# UNIVERSITY OF ESWATINI

## FIRST SEMESTER SUPPLEMENTARY EXAMINATION PAPER, JANUARY 2020

## FACULTY OF SOCIAL SCIENCES

## DEPARTMENT OF ECONOMICS

## COURSE CODE: ECO 419

## TITLE OF PAPER: ECONOMETRIC METHODS I

## TIME ALLOWED: 2 HOURS

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**Instructions**

1. This paper consists of Section (A) and (B).
2. Section A is compulsory.
3. Answer any two questions from Section B.

**Special Requirements**

Scientific calculator

*Candidates may complete the front cover of their answer book when instructed by the Chief Invigilator and sign their examination attendance cards but must **NOT** write anything else until the start of the examination period is announced.*

*No electronic devices capable of storing and retrieving text, including electronic dictionaries and any form of foreign material may be used while in the examination room.*

**DO NOT turn examination paper over until instructed to do so.**

## SECTION A

**QUESTION ONE: COMPULSORY** **[40 Marks]**

**PART I: Multiple Choice Questions** **(1 Mark Each= 10Marks)**

1. If OLS is used in the presence of autocorrelation, which of the following will be likely consequences?

(i) Coefficient estimates may be misleading

(ii) Hypothesis tests could reach the wrong conclusions

(iii) Forecasts made from the model could be biased

(iv) Standard errors may inappropriate

a) (ii) and (iv) only

b) (i) and (iii) only

c) (i), (ii), and (iii) only

d) (i), (ii), (iii), and (iv)

2. Suppose that the Durbin Watson test is applied to a regression containing two explanatory variables plus a constant with 50 data points. The test statistic takes a value of 1.53. What is the appropriate conclusion?

(a) Residuals appear to be positively autocorrelated

(b) Residuals appear to be negatively autocorrelated

(c) Residuals appear not to be autocorrelated

(d) The test result is inconclusive

3. Which of the following are plausible approaches to dealing with residual autocorrelation?

(i) Take logarithms of each of the variables

(ii) Add lagged values of the variables to the regression equation

(iii) Use dummy variables to remove outlying observations

(iv) Try a model in first differenced form rather than in levels.

(a) (ii) and (iv) only

(b) (i) and (iii) only

(c) (i), (ii), and (iii) only

(d) (i), (ii), (iii), and (iv)

4. Which of the following could result in autocorrelated residuals?

(i) Slowness of response of the dependent variable to changes in the values of the independent variables

(ii) Over-reactions of the dependent variable to changes in the independent variables

(iii) Omission of relevant explanatory variables that are autocorrelated

(iv) Outliers in the data

(a) (ii) and (iv) only

(b) (i) and (iii) only

(c) (i), (ii), and (iii) only

(d) (i), (ii), (iii), and (iv)

5. In the context of simultaneous equations modelling, which of the following statements is true concerning an endogenous variable?

(a) The values of endogenous variables are determined outside the system

(b) There can be fewer equations in the system than there are endogenous variables

(c) Reduced form equations will not contain any endogenous variables on the RHS

(d) Reduced form equations will contain only endogenous variables on the RHS

6. If OLS is applied separately to each equation that is part of a simultaneous system, the resulting estimates will be

(a) Unbiased and consistent

(b) Biased but consistent

(c) Biased and inconsistent

(d) It is impossible to apply OLS to equations that are part of a simultaneous system

7. Consider the following system of equations (with time subscripts suppressed and using standard notation). According to the order condition, the first equation is

(a) Unidentified

(b) Just identified

(c) Over-identified

(d) It is not possible to tell whether the equation is identified since the question does not give the reduced form models

8. The order condition is-:

(a)A necessary and sufficient condition for identification

(b)A necessary but not sufficient condition for identification

(c)A sufficient but not necessary condition for identification

(d)A condition that is neither necessary nor sufficient for identification

9. For a stationary autoregressive process, shocks will

(a)Eventually die away

(b)Persist indefinitely

(c)Grow exponentially

(d)Never occur

10. Consider the following model for $y_t$:

$y_t = \mu + \lambda t + u_t$

Which one of the following most accurately describes the process for $y_t$?

(a) A unit root process

(b) A stationary process

(c) A deterministic trend process

(d) A random walk with drift

**PART II: Short Answers**

1.(a) Assume we have the following model:

$$y_t = \alpha + \beta x_t + u_t$$

Where the explanatory variable $x_t$ is strictly exogenous, and the residual $u_t$ is serially correlated.

(i) Why is serial correlation often present in time series data? [5]

(ii) State the null hypothesis for testing serial correlation in (i) above. [2]

(b) An ECO 419 student made 2 specifications of a phenomenon under study-:

$$Y_t = \beta_0 + \beta_1 X_{1t}^2 + \varepsilon_t \quad (1.1)$$

$$Y_t = \beta_0 + \beta_1 X_{1t}^2 + \beta_2 X_{2t} + \varepsilon_t \quad (1.2)$$

The student collects and estimates the functions thereby obtaining the following results

$Y_t = 0.395 + 0.084X_{1t}^2$ (1)
SE= (0.125) (0.027)
$R^2$= 0.49
DW= 0.92
n= 18

$Y_t = 0.407 + 0.080X_{1t}^2 - 0.124X_{2t}$ (2)
$R^2$= 0.65
DW= 2.10
n= 18

(i) Check (at 5%) whether any of the models has autocorrelation. [12]

(ii) If autocorrelation exists in (i) above, what is its cause? [5]

(c) State the Order Condition for identification. [6]

## SECTION B

**Answer any Two (2) Questions** **(20 Marks Each)**

**Question Two** **(20 Marks)**

2. (a) Given the following three-equations system-:

$$Y_{1t} = a_0 + a_1X_t + u_{1t}$$
$$Y_{2t} = b_0 + b_1Y_{1t} + b_2X_t + u_{2t}$$
$$Y_{3t} = c_0 + c_1Y_{2t} + c_2X_t + u_{3t}$$

(i) Explain why this is not a simultaneous-equations model. [8]

(ii) Could OLS be used to estimate each equation of this system? Why? [6]

(b) Given the following demand-supply model, determine if the demand and/or supply is exactly identified, overidentified, or underidentified. [6]

Demand: $Q_t = a_0 + a_1 P_t + u_{1t}$ $a_1 < 0$

Supply: $Q_t = b_0 + b_1 P_t + u_{2t}$ $b_1 > 0$

**Question Three** **(20 Marks)**

3. (a) What is autocorrelation? [5]

(b) With the aid of diagram(s), explain the difference between negative and positive autocorrelation. [8]

(c) Why is autocorrelation a problem? [7]

**Question Four** **(20 Marks)**

4. (a) What are the problems associated with nonstationary time series? [6]

(b) Give an example of a nonstationary time series. [5]

(c) Assess whether the statements in (i)-(iii) are ***true*** or ***false***, and explain why.

(i) One of the assumptions that needs to hold for the process $\{yt\}$ to be weakly stationary is that $cov(yt, yt-k)$ is constant over time and depends on both $t$ and $k$. [2]

(ii) A white noise process is a non-stationary process for which all autocorrelations are equal to zero. [2]

(iii) If a series is non-stationary, it is safe to use OLS as the estimation method. [2]

(d) Describe the concept of cointegration. [3]

**TABLE D.5A**
DURBIN–WATSON $d$ STATISTIC: SIGNIFICANCE POINTS OF $d_L$ AND $d_U$ AT 0.05 LEVEL OF SIGNIFICANCE

| | $k'=1$ | | $k'=2$ | | $k'=3$ | | $k'=4$ | | $k'=5$ | | $k'=6$ | | $k'=7$ | | $k'=8$ | | $k'=9$ | | $k'=10$ | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $n$ | $d_L$ | $d_U$ | $d_L$ | $d_U$ | $d_L$ | $d_U$ | $d_L$ | $d_U$ | $d_L$ | $d_U$ | $d_L$ | $d_U$ | $d_L$ | $d_U$ | $d_L$ | $d_U$ | $d_L$ | $d_U$ | $d_L$ | $d_U$ |
| 6 | 0.610 | 1.400 | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| 7 | 0.700 | 1.356 | 0.467 | 1.896 | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| 8 | 0.763 | 1.332 | 0.559 | 1.777 | 0.368 | 2.287 | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| 9 | 0.824 | 1.320 | 0.629 | 1.699 | 0.455 | 2.128 | 0.296 | 2.588 | — | — | — | — | — | — | — | — | — | — | — | — |
| 10 | 0.879 | 1.320 | 0.697 | 1.641 | 0.525 | 2.016 | 0.376 | 2.414 | 0.243 | 2.822 | — | — | — | — | — | — | — | — | — | — |
| 11 | 0.927 | 1.324 | 0.658 | 1.604 | 0.595 | 1.928 | 0.444 | 2.283 | 0.316 | 2.645 | 0.203 | 3.005 | — | — | — | — | — | — | — | — |
| 12 | 0.971 | 1.331 | 0.812 | 1.579 | 0.658 | 1.864 | 0.512 | 2.177 | 0.379 | 2.506 | 0.268 | 2.832 | 0.171 | 3.149 | — | — | — | — | — | — |
| 13 | 1.010 | 1.340 | 0.861 | 1.562 | 0.715 | 1.816 | 0.574 | 2.094 | 0.445 | 2.390 | 0.328 | 2.692 | 0.230 | 2.985 | 0.147 | 3.266 | — | — | — | — |
| 14 | 1.045 | 1.350 | 0.905 | 1.551 | 0.767 | 1.779 | 0.632 | 2.030 | 0.505 | 2.296 | 0.389 | 2.572 | 0.286 | 2.848 | 0.200 | 3.111 | 0.127 | 3.360 | — | — |
| 15 | 1.077 | 1.361 | 0.946 | 1.543 | 0.814 | 1.750 | 0.685 | 1.977 | 0.562 | 2.220 | 0.447 | 2.472 | 0.343 | 2.727 | 0.251 | 2.979 | 0.175 | 3.216 | 0.111 | 3.438 |
| 16 | 1.106 | 1.371 | 0.982 | 1.539 | 0.857 | 1.728 | 0.734 | 1.935 | 0.615 | 2.157 | 0.502 | 2.388 | 0.398 | 2.624 | 0.304 | 2.860 | 0.222 | 3.090 | 0.155 | 3.304 |
| 17 | 1.133 | 1.381 | 1.015 | 1.536 | 0.897 | 1.710 | 0.779 | 1.900 | 0.664 | 2.104 | 0.554 | 2.318 | 0.451 | 2.537 | 0.356 | 2.757 | 0.272 | 2.975 | 0.198 | 3.184 |
| 18 | 1.158 | 1.391 | 1.046 | 1.535 | 0.933 | 1.696 | 0.820 | 1.872 | 0.710 | 2.060 | 0.603 | 2.257 | 0.502 | 2.461 | 0.407 | 2.667 | 0.321 | 2.873 | 0.244 | 3.073 |
| 19 | 1.180 | 1.401 | 1.074 | 1.536 | 0.967 | 1.685 | 0.859 | 1.848 | 0.752 | 2.023 | 0.649 | 2.206 | 0.549 | 2.396 | 0.456 | 2.589 | 0.369 | 2.783 | 0.290 | 2.974 |
| 20 | 1.201 | 1.411 | 1.100 | 1.537 | 0.998 | 1.676 | 0.894 | 1.828 | 0.792 | 1.991 | 0.692 | 2.162 | 0.595 | 2.339 | 0.502 | 2.521 | 0.416 | 2.704 | 0.336 | 2.885 |
| 21 | 1.221 | 1.420 | 1.125 | 1.538 | 1.026 | 1.669 | 0.927 | 1.812 | 0.829 | 1.964 | 0.732 | 2.124 | 0.637 | 2.290 | 0.547 | 2.460 | 0.461 | 2.633 | 0.380 | 2.806 |
| 22 | 1.239 | 1.429 | 1.147 | 1.541 | 1.053 | 1.664 | 0.958 | 1.797 | 0.863 | 1.940 | 0.769 | 2.090 | 0.677 | 2.246 | 0.588 | 2.407 | 0.504 | 2.571 | 0.424 | 2.734 |
| 23 | 1.257 | 1.437 | 1.168 | 1.543 | 1.078 | 1.660 | 0.986 | 1.785 | 0.895 | 1.920 | 0.804 | 2.061 | 0.715 | 2.208 | 0.628 | 2.360 | 0.545 | 2.514 | 0.465 | 2.670 |
| 24 | 1.273 | 1.446 | 1.188 | 1.546 | 1.101 | 1.656 | 1.013 | 1.775 | 0.925 | 1.902 | 0.837 | 2.035 | 0.751 | 2.174 | 0.666 | 2.318 | 0.584 | 2.464 | 0.506 | 2.613 |
| 25 | 1.288 | 1.454 | 1.206 | 1.550 | 1.123 | 1.654 | 1.038 | 1.767 | 0.953 | 1.886 | 0.868 | 2.012 | 0.784 | 2.144 | 0.702 | 2.280 | 0.621 | 2.419 | 0.544 | 2.560 |
| 26 | 1.302 | 1.461 | 1.224 | 1.553 | 1.143 | 1.652 | 1.062 | 1.759 | 0.979 | 1.873 | 0.897 | 1.992 | 0.816 | 2.117 | 0.735 | 2.246 | 0.657 | 2.379 | 0.581 | 2.513 |
| 27 | 1.316 | 1.469 | 1.240 | 1.556 | 1.162 | 1.651 | 1.084 | 1.753 | 1.004 | 1.861 | 0.925 | 1.974 | 0.845 | 2.093 | 0.767 | 2.216 | 0.691 | 2.342 | 0.616 | 2.470 |
| 28 | 1.328 | 1.476 | 1.255 | 1.560 | 1.181 | 1.650 | 1.104 | 1.747 | 1.028 | 1.850 | 0.951 | 1.958 | 0.874 | 2.071 | 0.798 | 2.188 | 0.723 | 2.309 | 0.650 | 2.431 |
| 29 | 1.341 | 1.483 | 1.270 | 1.563 | 1.198 | 1.650 | 1.124 | 1.743 | 1.050 | 1.841 | 0.975 | 1.944 | 0.900 | 2.052 | 0.826 | 2.164 | 0.753 | 2.278 | 0.682 | 2.396 |
| 30 | 1.352 | 1.489 | 1.284 | 1.567 | 1.214 | 1.650 | 1.143 | 1.739 | 1.071 | 1.833 | 0.998 | 1.931 | 0.926 | 2.034 | 0.854 | 2.141 | 0.782 | 2.251 | 0.712 | 2.363 |
| 31 | 1.363 | 1.496 | 1.297 | 1.570 | 1.229 | 1.650 | 1.160 | 1.735 | 1.090 | 1.825 | 1.020 | 1.920 | 0.950 | 2.018 | 0.879 | 2.120 | 0.810 | 2.226 | 0.741 | 2.333 |
| 32 | 1.373 | 1.502 | 1.309 | 1.574 | 1.244 | 1.650 | 1.177 | 1.732 | 1.109 | 1.819 | 1.041 | 1.909 | 0.972 | 2.004 | 0.904 | 2.102 | 0.836 | 2.203 | 0.769 | 2.306 |
| 33 | 1.383 | 1.508 | 1.321 | 1.577 | 1.256 | 1.651 | 1.193 | 1.730 | 1.127 | 1.813 | 1.061 | 1.900 | 0.994 | 1.991 | 0.927 | 2.085 | 0.861 | 2.181 | 0.795 | 2.281 |
| 34 | 1.393 | 1.514 | 1.333 | 1.580 | 1.271 | 1.652 | 1.208 | 1.728 | 1.144 | 1.808 | 1.080 | 1.891 | 1.015 | 1.979 | 0.950 | 2.069 | 0.885 | 2.162 | 0.821 | 2.257 |
| 35 | 1.402 | 1.519 | 1.343 | 1.584 | 1.283 | 1.653 | 1.222 | 1.726 | 1.160 | 1.803 | 1.097 | 1.884 | 1.034 | 1.967 | 0.971 | 2.054 | 0.908 | 2.144 | 0.845 | 2.236 |
| 36 | 1.411 | 1.525 | 1.354 | 1.587 | 1.295 | 1.654 | 1.236 | 1.724 | 1.175 | 1.799 | 1.114 | 1.877 | 1.053 | 1.957 | 0.991 | 2.041 | 0.930 | 2.127 | 0.868 | 2.216 |
| 37 | 1.419 | 1.530 | 1.364 | 1.590 | 1.307 | 1.655 | 1.249 | 1.723 | 1.190 | 1.795 | 1.131 | 1.870 | 1.071 | 1.948 | 1.011 | 2.029 | 0.951 | 2.112 | 0.891 | 2.198 |
| 38 | 1.427 | 1.535 | 1.373 | 1.594 | 1.318 | 1.656 | 1.261 | 1.722 | 1.204 | 1.792 | 1.146 | 1.864 | 1.088 | 1.939 | 1.029 | 2.017 | 0.970 | 2.098 | 0.912 | 2.180 |
| 39 | 1.435 | 1.540 | 1.382 | 1.597 | 1.328 | 1.658 | 1.273 | 1.722 | 1.218 | 1.789 | 1.161 | 1.859 | 1.104 | 1.932 | 1.047 | 2.007 | 0.990 | 2.085 | 0.932 | 2.164 |
| 40 | 1.442 | 1.544 | 1.391 | 1.600 | 1.338 | 1.659 | 1.285 | 1.721 | 1.230 | 1.786 | 1.175 | 1.854 | 1.120 | 1.924 | 1.064 | 1.997 | 1.008 | 2.072 | 0.952 | 2.149 |
| 45 | 1.475 | 1.566 | 1.430 | 1.615 | 1.383 | 1.666 | 1.336 | 1.720 | 1.287 | 1.776 | 1.238 | 1.835 | 1.189 | 1.895 | 1.139 | 1.958 | 1.089 | 2.022 | 1.038 | 2.088 |
| 50 | 1.503 | 1.585 | 1.462 | 1.628 | 1.421 | 1.674 | 1.376 | 1.721 | 1.335 | 1.771 | 1.291 | 1.822 | 1.246 | 1.875 | 1.201 | 1.930 | 1.156 | 1.986 | 1.110 | 2.044 |
| 55 | 1.528 | 1.601 | 1.490 | 1.641 | 1.452 | 1.681 | 1.414 | 1.724 | 1.374 | 1.768 | 1.334 | 1.814 | 1.294 | 1.861 | 1.253 | 1.909 | 1.212 | 1.959 | 1.170 | 2.010 |
| 60 | 1.549 | 1.616 | 1.514 | 1.652 | 1.480 | 1.689 | 1.444 | 1.727 | 1.408 | 1.767 | 1.372 | 1.808 | 1.335 | 1.850 | 1.298 | 1.894 | 1.260 | 1.939 | 1.222 | 1.984 |
| 65 | 1.567 | 1.629 | 1.536 | 1.662 | 1.503 | 1.696 | 1.471 | 1.731 | 1.438 | 1.767 | 1.404 | 1.805 | 1.370 | 1.843 | 1.336 | 1.882 | 1.301 | 1.923 | 1.266 | 1.964 |
| 70 | 1.583 | 1.641 | 1.554 | 1.672 | 1.525 | 1.703 | 1.494 | 1.735 | 1.464 | 1.768 | 1.433 | 1.802 | 1.401 | 1.837 | 1.369 | 1.873 | 1.337 | 1.910 | 1.305 | 1.948 |
| 75 | 1.598 | 1.652 | 1.571 | 1.680 | 1.543 | 1.709 | 1.515 | 1.739 | 1.487 | 1.770 | 1.458 | 1.801 | 1.428 | 1.834 | 1.399 | 1.867 | 1.369 | 1.901 | 1.339 | 1.935 |
| 80 | 1.611 | 1.662 | 1.586 | 1.688 | 1.560 | 1.715 | 1.534 | 1.743 | 1.507 | 1.772 | 1.480 | 1.801 | 1.453 | 1.831 | 1.425 | 1.861 | 1.397 | 1.893 | 1.369 | 1.925 |
| 85 | 1.624 | 1.671 | 1.600 | 1.696 | 1.575 | 1.721 | 1.550 | 1.747 | 1.525 | 1.774 | 1.500 | 1.801 | 1.474 | 1.829 | 1.448 | 1.857 | 1.422 | 1.886 | 1.396 | 1.916 |
| 90 | 1.635 | 1.679 | 1.612 | 1.703 | 1.589 | 1.726 | 1.566 | 1.751 | 1.542 | 1.776 | 1.518 | 1.801 | 1.494 | 1.827 | 1.469 | 1.854 | 1.445 | 1.881 | 1.420 | 1.909 |
| 95 | 1.645 | 1.687 | 1.623 | 1.709 | 1.602 | 1.732 | 1.579 | 1.755 | 1.557 | 1.778 | 1.535 | 1.802 | 1.512 | 1.827 | 1.489 | 1.852 | 1.465 | 1.877 | 1.442 | 1.903 |
| 100 | 1.654 | 1.694 | 1.634 | 1.715 | 1.613 | 1.736 | 1.592 | 1.758 | 1.571 | 1.780 | 1.550 | 1.803 | 1.528 | 1.826 | 1.506 | 1.850 | 1.484 | 1.874 | 1.462 | 1.898 |
| 150 | 1.720 | 1.746 | 1.706 | 1.760 | 1.693 | 1.774 | 1.679 | 1.788 | 1.665 | 1.802 | 1.651 | 1.817 | 1.637 | 1.832 | 1.622 | 1.847 | 1.608 | 1.862 | 1.594 | 1.877 |
| 200 | 1.758 | 1.778 | 1.748 | 1.789 | 1.738 | 1.799 | 1.728 | 1.810 | 1.718 | 1.820 | 1.707 | 1.831 | 1.697 | 1.841 | 1.686 | 1.852 | 1.675 | 1.863 | 1.665 | 1.874 |