University of Sri Jayewardenepura
Faculty of Humanities and Social Sciences
Bachelor of Arts Third Year Second Semester Examination - January /Feruary- 2018

Economics

ECON 3260.03 –Econometrics

Time: Three hours (03)
Answer FIVE (05) questions including FIRST QUESTION.
Calculators are permitted.

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1. Briefly interpret the following concepts related to regression analysis
   i. Nominal variable
   ii. Park test
   iii. Consistency
   iv. var $(u) = \sigma_{\mu_i}^2$
   v. Overall significance
   vi. Role of the error term
   vii. Second order tests

(2 marks each)

2. Consider the following model which is to be estimated using Ordinary Least Squares method.

$$Y = \propto + \beta X + u$$

   i. Briefly explain the assumptions of u (4 marks)
   ii. Derive OLS estimator β (slope coefficient) (4 marks)
   iii. Analyse the properties of β (6 marks)

3. Consider the following data

Country	Demand for Personal Computers	Per Capita Income ($)
Argentina	8.2	1141
Australia	60.18	2878
Belgium	31.81	2892
Brazil	7.48	751
Bulgaria	5.19	75
Canada	48.7	3004
China	2.76	498
Colombia	4.93	641
Czech Republic	17.74	1560
Ecuador	3.24	394
Egypt	2.91	394
France	34.71	2764
Germany	48.47	2761
Greece	8.17	1990
Guatemala	1.44	409
Hungary	10.84	1384
India	0.72	288
Indonesia	1.19	321
Italy	23.07	2683
Japan	38.22	2845
Mexico	8.3	898
Netherlands	46.66	2856

i. Estimate the demand function for personal computers and interpret your results (6 marks)

ii. Are the estimated coefficients individually significant ? (State your null hypothesis clearly) (4 marks)

iii. Construct an ANOVA table to check overall significance of the coefficients (4 marks)

4. Consider the following regression results (W= wages; N = number of workers)

Eq1 $W = 7.5 + 0.009N$ $R^2 = 0.90$

Eq 2 $\frac{W}{N} = 0.008 + 7.8(\frac{1}{N})$ $R^2 = 0.99$

i. What is the researcher's assumption in going Eq 1 to Eq 2 ? (3 marks)

ii. Can you choose between models using R^2 ? Explain reasons. (3 marks)

iii. How do you use the following tests to check whether the error variance is constant?

- Spearman rank – correlation test
- Goldfeld and Quandt test
- Gleser test (8 marks)

5. i. Why does serial correlation occur? (4 marks)

ii.Explain informal and two formal methods that can be used to ditect serial correlation. (6 marks)

iii. Explain consequences of Ordinary Least Squares method in the presence of serial correlation. (4 marks)

6. i. Consider the following model.

$Y = \propto + \beta_1 X_1 + \beta_2 X_2 + u$ and $X_1 = f(X_2)$,

Identify the problem and explain the reasons behind it. (6 marks)

ii. Analyse the practical consequences of the problem. (4 marks)

iii. Use your answer in Part (ii) to evaluate the following regression results

$$Y = 1.19 + 0.44X_1 + 0.3X_2$$

SE (0.78) (0.18) (0.08)

$R^2 = .810$ $r_{12} = .56$

Where, Y = Student performance; X_1 = Father's education; X_2 = Father's income

(4 marks)

$$\hat{\beta}_1 = \frac{n \Sigma X_i Y_i - \Sigma X_i \Sigma Y_i}{n \Sigma X_i^2 - (\Sigma X_i)^2}$$

$$\hat{\beta}_0 = \frac{\Sigma X_i^2 \Sigma Y_i - \Sigma X_i \Sigma X_i Y_i}{n \Sigma X_i^2 - (\Sigma X_i)^2}$$

$$Var\ (X) = \frac{\Sigma (X_i - X)^2}{n - 1}$$

$$Var\ (\hat{\beta}_1) = \frac{\sigma^2}{\Sigma x_i^2}$$

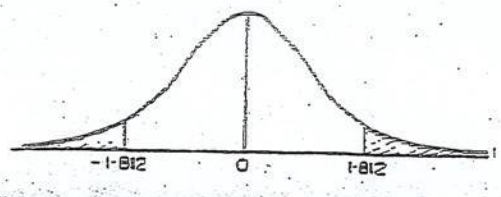
$$Var\ (\hat{\beta}_0) = \frac{\Sigma X_i^2}{n \Sigma x_i^2}\ \sigma^2$$

$$\hat{\beta}_1 = \frac{\Sigma x_i y_i}{\Sigma x_i^2}$$

$$\hat{\beta}_0 = \bar{Y} - \hat{\beta}_1 \bar{X}$$

$$\sigma_u^2 = \frac{\Sigma e^2}{n - k}$$

Table 2. Percentage Points of the t Distribution



Example

For ν = 10 degrees of freedom:

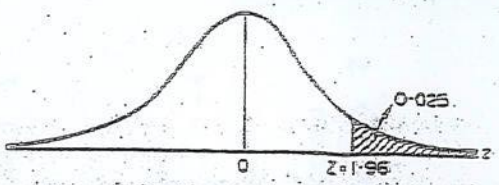
$P(t > 1{\cdot}812) = 0{\cdot}05$

$P(t < -1{\cdot}812) = 0{\cdot}05$

ν \ α	·25	·20	·15	·10	·05	·025	·01	·005	·0005
1	1·000	1·376	1·963	3·078	6·314	12·706	31·821	63·657	636·619
2	·816	1·061	1·386	1·886	2·920	4·303	6·965	9·925	31·598
3	·765	·978	1·250	1·638	2·353	3·182	4·541	5·841	12·941
4	·741	·941	1·190	1·533	2·132	2·776	3·747	4·604	8·610
5	·727	·920	1·156	1·476	2·015	2·571	3·365	4·032	6·859
6	·718	·906	1·134	1·440	1·943	2·447	3·143	3·707	5·959
7	·711	·896	1·119	1·415	1·895	2·365	2·998	3·499	5·405
8	·706	·889	1·108	1·397	1·860	2·306	2·896	3·355	5·041
9	·703	·883	1·100	1·383	1·833	2·262	2·821	3·250	4·781
10	·700	·879	1·093	1·372	1·812	2·228	2·764	3·169	4·587
11	·697	·876	1·088	1·363	1·796	2·201	2·718	3·106	4·437
12	·695	·873	1·083	1·356	1·782	2·179	2·681	3·055	4·318
13	·694	·870	1·079	1·350	1·771	2·160	2·650	3·012	4·221
14	·692	·868	1·076	1·345	1·761	2·145	2·624	2·977	4·140
15	·691	·866	1·074	1·341	1·753	2·131	2·602	2·947	4·073
16	·690	·865	1·071	1·337	1·746	2·120	2·583	2·921	4·015
17	·689	·863	1·069	1·333	1·740	2·110	2·567	2·898	3·965
18	·688	·862	1·067	1·330	1·734	2·101	2·552	2·878	3·922
19	·688	·861	1·066	1·328	1·729	2·093	2·539	2·861	3·883
20	·687	·860	1·064	1·325	1·725	2·086	2·528	2·845	3·850
21	·686	·859	1·063	1·323	1·721	2·080	2·518	2·831	3·819
22	·686	·858	1·061	1·321	1·717	2·074	2·508	2·819	3·792
23	·685	·858	1·060	1·319	1·714	2·069	2·500	2·807	3·767
24	·685	·857	1·059	1·318	1·711	2·064	2·492	2·797	3·745
25	·684	·856	1·058	1·316	1·708	2·060	2·485	2·787	3·725
26	·684	·856	1·058	1·315	1·706	2·056	2·479	2·779	3·707
27	·684	·855	1·057	1·314	1·703	2·052	2·473	2·771	3·690
28	·683	·855	1·056	1·313	1·701	2·048	2·467	2·763	3·674
29	·683	·854	1·055	1·311	1·699	2·045	2·462	2·756	3·659
30	·683	·854	1·055	1·310	1·697	2·042	2·457	2·750	3·646
40	·681	·851	1·050	1·303	1·684	2·021	2·423	2·704	3·551
60	·679	·848	1·046	1·296	1·671	2·000	2·390	2·660	3·460
120	·677	·845	1·041	1·289	1·658	1·980	2·358	2·617	3·373
∞	·674	·842	1·036	1·282	1·645	1·960	2·326	2·576	3·291

Source: This table is abridged from Table III of Fisher & Yates: *Statistical Tables for Biological, Agricultural and Medical Research* published by Oliver & Boyd Ltd., Edinburgh, and by permission of the authors and publishers.

Table 1. Areas under the Normal Curve



Example

$$Z = \frac{X - \mu}{\sigma}$$

$P(Z > 1{\cdot}96) = 0{\cdot}250$

z	·00	·01	·02	·03	·04	·05	·06	·07	·08	·09
0·0	·5000	·4960	·4920	·4880	·4840	·4801	·4761	·4721	·4681	·4641
0·1	·4602	·4562	·4522	·4483	·4443	·4404	·4364	·4325	·4286	·4247
0·2	·4207	·4168	·4129	·4090	·4052	·4013	·3974	·3936	·3897	·3859
0·3	·3821	·3783	·3745	·3707	·3669	·3632	·3594	·3557	·3520	·3483
0·4	·3446	·3409	·3372	·3336	·3300	·3264	·3228	·3192	·3156	·3121
0·5	·3085	·3050	·3015	·2981	·2946	·2912	·2877	·2843	·2810	·2776
0·6	·2743	·2709	·2676	·2643	·2611	·2578	·2546	·2514	·2483	·2451
0·7	·2420	·2389	·2358	·2327	·2296	·2266	·2236	·2206	·2177	·2148
0·8	·2119	·2090	·2061	·2033	·2005	·1977	·1949	·1922	·1894	·1867
0·9	·1841	·1814	·1788	·1762	·1736	·1711	·1685	·1660	·1635	·1611
1·0	·1587	·1562	·1539	·1515	·1492	·1469	·1446	·1423	·1401	·1379
1·1	·1357	·1335	·1314	·1292	·1271	·1251	·1230	·1210	·1190	·1170
1·2	·1151	·1131	·1112	·1093	·1075	·1056	·1038	·1020	·1003	·0985
1·3	·0968	·0951	·0934	·0918	·0901	·0885	·0869	·0853	·0838	·0823
1·4	·0808	·0793	·0778	·0764	·0749	·0735	·0721	·0708	·0694	·0681
1·5	·0668	·0655	·0643	·0630	·0618	·0606	·0594	·0582	·0571	·0559
1·6	·0548	·0537	·0526	·0516	·0505	·0495	·0485	·0475	·0465	·0455
1·7	·0446	·0436	·0427	·0418	·0409	·0401	·0392	·0384	·0375	·0367
1·8	·0359	·0351	·0344	·0336	·0329	·0322	·0314	·0307	·0301	·0294
1·9	·0287	·0281	·0274	·0268	·0262	·0256	·0250	·0244	·0239	·0233
2·0	·0228	·0222	·0217	·0212	·0207	·0202	·0197	·0192	·0188	·0183
2·1	·0179	·0174	·0170	·0166	·0162	·0158	·0154	·0150	·0146	·0143
2·2	·0139	·0136	·0132	·0129	·0125	·0122	·0119	·0116	·0113	·0110
2·3	·0107	·0104	·0102	·0099	·0096	·0094	·0091	·0089	·0087	·0084
2·4	·0082	·0080	·0078	·0075	·0073	·0071	·0069	·0068	·0066	·0064
2·5	·0062	·0060	·0059	·0057	·0055	·0054	·0052	·0051	·0049	·0048
2·6	·0047	·0045	·0044	·0043	·0041	·0040	·0039	·0038	·0037	·0036
2·7	·0035	·0034	·0033	·0032	·0031	·0030	·0029	·0028	·0027	·0026
2·8	·0026	·0025	·0024	·0023	·0023	·0022	·0022	·0021	·0020	·0019
2·9	·0019	·0018	·0018	·0017	·0016	·0016	·0015	·0015	·0014	·0014
3·0	·0013	·0013	·0013	·0012	·0012	·0011	·0011	·0011	·0010	·0010

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$\alpha = 0.05$

r_2 \ r_1	1	2	3	4	5	6	7	8	9	10
1	161.4	199.5	215.7	224.6	230.2	234.0	236.8	238.9	240.5	241.9
2	18.51	19.00	19.16	19.26	19.37	19.33	19.35	19.37	19.38	19.40
3	10.13	9.55	9.28	9.12	9.01	8.94	8.89	8.85	8.81	8.79
4	7.71	6.94	6.59	6.39	6.26	6.16	6.09	6.04	6.00	5.96
5	6.61	5.79	5.41	5.19	5.05	4.95	4.88	4.82	4.77	4.74
6	5.99	5.14	4.76	4.53	4.39	4.28	4.21	4.15	4.10	4.06
7	5.59	4.74	4.35	4.12	3.97	3.87	3.79	3.73	3.68	3.64
8	5.32	4.46	4.07	3.84	3.69	3.58	3.50	3.44	3.39	3.35
9	5.12	4.26	3.86	3.63	3.48	3.37	3.29	3.23	3.18	3.14
10	4.96	4.10	3.71	3.48	3.33	3.22	3.14	3.07	3.02	2.98
11	4.84	3.98	3.59	3.36	3.20	3.09	3.01	2.95	2.90	2.85
12	4.75	3.89	3.49	3.26	3.11	3.00	2.91	2.85	2.80	2.75
13	4.67	3.81	3.41	3.18	3.03	2.92	2.83	2.77	2.71	2.67
14	4.60	3.74	3.34	3.11	2.96	2.85	2.76	2.70	2.65	2.60
15	4.54	3.68	3.29	3.06	2.90	2.79	2.71	2.64	2.59	2.54
16	4.49	3.63	3.24	3.01	2.85	2.74	2.66	2.59	2.54	2.49
17	4.45	3.59	3.20	2.96	2.81	2.70	2.61	2.55	2.49	2.45
18	4.41	3.55	3.16	2.93	2.77	2.66	2.58	2.51	2.46	2.41
19	4.38	3.52	3.13	2.90	2.74	2.63	2.54	2.48	2.42	2.38
20	4.35	3.49	3.10	2.87	2.71	2.60	2.51	2.45	2.39	2.35
21	4.32	3.47	3.07	2.84	2.68	2.57	2.49	2.42	2.37	2.32
22	4.30	3.44	3.05	2.82	2.66	2.55	2.46	2.40	2.34	2.30
23	4.28	3.42	3.03	2.80	2.64	2.53	2.44	2.37	2.32	2.27
24	4.26	3.40	3.01	2.78	2.62	2.51	2.42	2.36	2.30	2.25
25	4.24	3.39	2.99	2.76	2.60	2.49	2.40	2.34	2.28	2.24
26	4.23	3.37	2.98	2.74	2.59	2.47	2.39	2.32	2.27	2.22
27	4.21	3.35	2.96	2.73	2.57	2.46	2.37	2.31	2.25	2.20
28	4.20	3.34	2.95	2.71	2.56	2.45	2.36	2.29	2.24	2.19
29	4.18	3.33	2.93	2.70	2.55	2.43	2.35	2.28	2.22	2.18
30	4.17	3.32	2.92	2.69	2.53	2.42	2.33	2.27	2.21	2.16
40	4.08	3.23	2.84	2.61	2.45	2.34	2.25	2.18	2.12	2.08
60	4.00	3.15	2.76	2.53	2.37	2.25	2.17	2.10	2.04	1.99
120	3.92	3.07	2.68	2.45	2.29	2.17	2.09	2.02	1.96	1.91
∞	3.84	3.00	2.60	2.37	2.21	2.10	2.01	1.94	1.88	1.83

$\alpha = 0.05$

12	15	20	24	30	40	60	120	∞	r_2 \ r_1
243.9	245.9	248.0	249.1	250.2	251.1	252.2	253.3	254.3	1
19.41	19.43	19.45	19.45	19.46	19.47	19.48	19.49	19.50	2
8.74	8.70	8.66	8.64	8.62	8.59	8.57	8.55	8.53	3
5.91	5.86	5.80	5.77	5.75	5.72	5.69	5.66	5.63	4
4.68	4.62	4.56	4.53	4.50	4.46	4.43	4.40	4.36	5
4.00	3.94	3.87	3.84	3.81	3.77	3.74	3.70	3.67	6
3.57	3.51	3.44	3.41	3.38	3.34	3.30	3.27	3.23	7
3.28	3.22	3.15	3.12	3.08	3.04	3.01	2.97	2.93	8
3.07	3.01	2.94	2.90	2.86	2.83	2.79	2.75	2.71	9
2.91	2.85	2.77	2.74	2.70	2.66	2.62	2.58	2.54	10
2.79	2.72	2.65	2.61	2.57	2.53	2.49	2.45	2.40	11
2.69	2.62	2.54	2.51	2.47	2.43	2.38	2.34	2.30	12
2.60	2.53	2.46	2.42	2.38	2.34	2.30	2.25	2.21	13
2.53	2.46	2.39	2.35	2.31	2.27	2.22	2.18	2.13	14
2.48	2.40	2.33	2.29	2.25	2.20	2.16	2.11	2.07	15
2.42	2.35	2.28	2.24	2.19	2.15	2.11	2.06	2.01	16
2.38	2.31	2.23	2.19	2.15	2.10	2.06	2.01	1.96	17
2.34	2.27	2.19	2.15	2.11	2.06	2.02	1.97	1.92	18
2.31	2.23	2.16	2.11	2.07	2.03	1.98	1.93	1.88	19
2.28	2.20	2.12	2.08	2.04	1.99	1.95	1.90	1.84	20
2.25	2.18	2.10	2.05	2.01	1.96	1.92	1.87	1.81	21
2.23	2.15	2.07	2.03	1.98	1.94	1.89	1.84	1.78	22
2.20	2.13	2.05	2.01	1.96	1.91	1.86	1.81	1.76	23
2.18	2.11	2.03	1.98	1.94	1.89	1.84	1.79	1.73	24
2.16	2.09	2.01	1.96	1.92	1.87	1.82	1.77	1.71	25
2.15	2.07	1.99	1.95	1.90	1.85	1.80	1.75	1.69	26
2.13	2.06	1.97	1.93	1.88	1.84	1.79	1.73	1.67	27
2.12	2.04	1.96	1.91	1.87	1.82	1.77	1.71	1.65	28
2.10	2.03	1.94	1.90	1.85	1.81	1.75	1.70	1.64	29
2.09	2.01	1.93	1.89	1.84	1.79	1.74	1.68	1.62	30
2.00	1.92	1.84	1.79	1.74	1.69	1.64	1.58	1.51	40
1.92	1.84	1.75	1.70	1.65	1.59	1.53	1.47	1.39	60
1.83	1.75	1.66	1.61	1.55	1.50	1.43	1.35	1.25	120
1.75	1.67	1.57	1.52	1.46	1.39	1.32	1.22	1.00	∞