BINDURA UNIVERSITY OF SCIENCE EDUCATION

FACULTY OF COMMERCE

DEPARTMENT OF ECONOMICS

JUN 2024

MSc ECONOMICS

ECONOMETRIC PRINCIPLES AND DATA ANALYSIS 2 (MEC 536)

EXAMINATION **DURATION: 3 HOURS**

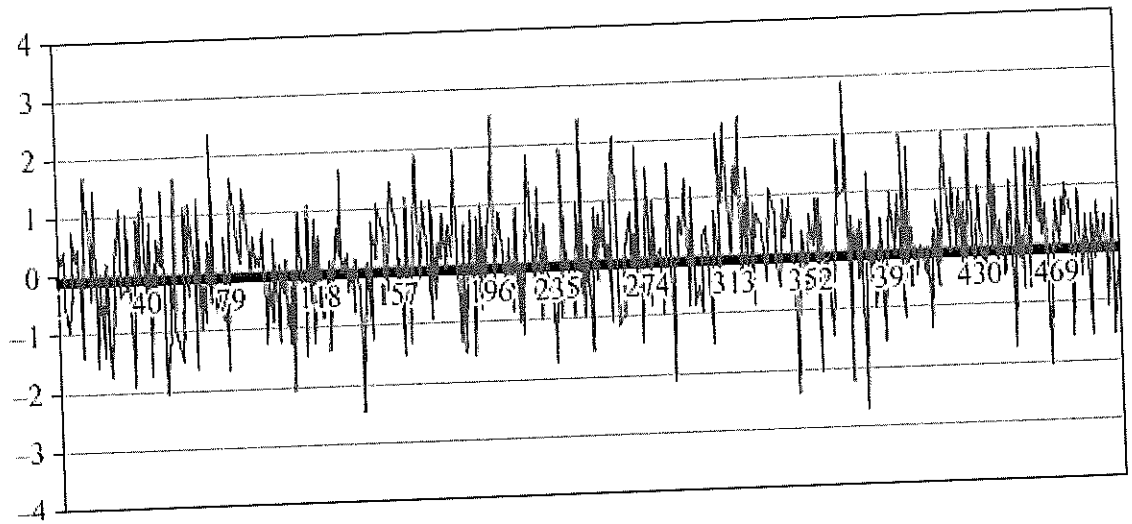
INSTRUCTIONS TO CANDIDATES

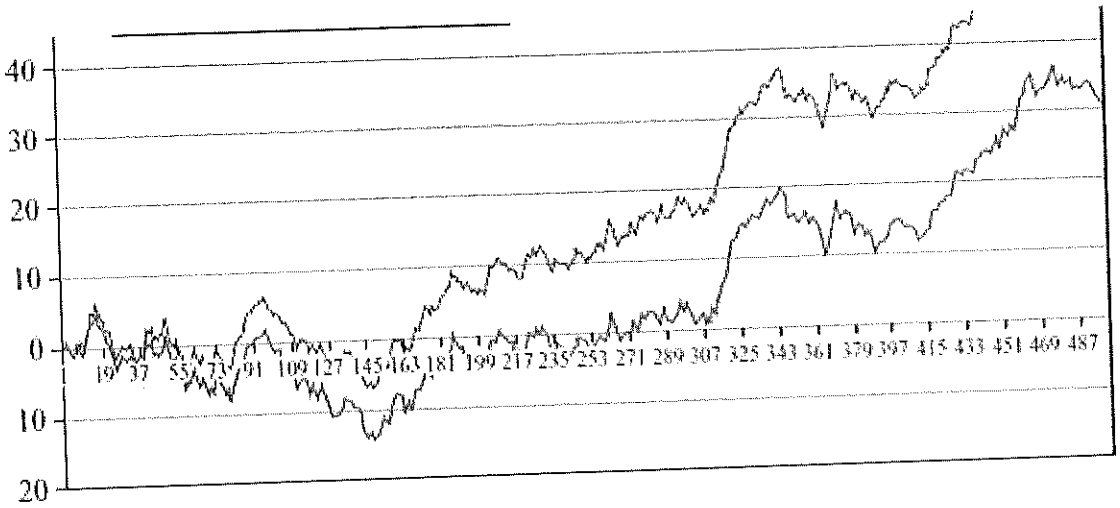
1. Answer question 1 in Section A and any other three questions from Section B.
2. Question 1 carries 40 marks.
3. All the questions in Section B carry equal marks of 20 each.
4. Cell-phones are not allowed into the examination room.

SECTION A (COMPULSORY)

Question 1

a) Cosider the following graphs:





i) Explain the time series concepts that correspond toeach of the graphs above choosing from the list given below. **(9 marks)**

- Random Walk with a drift.
- White noise process.
- Random Walk.
- A deterministic trend process.

ii) Plot the graph associated with the remaining concept. **(3 marks)**

b) A researcher uses the Johansen procedure and obtains the following test statistics (and critical values)

r	λ_{max}	5% critical value
0	38.962	33.178
1	29.148	27.169
2	16.304	20.278
3	8.861	14.036
4	1.994	3.962

Determine the number of cointegrating vectors. **(3 marks)**

c) Assume the following AR(1) model:

$x_t = px_{t-1} + \varepsilon_t$,

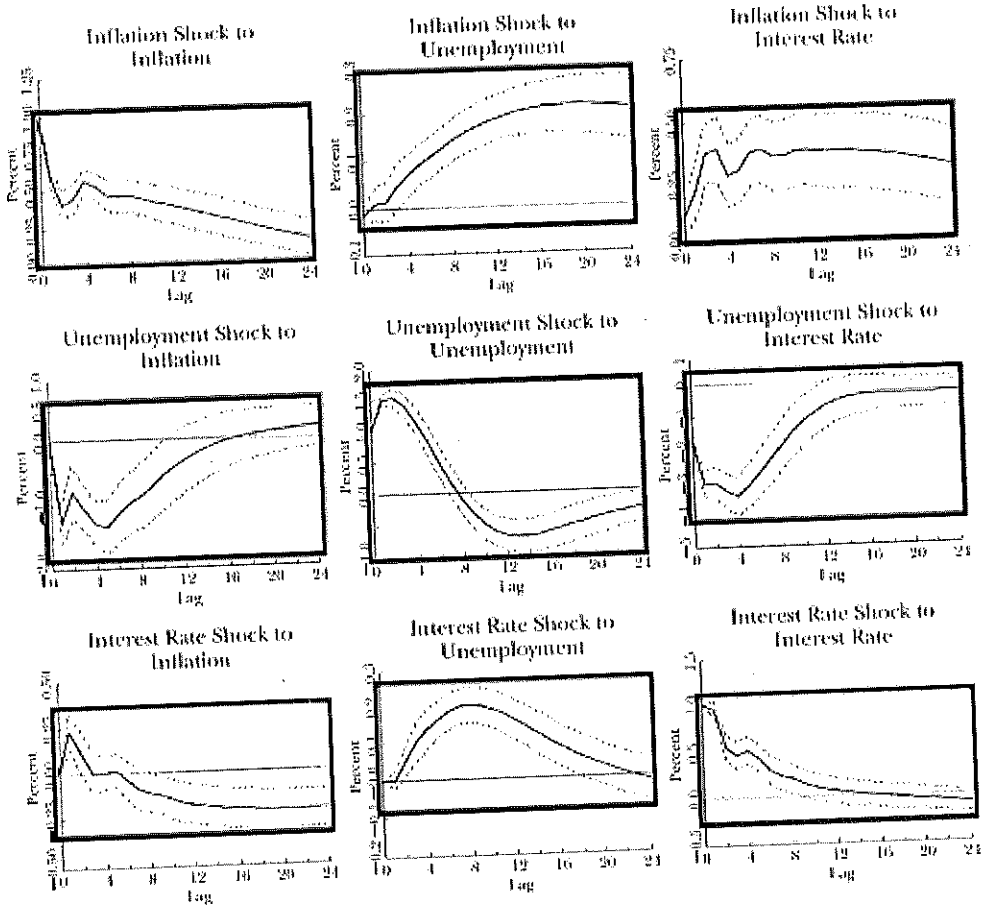
where εt~NID(0,σ2),

i) Distinguish between an AR(1) model and an AR (2) model **(3 marks)**

ii) Explain the differences of performing inference on the estimated p, when p <1.0 and when p=1.0. **(6 marks)**

d) Consider the following grahps extracted from Stock and Watson 2001 'Vector Autoregressions' paper:

Impulse Responses in the Inflation-Unemployment-Interest Rate Recursive VAR



i. Explain what each set of the impluse response graphs shows. **(6 marks)**

ii. What conclusion can you make basing on the impulse response functions given above?

(3 marks)

e) Consider the following estimated model:

$$\Delta \ln Cons_t = \beta_0 + \beta_1 \Delta \ln GDP_t + \beta_2 \ln CPI_t + \beta_3 \Delta\Delta R60c_t + e_t$$

where Δ is the first difference operator, GDP is gross domestic product, CPI is consumer price index, R60c is the three-month treasury billl rate.

The present sample is: 1969 (2) to 1994 (1)

Variable	Coefficient	Std.Error	t-value	HCSE
Constant	0.01692	0.00338	5.001	0.004597
Δ ln GDPt	0.36086	0.09173	3.934	0.093796
ln CPIt	0.25917	0.16066	1.613	0.241880
$\Delta\Delta$R60c t	0.00131	0.00103	1.269	0.001131

$R^2 = 0.174366$ $F(3,96) = 6.7581$ [0.0003] DW = 2.35

RSS = 0.02298197499 for 4 variables and 100 observations

AR 1- 2 F(2, 94) = 1.8497 [0.1630]

ARCH 4 F(4, 88) = 2.6102 [0.0408] *

Normality Chi^{2+} (2)= 4.4048 [0.1105]

RESET F(1, 95) = 0.94744 [0.3328]

Comment on the estimated model and its results. **(5 marks)**

f) What is meant by an ARCH(1) model? **(2 marks)**

[40 marks]

SECTION B (ANSWER ANY THREE QUESTIONS)

Question 2

a) Explain what stylised shapes would be expected for the autocorrelation and partial autocorrelation functions for the following stochastic processes:

i. white noise

ii. an AR(2)

iii. an MA(1)

iv. an ARMA (2,1). **(10 marks)**

b) i. What particular aspect(s) of the Box-Jenkins methodology has been the subject of criticism and why? **(4 marks)**

ii. Describe an alternative procedure that could be used for this aspect(s). **(3 marks)**

c) Why might ARMA models be considered particularly useful for financial time series?

(3 marks)

[20 marks]

Question 3

a) Consider the following vector autoregressive model:

$$y_t = \beta_0 + \sum_{i=1}^{k} \beta_i y_{t-i} + u_t$$

where y_t is a p × 1 vector of variables determined by k lags of all p variables in the system, u_t is a p× 1 vector of error terms, β_0 is a p× 1 vector of constant term coefficients and β_i are p × p matrices of coefficients on the ith lag of y.

i. If p = 2, and k = 3, write out all the equations of the VAR in full, carefully defining any new notation you use that is not given in the question. **(5 marks)**

ii. Why have VARs become popular for application in economics and finance, relative to structural models derived from some underlying theory? **(3 marks)**

iii. Discuss any weaknesses you perceive in the VAR approach to econometric modelling. **(4 marks)**

iv. Two researchers, using the same set of data but working independently, arrive at different lag lengths for the above VAR equation. Describe and evaluate two methods for determining which of the lag lengths is more appropriate. **(5 marks)**

v. Explain briefly the Hausman procedure for testing for exogeneity. **(3 marks)**

[20 marks]

Question 4

a) Consider a series of values for the spot and futures prices of a given commodity. In the context of these series, explain the concept of cointegration. Discuss how a researcher might test for cointegration between the variables using the Engle–Granger approach. Explain also the steps involved in the formulation of an error correction model. **(10 marks)**

b) Give a further example from finance where cointegration between a set of variables may be expected. Explain, by reference to the implication of non-cointegration, why cointegration between the series might be expected. **(4 marks)**

c) 'If two series are cointegrated, it is not possible to make inferences regarding the cointegrating relationship using the Engle–Granger technique since the residuals from the cointegrating regression are likely to be autocorrelated.' How does Johansen circumvent this problem to test hypotheses about the cointegrating relationship? **(3 marks)**

d) Compare the Johansen maximal eigenvalue test with the test based on the trace statistic. State clearly the null and alternative hypotheses in each case. Construct the Error Correction Model based on the long-run model given and justify the expected result of the error correction term.

(3 marks)

[20 marks]

Question 5

a) Why, in recent empirical research, have researchers preferred GARCH(1,1) models to pure ARCH(p)?

(3 marks)

b) Distinguish between the terms 'conditional variance' and 'unconditional variance'. Which of the two is more likely to be relevant for producing:

i. one-step-ahead volatility forecasts

ii. twenty-step-ahead volatility forecasts?

(8 marks)

c) Describe two extensions to the original GARCH model. What additional characteristics of financial data might they be able to capture?

(4 marks)

d) Discuss the principles behind the Granger causality tests.

(5 marks)

[20 marks]

END OF PAPER