

Economics 20: Econometrics

Syllabus

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Class time	TuThu 10:10-12:00 (10A)/TuThu 2:25-4:15 (02A); Silsby 126
Office hours	Mon 3:30-5:00; Silsby 310
Final Exam	Saturday, June 6, 3:00pm
TA:	Lulu Burnside: louisa.r.burnside.28@dartmouth.edu Aaron Cho aaron.k.cho@dartmouth.edu

Overview

This course covers the statistical techniques that economists use for estimating, testing, and forecasting economic relationships, with a particular focus on causal inference tools. The course emphasizes an understanding of the techniques involved as well as an understanding what these techniques mean in terms of the underlying economic issues. Successful completion of this course should allow you to (1) read much of the professional empirical literature in economics and (2) be prepared to start doing independent research using economic data in a 60-level course.

Prerequisites

This course assumes that you have a good grasp on the concepts covered on Economics 1, 10 and Math 3 (or Economics 3). You should be familiar with the material in Appendices A, B, and C (excluding the section on “maximum likelihood”) in [Wooldridge \(2019\)](#) (these appendices are posted on canvas for your reference). If you are not comfortable with this material, you should make time outside of class to review as it will be very difficult to succeed in this class without this knowledge and we will not cover this information in class. The first problem set is largely based on this material with very little lecture time to review it.

Class meetings

Most (but not all) class meetings will adhere to the following structure. During the first 60-75 minutes of class, we will cover key concepts in a lecture format. Note that participation in the form of questions or comments is still encouraged during lecture. After the lecture, we will take a 5-minute break. The remainder of class will be devoted to active learning activities (often in small groups) including solving practice problems and working with data.

Readings

The lecture notes are the primary materials for this class. The material covered during lecture and any provided handouts is what you are responsible for. There is also one assigned textbook for course: (AP) Angrist and Pischke, *Mastering Metrics: The Path from Cause to Effect* ([Angrist and Pischke, 2015](#)).

This is a very useful book that provides a digestible treatment of many of our key concepts, but is not quite technical enough for our course. In the past, this course has also used [Wooldridge \(2019\)](#). I am not requiring this textbook for our course and will not assign readings from it but you are, of course, welcome to track down a copy and read it on your own.

There will occasionally be other readings, such as an economics research paper or handout covering a specific topic. Note that if I am providing a handout on a given topic, that most likely means that I will not be covering that topic during lecture, but you are expected to know the handout material.

Statistical software

This course will emphasize the use of the statistical software program Stata. Follow the instructions online ([MacOS](#); [Windows](#)) to download and install Stata 18 on your computer. Make sure to follow the instructions for off-campus use if you are off campus. You first need to install the key access software and, if you are off campus, enable certain options. This software will be used throughout the class in STATA lab segments and for assignments. Additional help in getting Stata installed is available at the computing center, and additional help with using Stata can be obtained from myself or the course teaching assistants.

If you are an R user, you are free to use R for statistical programming assignments. I am actively working to update the course materials to include R examples and solutions. However, instruction will occur only in Stata, primarily because Stata will be used in your 60-level economics courses.

Assignments

There will be between four and six problem sets assigned throughout the term, covering both conceptual exercises (similar to standard problem sets in economics courses) and data exercises, which require statistical programming and apply course concepts to “real-life” data analysis. Problem sets will often be started briefly in class during the active-learning portion of class. These assignments will be graded very lightly based primarily on completion and punctuality (completed problem sets turned in on-time will typically receive full credit; incomplete assignments turned in on-time will typically receive partial credit; those turned in late will receive no credit). I recommend attempting the exercises as best as you can because these will be your main means of practicing for exams. I will provide no more than one practice exam for each of the three exams.

There will also be either a longer problem set or a short group project assigned at the end of the term. I will provide more details on this later.

Grading

The usual grade distribution for core economics class is a B or B+ median, broken down as roughly 30 percent A's (A, A-), 30 percent B's (B+, B, B-), and 30 percent C's (C+, C, C-) or below. The [economics department's grading policy](#) can be viewed on the department website.

The final grade in this course will be determined as follows:

Midterm 1	22.5%
Midterm 2	22.5%
Final Exam	25%
Problem Sets	15%
Project	10%
Participation	5%
Total	100%

The two midterm exams will be held during class on Tuesday, April 21 and Tuesday, May 19. The cumulative final exam will be held on Saturday, June 6 at 3pm.

Exam policies

Midterm and final exams must be taken at the scheduled times. Final exams are scheduled well in advance of the beginning of the term and all midterm exam dates are on the syllabus. If your plans conflict with the exam schedule, you should not take this class this term.

Exceptions may be made for Dartmouth-sponsored events such as varsity sports and other activities related to your Dartmouth education. On rare occasions, there may be a conflict with the final exam in another class. If possible, these conflicts will be resolved by taking the final exam for one of those classes during a different final exam period on the same day. Acute events, such as an illness or a death in the family will be handled on a case-by-case basis. In all cases, please inform me as soon as you are aware of any potential conflict

Generative AI policies

You should be familiar with [Dartmouth's policies on the use of generative AI tools in academic work](#). There are some contexts in which the use of tools like ChatGPT will be permitted in this course:

- As you begin learning to code in Stata, these tools can be very useful for getting over initial barriers to coding and for solving coding problems.
- You may use these tools for some components of the writing process, such as revising text that you have written (for clarity and grammar) or for generating a first draft of a tricky paragraph. You should not use AI tools to generate large portions of text.
- Use of generative AI tools will never be permitted on exams.

Please ask me about whether potential other uses you are considering are permitted. In all assignments, you must explicitly acknowledge in writing if you have used GenAI in any way and provide a brief description on how these tools were used. For both coding and writing, you must explain what specific tasks you used GenAI for and, if you used it to generate first draft of text or code, you should explain what portions of the AI-generated text or code you used, and how you improved on it. This acknowledgement and the explanation should not be AI-generated.

You should also keep in mind that over-reliance on GenAI tools throughout the term will harm your learning and make it more difficult to do well on the in-person exams, which account for 70 percent of your final grade.

Honor code

All students are expected to abide by [Dartmouth's Academic Honor Policy](#). While you are encouraged to work together on homework assignments, please turn in your own work. Do not give, seek, or receive help during exams. Please also try to avoid behaviors that might give the impression of collaborating on exams. Suspected violations of the Academic Honor Principle will be referred to the Office of Judicial Affairs for investigation.

Students with disabilities

Students with disabilities who may need disability-related academic adjustments and services for this course are encouraged to let me know as early in the term as possible. Students requiring disability-related academic adjustments and services must consult [Student Accessibility Services](#) (Carson Hall, Suite 125, 646-9900). Once SAS has authorized services, students must show the originally signed SAS Services and Consent Form and/or a letter on SAS letterhead to their professor. As a first step, if students have questions about whether they qualify to receive academic adjustments and services, they should contact the SAS office. All inquiries and discussions will remain confidential.

- Any extra time for exams will be contiguous with the scheduled exam time if at all possible. Generally, students will start the exam early and finish with the rest of the class or start with the rest of the class and finish late.
- In the week before each exam, it is your responsibility to verify all arrangements by email. It is your responsibility to make sure that the time and place for your exam is clear before the day of the exam for each exam during the term.

Religious observances

Some students may wish to take part in religious observances that occur during this academic term. If you have a religious observance that conflicts with your participation in the course, please meet with me before the end of the second week of the term to discuss appropriate accommodations.

Names and pronouns

In this classroom, we will respect and refer to people using the names and personal pronouns that they prefer. If you think I may use incorrect pronouns for you or if I have used incorrect pronouns for you, please email me and I will do my best to use the pronouns you identify with.

Wellness resources

The academic environment at Dartmouth is challenging, our terms are intensive, and classes may not be the only demanding part of your life. There are a number of resources available on campus to support your wellness, including:

- Your [undergraduate dean](#).
- The [counseling center](#) at Dick's House.
- The [student wellness center](#)

Working in groups

This class mainly involves working in groups. Please be respectful, inclusive, and considerate in and out of class. Please make an effort to understand one another's perspectives. This will make everyone's experience in the group more pleasant, and it is also likely to make the group more effective. Please also try to be understanding of the challenges your fellow students are facing.

Preliminary course outline

This course outline is preliminary and subject to change. Please see the course canvas page for the most updated version.

1. Course introduction and review

- Tue 03/31: Course logistics, introduction to causality
- Thu 04/02: Causality, statistics review

2. Basics of regression analysis

- Tue 04/07: Bivariate regression; analysis of variance
- Thu 04/09: Multiple regression; omitted variables bias
- Tue 04/14: Indicator variables; interaction terms; polynomial terms
- Thu 04/16: Statistical inference in regressions
- Tue 04/21: Midterm 01
- Thu 04/23: No class

3. Causal inference in cross-sectional data

- Tue 04/28: Experiments; selection on observables
- Thu 04/30: Instrumental variables
- Tue 05/05: Instrumental variables
- Thu 05/07: Instrumental variables; regression discontinuity

4. Causal inference in panel data

- Tue 05/12: Panel data
- Thu 05/14: Panel data
- Tue 05/19: Midterm 02
- Thu 05/21: Difference-in-differences
- Tue 05/26: Difference-in-differences

References

Joshua D. Angrist and Jörn-Steffen Pischke. *Mastering 'Metrics: The Path from Cause to Effect*. Princeton University Press, Princeton, NJ, 2015.

Jeffrey M. Wooldridge. *Introductory Econometrics: A Modern Approach*. Cengage Learning, Boston, MA, 7 edition, 2019.