ECON3500: Econometrics and Applications

In-Class Activity: Fixed Effects Showdown

Setup. Cheng and Hoekstra (2013) study whether **castle doctrine** laws increase homicide. You have a balanced panel of **50 U.S. states from 2000–2010** ($T = 11$, $N = 50$, 550 obs.). The dependent variable is the **log homicide rate**. The key regressor is **post**$_{it}$, an indicator equal to 1 once state i's castle doctrine law is in effect. States adopt at different times, so this is a staggered-adoption setting. You estimate:

$$\begin{aligned}
\text{(1) Pooled OLS:} \quad & \log(\text{homicide rate}_{it}) = \beta_0 + \beta_1\, post_{it} + u_{it} \\
\text{(2) Entity FE:} \quad & \log(\text{homicide rate}_{it}) = \beta_1\, post_{it} + \alpha_i + u_{it} \\
\text{(3) Entity + Time FE:} \quad & \log(\text{homicide rate}_{it}) = \beta_1\, post_{it} + \alpha_i + \gamma_t + u_{it} \\
\text{(4) First Difference:} \quad & \Delta\log(\text{homicide rate}_{it}) = \beta_1\, \Delta post_{it} + \Delta u_{it}
\end{aligned}$$

where α_i is a state fixed effect and γ_t is a year fixed effect.

	(1) Pooled OLS	(2) Entity FE	(3) Entity+Time FE	(4) First Diff.
$post_{it}$	0.193^{**}	-0.034	0.060^{**}	0.046^{*}
	(0.072)	(0.024)	(0.029)	(0.023)
State FE	No	Yes	Yes	—
Year FE	No	No	Yes	—
Differenced	No	No	No	Yes
SE type	Clustered	Clustered	Clustered	Clustered
N	550	550	550	500
R^2	0.033	0.914	0.934	0.005

*** p<0.01, ** p<0.05, * p<0.1. All regressions are weighted by state population, and all SEs are clustered by state. The TWFE specification is a simplified teaching version of Cheng and Hoekstra (2013). If treatment is coded as the fraction of the year that a castle doctrine law is in effect (rather than a binary post indicator), the weighted TWFE column corresponds closely to Table 5, Panel A, column 1.

1. For each specification, briefly state what omitted variables it *does* control for, and what it does *not* control for in this application.

(1) Pooled OLS:

(2) Entity FE:

(3) Entity + Time FE:

(4) First Difference:

2. Give one specific example of a *time shock* in this context (something that would affect homicide in all states in a given year). How does adding year fixed effects in specification (3) address it?

3. The coefficient on $post_{it}$ drops from 0.193 in pooled OLS to -0.034 with state fixed effects, then rises to 0.060 once year fixed effects are added. Explain what this pattern suggests about omitted variable bias in pooled OLS and about the role of year fixed effects.

4. Column (3) is the standard two-way fixed effects regression. Interpret the coefficient 0.060 in percentage terms. Is this interpretation exact or approximate?

5. Even with two-way fixed effects (specification 3), what threats to a causal interpretation remain? Identify at least **two** specific concerns.