Course Information

ECONOM 8473 (3 credit hours)

Class Meeting: Asynchronous

Professor: Alyssa Carlson (preferred address, Dr. Carlson or Professor Carlson)

Email: carlsonah@missouri.edu

Professor Office Hours: Wednesdays 11:00am-12:00pm CST/CDT on Zoom (or by appointment)

Course Description

This class is the second econometrics course in the master's program meant to build upon the foundations taught in Econ 7371 or Econ 8472. 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. In the last week, we may also cover a topic that the class finds particularly interesting (e.g., regression discontinuity, multinomial choice/demand estimation, simulation based estimation, spatial models, machine learning).

Prerequisites

Have taken Econ 7371 or Econ 8472; and Econ 7370 or Econ 8370; 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 pursuing (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, 2019.Links to an external site. 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. Note that there are not many changes from previous editions, so earlier editions should be OK. Appendix B Download Appendix B provides a good review of the fundamentals of probability theory and Appendix D Download Appendix Ddiscusses the basics of matrix algebra and notation which you can find in the Review of Linear Algebra/Calculus/Probability Theory (Week 1) module.
- Greene, William H. *Econometric Analysis*. Pearson, 2018.Links to an external site. 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 hereLinks to an external site.) 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.Links to an external site. 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.Links to an external site. 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.

Schedule of Topics

Below is the list of topics covered in the course, which weeks are allocated to covering that topic, and the relevant chapters in recommended Wooldridge and Greene textbooks.

Week	Topic	Wooldridge	Greene	Assignments
1	Review	App. B and D	App. A, B, and C	Quiz
2	Stata: an Introduction	n/a	n/a	Step 1
3	Review of Linear Regression Model	2.1, 3.1, 6.2, 7.1-7.5	2	Quiz, Stata Problem Set 1 assigned

4	Review of Least Squares Regression	2.2-2.4, 3.2, 3.6	3	Quiz, Stata Problem Set 1 due
5	Finite Sample Properties of OLS	2.5, 3.3-3.5	4.3	Quiz
6	Large Sample Properties of OLS	5, 8.1,8.2	4.4	Quiz, Step 2
7	Hypothesis Testing	4	5.1-5.4	Quiz, Stata Problem Set 2 assigned
8	Model Specification Testing	8.3, 9.1	5.8, 9.5	Quiz, Stata Problem Set 2 due
9	Time Series	10-11, 12.1-12.2,18.2-18.3	20.1-20.5, 20.7, 21.2	Quiz
10	Generalized Least Squares	8.4, 12.3-12.4	9.3-9.4,9.6, 20.8-20.9	Quiz, Step 3
11	Repeated Cross Section and Panel Data	13-14	11	Quiz, Stata Problem Set 3 assigned
12	Endogeneity	15	8	Quiz, Stata Problem Set 3 due
13	Maximum Likelihood and Binary Response	17.1	14, 17.1-17.3	Quiz
14	Policy Evaluation	N/A	N/A	Quiz, Step 4
15	Additional Topic (Class choice)	N/A	N/A	Final Project

See the on Calendar on Canvas for exact assignment due dates.

Grade Composition

Participation - 6%

Quizzes - 34%

Stata Problem Sets – 30%

Final Project – 30%

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 3 discussion boards throughout the semester. Posts contributing to a single discussion board is worth 2% of your letter grade, so if you only provide posts on 2 discussion boards throughout the semester then you only receive 4 out of 6 possible percentage points towards your final grade. Multiple posts on the same discussion board only counts once, so if you post 3 times on the same discussion board, you still only receive 2 percentage point.

Quizzes

The quizzes evaluate your progression throughout this course. Each module will be completed with a quiz for you to show your mastery of the material covered. These quizzes are open book and open note. Your lowest quiz score will be dropped and the remaining quizzes will have equal weight. Quizzes are due the Wednesday following the week that the material is covered. Quizzes may not be completed after the due date.

- Generative AI Policy: AI tools may not be used to answer quiz questions. Although quizzes are open book and open note, generative AI tools are not always accurate and have repeatedly led students to incorrect answers. Please refer to class notes and lectures to answer quiz questions.

Stata Problem Sets

There are three Stata problem sets throughout the course. The problem set asks you to apply what is taught in class to a specific research question. You have two weeks to do the problem sets. All problem sets come with a dataset that must be analyzed in Stata. Both the written answers as well as a log file of the Stata code/output must be submitted as a PDF.

- Generative AI Policy: AI tools can be used to help debug Stata code but cannot be used to answer the questions. All do-files, and answers to questions must be written by you, but you can use generative AI to help you determine the source of error in a code and find the correct syntax of the command. If you use generative AI as part of the Stata Problem Set, please include the following statement at the end of your answers:

I have used the AI tool,_____, when working on this assignment. I have adhered to the Generative AI policy required by this assignment.

(fill in the blank with the specific AI tool used)

Final Project

This project gives you the step by step practice of applying the econometrics tools learned throughout this course in a real empirical setting of your choice. This project is composed of 5 steps that will be turned in throughout the semester. The final step is a compilation of previously submitted and edited components of the projects as the final product. 20% of the grade is determined by completion of the 5 steps by each due date while the remaining 80% is determined by an evaluation of the final product. I will also provide written feedback on the submitted components so that you can improve your final report.

- Generative AI Policy: AI tools can be used to help debug Stata code but cannot be used for writing the paper. All sections of the paper must be written by you and not created by AI, but you can use generative AI to help you determine the source of error in a code and find the correct syntax of the command. If you use generative AI as part of the Final Project, please include the following statement at the end of the paper:

I have used the AI tool,_____, when working on this assignment. I have adhered to the Generative AI policy required by this assignment.

(fill in the blank with the specific AI tool used)

Late Assignments

Late quizzes will not be accepted. For Stata problem sets and final project assignments, if you think you will not make the deadline please email me with your concerns at least 24 hours before the due date. On a case by case basis, we can work together to figure the best solution. If we do not come up with an alternative due date, then if the 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.

Grading Scale

At minimum, you will receive the following letter grades:

>94% : A

90% - 94%: A-

87% - 90%: B+

84% - 87%: B

80% - 84%: B-

75% - 80%: C+

70% - 75%: C

65% - 70%: C-

60% - 65%: D+

55% - 60%: D

50% - 55%: D-

<50%: F

I reserve the right to lower the grading scale (e.g., a 93% becomes an A instead of an A-).

Course Expectations

You can expect me to

- Be available during office hours or appointments to talk all things econometrics! Because students in this class come from all across the globe, I only provide limited office hours with the understanding that the chosen time will not work for everyone. However, I am happy to set up appointments to meet during a time convenient for both of us.
- Provide clear and quick communication. I will notify you of all due dates via announcements. I will try to respond to emails within 24 hours (mostly likely faster). If I have not responded within 24 hours, I do ask that you email me again to make sure the correspondence was not lost in my inbox.
- Fair grading of homework, exams, and projects with a clear understanding of what the expectations are for each grade level.

I expect you to

- Actively participate in the course. What you get out of it is what you are willing to put into it. This also means that if you are struggling with the material, it is up to you to reach out for 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. Make sure that you take the time to review the lecture notes, textbook, and/or answer keys before the office hour/appointment so we can have a productive conversation.
- Be polite and respectful to me, your fellow classmates and yourself!

AI Policy

Learning to use AI responsibly and ethically is an important skill. AI tools are allowed and for specific assignments and tasks in this course, as designated, and with appropriate citation.

The use of generative AI tools **is permitted** in this course for the following activities:

- Code de-bugging for Stata Problem Sets
- Code de-bugging for Final Project

The use of generative AI tools **is not permitted** in this course for the following activities:

- Determining answers for Quizzes
- Interpreting Stata output for Stata Problem Sets or Final Project
- Writing a draft or final versions of the Final Project

Except as provided above, all other uses are prohibited without the prior consent of the instructor.

The content you submit is your responsibility. AI-generated content can be inaccurate, offensive, or biased. Your work must demonstrate your knowledge and avoid these pitfalls.

Sanctions and Applicability

- Sanctions for violation of these AI policies may include receiving a grade of F or 0 on the work submitted, as well as referral to the Academic Integrity Office.
- These AI policies apply to all written work submitted, including drafts.

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 or the Office of Academic IntegrityLinks to an external site..

Students are expected to adhere to this honor pledge on all graded work whether or not they are explicitly asked in advance to do so: “I strive to uphold the University values of respect, responsibility, discovery, and excellence. On my honor, I pledge that I have neither given nor received unauthorized assistance on this work.”

Academic Inquiry, Course Discussion, and Privacy

When students record something that happens in a course (a lecture, class discussions, meetings, etc.) it has an impact on the rights of the people captured in that recording. For example, the instructor and the University may have rights to the intellectual property contained in that recording. At the same time, another student who may have been recorded has the right to privacy. In order to protect these rights, MU employs a policy (called “Executive Order No. 38”Links to an external site.) to govern both situations you may encounter while taking a course – when an instructor allows recordings and when they do not.

Instructors should inform students which applies to their course:

- In this class, students may not make audio or video recordings of course activity, except students permitted to record as an accommodation undersection 240.040Links to an external site. of the Collected Rules.
- 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.

If the instructor doesn’t specifically prohibit recording course activity, then the students are allowed to record and the same prohibitions regarding distribution apply.

Students who violate this policy are subject to discipline in accordance with provisions of section 200.020Links to an external site. of the Collected Rules and Regulations of the University of Missouri pertaining to student conduct matters.

FERPA

The Family Educational Rights and Privacy ActLinks to an external site. (FERPA) of 1974 is a federal law designed to protect the privacy of educational records; to establish the rights of students to inspect and review their education records; and to provide guidelines for the correction of inaccurate and misleading data through informal and formal hearings. The

law applies to any individual who is or has been in attendance at an institution *and* regarding whom the institution maintains educational records. Once students have matriculated to the University of Missouri, i.e. enrolled in course work, FERPA rights transfer to the student, regardless of the student's age.
Students can enable certain individuals to have access to their education records by signing a FERPA waiverLinks to an external site.. The consent must specify records to be disclosed, state the purpose of the disclosure and identify the party or class of parties to whom the disclosure must be made.

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 Office of Academic IntegrityLinks to an external site., or the MU Office of Institutional EquityLinks to an external site.

Mental Health

The University of Missouri is committed to supporting student well-being through an integrated network of care, with a wide range of services to help students succeed. The MU Counseling Center offers professional mental health care, and can help you find the best approach to treatment based on your needs. Call to make an appointment at 573-882-6601. Any student in crisis may call or go to the MU Counseling Center between 8:00-5:00 M-F. After hours phone support is available at 573-882-6601.

Visit our website at https://wellbeing.missouri.edu/Links to an external site. to take an online mental health screening, find out about workshops and resources that can help you thrive, or learn how to support a friend.

Netiquette

Your instructor and fellow students wish to foster a safe online learning environment. All opinions and experiences, no matter how different or controversial they may be perceived, must be respected in the tolerant spirit of academic discourse. You are encouraged to comment, question, or critique an idea but you are not to attack an individual. Our differences, some of which are outlined in the University's nondiscrimination statement, will add richness to this learning experience. Please consider that sarcasm and humor can be misconstrued in online interactions and generate unintended disruptions. Working as a community of learners, we can build a polite and respectful course ambiance.

Religious Holidays & Accommodations

Many religious faiths are represented in the student body. The University of Missouri does not restrict student free exercise of religion, unless 1) the restriction is in the form of a rule of general applicability and does not discriminate against religion or among religions; and 2) it can be demonstrated that the application of the restriction is essential to furthering a compelling university interest, and is not unduly restrictive considering the relevant circumstance. The policy of the University attempts to strike a reasonable balance between accommodating the religious practice of students and meeting academic needs and standards.

Consult the Guide to ReligionsLinks to an external site. for the form that can be used to notify an instructor of an absence associated with religious practice. Students are expected to notify their instructor(s) by completing and submitting this form in a manner that is consistent with the procedure outlined in the university's policy on student religious accommodation. Providing false information regarding sincerely held religious practice is a violation of the university's Standard of Conduct and will not be tolerated.

Nondiscrimination Policy (Prohibited Discrimination)

The University of Missouri prohibits discrimination on the basis of race, color, national origin, ancestry, religion, sex,* sexual orientation, gender identity, gender expression, age, disability, veteran status, and any other status protected by applicable state or federal law. Discrimination includes any form of unequal treatment such as denial of opportunities, harassment, and violence.

*Including sex/gender and pregnancy discrimination; sexual assault; sexual harassment; dating/domestic violence; stalking; statutory rape; and incest. Retaliation for making or supporting a report of discrimination or harassment is also prohibited.

If you experience discrimination or sexual violence, you are encouraged (but not required) to report the incident to the MU Office of Institutional Equity. Learn more about your rights and options at equity.missouri.eduLinks to an external site. or call 573-882-3880. You also may make an anonymous report online.
If you are a survivor, or someone concerned about a survivor, and need immediate information on what to do, visit RSVP.missouri.eduLinks to an external site.. Both the Office of Institutional EquityLinks to an external site. and the RSVP CenterLinks to an external site. can provide assistance to students who need help with academics, housing, or other issues.

In the event that you choose to write or speak about having experienced any of these forms of prohibited discrimination or harassment, Mizzou policies require that, as your instructor, I share this information with the MU Office of Institutional Equity. They will contact you to offer information about resources, as well as your rights and options as a member of our campus community.

Students with Disabilities

The goal of the University of Missouri is to ensure an inclusive learning environment for all students. The University of Missouri Disability CenterLinks to an external site. provides services and accommodations for students to participate fully in the learning experience and to experience equitable evaluation of their performance. Students (including online students) with a documented disability can contact the Disability Center to establish an Accommodation PlanLinks to an external site.. Documented disabilities include *hearing, vision, mobility, learning and attention, psychological health, and physical health*. Students' accommodations are implemented with the input of students to maximize the learning experiences. The MU Disability Center keeps information about a student's disability confidential.

Please notify me of your eligibility for accommodations as soon as possible. Additionally, if there are aspects of the course that present as barriers, such as inaccessible course content (e.g., learning assessments, PowerPoints, non-captioned videos, images, tables, PDFs) or if you need an immediate accommodation due to an injury, please contact me or the Disability Center as soon as possible.