



PAMIBIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY

FACULTY OF COMMERCE, HUMAN SCIENCE AND EDUCATION

DEPARTMENT OF ECONOMICS, ACCOUNTING AND FINANCE

QUALIFICATION: BACHELOR OF ECONOMICS	
QUALIFICATION CODE: 07BECO	LEVEL: 7
COURSE CODE: ECM712s	COURSE NAME: ECONOMETRICS
SESSION: June 2023	PAPER: THEORY
DURATION: 3 HOURS	MARKS: 100
SECOND OPPORTUNITY EXAMINATION QUESTION PAPER	
EXAMINER(S)	MR. PINEHAS NANGULA
MODERATOR:	Dr R. KAMATI
INSTRUCTIONS	
1. Answer ALL the questions in section A and B 2. Write clearly and neatly. 3. Number the answers clearly.	

PERMISSIBLE MATERIALS

1. Scientific calculator
2. Pen and Pencil
3. Ruler

THIS QUESTION PAPER CONSISTS OF _5_ PAGES (Including this front page)

SECTION A

[20 MARKS]

MULTIPLE CHOICE QUESTIONS

1. Which of the following statements is TRUE concerning OLS estimation?
 - a) OLS minimises the sum of the vertical distances from the points to the line
 - b) OLS minimises the sum of the squares of the vertical distances from the points to the line
 - c) OLS minimises the sum of the horizontal distances from the points to the line
 - d) OLS minimises the sum of the squares of the horizontal distances from the points to the line.

2. The residual from a standard regression model is defined as
 - a) The difference between the actual value, y , and the mean, \bar{y}
 - b) The difference between the fitted value, \hat{y} , and the mean, \bar{y}
 - c) The difference between the actual value, y , and the fitted value, \hat{y}
 - d) The square of the difference between the fitted value, \hat{y} , and the mean, \bar{y}

3. Which of the following statements concerning the regression population and sample is FALSE?
 - a) The population is the total collection of all items of interest
 - b) The population can be infinite
 - c) In theory, the sample could be larger than the population
 - d) A random sample is one where each individual item from the population is equally likely to be drawn

4. Which of the following is an equivalent expression for saying that the explanatory variable is "non-stochastic"?
 - a) The explanatory variable is partly random
 - b) The explanatory variable is fixed in repeated samples
 - c) The explanatory variable is correlated with the errors
 - d) The explanatory variable always has a value of one

5. The line described by the regression equation attempts to
 - a) pass through as many points as possible.
 - b) pass through as few points as possible
 - c) minimize the number of points it touches
 - d) minimize the squared distance from the points

6. The regression equation for predicting number of speeding tickets (Y) from information about driver age (X) is $Y = -.065(X) + 5.57$. How many tickets would you predict for a twenty-year-old?

- a) 6
 - b) 4.27
 - c) 5.57
 - d) 1
7. What does it mean to say there is error in our regression?
- a) We calculated it wrong.
 - b) There were data entry errors.
 - c) We cannot predict Y perfectly.
 - d) The data points all fall on a straight line.
8. Heteroscedasticity occurs when
- a) there are larger values on X than Y.
 - b) there is a linear relationship between X and Y.
 - c) more error is accounted for than remains.
 - d) variability in Y depends on the exact value of X.
9. R^2 tells us
- a) how to determine someone's score.
 - b) how to describe a relationship.
 - c) the proportion of variability in Y accounted for by X.
 - d) all of the above.
10. Unless a relationship between X and Y is perfect, then predictions for Y
- a) will fall on a straight line.
 - b) will be closer to the mean of Y.
 - c) will be closer to the mean of X.
 - d) will be invalid.

SECTION B

[80 MARKS]

QUESTION ONE

[30 MARKS]

All questions pertain to the simple (two-variable) linear regression model for which the population regression equation can be written in conventional notation as:

$$Y_i = \beta_1 + \beta_2 X_i + u_i \text{ equation 1}$$

where Y_i and X_i are observable variables, β_1 and β_2 are unknown (constant) regression coefficients, and u_i is an unobservable random error term. The Ordinary Least Squares (OLS) sample regression equation corresponding to regression equation (1) is

$$Y_i = \hat{\beta}_1 + \hat{\beta}_2 X_i + \hat{u}_i \text{ equation 2}$$

where $\hat{\beta}_1$ is the OLS estimator of the intercept coefficient β_1 , $\hat{\beta}_2$ is the OLS estimator of the slope coefficient β_2 , \hat{u}_i is the OLS residual for the i -th sample observation, and N is sample size (the number of observations in the sample).

- a) State the Ordinary Least Squares (OLS) estimation criterion. State the OLS normal

equations. [5 marks]

- b) Derive the OLS normal equations from the OLS estimation criterion. [5 marks]
- c) Show that the OLS slope coefficient estimator $\hat{\beta}_1$, is a linear function of the Y_i , sample values. [10 marks]
- d) Stating explicitly all required assumptions, prove that the OLS slope coefficient estimator $\hat{\beta}_2$ is an unbiased estimator of the slope coefficient β_2 . [10 marks]

QUESTION TWO

[20 MARKS]

The following is the econometric model which is presented in four different forms. You are require to interpret each of them.

- a) $\hat{C} = - 8.078 + 0.70641 \text{Income}$ [5 marks]
- b) $\hat{C} = - 18.072 + 22.73841 \text{LogIncome}$ [5 marks]
- c) $\widehat{\text{Log}C} = 7.203 + 0.000218 \text{Income}$ [5 marks]
- d) $\widehat{\text{Log}C} = - 0.2957 + 1.0464 \text{Logincome}$ [5 marks]

QUESTION THREE

[30 MARKS]

The MacKinnon-White-Davidson (MWD) Test is used to choose between a linear model and log-linear model .

Income, I_i	Consumption, C_i
462003	308105
480307	324006
514001	340706
532305	356605
548707	370807
564905	382203

- a) the null and alternative hypothesis associated with MWD test [1 mark]
- b) If the estimated linear regression model is $\hat{C}_i = -14989.7 + 0.7I_i$, calculate the value of \hat{C}_i associated with each level of income. [6 marks]
- c) If the estimated log-linear model is $\widehat{\text{log}C}_i = 5.11 + 0.000000824I_i$, calculate the value of $\widehat{\text{log}C}_i$ associated with each level of income. [6 marks]

- d) Obtain the values of Z_{1i} [12 marks]
- e) The linear regression model which came from regressing consumption on income and Z_{1i} is $\hat{C}_i = -15023.5 + 0.700064I_i - 125428Z_{1i}$, standard error for Z_{1i} is 317372.1. Use t – statistic and t – critical to evaluate the significance Z_{1i} in the estimated equation. [5 marks]

All the best

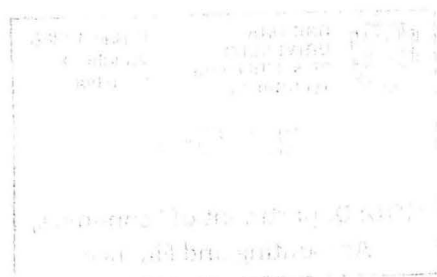


Table entry for p and C is the critical value t^* with probability p lying to its right and probability C lying between $-t^*$ and t^* .

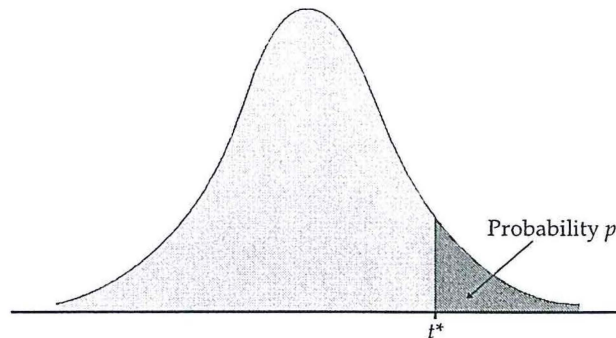


TABLE D

t distribution critical values

df	Upper-tail probability p											
	.25	.20	.15	.10	.05	.025	.02	.01	.005	.0025	.001	.0005
1	1.000	1.376	1.963	3.078	6.314	12.71	15.89	31.82	63.66	127.3	318.3	636.6
2	0.816	1.061	1.386	1.886	2.920	4.303	4.849	6.965	9.925	14.09	22.33	31.60
3	0.765	0.978	1.250	1.638	2.353	3.182	3.482	4.541	5.841	7.453	10.21	12.92
4	0.741	0.941	1.190	1.533	2.132	2.776	2.999	3.747	4.604	5.598	7.173	8.610
5	0.727	0.920	1.156	1.476	2.015	2.571	2.757	3.365	4.032	4.773	5.893	6.869
6	0.718	0.906	1.134	1.440	1.943	2.447	2.612	3.143	3.707	4.317	5.208	5.959
7	0.711	0.896	1.119	1.415	1.895	2.365	2.517	2.998	3.499	4.029	4.785	5.408
8	0.706	0.889	1.108	1.397	1.860	2.306	2.449	2.896	3.355	3.833	4.501	5.041
9	0.703	0.883	1.100	1.383	1.833	2.262	2.398	2.821	3.250	3.690	4.297	4.781
10	0.700	0.879	1.093	1.372	1.812	2.228	2.359	2.764	3.169	3.581	4.144	4.587
11	0.697	0.876	1.088	1.363	1.796	2.201	2.328	2.718	3.106	3.497	4.025	4.437
12	0.695	0.873	1.083	1.356	1.782	2.179	2.303	2.681	3.055	3.428	3.930	4.318
13	0.694	0.870	1.079	1.350	1.771	2.160	2.282	2.650	3.012	3.372	3.852	4.221
14	0.692	0.868	1.076	1.345	1.761	2.145	2.264	2.624	2.977	3.326	3.787	4.140
15	0.691	0.866	1.074	1.341	1.753	2.131	2.249	2.602	2.947	3.286	3.733	4.073
16	0.690	0.865	1.071	1.337	1.746	2.120	2.235	2.583	2.921	3.252	3.686	4.015
17	0.689	0.863	1.069	1.333	1.740	2.110	2.224	2.567	2.898	3.222	3.646	3.965
18	0.688	0.862	1.067	1.330	1.734	2.101	2.214	2.552	2.878	3.197	3.611	3.922
19	0.688	0.861	1.066	1.328	1.729	2.093	2.205	2.539	2.861	3.174	3.579	3.883
20	0.687	0.860	1.064	1.325	1.725	2.086	2.197	2.528	2.845	3.153	3.552	3.850
21	0.686	0.859	1.063	1.323	1.721	2.080	2.189	2.518	2.831	3.135	3.527	3.819
22	0.686	0.858	1.061	1.321	1.717	2.074	2.183	2.508	2.819	3.119	3.505	3.792
23	0.685	0.858	1.060	1.319	1.714	2.069	2.177	2.500	2.807	3.104	3.485	3.768
24	0.685	0.857	1.059	1.318	1.711	2.064	2.172	2.492	2.797	3.091	3.467	3.745
25	0.684	0.856	1.058	1.316	1.708	2.060	2.167	2.485	2.787	3.078	3.450	3.725
26	0.684	0.856	1.058	1.315	1.706	2.056	2.162	2.479	2.779	3.067	3.435	3.707
27	0.684	0.855	1.057	1.314	1.703	2.052	2.158	2.473	2.771	3.057	3.421	3.690
28	0.683	0.855	1.056	1.313	1.701	2.048	2.154	2.467	2.763	3.047	3.408	3.674
29	0.683	0.854	1.055	1.311	1.699	2.045	2.150	2.462	2.756	3.038	3.396	3.659
30	0.683	0.854	1.055	1.310	1.697	2.042	2.147	2.457	2.750	3.030	3.385	3.646
40	0.681	0.851	1.050	1.303	1.684	2.021	2.123	2.423	2.704	2.971	3.307	3.551
50	0.679	0.849	1.047	1.299	1.676	2.009	2.109	2.403	2.678	2.937	3.261	3.496
60	0.679	0.848	1.045	1.296	1.671	2.000	2.099	2.390	2.660	2.915	3.232	3.460
80	0.678	0.846	1.043	1.292	1.664	1.990	2.088	2.374	2.639	2.887	3.195	3.416
100	0.677	0.845	1.042	1.290	1.660	1.984	2.081	2.364	2.626	2.871	3.174	3.390
1000	0.675	0.842	1.037	1.282	1.646	1.962	2.056	2.330	2.581	2.813	3.098	3.300
z^*	0.674	0.841	1.036	1.282	1.645	1.960	2.054	2.326	2.576	2.807	3.091	3.291
	50%	60%	70%	80%	90%	95%	96%	98%	99%	99.5%	99.8%	99.9%
	Confidence level C											