Financial Econometrics | Lecture 7

Panel Data: Fixed Effects and Clustered Standard Errors

In Class Group Activity

· SJTU, Summer School 2026 · Fatih Kansoy

Lesson of the day. A panel lets you compare each entity with itself over time, so entity fixed effects sweep away every time-invariant confounder at once and can flip a misleading cross-sectional slope. But they buy you nothing against a confounder that moves over time, and the price is that your standard errors must be clustered.

Phase 1 – Concept checks

ANSWERS

ConcepTest 1. **Answer.** Option **(a)**. Bank fixed effects give each bank its own intercept, so they absorb only what is *fixed* within the bank. The rate cycle (b) is common across banks in a year, a *time* effect; risk appetite (c) moves within the bank, so it survives; (d) is the "fixed effects absorb everything" error. Only the time-invariant trait (a) is absorbed.

ConcepTest 2. **Answer.** Option **(b)**. This is the beer-tax story in finance clothing (cross-section $+0.15$, within -1.04). Between firms, a fixed trait confounds the slope; within a firm, comparing it with itself removes that trait and reveals the true relationship. A sign flip is not a contradiction (a); it is the confounding being stripped out. Option (c) trusts the bigger cross-section; (d) blames the method for revealing the confounding.

ConcepTest 3. **Answer.** Option **(a)**. Within a state, crime this year predicts crime next year, so the 23 yearly errors are not 23 independent pieces of information. Ordinary SEs overcount the information, shrink the SE to 0.019, and manufacture a t of -2.45. Clustering leaves -0.046 untouched and gives the honest SE 0.043, $t = -1.08$: not significant. Option (b) picks the SE that keeps significance; (c) thinks clustering moves the estimate; (d) is result-shopping.

Phase 2 – The desk problem

WORKED SOLUTIONS

(a) $\overline{X} = \dfrac{10+12+16+18+22+24}{6} = 17$, $\overline{Y} = \dfrac{12+10+16+14+20+18}{6} = 15$. Deviations of X: $-7, -5, -1, +1, +5, +7$; of Y: $-3, -5, +1, -1, +5, +3$. Cross-products sum to $21 + 25 - 1 - 1 + 25 + 21 = 90$; squared X-deviations sum to $49 + 25 + 1 + 1 + 25 + 49 = 150$. Pooled slope $= \dfrac{90}{150} = \mathbf{+0.60}$. At face value, more leverage goes with higher ROE, the confounded message.

(b) Each bank changed by $\Delta X = +2$ and $\Delta Y = -2$. First-difference slope $= \dfrac{\sum \Delta X\, \Delta Y}{\sum (\Delta X)^2} = \dfrac{(2)(-2)+(2)(-2)+(2)(-2)}{4+4+4} = \dfrac{-12}{12} = \mathbf{-1.0}$. The sign has **reversed**, from $+0.60$ pooled to -1.0 within. (Demeaning route: within each bank the demeaned X is $(-1, +1)$ and demeaned Y is $(+1, -1)$, so every bank's within slope is -1. Same answer.)

(c) The fixed effect absorbed each bank's *time-invariant* quality: a strong franchise. High-quality banks (Gamma) sit higher on both leverage and ROE than Alpha, manufacturing the positive

between-bank slope; differencing cancels that fixed quality and leaves the negative within-bank move. One *time-varying* confounder it does *not* fix: the credit cycle or macro conditions changing from 2015 to 2020 (e.g. falling interest margins squeezing ROE while banks happened to lever up). It moves within each bank, so it survives. The fix would be *time* fixed effects, a 2020 dummy common to all banks.

(d) Ordinary $t = \dfrac{-1.0}{0.40} = -2.50$: $|t| > 1.96$, significant. Clustered $t = \dfrac{-1.0}{0.90} = -1.11$: $|t| < 1.96$, not significant. The verdict **flips**. Because a bank's yearly returns are correlated over time, only the clustered $t = -1.11$ is honest, so you do not reject a zero effect. This mirrors the real Guns case ($t = -2.45$ ordinary to -1.08 clustered).

Phase 3 – The case

REVEAL AND ANSWERS

1. Any time-invariant firm trait that drives both: being a large, mature, well-governed blue-chip (a long-established FTSE-100 consumer-goods or pharma name), the sector, or the founding era. Such firms both diversify their boards and earn a steady, high ROA.

2. The firm fixed effects remove every fixed difference between firms, so the slope is identified only from how a firm's ROA moves as *its own* board composition changes over time.

3. *(Graded on reasoning.)* The strongest prediction is that the slope shrinks sharply towards zero, because the cross-firm association was likely driven by a fixed firm type rather than by board composition itself.

4. Cluster the standard errors by firm, because a firm's ROA errors are correlated over time, so ordinary standard errors are too small and would overstate significance.

Instructor reveal. With firm fixed effects the slope falls to 0.02 with a clustered SE of 0.05, $t = 0.4$: indistinguishable from zero. When a firm actually added women to its board, its ROA did not measurably change. The entire +0.18 was between-firm confounding: a particular kind of large, mature, well-run firm both diversifies its board and earns a high, stable ROA. Meridian's quant lead kills the premium-fee pitch. The honest conclusion is not "diversity hurts" and not "diversity pays"; it is that this panel cannot detect a within-firm performance effect, and the marketing claim was built on confounding. This mirrors the Guns pattern (-0.37 to -0.05 to -0.03).

Reserve alternate (star-manager mirage). Pooled OLS says elite-MBA managers beat the rest by +1.5% a year ($t = 3.1$); add fund fixed effects and the effect collapses to +0.1% ($t = 0.3$). The "manager effect" was a fixed fund trait (mandate, house style) correlated with hiring pedigreed managers.

End of worked solutions.