

Lecturer: Michael Curran

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ECTS VALUE: 10

Overview:

This course starts with a brief expedition into the problem of identification. What could we claim to know if we were fortunate to be in the ideal scenario, having data on the entire population rather than a subset or sample? Logically, identification precedes inference. Here we will investigate different assumptions – implicit and explicit – when we have missing data, showing how two theorems (law of total probability and law of iterated expectations) can be combined with straightforward logic to solve many problems in identification for prediction and decision. Depending on time, topics may include conditional prediction, incomplete data (missing outcomes / IV / nonparametric and parametric prediction / decomposition of mixtures) and treatment response (selection problem / simultaneous equation models / monotone treatment response / mixing problem / planning under ambiguity / planning with sample data – integrating statistical decision theory [identification] with statistical inference).

Building on these foundations, we will proceed to the question of inference and devote a large portion of the course to the topic of stationary time series. Here we will first explore the basic AR, MA, ARMA and ADL models in addition to ACF and PACF in line with identification, estimation, testing and forecasting before looking at modeling heteroscedastic second order moments through ARCH/GARCH/MS/SV models. We will then shift focus in the last topic on stationary time series, *viz.* frequency domain time series. Lots of early research in time series was carried out in the frequency domain, especially since other sciences contributed here. Today, while such courses are often left to more advanced masters/PhD courses since they can form the basis for advanced simulation/filtering time series second year PhD 'field courses' internationally, it seems to be the case that most leading theoretical econometric research in time series is now conducted within the time series domain approach as opposed to the frequency domain approach since most of the issues within the frequency domain approach have been worked out a long time ago! The frequency domain is presented here to provide a more complete, chronological, history of thought approach. Depending on time, topics may include a review of elementary time-series, spectral representation theorems of stationary processes, filters (spectral properties), multivariate spectra and spectral estimation.

Next we will consider further issues with forecasting as an extra topic. After a very brief revision of forecasting and how one can estimate parameters for forecasting, we will look at two issues. Firstly, when looking at different forecasts from different forecasting companies,

we may want to know which is better – evaluating forecasts and forecasters. Secondly, we can also use these forecast assessment tools as a diagnostic device for our own model – evaluating models and forecasting models using pseudo-out-of-sample forecasting techniques. Finally, if time permits, we will cover forecasting with many predictors since it has been a recent 'hot topic' in time-series research. This is a particularly interesting area since it would appear at first glance to violate the principle of parsimony!

The final item on the agenda is the topic of filtering and simulation. We will look at filters and smoothers before covering some simulation methods. Simulation methods have become more and more common as computer technology has improved and costs have come down widening its applicability. We will investigate some econometric simulation methods, dealing with linearity and non-linearity, Gaussianity and non-Gaussianity, time-variation, state-space models, filtering (linear and non-linear), classical and Bayesian approaches and applications in computational economics (2/3 papers in macroeconometrics, time permitting).

Materials include my chapter notes, assigned reading (books and papers) and work for tutorials including problem sets. Apart from the first topic on identification for which Stata will be useful, the main computer package used for this part of the course is MATLAB and there will be lab demonstrations on its use pertaining to project work and problem sets, in addition to the MATLAB session on Saturday January 12th. In terms of prerequisites, students should be comfortable with the probabilistic foundations underlying econometrics and asymptotic theory from the refresher course at the beginning of the MSc program.

Objectives:

This part of EC7004 consists of 4.5 weeks of two-hour classes (9 hours in total). Laboratory sessions are designed to provide guidance on project work and to go over problem sets. These econometric computer programming and problem solving sections are designed to facilitate your development as an economic scholar and to help with your preparation for examinations since homework contain similar types of questions. The link between lectures and lab sessions is while lectures introduce material, lab sessions will require more of your interaction with the subject matter and with each other, in addition to allowing you to benefit from the TA's supervision in an interactive classroom environment in the computer room. Active engagement and independent learning are key to your success. Firstly, I want you to be able to wield the concepts (memorising, applying, critiquing); based on this, I want you to be able to answer questions (formulating, method and application, solving accurately); and finally, I want you to be able to answer subject to time constraints, which will be up to you to practice.

Assessment:

There will be two problem sets. The problem sets and written exam require students to solve theoretical and applied econometric problems on the range of topics studied during the course. The problem sets (for the entire year) contribute 5% towards the overall mark. I highly recommend you work in groups with a maximum of 3 people per group where each hands in their own copy of homework; do not forget to list your group members on the homework. Lab sessions are worth 5%, where attendance at lab sessions will be monitored in addition to a reasonable effort made at understanding the material. Failure to attend tutorials and / or submit homework assignments, without appropriate justification (e.g. medical certificates)

may lead to a Non-Satisfactory report. Prof Newman is the person to contact and effectively acts as your tutor. The presentation of your time series project in the fourth week of this term during labs will be attended by Prof Bénétrix, Clemens Struck and I. The purpose is to make sure each of you are on track with a feasible topic. The project is due Friday of the tenth week and is worth 10% of the total mark. The TA will convey what is important in the project during lab sessions, i.e. formulating the research question and economic model, accurately choosing the econometric approach, rigorously testing and correcting for misspecification errors, discussing the results and writing the paper in a format that displays logical consistency and linguistic accuracy. There will be a written examination in June for EC7004 that represents 80% of the overall mark.

Plagiarism is taken very seriously by the University. 'Plagiarism is interpreted by the University as the act of presenting the work of others as one's own work, without acknowledgement.' (University Calendar, 2012-13)

Deadlines and Submissions:

Homework must be handed to the TA, in hard copy, **at the start** of the tutorial. MATLAB m files and diary files should be emailed to the TA **before the start of the tutorial**. Problem sets one and two are due by 1pm Wednesday January 30th and by 1pm Wednesday February 20th, respectively. Solutions will be available afterward online at my teaching page.

Tutorial Rules:

- No ringing cell phones, no texting, no inappropriate computer use
- Respect the diversity of interests, experience, and background of your classmates

Contacting Me:

The TA is the first person you should contact if you have any issues with this course. Please note that I stop checking email around 10:00pm. Any email I receive from you after that time will not be read until the following day. Apart from weekends, I typically respond to emails within 24 hours. It may not always be necessary to see me in office hours so feel free to send me an email if you have a problem related to the course that you were unable to resolve with the TA. If you plan to see me in office hours, do drop in, but you might wish to send me an email the day before (Monday) with some idea of the question(s) you may want to raise.

Syllabus: (Metrics, HT Part (i))

1. **Identification:** problem of identification (conditional prediction); incomplete data; treatment response
2. **Stationary Time Series:** AR, MA, ARMA, ADL models; ACF/PACF, identification, estimation, testing and forecasting; ARCH/GARCH/MS/SV models; frequency domain
3. **Forecasting:** forecast assessment; forecasting with many predictors
4. **Filtering & Simulation:** filters & smoothers; simulation methods