BINDURA UNIVERSITY OF SCIENCE EDUCATION

FACULTY OF COMMERCE

DEPARTMENT OF ECONOMICS

MSc ECONOMICS

ECONOMETRIC PRINCIPLES AND DATA ANALYSIS 2 (MEC 536) (3)

EXAMINATION DURATION: 3 HOURS TOTAL MARKS: 100

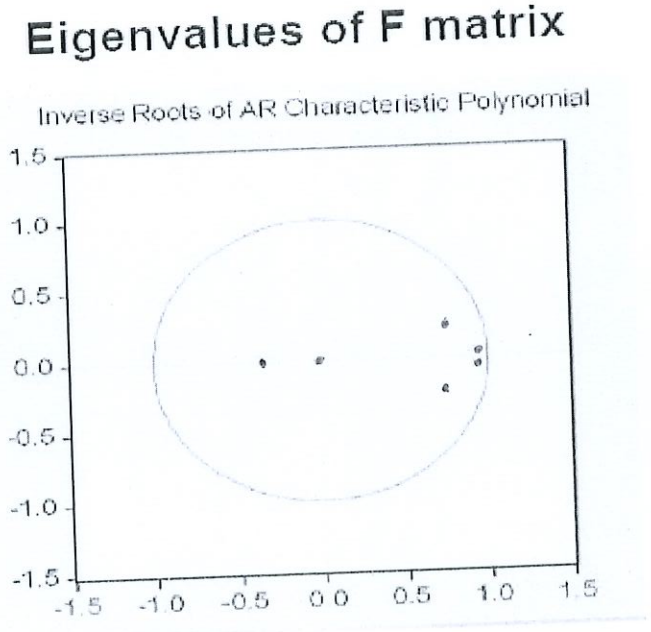
INSTRUCTIONS TO CANDIDATES

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 inverse roots for the autoregressive (AR) characteristic polynomial:



i) Describe the characteristics of the AR model represented by the figure above. **(5 marks)**

ii) Explain the implicaton and remedy if a characteristic root does not lie inside the unit circle. **(6 marks)**

b)

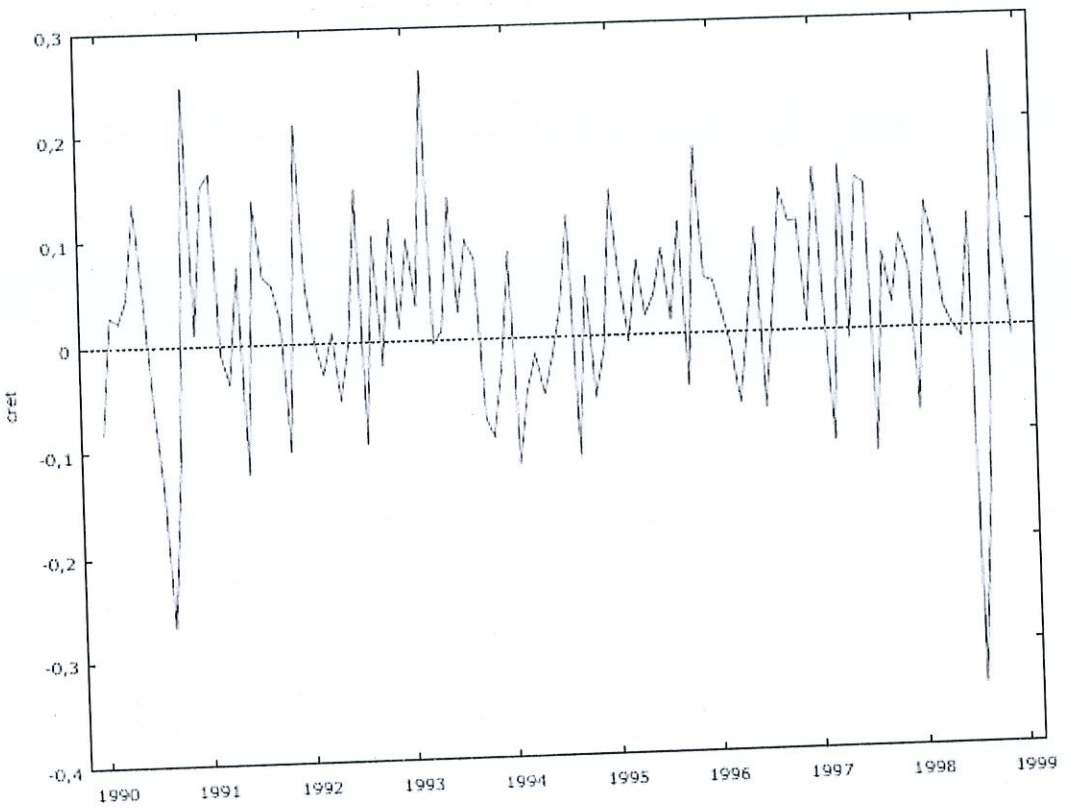


Figure 1.1. Monthly returns on Citigroup stock.

Does the graph in Figure 1.1 above show a Random walk process, a White noise process or a Stationary process. **(9 marks)**

c) 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. **(5 marks)**

d) Assume the following AR(1) model:

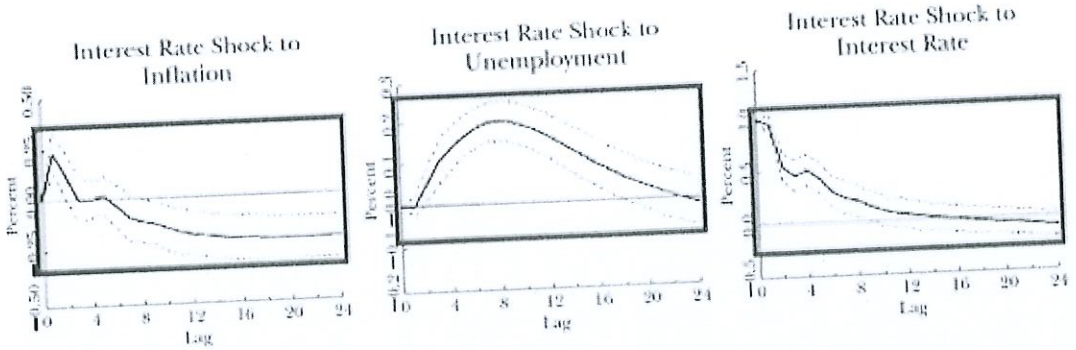
$$x_t = px_{t-1} + \varepsilon_t ,$$

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)**

e) Consider the following section of grahps of the impulse responsese in the Inflation-Unemployment- Interest rate recursive VAR.



Interpret the graphs. **(6 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 *i*th 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. **(6 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. **(7 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) Explain Giving an example in finance a situation where cointegration between a set of variables may be expected. **(4 marks)**

c) Describe how you can establish stationarity using a correlogram. **(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. **(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