

## Sample Exam Questions for Econometrics

1

- a) What is meant by marginalisation and conditioning in the process of model reduction within the dynamic modelling tradition? (30%)
- b) Having derived a model for the exchange rate  $s_t$  as a function of the interest rate differential  $r_t$  and performed the following regression.

$$s_t = a + b r_t + e_t$$

Where  $e_t$  is an error term. How would you check for the presence of serial correlation in the error term and how would you deal with it. (30%)

- c) Explain what recursive estimation is and how it would be used to assess the stability of this equation. (40%)

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- a) Define the term's weak stationarity, Integrated of order one and uniform mixing. How would you assess the stationarity of a variable X. (30%)

b) Suppose X was the US stock market index and your data period was from 1920-1938 (to include the stock market crash). How would the testing procedure for stationarity be affected? (30%)

- c) If both the Dollar/Sterling exchange rate (E) and the Yen/Dollar exchange rate (Y) were I(1) but there was in fact no relationship between the two variables, what would you expect the result would be of performing the following regression. (40%)

$$E_t = a + b Y_t + v_t$$

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Suppose both X and Y are I(1) variables which are generated by the following true system

$$X_t = a + b Y_t + e_t$$

$$Y_t = Y_{t-1} + v_t$$

Where e and v are stationary error processes.

- a) Define the common stochastic trend underlying this model (20%)
- b) What is the cointegrating vector(20%)
- c) Explain the relationship between the number of cointegrating vectors in a system and the number of stochastic trends.(20%)
- d) What is the importance of the Granger Representation theorem to practical modelling?(40%)

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Suppose we are estimating a model for the return on a bond  $r_t$  of the form,

$$r_t = a + br_{t-1} + e_t$$

where  $e$  is an error term.

- a) Explain the difference between the conditional variance and the unconditional variance of  $r$ . Which of the two is more relevant for financial decision making? (20%)
- b) If we suspect that the variance of  $e$  changes systematically through time what would be the consequences for standard OLS estimation. Outline the ARCH and GARCH models, which would allow us to deal with this problem fully. (30%)
- c) If you believed that the variance of  $e$  affects the return on the bond how would adapt the GARCH model to allow for this. (30%)
- e) If you were investigating a model such as the capital asset pricing model which used the covariance between the market return  $r_m$  and the bond return  $r$ , How could the GARCH model be extended to allow for this case? (20%)

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- a) Define the components, which make up an ARIMA model. (20%)
- b) Why is Wolds decomposition fundamental to time series modelling? (20%)
- c) Outline the Box-Jenkins identification methodology. (30%)
- d) Define the exponentially weighted moving average time series forecasting approach and give examples of commonly used versions of this model. (30%)

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The following table of test results has been derived for a system of 5 variables using the Johansen maximum likelihood procedure.

r	Trace test	5% critical val.	Lambda-max test	5% critical val.
1	15.4	8.08	11.1	8.1
2	24.1	17.8	17.3	14.6
3	29.1	31.2	19.2	21.3
4	33.4	48.4	24.1	27.3
5	37.3	69.9	26.7	33.2

- Interpret the two tests. What is the cointegrating rank of the system? (20%)
- Outline the order condition for identifying cointegrating vectors and illustrate it with an example of identifying a system with 2 cointegrating vectors (30%)
- If there were more theoretical restrictions available than were needed for identification how could this situation be used to test the theory being applied? (30%)
- If we assume  $r=2$  (2 cointegrating vectors) amongst 4 variables write out a general vector error correction model. (20%)

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- Explain the problem of spurious regression and relate it to the question of stationarity of the data(25%).
- Define the terms ergodic, stationary, non-stationary and integrated(25%).
- How would you test for stationarity? (25%)
- When does non-stationary data not give rise to the problems of a spurious regression. (25%)

4

- What is meant by marginalisation and conditioning in the process of model reduction within the dynamic modelling tradition? (30%)
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$$s_t = a + b r_t + e_t$$

Where  $e_t$  is an error term. How would you check for the presence of serial correlation in the error term and how would you deal with it. (30%)

- f) Explain what recursive estimation is and how it would be used to assess the stability of this equation. (40%)

8

- a) Explain the structure of an AR model and an MA model. How are they related? (20%)
- b) Outline the structure of one of the well-known EWMA forecasting models. (30%)
- c) What is the Wald decomposition? (20%)
- d) How would you set about identifying the appropriate structure of an ARIMA model. (30%)

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- a) Is the conditional or unconditional variance a more appropriate measure of uncertainty? (15%).
- b) Contrast an ARCH model with a GARCH model and discuss the relative merits of the two formulations. (25%)
- c) What is the appropriate likelihood function for the two models in part b? (20)
- d) In many finance applications risk terms affect pricing and other decisions directly. How could the GARCH model be extended to allow for this possibility and how would the likelihood function change? (20%)
- e) What are the problems in using this framework to model covariance terms between assets? (20%).

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Suppose both  $X$  and  $Y$  are  $I(1)$  variables which are generated by the following true system

$$X_t = a + bY_t + e_t$$

$$Y_t = Y_{t-1} + v_t$$

Where  $e$  and  $v$  are stationary error processes.

- f) Define the common stochastic trend underlying this model (10%)
- g) What is the cointegrating vector(10%)
- h) Explain the relationship between the number of cointegrating vectors in a system and the number of stochastic trends.(10%)
- i) What are the properties of the OLS estimate of the parameter  $b$ ? How do these properties vary from that of a spurious regression?(30%)
- j) How would you assess the possibility that two series such as  $X$  and  $Y$  actually do cointegrate?(40%)

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- a) What is meant by stationarity? What is an integrated variable? (20%)
- b) Explain the relationship between stationarity and a spurious regression, why does the OLS estimator give such bad results? (20%)
- c) How would you assess the stationarity of a variable? (60%)

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- a) Outline the process of model reduction which is a central part of the LSE econometric tradition(25%)
- b) How is testing used to assess the validity of a model?(40%)
- c) What is the Encompassing principle?(25%)
- d) What is the rationale for an Error Correction Model? (10%).

B13

- a) What is the main purpose of Time series forecasting in contrast to mainstream econometrics?(10%)
- b) Outline the two basic structures that form the building blocks of time series modelling. (10%)

- c) How is non-stationarity usually handled in this framework? (10%)
- d) Outline the basic structure of the EWMA model and contrast the purpose of the centred EWMA with the non centred one. (20%).
- e) Outline the process of Box-Jenkins modelling including the use of the autocorrelation function and the partial autocorellation function. (50%)