Econ 616: Macroeconometrics – Fall 2019

Instructor

Ed Herbst ed.herbst@gmail.com | website

Course Time and Location

Class will meet once a week Tuesdays from 6:30p-9:00 for lecture.

Course Description

The course is an introduction to univariate and multivariate time series models. Time domain methods, including VAR's, structural VAR's, Bayesian VAR's for linear models and GMM for non-linear stationary models are covered. An introduction to non-stationary time series models is given. Frequency domain methods and their applications to business cycle inference is also covered. The course starts by introducing basic concepts and progresses to more complicated models. The course intends to meet two goals. It provides tools for empirical work with time series data, mostly for macroeconomic applications and provides a heuristic introduction into the theoretical foundation of time series models.

Webpage

Course documents and information are available via canvas.

Course Requirements

Prerequisites: Econ 613 and 614.

Assessment. Your grade will be equally weighted based on problems sets and a final exam.

- *Problem Sets:* [50%] There will be approximately 6 problem sets assigned during the semester. The problem sets are designed to give the students the opportunity to review, enhance, and extend the material learned in class. Students are encouraged to form small study groups, however, each student has to submit his or her own write-up of the solution. These solutions must be submitted on the specified due dates.
- *Final Exam:* [50%] (take home)

Programming and Computation. Macroeconometrics is an intensely computational field. It is important to be proficient in at least one interpeted programming language popular in economics. The assignments will require (some) light programming. I'll say more about this on the first day of class.

Course Text

There is no one textbook that exactly matches the material covered in class. I will make my lecture notes available on the internet. You should get a copy of Hamilton [1994], which broadly classical approach to time series analysis (and some Bayesian analysis).

- James Hamilton. *Time Series Analysis.* Princeton University Press, Princeton, New Jersey, 1994

Other textbooks that you might find helpful are.

General Econometrics

- Takeshi Amemiya. *Advanced Econometrics.* Harvard University Press, 1985
- Halbert White. *Asymptotic Theory For Econometricians.* Academic Press, 2001
- F. Hayashi. *Econometrics.* Princeton University Press, 2011. ISBN 9781400823833. URL https://books.google.com/books?id=QyIW8WUIyzcC

Time Series Analysis:

- Peter J. Brockwell and Richard A. Davis. Time series: Theory and methods. *Springer Series in Statistics*, 1987. ISSN 0172-7397. doi: 10.1007/978-1-4899-0004-3. URL http://dx.doi.org/10.1007/978-1-4899-0004-3
- A.W. Lo Campbell, J.Y. and A.C. MacKinlay. *Econometrics of Financial Markets.* Princeton University Press, Princeton, 1997
- C.W.J. Granger and P. Newbold. *Forecasting Economic Time Series.* Academic Press, ., 1987
- A.C. Harvey. *The Econometric Analysis of Time Series.* MIT Press, Cambridge, 1990

Modern Macroeconometrics

- Fabio Canova. *Methods for Applied Macroeconomic Research.* Princeton University Press, 2007
- Dave Chetan and David DeJong. *Structural Macroeconometrics.* Princeton University Press, 2011
- Edward Herbst and Frank Schorfheide. *Bayesian Estimation of DSGE Models.* Princeton University Press, Princeton, 2015

Bayesian Statistics and Econometrics

- Andrew Gelman, John B. Carlin, Hal S. Stern, and Donald B. Rubin. *Bayesian Data Analysis*. Chapman & Hall/CRC, second edition, 2003,
- John Geweke. *Contemporary Bayesian Econometrics and Statistics*. John Wiley & Sons, Inc., 2005,
- Gary Koop. *Bayesian Econometrics*. John Wiley & Sons, Inc., 2003,
- Tony Lancaster. *An Introduction to Modern Bayesian Econometrics*. Blackwell Publishing, 2004,
- Christian P. Robert. *The Bayesian Choice*. Springer-Verlag, New York, 1994

Course Outline

Note: This course outline is subject to change during the semester!

Time Series Models

- **Stationary ARMA Processes**

  Topics: Estimation and Serial Dependence, Empirical Measures of Dependency; Covariance Stationarity, Stationarity and Ergodicity; Martingales and Martingale Difference Sequences Theoretical Properties: Moving Average Processes Theoretical Properties: Autoregressive Models.

  Readings: Hamilton, Chapter 1 - 3;

  Literature: Eugen Slutzky. The summation of random causes as the source of cyclic processes. *Econometrica*, 5(2):105–146, 1937. URL http://www.jstor.org/stable/1907241

- **Analysis of Difference Stationary Time Series**

  - Analysis of the Deterministic Trend Model: Rates of Convergence, OLS
  - Autoregressive Models with a Unit Root
  - Testing for Unit Roots
  - Unit Roots from the Frequentist and the Bayesian Perspective
  - Cointegration and Error Correction Models

- **Introduction to Spectral Analysis + Extremum Estimation**

  - Typical Spectrum of Macroeconomic Time Series
  - Spectral Representation for the Linear Cyclical Model
  - Spectral Representation for Stationary Processes
  - Filters
  - Spectral Estimation
  - Generalized method of moments and maximum likelihood estimation interpreted as extremum estimation.

- **Vector Autoregressions**

  - VAR extension of AR(p) model

– Estimation of VARs

– Forecasting with VARs

Literature: Christopher A. Sims. Macroeconomics and reality. *Econometrica*, 48(4): 1–48, December 1980. URL http://ideas.repec.org/a/ijc/ijcjou/y2007q4a4.html

Valerie Ramey. Macroeconomic shocks and their propagation. Feb 2016. doi: 10. 3386/w21978. URL http://dx.doi.org/10.3386/w21978

• **Bayesian Analysis of Linear Time Series Models**

– Introduction to Bayesian Statistics: Point Estimation, Testing Theory

– Bayesian Analysis of AR Models

– Bayesian Model Selection: Determining the Order of an AR process

– Markov-Chain Monte Carlo Methods to Generate Draws from Posteriors

• **State Space Models**

– Bayesian Interpretation of the Kalman Filter

– Computing likelihood functions for LRE models

– Nonlinear Models: Markov-Switching

• **Factor Models**

– Principal Components Analysis

– Dynamic Factors

– Determining Number of Factors

– Factor Augmented VAR

Literature: James H. Stock and Mark W. Watson. Dynamic factor models. *Oxford Handbooks Online*, Jul 2011. doi: 10.1093/oxfordhb/9780195398649.013.0003. URL http://dx.doi.org/10.1093/oxfordhb/9780195398649.013.0003

Domenico Giannone, Lucrezia Reichlin, and Michele Lenza. Explaining the great moderation: It isn't the shocks. *Journal of the European Economic Association*, 6(2-3):621 – 633, 2008

Structural Models

- **Structural VARs**

    - Identification

    - Algorithms for Inference

    - Extensions: MS-VAR, TVP-VAR, Proxy-SVAR

- **Linear (and Nonlinear) Rational Expectations (LRE) Models**

    - LRE models as approximations to dynamic stochastic equilibrium (DSGE) models.

    - Moment-based Estimation of linear and nonlinear rational expectations models

    - Likelihood-based Estimation of LRE models.

- **Hybrid Models**

    - DSGE-VARs

    - DSGE-DFM

    - Proxy SVAR

- **Semiparametric Models, Macro with Microdata**

    - Local Projections

    - HANK

Advanced Topics

- **Monte Carlo Methods**

    - Sequential Monte Carlo for static parameters

    - Particle Filtering

    - Advanced MCMC

References

James Hamilton. *Time Series Analysis.* Princeton University Press, Princeton, New Jersey, 1994.

Takeshi Amemiya. *Advanced Econometrics.* Harvard University Press, 1985.

Halbert White. *Asymptotic Theory For Econometricians.* Academic Press, 2001.

F. Hayashi. *Econometrics.* Princeton University Press, 2011. ISBN 9781400823833. URL https://books.google.com/books?id=QyIW8WUIyzcC.

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James H. Stock and Mark W. Watson. Dynamic factor models. *Oxford Handbooks Online*, Jul 2011. doi: 10.1093/oxfordhb/9780195398649.013.0003. URL http://dx.doi.org/10.1093/oxfordhb/9780195398649.013.0003.

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