ADVANCED ECONOMETRICS I (INTRODUCTION TO TIME SERIES ECONOMETRICS)
Ph.D. Fall 2013

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Description
Advanced Econometrics I (Introduction to Time Series Analysis) examines the models and statistical techniques used to study time series data in economics. A central message is that THEORETICAL time series analysis is useful because it helps us understand patterns in actual economic data, as well as dynamic CAUSAL relationships.

The course has two specific objectives. The first is to equip students with the tools necessary for state-of-the-art empirical research with economic time series data. This is designed for those students who are likely to use time series data in their Ph.D. theses (macro-economics, finance, marketing, accounting,...etc). The second objective is to lay out the econometric theory of time series analysis, with an emphasis on recent developments during the past 10-20 years.

The first block (part II) of the course presents the theory of univariate stationary and non-stationary time series variables. The second block (part III) focus on the multivariate level covering the different aspects of the VAR modelling that have been relevant in the recent macroeconomic time series literature. The last block (part IV) consists of some further topics that have become recently very popular in time series econometrics (some of these topics are excellent candidates to write a dissertation on).

Grading
The course work consists of a final exam, five problem sets that will require theoretical and computationally work and a FIVE-page project. The project can be theoretical or applied (see the web page). For the applied project this year we will focus on the causal relationship between interest rates and seasonally adjusted GNP (or IPI). Grades for this course will be based on the final exam (70%), and the project (30%). The problem sets are a necessary condition in order to get a final grade. I encourage individuals to work together on the problem sets. You will undoubtedly teach each other more about time series while working in a problem set than I will in class. Each individual is, however, required to turn in a separate problem set answer sheet.

Software
Econometrics and Time Series software: E-views, GAUSS, Matlab, STATA, etc. I recommend the students to become familiar as soon as possible with at least two of the packages (E-views or STATA and Gauss or Matlab). One menu-driven (good to analyze empirical data) and the other better designed for programming (good for simulations).
COURSE OUTLINE

PART I: INTRODUCTION

1. BASIC CONCEPTS OF STOCHASTIC PROCESSES
   Definitions and examples of stochastic processes and time series. Stationarity and ergodicity. The mean. The autocovariance and autocorrelation function. One of the goals of time series analysis: Forecasts based on conditional expectation and Forecasts based on linear projection (least squares)

2. STATIONARY LINEAR MODELS I: CHARACTERIZATION AND PROPERTIES

3. STATIONARY LINEAR MODELS I’: SPECTRAL ANALYSIS

4. STATIONARY LINEAR MODELS II: ESTIMATION AND INFERENCE
   Estimation: The maximum likelihood method (the likelihood function for a gaussian AR(1) and a gaussian MA(1)) and Least squares. Asymptotic behavior of the sample mean and autocovariance function. Estimation of the Long-Run Variance. Inference on the parameters of ARMA models.
   **Appendix**: Asymptotics for linear processes (LLN and CLT). Martingale Theory.

5. MODEL SELECTION
   Box-Jenkins Methodology. Information Criteria: AIC, BIC, HQ and LCIC. Consistency of the IC. Inference on models selected by the IC. Testing versus IC.

6. FORECASTING

7. NON-STATIONARY LINEAR MODELS: THE CASE OF AN AR WITH A UNIT ROOT
   **Appendix**: The functional central limit theorem and the continuous mapping theorem.
8. NON-STATIONARY MODELS: THE CASE OF STRUCTURAL BREAKS

PART III: MODELS BASED ON MULTIVARIATE INFORMATION

9. STATIONARY MULTIVARIATE LINEAR MODELS: VARs

10. NON-STATIONARY MULTIVARIATE LINEAR MODELS I: VAR MODELS WITH UNIT ROOTS- COINTEGRATION
    Appendix: Asymptotic results for non-stationary vector processes.

11. NON-STATIONARY MULTIVARIATE LINEAR MODELS II: VAR MODELS WITH UNIT ROOTS- COINTEGRATION

12. MODEL SELECTION
    Consequences of lag or/and rank misspecification in VARs. Information criteria approach to select the number of lags and the rank of cointegration. Consistency of the IC; Testing versus IC.

PARTE IV: FURTHER TOPICS

13. LONG MEMORY

14. THRESHOLD MODELS

15. DYNAMIC FACTOR MODELS
TEXTBOOKS

The primary texts are Brockwell and Davis (1991), Hamilton (1994), and Hayashi (2000). The other texts provide treatments of various subtopics.

Primary Texts


Secondary Texts (for particular topics)


+ Lecture Notes and Papers

I hope you enjoy the course. GOOD LUCK

WHAT TO DO WHEN THIS COURSE IS FINISHED?
Note that part of the material of this course will be complemented by other Advanced Econometrics courses offered in this PhD program. Particularly I encouraged all of you to take the Topic Courses on Introduction to Empirical Processes (by W. Stute and or Juan Carlos Escanciano), Introduction to Bootstrap (by E. Paparoditis), Stochastic Calculus (by D.Nualart), etc. These courses are NOT only designed for those students thinking on writing a dissertation on Econometrics. The courses will be useful for anyone aiming to write a good dissertation in Economics.