any variation in the employment rate

Check on model design

We estimate the model, i.e.

$$dw = \beta_0 + \beta_1 NJ + \beta_2 low\_wage + \beta_3 (NJ \times low\_wage),$$

where β_2 measures the low-wage effect in PA and $\beta_2 + \beta_3$ the low-wage effect in NJ.

- In PA (no policy change), low-wage restaurants should not show an additional wage increase attributable to the reform
- In NJ (policy treatment), low-wage restaurants should exhibit an additional wage increase caused by the minimum wage increase.
- The key parameter β_3 captures the difference in low-wage effects between NJ and PA . A positive value indicates that the DiD approach correctly identifies the policy impact.

5.3 - Statistical test for wages

	Estimate	Std. Error	t value	Pr($>\|t\|$)
(Intercept)	-0.26522	0.05156	-5.144	4.51e-07 ***
NJ	0.26113	0.05987	4.361	1.71e-05 ***
low_wage	0.35359	0.06388	5.536	6.13e-08 ***
NJ:low_wage	0.26228	0.07270	3.608	0.000354 ***

Table 9: Regression results for model $dw \sim NJ + low\_wage + NJ\ low\_wage$

- Model indicates that the minimum wage increase primarily affected restaurants in NJ that were below the old minimum wage before the reform

5.4 - Statistical test for employment

	Estimate	Std. Error	t value	Pr($>\|t\|$)
(Intercept)	-3.8478	1.7635	-2.182	0.0298 *
NJ	1.5978	2.0478	0.780	0.4358
low_wage	2.8129	2.1848	1.288	0.1988
NJ:low_wage	0.4884	2.4867	0.196	0.8444

Table 10: Regression results for model $dftw \sim NJ + low\_wage + NJ\ low\_wage$

- Model provides no evidence that the minimum wage reform affected employment in NJ fast-food restaurants.

What we can conclude

- The results show that low-wage restaurants in NJ experience an additional wage increase relative to PA, consistent with a positive β_3.
- Therefore, the Diff-in-Diff methodology appears to work as intended and successfully recovers the causal effect of the minimum wage reform.

Main results

- The reform leads to wage increases in the low wage sector in NJ
- Wages in the high wage sector remain relatively constant
- The data shows no decline in employment in NJ
- Contrary to theory
- PA = Employment unchanged or slightly down

Source

- Card, David and A. B. Krueger, “Minimum Wages and Employment: A Case Study of the Fast-Food Industry in New Jersey and Pennsylvania,” American Economic Review, Vol. 84 (September 1994) 772-793.

Appendix

state	wage_st2	wage_st	dw
NJ	5.08	4.61	0.469
PA	4.62	4.65	-0.0348
diff	0.463	-0.0407	0.504

Table 11: Wage

state	fte2	fte	dfte
NJ	17.6	17.3	0.287
PA	18.1	20.1	-2.02
diff	-0.536	-2.84	2.30

Table 12: Employment