Final Exam in Econometrics (II)

Date: June, 2005

Time Allowed: 3 hours

Answer all questions

46 marks

1. (4 marks) Consider the regression model $y_i = \beta_1 + \beta_2 x_{2i} + \beta_3 x_{3i} + \varepsilon_i$. Suppose that you are concerned with that both x_2 and x_3 are measured with error, and that z_2 and z_3 are considered to be possible instruments for x_2 and x_3, respectively. How would you perform a Hausmen test to evaluate the presence or absence of measurement error?

2. (4 marks) Suppose $y = \beta x + \varepsilon$ where all the classical regression assumptions hold except that the variance of the error term ε is a constant K times x^2. Then the BLUE is the average of the y divided by the average of the x. True, false or uncertain. Explain.

3. (8 marks) Suppose that $y = (\alpha + \beta x)\varepsilon$ where the multiplicative error term ε has a mean equal to 1, $E(\varepsilon) = 1$. (a) How would you estimate α and β? *Hints:* Express ε as one plus a new error. (b) How would you estimate α and β, if in addition you knew that ε is distributed normally? Be explicit.

4. Suppose $y = \beta x + \varepsilon$ and you wish to calculate the heteroskedasticity-consistent estimate of the variance of the OLS estimator. The error term ε has a mean 0 with possible heteroskedasticity of unknown form. Note that x is just a scalar. Define a transformation matrix P with the inverse of the OLS residuals on the diagonal and zeros elsewhere. Transform y and x to obtain $y^* = Py$,and $x^* = Px$, and create $w = P^{-1}x$. (a) (4 marks) Show that the IV estimator of y^* regressed on x^*, using w^* as a set of instruments for x^*, is just β^{ols}. (b) (4 marks) Use the formula for the variance of the IV estimator to find the estimated variance-covariance matrix of this estimator. (c) *(Bonus, 4 marks)* How is the estimated variance-covariance matrix related to the White's heteroskedasticity-consistent estimate of the variance of the OLS estimator.

5. (4 marks) Suppose the regression model applied to $y = \alpha_0 + \alpha_1 x + \alpha_2 w + \varepsilon$ except that estimated values of w has been employed in the samples. If the measured w is the true w plus a random error distributed uniformly between 0 and 4, what are the implications for your estimates of the α_i?

6. (12 marks) Consider $y = \alpha x + \varepsilon$ where x is measured with error (Note: not intercept in the model). Some argue that an variable z taking value 1 if x is greater than median of x, or 1 otherwise might be a qualified instrument for x.

   (a) Explain how to test $E(z\varepsilon) = 0$, the validity of the instrument z.

   (b) Derive the IV estimator for β using the instrument z.

   (c) Show the consistency of the derived estimator.

7. (6 marks) Explain how to conduct a simulation study to compare OLS and IV estimators in the context of measurement errors.