

# Chapter 5 of MHE: Fixed Effects, Diff-in-Diff and Panel Data

09 May, 2018

## (MHE) Section 5.2.1 - Regression Difference in Difference

We want to reproduce Figure 5.2.4 from MHE. This figure was originally produced by Autor (2003) (Figure 3 in the original) to show the estimated impact of a law (implied-contract exceptions to the employment-at-will doctrine) over an outcome (the use of temporary workers).

### Download and load the data

First download the data from the author's website (will migrate to external data repo in the future!), and load it in to R.

```
# Download the data and unzip it
download.file('http://economics.mit.edu/~dautor/outsourcingatwill_table7.zip',
             'outsourcingatwill_table7.zip')
unzip('outsourcingatwill_table7.zip')
```

```
# Load the data
autor <- read.dta('table7/autor-jole-2003.dta')
```

The data downloaded data set contains 24 years (from 74 to 97) and 50 states, for a total of 1200 observations.

### “Clean” the data

Restrict sample to years between 1979 and 1995 (inclusive), and deleting Guam from the sample (state = 98).

```
# Restrict sample
autor <- autor[which(author$year >= 79 & autor$year <= 95), ]
autor <- autor[which(author$state != 98), ]
```

The clean data now contains 17 years (from 79 to 95) and 50 states, for a total of 850 observations.

### “Build” analytic file

In addition to the variables already defined in the data, we need to construct the following variables:

- Log of total employment
- Normalize the year variable to 1978

```
# Log total employment: from BLS employment & earnings
autor$lnemp <- log(autor$annemp)

# Normalize year to 1978
autor$t <- autor$year - 78
```

```
# Create state and year factors (required format for fe reg package)
autor$state <- factor(autor$state)
autor$year  <- factor(autor$year)
```

## Define model to estimate

We want to estimate a fixed effect model with lead and lag treatment variables:

$$y_{st} = \gamma_{0s} + \gamma_{1s}t + \lambda_t + \sum_{\tau=0}^m \delta_{-\tau} D_{s,t-\tau} + \sum_{\tau=1}^q \delta_{+\tau} D_{s,t+\tau} + X'_{st}\beta + \varepsilon_{st} \quad (1)$$

Where:

- $y_{st}$  is the (log) number of jobs under the category of Temporary Help Services for each state.
- $\gamma_{0s}$  are the state fixed effect,  $\lambda_t$  are the time fixed effect, and  $\gamma_{1s}t$  are state specific time trends.
- $X'_{st}$  contains: log state nonfarm employment, and leads and lags of adoption of the public policy and good faith exceptions.
- Treatment variables in contemporary ( $\delta D_{s,t}$ ) leads  $\delta_{+\tau} D_{s,t+\tau}$  and lags  $\delta_{-\tau} D_{s,t-\tau}$

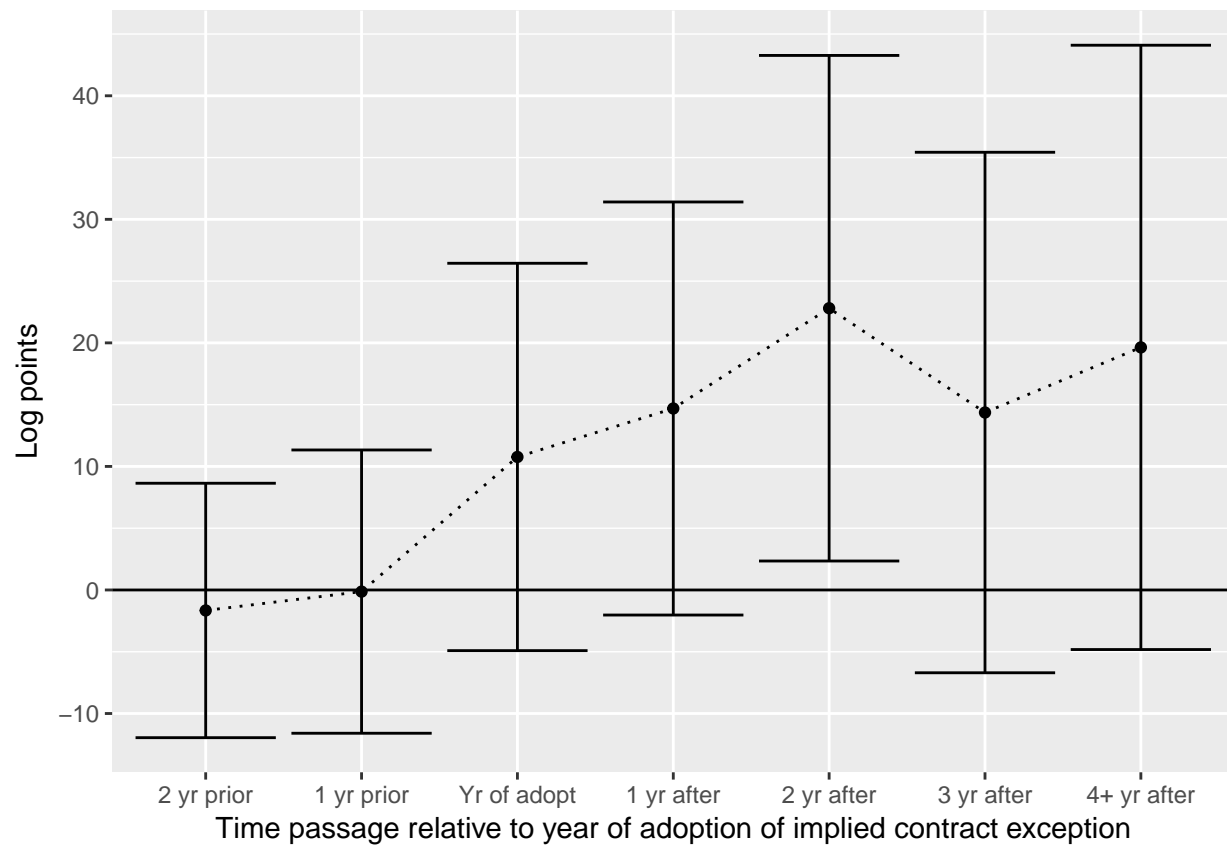
The estimation of this model is presented in column 2 of table 7 of the original paper.

```
# Diff-in-diff regression
did <- felm(lnths ~ lnemp + admico_2 + admico_1 + admico0 + admico1 + admico2 +
              admico3 + mico4 + admppa_2 + admppa_1 + admppa0 + admppa1 +
              admppa2 + admppa3 + mppa4 + admgfa_2 + admgfa_1 + admgfa0 +
              admgfa1 + admgfa2 + admgfa3 + mgfa4
              | state + year + state:t | 0 | state, data = autor)
```

## Vizualize the results

And this estimates are then used to create figure 3 of the original paper, which is figure 5.2.4 in MHE.

```
# Plot results
lags_leads <- c("admico_2", "admico_1", "admico0",
               "admico1", "admico2", "admico3",
               "mico4")
labels     <- c("2 yr prior", "1 yr prior", "Yr of adopt",
               "1 yr after", "2 yr after", "3 yr after",
               "4+ yr after")
results.did <- data.frame(label = factor(labels, levels = labels),
                        coef = summary(did)$coef[lags_leads, "Estimate"] * 100,
                        se = summary(did)$coef[lags_leads, "Cluster s.e."] * 100)
g <- ggplot(results.did, aes(label, coef, group = 1))
p <- g + geom_point() +
      geom_line(linetype = "dotted") +
      geom_errorbar(aes(ymax = coef + 1.96 * se,
                       ymin = coef - 1.96 * se)) +
      geom_hline(yintercept = 0) +
      ylab("Log points") +
      xlab(paste("Time passage relative to year of",
                  "adoption of implied contract exception"))
print(p)
```



```
ggsave(p, file = "Figure 5-2-4-R.png", height = 6, width = 8, dpi = 300)
```

```
# End of script
```