

7. Comment whether the following statements are correct. Give proper explanations wherever possible. Attempt any four.

- (i) In a log-linear model, the slope coefficient directly gives the elasticity of the dependent variable with respect to the independent variable.
- (ii) A high R^2 always indicates a good regression model that can be used for reliable predictions.
- (iii) The Durbin-Watson statistic can take values between 0 and 4, where a value around 2 indicates no autocorrelation.
- (iv) If the error term violates the normal distribution, then the estimator is biased.
- (v) Adding more explanatory variables to a regression model will always increase the R^2 but may decrease the adjusted R^2 .
- (vi) The Durbin-Watson statistic is used to test for heteroscedasticity in the error term.

(4×4.5=18)

(800)

[This question paper contains 8 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 5006

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Unique Paper Code : 2922103501

Name of the Paper : Basic Econometrics

Name of the Course : **B.A. (H) Business Economics**

Semester : V

Duration : 3 Hours

Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt any **five** questions, all questions carry equal marks (**18** marks each).
3. Use of simple calculator is allowed.
4. If any assumption is made while solving a problem, the same must be stated clearly and a note must be mentioned after the answer.
5. Use of statistical tables is allowed.

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1. (a) A researcher studying the relationship between advertising (X) and profit (Y) for the following data for 6 quarters :

Quarter	Profit (₹ lakhs) Y	Advertising Expenditure (₹ lakhs) X
Q1	46	8
Q2	53	10
Q3	39	6
Q4	63	12
Q5	42	7
Q6	57	11

- Estimate the simple linear regression equation $Y = \beta_1 + \beta_2 X + u$ using OLS method.
- Calculate the coefficient of determination (R^2) and interpret its meaning.
- Compute the residual sum of squares (RSS) and total sum of squares (TSS).
- Test at 5% significance level whether advertising expenditure has a positive significant impact on sales revenue.

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- Test whether the slope coefficient is significantly different from 0.75 at 5% level.
- Calculate the standard error of estimate of the regression and interpret it.
- Suppose you suspect that the relationship might have changed after economic liberalization in 1991. How would you test for structural break? Set up the hypothesis and explain the Chow test procedure.
- Is there any alternative technique available to test structural stability? Explain in details and list the advantages. (3,3,6,6)

6. Write short notes on (Attempt any 3)

- JB Test
- PRF vs SRF
- Goldfeld Quandt test
- Lin-log and Log-lin models
- Specification Errors

(6×3=18)

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- (i) Identify the functional form of this model. Interpret the coefficient of $\log(\text{Size})$.
- (ii) The DW statistic is 0.95. Test the presence of autocorrelation given that $dL = 1.38$ and $dU = 1.60$ at 5% significance level.
- (iii) Assuming autocorrelation is present, explain its causes and consequences on OLS estimators?
- (iv) Suggest one method to correct for autocorrelation.
- (v) Apart from autocorrelation, what other problem (any one) are you likely to encounter in such regression. Suggest a way to detect the problem, its consequence and a suitable remedy. (2,3,3,2,4)

(b) Derive .) where Cov is covariance and (4)

5. (a) An economist studying the consumption function estimated the following model :

$$S.E \quad (125.6) \quad (0.045)$$

$$R^2 = 0.923, n = 25, e_t^2 = 1250$$

- (v) Calculate the 95% confidence interval for the slope coefficient β_2 . (4,2,3,4,3)

- (b) State the Gauss-Markov theorem and explain its significance in the context of OLS estimation? (2)

2. A researcher fitted the following model for 64 employees where wages in rupees ('000) was regressed on experience in years (Exp) and age of employee in years (Age). The following are his results:

$$\text{Wages}_i = 20 + 0.325 \text{ Exp}_i - 0.003 \text{ Age}_i$$

$$\text{SE: } (0.3) \quad (0.032) \quad (0.00073) \quad R^2 = 0.667$$

- (i) Interpret the two partial slope coefficients.
- (ii) Test whether Experience and Age are significant variables at 5% level of significance
- (iii) Is the model overall significant at 5% level of significance?
- (iv) How will you calculate adjusted R^2 ? Which of the two R^2 or adjusted R^2 is a better measure of goodness of fit here and why?

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- (v) What will be the wages of the employee who has an experience of 11 years and whose age is 50 years?
- (vi) Why do you think the sign of the variable Age is negative? (3,4,3,4,2,2)
3. (a) A marketing research firm wants to analyze the factors affecting monthly household expenditure on groceries (Y) for 80 families. The explanatory variables are :
- X : Monthly household income (in '000 Rs)
- X : Family size (number of members)
- D : Location dummy (1 if urban, 0 if rural)
- D : Education dummy (1 if head of family has a graduate degree (Educated), 0 otherwise (uneducated))
- (i) Write the complete regression model incorporating these variables. Explain the interpretation of each coefficient, including the dummy variable coefficients.

- (ii) Suppose you want to test whether there's a difference in grocery expenditure pattern between urban educated and rural uneducated households. Create an interaction dummy variable and show how to test this hypothesis.
- (iii) How would you test the joint significance of monthly household income and family size? State the null and alternative hypotheses and show how you will test it.
- (iv) Explain the dummy variable trap and how to avoid it. (4,3,4,3)
- (b) Show that The OLS estimator of slope is unbiased. (4)
4. (a) Consider the following regression output for a study on factors affecting house prices :
- | | | | | |
|----|--------|---------|---------|---------|
| SE | (0.45) | (0.015) | (0.018) | (0.067) |
|----|--------|---------|---------|---------|
- $R^2 = 0.756$, $n = 50$, $DW = 0.95$
- Where: Price = House price in ₹ lakhs, Size = House size in sq.ft, Rooms = Number of rooms, Location dummy (1 if urban, 0 if rural)