ECON 7800: Econometrics I

University of Utah - Department of Economics
Spring 2021

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Office Hours: Tuesdays 1-3pm and by appointment

Location: GC 2140
Time: Monday and Wednesday 3-4:20 p.m.
Credit Hours: 3

Course Description:
This course aims at introducing students to the theory of data analysis in social sciences. Students will be introduced to the philosophy of inference and applied methods in statistical analysis with a focus on modern Bayesian methods.

Student Learning Outcomes: By the end of the course, students will have a firm understanding of the logic of inference and be able to construct useful analysis with data using modern econometric techniques. Students will have a working understanding of foundational concepts such as priors, and posterior probabilities and be equipped with a logical understanding of statistical inference in social science. Emphasis will be placed on students leaving this course with a command over regression analysis and posterior simulation using Markov Chain Monte Carlo (MCMC) methods.

Assignments: Students will be required to complete several written assignments as well as a final exam.

Homework Policy:
All R exercises must be submitted as a clear, annotated and executable script. Homework will be marked down a grade for each day it is late (From an A to B, not from A to A-). Problem sets should be clearly written or preferably typed and emailed to me day they are due before class. If you do not receive full credit for a problem, you can resubmit the problem for half-credit. For me to keep track of resubmissions please clearly mark which problem you are resubmitting. You must also attach your initial submission when resubmitting homework. All resubmissions must be turned in **no later than one week after they are returned**. Unlike the initial submission, no late resubmissions will be accepted.

Teaching and Learning Methods:
This course is a traditional lecture based course. All lectures will be live and in person.

Attendance: While attendance is required for this course it is highly recommended that you attend all lectures. If for any reason you cannot attend a lecture please contact me ahead of time.

Grading Policy: Assignments (75%), Final (25%)

Scale	Score
A	93-100
A-	90-92
B+	87-89
B	83-86
B-	80-82
C+	77-79
C	73-76
C-	70-72
D+	67-69
D	63-66
D-	60-62
E	0-59

Main References: All books can be found at http://used.addall.com/.

Required (*)

- *A. Zellner, *An Introduction to Bayesian Inference in Econometrics*, Wiley, 1971.
- *T. Lancaster, *An Introduction to Modern Bayesian Econometrics*, Blackwell, 2004.
- E. T. Jaynes, *Probability Theory, The Logic of Science*, Cambridge University Press, 2003.
- A. Gelman, J. Carlin, H. Stern, D. Dunson, A. Vehtari, and D. Rubin, *Bayesian Data Analysis.*, Chapman & Hall/CRC Texts in Statistical Science; 3rd ed. 2013.
- A. Gelman, J. Hill, *Data Analysis Using Regression and Multilevel/Hierarchical Models*, Cambridge University Press, 2007.
- M. H. DeGroot and M. J. Schervish, *Probability and Statistics*, Pearson.

Useful Resources:

- R - http://www.r-project.org
- RStudio - http://www.rstudio.com
- RStan - http://mc-stan.org/rstan.html

Tentative Course Outline:
Required readings (*)

1. *Probability Theory*
   Readings:
   - *A. Zellner (1971) Ch. 1
   - *E.T. Jaynes (2003) Preface and Ch. 1-2
   - *E. T. Jaynes, "Bayesian Methods: General Background: An Introductory Tutorial," in *Maximum Entropy and Bayesian Methods in Applied Statistics*, J. H. Justice, (ed.), Cambridge University Press. 1985.
   - M. H. DeGroot and M. J. Schervish (2012) Ch. 1-3
2. *Inference for the Normal Distribution*
   Readings:
   - *A. Zellner (1971) Ch. 2
   - T. Lancaster (2004) Ch. 1
   - M. H. DeGroot and M. J. Schervish (2012) Ch. 4, 7
   - A. Gelman et al. (2013) Ch. 2-3
3. *Markov Chain Monte Carlo*
   Readings:
   - *T. Lancaster (2004) Ch. 4

- *J. Savage, "A quick-start introduction to Stan for economists," https://nbviewer.jupyter.org/github/QuantEcon/QuantEcon.notebooks/blob/master/IntroToStan_basics_workflow.ipynb
- A. Gelman et al. (2013) Ch.10-11
- M. H. DeGroot and M. J. Schervish (2012) Ch. 12.
- S. Chib and E. Greenberg (1995). Understanding the Metropolis-Hastings Algorithm, *American Statistical Association*, 49(4).
- G. Casella and E. George (1992). Explaining the Gibbs Sampler, *The American Statistician*, 46(3).
- R. Neal (2011) MCMC using Hamiltonian dynamics, *Handbook of Markov Chain Monte Carlo*, ed. S. Brooks, A. Gelman, G. Jones, and X. Meng.
- J. K. Kruschke (2015) Ch. 7: MCMC Methods, Ch. 9: Stan.

4. *Model Checking*
Readings:
   - *T. Lancaster (2004) Ch. 2.
   - *A. Gelman et al. (2013) Ch. 6-7.

5. *The Standard Normal Linear Model*
Readings:
   - *A. Zellner (1971) Ch. 3.
   - T. Lancaster (2004) Ch. 3.1-3.4.
   - M. H. DeGroot and M. J. Schervish (2012) Ch. 11.

6. *Probability and Frequency*
Readings:
   - *E.T. Jaynes (2003) Ch. 10 and 16

7. *Extending the SNLM*
Readings:
   - *A. Zellner (1971) Ch. 4
   - *T. Lancaster (2004) Ch. 3.6-3.7
   - J. Geweke (1993) "Bayesian Treatment of the Independent Student-t Linear Model, *Journal of Applied Econometrics*, 8

8. *Non-linear Regression*
Readings:
   - *T. Lancaster (2004) Ch. 6
   - *A. Gelman and J. Hill (2007) Ch. 5

9. *Quantile Regression*
Readings:
   - *K. Yu and R. A. Moyeed (2001) "Bayesian Quantile Regression." *Statistics and Probability Letters*, 54, pp. 437-447

10. *Causal Inference*
Readings:

- *T. Lancaster (2004) Ch. 5
- *C. Sims (2010) "But Economics is Not an Experimental Science," *Journal of Economic Perspectives*, 24(2), pp. 59-68
- *J.D. Angrist and J. Pischke (2010) "The Credibility Revolution in Empirical Economics: How Better Research Design is Taking the Con out of Econometrics," *Journal of Economic Perspectives*, 24(2), pp. 3-30
- A. Gelman and J. Hill (2007) Ch. 9, 10

11. *Panel Methods*
Readings:

- *T. Lancaster (2004) Ch. 7
- *A. Gelman and J. Hill (2007) Ch. 11, 12

12. *Instrumental Variables*
Readings:

- *T. Lancaster (2004) Ch. 5

13. *Mixture Models*
Readings:

- *A. Gelman et al. (2013) Ch. 12: Finite Mixture Models
- G. J. McLachlan, S. X. Lee, and S. I. Rathnayake (2019) "Finite mixture models," *Annual review of statistics and its application*, 6, pp. 355–378

Note: This syllabus is meant to serve as an outline and guide for our course. Please note that I may modify it with reasonable notice to you. I may also modify the Course Schedule to accommodate the needs of our class. Any changes will be announced in class and posted on Canvas under Announcements.

Academic Honesty:

"The term plagiarism includes, but is not limited to: (i) use by paraphrase or direct quotation of the published or unpublished work of another person without fully and properly crediting the author with footnotes, citations or bibliographical reference; (ii) unacknowledged use of materials prepared by another person or agency engaged in the selling of term papers or other academic materials; or (iii) unacknowledged use of original work/material that has been produced through collaboration with others without release in writing from collaborators."

There are many types of plagiarism, all are serious offenses and will be treated according to the University of Missouri Rules and Procedures of Student Conduct Matters. Using another author's or researcher's work without attribution is plagiarism. Rewriting another author's or researcher's work (changing words or word order) while retaining the structure and ideas of the work is plagiarism. Submitting your own work from other courses without permission is plagiarism. Sloppy citations, such as missing quotations marks even when a footnote appears, are plagiarism. Any incidents of plagiarism will result in a grade of zero for the assignment. All essays and assignments must be written in your own words with proper citations.

See the The Code of Student Rights and Responsibilities at https://regulations.utah.edu/academics/6-400.php for more details.

University Policies:

1. The Americans with Disabilities Act. The University of Utah seeks to provide equal access to its programs, services, and activities for people with disabilities. If you will need accommodations in this class, reasonable prior notice needs to be given to the Center for Disability Services, 162 Olpin Union Building, (801) 581-5020. CDS will work with you and the instructor to make arrangements for accommodations. All written information in this course can be made available in an alternative format with prior notification to the Center for Disability Services. [The Addressing Sexual Misconduct Statement is strongly suggested on every course syllabus. According to University policy, at minimum instructors must include the contact information of the Title IX Coordinator.]

2. Addressing Sexual Misconduct. Title IX makes it clear that violence and harassment based on sex and gender (which Includes sexual orientation and gender identity/expression) is a civil rights offense subject to the same kinds of accountability and the same kinds of support applied to offenses against other protected categories such as race, national origin, color, religion, age, status as a person with a disability, veteran's status or genetic information. If you or someone you know has been harassed or assaulted, you are encouraged to report it to the Title IX Coordinator in the Office of Equal Opportunity and Affirmative Action, 135 Park Building, 801-581-8365, or the Office of the Dean of Students, 270 Union Building, 801-581-7066. For support and confidential consultation, contact the Center for Student Wellness, 426 SSB, 801-581-7776. To report to the police, contact the Department of Public Safety, 801-585-2677(COPS).

3. All students are expected to maintain professional behavior in the classroom setting, according to the Student Code, spelled out in the Student Handbook. Students have specific rights in the classroom as detailed in Article III of the Code. The Code also specifies proscribed conduct (Article XI) that involves cheating on tests, plagiarism, and/or collusion, as well as fraud, theft, etc. Students should read the Code carefully and know they are responsible for the content. According to Faculty Rules and Regulations, it is faculty responsibility to enforce responsible classroom behaviors, beginning with verbal warnings and progressing to dismissal from class and a failing grade. Students have the right to appeal such action to the Student Behavior Committee.

Covid-19 Policies:

1. University leadership has urged all faculty, students, and staff to model the vaccination, testing, and masking behaviors we want to see in our campus community.

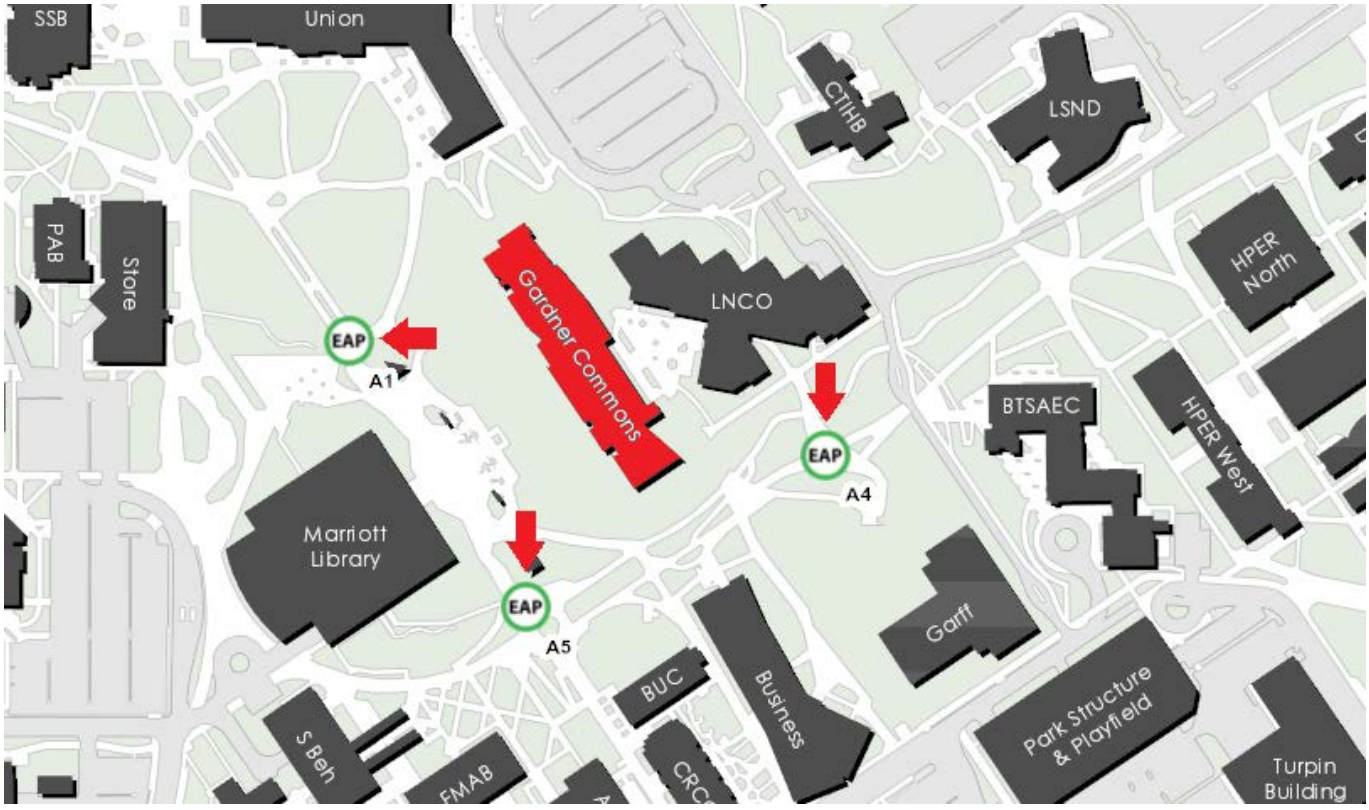
   These include: Vaccination, Masking indoors, If unvaccinated, getting weekly asymptomatic coronavirus testing

   - Vaccination
     - Get a COVID-19 vaccination if you have not already done so. Vaccination is proving highly effective in preventing severe COVID-19 symptoms, hospitalization and death from coronavirus. Vaccination is the single best way to stop this COVID resurgence in its tracks.
     - Many in the campus community already have gotten vaccinated:
     - More than 80% of U. employees
     - Over 70% of U. students
     - Visit http://mychart.med.utah.edu/, http://alert.utah.edu/covid/vaccine, or http://vaccines.gov/ to schedule your vaccination.
   - Masking
     - While masks are no longer required outside of Health Sciences facilities, UTA buses and campus shuttles, CDC guidelines now call for everyone to wear face masks indoors.
     - Check the CDC website periodically for masking updates—https://www.cdc.gov/coronavirus/2019-ncov/vaccines/fully-vaccinated-guidance.html

  - Treat masks like seasonal clothing (i.e. during community surges in COVID transmission, masks are strongly encouraged indoors and in close groups outside).

- Testing
  - If you are not yet vaccinated, get weekly asymptomatic coronavirus tests. This is a helpful way to protect yourself and those around you because asymptomatic individuals can unknowingly spread the coronavirus to others.
  - Asymptomatic testing centers are open and convenient:
  - Online scheduling
  - Saliva test (no nasal swabs)
  - Free to all students returning to campus (required for students in University housing)
  - Results often within 24 hours
  - Visit alert.utah.edu/covid/testing
  - Remember: Students must self-report if they test positive for COVID-19 via this website: https://coronavirus.utah.edu/.
- Student Mental Health Resources
  - Rates of burnout, anxiety, depression, isolation, and loneliness have noticeably increased during the pandemic. If you need help, reach out for campus mental health resources, including counseling, trainings and other support.
  - Consider participating in a Mental Health First Aid or other wellness-themed training provided by our Center for Student Wellness and sharing these opportunities with your peers, teaching assistants and department colleagues.

CSBS EMERGENCY ACTION PLAN



BUILDING EVACUATION

EAP (Emergency Assembly Point) – When you receive a notification to evacuate the building either by campus text alert system or by building fire alarm, please follow your instructor in an orderly fashion to the EAP marked on the map below. Once everyone is at the EAP, you will receive further instructions from Emergency Management personnel. You can also look up the EAP for any building you may be in on campus at http://emergencymanagement.utah.edu/eap.

CAMPUS RESOURCES

U Heads Up App: There's an app for that. Download the app on your smartphone at alert.utah.edu/headsup to access the following resources:

- **Emergency Response Guide:** Provides instructions on how to handle any type of emergency, such as earthquake, utility failure, fire, active shooter, etc. Flip charts with this information are also available around campus.
- **See Something, Say Something:** Report unsafe or hazardous conditions on campus. If you see a life threatening or emergency situation, please call 911!

Safety Escorts: For students who are on campus at night or past business hours and would like an escort to your car, please call 801-585-2677. You can call 24/7 and a security officer will be sent to walk with you or give you a ride to your desired on-campus location.

College of Social and Behavioral Science
THE UNIVERSITY OF UTAH