

**Bayesian Econometrics****Course Description and Outline*****Subject Matter:***

This course provides a graduate level introduction to Bayesian econometrics. We begin with a basic introduction to the Bayesian approach, and then examine how familiar estimation problems can be recast in a Bayesian light. Emphasis is practical technique, rather than philosophical questions.

***Gauchospace site:***

<https://gauchospace.ucsb.edu/courses/course/view.php?id=15613>

***Prerequisites:***

You should have had the first year graduate sequence in econometrics, Economics 241A/B/C.

***Instructor:***

Professor Dick Startz, [startz@ucsb.edu](mailto:startz@ucsb.edu), office hours: Tuesday 2:00-3:00 or knock on door. Office: North Hall 3038.

***Course Requirements:***

The required text for the course is: *Bayesian Econometrics*, by Gary Koop, John Wiley & Sons.

There are three basic course requirements:

1. Do all the questions in the “Class Questions” document. (Some of these are easy, some are quite hard and will take considerable time.) Be prepared to *teach* the answer to each question, including explaining how your Matlab code works. I will call on someone randomly to present each question (unless someone is looking sheepish, in which case they’re more likely to get picked.) *Bring slides and code with you to each class!* After class, whoever is called on should upload slides and Matlab to Gauchospace.
  - a. I expect graduate students to work together. You may also find useful code online. At the same time, you are supposed to do each assignment yourself—not using canned code.
  - b. Questions are often due on the day that we discuss the underlying material. Looking ahead in the slides may be helpful.
  - c. Each question is marked as to the lecture where it will be presented, but don’t be surprised if we fall behind.

2. Write a term paper. The term paper is due March 24 at 8:00am. You can choose from three general types of topics: (1) A short research paper that uses Bayesian techniques in a meaningful way; (2) An expository paper teaching some more advanced Bayesian technique, generally with an illustrative application; or (3) A replication study, in which you reproduce a published Bayesian paper—recoding programs, etc., as part of the replication.
  - a. A one paragraph proposal is due to me Friday, February 3 at 8am. Feel free to submit earlier.
  - b. The term paper is due March 24 at 8:00am and must be in Microsoft Word or a pdf.
  - c. Sign up for a 35 minute discussion slot in which the class will go through your rough draft on GauchoSpace.
  - d. Post your “rough draft” to GauchoSpace *three days* before your paper is scheduled to be discussed.
  - e. It is very tempting to go as late in the term as possible. But remember that you are going to get feedback from your classmates and from me that you can use to improve the final paper. Getting feedback early is an advantage.
3. Edit and discuss everyone else’s rough draft. Download the rough draft from GauchoSpace for editing and commenting. Comments should be constructive. They should not be “evaluative.” We will go around the room to give everyone a chance to make substantive comments.
  - a. Provide printed copies of your comments at the class section where the paper is discussed. One copy to the author and one copy to me. Copy-editing type comments should be included in the printed copy but not discussed orally.
  - b. Remember that you have a rough draft. Your goal is to be helpful to a classmate. And, of course, to impress me with how thorough and helpful you can be.

### A somewhat random collection of other useful things you might want to read

(There are thousands of articles and books using or extending Bayesian techniques. Rather than providing a reading list, I'm just mentioning a few items to get you started. They are in no particular order. Pick a few that you think will be useful to you.)

- Sharon McGrayne, *The Theory That Would Not Die: How Bayes' Rule Cracked the Enigma Code, Hunted Down Russian Submarines, and Emerged Triumphant from Two Centuries of Controversy*.
- Edward Greenberg, *Introduction to Bayesian Econometrics*, 2<sup>nd</sup> edition, Cambridge University Press.
- Dale J. Poirier, *Intermediate Statistics and Econometrics*, MIT Press.
- John Geweke, Gary Koop, and Herman Van Dijk, *Oxford Handbook of Bayesian Econometrics*, Oxford University Press.
- Gary Koop, Dale J. Poirier, and Justin L. Tobias, *Bayesian Econometric Methods*, Cambridge University Press.
- Luc Bauwens, Michel Lubrano, Jean-François Richard, *Bayesian Inference in Dynamic Econometric Models*, Oxford, 1999.
- Andrew Gelman, John Carlin, Hal Stern, David Dunson, Aki Vehtari, and Donald Rubin, *Bayesian Data Analysis*, 3<sup>rd</sup> edition, Taylor & Francis, 2013.
- Sui Luo and Richard Startz, "Is It One Break or Ongoing Permanent Shocks that Explains U.S. Real GDP?," *Journal of Monetary Economics*, 2014.
- J. Durbin and S.J. Koopman, *Time Series Analysis by State Space Methods*, Chapter 8, "Bayesian Analysis," Oxford University Press, 2001.
- Richard Startz, "Choosing the More Likely Hypothesis," *Foundations and Trends in Econometrics*, Vol. 7, No. 2, 2014.
- Richard Startz, "The Next Hundred Years of Growth: Growth and Convergence," UCSB working paper 2016.
- Andrew Gelman and Christian Robert, "'Not Only Defended But Also Applied': The Perceived Absurdity of Bayesian Inference," *The American Statistician*, (also comments following) February 2013.
- \_\_\_\_\_, "Special Issue: Bayes Then and Now," *Statistical Science*, February 2004.
- Gabriella Conti, Sylvia Frühwirth-Schnatter, James J. Heckman, Rémi Piatek, Bayesian exploratory factor analysis, *Journal of Econometrics*, Available online 27 June 2014
- Mingliang Li, Justin L. Tobias, Bayesian inference in a correlated random coefficients model: Modeling causal effect heterogeneity with an application to heterogeneous returns to schooling, *Journal of Econometrics*, Volume 162, Issue 2, June 2011, Pages 345-361
- Gary Koop, Roberto Leon-Gonzalez, Rodney W. Strachan, Bayesian inference in a time varying cointegration model, *Journal of Econometrics*, Volume 165, Issue 2, December 2011, Pages 210-220
- John Marriott, Paul Newbold, The strength of evidence for unit autoregressive roots and structural breaks: A Bayesian perspective, *Journal of Econometrics*, Volume 98, Issue 1, September 2000, Pages 1-25
- Ulrich K. Müller, Measuring prior sensitivity and prior informativeness in large Bayesian models, *Journal of Monetary Economics*, Volume 59, Issue 6, October 2012, Pages 581-597
- Pau Rabanal, Juan F. Rubio-Ramírez, Comparing New Keynesian models of the business cycle: A Bayesian approach, *Journal of Monetary Economics*, Volume 52, Issue 6, September 2005
- Fallaw Sowell, On DeJong and Whiteman's Bayesian inference for the unit root model, *Journal of Monetary Economics*, Volume 28, Issue 2, October 1991
- Thomas A. Lubik, Frank Schorfheide, Do central banks respond to exchange rate movements? A structural investigation, *Journal of Monetary Economics*, Volume 54, Issue 4, May 2007, Pages 1069-1087
- Fabio Milani, Expectations, learning and macroeconomic persistence, *Journal of Monetary Economics*, Volume 54, Issue 7, October 2007, Pages 2065-2082
- Schorfheide, Frank, and Kenneth I. Wolpin. 2012. "On the Use of Holdout Samples for Model Selection." *American Economic Review*, 102(3): 477-81.

- Geweke, John, and Gianni Amisano. 2012. "Prediction with Misspecified Models." *American Economic Review*, 102(3): 482-86.
- Enrique Moral-Benito, "Determinants of Economic Growth: A Bayesian Panel Data Approach," *Review of Economics and Statistics*, 2012 94:2, 566-579
- Tobias F. Rötheli, "Pattern-Based Expectations: International Experimental Evidence and Applications in Financial Economics," *Review of Economics and Statistics*, 2011 93:4, 1319-1330
- Michele Campolieti, "Bayesian Estimation and Smoothing of the Baseline Hazard in Discrete Time Duration Models," *Review of Economics and Statistics*, 2000 82:4, 685-694
- Andrew N. Kleit and Dek Terrell, "Measuring Potential Efficiency Gains from Deregulation of Electricity Generation: A Bayesian Approach," *Review of Economics and Statistics*, 2001 83:3, 523-530
- Chang-Jin Kim and Charles R. Nelson, "Has the U.S. Economy Become More Stable? A Bayesian Approach Based on a Markov-Switching Model of the Business Cycle," *Review of Economics and Statistics*, 1999 81:4, 608-616
- Chang-Jin Kim and Charles R. Nelson, *State-Space Models with Regime Switching: Classical and Gibbs-Sampling Approaches with Applications*, MIT Press, 1999.
- Jon Faust, Simon Gilchrist, Jonathan H. Wright, and Egon Zakrajšek, "Credit Spreads as Predictors of Real-Time Economic Activity: A Bayesian Model-Averaging Approach," *Review of Economics and Statistics*, 2013 95:5, 1501-1519
- Christian P. Robert, "Bayesian Computational Tools," *Annual Review of Statistics and Its Application*, 2014.
- Radu V. Craiu and Jeffrey S. Rosenthal, "Bayesian Computation Via Markov Chain Monte Carlo," *Annual Review of Statistics and Its Application*, 2014.
- B. Carlin and T. Louis, *Bayes and Empirical Bayes Methods for Data Analysis*, Chapman & Hall, 2000.
- George Casella, "An Introduction to Empirical Bayes Analysis," *The American Statistician*, Volume 39, Issue 2, 1985.
- George Casella, "An Illustrating Empirical Bayes Methods," *Chemometrics and Intelligent Laboratory Systems*, Volume 16, Issue 2, October 1992.
- George Casella & Edward I. George, "Explaining the Gibbs Sampler," *The American Statistician*, Volume 46, Issue 3, 1992.
- Several authors, several articles, *The American Statistician*, Volume 67, Issue 1, 2013.
- Richard Krutchfield, "Empirical Bayes Estimation," *The American Statistician*, Volume 26, Issue 5, 1972.
- B. Efron, "Why Isn't Everyone a Bayesian?" *The American Statistician*, Volume 40, Issue 1, 1986.

### Approximate Lecture Schedule

Note that the “schedule” lists all “lectures” first and then student discussions at the end. The expectation is that in many of the classes after the first few weeks the class will be half lecture and half discussion, so we’ll probably get to much of the material later than indicated.

#	Day	Date	Lecture	Reading
1	T	Jan 10	Introduction	Chap. 1, Appendix A, B.1, B.2.
2	Th	Jan 12		
3	T	Jan 17	Introduction to Bayesian Regression	Chap. 2, 3.1-3.6
4	Th	Jan 19	Multiple regression	Chap. 3
5	T	Jan 24		
6	Th	Jan 26	Large Sample Properties, numerical methods	
7	T	Jan 31	Gibbs sampling	Chap 4.1-4.2.4
8	Th	Feb 2		
9	T	Feb 7	Model comparison	Chap. 4.2.5, 7.5
10	Th	Feb 9	Metropolis-Hastings	Chap. 5
11	T	Feb 14	SUR, Limited dependent variables	Chap. 6.6, Chap 9.1-9.4
12	Th	Feb 16	Kalman Filter	Chap. 8.
13	T	Feb 21	VAR	
14	Th	Feb 23	Rough draft discussions	
15	T	Feb 28	Rough draft discussions	
16	Th	Mar 2	Rough draft discussions	
17	T	Mar 7	<b>Class cancelled</b>	
18	Th	Mar 9	Rough draft discussions	
19	T	Mar 14	Student presentation	
20	Th	Mar 16	Rough draft discussions or “The Next Hundred Years of Growth”	Paper on my website