ECON 4848 - Applied Econometrics
Professor Carlos Martins-Filho
Final Examination
Date: 5.5.2010

IMPORTANT INSTRUCTIONS:

1. Your answers should be on just one side of a sheet of paper. Use a new sheet of paper to start the answer of each question.

2. Question 5 involves the use of the Stata data set file located on the course webpage:

http://spot.colorado.edu/~martinsc/ECON_4848.html

You will have to write and run a Stata `do` file to answer some of the items in Question 5. You DO NOT need to submit the output of your `do` file as part of your answers. Also, you do not have to submit the `do` file as part of your answers.

3. Answer ONLY FOUR questions. Either 2, 3, 4, 5 or 1, 2, 3, 5.

QUESTIONS:

Question 1. Consider the following regression model,

$$y_t = \beta_0 + \beta_1 X_{t1} + \beta_2 X_{t2} + u_t \tag{1}$$

with $t = 1, ..., 20$, u_t is IID and $u_t \sim N(0, \sigma^2)$. After applying the ordinary least squares method a researcher finds that,

$$\begin{pmatrix} \hat{\beta}_0 \\ \hat{\beta}_1 \\ \hat{\beta}_2 \end{pmatrix} = \begin{pmatrix} .96 \\ .69 \\ 1.77 \end{pmatrix}, Cov \begin{pmatrix} \hat{\beta}_0 \\ \hat{\beta}_1 \\ \hat{\beta}_2 \end{pmatrix} = \begin{pmatrix} .21 & .019 & -.05 \\ .019 & .048 & -.031 \\ -.05 & -.031 & .037 \end{pmatrix},$$

$\hat{\sigma}^2 = 2.5193$ and $R^2 = .94$.

a) Find the total, explained and residual sum of squares.

b) Find a 99 percent confidence interval for β_3.

c) Perform the following test: $H_o : \beta_2 \geq 0$ against $H_A : \beta_2 < 0$. Level of confidence is 1 percent.

d) Perform the following test: $H_o : \beta_2 = \beta_3 = 0$ against $H_A : \beta_2 \neq 0$ or $\beta_3 \neq 0$. Level of confidence is 1 percent.

Question 2: The following is an OLS estimated regression model for CEO salaries:

$$\widehat{log(salary)} = \underset{(.3)}{4.59} + \underset{(.032)}{.257}\, log(sales) + \underset{(.004)}{.011}\, roe + \underset{(.089)}{.158}\, finance$$

$$+ \underset{(.085)}{.181}\, consprod - \underset{(.099)}{.283}\, utility$$

where the sample size is $n = 209$, $R^2 = .357$ and $finance$, $consprod$ and $utility$ are binary variables taking on the value 1 if the CEO works for a firm in the financial, consumer products or utility industries (the

omitted industry is *transportation*) and *roe* is the return on equity. The numbers in parentheses below the estimated parameters are estimated standard deviations.

a) What is the estimated percentage difference in CEO salary between the utility and transportation industry, holding sales and *roe* fixed? Is the difference significant at the 1 percent level? List all assumption you have made to conduct this test

b) What is the meaning of the estimated coefficient associated with $log(sales)$? What does it say regarding the amount of sales and the salary of a CEO?

Question 3: Consider the regression model

$$E(y_i|x_i) = \beta x_i$$

for $i = 1, ..., n$ where $V(y_i|x_i) = \sigma^2$ and $\{(y_i, x_i)\}_{i=1,2,\cdots}$ forms an independent and identically distributed sequence (β is a scalar).

a) Obtain the ordinary least squares estimator ($\hat{\beta}$) for β and give conditions under which $\sqrt{n}(\hat{\beta}-\beta) \xrightarrow{d} N(0, v)$ as $n \to \infty$. What is v?

b) How would you test the hypothesis that $\beta = 0$ against the alternative that it is not equal to zero under the conditions described in a)?

Question 4: Consider the following regression model to explain monthly beer consumption:

$$beer = \beta_0 + \beta_1 income + \beta_2 price + \beta_3 education + \beta_4 female + u$$

with $E(u|income, price, education, female) = 0$ and $E(u^2|income, price, education, female) = exp(\theta_0 + \theta_1\ income)$, and female a dummy variable that takes on the value 1 if the individual is a female.

a) Describe, in detail, how you would obtain the Feasible Generalized Least Squares estimator for $\beta_0, \cdots, \beta_4$.

b) In this case, is β_{FGLS} identical to β_{GLS}? Explain.

c) If you had the choice of using the FGLS estimator you described in a) or the OLS estimator with robustly estimated standard errors to test the hypothesis that $\beta_2 = 0$ against the alternative that it is different from zero, which would you use? Explain.

Question 5: Use the data set $401ksubs.dta$ for this question.

a) Estimate the following regression model by OLS.

$$e401k = \beta_0 + \beta_1 inc + \beta_2 inc^2 + \beta_3 age + \beta_4 age^2 + \beta_5 male + u$$

b) Is the conditional variance of $e401K$ given the regressors constant? If not, what equation describes this conditional variance?

c) Using heterocedastic robust standard errors test the hypothesis that β_1 and β_2 are equal to zero, against the alternative that either one is not at the 5% level of significance.

d) Obtain the FGLS estimator for the parameters of the regression given above. Test that β_3 and β_4 are equal to zero, against the alternative that either one is not at the 5% level of significance.