

Financial Econometrics | Lecture 7

Panel Data: Fixed Effects and Clustered Standard Errors

In Class Group Activity

· SJTU, Summer School 2026 · Fatih Kansoy

How this block runs. You work in your home group of three or four, textbook open. Roles rotate: **Scribe**, **Reporter**, **Sceptic**, **Timekeeper**. All money today is in US dollars (\$), pounds sterling (£) and euros (€).

- **Phase 1, Concept checks (~10 min).** Vote, talk for 90 seconds, vote again.
- **Phase 2, Desk problem (~20 min).** Fit a pooled and a within estimator by hand and watch the sign reverse.
- **Phase 3, Case (~25 min).** One real story, ending hidden.

A short word list. A **panel** follows many entities over time. **Between** variation compares different entities; **within** variation compares an entity with itself over time. **Entity fixed effects** give each entity its own intercept, absorbing every **time-invariant** confounder, observed or not, but *not* anything that changes within the entity. **Time fixed effects** absorb shocks common to all entities in a period. **Clustered standard errors** allow an entity's errors to be correlated over time, which ordinary standard errors wrongly assume away.

Phase 1 – Concept checks

~10 MIN

ConceptTest 1. You study 200 European banks observed yearly from 2010 to 2020. You regress each bank's return on equity on its leverage ratio, and you add **bank fixed effects**. Which confounder is now controlled for?

- (a) The bank's home-country legal tradition, which never changes over the sample.
- (b) The euro-area interest-rate cycle, which moves every year and hits all banks.
- (c) Each bank's own changing risk appetite, which rises and falls year to year.
- (d) All three, because fixed effects absorb everything.

ConceptTest 2. Across many firms in one year, firms with higher leverage tend to have *higher* returns (slope +0.30). You then follow the same firms over ten years and add firm fixed effects; now within each firm, years of higher leverage go with *lower* returns (slope -0.12). The most accurate reading is:

- (a) The data contradict themselves; one regression must be wrong.
- (b) A fixed firm trait (such as being a high-growth tech firm) drives both high leverage and high returns *between* firms, so the pooled +0.30 is confounded; *within* a firm, more leverage actually lowers returns.
- (c) The pooled +0.30 is the causal effect, because it uses more variation.
- (d) Fixed effects caused the negative sign artificially by throwing away data.

ConceptTest 3. In the Guns state panel, the shall-issue law coefficient with state fixed effects

is -0.046 . The ordinary SE is 0.019 ($t = -2.45$); the SE clustered by state is 0.043 ($t = -1.08$). Why is the clustered SE the right one?

- (a) A state's errors are correlated over time, so its yearly observations are not independent; ordinary SEs assume they are and come out too small. Clustering corrects this, and the effect becomes not significant.
- (b) The clustered SE is larger, so always pick the smaller one to keep more power.
- (c) Clustering changes the coefficient, so -0.046 is wrong.
- (d) Both SEs are valid; report whichever matches your prior about the law.

Phase 2 – The desk problem

~20 MIN

Three banks, two years: when the sign flips

The setting. Three European banks, each observed in 2015 and 2020. Y is return on equity (ROE, %); X is the leverage ratio (assets/equity). Treat the six rows as your sample.

Bank	Year	Leverage X	ROE Y (%)
Alpha	2015	10	12
Alpha	2020	12	10
Beta	2015	16	16
Beta	2020	18	14
Gamma	2015	22	20
Gamma	2020	24	18

(a) **Naive pooled OLS.** Pool all six rows. Compute $\bar{X}$, $\bar{Y}$, then the pooled slope $\sum(X - \bar{X})(Y - \bar{Y}) / \sum(X - \bar{X})^2$. What does the sign say at face value?

(b) **The within (first-difference) estimator, by hand.** For each bank compute $\Delta X = X_{2020} - X_{2015}$ and $\Delta Y = Y_{2020} - Y_{2015}$. Then the first-difference slope is $\sum(\Delta X \Delta Y) / \sum(\Delta X)^2$. Compare it with the pooled slope. What happened to the sign?

(c) **What did the fixed effect absorb?** The bank fixed effect cancelled a time-invariant confounder. Name it (look at how Gamma differs from Alpha). Then name one *time-varying* confounder the fixed effect does *not* fix.

(d) **The clustering twist.** In a larger version of this panel you estimate a leverage slope of -1.0 . The software reports an ordinary SE of 0.40 and a clustered-by-bank SE of 0.90. Compute the t -statistic both ways. Does the 5% verdict change?

Phase 3 – The case

~25 MIN

The Diversity Dividend

How to run this. Read the story with your group. The ending is hidden on purpose. Commit a written position before the reveal. Do not search the internet.

The story. A London asset manager, Meridian Capital, is preparing a marketing deck. Its quant

team pulls a panel of 300 FTSE-listed firms over 2012 to 2021 and asks: do firms with more women on the board perform better? They set X = share of board seats held by women (%) and Y = return on assets (ROA, %). Their first regression pools all firm-years:

$$\text{ROA} = 6.0 + 0.18(\text{female board share}), \quad t = 4.7.$$

The marketing team is thrilled: “every 10 points of board diversity buys 1.8 points of ROA. We will launch a ‘Diversity Leaders’ fund and charge a premium.” A junior analyst asks: “Before we print this, can I add firm fixed effects, comparing each firm with itself as its board changed?” She reruns it. The room goes quiet when her screen updates.

The story stops here.

Four discussion questions (answer all four; take a position):

1. Name one *time-invariant* firm trait that could drive both a high female board share and high ROA, confounding the +0.18.
2. In one sentence, what will the firm fixed effects remove that the pooled regression left in?
3. **Commit a prediction.** Will the firm-fixed-effects slope stay near +0.18, shrink towards zero, or reverse? Write a number and one sentence of reasoning.
4. Suppose the fixed-effects slope is small but the ordinary SE makes it look significant. What must the analyst do to the standard errors before reporting, and why?

End of activity handout. Solutions are distributed after the block.