

DO NOT REMOVE THE QUESTION PAPER FROM THE EXAMINATION HALL

UNIVERSITY OF LONDON

CENTRE FOR FINANCIAL AND MANAGEMENT STUDIES

MSc Examination
for External Students

91 DFMM459

FINANCE (BANKING)
FINANCE (ECONOMIC POLICY)
FINANCE (FINANCIAL SECTOR MANAGEMENT)
FINANCE (QUANTITATIVE FINANCE)

Financial Econometrics

Specimen Examination

*This is a specimen examination paper designed to show you the type of examination you will have at the end of the year for **Financial Econometrics**. The number of questions and the structure of the examination will be the same but the wording and the requirements of each question will be different. Best wishes for success in your final examination.*

The examination must be completed in **THREE** hours.

Answer **THREE** questions.

The examiners give equal weight to each question; therefore, you are advised to distribute your time approximately equally between three questions.

PLEASE TURN OVER

Answer **THREE** questions.

1. *Answer ALL parts of the question.*

Consider the following GARCH(1,1) model

$$r_t = \mu + u_t \quad u_t \sim N(0,1)$$

$$\sigma_t^2 = \alpha_0 + \alpha_1 u_{t-1}^2 + \beta_1 \sigma_{t-1}^2$$

where r_t is a daily stock return series.

- a) Explain carefully how you would estimate this model.
- b) Interpret the estimated coefficients of the model.
- c) Explain the difference between the conditional variance and the unconditional variance. Calculate the unconditional variance for the model. Under what conditions will unconditional variance be stationary?
- d) Describe two extensions to the original GARCH model. What additional characteristics of financial data might they be able to capture?

2. *Answer ALL parts of the question.*

Suppose that you are interested in modelling the correlation between the returns on the stock of the International Airlines Group (owner of British Airways) and the returns on crude oil.

- a) Write down a constant correlation problem for this model.
- b) Explain carefully how you would estimate the model in part (a).
- c) Discuss the values of the coefficient estimates that you would expect.
- d) Discuss two alternative approaches to correlation modelling. What are the strengths and weaknesses of the multivariate GARCH model compared to the alternatives you propose?

PLEASE TURN OVER

3. *Answer ALL parts of the question.*
- a) Explain why the linear model is inadequate as a specification for limited dependent variable estimation.
 - b) How does the logit model overcome the problem identified in part (a)?
 - c) Describe the intuition behind the maximum likelihood estimation technique used for a limited dependent variable model.
 - d) How can we measure whether an estimated logit model fits the data well or not?
4. *Answer ALL parts of the question.*
- a) Explain the underlying philosophy behind maximum likelihood estimation.
 - b) OLS and maximum likelihood are used to estimate the parameters of a standard linear regression model. Will they give the same estimates? Explain your answer.
 - c) Discuss the main advantages and limitations of the maximum likelihood method.
 - d) Describe one hypothesis testing procedure that is available under the maximum likelihood estimation.
5. *Answer ALL parts of the question.*
- a) Discuss three stylised features of financial data.
 - b) Can any of these features be modelled using linear time series models? Explain your answer.
 - c) Explain the moments of a random variable. How can you estimate these in empirical applications?
 - d) Explain carefully the Jarque–Bera test, stating clearly the null and alternative hypothesis. In the case of financial data, do you expect the Jarque–Bera test to accept or reject the null hypothesis? Explain your answer.

PLEASE TURN OVER

6. *Answer ALL parts of the question.*

Consider the following three models, which a researcher suggests might be a reasonable model of stock market returns.

$$y_t = y_{t-1} + u_t \quad (1)$$

$$y_t = 0.5 y_{t-1} + u_t \quad (2)$$

$$y_t = 0.8 u_{t-1} + u_t \quad (3)$$

- a) What classes of models are these examples of?
- b) What would the autocorrelation function for each of these processes look like? (Don't calculate the acf; simply consider the shape.)
- c) Describe the steps that Box and Jenkins suggested should be involved in constructing the above models.
- d) What procedure may be used to estimate the parameter in equation (3)? Explain how such a procedure works and why OLS is not appropriate.

7 *Answer ALL parts of the question.*

- a) Explain why VAR models have become popular for application in economics and finance, relative to structural models derived from some underlying theory.
- b) Define carefully the following terms:
 - i) the structural VAR model
 - ii) the standard VAR model.
- c) Describe and evaluate two methods for determining the appropriate lag lengths in VARs.
- d) Explain carefully the Granger causality test in a multivariate framework.

PLEASE TURN OVER

8 *Answer ALL parts of the question.*

Consider the following model where the dependent variable (say stock returns) is assumed to be dependent on k explanatory variables (including the constant) such that

$$\begin{aligned} y_1 &= \beta_1 + \beta_2 x_{2,1} + \beta_3 x_{3,1} + \beta_4 x_{4,1} + \dots + \beta_k x_{k,1} + u_1 \\ y_2 &= \beta_1 + \beta_2 x_{2,2} + \beta_3 x_{3,2} + \beta_4 x_{4,2} + \dots + \beta_k x_{k,2} + u_2 \\ &\vdots \\ y_T &= \beta_1 + \beta_2 x_{2,T} + \beta_3 x_{3,T} + \beta_4 x_{4,T} + \dots + \beta_k x_{k,T} + u_T \end{aligned}$$

- a) Write the above model in matrix form.
- b) Derive the estimators of the parameters of the model in part (a) using the method of least squares.
- c) What is meant by multifactor models? How are these models used in finance?
- d) Consider a two factor model such that

$$\mathbf{y} = \boldsymbol{\alpha} + \mathbf{X}\boldsymbol{\beta} + \mathbf{u}$$

where \mathbf{y} is the vector of returns, $\boldsymbol{\alpha}$ is a vector of ones (multiplied by the constant), $\boldsymbol{\beta}$ is a vector of betas, and \mathbf{X} is the matrix of the factors. Derive the expected value and the variance of returns. Comment on the results.

[END OF EXAMINATION]