

Lecture Module 10 A

Agenda

- 1 Panel Data: Difference-In-Difference
- 2 Panel Data: Examples

Difference in Difference

- "Diff-in-Diff" is a common panel technique used for identification.
- We have two periods, pre and post.
 - Post period identified by the dummy variable, $Post_t$.
- Two groups, Treatment and Control.
 - Treatment group identified by the dummy variable, $Treat_i$.
- Diff-in-Diff Specification on the wage:

$$wage_{it} = \beta_0 + \beta_1 Post_t + \beta_2 Treat_i + \delta Post_t \cdot Treat_i + u_{it}$$

- δ is called the "differences-in-differences" estimator.
- δ is also called the "average treatment effect".
- Where does the term "diff-in-diff" come from?

Difference in Difference

- The equation:

$$wage_{it} = \beta_0 + \beta_1 Post_t + \beta_2 Treat_i + \delta Post_t \cdot Treat_i + u_{it}$$

- "Diff-in-Diff" takes two differences:
- Post vs. Pre
 - Post might naturally differ from Pre: β_1 .
- Treatment vs. Control
 - Treatment group might naturally differ from control: β_2 .
- Write out predictions, their difference, then the diff-in-diff:

	Before	After	After - Before
Control	β_0	$\beta_0 + \beta_1$	β_1
Treatment	$\beta_0 + \beta_2$	$\beta_0 + \beta_1 + \beta_2 + \delta$	$\beta_1 + \delta$
Control - Treatment	β_2	$\beta_2 + \delta$	δ

- The average treatment effect, δ , removes existing differences in groups and any trend affecting both groups.

Difference in Difference

- How do we calculate the difference-in-difference, δ ?
- Using the wage panel dataset, restrict observations to 1980 and 1987.
- Evaluate the effects of the Reagan administration on union wages.
 - This is difficult, since there were other trends in wages happening at the same time, and union jobs naturally differ from non-union jobs
- Define $Union_{it}$ as a dummy variable identifying individual i working at a union job in year t .
- Define D_t^{87} as a dummy variable identifying observations from 1987.
- Estimate the following
$$\log(wage_{it}) = \beta_0 + \beta_1 D_t^{87} + \beta_2 Union_{it} + \delta D_t^{87} \cdot Union_{it} + \alpha_i + u_{it}$$
- We will calculate the difference in difference effect in a variety of ways to build confidence with these interactions.

Difference in Difference

- First estimate in stata using:
 - **xtreg lwage union##i.year,fe**

- This yields:

$$\log(wage_{it}) = 1.384 + 0.45D_t^{87} + 0.178Union_{it} - 0.060D_t^{87} \cdot Union_{it}$$

- Predicted Non-Union wage in 1980:
 - **1.384**
- Predicted Union wage in 1980:
 - $1.384+0.178 = \mathbf{1.562}$
- Predicted Non-Union log wage in 1987:
 - $1.384+0.45 = \mathbf{1.834}$
- Predicted Union log wage in 1987:
 - $1.384+0.45+0.178-0.060 = \mathbf{1.952}$

Difference in Difference

- What happened to non-union wages between 1980 and 1987?
 - $1.834 - 1.384 = 0.45$
- What happened to union wages between 1980 and 1987?
 - $1.952 - 1.562 = 0.39$
- Take the difference to find the effect of the 1980-1987 period on union wages.
 - $0.39 - 0.45 = -0.06$
- Basic Interpretation:
 - Within individuals, over the 1980-1987 period, union wages fell by 6% relative to non-union wages.
- If the treatment refers to a policy:
 - Within individuals, Reagan labor policy reduced union wages by 6% relative to non-union wages.