ECONOM – 8473 (online)
Applied Econometrics
Fall 2022
Course Syllabus

# Course Information

**Class Meeting:** Asynchronous

**Professor:** Alyssa Carlson (carlsonah@missouri.edu)

**Professor Office Hours:** T 10:00-11:00am CDT/CST on Zoom (or by appointment)

**Teaching Assistant:** Yong Feng (yong.feng@mail.missouri.edu)

**Teaching Assistant Office Hours:** TBD

# 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. 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 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 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. Appendices are provided on Canvas. 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. Appendices are provided on Canvas. The appendices 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.

# 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 |

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| 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 | THANKSGIVING BREAK | N/A | N/A | Step 4 |
| 15 | Policy Evaluation | | | Quiz |
| 16 | Additional Topic (If time permitted) | | | |

# 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 but are timed. 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.

**Stata Problem Sets -** There are three Stata problem sets throughout the course. The problem set ask 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. If a problem set 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 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.

# 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**

- 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. 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.

# 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 Integrity.

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."

# Accommodation of Disabilities

The goal of the University of Missouri is to ensure an inclusive learning environment for all students. The University of Missouri Disability Center 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 Plan. 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.

# 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 Integrity, or the MU Equity Office.

# 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") to govern both situations you may encounter while taking a course – when an instructor allows recordings and when they do not.

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 200.020of the Collected Rules and Regulations of the University of Missouri pertaining to student conduct matters.

# FERPA

The Family Educational Rights and Privacy Act (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 waiver. 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.

# Nondiscrimination Policy

The University of Missouri does not discriminate on the basis of race, color, national origin, ancestry, religion, sex* (including gender), pregnancy, sexual orientation, gender identity, gender expression, age, disability, protected 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. *Sex discrimination includes rape, sexual assault, sexual harassment, unwanted touching, stalking, dating/domestic violence, stalking, and sexual exploitation. 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 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.

If you are a survivor, or someone concerned about a survivor, and need immediate information on what to do, see RSVP Resources page. 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.

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 for Civil Rights & Title IX. They will contact you to offer information about resources, as well as your rights and options as a member of our campus community.

# 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/ 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. Download Sanvello, a phone app that teaches skills and strategies to help you maintain

good mental health. Log in with your Mizzou e-mail to unlock all the tools available through Sanvello at no additional cost to you.

# Last date of attendance and impact on financial aid

Federal regulations for financial aid require the student financial aid office to document the attendance of students who have received federal financial aid if they do not successfully complete any courses during the term. As a result, the last day of attendance (or activity) for any student receiving an F, U, or FN in this course will be recorded in the grade roster and reported to the financial aid office. **Based on the last day of attendance, students may be required to repay a portion of their financial aid award for the semester.**

A student's last day of attendance (or activity) is the last day on which a student participates in an academically-related activity at the University. These include:

- Attendance in class, lab, or an instructor's office hours
- The completion of an assignment or examination
- An appointment with a professor or e-mail correspondence regarding course material
- (Online courses only) For online courses, the last day a student submits an assignment or exam. Only logging into an online class without participating is *not* acceptable for last day of attendance

Please note that discussing a course withdrawal or notifying the instructor of an absence in class does not constitute participation for financial aid purposes. Moreover, any office hour visits or email correspondence must be related to the course material.

# 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 standard.

Consult IDE's Guide to Religions 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.

# Decreasing the Risk of COVID-19 in Classrooms and labs

If you have tested positive for COVID-19 or have been identified as someone who needs to quarantine, do not attend class in person until the mandated period for isolation or quarantine has passed. Your instructor will work with you on arrangements to access class material while you are in isolation or quarantine.

Additionally, if you are experiencing any COVID-related symptoms, or are otherwise feeling unwell, do not attend in-person classes and contact your health care provider and/or student health immediately. COVID symptoms include: fever greater than 100.4 or chills; cough, shortness of breath or difficulty breathing; fatigue; unexplained muscle or body aches; headache; new loss of taste or smell; sore throat; congestion or runny nose; nausea or vomiting; diarrhea.

Instructors or students with concerns about how a student is following any University-mandated COVID-19 policies and protocols should report those concerns to the Office of the Dean of Students. Concerns can be documented on a COVID Safety Measures Reporting Form.

Please note that sub-groups of students may have specific needs during COVID or online learning. One group is international students, who may be participating in class from their home countries and in different time zones. The instructor may be able to make reasonable accommodations to support the success of international students currently living in time zones that differ significantly from that of Columbia, MO. International students are expected to consult with their instructor about possible accommodations as soon as possible after the start of the course.

- Info for Students & Families
- Info for Faculty
- Info for Staff