Homework Solutions
Applied Regression Analysis

WEEK 4

Exercise Four: F-Tests

1. Carry out F-tests for the significance of the straight-line regression of Y on X

$$F_{regression} = \frac{SS_{reg}/df}{SS_{res}/df} = \frac{12.7}{4.65/16} = 43.7, \quad p\text{-value}<0.001$$

> We reject the null ($\beta_1=0$); there is evidence of a significant linear relationship between Y and X.

2. Carry out an overall F-test for the significance of the quadratic regression of Y on X and a test for the significance of the addition of x^2 to the model

> For this question, we must calculate the overall F-statistic, as well as the partial F-statistic for the addition of x^2:

$$\text{Overall Regression } F_{regression} = \frac{SS_{reg}/df}{SS_{res}/df} = \frac{16.6/2}{0.75/15} = 166.8, \quad p\text{-value}<0.001$$

$$\text{Test for addition of } X^2 \; F_{add\,x^2} = \frac{SS_{X|X^2}/df}{SS_{res}/df} = \frac{3.9}{0.75/15} = 79.1, \quad p\text{-value}<0.001$$

> The overall F-test (p<0.001) indicates that we can reject the null ($H_0: \beta_1=\beta_2=0$) and conclude that the quadratic regression of Y on X is significant.

> The partial F-test (p<0.001) indicates that we can reject the null ($H_0: \beta_2=0$) and conclude that x^2 contributes significantly to the model.

3. For the straight-line regression of lnY on X, carry out F-tests for the significance of the overall regression

$$F_{regression} = \frac{SS_{reg}/df}{SS_{res}/df} = \frac{42.75}{0.15/16} = 4556, \quad p\text{-value}<0.001$$

> We reject the null ($\beta_1=0$); there is evidence of a significant linear relationship between lnY and X.