

MODULE SPECIFICATION • CORE

Time Series Econometrics and Forecasting

The purpose of this core course is to provide students with an in-depth understanding of the fundamental concepts of time series econometrics and forecasting and with the practical skills to use econometric software to model and forecast economic time series and identify models with the best forecasting abilities. The module builds on the foundation of the econometrics core course and prepares students for MSc and PhD research.

20	25h	175h	200h
CREDITS	CONTACT HOURS	PRIVATE STUDY	TOTAL STUDY

COURSE CONVENOR

NAME	Prof Dr Christian Francq
OFFICE	By appointment — please email to arrange a convenient time

COURSE STRUCTURE

Econ 7902 is a core 20-credit course and students are expected to input approximately 200 hours of study. The total number of contact hours is 25 hours, leaving 175 hours for private study. Delivery is by lectures — 5 days of 4-hour lectures — plus 5 hours of tutorials and labs.	During private study, strike a balance between reading textbook and journal materials, thinking critically about how these fit into the body of knowledge on the subject and about how our level of knowledge can be improved, performing exercises and revising for examinations.
---	--

MODULE PROGRAMME

LECT.	TOPIC	SESSION CONTENT
01	Introduction and key concepts — Day 1	- Definitions of time series - Strictly and weakly stationary processes - Conditional moments
02	Moments, stochastic processes and lag operators — Day 1	- Simple stochastic processes - Lag operators and data transformations
03	The autoregressive model of order 1 — Day 1	- Definition of AR(1) - Stability and moments
04	ARMA models — Day 2	- Overview of ARMA models - Stability and moments

LECT.	TOPIC	SESSION CONTENT
05	ARMAX models — Day 2	- Overview of ARMAX/ADL models - Stability and moments - Short-run and long-run multipliers
06	Forecasting and impulse response functions — Day 2	- Forecasting and IRFs for ARMA models - Forecasting and IRFs for ARMAX plus ARMA models - Examples
07	ARMA model estimation — Day 3	- The maximum likelihood estimator - Estimator properties
08	ARMA model specification — Day 3	- General-to-specific estimation - Residual testing
09	Testing and validation — Day 3	- Testing and diagnostic checking - ARMA model validation and comparison
10	Multivariate Time Series — Day 4	- Concepts and properties - VARs and seemingly unrelated regression
11	Estimation and forecasting of VAR models — Day 4	- Estimation by ML - Forecasting vector models - Impulse response functions
12	Unit Roots and Stationarity Tests — Day 5	- Introduction to the notion of stationarity and unit roots - The Dickey-Fuller unit root test - Other stationarity and unit root tests
13	SARIMA Models — Day 5	- The Box-Jenkins methodology - Integrated ARMA models - Seasonal ARIMA models
14	Multivariate forecasting I — spurious or cointegrated systems — Day 6	- Spurious regressions, Vector AutoRegressions (VAR) - Fitting stationary VAR - Long-run equilibrium relationships (with economic examples) - The Vector Error Correction Model (VECM)
15	Multivariate forecasting II — forecasting cointegrated series and Granger causality — Day 6	- Cointegrated VARs: Granger approach and Johansen's test for cointegration - Estimating and interpreting a VECM (examples in R) - Causality and instantaneous causality - Testing causality between the components of a VAR

KEY SKILLS

By the end of this course, students should have some knowledge and understanding of:

- Understand how to model a univariate or multivariate time series process
- Understand the Maximum Likelihood estimation method
- Distinguish between stationary and nonstationary series and understand the implications of using nonstationary series

- Understand how to forecast a univariate or a multivariate time series process
- Be able to conduct forecast evaluation with statistical and economic loss functions

DESIRED OUTCOMES

By the end of this course, students should be able to:

- Build, estimate and forecast from univariate and multivariate time series models using econometric software
- Understand and critically evaluate recent research in forecasting
- Engage in abstract thinking by extracting the essential features of complex systems to facilitate problem solving and decision-making
- Communicate and present complex arguments in oral and written form with clarity and succinctness
- Present, interpret and analyse information in numerical form
- Utilise effectively statistical and other packages
- Apply econometrics techniques to aid understanding of the financial and macroeconomic environment
- Work effectively both individually and within a team environment

ASSESSMENT

WEIGHTING	100% coursework
ISSUED	End of week 6
DUE	End of week 10 (22 March) — four weeks for completion
SUBMISSION	Electronically via the Moodle site for this course

Marking criteria are set out on pages 21–22 of the Economics Undergraduate Handbook. An electronic copy can be found on the Econ Part 1 and Econ Part 2 Moodle pages.

COURSE TEXT & RECOMMENDED READING

Copies of the lecture slides are made available on the course web pages. You must print off the notes for each lecture prior to attending. Solutions to exercises, additional material and course announcements are also placed on this website.

- Brooks, C. (2019). *Introductory Econometrics for Finance*. Cambridge University Press
- Hamilton, J. D. (1994). *Time Series Analysis*. Princeton University Press
- Greene, W. (2003). *Econometric Analysis*. Prentice Hall
- Brockwell, P. and Davis, R. (2002). *Introduction to Time-Series and Forecasting*
- Stock, J. and Watson, M. *Introduction to Econometrics*
- Verbeek, M. (2000). *A Guide to Modern Econometrics*
- Griffiths, W. E., Hill, R. C. and Lim, G. C. *Using EViews for Principles of Econometrics*, 5th edition. Wiley — presents the EViews commands required for the examples in *Principles of Econometrics*
- Wooldridge, J. M. (2012). *Introductory Econometrics: A Modern Approach*, 5th edition. CENGAGE Learning Custom Publishing
- Dougherty, C. (2011). *Introduction to Econometrics*. Oxford University Press
- Pindyck, R. S. and Rubinfeld, D. L. (1997). *Econometric Models and Economic Forecasts*, 4th edition. McGraw-Hill



- Greene, W. H. (2011). *Econometric Analysis*. Pearson Education
- Maylor, H. and Blackmon, K. (2005). *Researching Business and Management*. Palgrave Macmillan
- Maddala, G. (1983). *Limited Dependent and Qualitative Variables in Econometrics*. Cambridge University Press
- Gujarati, D. (1995). *Basic Econometrics*. McGraw-Hill
- Kennedy, P. (1993). *A Guide to Econometrics*. Basil Blackwell
- Maddala, G. (1992). *Introduction to Econometrics*. Macmillan
- Stewart, M. and Wallis, K. (1990). *Introductory Econometrics*. Basil Blackwell

ADDITIONAL PROGRAMME INFORMATION

LECTURER AND TUTOR CONTACT

Available by appointment — please email to arrange a convenient time.

ADMINISTRATIVE SUPPORT STAFF

John Sharples, j.sharples8@lancaster.ac.uk, Tel: 01524 594228. The administrative staff are your primary point of contact for all administrative matters concerning Economics courses. Most matters can be resolved with a single face-to-face meeting. You may also contact the Economics Department Office via email. Office hours: Mon–Fri, 9:30–11:30 and 14:00–16:00, room MS B34. Please email if you are unable to attend during office hours to arrange an appointment. The course website on Moodle is the primary means of communication with students; emails are sent to your Lancaster account, which you should check regularly.

MOODLE

Course website via Moodle:
<https://mle.lancs.ac.uk/course>. Log in using your regular Lancaster University access details. This opens a page headed MLE: My home.

ATTENDANCE AND LECTURES

Attendance is monitored by class register at all compulsory classes — tutorials, lecture seminars, computer laboratory sessions and workshops. Absences are recorded electronically against an individual's record, and it is the responsibility of each student to ensure their attendances are correctly recorded. Students must report all absences using the online self-certification system. Where illness causes you to miss a coursework element or a continued number of classes, you are required to provide medical confirmation after consultation with a doctor. Students who are absent without explanation will be recorded as an unauthorised absence and this will be reported to the appropriate Director of Studies. Persistent failure to attend without explanation will lead to referral to the Standing Academic Committee and the risk of permanent exclusion from the University. Please note that the University teaching day runs until 20:00.

FINAL MARKING

The final exam takes place three weeks after the end of the course, and resits are offered 9 weeks after the release of the exam results.

RESEARCH ETHICS

If your coursework involves collecting information from or conducting interviews with individuals you should be aware of the LUMS research ethics code of conduct. You will need to sign on the coursework submission form that you have followed these guidelines.



CODE OF CONDUCT

Students agree to conduct empirical research involving human participants in line with the University ethical research guidelines; to ensure participation is based on informed consent; to be honest in all their relationships with research participants; to be transparent as to the context and purpose of data collection; to respect the confidentiality of information collected; to respect the rights and well-being of all individuals and organisations affected by their research; to ensure respondents are not harmed or adversely affected; to respect the needs of participating individuals and organisations and the requirements of the University; and to discuss the research, design and its operationalisation with their supervisors or module tutors before conducting the research.

STUDENT FEEDBACK

At the end of the course students are given the opportunity to provide feedback through an online questionnaire. Students are notified via email during the course as to when the questionnaires will be available. This feedback enables the University to identify areas of strength and weakness so that the course can be improved in future.