

**Economics X Paper (Eco. 510) (New Course)**  
**[Econometrics (Eco. 510-1), 2058]**

Time: 4 hrs. Full marks: 100  
 Attempt any THREE questions from "Group A" and FOUR from "Group B".

**Group A 3×20=60**

- 1. The total investment function for the economy as a whole is assumed to be of the form.**

$$I = b_0 \cdot r^{b_1} \cdot e^u$$

where I= investment, r= interest rate

The following sample is given:

|                |     |     |     |     |     |     |     |     |     |     |     |
|----------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| I (\$ billion) | 9.0 | 5.5 | 8.5 | 4.0 | 3.5 | 2.5 | 3.0 | 1.5 | 1.2 | 1.8 | 1.5 |
| r (percent)    | 2   | 3   | 2   | 4   | 5   | 6   | 4   | 6   | 8   | 7   | 9   |

For simplicity, the intermediates results are given as follows:

Intermediate results (in log):

$$\Sigma(\log_e I) = 12.2770 \quad \Sigma(\log_e r) = 16.6730$$

$$\Sigma(\log_e I)^2 = 18.5591 \quad \Sigma(\log_e r)^2 = 27.9610$$

$$\Sigma(\log_e I)(\log_e r) = 15.1223 \quad N=11$$

- a) Using the intermediate results, estimate the parameters of the investment function by OLS.
- b) Test the statistical significance of the coefficients at the 1 percent level of significance. Interpret your results.

- 2. Consider the following simple macro-economic model of an economy:**

$$C_t = \alpha + \alpha_2 Y_t + \alpha_3 r_t + u_{1t}$$

$$I_t = \beta_1 + \beta_2 r_t + \beta_3 (Y_t - Y_{t-1}) + u_{2t}$$

$$r_t = \delta_1 + \delta_2 I_t + \delta_3 M_t + u_{3t}$$

$$Y_t = C_t + I_t + G_t$$

Which of the above equations (if any) are unidentified? Exactly identified? Overidentified? How would you estimate the identified equations?

3. a) Consider the model  $Y_t = b_0 + b_1 x_t + u_t$ , where  $u_t$  is auto-correlated with a first order auto-regressive scheme.

$$u_t = \rho u_{t-1} + v_t \quad (v_t = \text{random term satisfying all the usual assumptions})$$

Show that the OLS estimates  $\hat{b}_1 = \frac{\sum xy}{\sum x^2}$  is unbiased despite the presence of

auto-correlation.

- b) 'Auto-correlation is a problem that normally arises when using time-series data'. Explain with an economic examples.
4. Discuss the Indirect Least Squares Method (ILS). Under what condition ILS estimates will be the same as those under the Two Stage Least Squares (2SLS) method?

**Group B 4×10=40**

5. What are the relevant indicators of the seriousness of multi-collinear X's?
6. Discuss the major steps for conducting the Golfield-Quandt test for heteroscedasticity.
7. Discuss the use of dummy variable for seasonal adjustment of time series data. Give a suitable example to illustrate how dummy variables can be used in removing seasonal variations in time series data.
8. Given the following estimated consumption function

$$\hat{C}_1 = 5,000 + 0.8Y_1 \quad r^2 = 0.95$$

$$\text{S.c.} \quad (500) \quad (0.09) \quad N=15$$

Where C= consumption expenditure; Y= income

- a) Estimate the savings function.
  - b) Estimate the marginal propensity to consume (MPC) and marginal propensity to save (MPS).
  - c) Forecast the level of consumption for 2010 if in that year income is \$200,000.
9. Illustrate the assumption of the Classical Linear Regression Model.
10. Write a note on an Auto-regressive and Moving Average (ARMA) Process in time series data.



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## Economics X Paper (New Course)

[Econometrics (Eco. 510-1), 2059]

Time: 4hrs.

Full Marks: 100

Attempt any THREE questions from "Group A" and FOUR from "Group B".

### "Group A" 3×20=60

1. The savings function for the economy as a whole is given as:

$$S_t = b_0 + b_1 Y_t + b_2 r_t + u_t$$

Where S = aggregate saving, Y = national income, r = interest rate. Given the following intermediate results:

$$\Sigma S = 399 \quad \Sigma Y = 1930 \quad \Sigma r = 0.37$$

$$\Sigma SY = 76,010 \quad \Sigma Y^2 = 369,700 \quad \Sigma r^2 = 0.0137$$

$$\Sigma Sr = 14.58 \quad \Sigma S^2 = 15,707 \quad \Sigma rY = 70.70$$

$$N = 11 \text{ (no. of observation)}$$

- Estimate the parameters of the savings function by OLS. Interpret your results.
- Compute the marginal propensity to consume and the marginal propensity to save.
- Forecast the level of savings at  $Y=300$  and  $r=0.8$ .

2. Consider the following system of three equations:

$$Y_1 = \alpha_1 + \alpha_2 Y_2 + \alpha_4 X_1 + \alpha_5 Z_2 + u_1$$

$$Y_2 = \beta_1 + \beta_2 Y_3 + \beta_5 X_2 + u_2$$

$$Y_3 = \delta_1 + \delta_2 Y_2 + u_3$$

Which of the above equations (if any) are unidentified? Exactly identified? Over identified? How would you estimate the identified equations?

3. Consider the investment model

$$I_t = b_0 + b_1 (S_t - S_{t-1}) + b_2 r_t + u_t$$

$$u_t = c_1 u_{t-1} + c_2 u_{t-2} + V_t$$

Where I = investment, S = sales, r = interest rate

V = random term satisfying the usual assumptions.

- Outline a method for obtaining estimates of  $e_1$  and  $e_2$  of the second-order autocorrelation.
- Write the transformed variables which you would use in order to eliminate the assumed pattern of autocorrelation.
- Show that your transformation in (b) eliminates the second-order autocorrelation.

4. Discuss the method of Generalised Least Squares Estimation.

### Group B 4×10=40

5. Consider the model

$$Y_t = b_0 + b_1 X_t + b_2 X_t^2 + u_t$$

Does this model have perfect multicollinearity?

6. Explain the 'dummy variable trap'. Illustrate your answer with an example of your own.

- Outline the method of the Almon lag scheme assuming that a certain function  $Y = f(x)$  includes six lags, and that the degree of the approximation polynomial is 3.
- What is the difference between confidence interval and hypothesis testing?
- Write a note on Recursive equation systems.
- What do you mean by a Probit model? Explain under what circumstances, would this be used as a method of estimation?



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## Economics X Paper (New Course)

[Econometrics (Eco. 510-1), 2060]

Time: 4hrs.

Full Marks: 100

Attempt any THREE questions from "Group A" and FOUR from "Group B".

### "Group A" 3×20=60

1. In a sample study, the following data were obtained which indicated the respective height of 12 fathers (X) and their sons (Y)

$$\Sigma X = 800 \quad \Sigma Y = 811 \quad \Sigma XY = 54107$$

- d)  $\Sigma X^2 = 53,418 \quad \Sigma Y^2 = 54849 \quad N = 12$
- e) Estimate the linear regression of the height of sons (Y) on the height of fathers (X). Interpret the results.
- a) Is the height of sons dependent on the height of their fathers? Use 5% level of significance.
- b) Estimate the height of the son if the father was 70 inches tall.
- 2) The following is a model in five equations with five endogenous variables  $Y_s$  and four exogenous variables  $X_s$

| Equation no. | $Y_1$        | $Y_2$        | $Y_3$        | $Y_4$        | $Y_5$        | $X_1$    | $X_2$    | $X_3$    | $X_4$    |
|--------------|--------------|--------------|--------------|--------------|--------------|----------|----------|----------|----------|
| 1            | 1            | $\beta^{12}$ | 0            | $\beta_{14}$ | 0            | $Y_{11}$ | 0        | 0        | $Y_{14}$ |
| 2            | 0            | 1            | $\beta_{23}$ | $\beta_{24}$ | 0            | 0        | $Y_{22}$ | $Y_{23}$ | 0        |
| 3            | $\beta_{31}$ | 0            | 1            | $\beta_{34}$ | $\beta_{35}$ | 0        | 0        | $Y_{33}$ | $Y_{34}$ |
| 4            | 0            | $\beta^{42}$ | 0            | 1            | 0            | $Y_{41}$ | 0        | $Y_{43}$ | 0        |
| 5            | $\beta_{51}$ | 0            | 0            | $\beta_{54}$ | 1            | 0        | $Y_{52}$ | $Y_{53}$ | 0        |

Determine the identifiability of each equation with the help of the order and rank conditions of identification.

2. Consider the following model;
- $$Y_1 = b_0 + b_1 X_1 + u_1 \quad \text{---(1)}$$
- Where  $u$  depends on  $X$  in the following way
- $$u_1 = b_2 X_1^2 + V_1 \quad \text{---(2)}$$
- where,  $V_1$  is a random variable which is dependent of  $X$  and satisfies all the other assumptions of the linear regression model.
- a) Which assumptions of the linear regression model are violated in (1)?
- b) How would you estimate equation (1)? Explain clearly.
3. From economic theory we know that the level of current consumption is affected by the current and past levels of income.

$$C_t = f(Y_t, Y_{t-1}, Y_{t-2}, Y_{t-3}, \dots)$$

Use of Koyck transformation to derive an appropriate model of the above consumption function. State clearly the assumptions of the Koyck transformation.

### Group B 4×10=40

5. What are the consequences of multicollinearity? Explain.
6. Write a note on Logit model.
7. Outline the steps involved in using the Indirect Least Squares Method of estimation with a simple simultaneous equation model as an example.

8. Explain the method of deseasonalisation in time series data with the help of dummy variables.
9. Distinguish between  $R^2$  and  $\overline{R^2}$ . Also show the relationship between them.
10. Write a note on the Maximum Likelihood Method of Estimation.



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### Economics X Paper (New Course)

[Econometrics (Eco. 510-1), 2061]

Time: 4hrs.

Full Marks: 100

Attempt any THREE questions from "Group A" and FOUR from "Group B".

#### "Group A" 3×20=60

1. Describe the indirect least squares (ILS) method. Under what conditions(s) will ILS estimates be the same as the two stage least squares (2SLS) estimates?
2. State the assumptions underlying the method of least squares and discuss the procedure to compute the variance-covariance matrix of the parameters in n-variable linear regression model.
3. Discuss method of Durbin-Watson test for first-order autocorrelation. Also suggest remedial measures to solve the problem of autocorrelation.
4. Consider the following simple macroeconomic model of an economy.

$$C_t = a_1 + a_2 Y_t + a_3 r_t + u_{1t}$$

$$I_t = b_1 + b_2 r_t + b_3 (y_t - y_{t-1}) + u_{2t}$$

$$r_t = c_1 + c_2 I_t + c_3 M_t + u_{3t}$$

$$Y_t = c_1 + I_t + G_0$$

Which of the above equations are unidentified? Exactly identified? Over-identified? How might you estimate the identified equations?

#### Group B 4×10=40

5. What do you mean by a Probit model? Explain under what circumstances would this model be used as a method of estimation.
6. Consider the following model:  
$$Y_t = a_0 + a_1 X_{1t} + a_2 X_{2t} + u_t$$
Derive, by employing OLS technique, the normal equations for the given model.
7. Write a note on stochastic regressions.
8. Show the relationship between confidence interval and hypothesis testing.
9. Describe the procedure for Almon lag model.
10. Consider the following correlation matrix.

$$\begin{matrix} & X_1 & X_2 & X_3 \\ X_1 & \left( \begin{matrix} 1.0 & 0.974 & 0.928 \end{matrix} \right) \\ X_2 & & \left( \begin{matrix} 1.0 & 0.87 \end{matrix} \right) \\ X_3 & & & \left( \begin{matrix} 1.0 \end{matrix} \right) \end{matrix}$$

Find out the above matrix whether there is any multi-collinearity or not. Also identify the type of multi-collinearity, if there is any.



### Economics X Paper (New Course)

[Econometrics (Eco. 510-1), 2062]

Time: 4hrs.

Full Marks: 100

Attempt any THREE questions from "Group A" and FOUR from "Group B".

#### "Group A" 3×20=60

1. Why is identifiability necessary in simultaneous equation system? Examine the identifiability of the consumption ( $C_t$ ) and investment ( $I_t$ ) functions in the following model:

$$C_t = a_0 + a_1 y_t + a_2 c_{t-1} + u_{1t}$$

$$I_t = b_0 + b_1 r_t + b_2 I_{t-1} + u_{2t}$$

$$r_t = c_0 + c_1 y_t + c_2 m_t + u_{3t}$$

$$Y_t = C_t + I_t + G_0$$

2. Discuss the problems of multicollinearity. What measures do you suggest to remove the problem of multicollinearity?
3. Describe the Koyak Lag Model. Convert the following model into a simpler form by employing Koyck transformation:

$$y_t = a_0 + a_1 x_t + b_0 z_t + b_1 z_{t-1} + \dots + u_t$$

$$\text{Where } b_i = b_0 \lambda^i, i = 1, 2, 3, \dots$$

4. Define dummy variables trap. How does it occur? Prescribe, with example, two methods to avoid such traps.

#### Group B 4×10=40

5. Describe the procedure for Durbin-Watson test.
6. Write a note on instrumental variable method in regression analysis.
7. Discuss the method of generalised least squares.
8. Describe the procedure of three stages least squares (3SLS)
9. Distinguish between  $R^2$  and Adj.  $R^2$ . Give reasons why do economists usually report  $R^2$  rather than Adj.  $R^2$ .
10. What do we mean by hypothesis testing in regression analysis? What are its procedures?



**Economics X Paper (New Course)**  
[Econometrics (Eco. 510-1), 2063]

Time: 4hrs.

Full Marks: 100

Attempt any THREE questions from "Group A" and FOUR from "Group B".

**"Group A" 3×20=60**

1. Define dummy variables in regression analysis. Discuss about the estimation procedure of binominal logit model and explain why this model is superior to the linear probability model.
2. Discuss the method of generalised least-squares estimation.
3. Consider theregression model:  
 $Y_t = a_0 + a_1 X_{1t} + a_2 X_{2t} + u_t$ 
  - a) List the standard assumptions underlying this model.
  - b) Write down its normal equations and indicate the particular assumptions corresponding to each equation.
  - c) Suppose  $n=100$ ,  $\Sigma X_1 = \Sigma X_2 = \Sigma X_1 X_2 = 0$ ,  $\Sigma Y = 10$ ,  $\Sigma Y X_1 = 30$ ,  $\Sigma Y X_2 = 20$ ,  $\Sigma X_1^2 = 35$ , and  $\Sigma X_2^2 = 3$ ; estimate  $a_0$ ,  $a_1$ , and  $a_2$ .
4. What is heteroscedasticity and what are its consequences? Discuss the procedure of Goldfed- Quandt test to test for the presence of heteroscedasticity.

**Group B 4×10=40**

5. Discuss the estimation method of maximum likelihood.
6. Explain the estimation procedure of a stock adjustment model.
7. Describe the estimation procedure for simultaneous estimation system.
8. Explain the procedure of the three stages Least Square (3 SLS)
9. Illustrate the relationship between confidence interval and hypothesis testing.
10. Distinguish between  $R^2$  adj.  $R^2$ . Why do economics usually report  $R^2$  values rather than adj.  $R^2$  values.



**Economics X Paper (New Course)**  
[Econometrics (Eco. 510-1), 2064]

Time: 4hrs.

Full Marks: 100

Attempt any THREE questions from "Group A" and FOUR from "Group B".

**"Group A" 3×20=60**

1. Discuss the method of Durbin-Watson test for the first-order autocorrelation. Also suggest remedial measures to solve the problem of autocorrelation.
2. Consider the following model:  
 $Y = a_1 + b_1 X + c_1 Z$   
 $Y = a_2 + b_2 X + c_2 W$   
Where X and Y are endogenous, an W and Z are exogenous variables. The reduced -form equations are estimated to be:  
 $X = 50 + 4Z + 2W$   
 $Y = 100 + 2Z + 6W$   
What are the estimates of  $b_1$ ,  $b_2$ ,  $c_1$ , and  $c_2$ ?
3. Suppose that you want to estimate the simple linear consumption function  $C_1 = a + bY_1 + u_1$  across x individuals. How would you take account of a possible shift in the function between urban and rural consumers if the intercept and the slope are assumed to be affected by the residential location of the individual.
4. What is Almon Lag Model? Describe the procedure to estimate this model.

**Group B 4×10=40**

5. Define and distinguish R-square and Adjusted R-square. also show the relationship between them.
6. Discuss about Autoregressive and Moving Average (ARMA) process in time series data.
7. Distinguish between conditional and unconditional forecasting. Also explain the methods of to do such forecasting.
8. Write a note on recursive equation systems.
9. Describe the Goldfeld-Quandt test for heteroscedasticity.
10. What do you mean by hypothesis testing in statistical inference? Describe its procedure.



## Economics X Paper (New Course)

[Econometrics (Eco. 510-1), 2065]

Time: 4hrs.

Full Marks: 100

Attempt any THREE questions from "Group A" and FOUR from "Group B".

### "Group A" 3×20=60

1. Describe the Koyck Lag Model. Convert the following model into a simpler form by employing Koyck transformation:

$$y_t = a_0 + a_1 X_t + b_0 Z_t + b_1 Z_{t-1} + \dots + u_t$$

Where  $b_i = b_0 \lambda^i$ ,  $i=1,2,3 \dots$

2. Consider the following simple macroeconomic model of an economy:

$$C_t + a_1 + a_2 y_t + a_3 r_t + u_{1t}$$

$$I_t = b_1 + b_2 r_t + b_3 (y_t - y_{t-1}) + u_{2t}$$

$$r_t = d_1 + d_2 I_t + d_3 M_t + u_{3t}$$

$$Y_t = C_t + I_t + G_0$$

Test for the identification for each of the above equations by employing order and rank conditions.

How might you estimate the identified equations?

3. Define the term multicollinearity. Explain how you would detect its presence in a multiple regression equation you have estimated. What are the consequences of multicollinearity and what are the solutions?
4. What do you mean by a Logit model? Explain the procedure to estimate and interpret the coefficients of this model.

### Group B

4×10=40

5. How do you evaluate simulation models? Explain.
6. Illustrate the assumptions of ordinary least squares model.
7. Show the relationship, if any, between confidence interval and hypothesis testing.
8. Discuss the process of indirect least squares. When is this method used in regression analysis?
9. Describe the Cochrane-Orcutt procedure to correct for the problem of autocorrelation.
10. Write a note on stochastic regressors.



## Economics X Paper (New Course)

[Econometrics (Eco. 510-1), 2066]

Time: 4hrs.

Full Marks: 100

Attempt any THREE questions from "Group A" and FOUR from "Group B".

### "Group A" 3×20=60

1. What is a regression model? Describe the procedure to estimate regression parameters, from OLS, for a two-independent variable model.

2. Consider the following three-equation model system:

$$Y_1 = \alpha_1 + \alpha_2 Y_2 + \alpha_4 Y_1 + \alpha_5 + Z_2 u_1$$

$$Y_2 = \beta_1 + \beta_3 Y_3 + \beta_5 X_2 + u_2$$

$$Y_3 = \delta_1 + \delta_2 Y_2 + u_3$$

Which of the above equations are unidentified? Exactly identified. Over identified. How might you estimate the identified equations?

3. Discuss the method of Generalized Least Squares estimation.
4. What is heteroscedasticity and what are its consequences? Discuss the procedure of- Godfeld-Quandt test to test the presence of heteroscedasticity.

### Group B

4×10=40

5. Explain the estimation procedure for a Almon distributed lag model.
6. What do you mean by Theil inequality index? Explain the importance of it in econometric forecasting.
7. What do you mean by a Logit model? Explain under what circumstances would this model be used as a method of estimation.
8. Discuss about the use of instrumental variables in estimating parameters of a simultaneous equation model.
9. Consider the model:  $Y_1 = b_0 + b_1 X_1 + b_2 X_2$ ,  $u_1$   
Does this model have perfect multicollinearity?  
How can we estimate  $b_0, b_1$ , and  $b_2$ ?
10. Distinguish between conditional and unconditional forecasting. Also explain the methods to do such forecasting.



## Economics X Paper (New Course)

[Econometrics (Eco. 510-1), 2067]

Time: 4hrs.

Full Marks: 100

Attempt any THREE questions from "Group A" and FOUR from "Group B".

### "Group A" 3×20=60

1. Discuss the method of Durbin- Watson test for the first-order autocorrelation. Also suggest remedial measures to solve the problem of autocorrelation.
2. Describe the Koyck lg model. Convert the following model into a simpler form by employing Koyck transformation:  
$$Y_t = a_0 + a_1 x_t + b_0 z_t + b_1 Z_{t-1} + \dots + u_t$$
where  $b_1 = b_0 \lambda^i$ ,  $i=1,2,3,\dots$
3. Consider the following three-equation model:  
$$Y_1 = \alpha_1 + \alpha_2 Y_2 + \alpha_4 X_1 + \alpha_5 X_2 + u_1$$
$$Y_2 = \beta_1 + \beta_3 Y_3 + \beta_5 X_2 + u_2$$
$$Y_3 = \delta_1 + \delta_2 Y_2 + u_3$$
Which of the above equations, if any, are identified? Just identified? Over identified? How? How can you estimate the coefficients of the identified equations?
4. Describe the method of Indirect Least Squares (ILS). Under what conditions will ILS estimates be the same as the two-stage least squares (2SLS)?

### Group B

4×10=40

5. Define dummy variable trap. When does it occur and how can we get rid of this problem?
6. Describe the Goldfeld-Quandt test for heteroscedasticity?
7. Write a note on recursive equation systems.
8. Illustrate the relationship between confidence interval and hypothesis testing.
9. Discuss the estimation method of maximum likelihood.
10. Define and distinguish between R-Square and Adjusted R-Square. Also show the relationship between them.

