B203 Exercise Sheet 8

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1. EFFICIENT ESTIMATION WITH HETEROSKEDASTICITY OF KNOWN FORM.

Suppose we have a regression model of the form

$$Y_i = a + bX_i + u_i$$

$$E(u_i^2 \mid X) = s^2 X_i^2$$

The error term satisfies all assumptions for OLS to be BLUE (made in the lecture) except the assumption of homoskedasticity.

Now divide all variables by X_i. This leads to the regression function

$$\frac{Y_i}{X_i} = a\left(\frac{1}{X_i}\right) + b + \frac{u_i}{X_i}$$

Show that the new error term $v_i = \frac{u_i}{X_i}$ satisfies all the assumptions, including homoskedasticity. What is the variance of the new error term? In view of this suggests how we can obtain **efficient** estimates of b_i.

2. Suppose it is known that the variance of tastes for food, reflected in the error term of a regression of food expenditure on total expenditure, is higher for individuals with larger expenditure. In view of this explain why we often estimate the expenditure equations using as dependent variable the proportion of the budget spent on food, rather than the expenditure on food. [Use the previous question as an example].

3. You wish to estimate a model of investment. The dependent variable is the investment rate (investment divided by capital) and the explanatory variable is the stock market value of the firm divided by the capital stock. This is called the Q model of investment. For a number of reasons relating to the theory, it is interesting to test whether there is serial correlation. Use the steps described in the lecture for estimating models with serial correlation to devise a test of the hypothesis that there is no serial correlation.