Financial Econometrics
Shangai Jiao Tong University Summer School 2025-2026
Problem Set - Lecture 3

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Reference: Stock, J.H. and Watson, M.W., Introduction to Econometrics (4th Edition, Global Edition)

Chapter 5: Regression Hypothesis Tests and Confidence Intervals

Question 1. Suppose that a researcher, using wage data on 200 randomly selected male workers and 240 female workers, estimates the OLS regression:

$$\widehat{Wage} = 10.73 + 1.78 \times Male, \quad R^2 = 0.09, \quad SER = 3.8$$

$$\text{(Standard errors:)} \quad (0.16) \quad (0.29)$$

where $Wage$ is measured in dollars per hour and $Male$ is a binary variable that is equal to 1 if the person is a male and 0 if the person is female. Define the wage gender gap as the difference in mean earnings between men and women.

(a) What is the estimated gender gap?

(b) Is the estimated gender gap significantly different from 0? (Compute the p-value for testing the null hypothesis that there is no gender gap.)

(c) Construct a 95% confidence interval for the gender gap.

(d) In the sample, what is the mean wage of women? Of men?

(e) Another researcher uses these same data but regresses $Wages$ on $Female$, a variable that is equal to 1 if the person is female and 0 if the person is male. What are the regression estimates from this regression?

Question 2. In the 1980s, Tennessee conducted an experiment in which kindergarten students were randomly assigned to "regular" and "small" classes and given standardized tests at the end of the year. (Regular classes contained approximately 24 students, and small classes contained approximately 15 students.) Suppose, in the population, the standardized tests have a mean score of 925 points and a standard deviation of 75 points. Let $SmallClass$ denote a binary variable equal to 1 if the student is assigned to a small class and equal to 0 otherwise. A regression of $TestScore$ on $SmallClass$ yields:

$$\widehat{TestScore} = 918.0 + 13.9 \times SmallClass, \quad R^2 = 0.01, \quad SER = 74.6$$

$$\text{(Standard errors:)} \quad (1.6) \quad (2.5)$$

(a) Do small classes improve test scores? By how much? Is the effect large? Explain.

(b) Is the estimated effect of class size on test scores statistically significant? Carry out a test at the 5% level.

(c) Construct a 99% confidence interval for the effect of $SmallClass$ on $TestScore$.

(d) Does least squares assumption 1 plausibly hold for this regression? Explain.

Question 3. Suppose (Y_i, X_i) satisfy the least squares assumptions in Key Concept 4.3. A random sample of size $n = 250$ is drawn and yields:

$$\hat{Y} = 5.4 + 3.2X, \quad R^2 = 0.26, \quad SER = 6.2$$

$$\text{(Standard errors:)} \quad (3.1) \quad (1.5)$$

(a) Test $H_0 : \beta_1 = 0$ vs. $H_1 : \beta_1 \neq 0$ at the 5% level.

(b) Construct a 95% confidence interval for β_1.

(c) Suppose you learned that Y_i and X_i were independent. Would you be surprised? Explain.

(d) Suppose Y_i and X_i are independent and many samples of size $n = 250$ are drawn, regressions estimated, and (a) and (b) answered. In what fraction of the samples would H_0 from (a) be rejected? In what fraction of samples would the value $\beta_1 = 0$ be included in the confidence interval from (b)?