

Syllabus for Econ 201 - Introduction to Econometrics

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Fall 2021

created: 9/16/21

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We will meet three times a week: Mondays, Wednesdays and Fridays from 9-9.50am. The room is Tech LR3.

Office hours: Tuesdays 9-11am in KGH 3493 (i.e. Kellogg Building, 3rd floor), Thursdays 12-2pm (over Zoom).

The TAs (Diego, Bruno and Hans) will announce their office hours separately.

All Zoom links for office hours will be posted on Canvas.

1 Course Overview

This is an introductory course in econometrics. The aim is to equip students with the basic tools needed to estimate and analyse empirical relationships between economic variables. It will be a mixture of theory and practice. The theory is essential if you are to understand why you're doing what you're doing. The practice will help you get a feel for the type of software used in empirical economics, and for the correct interpretation of the results such software generates. So, there will necessarily be a significant theoretical component to the course, but you will occasionally get your hands dirty with real data.

Prerequisites for the course are 201, 202, MATH 220, STAT 210 or equivalent. Of these STAT 210 is most important; get in touch with me if you have not done this course already.

All students are required to wear masks in class, at all times. I will take off my mask to lecture, as is permitted for fully-vaccinated instructors. I'll talk more about classroom policy when we first meet; for now take a look at the statement in section 6.3.

You are allowed to use a laptop or tablet in class, but to do so you must be sitting in one of the first two rows.

2 Evaluation

- Three assignments, due on Fridays of October 8th, October 29th and November 19th. (10% each).
- Two midterms, in class on Friday October 15th and Monday November 8th. (20% each)

- Final exam on Thursday December 9th at 3pm. (30%)

I will be explicit about what is required on the midterms and final closer to the times.

Important: should you get a lower percentage score on an assignment than on a corresponding exam, then that exam will replace the assignment in the weight of the class overall. For example, if you score 70% on assignment 2 and 80% on midterm 2, then midterm 2 will count for 30% of the class overall and assignment 2 will disappear. [Note that this means you could choose to not complete any assignments at all, and simply take the exams. This is a risky strategy, as assignment scores are typically higher than exam scores.]

3 Sections

Each student will have registered for one of the following discussion sections:

Section #	Day/time	Room	TA
21	Tuesday 4-4.50pm	UNV 121	Hans
22	Thursday 4-4.50pm	2122SH 250	Hans
23	Tuesday 5-5.50pm	TCH M164	Bruno
24	Thursday 5-5.50pm	TCH M164	Bruno
25	Tuesday 4-4.50pm	TCH L150	Diego
26	Thursday 4-4.50pm	TCH L211	Diego

I am often asked if the sections are mandatory. They are not, at least inasmuch as you will not be directly penalised for not attending. However, the sections will be very useful. There will be exercises for each section that I **strongly** advise you attempt beforehand. Econometrics is one of the subjects where practice is essential for understanding. You will get a lot more from the course, and find the midterms and final much easier, if you try the exercises before you see the answers.

There is no section in week 1. Sections begin in week 2, i.e. the week starting with Monday September 27th.

4 Course materials

The textbook will be *Introduction to Econometrics* [5th edition] by Christopher Dougherty. We will be following this book very closely, and it will serve as the blueprint for the course. It is absolutely essential that you get your hands on a copy.

This is an excellent textbook. Dougherty has taught the 281 equivalent at the London School of Economics since before I was your age, and essentially the book comprises his lecture notes. Dougherty talks the reader through the equations in a more explicit manner than in most other books, and provides the underlying intuition wherever possible.

Another feature is the body of supporting material available at Dougherty's website, the link to which is provided below. This includes a study guide which has an overview of what you should have learned from each chapter, answers to some of the textbook exercises and further exercises (with answers). If you ever want more practice than the questions I provide in sections, this is the place to go. He also posts some Powerpoint slideshows, though you can probably ignore these.

Dougherty also provides downloadable datasets to be used in some of the textbook exercises.

Finally, this book is inexpensive relative to its competitors, which is always nice.

4.1 textbook website

The URL for the website with supporting material is <http://global.oup.com/uk/orc/busecon/economics/dougherty5e/>. There you should find the following resources:

- downloadable slideshows
- study guide for the textbook
- datasets that will be used for some computer exercises

In general, refer to Canvas for administrative material/announcements. You should treat Dougherty's site as an invaluable supplement.

4.2 STATA

In the three assignments you'll be asked to use STATA. You'll only need to do some pretty basic things with it, but this will nonetheless be a good introduction to one of the most widely-used econometric software packages.

STATA is available on campus at pretty much all the computers: <https://www.library.northwestern.edu/visit/technology/computers/index.html>. It's also available via NUworkspace: <https://nuworkspace.northwestern.edu/>.

4.3 other materials

I will post on Canvas the slides I'll project in class. There will be three versions of the slides available: one identical to that I use in class; one in 'handout' form that omits the dynamic overlays but otherwise resembles the version used in class; and one in 'article' form that's even more compact.

I suggest you print out the handout version of the slides and bring them with you to class to annotate. **Note that reading the slides is not a perfect substitute for reading the book, which you must do.**

5 Lecture topics

We are not going to get through the whole book. The provisional plan is that we cover, in order, all the chapters up to and including Chapter 9 (simultaneous equations). If it seems we are falling behind schedule, my preference is to drop material from the syllabus rather than speed up. I will alert you as soon as this looks likely. We will typically spend a couple of classes on each chapter.

Review chapter: Random variables, sampling, estimation and inference

Probability distribution of a random variable. Expected value of a random variable. Expected value of a function of a random variable. Population variance of a discrete random variable and alternative expression

for it. Expected value rules. Independence of two random variables. Population covariance, covariance and variance rules, and correlation. Sampling and estimators. Unbiasedness. Efficiency. Loss functions and mean square error. Estimators of variance, covariance and correlation. Probability limits and their rules. Consistency. The central limit theorem. [Note that while the textbook reviews hypothesis testing in this chapter, I will defer this until Chapter 2.]

Chapter 1: Simple regression analysis

Simple regression model. Derivation of linear regression coefficients. Interpretation of a regression equation. Goodness of fit.

Chapter 2: Properties of the regression coefficients

Types of data and regression model. Assumptions for Model A. Regression coefficients as random variables. Unbiasedness of the regression coefficients. Precision of the regression coefficients. Gauss-Markov theorem. t test of a hypothesis relating to a regression coefficient. Type I error and Type II error. Confidence intervals. One-sided tests. F test of goodness of fit.

Chapter 3: Multiple regression analysis

Multiple regression with two explanatory variables. Graphical representation of a relationship in a multiple regression model. Properties of the multiple regression coefficients. Population variance of the regression coefficients. Decomposition of their standard errors. Multicollinearity. F tests in a multiple regression model.

Chapter 4: Transformation of variables

Linearity and nonlinearity. Elasticities and double-logarithmic models. Semilogarithmic models. The disturbance term in nonlinear models. Nonlinear regression. .

Chapter 5: Dummy variables

Dummy variables. Dummy classification with more than two categories. The effects of changing the reference category. Multiple sets of dummy variables. Slope dummy variables.

Chapter 6: Specification of regression variables: a preliminary skirmish

Omitted variable bias. Consequences of the inclusion of an irrelevant variable. Proxy variables. F test of a linear restriction. Reparameterization of a regression model. t test of a restriction. Tests of multiple restrictions. Tests of zero restrictions.

Chapter 7: Heteroscedasticity

Meaning of heteroscedasticity. Consequences of heteroscedasticity. Goldfeld-Quandt and White tests for heteroscedasticity. Elimination of heteroscedasticity using weighted or logarithmic regressions. Use of heteroscedasticity-consistent standard errors.

Chapter 8: Stochastic regressors and measurement errors

Stochastic regressors. Assumptions for models with stochastic regressors. Finite sample and asymptotic properties of the regression coefficients in models with stochastic regressors. Measurement error and its consequences. Friedman's Permanent Income Hypothesis. Instrumental variables.

Chapter 9: Simultaneous equations estimation

Definitions of endogenous variables, exogenous variables, structural equations and reduced form. Inconsistency of OLS. Use of instrumental variables. Exact identification, underidentification, and overidentification. Two-stage least squares.

6 Various statements

All instructors have been asked to include the following statements on syllabi this quarter.

6.1 Academic Integrity Statement

Students in this course are required to comply with the policies found in the booklet, "Academic Integrity at Northwestern University: A Basic Guide". All papers submitted for credit in this course must be submitted electronically unless otherwise instructed by the professor. Your written work may be tested for plagiarized content. For details regarding academic integrity at Northwestern or to download the guide, visit: <https://www.northwestern.edu/provost/policies/academic-integrity/index.html>

6.2 Accessibility Statement

Northwestern University is committed to providing the most accessible learning environment as possible for students with disabilities. Should you anticipate or experience disability-related barriers in the academic setting, please contact AccessibleNU to move forward with the university's established accommodation process (e: accessiblenu@northwestern.edu; p: 847-467-5530). If you already have established accommodations with AccessibleNU, please let me know as soon as possible, preferably within the first two weeks of the term, so we can work together to implement your disability accommodations. Disability information, including academic accommodations, is confidential under the Family Educational Rights and Privacy Act.

6.3 COVID-19 Classroom Expectations Statement

Students, faculty, and staff must comply with University expectations regarding appropriate classroom behavior, including those outlined below and in the COVID-19 Code of Conduct.¹ With respect to classroom procedures, this includes:

- *Policies regarding masking and social distancing evolve as the public health situation changes. Students are responsible for understanding and complying with current masking, testing, Symptom Tracking, and social distancing requirements.*
- *In some classes, masking and/or social distancing may be required as a result of an Americans with Disabilities Act (ADA) accommodation for the instructor or a student in the class even when not generally required on campus. In such cases, the instructor will notify the class.*
- *No food is allowed inside classrooms. Drinks are permitted, but please keep your face covering on and use a straw.*

¹<https://www.northwestern.edu/communitystandards/about-us/northwestern-university-student-expectations-covid-19-code-of-conduct.html>

- *Faculty may assign seats in some classes to help facilitate contact tracing in the event that a student tests positive for COVID-19. Students must sit in their assigned seats.*

[Note from RW: as I said earlier, I will take off my mask to lecture. I do not plan to assign seats.]

6.4 COVID-19 Testing Compliance Statement

To protect the health of our community, Northwestern University requires unvaccinated students who are in on-campus programs to be tested for COVID-19 twice per week.

Students who fail to comply with current or future COVID-19 testing protocols will be referred to the Office of Community standards to face disciplinary action, including escalation up to restriction from campus and suspension.

6.5 Exceptions to Class Modality

Class sessions for this course will occur in person. Individual students will not be granted permission to attend remotely except as the result of an Americans with Disabilities Act (ADA) accommodation as determined by AccessibleNU.

6.6 Guidance on Class Recordings

This class or portions of this class will be recorded by the instructor for educational purpose and available to the class during the quarter. Your instructor will communicate how you can access the recordings. Portions of the course that contain images, questions or commentary/discussion by students will be edited out of any recordings that are saved beyond the current term.

[Note from RW: I am not currently planning to record anything, but am including the above just in case that changes.]

6.7 Prohibition of Recording of Class Sessions by Students

Unauthorized student recording of classroom or other academic activities (including advising sessions or office hours) is prohibited. Unauthorized recording is unethical and may also be a violation of University policy and state law. Students requesting the use of assistive technology as an accommodation should contact AccessibleNU. Unauthorized use of classroom recordings - including distributing or posting them - is also prohibited. Under the University's Copyright Policy, faculty own the copyright to instructional materials - including those resources created specifically for the purposes of instruction, such as syllabi, lectures and lecture notes, and presentations. Students cannot copy, reproduce, display, or distribute these materials. Students who engage in unauthorized recording, unauthorized use of a recording, or unauthorized distribution of instructional materials will be referred to the appropriate University office for follow-up.

6.8 Support for Wellness and Mental Health

Northwestern University is committed to supporting the wellness of our students. Student Affairs has multiple resources to support student wellness and mental health. If you are feeling distressed or overwhelmed, please reach out for help. Students can access confidential resources through the Counseling and Psychological Services (CAPS), Religious and Spiritual Life (RSL) and the Center for Awareness, Response and Education (CARE). Additional information on all of the resources mentioned above can be found here:

<https://www.northwestern.edu/counseling/>

<https://www.northwestern.edu/religious-life/>

<https://www.northwestern.edu/care/>