Dataset Exercises

Chapter 11 Heteroscedasticity

We return to the simple linear regression of acceleration on horsepower, vehicle weight and miles per gallon for the full sample.

1. Re-estimate this equation and save your residuals These should be in unstandardised form for conducting hypothesis tests. The residuals will appear at the end of the spreadsheet with a name given by the package (you might want to rename these to something more memorable). The residuals will only be saved when you quit if you save your updated version of the file.

2. Produce and interpret a plot (scatter diagram) of the residuals against miles per gallon. This is an exploration of the hypothesis that the variance of the error term is proportional to fuel consumption. It is NOT a test of this hypothesis as this requires moving on to the next questions.

3. We now move on to tests of the Glejser-Parks type. Use the saved residuals to create two new variables:

   (a) absolute residuals
   (b) squared residuals

4. Perform the following two regressions:

   (a) the absolute residuals from (3) on mpg
   (b) the squared residuals from (3) on mpg

5. Examine the 't' ratios on the mpg coefficient in each of these equations and comment on what they tell us about the likelihood of heteroscedasticity being a problem in our model of car acceleration.

6. Repeat question 5 with the country dummies present in the regression equation. This will require you to go back and save a new set of residuals.

7. Explore the possibility that the relationship with the 'suspect' variable is not linear by estimating some alternative functional forms for Question 4.

8. You may or may not have concluded that the acceleration model has got a problem of heteroscedasticity. Leaving this issue aside we go on to estimate a WLS equation on the **assumption** that there is heteroscedasticity of the form:

$$\text{var}(u) = \lambda \, \text{mpg}^2$$

Let us use the linear form of the model. This means that our estimating equation is now:

$$\text{Accel/mpg} = 1/\text{mpg} + b1 + b2 \ \text{weight/mpg} + b3 \ \text{horsepower/mpg}$$

$$+ u/mpg$$

If you do not use a weighting option for estimation you must create the four new variables using transformations. This situation does not require you to drop the intercept but the meaning of the coefficient is now different as it is the coefficient for mpg and the coefficient on 1/mpg is the intercept.

9. Repeat Q.8. using the hypothesis that:

$$\text{var } u = \lambda \text{ mpg}$$

$$\text{Accel/mpg} = 1/\sqrt{\text{mpg}} + b1/\sqrt{\text{mpg}} + b2 \text{ weight}/\sqrt{\text{mpg}} + b3 \text{ horsepower}/\sqrt{\text{mpg}}$$

$$+ u/\sqrt{\text{mpg}}$$

Unlike the version in Q.8, this has no intercept in the estimating equation although there is one in the model. This means you must suppress the intercept if the package includes it by default, if you are doing the equation by creating all the transformed variables. You do not have to do this as you can go straight to the menu called Weight Estimation after Analyze>Regression have been chosen.