

Bayesian Statistics and Marketing  
(business)

Bayesian Micro-Econometrics  
(econ)

Bayesian Methods for Non-Trivial  
Problems  
(stat)

# Course Overview

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## Principles of Bayesian Inference

(often poorly understood)

## Conjugate Problems

- Regression + analysis of covariance matrices

## Basics of iid simulation

- asymptotics
- I.S. methods

# Course Overview cont.

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## MCMC methods

- Some theory

- Some practical examples

## Conditional likelihoods for unit level analysis

- Latent variable models for discreteness

- Demand theory and discrete choice

## Hierarchical Models

- importance of priors

- beyond normal random effects

# Course Overview cont.

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## Decision Theory

BF

Decision Theory and the value of data information

## Strategically Determined Xs

Bayesian approach to I.V. models

Breaking independence assumption in random effect models

## Dirichlet Processes – Bayes Non-parametrics

density estimation

application to IV problem

# References

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Rossi, Allenby and McCulloch, *Bayesian Statistics and Marketing*

Gamerman and Lopes, *Markov Chain Monte Carlo*

Pros- well-written and accessible

Robert + Casella, *Monte Carlo Statistical Methods* (2<sup>nd</sup> Ed)

Pros – comprehensive treatment of MCMC methods, up-to-date, well-written (some intuition)

Cons – too much emphasis on convergence theory (duh!), toy examples, virtually no discussion of priors

# References cont.

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Liu, *Monte Carlo Strategies in Scientific Computing*

Pros – good companion to RTS, emphasizes theoretical properties of algorithms, assuming convergence

Cons – no intuition. Actual performance does not always follow theoretical analysis.

# References cont.

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Gelman, et al., *Bayesian Data Analysis*

Pros – well-written, includes data examples, logical progression

Cons – models are mostly univariate, prior?

Appendix A on distributions is useful!

Zellner (1971), *Intro to Bayesian Inference in Econometrics* (the classic)

# References cont.

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Recent Bayesian Econometrics books –

Koop, *Bayesian Econometrics*

Pros – well-written with illustrative examples

Cons – priors?

Lancaster, *An Introduction to Modern Bayesian Econometrics*

Pros – well-written with good intuition, illustrated with BUGS

Cons – priors?, BUGS



# References cont.

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Recent Bayesian Econometrics books –

Geweke, *Contemporary Bayesian Econometrics and Statistics*

Pros – overlap in topics with BSM but more theoretical, emphasis on Bayesian approach to model comparison

Cons – priors, software

# Computing + this Course

You don't know anything that you haven't computed!

Don't just compute, compute often!

- limitations of models + methods

You will learn a computing environment that is viable for research in this course

# R Computing Philosophy

- code in a higher level language (as close as possible to the math)
- profile your code
- identify bottle necks
- develop and install low-level functions (in C)

In the case of our book: 4000+ R / <500 C/C++

# Why R?

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- free
- widely accepted in stat community
  - 1000s of contributed functions
  - latest methods
- good support for optimized linear algebra
- excellent graphics
- support for low-level add-ins

# Why R?

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## Why not Matlab?

- it's not free; some problems!
- ~ R in linear algebra

## Why not BUGS?

- too slow for any real problem
- not extendible

## Why not C++ / Python?

- fixed cost too high

# Course Requirements

Weekly HW – mostly computing / some theory

Course Project – replicate a paper or do your own thing