

Econometrics I  
Problem Set 6  
Jan. 3, 2003  
Due: Jan. 10, 2003

1. The file ps6q1.dat contains 9 observations of 2 variables. The two variables are average compensation  $Y$  and average productivity  $X$ .
  - (a) Regress  $Y$  on  $X$ . Is the coefficient of  $X$  significant?  
From the preceding regression obtain the residuals  $\hat{u}_i$ . (hint: use the command **predict**)
  - (b) Following the Park test, regress  $\ln \hat{u}_i^2$  on  $\ln X_i$  to test for heteroscedasticity.
  - (c) Following the Glejser approach, regress  $|\hat{u}_i|$  on  $X_i$  and then regress  $|\hat{u}_i|$  on  $\sqrt{X_i}$ , and comment on your results.
2. The file ps6q2.dat contains 2 variables from Tabel 11.5— R&D expenses  $Y$  and sales  $X$  respectively.
  - (a) Run an OLS regression of  $Y$  on  $X$ .
  - (b) According to the Breusch-Pagan-Godfrey test, is the error variance of the regression homoscedastic?
  - (c) According to the White's general heteroscedasticity test, is the error variance of the regression homoscedastic?
  - (d) Regress  $Y$  on  $X$  and use White's heteroscedasticity-consistent variances. Is the standard error of the coefficient of  $X$  greater or smaller than the standard error in (a)? (hint: use **robust** option in **regress**)
3. Assume the first-order autoregressive scheme  $u_t = \rho u_{t-1} + \epsilon_t$  where  $\epsilon_t$  satisfies the assumption of the classical linear regression model.
  - (a) Show that  $\text{Var}(u_t) = \sigma^2 / (1 - \rho^2)$ , where  $\sigma^2 = \text{Var}(\epsilon_t)$ .
  - (b) What is the covariance between  $u_t$  and  $u_{t-1}$ ? Between  $u_t$  and  $u_{t-2}$ ? generalize your results.
  - (c) Write the covariance matrix of the  $u$ 's.
4. In the model

$$Y_i = \beta_2 X_i + u_i$$

Note that there is no intercept in the model. You are told that  $\text{Var}(u_i) = \sigma^2 X_i^2$ . Show that

$$\text{Var}(\hat{\beta}_2) = \frac{\sigma^2 \sum X_i^4}{(\sum X_i^2)^2}$$