

intercept term is absent.

- (ii) Testing linear equality restriction in a Cobb-Douglas production function is equivalent to testing of 'returns to scale'
- (iii) In lin-log model elasticity of the dependent variable with respect to the independent variable is given by the slope coefficient β_2
- (iv) Precision of OLS intercept estimator is inversely related to the sample size.
- (v) If error terms are normally distributed, it implies regression parameters are also normal ($6 \times 3 = 18$)

[This question paper contains 8 printed pages.]

Your Roll No.....

आपका अनुक्रमांक.....

Sr. No. of Question Paper : 1686

I

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 : 90

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
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.

1. (a) You are given information about five-year data of a firm where profits earned (000) is taken as a function of good produced(million units). The following is given :-

Year	Profits (000)	Goods Produced(million)
2020	60	6
2021	90	5
2022	80	4
2023	70	3
2024	50	2

- (i) Estimate the equation of the linear regression line of Y on X
- (ii) Calculate the residual sum of squares for the regression.
- (iii) What proportion of the variation in Y is explained by X?
- (iv) Test at 5% level of significance whether the slope coefficient is greater than 2.
- (v) Test the overall significance of the model.(4,2,2,3,4)
- (b) Explain the significance of the stochastic error term in the regression model. (3)
2. (a) Total annual gross sales of refrigerators (in thousands) at Co's retail outlet over the last 26 years is regressed upon five explanatory variables with following results:

to the problem above, how many regression equations should the researcher develop if he wants to test whether the relationship amongst the variables has changed or not? Develop these equations considering the information provided above. Also clearly establish the hypothesis and econometric tests involved for the same.

- (iv) Furthermore, his friend pointed out that the researcher just needs a single equation and not multiple equations. Do you agree with the point raised by the researcher's friend. If yes, then develop such an equation clearly specifying the variables that need to be included showing complete details with superscript and subscript.
- (v) How is the model in (iv) an improvement over the model developed in part (iii) above (3, 3, 5,5,2)

6. Comment whether the statements given are correct. Give your own explanations. Include illustrations wherever possible. Do any three.

- (i) Regression equation cannot be determined when

- (iii) Calculate the value of adjusted R^2 .
- (iv) Compute and interpret correctly the 't' values for intercept and slope coefficient for the model. Also comment upon the functional form of the model under consideration.
- (v) Using 'p', show the basic steps involved in transformation of above equation for the removal of autocorrelation. (3,3,2,5,5)

5. (i) Explain what do you understand by the term 'structural break' in time series. Does by including such a break in time series impact the linearity of such a series. Comment

(ii) A researcher wanted to determine whether Covid-19 has resulted in structural break in the relationship between NSE Nifty 50 stock index and the S&P 500 index. The researchers after collecting daily closing prices data on both stock indices and for three years before and three years after covid date were confused about modeling the data. Help the researcher in finding a solution for the same.

(iii) Assuming the researcher was able to find a solution

$$SQ_t = -7.2 + 200.3PC_t - 150.6PQ_t + 20.6Y_t - 15.8C_t + 201.1N_t$$

$$t_{\text{computed}} (0.801) (-1.199) (0.514) (-1.491) (1.937) \\ (\bar{R}^2 = 0.821, DW(d) = 1.023,)$$

where SQ_t = sale of refrigerators at the Co's retail outlet in time t

PQ_t = average price of refrigerators at Co's retail outlet in period t

PC_t = average price of refrigerators at competitors retail outlets in period t

Y_t = India's GDP in period t (billion INR)

C_t = India's aggregate consumption in period t (billion INR)

N_t = number of Co's stores open in period t

- (i) What econometric problems are likely to occur in the above model. What is the likely impact of these problems on the OLS estimators. Justify your answer with proper reasons (4)
- (ii) Give appropriate test (one each) for detection of the above problem(s). (4)
- (iii) Suggest any two remedies for the solution to these problems. (4)
- (iv) Do you think the coefficient of Y_t would change if it was expressed in millions INR instead. Will it also impact on the value of $\bar{R}^2$. Comment (3)

- (b) Can R^2 indicate the correctness of the regression model. Explain your viewpoint (3)
3. A college wants to study for 100 students, the relation between student's Marks obtained in Econometrics paper as the dependent variable and his choice of a computer based SEC paper (Yes/No) as an explanatory variable in addition to average hours of study put in by the student daily.
- (i) What are such models called? Develop a regression model being considered (clearly show all the parameters, variables and relevant subscripts and superscripts in the regression model), interpret the slope of the explanatory variables.
- (ii) Can you add another variable 'attendance' and where college is only concerned whether the student has achieved a minimum $2/3^{\text{rd}}$ attendance or not. Incorporate this variable stating the Null Hypothesis, rewrite the regression and interpret again assuming this too is also significant.
- (iii) Suppose college considers the variable 'attendance' without placing the above restriction and such a variable would signify percentage of classes attended by a student. Show how will this change impact your regression. Also, will the interpretation of slope also change. Discuss (iv) How will you test the hypothesis for the independent variables attendance (in ii above) and average hours studied to be jointly significant and no. of hours studied

- and attendance (as used in iii above). Also state the Null Hypothesis with the help of parameters stated in the equations developed by you for the same.
- (v) Create a new variable by multiplying the above twocategorical explanatory variables mentioned above in point(s) (i) and (ii) above. What is the nature of this new variable, interpret the same for the above equation. Also explain how will this impact the R^2 of the model and overall goodness of the model fit. (3,3,3,5,4)
4. (a) The quarterly expenditure on a car which includes expenditure on petrol, maintenance and repairs (000) for 15 years is modelled as a function of no. of kms travelled and following are the results.
 $R^2 = 0.888$, d computed (DW) = 0.83
- InExp on Car = $22.3 + 0.4881 \text{nkms travel} + -u_i$
- S.E (0.13) (0.043)
- (DW table at 5%, $dL = 1.383$, $dU = 1.45$ for $n = 60$, table 't' may be taken as '2')
- (i) Comment on calculated values of DW 'd', write down its formula based upon residuals and compute 'p'(coefficient of autocorrelation). What is the relation between DW 'd' and 'p'
- (ii) Check whether autocorrelation is present in the model? If yes, what is its nature. Conduct test of hypothesis.