**UNIVERSITY OF DUBLIN**

**TRINITY COLLEGE**

**FACULTY OF ARTS, HUMANITIES AND SOCIAL SCIENCES**

**DEPARTMENT OF ECONOMICS**

**Junior Sophister Michaelmas Term 2013**

**Supplemental Examination**

**EC3090 Econometrics**

**DATE VENUE TIME**

Professors O. Henry, C. Newman, A. Bénétrix and Mr M. Curran

EXAM INSTRUCTIONS

Section A: Please answer Q1 **and** one of **either** Q2 **or** Q3

Section B: Please answer TWO from Q4, Q5, Q6, Q7

**Materials Permitted for this Examination**

Standard non-programmable calculator

**You may not start this examination until you are instructed to do so by the Invigilator.**

**Section A**

**Please answer Q1 and EITHER Q2 OR Q3**

**Question 1 (100 marks)**

1. Consider the following linear regression model:



Assume that the error term, , is characterised by  and .

1. What are the consequences for Ordinary Least Squares estimation of this model?
2. Explain how you would proceed with the estimation of this model in practice.

*[25 marks]*

1. Let  be a random sample from a population with a normal distribution with mean  and variance . Consider the following two alternative estimators for :

 and 

Comment on the unbiasedness and consistency properties of these estimators.

*[25 marks]*

1. Consider the following linear regression model estimated using Ordinary Least Squares:



1. Explain how you would measure the *goodness of fit* of this estimated regression model.
2. Explain in detail how you would test for the overall statistical significance of this model.

*[25 marks]*

1. Derive a test of the null hypothesis that  in the model , where .

*[25 marks]*

**Question 2 (100 marks)**

Consider the following population model:



1. Derive the Ordinary Least Squares (OLS) estimator for . [10 marks]
2. What assumptions are required for  to be unbiased? Explain in a practical sense what each of these assumptions mean using examples. Show that the OLS estimator of  is unbiased under these assumptions. [30 marks]

c) Derive an estimator for the variance of  (the OLS estimator of ) and comment on each of its components. What assumptions are required in order to derive this estimator? Explain in a practical sense what each of these assumptions mean using examples. [30 marks]

d) Outline the steps you would take to perform Ramsey’s RESET test of functional form misspecification of this model. Suppose that the true functional form is given by . How would you measure the impact of a unit change in  on  using the OLS estimators of the parameters of this model? Give an example of an economics application where assuming this functional form might be appropriate. [30 marks]

**Question 3 (100 marks)**

Consider the following equation to explain the productivity of workers

() in shoe making factories (measured as number of shoes produced per day) and the level of in-house training () provided to workers by their employers (measured as number of days):



where  is the age of the worker and  is the years of formal education the worker has.

a) What sign might you expect on the parameter ? Explain your answer. [10 marks]

b) Explain why age and education are important control variables in estimating the relationship between in-house training and productivity. What sign might you expect on the parameters  and ? Explain your answer. [20 marks]

c) Using data on 1,000 workers the following equation was estimated using Ordinary Least Squares (OLS) estimation (estimated standard errors are given in parenthesis):



   



i) Use this model to predict the average number of shoes made in a day () by a 50 year old worker, with 10 years of formal education and 10 days of in-house training. [10 marks]

ii) Interpret the estimated parameters on ,  and  in terms of their economic and statistical significance. [15 marks]

iii) Explain how  is constructed and comment on the  value from this regression. [10 marks]

d) The model is extended to include the square of the days of in-house training received by workers () and years of experience of the workers ().



The  obtained from estimating this model for the same 1,000 workers using OLS is .

1. Perform a test between this and the regression model given in part (c). [10 marks]
2. What sign might you expect to see on the parameter ? Explain your answer. How does the inclusion of  affect the interpretation of the impact of training on worker productivity? [15 marks]
3. What assumptions are required to show that OLS estimation of this model will yield unbiased estimates of the population parameters? Are these assumptions likely to hold? Explain your answer. [10 marks]

**Section B**

**Please answer TWO from Q4, Q5, Q6, Q7**

**Question 4 (100 marks) –** Identification & Simultaneous Equations Models

Part (a): (50 Marks)

Motivate an example of an econometric identification problem. How does it differ from a problem of econometric inference? Describe any two common identification assumptions that are often violated.

Recall when  is in the support of  , the empirical non-parameteric estimator



A survey firm conducting an election poll can contact voters by any of two modes: internet or telephone. Let  denote the mode that the firm uses to contact a voter. Suppose that the firm contacts 800 voters; 400 by internet (  ) and 400 by telephone (  ). These voters are asked if they want Fianna Fáil to return to government in the year 2016. The possible responses are no (  ), indifferent (  ) and yes (  ). Suppose that all voters have a value of  , but some of them choose not to respond to the survey. The data obtained are reported in table 1.Consider these 800 voters to be the population of interest, not a sample drawn from a larger population. You are asked to predict  conditional on the event (  ). Given the available data, what can you deduce about the best predictor of  conditional on (  ), under square loss?

Response to Survey Question Internet (x=0) Telephone (x=1)

y = 0 100 100

y = ½ 100 100

y = 1 100 100

no response 100 100

Table 1: A 2016 return for Fianna Fáil.

Part (b): (50 Marks)

Consider the following macroeconomic model in structural form:



Is the system complete? Explain your answer. Check the identifiability of the consumption equation. Show your workings. Based on your answer, motivate an appropriate estimation technique for the consumption equation.

Question 5 (100 Marks) -- Limited Dependent Variables & Instrument Variables.

Part (a): (50 Marks)

Consider the following regression where  is the hourly wage in Dollars,  is a binary variable equal to  if female and  if male and  is the years of education:

 (1)

Now suppose we want to include single men, single women, married men and married women. Consider allowing salary differentials across these four categories with married females as the base group. Write out the corresponding regression equation. Next suppose we wanted instead to focus on wages for individuals who have attended law schools. Suppose there are 100 law schools ranked from 1 (best) to 100 (worst). How might we – in a limited amount of time – construct a model and test whether the ranking of law school has a constant partial effect?

Suggest an example of a count variable. We will model the expected value as an exponential function:



Interpret  . How do we estimate Poisson models? Why might we consider Poisson models to be restrictive? Why might we still use Poisson models and if we do not assume the Poisson distribution, how can we estimate these models?

Part (b): (50 Marks)

Consider the following wage regression



where the dependent variable is the log hourly wage and  denotes years of education. Why might education be endogenous in this model? Suggest a possibly omitted variable. How would our estimates be affected by an omitted variable?

Suppose we add the exogenous variables *exper* and *tenure* to our wage regression:

 (2)

where *exper* is years of labour market experience and *tenure* is years with the current employer. Let us suppose that you have two excluded exogenous regressors (instruments)  and  where  is the years of mother's education and  is years of father's education. Suggest an alternative instrument that might be better and explain why.

Estimating equation (2) by 2SLS in Stata, we obtain the following results

log(wage) = .047 + .062educ + .043exper + .002tenure

(.399) (.032) (.012) (.006)

n = 428,  = .139

Interpret the coefficient on  . Why might the 2SLS estimate be barely significant at the 5% level against a two-sided alternative?

Question 6 (100 Marks)

a) Discuss how you would estimate a model for which its dependent variable presents a seasonal pattern. [15 marks]

b) Explain what is a stationary process. List and discuss the conditions that make a stochastic process with finite second moment to be covariance stationary. *[25 Marks]*

c) The *efficient markets hypothesis* (EMH) states that information observable in the market prior to period should not help to predict returns during period . One way of testing the EMH is to estimate the following model:

.

Suppose that after estimating this model we run the following regression

and find that and , where the numbers in parenthesis are the coefficient’s standard deviation, and . What do these findings imply? Discuss. *[30 marks]*

d) Explain what is a weakly dependent process is and discuss at least two examples of weakly dependent processes. *[30 marks]*

Question 7 (100 Marks)

a) Discuss why it is important to relax the assumption of strict exogeneity in dynamic models [40 marks]

b) Discuss the properties of a random walk process. Explain how a random walk without drift differs from a random walk with drift and from a stable AR(1) process. In addition, discuss what the best predictor of is when is a random walk process without drift and when is a random process with drift. [25 marks]

c) Discuss the implications of serial correlation in model in models including lagged dependent variables. How would you test for serial correlation in the context of an AR(1) process without strictly exogenous general regressors,(i.e. one or more are correlated with ? [10 marks]

d) In the context of panel data models: discuss the differences, advantages and disadvantages of the fixed effects and random effects models. [25 marks]









© UNIVERSITY OF DUBLIN 2013