ECONOM – 8473
Applied Econometrics
Fall 2020
Course Syllabus

Course Information

Class Meeting: TBD

Instructor: Alyssa Carlson (carlsonah@missouri.edu)

Office Hours: T 2:00-3:00pm

Course Description

This class is the second econometrics course in the master's program meant to build upon the foundations taught in Econ 7371. There will be an emphasis on applications of theory to estimation and inference. This means we will be reviewing theorems and proofs as well as going over empirical applications. This course is neither predominantly theoretical or predominantly empirical. As a master's courses, some will have interest to continue on in academia and others have interest in applying what they learn in industry, this course should be able to accommodate both goals.

We will review and strengthen your understanding of linear and non-linear regression, instrumental variable approach to endogeneity, and methods for statistical inference (hypothesis testing, confidence interval, etc.). But to better equip you with the data challenges we face today, we will also cover more advanced estimation techniques. This included maximum likelihood estimation, generalized least square, panel data methods and time series. If time allows, we may also cover a topic that the class finds particularly interesting (regression discontinuity, multinomial choice/demand estimation, Simulation based estimation, spatial models, machine learning).

Prerequisites

Have taken Econ 7371 or equivalent. This means you have learned basic mathematical statistics, introduced to linear regression and hypothesis testing, and are familiar with working with data. It is strongly recommended that you also have knowledge in linear algebra (matrix notation and manipulations), basic calculus (know derivatives for optimization), and experience with programming in STATA or similar software. If you would like some refreshers in these topics please refer to the section on Texts and Materials for references. The appendices associated with the Wooldridge text are short and simple reviews that cover the basics of most of the things you need to know. The appendices associated with the Greene text are slightly more comprehensive and will cover the material a bit deeper and further than what is needed in this course.

Learning Objectives

At the end of the course you will be able to

1. Design an econometric model to answer an economic question of interest (e.g.: linear vs non-linear, logs vs levels, exogenous vs endogenous, fixed effects vs. random effects, etc.).
2. Recall the assumptions needed for different estimation procedures to be valid (unbiased or consistent) and/or efficient.
3. Choose an estimation technique that best fits a particular setting, justify your chosen approach (in contrast to other approaches), and explain the limitations of the chosen approach.
4. Obtain estimates, execute inference, and apply testing procedures using STATA.
5. Explain (in words) the results of different estimation procedures, the statistical significance and economic significance of estimates, and outcomes of specification tests.
6. Compare results across different specifications, different estimators, different models, explaining how changing each component will alter the interpretation of the result.

Each of the learning objectives are milestones that will help you to achieve the ultimate goal:

At the end of this course, I will have knowledge to correctly apply econometric methods to a variety of data settings, provide clear communication of the results, and have the confidence to argue both the strengths and weaknesses of my approach.

Whether you plan to enter private industry, government, or academia, this skill is highly valued and worth pursing (beyond just a good grade in the class).

Text and Material

There is no required text for this course. The lecture notes will provide you with enough text and information to master the material. If you would like to have additional references throughout the course, the following texts are recommended.

- Wooldridge, Jeffrey M. *Introductory econometrics: A modern approach*. Nelson Education, 2016. This text is an upper level undergraduate textbook. This is a great book if you need to brush up on some of the undergraduate level econometric methods but also provides more advanced chapters that work for a graduate level course. Appendix B provides a good review of the fundamentals of probability theory and Appendix D discusses the basics of matrix algebra and notation.
- Greene, William H. *Econometric Analysis*. Pearson, 2018. This is a standard graduate (PhD) level econometrics textbook. This reads more like an encyclopedia and covers much more than what we can cover in this course. If you plan on continuing graduate work using econometrics methods, I highly suggest investing in this text. The appendices (download here) provide some review of concepts that are needed throughout the course. If you think you need to brush up on linear algebra (matrix notation and manipulation) and optimization, please review appendix A. If it has been a long time since your last statistics or econometrics courses, please take a look at appendices B.1-B.3, B.7-B.8, C.1-C.5, and C.7.
- Wooldridge, Jeffrey M. *Econometric Analysis of Cross Section and Panel Data*. MIT Press, 2010. This is another standard graduate level text but with a strong focus on panel data.
- Pischke, Jörn-Steffen, and Angrist, Joshua D. *Mostly Harmless Econometrics: An Empiricist's Companion*. Princeton University Press, 2008. This is a short and relatively cheap text that focuses on treatment effects estimation and simplifying econometrics methods for applied researcher. This is not a stand-alone textbook but is a useful accompaniment to other texts.

Grade Composition

Participation - 5%

Problem Sets – 35%

Final Project – 30%

Midterm – 15%

Final – 15%

Participation - Participation will be based on your contributions to discussion boards. In addition to the Introductions discussion, each lecture will be recorded and posted with an attached discussion forum. Within the discussion forum you can write down and comments and/or questions. I will respond to your comments and questions within a 48 hour period. To receive full credit for participation you must post on 5 discussion boards throughout the semester. Posts contributing to a single discussion board is worth 1% of your letter grade, so if you only provide posts on 3 discussion boards throughout the semester then you only receive 3 out of 5 possible percentage points towards your final grade. Multiple posts on the same discussion board only counts once, so if you post 5 times on the same discussion board, you still only receive 1 percentage point.

Problem Sets- The problem sets are designed to help you better understand the course material, give you practice with analytical problems, and help prepare you for exams. Note that some of the material that we cover in class (and that is eligible to appear on exams) may not be reviewed in problem set exercises. While collaboration on the homework assignments is encouraged, each student must turn in his/her own homework assignment, written in his/her own words (no direct copies or photocopies allowed). Assignments must be submitted on time as a PDF. If an assignment is turned in within 24 hours after the due date, it will automatically lose 50% of the grade. No credit is given to assignments handed in more than 24 hours late.

Final Project - This project is meant to give you the step by step practice of applying the econometrics tools learned throughout this course in a real empirical setting. This project is composed of 4 components that will be turned in throughout the semester and then a final compilation of all the 4 components as the final product. 20% of the grade is determined by completion of the four components by each due date while the remaining 80% is determined by an evaluation of the final product. I will also provide written feedback on these components so that you can improve your final report.

Exams – You will have 24 hours to complete the exams (Midterm and Final). These exams are open note and open book, but you are not allowed to discuss the questions with your classmates. You will type or write up your answers and submit them online as a PDF. Your submission should be clear as to which answers go to which questions (label your answers and pages!). The midterm will cover everything in the first half of the course, and the final will cover everything in the second half of the course. I do not like to say the exam is not cumulative, because mastering the material in the second half of the course requires understanding the first half of the course. But I will not waste any questions on the final to exclusively ask about something covered in the first half of the course.

Course Expectations

You can expect me to

- Be available during office hours or appointments to talk all things econometrics!
- Provide clear and quick communication. I will notify you of all due dates via announcements. I will respond to emails within 24 hours (mostly likely faster).
- Fair grading of homework, exams, and projects

I expect you to

- Be prepared for class with access to lecture slides and materials for taking notes.
- Actively participate in the course. What you get out of it is what you are willing to put into it.
- Turn in problem sets on time and individually but you may work together or use other resources (the textbook, wikipedia, youtube tutorials are all great resources you should feel comfortable using) but all answers should be written in your own words.
- Come prepared to office hours/appointments when you have questions about the material or homework. I will not "pre-grade" homework during office hours. This means you cannot ask me "Is my answer correct?", "Will I get full points for this answer?", or "what do I need to write to get full points?" If you can't argue to me why your correct then you don't understand the material. I am happy to answer questions about specific concerns/confusions in the homework. So you may ask "I tried part (a) and I got this far but then I got confused after this step", "I was confused in your wording of the question and wanted to clarify that you would like me to provide explanations for all three of these parts of the problem", or "My friend and I both worked on the Stata problem and ran what we think is the same set of commands but we keep getting different answers, and we cannot figure out why, can you look at both our codes to find the difference?"

Academic Integrity

Academic integrity is fundamental to the activities and principles of a university. All members of the academic community must be confident that each person's work has been responsibly and honorably acquired, developed, and presented. Any effort to gain an advantage not given to all students is dishonest whether or not the effort is successful. The academic community regards breaches of the academic integrity rules as extremely serious matters. Sanctions for such a breach may include academic sanctions from the instructor, including failing the course for any violation, to disciplinary sanctions ranging from probation to expulsion. When in doubt about plagiarism, paraphrasing, quoting, collaboration, or any other form of cheating, consult the course instructor.

Accommodation of Disabilities

Students with Disabilities:

If you anticipate barriers related to the format or requirements of this course, if you have emergency medical information to share with me, or if you need to make arrangements in case the building must be evacuated, please let me know as soon as possible.

If disability related accommodations are necessary (for example, a note taker, extended time on exams, captioning), please establish an accommodation plan with the MU Disability Center, S5 Memorial Union, 573-

882-4696, and then notify me of your eligibility for reasonable accommodations. For other MU resources for persons with disabilities, click on "Disability Resources" on the MU homepage.

Intellectual Pluralism

The University community welcomes intellectual diversity and respects student rights. Students who have questions or concerns regarding the atmosphere in this class (including respect for diverse opinions) may contact the departmental chair or divisional director; the director of the Office of Students Rights and Responsibilities; the MU Equity Office, or equity@missouri.edu.

All students will have the opportunity to submit an anonymous evaluation of the instructor(s) at the end of the course.

Academic Inquiry, Course Discussion, and Privacy

University of Missouri System Executive Order No. 38 lays out principles regarding the sanctity of classroom discussions at the university. The policy is described fully in Section 200.015 of the Collected Rules and Regulations. In this class, students may make audio or video recordings of course activity unless specifically prohibited by the faculty member. However, the redistribution of audio or video recordings of statements or comments from the course to individuals who are not students in the course is prohibited without the express permission of the faculty member and of any students who are recorded. Students found to have violated this policy are subject to discipline in accordance with provisions of section 200.020 of the Collected Rules and Regulations of the University of Missouri pertaining to student conduct matters.

Title IX

University of Missouri policies prohibit discrimination on the basis of race, color, national origin, ancestry, religion, sex, gender, gender identity, gender expression, sexual orientation, pregnancy, age, genetic information, disability and protected veteran status. Discrimination includes any form of unequal treatment such as denial of opportunities, harassment, and violence. Sex-based violence includes rape, sexual assault, unwanted touching, stalking, dating/interpersonal violence, and sexual exploitation.

If you experience discrimination, you are encouraged (but not required) to report the incident to the MU Office for Civil Rights & Title IX. Learn more about your rights and options at civilrights.missouri.edu or call 573-882-3880. You also may make an anonymous report online.
Students may also contact the Relationship & Sexual Violence Prevention (RSVP) Center, a confidential resource, for advocacy and other support related to rape or power-based personal violence at rsvp@missouri.edu or 573-882-6638, or go to rsvp.missouri.edu.
Both the Office for Civil Rights & Title IX and the RSVP Center can provide assistance to students who need help with academics, housing, or other issues.