84

1st SEM. 2020/2021

UNIVERSITY OF ESWATINI

SPECIAL EXAMINATION PAPER

PROGRAMME: B.Sc. in Agricultural Economics and Agribusiness Management
Year 3

COURSE CODE: AEM307

TITLE OF PAPER: INTRODUCTION TO ECONOMETRICS

TIME ALLOWED: TWO (2) HOURS

INSTRUCTION: 1. ANSWER ALL QUESTIONS
2. EACH QUESTION CARRIES TWENTY FIVE (25) MARKS

DO NOT OPEN THIS PAPER UNTIL PERMISSION HAS BEEN GRANTED BY THE CHIEF INVIGILATOR

QUESTION 1

1. You have been commissioned to investigate the relationship between the birth weights of newborn females and the number of prenatal visits to a physician or midwife that their mothers made during pregnancy. The dependent variable is $bwght_i$, the birth weight of the i-th newborn female, measured in *grams*. The explanatory variable is $pnvisits_i$, the number of prenatal visits of the i-th newborn's mother during pregnancy, measured in number of visits. The model you propose to estimate is given by the population regression equation:

$$bwghti = \beta 0 + \beta_1 pnvisitsi + \mu$$

Your research assistant has used 857 sample observations on bwghti and pnvisitsi to estimate the following OLS sample regression equation, where the figures in parentheses below the coefficient estimates are the *estimated standard errors* of the coefficient estimates:

$$bwght_i = \underset{(65.6909)}{3199.02} + \underset{(5.36347)}{14.1219} pnvisits_i + \hat{u}_i \qquad (i = 1, \ldots, N) \qquad N = 857$$

← (standard errors)

86

i. Interpret the estimated coefficient on pnvisits. **[3 Marks]**

ii. Perform a test of the null hypothesis H0: $\beta 1=0$ against the alternative hypothesis H1: $\beta_1 \neq 0$ at the 1% significance level (i.e., for significance level $\alpha = 0.01$). Show how you calculated the test statistic. State the decision rule you use, and the inference you would draw from the test. What would you conclude from the results of the test? **[8 MARKS]**

iii. Compute the two-sided 95% confidence interval for the intercept coefficient $\beta 0$. Use this two-sided 95% confidence interval for $\beta 0$ to test the hypothesis that the mean birth weight of newborn females whose mothers made no prenatal visits to a physician or midwife equals 3,000 grams. State the null hypothesis H0 and the alternative hypothesis H1. State the decision rule you use, and the inference you would draw from the test. **[7 MARKS]**

iv. Perform a test of the proposition that each additional prenatal visit made by the mother is associated on average with an increase in their newborn females' birth weight of less than 25 grams. Use the 5 percent significance level (i.e., $\alpha = 0.05$). State the null hypothesis H0 and the alternative hypothesis H1. Show how you calculated the test statistic. State the decision rule you use, and the inference you would draw from the test. **[7 MARKS]**

QUESTION 2

i. Why do we need regression analysis? Why not simply use the mean value of the regressand as its best value? [7 MARKS]

ii. Briefly explain the purpose of including an error term in a regression equation. [5 MARKS]

iii. Say true or false or uncertain and explain: Even though the disturbance term in the CLRM is not normally distributed, the OLS estimators are still unbiased. [5 MARKS]

iv. What is the difference between the population and sample regression functions? Is this a distinction without difference? [8 MARKS]

QUESTION 3

Consider the earnings model: $Wagei = \beta 1 + \beta 2Experi + \beta 3Educi + ui$, Where Wage is measured in dollars per hour, $Exper$ is work experience in years, and $Educ$ is the number of years of schooling. The OLS regression results for□N =100 males in a given year is shown in Table 1 below:

Table 1. STATA results from OLS estimation of the earnings model

Source	SS	df	MS		
Model	2057.5037	2	1028.75185	Number of obs =	100
Residual	6059.71269	97	62.4712648	F(2, 97) =	16.47
Total	8117.21639	99	81.9920847	Prob > F =	0.0000
				R-squared =	0.2535
				Adj R-squared =	0.2381
				Root MSE =	7.9039

wage	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
Educ	1.435782	.321546	4.47	0.000	.7976026	2.073962
Exper	.328525	.0658247	4.99	0.000	.1978813	.4591687
_cons	-11.91922	4.750254	-2.51	0.014	-21.34716	-2.491275

i. The researcher performed a correlation test and received the results presented in Table 2 below:

Table 2. Pairwise correlations

	grade	exper	wage
grade	1.0000		
exper	-0.3665	1.0000	
wage	0.2485	0.3163	1.0000

Use the results in Table 2 to discuss the severity of the multicollinearity and the likely impacts on the OLS results in Table 1. [10 MARKS]

ii. Using the results in Table 3 below.

Table 3. STATA results with squared OLS residuals as the dependent variable

Source	SS	df	MS		
Model	498933.661	5	99786.7323	Number of obs =	100
Residual	4759291.93	94	50630.7652	F(5, 94) =	1.97
Total	5258225.59	99	53113.3898	Prob > F =	0.0901
				R-squared =	0.0949
				Adj R-squared =	0.0467
				Root MSE =	225.01

res2	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
Grade	-7.357599	79.35932	-0.09	0.926	-164.9274	150.2122
Exper	-23.67913	16.87954	-1.40	0.164	-57.19386	9.835591
Grade^2	-1.048003	2.223082	-0.47	0.638	-5.461984	3.365978
Exper^2	.270444	.162453	1.66	0.099	-.0521102	.5929982
Exper*Grade	.5788711	.7165818	0.81	0.421	-.8439188	2.001661
_cons	108.2517	582.867	0.19	0.853	-1049.044	1265.548

Perform White's general test for heteroscedasticity. Be sure to carefully set up the null and alternative hypotheses and draw a conclusion. [15 MARKS]

QUESTION 4

The relationship between nominal exchange rate and relative prices. From annual observations from 1980 to 1994, the following regression results were obtained, where Y = exchange rate of the German mark to the U.S. dollar (GM/$) and X = ratio of the U.S. consumer price index to the German consumer price index; that is, X represents the relative prices in the two countries:

$$\hat{Y} = 6.682 - 4.318X_t \qquad r^2 = 0.528$$

Standard errors = (1.22) (1.333)

i. Interpret this regression. How would you interpret r^2? **[10 MARKS]**

ii. Does the negative value of X_t make economic sense? What is the underlying economic theory? **[8 MARKS]**

iii. Suppose we were to redefine X as the ratio of German CPI to the U.S. CPI. Would that change the sign of X? Why? **[7 MARKS]**

Percentage Points of the t-Distribution

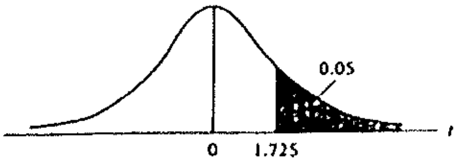
TABLE D.2
Percentage points of the *t* distribution

Example

Pr(*t* > 2.086) = 0.025

Pr(*t* > 1.725) = 0.05 for df = 20

Pr(|*t*| > 1.725) = 0.10



df \ Pr	0.25 0.50	0.10 0.20	0.05 0.10	0.025 0.05	0.01 0.02	0.005 0.010	0.001 0.002
1	1.000	3.078	6.314	12.706	31.821	63.657	318.31
2	0.816	1.886	2.920	4.303	6.965	9.925	22.327
3	0.765	1.638	2.353	3.182	4.541	5.841	10.214
4	0.741	1.533	2.132	2.776	3.747	4.604	7.173
5	0.727	1.476	2.015	2.571	3.365	4.032	5.893
6	0.718	1.440	1.943	2.447	3.143	3.707	5.208
7	0.711	1.415	1.895	2.365	2.998	3.499	4.785
8	0.706	1.397	1.860	2.306	2.896	3.355	4.501
9	0.703	1.383	1.833	2.262	2.821	3.250	4.297
10	0.700	1.372	1.812	2.228	2.764	3.169	4.144
11	0.697	1.363	1.796	2.201	2.718	3.106	4.025
12	0.695	1.356	1.782	2.179	2.681	3.055	3.930
13	0.694	1.350	1.771	2.160	2.650	3.012	3.852
14	0.692	1.345	1.761	2.145	2.624	2.977	3.787
15	0.691	1.341	1.753	2.131	2.602	2.947	3.733
16	0.690	1.337	1.746	2.120	2.583	2.921	3.686
17	0.689	1.333	1.740	2.110	2.567	2.898	3.646
18	0.688	1.330	1.734	2.101	2.552	2.878	3.610
19	0.688	1.328	1.729	2.093	2.539	2.861	3.579
20	0.687	1.325	1.725	2.086	2.528	2.845	3.552
21	0.686	1.323	1.721	2.080	2.518	2.831	3.527
22	0.686	1.321	1.717	2.074	2.508	2.819	3.505
23	0.685	1.319	1.714	2.069	2.500	2.807	3.485
24	0.685	1.318	1.711	2.064	2.492	2.797	3.467
25	0.684	1.316	1.708	2.060	2.485	2.787	3.450
26	0.684	1.315	1.706	2.056	2.479	2.779	3.435
27	0.684	1.314	1.703	2.052	2.473	2.771	3.421
28	0.683	1.313	1.701	2.048	2.467	2.763	3.408
29	0.683	1.311	1.699	2.045	2.462	2.756	3.396
30	0.683	1.310	1.697	2.042	2.457	2.750	3.385
40	0.681	1.303	1.684	2.021	2.423	2.704	3.307
60	0.679	1.296	1.671	2.000	2.390	2.660	3.232
120	0.677	1.289	1.658	1.980	2.358	2.617	3.160
∞	0.674	1.282	1.645	1.960	2.326	2.576	3.090

Selected Upper Percentage Points of the F-Distribution

TABLE D.3
Upper percentage points of the F distribution (*continued*)

df for denominator N_2	Pr	1	2	3	4	5	6	7	8	9	10	11	12
		df for numerator N_1											
	.25	1.40	1.48	1.47	1.45	1.44	1.42	1.41	1.40	1.39	1.39	1.38	1.37
22	.10	2.95	2.56	2.35	2.22	2.13	2.06	2.01	1.97	1.93	1.90	1.88	1.86
	.05	4.30	3.44	3.05	2.82	2.66	2.55	2.46	2.40	2.34	2.30	2.26	2.23
	.01	7.95	5.72	4.82	4.31	3.99	3.76	3.59	3.45	3.35	3.26	3.18	3.12
	.25	1.39	1.47	1.46	1.44	1.43	1.41	1.40	1.39	1.38	1.38	1.37	1.36
24	.10	2.93	2.54	2.33	2.19	2.10	2.04	1.98	1.94	1.91	1.88	1.85	1.83
	.05	4.26	3.40	3.01	2.78	2.62	2.51	2.42	2.36	2.30	2.25	2.21	2.18
	.01	7.82	5.61	4.72	4.22	3.90	3.67	3.50	3.36	3.26	3.17	3.09	3.03
	.25	1.38	1.46	1.45	1.44	1.42	1.41	1.39	1.38	1.37	1.37	1.36	1.35
26	.10	2.91	2.52	2.31	2.17	2.08	2.01	1.96	1.92	1.88	1.86	1.84	1.81
	.05	4.23	3.37	2.98	2.74	2.59	2.47	2.39	2.32	2.27	2.22	2.18	2.15
	.01	7.72	5.53	4.64	4.14	3.82	3.59	3.42	3.29	3.18	3.09	3.02	2.96
	.25	1.38	1.46	1.45	1.43	1.41	1.40	1.39	1.38	1.37	1.36	1.35	1.34
28	.10	2.89	2.50	2.29	2.16	2.06	2.00	1.94	1.90	1.87	1.84	1.81	1.79
	.05	4.20	3.34	2.95	2.71	2.56	2.45	2.36	2.29	2.24	2.19	2.15	2.12
	.01	7.64	5.45	4.57	4.07	3.75	3.53	3.36	3.23	3.12	3.03	2.96	2.90
	.25	1.38	1.45	1.44	1.42	1.41	1.39	1.38	1.37	1.36	1.35	1.35	1.34
30	.10	2.88	2.49	2.28	2.14	2.05	1.98	1.93	1.88	1.85	1.82	1.79	1.77
	.05	4.17	3.32	2.92	2.69	2.53	2.42	2.33	2.27	2.21	2.16	2.13	2.09
	.01	7.56	5.39	4.51	4.02	3.70	3.47	3.30	3.17	3.07	2.98	2.91	2.84
	.25	1.36	1.44	1.42	1.40	1.39	1.37	1.36	1.35	1.34	1.33	1.32	1.31
40	.10	2.84	2.44	2.23	2.09	2.00	1.93	1.87	1.83	1.79	1.76	1.73	1.71
	.05	4.08	3.23	2.84	2.61	2.45	2.34	2.25	2.18	2.12	2.08	2.04	2.00
	.01	7.31	5.18	4.31	3.83	3.51	3.29	3.12	2.99	2.89	2.80	2.73	2.66
	.25	1.35	1.42	1.41	1.38	1.37	1.35	1.33	1.32	1.31	1.30	1.29	1.29
60	.10	2.79	2.39	2.18	2.04	1.95	1.87	1.82	1.77	1.74	1.71	1.68	1.66
	.05	4.00	3.15	2.76	2.53	2.37	2.25	2.17	2.10	2.04	1.99	1.95	1.92
	.01	7.08	4.98	4.13	3.65	3.34	3.12	2.95	2.82	2.72	2.63	2.56	2.50
	.25	1.34	1.40	1.39	1.37	1.35	1.33	1.31	1.30	1.29	1.28	1.27	1.26
120	.10	2.75	2.35	2.13	1.99	1.90	1.82	1.77	1.72	1.68	1.65	1.62	1.60
	.05	3.92	3.07	2.68	2.45	2.29	2.17	2.09	2.02	1.96	1.91	1.87	1.83
	.01	6.85	4.79	3.95	3.48	3.17	2.96	2.79	2.66	2.56	2.47	2.40	2.34
	.25	1.33	1.39	1.38	1.36	1.34	1.32	1.31	1.29	1.28	1.27	1.26	1.25
200	.10	2.73	2.33	2.11	1.97	1.88	1.80	1.75	1.70	1.66	1.63	1.60	1.57
	.05	3.89	3.04	2.65	2.42	2.26	2.14	2.06	1.98	1.93	1.88	1.84	1.80
	.01	6.76	4.71	3.88	3.41	3.11	2.89	2.73	2.60	2.50	2.41	2.34	2.27
	.25	1.32	1.39	1.37	1.35	1.33	1.31	1.29	1.28	1.27	1.25	1.24	1.24
∞	.10	2.71	2.30	2.08	1.94	1.85	1.77	1.72	1.67	1.63	1.60	1.57	1.55
	.05	3.84	3.00	2.60	2.37	2.21	2.10	2.01	1.94	1.88	1.83	1.79	1.75
	.01	6.63	4.61	3.78	3.32	3.02	2.80	2.64	2.51	2.41	2.32	2.25	2.18

Source: Damodar N. Gujarati, *Basic Econometrics*, Third Edition. New York: McGraw-Hill, 1995, p. 814.

TABLE G.4

Critical Values of the Chi-Square Distribution

Degrees of Freedom	Significance Level .10	.05	.01
1	2.71	3.84	6.63
2	4.61	5.99	9.21
3	6.25	7.81	11.34
4	7.78	9.49	13.28
5	9.24	11.07	15.09
6	10.64	12.59	16.81
7	12.02	14.07	18.48
8	13.36	15.51	20.09
9	14.68	16.92	21.67
10	15.99	18.31	23.21
11	17.28	19.68	24.72
12	18.55	21.03	26.22
13	19.81	22.36	27.69
14	21.06	23.68	29.14
15	22.31	25.00	30.58
16	23.54	26.30	32.00
17	24.77	27.59	33.41
18	25.99	28.87	34.81
19	27.20	30.14	36.19
20	28.41	31.41	37.57
21	29.62	32.67	38.93
22	30.81	33.92	40.29
23	32.01	35.17	41.64
24	33.20	36.42	42.98
25	34.38	37.65	44.31
26	35.56	38.89	45.64
27	36.74	40.11	46.96
28	37.92	41.34	48.28
29	39.09	42.56	49.59
30	40.26	43.77	50.89

Example: The 5% critical value with $df = 8$ is 15.51.
Source: This table was generated using the Stata® function invchi.