SYLLABUS FOR AAEC6564
"BAYESIAN ECONOMETRIC ANALYSIS"

INSTRUCTOR: KLAUS MOELTNER

Contact Information:

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Course Information:

location:	Davidson 201
time:	TR 11:00am - 12:15pm
office hours:	TR, 1-2pm or by appointment

PREREQUSITES:
AAEC 5126 or STAT 5304 or STAT 5444 (or talk to me....)

Course Description and Objectives

This course is primarily designed for PhD students in Agricultural and Applied Economics (AAEC) and Economics (ECON) beyond their first year. It should also be suitable as an elective for graduate students in Statistics (STAT) with an interest in applied Bayesian modeling.

The primary objective of the course is to implement commonly used econometric models in a Bayesian estimation framework. Examples are panel data models, models to detect selection and treatment effects, and models with otherwise limited dependent variables. We will focus on applications where the Bayesian approach brings clear advantages over classical methods, such as estimation under small samples, strong prior information, or model uncertainty. A parallel goal is to instill fluency in Bayesian computational sampling and simulation, most notably Markov-Chain Monte Carlo (MCMC) methods. We will use the software package `Matlab` for this purpose. Students will program all algorithms "from scratch" to become familiar with all model components and details. Throughout the course, we will work with "real-world" empirical data sets from various fields of economics.

Textbooks

I will be primarily using my own lecture notes and sample `Matlab` code (posted on the web as we move along), but I recommend the following textbooks as useful reference and background sources:

(1) Koop et al. (2007): An applied Bayesian text that is light on theory and heavy on intuition, examples, and practice.
(2) Koop (2003). Similar to Koop et al. (2007), but with more details on methodologies and techniques.
(3) Gelman et al. (2004). A comprehensive, all-around reference for Bayesian methods. Nice appendix with explicit forms for many density functions.

For those of you interested in the statistical origins and fundamentals of Bayesian analysis, I recommend STAT 5444 "Bayesian Statistics", taught by our Statistics Department. Two introductory textbooks used in that course, with focus on statistical foundations of Bayesian methods, are:

(1) Hoff (2009): Very accessible, with detailed derivations.
(2) Berger (2006): Focus on decision theory and Bayes

Other Bayesian textbooks I use here and there:

(1) Robert (2007): Decision theory
(2) Albert (2009): Using R for Bayesian analysis
(3) Robert and Casella (2010): Using R for Bayesian-style simulation methods

1. Grading and Other Administrative Issues

Grading. There will be 6 problem sets that can be completed in team work. However, everybody needs to hand in an individual version. You can earn up to 20 points for each PS for a total of 120 points. The 6^{th} problem set has to be handed in on May 8, between 10:05am and 12:05am in lieu of a final exam.

Student conduct. The Virginia Tech honor system applies to all graded work in this course. For more information, visit http://www.honorsystem.vt.edu

Students with disabilities. Please let me know if you have a documented disability, so we can provide any accommodations you may need.

References

Albert, J. (2009). *Bayesian computiation with R*, 2nd edn, Springer.
Berger, J. (2006). *Statistical decision theory and Bayesian analysis*, 2nd edn, Springer.
Gelman, A., Carlin, J., Stern, H. and Rubin, D. (2004). *Bayesian Data Analysis*, 2nd edn, Chapman & Hall/CRC.
Hoff, P. (2009). *A first course in Bayesian statistical methods*, Springer.
Koop, G. (2003). *Bayesian Econometrics*, Wiley.
Koop, G., Poirier, D. and Tobias, J. (2007). *Bayesian Econometric Methods*, Cambridge University Press.
Robert, C. (2007). *The Bayesian choice*, 2nd edn, Springer.
Robert, C. and Casella, G. (2010). *Introducing Monte Carlo methods with R*, 1st edn, Springer.

Semester Schedule for AAEC6564, Spring 2020
(subject to adjustments)

Week	Dates	Topic	References*	PS's / Exams
Module 1: Introduction to Bayesian Inference				
1	Jan. 23**	Bayesian model components	K. 1, KPT. 1,2	
2	Jan. 28, 30	Comparison to classical methods / MLE	KPT. 4	
Module 2: Gibbs Sampling				
3	Feb. 4, 6	Convergence plots and diagnostics; Autocorrelation plots	K. 4, KPT. 11	
4	Feb. 11**	Effect of: sample size, priors, starting values, blocking; Monte Carlo Integration		PS1 due Feb. 11
Module 3: Coverage and Prediction in Bayesian Analysis				
5	Feb. 18, 20	Interval Estimation	KPT. 5	
6	Feb. 25, 27	Posterior Predictive Densities	KPT. 7	
Module 4: Bayesian Model Comparison				
7	Mar. 3, 5	Bayes Factors; Savage-Dickey Density Ratio	K. 4,6; KPT. 5,13	PS2 due Mar. 5
8	Mar. 17, 19	Gelfand-Dey method; Chib method		
Module 5: Hierarchical Models, Data Augmentation				
9	Mar. 24, 26	Concepts and tools	K. 7, KPT. 12	PS3 due Mar. 26
10	Mar. 31, Apr. 2	Specific models		
Module 5: Metropolis-Hastings Methods				
11	Apr. 7, 9	MH with random walk chains	K. 5, KPT. 11	
12	Apr. 14, 16	MH with tailored proposal densities		PS4 due Apr. 16
Module 6: Bayesian Model Search and Model Averaging				
13	Apr. 21, 23	MC3 Method	K. 11, KPT. 16	
14	Apr. 28, 30	SSVS method		PS5 due Apr. 30
Module 7: Finite Mixture Models				
15	May 5	Multinomial and Dirichlet priors	KPT. 15	
16	May 8			PS6 due, hand in between 10:05 am - 12:05 pm

*K=Koop, KPT=Koop, Poirier,Tobias / **Instructor out of town on Jan. 21 and Feb. 13