University of Illinois at Urbana-Champaign, Department of Economics

Syllabus, ECON 577, Spring 2014

Instructor: Andriy Norets (anorets@illinois.edu)

Lectures: Tuesday and Thursday, 3:30-4:50pm, 317 David Kinley Hall

Office Hours: Thursday 5-6pm, 109 David Kinley Hall

Course Description: This course will cover a number of topics in Bayesian econometrics starting with introductory textbook material. A tentative list of topics with corresponding readings is given below. This list will be updated as we go along. Readings marked with asterisk * are not required. A lot of topics will be based on the following textbook: Geweke, 2005, Contemporary Bayesian Econometrics and Statistics (denoted by G bellow).

Grading: The grade for the course will be based on problem sets. The problem sets will include analytical and numerical problems. The numerical problems will require the use of a programming language, such as Matlab or R.

Useful books:

- Ferguson (1967) and Berger (1985) are books on statistical decision theory and Bayes.
- Berger and Wolpert (1984) contains good critique of frequentist procedures.
- Lancaster (2004) and Koop (2003) are introductions to Bayesian econometrics.
- Gelman et al. (2003) is a book on Bayesian statistics.
- Ghosh and Ramamoorthi (2003) - frequentist properties of Bayesian nonparametric procedures.

List of topics

1. Bayesian approach to inference
   - 1.1 Probability as a degree of belief
   - 1.2 Conditioning
   - 1.3 Bayesian Modelling: ingredients, complete model, estimation, credible sets, model comparison (G Ch 2);
   - 1.4 Prior distributions: conjugate, non-informative, hierarchical (G Ch 3.1, 3.2; Berger (1985)*, Ch 3*; Bernardo (1979)*, Berger et al. (2009)*);
2. Frequentist asymptotic properties of posterior distributions in parametric Bayesian models

2.1 Posterior consistency (G 3.4, Ghosh and Ramamoorthi (2003)*)

2.2 Posterior asymptotic normality / Bernstein-von Mises theorem (G 3.4, Ghosh and Ramamoorthi (2003)*)

2.3 Laplace approximations and BIC (Kass (1993)*), consistency of BIC (Hong and Preston (2012)*)

3. Simulation methods for Bayesian inference

3.1 Basic simulation methods: pseudo random numbers, inverse cdf method, acceptance and importance sampling (G Ch 4);

3.2 Intro to MCMC, Gibbs sampling, Metropolis-Hastings, and Hybrid MCMC algorithms (G Ch 4);

3.3 Econometric models: linear models, models with latent variables, hierarchical models for heterogeneity, time series models, SUR, mixtures of distributions (G Ch 5, 6, 7)

3.4 Practical issues: implementation checks, convergence testing, numerical accuracy, improving mixing, variance reduction, (G Ch 4.4, 4.7, 8.1).

3.5 MCMC for classical inference (Chernozhukov and Hong (2003)).

3.6 Unbiased likelihood simulation and MH (Flury and Shephard (2011))

3.7 Computing marginal likelihood (G Ch 8.2)

4. Foundations of Bayesian approach to inference

4.1 Subjective probability and utility (Ferguson (1967))

4.2 Frequentist decision theory and complete class theorem (Ferguson (1967), Berger (1985)*)

4.3 Confidence sets and betting (Müller and Norets (2012))

4.4 Likelihood principle (G Ch 1, 3.5; Berger and Wolpert (1984), Ch 1-3);

4.5 De Finetti theorem (Heath and Sudderth (1976)*);

5. Bayesian bootstrap

(Rubin (1981), Lancaster (2003), Poirier (2011), Chamberlain and Imbens (2003))

6. Bayesian nonparametrics: Dirichlet process priors

6.1 Introduction (Ghosh and Ramamoorthi (2003), Ch 3; Ferguson (1973), Sethuraman (1994));

6.2 Applications (Escobar and West (1995); Hirano (2002)*; Conley et al. (2008)*)

7. Bayesian nonparametrics: Gaussian process priors

G 5.4.1, Rasmussen and Williams (2006)*

8. Estimation of dynamic discrete choice models

8.1 Rust (1994); survey by Aguirregabiria and Mira (2010); Hotz and Miller (1993);

8.2 Bayesian inference (Norets (2009), Norets and Tang (2010))

9. Theory of MCMC

   Tierney (1994), Roberts and Rosenthal (2004)

10. Frequentist asymptotic properties of posterior distributions in nonparametric models

    Ghosh and Ramamoorthi (2003) Ch4

11. Some applied papers

    11.1 Dehejia (2005) - an application of Bayesian decision theory

    11.2 Barberis (2000) - taking into account parameter uncertainty

References

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