ECON 4706 A Fall 2018 Simon Power

Sample Final Exam

NOTE: This sample final exam is based on a slightly different version of the course, using a different textbook and a different software package. So, it is just meant to be a general indication of the kind of final exam which you might expect. I will talk more about the final exam for this course closer to the time.

PART A

1. Consider the following CNLRM:

 i = 1, 2, …, 5

and the following data:

X Y

4 8

6 14

2 6

10 18

18 34

i) Compute the ordinary least squares estimates of the  and  parameters.

ii) Compute .

iii) Compute .

iv) Compute adjusted-.

v) Construct a two-sided 95% confidence interval for .

vi) Test the null hypothesis  against the alternative hypothesis  at the 5% significance level.

2. Consider the intercept-only CNLRM:

 i = 1, 2, …, n

where ~ N.

i) Derive the least squares estimator of .

ii) Prove that this least squares estimator is (a) linear and (b) unbiased.

iii) Derive the variance of this least squares estimator.

iv) Write down the appropriate unbiased estimator of  that would be used with this model for regular econometric inference.

v) Derive the maximum likelihood estimators of  and . (NOTE: You do NOT need to check the second-order condition.)

3. Discuss the Chow Test and the MWD Test. Be sure to include the following elements in your discussion:

i) Purpose

ii) Detailed instructions as to practical implementation

iii) Interpretation of results

iv) Implications of results for further econometric investigation

(NOTE: You MAY wish to include a SHAZAM sub-program as a part of your answer to part ii).)

PART B

4. One day you happen to overhear part of a conversation between two graduate students in the Loeb Cafeteria. The first student claims that “Multicollinearity is no big deal. I really don’t know what all the fuss is about. After all, you can always just drop a variable or two, find some more data, or, if absolutely necessary, use ridge regression.” The second student is speechless. What do you think? Explain.

5. What do we mean by the term “autocorrelation”? Describe the impact of autocorrelation on estimation and inference within the context of the CNLRM. How can we detect the presence of autocorrelation? Should anything be done about autocorrelation if it is detected? If so, what should be done? Be specific. If not, why not?

6. Imagine that you have just been hired by Human Resources and Social Development Canada (HRSDC) as a junior economist. On your first day at work, your boss takes you out for lunch and, over an excellent bowl of home-made butternut squash soup, explains that the newly-appointed Minister will shortly be attending an important policy conference with her provincial counterparts in order to discuss the determinants of wages, with a view to developing policies to improve productivity. Apparently, the Minister has recently come across an interesting article in the newspaper extolling the benefits of econometrics for policy analysis. As a result, she has asked your boss to prepare a briefing note for her on the basis of some SHAZAM output that has been discovered in her office and which is believed to be relevant:

|\_\*

|\_\* WAGE = wage rate per month (dollars)

|\_\* EDUC = years of education beyond eighth grade when hired

|\_\* EXPER = number of years at the company

|\_\*

|\_sample 1 49

|\_read wage educ exper

3 VARIABLES AND 49 OBSERVATIONS STARTING AT OBS 1

|\_\*

|\_genr lnwage = log(wage)

|\_genr educ2 = educ\*educ

|\_genr exper2 = exper\*exper

|\_genr educexp = educ\*exper

|\_ols lnwage educ exper / resid=res predict=yhat auxrsqr

REQUIRED MEMORY IS PAR= 9 CURRENT PAR= 4000

OLS ESTIMATION

49 OBSERVATIONS DEPENDENT VARIABLE= LNWAGE

...NOTE..SAMPLE RANGE SET TO: 1, 49

R-SQUARE OF EDUC ON OTHER INDEPENDENT VARIABLES = 0.0750

R-SQUARE OF EXPER ON OTHER INDEPENDENT VARIABLES = 0.0750

R-SQUARE OF CONSTANT ON OTHER INDEPENDENT VARIABLES = 0.0000

R-SQUARE = 0.3275 R-SQUARE ADJUSTED = 0.2982

VARIANCE OF THE ESTIMATE-SIGMA\*\*2 = 0.68636E-01

STANDARD ERROR OF THE ESTIMATE-SIGMA = 0.26199

SUM OF SQUARED ERRORS-SSE= 3.1573

MEAN OF DEPENDENT VARIABLE = 7.4550

LOG OF THE LIKELIHOOD FUNCTION = -2.34628

MODEL SELECTION TESTS - SEE JUDGE ET AL. (1985,P.242)

AKAIKE (1969) FINAL PREDICTION ERROR - FPE = 0.72839E-01

(FPE IS ALSO KNOWN AS AMEMIYA PREDICTION CRITERION - PC)

AKAIKE (1973) INFORMATION CRITERION - LOG AIC = -2.6197

SCHWARZ (1978) CRITERION - LOG SC = -2.5038

MODEL SELECTION TESTS - SEE RAMANATHAN (1998,P.165)

CRAVEN-WAHBA (1979)

GENERALIZED CROSS VALIDATION - GCV = 0.73113E-01

HANNAN AND QUINN (1979) CRITERION = 0.76099E-01

RICE (1984) CRITERION = 0.73425E-01

SHIBATA (1981) CRITERION = 0.72324E-01

SCHWARZ (1978) CRITERION - SC = 0.81771E-01

AKAIKE (1974) INFORMATION CRITERION - AIC = 0.72828E-01

ANALYSIS OF VARIANCE - FROM MEAN

SS DF MS F

REGRESSION 1.5374 2. 0.76872 11.200

ERROR 3.1573 46. 0.68636E-01 P-VALUE

TOTAL 4.6947 48. 0.97807E-01 0.000

ANALYSIS OF VARIANCE - FROM ZERO

SS DF MS F

REGRESSION 2724.8 3. 908.26 13232.895

ERROR 3.1573 46. 0.68636E-01 P-VALUE

TOTAL 2727.9 49. 55.672 0.000

VARIABLE ESTIMATED STANDARD T-RATIO PARTIAL STANDARDIZED ELASTICITY

NAME COEFFICIENT ERROR 46 DF P-VALUE CORR. COEFFICIENT AT MEANS

EDUC 0.64505E-01 0.1656E-01 3.895 0.000 0.498 0.4897 0.0539

EXPER 0.22954E-01 0.6285E-02 3.652 0.001 0.474 0.4592 0.0272

CONSTANT 6.8506 0.1351 50.72 0.000 0.991 0.0000 0.9189

DURBIN-WATSON = 1.5940 VON NEUMANN RATIO = 1.6272 RHO = 0.19929

RESIDUAL SUM = -0.11585E-12 RESIDUAL VARIANCE = 0.68636E-01

SUM OF ABSOLUTE ERRORS= 10.259

R-SQUARE BETWEEN OBSERVED AND PREDICTED = 0.3275

RUNS TEST: 21 RUNS, 22 POS, 0 ZERO, 27 NEG NORMAL STATISTIC = -1.2388

COEFFICIENT OF SKEWNESS = 0.4167 WITH STANDARD DEVIATION OF 0.3398

COEFFICIENT OF EXCESS KURTOSIS = -0.1956 WITH STANDARD DEVIATION OF 0.6681

JARQUE-BERA NORMALITY TEST- CHI-SQUARE(2 DF)= 1.5111 P-VALUE= 0.470

GOODNESS OF FIT TEST FOR NORMALITY OF RESIDUALS - 6 GROUPS

OBSERVED 0.0 9.0 18.0 15.0 5.0 2.0

EXPECTED 1.1 6.7 16.7 16.7 6.7 1.1

CHI-SQUARE = 3.3261 WITH 1 DEGREES OF FREEDOM, P-VALUE= 0.068

|\_genr ressq = res\*res

|\_genr yhat2 = yhat\*yhat

|\_gen1 sigma2 = $sse/$n

..NOTE..CURRENT VALUE OF $SSE = 3.1573

..NOTE..CURRENT VALUE OF $N = 49.000

|\_genr p = ressq/sigma2

|\_ols ressq educ exper educ2 exper2 educexp

REQUIRED MEMORY IS PAR= 11 CURRENT PAR= 4000

OLS ESTIMATION

49 OBSERVATIONS DEPENDENT VARIABLE= RESSQ

...NOTE..SAMPLE RANGE SET TO: 1, 49

R-SQUARE = 0.3557 R-SQUARE ADJUSTED = 0.2807

VARIANCE OF THE ESTIMATE-SIGMA\*\*2 = 0.51939E-02

STANDARD ERROR OF THE ESTIMATE-SIGMA = 0.72069E-01

SUM OF SQUARED ERRORS-SSE= 0.22334

MEAN OF DEPENDENT VARIABLE = 0.64434E-01

LOG OF THE LIKELIHOOD FUNCTION = 62.5488

MODEL SELECTION TESTS - SEE JUDGE ET AL. (1985,P.242)

AKAIKE (1969) FINAL PREDICTION ERROR - FPE = 0.58299E-02

(FPE IS ALSO KNOWN AS AMEMIYA PREDICTION CRITERION - PC)

AKAIKE (1973) INFORMATION CRITERION - LOG AIC = -5.1460

SCHWARZ (1978) CRITERION - LOG SC = -4.9143

MODEL SELECTION TESTS - SEE RAMANATHAN (1998,P.165)

CRAVEN-WAHBA (1979)

GENERALIZED CROSS VALIDATION - GCV = 0.59186E-02

HANNAN AND QUINN (1979) CRITERION = 0.63576E-02

RICE (1984) CRITERION = 0.60362E-02

SHIBATA (1981) CRITERION = 0.56742E-02

SCHWARZ (1978) CRITERION - SC = 0.73406E-02

AKAIKE (1974) INFORMATION CRITERION - AIC = 0.58227E-02

ANALYSIS OF VARIANCE - FROM MEAN

SS DF MS F

REGRESSION 0.12328 5. 0.24655E-01 4.747

ERROR 0.22334 43. 0.51939E-02 P-VALUE

TOTAL 0.34661 48. 0.72211E-02 0.002

ANALYSIS OF VARIANCE - FROM ZERO

SS DF MS F

REGRESSION 0.32671 6. 0.54452E-01 10.484

ERROR 0.22334 43. 0.51939E-02 P-VALUE

TOTAL 0.55005 49. 0.11226E-01 0.000

VARIABLE ESTIMATED STANDARD T-RATIO PARTIAL STANDARDIZED ELASTICITY

NAME COEFFICIENT ERROR 43 DF P-VALUE CORR. COEFFICIENT AT MEANS

EDUC -0.34957E-01 0.2853E-01 -1.225 0.227-0.184 -0.9766 -3.3770

EXPER -0.52870E-02 0.8137E-02 -0.6497 0.519-0.099 -0.3892 -0.7251

EDUC2 0.39357E-02 0.1843E-02 2.136 0.038 0.310 1.5194 2.7038

EXPER2 0.36543E-03 0.3057E-03 1.196 0.238 0.179 0.5750 0.6603

EDUCEXP -0.35201E-03 0.8295E-03 -0.4244 0.673-0.065 -0.1734 -0.2787

CONSTANT 0.12994 0.1089 1.193 0.239 0.179 0.0000 2.0167

|\_ols ressq yhat2

REQUIRED MEMORY IS PAR= 10 CURRENT PAR= 4000

OLS ESTIMATION

49 OBSERVATIONS DEPENDENT VARIABLE= RESSQ

...NOTE..SAMPLE RANGE SET TO: 1, 49

R-SQUARE = 0.0909 R-SQUARE ADJUSTED = 0.0716

VARIANCE OF THE ESTIMATE-SIGMA\*\*2 = 0.67041E-02

STANDARD ERROR OF THE ESTIMATE-SIGMA = 0.81879E-01

SUM OF SQUARED ERRORS-SSE= 0.31509

MEAN OF DEPENDENT VARIABLE = 0.64434E-01

LOG OF THE LIKELIHOOD FUNCTION = 54.1163

MODEL SELECTION TESTS - SEE JUDGE ET AL. (1985,P.242)

AKAIKE (1969) FINAL PREDICTION ERROR - FPE = 0.69778E-02

(FPE IS ALSO KNOWN AS AMEMIYA PREDICTION CRITERION - PC)

AKAIKE (1973) INFORMATION CRITERION - LOG AIC = -4.9651

SCHWARZ (1978) CRITERION - LOG SC = -4.8879

MODEL SELECTION TESTS - SEE RAMANATHAN (1998,P.165)

CRAVEN-WAHBA (1979)

GENERALIZED CROSS VALIDATION - GCV = 0.69894E-02

HANNAN AND QUINN (1979) CRITERION = 0.71849E-02

RICE (1984) CRITERION = 0.70021E-02

SHIBATA (1981) CRITERION = 0.69554E-02

SCHWARZ (1978) CRITERION - SC = 0.75376E-02

AKAIKE (1974) INFORMATION CRITERION - AIC = 0.69774E-02

ANALYSIS OF VARIANCE - FROM MEAN

SS DF MS F

REGRESSION 0.31521E-01 1. 0.31521E-01 4.702

ERROR 0.31509 47. 0.67041E-02 P-VALUE

TOTAL 0.34661 48. 0.72211E-02 0.035

ANALYSIS OF VARIANCE - FROM ZERO

SS DF MS F

REGRESSION 0.23496 2. 0.11748 17.523

ERROR 0.31509 47. 0.67041E-02 P-VALUE

TOTAL 0.55005 49. 0.11226E-01 0.000

VARIABLE ESTIMATED STANDARD T-RATIO PARTIAL STANDARDIZED ELASTICITY

NAME COEFFICIENT ERROR 47 DF P-VALUE CORR. COEFFICIENT AT MEANS

YHAT2 0.95550E-02 0.4407E-02 2.168 0.035 0.302 0.3016 8.2461

CONSTANT -0.46690 0.2453 -1.903 0.063-0.267 0.0000 -7.2461

|\_ols p educ

REQUIRED MEMORY IS PAR= 10 CURRENT PAR= 4000

OLS ESTIMATION

49 OBSERVATIONS DEPENDENT VARIABLE= P

...NOTE..SAMPLE RANGE SET TO: 1, 49

R-SQUARE = 0.2359 R-SQUARE ADJUSTED = 0.2196

VARIANCE OF THE ESTIMATE-SIGMA\*\*2 = 1.3574

STANDARD ERROR OF THE ESTIMATE-SIGMA = 1.1651

SUM OF SQUARED ERRORS-SSE= 63.796

MEAN OF DEPENDENT VARIABLE = 1.0000

LOG OF THE LIKELIHOOD FUNCTION = -75.9926

MODEL SELECTION TESTS - SEE JUDGE ET AL. (1985,P.242)

AKAIKE (1969) FINAL PREDICTION ERROR - FPE = 1.4128

(FPE IS ALSO KNOWN AS AMEMIYA PREDICTION CRITERION - PC)

AKAIKE (1973) INFORMATION CRITERION - LOG AIC = 0.34550

SCHWARZ (1978) CRITERION - LOG SC = 0.42271

MODEL SELECTION TESTS - SEE RAMANATHAN (1998,P.165)

CRAVEN-WAHBA (1979)

GENERALIZED CROSS VALIDATION - GCV = 1.4151

HANNAN AND QUINN (1979) CRITERION = 1.4547

RICE (1984) CRITERION = 1.4177

SHIBATA (1981) CRITERION = 1.4082

SCHWARZ (1978) CRITERION - SC = 1.5261

AKAIKE (1974) INFORMATION CRITERION - AIC = 1.4127

ANALYSIS OF VARIANCE - FROM MEAN

SS DF MS F

REGRESSION 19.691 1. 19.691 14.507

ERROR 63.796 47. 1.3574 P-VALUE

TOTAL 83.486 48. 1.7393 0.000

ANALYSIS OF VARIANCE - FROM ZERO

SS DF MS F

REGRESSION 68.691 2. 34.345 25.303

ERROR 63.796 47. 1.3574 P-VALUE

TOTAL 132.49 49. 2.7038 0.000

VARIABLE ESTIMATED STANDARD T-RATIO PARTIAL STANDARDIZED ELASTICITY

NAME COEFFICIENT ERROR 47 DF P-VALUE CORR. COEFFICIENT AT MEANS

EDUC 0.26979 0.7083E-01 3.809 0.000 0.486 0.4856 1.6793

CONSTANT -0.67929 0.4713 -1.441 0.156-0.206 0.0000 -0.6793

|\_print $ssr

$SSR 19.69057

..COMPLETED..

Your boss then explains, rather sheepishly, that what he knows about econometrics could be written in large letters on the back of a postage stamp and it soon becomes apparent that you are going to be delegated to prepare the briefing note. Moreover, as he rushes out of the restaurant, leaving you to pay the check, he pauses to observe that he would like a good first draft of the briefing note on his desk by the end of the day.

Use your knowledge of econometrics to analyse the SHAZAM printout and then prepare a suitable briefing note for the Minister.

In writing the briefing note, be sure to take into consideration:

i) the overall quality and reliability of the estimated model

ii) any specific problems that can be identified with the estimated model

iii) the interpretation of the model

iv) how the current specification might be improved

Keep in mind that a good briefing note should always aim to represent a model of clarity and exposition.