

Queen Mary College, University of London, MSc. (Econ)

Course: ECOM O14 TIME-SERIES ANALYSIS

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COURSE PROSPECTUS

1. Aims of the unit

This course aims to teach the methods of time-series modelling which are applicable in econometrics and throughout a wide range of disciplines in the physical and social sciences. It also intends to provide a firm foundation for the course of *Financial Econometrics* which is taught in the following semester. The concepts of time-series analysis in both the time-domain and the frequency domain will be illustrated with some computer software specially written for the course and with one of the commercially available software packages.

2. Learning Outcomes

By the end of the course, the students should have a firm grasp of the mathematical foundations of time-series analysis including the operator calculus which is used in time-domain analysis and the Fourier methods which are used in frequency-domain analysis.

They will have developed a familiarity with the autoregressive moving-average (ARMA) models for stationary processes and with the associated methods of model identification and forecasting. The multivariate extensions of the ARMA models should also become familiar as well as the ARCH and GARCH models, which can be seen as extensions of the ARMA model.

The course will also encompass the Wiener–Kolmogorov theory of signal extraction which will be developed, in the first instance, in reference to doubly infinite stationary time series. Thereafter, it will be adapted to deal with cases where the series are nonstationary and of a strictly limited duration. The students should understand how these methods can be used for detrending and deseasonalising econometric and financial data.

3. Topics to be Studied

The Algebra of the Lag Operator

Algebraic Polynomials

Fourier Transforms and z-Transforms

Difference and Differential Equations

The Solution of Linear Dynamic Equations

The State-Space Approach to Dynamic Modelling:

Fourier Analysis

Periodic and Aperiodic Functions

The Fast Fourier Transform

Stationary Stochastic Processes and Linear Stochastic Models

Autoregressive and Moving-Average Models

Transfer-Function Models

Multivariate Dynamic Models

Spectral Analysis

The Power Spectrum of a Stationary Process

Linear Filters

Forecasting with Linear Stochastic Models

The Wiener–Kolmogorov Approach to Forecasting

Forecasting via the Kalman Filter

Nonstationary Models

Reduction to Stationarity

Integration and Co-integration

Signal Extraction and Filtering

Signal Extraction for Stationary Series of Infinite Duration

Signal Extraction for Nonstationary Series of Limited Duration

4. Arrangements for Teaching and Assessment

The course is taught in the autumn semester. The lectures are given each week in two consecutive hours (Tuesday, 2–4pm) and there will be a one-hour class each week which will take place in a computer laboratory. The students are expected to take accurate notes during the lectures and to access the adjunct material which is to be found on the associated web page and in the text books mentioned below.

The students will be assessed in a two-hour examination in June. Examples of examination papers from previous years are available on the Web site.

5. Readings

The principal texts for the course are POLLOCK, *Lectures in Times Series Analysis and Forecasting* and POLLOCK, *Time-Series Analysis, Signal Processing and Dynamics*, both of which are available on the Web at the address qmw.ac.uk/economics/staff/~ugte133. Students should also have recourse to the *Brief Notes in Time-Series Analysis* which are to be found on the Web at this address.

The students are encouraged to provide the course organiser with a blank CD disc on which the texts mentioned above will be written together with some related texts in mathematics and mathematical statistics. An extensive suit of software that runs on both a DOS computer and a Macintosh computer will also be written to the disc.

There are several published textbooks to which the student are encouraged to have recourse. These will be itemised at the beginning of the course when their relative merits will be discussed. The students are encouraged to purchase and to quickly absorb the material of the text of C. Chatfield titled *The Analysis of Time Series: An Introduction*, published by Chapman and Hall, which is on a relatively elementary level.