Financial Econometrics | Lecture 4

Testing a Regression Slope: t-statistics, Confidence Intervals and Robust 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 ($) and pounds sterling (£).

- **Phase 1, Concept checks (~10 min).** Vote on your own, talk for 90 seconds, then vote again.
- **Phase 2, Desk problem (~20 min).** Test a stock's beta from a regression printout.
- **Phase 3, Case (~25 min).** One real story, ending hidden. You take a position, then we reveal what happened.

A short word list. The slope's **t-statistic** is $t = (\widehat{\beta}_1 - \beta_{1,0})/SE(\widehat{\beta}_1)$, where $\beta_{1,0}$ is the value under the null; you reject a two-sided test at 5% when $|t| > 1.96$. A **confidence interval** for the slope is $\widehat{\beta}_1 \pm 1.96\,SE$, and a value outside it is rejected at 5%. A **non-zero null** tests the slope against an economically meaningful number, not just zero (for a stock's market beta, the interesting null is $\beta = 1$). **Heteroskedasticity-robust standard errors** allow the error variance to change with X; they change the standard error, the t and the interval, but never the slope estimate.

Phase 1 – Concept checks

~10 MIN

ConcepTest 1. You regress a fund's monthly excess return on the market's excess return and report a 95% confidence interval for the market beta of [0.80, 1.20]. Which statement is correct?

(a) There is a 95% probability that the true beta lies between 0.80 and 1.20.

(b) If you repeated the study on many fresh samples, about 95% of the intervals built this way would contain the true beta.

(c) 95% of the monthly returns in your sample lie between 0.80 and 1.20.

(d) Because the interval is wide, the beta is not statistically significant.

ConcepTest 2. You run the same regression of a stock's excess return on the market twice: once with ordinary (homoskedasticity-only) standard errors, once with heteroskedasticity-robust ones. The estimated beta is 1.30 the first time. What is the estimated beta the second time?

(a) Exactly 1.30: robust standard errors change the standard error, not the coefficient.

(b) Larger than 1.30, because robust standard errors correct an upward bias in the slope.

(c) Smaller than 1.30, because robust standard errors shrink the estimate towards zero.

(d) You cannot tell; it depends on how strong the heteroskedasticity is.

ConcepTest 3. For a stock the estimated market beta is 0.90 with a standard error of 0.04 (large n). A classmate says: "The beta is highly significant, so this is a high-risk, market-tracking stock." Test the beta against the economically interesting benchmark of 1. Which conclusion is right?

(a) Since t against 0 is $0.90/0.04 = 22.5$, the beta is significant, so it is significantly different from 1 as well.

(b) Test against 1: $t = (0.90 - 1)/0.04 = -2.5$, so the beta is significantly below 1; statistically this is a lower-risk, defensive stock.

(c) Because 0.90 is close to 1, the beta cannot be statistically different from 1.

(d) Significance against 0 is irrelevant for a beta; you can never test a beta against a non-zero value.

Phase 2 – The desk problem

~20 MIN

The market model for Riverstone Logistics

The setting. You are on the risk desk. Riverstone Logistics plc trades in London. You run the single-factor **market model**: the stock's monthly excess return on the market's monthly excess return, over the last five years ($n = 60$). The slope is the stock's market beta. Your software prints:

	coef	SE (homosk.)	SE (robust)
market beta	1.24	0.085	0.120
alpha (const)	0.15	0.21	0.24

$R^2 = 0.58$. Use the robust SEs in parts (a) to (c) and 1.96 as the 5% critical value.

(a) Confidence interval. Build the 95% confidence interval for the beta, $\widehat{\beta} \pm 1.96\, SE$. Then write one sentence saying what it means (and one saying what it does *not* mean).

(b) Does the stock move with the market? Test $H_0 : \beta = 0$ against a two-sided alternative at 5%. Compute $t = \widehat{\beta}/SE$ and decide. Is your verdict consistent with the interval in (a)?

(c) Is it more volatile than the market? This is the economically interesting test. Test the *non-zero* null $H_0 : \beta = 1$ using $t = (\widehat{\beta} - 1)/SE$. Decide at 5%, and say in plain words what it means for the stock's risk.

(d) Robust against homoskedastic. Redo (b), (c) and the interval using the *homoskedastic* SE of 0.085 instead of the robust 0.120. What changes, and what stays exactly the same? Which standard error should you trust for a finance return series, and why?

Phase 3 – The case

~25 MIN

Helix Capital and its "Defensive Equity" fund

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

The factsheet (March 2026). Helix Capital markets its Defensive Equity fund to pension clients across the UK and EU with one promise: "lower risk than the market, with skill on top." The factsheet shows a CAPM regression of the fund's monthly excess return on the market's excess return, over five years ($n = 60$):

- estimated **market beta** = 0.88, reported standard error **0.07**;
- estimated **alpha (monthly)** = 0.22%, reported standard error **0.10**%;
- a footnote, in small type: "standard errors computed under the classical (homoskedasticity-only) model".

The headline claims, in bold: (1) "Beta of 0.88, a genuinely defensive, lower-than-market fund"; (2) "Statistically significant positive alpha, the manager adds value (t over 2)".

A pension trustee asks your team to check both claims before committing £40 million. You re-run the regression. The slope comes back identical at 0.88 and the alpha at 0.22%, as expected. But with **heteroskedasticity-robust** standard errors you get $SE(\beta) = \mathbf{0.11}$ and $SE(\text{alpha}) = \mathbf{0.13}\%$, both larger, because the fund's returns are far more volatile in crisis months than in calm ones.

The story stops here.

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

1. **Read the claim.** In the language of testing, what does "beta of 0.88, defensive" actually assert? Which null should you test, $\beta = 0$ or $\beta = 1$?
2. **Test claim 1.** Using the robust $SE = 0.11$, test whether beta is below 1. Compute $t = (0.88 - 1)/0.11$ and decide. Build the 95% interval. Does it contain 1?
3. **Test claim 2.** The alpha is 0.22% with homoskedastic $SE = 0.10\%$ and robust $SE = 0.13\%$. Compute the t for $H_0 : \text{alpha} = 0$ both ways. Does the "adds value" claim survive the robust standard error?
4. **Decide.** Write the one-line recommendation you send the trustee. Does Helix's marketing survive an honest re-test?

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