Econ 8473
Applied Econometrics
Fall 2019

COURSE INFORMATION

Class Meeting: MW 3:30-4:45pm
                Middlebush Hall 309
Instructor: Alyssa Carlson
                235 Professional Building
                Email: carlsonah@missouri.edu
                Office: 573-882-3161
Website: http://courses.missouri.edu
Office Hours: TW 2:00-3:00pm

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.

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)

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LEARNING OBJECTIVES

- Given a data set and economic question,
    - You will know how to build an econometric model composed of random variables, parameters and unobserved factors.
    - You will be able to defend and argue for the choices you make in building the model (linear vs non-linear, homoscedastic, heteroskedastic, endogeneity, fixed effects vs. correlated random effects) and understand the limitations of your model
    - You will be able explain how your model is able to answer the economic question of interest.
- Given a data set, economic question and model,
    - You will be able to choose an estimation technique that best fits the setting. This can mean choosing between Linear Least Squares, Maximum Likelihood, Non-Linear Least Squares, Generalized Least Squares, IV /2SLS, Fixed Effects, Random Effects or others.
    - You will be able to justify your choice and explain why other methodologies are not appropriate while also understanding the limitations of your chosen approach.
    - You will be able to recall the assumptions needed for the estimation procedure to be valid (and know what I mean by valid!) and have a rough understanding of how those assumptions play a role in showing consistency and deriving standard errors.
    - You will be able to obtain estimates using STATA or other similar software.
- Given a data set, economic question, model and estimates,
    - You will be able to interpret your results – statistical significance, economic significance.
    - You will know how to test for misspecification or, if applicable, the assumptions underlying the model/estimator.
    - You will be able to compare results across different specifications, different estimators, different models, understanding how changing each component will alter the interpretation of the result.

TEXT AND MATERIAL

We will be using William Greene (2017) "Econometric Analysis" 8th Ed. Other editions should be fine, I have both 8th and 7th which I am happy to lend out for short periods of time to students who would like to borrow them. Although the class roughly follows the text, the lecture notes will be much more important for study and tests. However, if you believe you will be using econometric methodology regularly (which I hope you will!) or plan to continue taking econometrics courses I highly recommend purchasing your own copy of the text. It is a highly referenced text that also includes topics that we will not be able to cover in class. It is used for many first year PhD econometrics sequences.

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.

Topics

Chapters	Topic
Appendices A, B, C, and D	Review of Calculus, Matrix Algebra, Probability and Statistics
2	Review of Linear Regression Model
3, 4.1-4.2	Review of Least Squares Regression
4.3-4.4	Finite Sample and Large Sample Properties
5.1-5.7	Review of Hypothesis testing and Model Selection
4.5, 9.1-9.3	Heteroscedasticity and Clustering
8.1-8.7	Instrumental Variables
9.4-9.8	Generalized Least Squares
7.1-7.2	Non-Linear Least Squares
14.1-14.6, 17.1,17.3	Maximum Likelihood Estimation
11, 20	Panel Data and Time Series

Grade Composition

Homeworks – 25%
Project – 15%
Midterm – 25%
Final (**Dec 12, 7:30am-9:30am**)– 35%

Homeworks - The homework assignments 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 homework exercises. While collaboration on the homework assignments is permitted, 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 turned in on time and in hard copy format (email submissions only allowed if discussed with me before the due date). 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 homework assignments handed in more than 24 hours late. All homeworks will be distributed a week before they are due.

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. Specific details on the project (including the due dates of the specific components and tips for finding datasets) will be distributed soon.

Exams – You will have the entire class time (1hr15min) to complete the midterm. For the midterm you may bring three 8.5x11 pieces of paper with your own study material (cheat sheets) as well as a calculator and pen/pencil. You may not use your phone as a calculator and the cheat sheets must be your own work (no printing multiple copies for multiple students). For the cumulative final exam, in addition to the three cheat sheets from the midterm, you are allowed three more 8.5x11 pieces of paper with your own study material. If you have a significant reason that you believe would justify rescheduling an exam, you must contact me **as soon as possible**. Significant reasons that can be anticipated (e.g. any schedule conflicts with final exams, required participation in University-sponsored activities, conferences, etc.) must be given to me at least **two weeks** before the exam. For reasons that cannot be anticipated, see me immediately to make appropriate arrangements. Generally, if circumstances warrant it, makeup exams will only be provided *before* the regularly scheduled exam. However, the resolution of any conflicts will be handled on a case-by-case basis.

COURSE EXPECTATIONS

You can expect me to
- Be available during office hours or appointments to talk all things econometrics!
- Be prepared for class by having lecture slides uploaded at least 24 hours before class.
- Provide clear and quick communication. I will notify you of all due dates in class and via email. 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. I allow phones, computers, tablets, etc. as long as they are on silent or vibrate.
- Actively participate in the course. What you get out of it is what you are willing to put into it.
- Be vocal on where you are confused or where we are moving too quickly. If you are having trouble understanding the material, it is likely others in the class are also confused. I will only be able to help you if you tell me you need help.
- 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.