Summer Examinations 2015

ECN201415N

<table>
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<tr>
<th>MODULE TITLE</th>
<th>Date Analysis for Economists</th>
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<tr>
<td>LEVEL</td>
<td>Five</td>
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<tr>
<td>TIME ALLOWED</td>
<td>Two hours</td>
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Instructions to students:

- Enter your student number **not** your name on all answer books.
- The examination is divided into two sections.
- Candidates are required to answer **three** questions in total:
  - **One** question **from Section A**
  - **One** question **from Section B**
  - **One** other question of your choice (**from Section A or B**)
- All questions are equally weighted. Where a question has more than one part the division of marks is stated.
- Begin each answer in a separate booklet; label each booklet clearly with the number of the question you are answering.
- The use of a non-programmable calculator is permitted.
- Formula sheets, Durbin-Watson table, t test tables and F test tables are provided in a separate document.

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Section A

1. Data was collected on the Taiwanese manufacturing sector on the real gross product \(Y_t\), labour input \(X_{2t}\) and capital input \(X_{3t}\) for 1998 – 2012. All the data was converted into natural logarithms. You are given the following information based on 15 observations.

\[ \sum Y_t = 149.2377 \quad \sum X_{2t} = 94.0653 \quad \sum X_{3t} = 177.1155 \quad \sum y_t^2 = 4.4896 \]
\[ \sum y_t x_{2t} = 3.4720 \quad \sum y_t x_{3t} = 3.6750 \quad \sum x_{2t}^2 = 2.7967 \quad \sum x_{3t}^2 = 6.5867 \]
\[ \sum x_{2t} x_{3t} = 2.7634 \]

where lowercase letters denote deviations from sample mean values \(\text{i.e. } y_t = Y_t - \bar{Y} \).

a. What are a priori expectations regarding the anticipated signs of the regression coefficients? Justify your decision.  
(5 marks)

b. Use the above information to derive the OLS estimates of the intercept coefficient \(B_1\) and the slope coefficients \(B_2\) and \(B_3\). Show all workings.  
(12 marks)

c. Interpret the regression results and explain in words what they mean.  
(8 marks)

d. Obtain \(R^2\) and explain its meaning.  
(8 marks)

(Total: 33 marks)
A model, with parameters $B_0$, $B_1$ and $B_2$ is estimated by least squares with the following results:

(1) $\hat{Y}_t = 1.2 + 0.8 X_{1t} + 1.5X_{2t}$

The residual sum of squares, $RSS = 20$; the total sum of squares, $TSS = 100$; and the number of observations is $n = 25$.

A revised model, adding two extra variables with parameters $B_3$ and $B_4$ gave;

(2) $\hat{Y}_t = 1.6 + 0.9 X_{1t} + 0.7X_{2t} - 1.1 X_{3t} + 3.0X_{4t}$  $RSS = 5$

\[ \text{a. Calculate } R^2 \text{ for each model.} \]

\[ \text{(10 marks)} \]

\[ \text{b. For model (1) test the hypothesis that } B_1 = B_2 = 0. \]

\[ \text{(7 marks)} \]

\[ \text{c. Test the hypothesis that } B_3 = B_4 = 0 \text{ using the RSS values for the two models.} \]

\[ \text{(7 marks)} \]

\[ \text{d. A variable } X_{5t} \text{ with parameter } B_5 \text{ is added to model (2) which is then re-estimated. The RSS for this larger model is } RSS = 4 \text{ and } B_5 = 2.0. \text{ What is the standard error of } B_5? \]

\[ \text{(9 marks)} \]

\[ \text{(Total: 33 marks)} \]
3. The equation below is a least squares estimated relationship between urbanisation (Y), measured as the percentage of the population living in urban areas, and gross domestic product per head (X), in thousands of $US. The data is a sample of 28 developing countries in 2001.

\[ \hat{Y}_i = 53.85 + 0.22X_i \quad i = 1, 2, \ldots, 28 \]

a. Interpret the coefficients.  
(b) The correlation coefficient is \( r = 0.26 \). Explain what this shows. 
(c) The standard error of \( B_1 \), the estimated coefficient of \( X \), is equal to 0.16. Use a test of significance approach and a confidence interval approach at the 95% level to determine whether or not \( B_1 \) is significantly different from zero. 
(d) Use the equation to predict the degree of urbanisation for a country with a GDP per capita of £10,000. Give reasons why this prediction may not be accurate. 

(5 marks)

(7 marks)

(14 marks)

(7 marks)

(Total: 33 marks)
Section B

4. In studying the movement in the production workers’ share in value added (i.e. labour’s share), the following regression results were obtained based on US data for the years 1949 to 1964. (t ratios in parentheses).

\[
\text{Model A: } Y_t = 0.4529 - 0.0041t; \quad r^2 = 0.5284; \quad d = 0.8252 \\
t = (-3.9608)
\]

\[
\text{Model B: } Y_t = 0.4786 - 0.00127t + 0.0005t^2; \quad R^2 = 0.6629; \quad d = 1.82 \\
t = (-3.2724) \quad (2.7777)
\]

where \( Y = \) labour’s share and \( t = \) time

a. What is meant by serial correlation? (5 marks)

b. Is there serial correlation in Model A? Justify your answer. (8 marks)

c. Is there serial correlation in Model B? Justify your answer. (8 marks)

d. What does this example tell us about the usefulness of the \( d \) statistic in detecting autocorrelation? (12 marks)

(Total: 33 marks)

5. a. What is meant by heteroscedasticity? (5 marks)

b. Explain its effects on:
   i. OLS estimators and their variances;
   ii. Confidence intervals;
   iii. The use of \( t \) and \( F \) tests of significance. (12 marks)

c. Explain the logic behind the following methods of detecting heteroscedasticity:
   i. The graphical method;
   ii. The Park test. (16 marks)

(Total: 33 marks)
6. a. What is meant by collinearity? And by multicollinearity? (7 marks)

b. Consider the following model:

\[ Y_t = B_1 + B_2 X_t + B_3 X_{t-1} + B_4 X_{t-2} + B_5 X_{t-3} + u_t \]

Where

\( Y \) = the consumption  \\
\( X \) = the income  \\
\( t \) = the time

This model states that consumption expenditure at time \( t \) is a linear function of income not only at time \( t \) but also of income in two previous time periods. Such models are called distributed lag models and represent what are called dynamic models.

i. Would you expect multicollinearity in such models and why? (13 marks)

ii. If multicollinearity is suspected, how would you remove it? (13 marks)

(Total: 33 marks)

End of Section B
End of paper