ECON 4230 Intermediate Econometric Theory

1 Multiple Regression Analysis: Inference

Normality Assumption

- t statistic & distribution
- F statistic & distribution
- Large n & the central limit theorem
- Jarque-Bera test

Hypothesis Testing for Individual Coefficients

- Regression model: $Y_i = \beta_1 + \beta_2 X_{2i} + \beta_3 X_{3i} + u_i$
- Hypothesis test on β_2
- One tailed: H_0: $\beta_2 \leq 0$ vs. H_1: $\beta_2 > 0$
- Two tailed: H_0: $\beta_2 = 0$ vs. H_1: $\beta_2 \neq 0$

Hypothesis Testing for Overall Significance

- Question. Does the regression model explain any significant variation in Y?
- Economic significance?
- Two tailed: H_0: $\beta_2 = \beta_3 = 0$ vs. H_1: H_0 false
- Analysis of variance: $TSS = ESS + RSS$
- $F = \frac{ESS/(k-1)}{RSS/(n-k)} = \frac{R^2/(k-1)}{(1-R^2)/(n-k)} \sim F(k-1, n-k)$
- Relationship between individual and overall tests of significance

General (Linear) Hypothesis Testing

- For example, how do you test H_0: $\beta_2 = \beta_3$ vs. H_1: $\beta_2 \neq \beta_3$?
- You can use a general F test
- $F = \frac{(R^2_{UR} - R^2_R)/m}{(1-R^2_{UR})/(n-k)} \sim F(m, n-k)$ where m is the number of restrictions
- When $m = 1$, you can also perform a t test

- Rewrite hypothesis as H_0: $\beta_2 - \beta_3 = 0$ vs. H_1: $\beta_2 - \beta_3 \neq 0$
- $t = \frac{\hat{\beta}_2 - \hat{\beta}_3}{se(\hat{\beta}_2 - \hat{\beta}_3)} = \frac{\hat{\beta}_2 - \hat{\beta}_3}{\sqrt{var(\hat{\beta}_2) + var(\hat{\beta}_3) - 2cov(\hat{\beta}_2, \hat{\beta}_3)}}$
- Unrestricted vs. restricted approach