Empirical Analysis 2, Econ 311. Winter 2019

Prof. Harald Uhlig, huhlig@uchicago.edu, off. hours Wedn 11:00-12:00.
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January 3, 2019

Abstract

This course introduces Bayesian econometrics and provides an introduction to time series analysis. We start from decision-theoretic approach and develop a Bayesian perspective. Conjugate priors as well as numerical approaches such as Markov-Chain-Monte-Carlo (MCMC) methods, the Metropolis-Hastings algorithm and Gibbs sampling are discussed ("Topic 3"). Building on the Bayesian approach, the Kalman Filter is developed. The Kalman Filter as well as the Normal-Wishart distribution is applied to the analysis of Bayesian vector autoregressions (BVARs) ("Topic 4"). This leads into an introduction to time series analysis and its key concepts. First, a univariate perspective is provided. Autoregressive (AR) and Moving Average (MA) processes are introduced. Students will learn lag operator calculus, the Wold decomposition theorem, spectral analysis and their interrelationship. An introduction into unit root econometrics is provided, including the functional central limit theorem and a comparison of the classical to the Bayesian approach ("Topic 5"). In the multivariate setting, the focus is on vector autoregressions (VARs). Cointegration is introduced. The challenge of identifying economically meaningful shocks is explained ("Topic 6").

Book recommendations

The course will be largely self-contained. The references should prove useful, though, for providing clarifications, more in-depth material, further ramifications or for further study and own research.

Main recommendations: Kilian and Lütkepohl (2018), Hamilton (1994).
Further recommendations: Greene (2003), Hayashi (2000), Lütekpohl (2005), Davidson and MacKinnon (2004), Ruud (2000), Canova (2007), Dejong and Dave (2011), Geweke (2005), Zellner (1996), Box and Tiao (1992), Leamer (1978), Billingsley (1995), Dunford and Schwartz (1988), Wooldridge (2002), Amemiya (1985), Berger and Wolpert (1988), Muirhead (1982), Bickel and Doskum (1976)

Grading and Exams

1. Unless announced otherwise, Monday and Wednesdays are lectures, Fridays are TA sessions. There is no class on Monday, January 21st, due to observance of the Martin Luther King day.
2. There will be a mid-term on Wednesday, February 6th, in class, determining the exam grade portion for the first half of the quarter.
3. The final exam will cover the material of the second half, taught by Lars Hansen.
4. There will be homeworks. Groups of two are allowed, but not three or more. Homeworks will be posted no later than Thursday evening and are due Monday morning, before class.
5. Grading for the first half: 40% homework, 60% midterm.

Course Outline

1. Bayesian Inference
   (a) The Likelihood Principle
   (b) Admissibility and Bayes estimators.
   (c) Exponential families, conjugacy, priors.

(d) Markov-Chain-Monte-Carlo (MCMC) in general.
(e) Metropolis-Hastings algorithm
(f) Gibbs-sampling
(g) Dynare

Main references: Berger and Wolpert (1988), Robert (2001), Box and Tiao (1992), Bickel and Doskum (1976)

Further references: , Fan (1952) Ferguson (1967), Berger (1985), Canova (2007),Dejong and Dave (2011), Geweke (2005), Smets and Wouters (2003), Zellner (1996), Leamer (1978), Muirhead (1982),

2. The Kalman Filter and BVARs

   (a) Two useful lemmas.
   (b) The state space system.
   (c) The Kalman Smoother.
   (d) BVARs per Kalman Filtering.
   (e) BVARs per Normal-Wishart distributions.

   Main references: Kilian and Lütkepohl (2018), Hamilton (1994), Uhlig (1994)

   Further references: Robert (2001), Bauwens, Lubrano, and Richard (2003), Canova (2007), Zellner (1996), Box and Tiao (1992), Gamerman and Lopes (2006), Sims and Uhlig (1991), Greene (2003), Lütekpohl (2005), Dejong and Dave (2011), Kim and Nelson (1999), Geweke (2005),

3. Univariate time series analysis.

   (a) Lag Operator Calculus.
      i. ARs, MAs, ARMAs
      ii. Autocovariances
      iii. The characteristic polynomial
      iv. Wold decomposition
      v. Forecasting and impulse responses

(b) Spectral theory

   i. Fourier transforms

   ii. The spectrum

(c) Unit roots

   i. Some terminology

   ii. The functional central limit theorem

   iii. The spectrum at frequency zero

   iv. A Bayesian perspective

References: Kilian and Lütkepohl (2018), Greene (2003), Hayashi (2000), Hamilton (1994), Lütekpohl (2005), Sims and Uhlig (1991), Sargent (1979)
Further References: Yule (1927), Slutsky (1937), Box and Tiao (1992), Hayashi (2000), Leeper, Walker, and Yang (2009), Brock, Dechert, Scheinkman, and LeBaron (1996)

4. Multivariate time series analysis.

(a) Roots, impulse responses and cointegration

   i. The characteristic polynomial

   ii. Impulse responses

   iii. Cointegration and error correction

(b) Identification of shocks

   i. Cholesky decompositions, structural VARs

   ii. Sign restrictions

   iii. An application: monetary policy shocks.

References: Kilian and Lütkepohl (2018), Greene (2003), Hayashi (2000), Hamilton (1994), Uhlig (2005), **?**), Sims and Zha (1999), Tao Zha's code:

`https://webdrive.service.emory.edu/users/tzha/ProgramCode/ProgramCode.html`

Further References: Yule (1927), Slutsky (1937), Sims (1980), Zha (1999), Box and Tiao (1992), Lütekpohl (2005), Blanchard and Quah

(1989), Cocrhane (1994), Leeper, Sims, and Zha (1996), Christiano, Eichenbaum, and Evans (1999), Barsky and Sims (2010), Lettau and Ludvigson (2004), Dejong and Dave (2011), Gali (1999), Fisher (2006)

5. Topics and applications of time series analysis.

   (a) To be announced.

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