14E026
Advanced Econometric Methods III

Prerequisites to Enroll
Advanced Econometrics I and II are prerequisites for this course.

Overview and Objectives
This is an advanced course in time series econometrics. We examine the models and statistical techniques used to study time series data in economics. The course is intended to fulfill two needs: (1) to provide students with applied interests with up-to-date techniques used in empirical time series analysis, and (2) to introduce students with more theoretical inclinations and those who are likely to use time series in their Ph.D. work to the tools that are used to derive some of the more interesting results.

The first block of the course introduces the students univariate time series processes and presents some important results. The second block focuses on estimation and inference for univariate models, deriving the limit distribution for the OLS estimator in autoregressive models under stationary, unit root and explosive setups. The third block extends the stationary analysis to multivariate modeling, and discusses further topics such as likelihood estimation, state space models, Bayesian methods, and applications to dynamic stochastic general equilibrium models.

Course Outline

**Part I: Univariate time series processes**
Univariate time series
ARMA processes
Covariance stationarity and the Wold representation theorem
Martingales and martingale differences
WLLNs for covariance stationary processes, Martingale convergence theorem, and Martingale CLT

**Part II: Estimation and inference for univariate time series processes**
Estimation and inference with univariate stationary models, explosive processes, and unit root processes
Spurious regression and univariate cointegration regression

**Part III: Multivariate time series models and Applications**
Estimation and inference with covariance stationary vector time series
Structural analysis with VARs
Forecasting and Bayesian VARs
Likelihood estimation, state space modeling and the Kalman filter
Estimation and inference with DSGE models
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Required Activities
The course comprises four hours of lecture each week. In addition, students will complete weekly problem sets and hand them in before the TA-sessions. The problem sets will have a theoretical component and an applied component. For the applied part students will need to use Matlab. Students are also required to read the required chapters and papers marked by (*).

Evaluation
Grades will be based on the problem sets (40%) and the final exam (60%).

Competences
☐ Capacity of utilization of the theoretical instruments of the to analyze situations of coherent form.
☐ Ability to use the appropriate (statistical and numerical) techniques.
☐ Ability to identify and successfully search for the data necessary for the analysis, either grossly or in the form of more elaborate databases.
☐ Ability to make independent judgments and defend them dialectically.
☐ Ability to write formal reports.
☐ Acquire a solid knowledge base for the study of quantitative issues.
☐ Ability to Recognize and know how to use the principles of econometrics and statistics.
☐ Ability to work with microeconomic analysis tools and their empirical and theoretical applications.

Learning Outcomes
☐ Students should get an overview of economic and financial theory.
☐ Students must be able to recognize theories and present arguments with precise examples.
☐ Students will have the ability to understand how markets work and explain their weaknesses.
☐ Students will acquire the technical tools that will allow them to perform the advanced analytics required in the second module as econometric methods.
Students will know what the appropriate inference for each situation is.

**Materials**

**Textbooks:**

Tsay, R. S Analysis of Financial Time Series, University of Chicago

**Course Outline**

**Part I: Univariate time series processes**
L1: Univariate time series, Covariance Stationarity
L2: ARMA processes
L3: Linear processes and the Wold Representation theorem
L4: Martingales and Martingale differences
L5: Limit theorems: WLLNs, Martingale convergence theorem, and Martingale central limit theorem

**Part II: Estimation and inference for univariate time series processes**
L6: Estimation and inference with univariate stationary models
L7: Long-run variance estimation for I(0) processes
L8: Estimation and inference with explosive processes
L9: Functional central limit theorem: estimation and inference with unit root processes
L10: Spurious regression and univariate cointegrating regression

**Part III: Multivariate stationary time series models and applications**
L11: Stationary vector time series processes, VARMA processes
L12: Estimation and inference with covariance stationary vector time series
L13: Structural VARs and Applications
L14: Forecasting with VARs
L15: Bayesian VARs
L16-L17: Maximum likelihood, state space modeling and the Kalman filter with applications
L18-L19: DSGE models: solution, estimation and inference