ECON 5043-001
MANAGERIAL ECONOMICS II
SPRING 2021

Location and time Tues/Thurs, 5:00 PM – 6:15 PM
Video Conference

Duration January 25, 2021 – May 14, 2021

Instructor Dr. Jonathan McFadden
335 Cate Center One
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Office hours Virtual (Zoom)
- Wednesdays, 1-3 PM. Email me, and I will send you a Zoom meeting link.
- By appointment

Teaching assistant Cheng Ma
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TA Office hours Virtual (Zoom)
- Thursdays, 9:00 AM – 10:00 AM
- By appointment

Course description In recent years, this course has emphasized the econometric techniques of machine learning and causal inference. This semester, we will focus on methods of so-called Bayesian data analysis within the field of applied econometrics. Bayesian inference can be thought of as the process of fitting probability models to datasets, resulting in probability distributions of model parameters and other unobserved quantities (e.g., predictions). The course will emphasize estimation of regression and other multivariate models, model checking, evaluation and extension, and the fundamentals of Markov Chain simulation. Recurring comparisons to classical econometric methods will permit assessments of the relative strengths and weaknesses of the Bayesian approach to data analysis.

Course prerequisites The prerequisite for this course is ECON 5033: Managerial Economics I. However, this course will draw on material from ECON 5033 only minimally. Students need to have knowledge obtained in ECON 2843: Elements of Statistics. In addition, it would be ideal if students have taken (or are concurrently enrolled in) at least one course from the following:

- ECON 4223: Econometric Analysis
- ECON 5023: Statistics for Decision Making
- ECON 5253: Data Science for Economists
- Any other data analytics/data analysis elective approved for the BA/MA Accelerated Program in Managerial Economics with Data Emphasis

Course goal

The course is not designed so that students become solely Bayesian economists. Rather, the course is intended to provide a rigorous—but applied—first treatment of Bayesian methods to expand students' empirical toolkit and increase the likelihood of finding and applying the most appropriate methods of data analysis within project scope and timeframe.

After taking this course, students should be able to make an educated determination regarding whether a Bayesian approach is the most suitable method for an analysis of economic data of interest. If so, students should know how to fit the models discussed in this course to their dataset, evaluate model performance, carry out sensitivity analysis, and rigorously extend the model, if deemed appropriate. If they determine Bayesian methods are not the most suitable for their application, they should understand which features of the classical approach make it a more compelling choice for their economic problem of interest.

Course topics

Among other subjects, this course will delve into the following, though not necessarily in this order:

- Overview of probability and inference
- Single-parameter and certain multiparameter models
- Connections with classical methods
- Model checking, diagnostics, and evaluation
- Fundamentals of Bayesian computation
- Markov chain simulation
- Regression
- Time-varying parameters models (if time permits)

Textbook (required)

Bayesian Data Analysis, 3rd edition, Chapman & Hall/CRC Press
A. Gelman, J.B. Carlin, H.S. Stern, D.B. Dunson, A. Vehtari, and D.B. Rubin

Given students' diverse academic backgrounds and familiarity with statistics, applied econometrics, and other data analysis methods, there is no single treatment of applied Bayesian methods most suitable for this course. Material from additional sources will be used for certain topics.

Other recommended textbooks

C. Kleiber and A. Zeileis, *Applied Econometrics with R*, 2008, Springer

G. Koop, *Bayesian Econometrics*, 2003, Wiley

Course website

Canvas

Important dates

These are university holidays, tentative dates for the midterm, final exam preparation week, and final exam time:

Midterm:	Tuesday, 3/16
Instructional Holiday:	Tuesday, 4/6
Finals Preparation week:	Monday – Friday, 5/3 – 5/7
Final Exam:	Tuesday, 5/11, 4:30 PM - 6:30 PM

Grading

Assignments and exams in the course have these weights:

Homework:	30%
Midterm:	30%
Final Exam:	30%
Participation	10%

Participation is broadly defined as attending and engaging with class online (Zoom), commenting or asking questions in class as needed, and/or attending office hours as needed.

There is no set "curve" for this course or designated number of certain grades. Extra credit opportunities available for all students will be at my discretion. Course grades are A: 90 or above, B: 80-89, C: 70-79, D:60-69, F: lower than 60.

Class format

Readings

Weekly textbook readings will be given. Upcoming readings will be announced as much as possible. For some topics, it will be necessary to supplement textbook content with material from other sources (mainly other books). Please come to class prepared.

In-Class Coding and Data Analysis

The R software will be used in lecture for demonstration of Bayesian applications and for homework assignments. RStudio is a useful IDE for R, which I highly recommend you use.

For certain applications and assignments, additional Bayesian software, JAGS, will be used, which can be called within the R environment. You must install JAGS on your computer, which will work in the background when calling the RJAGS package in R.

Download/install R: https://cran.r-project.org/bin/windows/base.
Download/install RStudio: https://rstudio.com.

Download/install JAGS: https://sourceforge.net/projects/mcmc-jags.
Download/install RJAGS in RStudio: "Tools" -> "Install Packages" -> "RJAGS"

If you have questions downloading, installing, or working with R, please let me know. For some questions, I may refer you to our TA, who is an excellent resource. I do not require that you use R Markdown, but you may do so if you like.

Homework

There will be roughly 5-7 homework assignments (tentatively) throughout the semester. You will generally have one work to work on them. Please turn them in online in Canvas. They will cover a range of topics and for most assignments, the problems will be split between theory-type questions and data analysis. You are encouraged to work with your classmates on these problems, but you must turn in your own write-ups.

Exams

The midterm and final exam will be done at home and submitted online through Canvas. Any material from lectures or other course content could be covered. The final exam is comprehensive but will be weighted more toward material covered after the midterm.

Make-up exams will only be given for legitimate reasons (e.g., illness, family emergency, student athletics, religious holiday) with verifiable documentation (e.g., letter from physician). Unless you have a legitimate reason with third-party, verifiable documents for your absence during an exam, you will not be allowed to take a make-up exam. Notification in advance, if possible, is appreciated.

Course Expectations

You can expect that I will: 1) treat you with respect, 2) respond to your emails and return grades within a reasonable time period, 3) grade all assignments consistently and fairly, and 4) be available during office hours unless otherwise stated and announced in advance.

In return, I expect that you will: 1) treat me and your peers with respect, 2) come to class prepared, have your camera on throughout lecture (as if we were in a regular classroom environment), and participate in lecture, and 3) be proactive with learning, including completing reading assignments and homeworks, turning in assignments on time, and asking me or the TA for help if needed. If you cannot meet these expectations, let me know as soon as possible.

COVID-19 Related University Policies

General Information

Due to the rapidly evolving nature of the current situation, changes (additions or deletions) to this syllabus may be required one or more times throughout the semester. I well let you know ahead of time about any necessary changes, which will be made in accordance with university policy.

Mandatory Masking

As outlined by the University of Oklahoma[1]s Chief COVID Officer, until further notice, employees, students, and visitors of the OU community will be mandated to wear masks (1) when they are inside University facilities and vehicles and (2) when they are outdoors on campus and social distancing of at least six feet is not possible. For the well-being of the entire university community it is important that everyone demonstrate the appropriate health and safety behaviors outlined in the University Mandatory Masking Policy (https://www.ou.edu/coronavirus/masking-policy). As this mandate includes all campus classrooms, please make sure you are wearing your mask while in class. If you do not have a mask or forgot yours, see the professor for available masks. If you have an exemption from the Mandatory Masking Policy, please see the professor to make accommodations before class begins. If and where possible, please make your professor aware of your exemption and/or accommodation prior to arriving in class.

Attendance

A temporary university policy has been established to protect the OU community by ensuring that students who are ill or required to isolate feel encouraged to remain at home. Missing a class session or other class activity due to illness or isolation will not result in a penalty for the absence, and the student will not be asked to provide formal documentation from a healthcare provider to excuse the absence. This policy is based on all students and faculty adhering to the principles of integrity, honesty, and concern for others.

Students who are experiencing symptoms of COVID-19, including cough, fever, shortness of breath, muscle pain, headache, chills, sore throat, loss of taste or smell, congestion or runny nose, nausea or vomiting, or diarrhea or who have been in close contact with others who have symptoms should:

- Remain at home to protect others
- Ensure that any needed screening has been conducted (COVID-19 Screening and Reporting Tool) and any needed treatment obtained
- Contact the instructor prior to absence or inability to participate, if possible, and provide an honest report of the reason for which you cannot attend class or complete a course activity
- Continue to complete coursework to the extent possible, using Canvas, Zoom, and other online tools
- Submit assignments electronically to the extent possible and as directed by the instructor
- Communicate with the instructor to arrange modifications to deadlines or work requirements or reschedule exams or other important course activities, when it is necessary

Other University Policies

Academic integrity

Cheating is strictly prohibited at the University of Oklahoma. Academic misconduct inhibits learning, erodes educational value, and damages the professional reputations of those affiliated with the University. Violations have serious consequences and will be referred to the Office of Academic Integrity Programs.

Reasonable accommodation

Students in this course who have a disability that may prevent them from fully demonstrating their abilities should contact me personally as soon as possible so we can discuss accommodations necessary to ensure full participation and facilitate educational opportunities. Note that the Disability Resources Center is located in Goddard Health Center, Room 166 (tel: 405-325-3852).

Title IX resources

For any concerns regarding gender-based discrimination, sexual harassment, sexual misconduct, stalking, or intimate partner violence, the University offers a variety of resources, including advocates on-call 24/7, counseling services, mutual no contact orders, scheduling adjustments and disciplinary sanctions against the perpetrator. Please contact the Sexual Misconduct Office at 405-325-2215 (8-5, M-F) or OU Advocates at 405-615-0013 (24/7) to learn more or to report an incident.

Adjustments for pregnancy or childbirth issues

Should you need modifications or adjustments to course requirements because of documented pregnancy-related or childbirth-related issues, please contact me as soon as possible. Generally, modifications will be made where medically necessary and similar in scope to accommodations based on temporary disability. Please see http://www.ou.edu/eoo/faqs/pregnancy-faqs.

Religious observances

It is the policy of the University to excuse student absences that result from religious observances and reschedule examinations and additional required classwork that may fall on religious holidays, without penalty.

Tentative Outline

Note that several of the dates are likely to change over the semester, depending on how much class time is devoted to each topic. This outline is interpreted as an indication of the kinds of topics that will be covered and a general estimate of the timeline.

Date	Day	Week	Topic	Reading
1/26	Tues	1	Syllabus, Overview, and Statistics Review	Chapter 1
1/28	Thurs	1	Statistics Review and Matrix Algebra	Chapter 1
2/2	Tues	2	Mathematics Wrap-Up, Intro to Single Parameter Models	Chapters 1-2
2/4	Thurs	2	Bayes Theorem and the Binomial Model	Chapter 2
2/9	Tues	3	Priors, Binomial Model Generalization, Example	Chapter 2
2/11	Thurs	3	Univariate Normal Model	Chapter 2
2/16	Tues	4	Normal Model, Poisson Model	Chapter 2
2/18	Thurs	4	Exponential Model and Several Examples	Chapter 2
2/23	Tues	5	Noninformative Priors, Improper Dsns., Jeffreys' Prior	Chapter 2
2/25	Thurs	5	Priors Wrap-Up, Intro to Multivariate Models	Chapter 3
3/2	Tues	6	Normal Model: Unknown Mean and Variance	Chapter 3
3/4	Thurs	6	Multinomial Model, Multivariate Normal Model	Chapter 3
3/9	Tues	7	Multivariate Normal Model	Chapter 3
3/11	Thurs	7	Topics Wrap-Up, Midterm Review	--
3/16	Tues	8	Midterm Exam	--
3/18	Thurs	8	Intro to Bayesian Computation, Rejection Sampling	Chapter 10
3/23	Tues	9	Importance Sampling and Resampling	Chapter 10
3/25	Thurs	9	Intro to Markov Chain Simulation, Gibbs Sampler	Chapter 11
3/30	Tues	10	Metropolis Algorithm	Chapter 11
4/1	Thurs	10	Metropolis Wrap-Up, Assessing Convergence	Chapter 11
4/6	Tues	11	Instructional Holiday – no class	--
4/8	Thurs	11	JAGS and RJAGS in a Nutshell	See slides
4/13	Tues	12	Predictive Accuracy and Information Criteria	Chapter 7
4/15	Thurs	12	Bayesian Cross-Validation, Bayes Factors	Chapter 7
4/20	Tues	13	Bayesian Ordinary Linear and Multiple Regression	Chapter 14
4/22	Thurs	13	Multiple Regression, Logistic Regression	Chapter 14
4/27	Tues	14	Multinomial Logit Model, Bayesian Time Series	See slides
4/29	Thurs	14	Bayesian Dynamic Linear Models	See slides
5/4	Tues	15	DLMS and Filtering	See slides
5/6	Thurs	15	Topics Wrap-Up, Midterm Review	--
5/11	Tuesday	16	Final Exam: 4:30-6:30 PM	--