

Economics 421/521
Winter 2011
Final Exam

Answer five of the following six questions (20 points each).

1. (a) Suppose that

$$Y_i = \beta_1 + \beta_2 X_{2i} + \beta_3 X_{3i} + u_i$$

and that you suspect heteroskedasticity of the form:

$$\sigma_i^2 = \alpha_1 + \alpha_2 X_{2i} + \alpha_3 X_{3i}$$

Describe how to test for the presence of heteroskedasticity. (b) If you find heteroskedasticity, how can it be corrected?

2. (a) The Durbin-Watson statistic is:

$$DW = \frac{\sum_{t=2}^T (u_t - u_{t-1})^2}{\sum_{t=1}^T (u_t)^2}$$

Show that the Durbin-Watson statistic is between 0 and 4, and that it is 0 with perfect positive correlation, 2 when there is no correlation at all, and 4 when there is perfect negative correlation. (b) Explain why the Durbin-Watson test is biased when there is a lagged dependent variable on the right-hand side of the regression model. What test should be used?

3. Suppose that the true model is:

$$Y_t = \beta_0 + \beta_1 X_t^* + v_t$$

However, data on X_t^* are not available. Instead, you use $X_t = X_t^* + w_t$ as the explanatory variable, where w_t is independent of all other variables in the model, to estimate the model with OLS. (a) Show that the OLS estimates are inconsistent. (b) Suppose that the dependent variable, Y_t , is also measured with error. What additional problems does this cause?

4. Given that

$$Y_t = a + bR_t + cG_t + dA_t + u_t$$

$$R_t = g + hY_t + kP_t + v_t$$

where Y and R are endogenous, and the constant, G , A , and P are exogenous, answer the following. (a) Find the reduced form equations. (b) Give a graphical and intuitive explanation for why the first equation is exactly identified and the second equation is over identified. (c) Explain intuitively why estimating the first equation using OLS gives a biased and inconsistent estimate of b . What estimation procedure should be used (simply name it)?

5. Suppose that

$$Y_i = \beta_1 + \beta_2 X_{i2} + u_i$$

In this model, X_{i2} is correlated with u_i , but fortunately an instrument, Z_i , is available.

(a) What properties should the instrumental variable, Z_i , have? (b) What are the consequences of estimating the model with OLS? (c) Show that the instrumental variables estimator for β_2 is unbiased.

6. (a) Explain how the presence of limited dependent variables can cause OLS estimates to be biased. What type of estimator should be used in this case? (b) Give a brief description of maximum likelihood estimation. What are the properties of maximum likelihood estimates?