OUTLINE OF GRADUATE ECONOMETRICS SEQUENCE

The following provides a rough overview of the graduate econometrics sequence. Of course, the specific selection of topics, etc., will be determined by the respective instructors. While rigorous the sequence of Econometrics I-IV is geared **towards the training of applied economists**. The aim is to enable students to read intelligently all empirical research (with a proper understanding of the underlying methodology of inference), and to conduct empirical research suitable for publication in any economics or econometrics journal. Econometrics I and II are required courses. Econometrics III and IV, offered in the second year, are recommended for and geared towards students broadly interested in macro and micro econometric topics, respectively. Students interested in econometrics as a field are encouraged to take both Econometrics III and IV. Students interested in working on theoretical econometric topics are advised to consult with the econometrics faculty early on in their studies.

COURSE DETAILS

Introduction to Probability and Statistics (summer prior to 1st year)
> This course provides an introduction to basic concepts in mathematical statistics, and lays a foundation for a rigorous discussion of econometric methods. Topics include: probability measure, random variables, density and distribution functions, expectations, moment generating functions, conditional distributions, independence, distribution of functions of random variables, parameter estimators, hypothesis testing, sufficient statistics, asymptotic distribution theory. This course is offered in the summer and is intended to help students fulfill the probability and statistics prerequisite.

Econometrics I (Econ 623, 1st year, fall; required)

- Classical Linear Regression Model (specification; algebra of OLS estimation; coefficient of determination; basic concepts of finite sample analysis; finite sample properties of OLS and hypothesis tests; basic concepts of large sample analysis; asymptotic properties of OLS and hypothesis tests; multicollinearity, partial and multiple correlation coefficients; scaling and units of measurement; functional form; some issues of misspecification)
- Instrumental Variable Estimation (inconsistency of OLS; asymptotic properties of IV; two stage least squares; Hausman specification test)
- Generalized Linear Regression Model (True GLS estimator; Aitken theorem; feasible GLS estimator; finite sample properties of GLS and hypothesis tests; asymptotic properties of GLS and hypothesis tests; autocorrelation; heteroskedasticity; seemingly unrelated regression).
- Quantile Regression Models (Median and quantile regression; least absolute deviation estimator; asymptotic properties)
- Econometric software planned to be used in this course is TSP, Stata, or another major econometric package.

Econometrics II (Econ 624, 1st year, spring, required)
- Classical Nonlinear Models (consistency and asymptotic normality of extremum estimators (or M-estimators); nonlinear least squares; maximum likelihood estimation (with applications to discrete response models, censored regression models, count data models, etc.); generalized method of moments estimation (with applications to 2SLS, 3SLS, etc.); numerical optimization methods)
- Panel Data Models (Fixed and random effects panel data models, within estimator; between estimator; GLS estimator; dynamic panel data models, IV estimator)
- Univariate Dynamic Models
  - Autoregressive regression models (autoregressive regression model with i.i.d. errors and with autocorrelated errors, autoregressive distributed lag models, error correction model)
  - Stationary time series (stationary stochastic processes; ARMA processes; auto and partial autocorrelation function; prediction of ARMA processes; estimation of ARMA processes)
  - Nonstationary time series (unit root processes; trend stationary processes; tests for unit rots)

- Multivariate Dynamic Models
  Dynamic Linear Simultaneous Equation Models (Simultaneous equation bias; identification; OLS of structural and reduced form parameters; limited information and full information instrumental variable estimation (2SLS, k-class estimator, LIVE, 3SLS, FIVE); FIML estimator and structure of simultaneous equation; estimation of stationary vector autoregressive (VAR) processes)
- Nonparametric/Semiparametric Methods
- Econometric software planned to be used in this course is Stata

Econometrics III (Econ 721, 2nd year, fall)

This course is oriented towards macro-econometric methods. Topics covered in this course will be selected from the following:
- More on GMM and ML
- More on Stationary Multivariate Time Series Models
- More on Nonlinear Time Series Models
- Exogeneity and Causality
- Non-stationary Time Series Models (Unit roots, co-integration, the error correction model, vector autoregressive (VAR) models)
- Econometric Models of Volatility (Autoregressive conditional heteroskedastic (ARCH) models, generalized ARCH (GARCH) models, and stochastic volatility model)
- Non-stationary Time Series Models (Unit roots, co-integration, the error correction model, vector autoregressive (VAR) models, autoregressive and conditional heteroskedastic (ARCH) models, and generalized ARCH (GARCH) models.)
- Rational Expectations Models
- Non-stationary Panel Data (unit root tests for panel data; residual based co-integration tests for panel data; co-integration panel estimation; spurious panel regression)
- Tests for Structural Change (tests for breaks in coefficients in time series regression; tests based on recursive coefficient estimates and recursive residuals; tests against time-varying parameter model; tests for trend breaks)
- Bayesian Econometrics and Methods for Bayesian Computation (Laplace approximation; importance sampling; Metropolis-Hasting algorithm; Gibbs sampling)

Econometrics IV (Econ 722, 2nd year, spring)

This course is oriented towards micro-econometric methods. Topics covered in this course will be selected from the following:
- More on GMM and ML (and their relation to "calibration methods")
- Binary Response Models (single equation, multiple equations, randomized experiment models)
- Multinomial Response Models
- Censored and Truncated Regression Models
- Sample Selection Models
- Count Data Models
- Duration Models
- Program Evaluation and Treatment Effects Methods
- Structural Econometrics
- The Identification Problem
- Stratified and Clustered Samples
- Spatial Models (Cross Sectional Dependence)
- Dynamic Panel Data Models
- Weak Instruments
- Non-parametric estimation
- Boot strap and Jack Knife methods

- Pre-test estimators

APPLIED MICRO AND MACO ECOMETRICS

In addition to Econometrics I-IV the Department plans to offer Applied Micro Econometrics (ECON 626) and Applied Macro Econometrics (ECON 627). They should not be viewed as substitutes, but as compliments to the above courses. Taking one of the applied econometrics courses is strongly recommended.

ADVANCED TOPICS COURSES

Depending on resources the Department may offer also advanced topics courses in econometrics. Possible advanced topics courses could be:

Advanced Topics in Econometrics:
Treatment Effects: Theory and Applications
Advanced Topics in Econometrics:
Computationally Intensive Methods in Econometrics: Structural Model Estimation, Bootstrap, Method of Simulated Moments, Non-parametric Estimation

Student feedback would be most welcome.