BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE, PILANI
SECOND SEMESTER – 2016-17

Course No.: ECON F342 **Course Title: APPLIED ECONOMETRICS**
Date: 10 MARCH 2017 **Max. Marks: 30**

MID SEMESTER TEST

NOTE:
Place your name on EACH page of the test in the space provided.
Answer every question in the space provided. If separate sheets are needed, make sure to include your name and clearly identify the problem being solved.
Read each question carefully and answer to the point. The exam is open book and open notes.

1 Given the following model,
$Foodexp_i = b_0 + b_1 Income_i + u_i$ (1)

(5.0)

A. You suspect the presence of measurement error in the left hand side (dependent) variable on the amount of expenditure done on food, (Foodexp).

i.e $Foodexp^{observed} = Foodexp^{true} + e$; where e is a (random) error term

Given the following information below, work out the consequences of this type of measurement error for OLS estimation of (1)

N=100 $Cov(Foodexp, Income^{true}) = 5$
$Cov(Foodexp, Income^{observed}) = 1$
$Var(Income^{true}) = 5$; $Var(u) = 100$
$Var(Foodexp) = 200$; $Var(e) = 100$

B. You are given new information that says that it is the right hand side variable that is measured with error

i.e $income^{observed} = income^{true} + w$; where w is a random error

Find

i The true (unobserved) OLS estimate of the effect of income on food expenditure and income in the absence of measurement error ii The OLS estimate in the presence of this type of measurement error

iii Why do the results change like this?

2 The equation given below explains weekly hours of television viewing by a child in terms of the child's age, mother's education, father's education, and number of siblings:

$$\textbf{vhours}^* = \beta_0 + \beta_1 \textbf{age} + \beta_2 \textbf{age}^2 + \beta_3 \textbf{motheduc} + \beta_4 \textbf{ fatheduc} + \beta_5 \textbf{sibs} + \textbf{u.}$$

The researcher worried that tvhours* is measured with error in that survey. Let tvhours denote the reported hours of television viewing per week.

What do the classical errors-in-variables (CEV) assumptions require in this model? Do you think the CEV assumptions are likely to hold? Briefly explain.

(3.0)

3 A researcher has used the following model to estimates of the effects of 401(k) plan eligibility on net financial assets. The model is

$nettfa = \beta_0 + \beta_1 inc + \beta_2 inc^2 + \beta_3 age + \beta_4 age^2 + \beta_5 male + \beta_6 e401k + u$.

The model was estimated using OLS and the results were presented

The equation estimated by OLS is

$$\begin{aligned} \widehat{nettfa} = &\ \underset{(9.992)}{21.198} - \underset{(.075)}{.270}\, inc + \underset{(.0006)}{.0102}\, inc^2 - \underset{(.483)}{1.940}\, age + \underset{(.0055)}{.0346}\, age^2 \\ &+ \underset{(1.486)}{3.369}\, male + \underset{(1.277)}{9.713}\, e401k \end{aligned}$$

$n = 9{,}275,\ R^2 = .202$

The OLS regression of $\hat{u}_i^2$ on inc_i, inc_i^2, age_i, age_i^2, $male_i$, and $e401k_i$ was run and got $R^2_{\hat{u}^2} = 0.0374$,

The equation estimated by LAD is

$$\begin{aligned} \widehat{nettfa} = &\ \underset{(1.382)}{12.491} - \underset{(.010)}{.262}\, inc + \underset{(.00008)}{.00709}\, inc^2 - \underset{(.067)}{.723}\, age + \underset{(.0008)}{.0111}\, age^2 \\ &+ \underset{(.205)}{1.018}\, male + \underset{(.177)}{3.737}\, e401k \end{aligned}$$

$n = 9{,}275$, Psuedo $R^2 = .109$

a Interpret the coefficient on e401k estimated by OLS method.

b Make use the OLS residuals regression results to test for heteroskedasticity. Is the error term u independent of the explanatory variables?

c Use the estimated equation by Least Absolute Deviation (LAD) and interpret the LAD estimate of β_6.

d Reconcile your findings from parts (a) and (b).

(A 401(k) plan is a qualified employer-established plan to which eligible employees may make salary deferral (salary reduction) contributions on a post-tax and/or pretax basis. Employers offering a 401(k) plan may make matching or non-elective contributions to the plan on behalf of eligible employees and may also add a profit-sharing feature to the plan. Earnings in a 401(k) plan accrue on a tax-deferred basis.)

(5.0)

4 Let $gGDP_t$ denote the annual percentage change in gross domestic product and let int_t denote a short-term interest rate. Suppose that $gGDP_t$ is related to interest rates by:

$gGDP_t = \alpha_0 + \delta_0 \, int_t + \delta_1 \, int_{t-1} + u_t$, where u_t is uncorrelated with int_t, int_{t-1}, and all other past values of interest rates.

Suppose that the Federal policy rule is : $int_t = \gamma_0 + \gamma_1(gGDP_{t-1} - 3) + v_t$,

where $\gamma_1 > 0$. (When last year's GDP growth is above 3%, the Fed increases interest rates to prevent an "overheated" economy.) If v_t is uncorrelated with all past values of int_t and u_t, argue that int_t must be correlated with u_{t-1}. (Hint: Lag the first equation for one time period and substitute for $gGDP_{t-1}$ in the second equation.) Which Gauss-Markov assumption does this violate? Briefly explain.

(5.0)

5 An econometrician has used the data set CONSUMP.DAT and estimated a simple regression model relating the growth in real per capita consumption (of nondurables and services) to the growth in real per capita disposable income.

(5.0)

Used the change in the logarithms in both cases and reported the results in the usual form. The estimated equation is

$$gc_t = \underset{(.0019)}{.0081} + \underset{(.067)}{.571}\, gy_t \qquad n = 36, \quad R^2 = 0.679.$$

a Interpret the equation and discuss statistical significance.

b Added a lag of the growth in real per capita disposable income to the equation from the above part. Adding gy_{t-1} to the equation gives

$$gc_t = .0064 + .552\, gy_t + .096\, gy_{t-1}$$
$$(.0023) \quad (.070) \quad (.069) \qquad n = 35, \quad R^2 = 0.695.$$

What do you conclude about adjustment lags in consumption growth?

c Further he added the real interest rate to the equation in the first part. If we add $r3_t$ to the model estimated in part and he obtained

$$\begin{aligned} gc_t &= .0082 + .578\, gy_t + .00021\, r3_t \\ &\quad\;(.0020) \quad\;\; (.072) \qquad\;\; (.00063) \qquad n = 36, \quad R^2 = .680. \end{aligned}$$

Does it affect consumption growth?

6 i) Consider a non-stationary process that contains a deterministic trend:

$$z_t = \alpha + \delta t + \epsilon_t \qquad \epsilon_t \text{ IID } \left(0, \sigma_\epsilon^2\right).$$

Which of the following statements is/are correct and also prove your answer?

A The process is made stationary by regressing Z_t on t on and then replacing Z_t with $z_t - \hat{\alpha} - \hat{\delta} t = \hat{\epsilon}_t$ which is white noise under the assumption that the original model was correctly specified

B The process is made stationary by taking its first difference.

C Because it is non-stationary, Zt follows a random walk.

D If the variable Zt is first-differenced, this originates a non-invertible MA(1) that therefore cannot be represented as a stationary autoregressive process.

(2.0)

ii) Consider random walk with drift and noise: $yt = c + y_{t-1} + \epsilon_t + \Delta\eta_t$,
where $\{\epsilon t\}$ is white noise with $E[\epsilon_t^{2]} = \sigma^2_\epsilon$; $\Delta\eta t = \eta t - \eta t-1$; $\{\eta t\}$ is white noise with $E[\eta_t^2] = \sigma_\eta^2$; $E[\epsilon t \eta s] = 0$ for any t and s; y0 and η0 are non-stochastic initial values.

What is E[yt] and Var[yt]. Compute $Cov[y_t, y_{t-h}]$
Is {yt} covariance stationary? Explain why or why not.

(2.0)

iii) In an estimated efficient markets hypothesis model the researcher found evidence of heteroskedasticity in u_t in equation of

$$return_t = \beta_0 + \beta_1 return_{t-1} + u_t.$$

The EMH states that $\beta_1 = 0$. When he tested this hypothesis using the data in stock exchange, we obtained $t_{\beta 1} = 1.55$ with n = 689. With such a large sample, this is not much evidence against the EMH. Although the EMH states that the expected return given past observable information should be constant, it says nothing about the conditional variance.

Therefore he computed the heteroskedasticity-robust standard errors (in [.]) along with the usual standard errors as

$$\widehat{return_t} = .180 + .059\, return_{t-1}$$
$$(.081) \quad (.038)$$
$$[.085] \quad [.069]$$
$$n = 689,\ R^2 = .0035,\ \bar{R}^2 = .0020.$$

What does using the heteroskedasticity-robust t statistic do to the significance of $return_{t-1}$?

(3.0)