ECON 4261: COURSE SYLLABUS

- Instructor : Luis Díez-Catalán

  Office : 3-107 Hanson Hall

  Email : diezx010@umn.edu

  Office Hours : 11 am - 12.15 pm, Tuesday
  and 11 am - 11.45 am, Thursday
  or by appointment

- Recitation Leader : Sergiy Golovin

  Office : 3-127 Hanson Hall

  Email : golov006@umn.edu

  Office Hours : 9 am - 11 am, Friday
  or by appointment

- Recitation Leader : Isaac Swift

  Office : 3-151 Hanson Hall

  Email : swift105@umn.edu

  Office Hours : 9 am - 11 am, Monday
  or by appointment

Please include ECON4261 in the subject of your email with a couple of key words describing the content of your email. You can expect an answer within 24 hours.

1 Introduction

Econometrics is a body of theory and methods for analyzing economic data. Econometrics draws primarily from statistics, probability and economic theory to address empirical questions about the economy.

This course will start with some classic examples of econometric models; some are derived from economic theory, others are not. These will serve as an introduction to econometric modeling. Three key concepts: unbiasedness, consistency and efficiency of an estimator will then be studied. We will discuss the Classical Linear Model and the estimation method of Ordinary Least Squares (OLS) and Method of Moments. We will then be precise about assumptions under which OLS is unbiased, consistent, and efficient. Inference, still in the Classical Linear Model, will have us study hypothesis tests and confidence intervals. Before moving onto refinement of the above theory, we will cover identification problems to gain a better understanding of what can and cannot be said from the data. Violations of the assumptions alluded to above and associated remedies will then be studied: Generalized Least Squares (GLS) for serial correlated and heteroskedastic errors and IV for endogeneity. Endogeneity and the use of instrumental variables will provide natural grounds for a discussion of causality. We will also cover the method of Maximum Likelihood. Applications of the above techniques to economic data with Stata will be a constant theme. If time allows, we will also cover basic concepts in time series analysis and panel data models for which data is organized along both the cross-sectional dimension and the time series dimension. We will study methods of estimation called pooled OLS, fixed effects, and random effects.

1.1 Learning goals

After taking this course, a student will be able to read critically and conduct empirical analysis of economic data. In particular, the student will be able to:

- estimate parameters of an economic model and conduct inference;

- read and interpret empirical analysis critically, and in particular, appreciate the difference between correlation and causation;
- appreciate what can and cannot be said from economic data (identification).

2 Course Details

2.1 Times and Location

Lecture is held Tuesdays and Thursdays from 9.45 am to 11 am in Anderson Hall 230. Your attendance is expected.

2.2 Recitation

Recitations will be held on Tuesdays, from 12.20 to 1.10 pm in Blegen Hall 220 (led by Isaac Swift), Thursdays from 12.20 to 1.10 pm in Blegen Hall 220 (led by Isaac Swift) and Thursdays from 1.25 to 2.15 pm in Blegen Hall 125 (led by Sergiy Golovin). Your attendance is expected in the section in which you registered.

2.3 Homework

There will be four assignments which will involve analytical derivations as well as using a statistical software to conduct estimation and inference and report your results. You will be granted access to Stata by CLA OIT; make sure that by the end of the second week of class you know how to access Stata.

The due dates for the assignments are Thursday February 9, March 2, April 6 and April 27. These due dates are subject to change, in which case you will be informed during class or recitation.

All homework assignments will be available online at the class webpage, no hard copies will be provided. We do not require that your assignments be typed (although learning to use something like LaTex wouldn't be a bad skill to learn), but all assignments must be neatly done. Homework will be collected at the lecture on the due date. No late assignments will be accepted. Only documented special circumstances (e.g. severe illness with doctor's note) are possible exceptions to this. If you cannot attend class on the due date, you must turn it in before the class. You will lose 15 points if you do not staple your homework and 25 points if it is nearly illegible. Also, you will lose 10 points if you do not write your recitation section correctly.

2.4 Exam

There will be six 10 minutes quizzes (multiple choice format) covering the material covered since the previous quiz (or the beginning of class for the first quiz) on Tuesday January 31, February 14, February 28, April 4, April 18 and May 2 2017 at the beginning of the class. There will be no makeup quiz.

There will be a midterm on Thursday March 9, 2017 during the lecture time. The material for the midterm exam will include everything we will have covered by then (more details will be provided in due time).

The final exam will be on Thursday May 11, 2017 from 1.30 pm to 3.30 pm. The material for the final exam is cumulative with an emphasis on the material covered after the midterm.

All exams are closed book and closed notes.

2.5 Grading

- 6 Quizzes - 30 percent (average of best four out of six)

- 4 Homeworks - 20 percent
- Midterm - 20 percent
- Final - 30 percent

Below is the grading scale for the course. We reserve the right to lower these cut-offs points (i.e. increase the letter grades for percentages), but we will not raise the cut-offs (i.e. make it harder to get good grades).

Table 1: Grading Scale

% Points	0-59	60-67	68-69	70-71	72-77	78-79	80-81	82-87	88-89	90-91	92+
Grade	F	D	D+	C-	C	C+	B-	B	B+	A-	A

2.6 Course Material

Material will be posted on the Moodle course website (https://moodle2.umn.edu/). Please check it regularly. The material for the course will be based on lecture notes (students are expected to take notes during classes). References to ETM, Greene and Hayashi (see the list below) will be given in class for each topic we will cover.

- Greene, W., H., *Econometric Analysis*, 2012, Prentice Hall [Greene].
- Davidson R. and J. G. MacKinnon, *Econometric Theory and Methods*, 2004, Oxford [ETM].
- Hayashi F., *Econometrics*, 2000, Princeton [Hayashi].
- For the computational part of the course, a particularly useful textbook is Baum, C. F. *An Introduction to Modern Econometrics Using Stata*, 2006, Stata Press.
- Angrist, J. and J. Pischke, *Mastering Metrics: The Path from Cause to Effect*, 2015, Princeton [AP].

2.7 Disability Services

Students with disabilities must be registered with Disability Services. Contact http://ds.umn.edu. The Department of Economics, in conjunction with Disability Services, will make appropriate accommodations for students with disabilities. Specifically, exams will be administered by Disability Services to meet student needs. Please contact the instructor as soon as possible if you need accommodation.

2.8 Prerequisits

The prerequists for this course are:

- ECON 3101 Intermediate Micro
- MATH 1271/2 Calculus
- MATH 2243 Linear Algebra
- MATH 2263 Multivariate Calculus
- STAT 4/5101/2 Theory of Statistics
- MATH 4242 Applied Linear Algebra is strongly recommended
- Familiarity with computers.

2.9 Academic Dishonesty

For the purpose of this class, students are allowed (and in fact encouraged) to work together on homework provided the following rules are followed: any collaboration must be acknowledged explicitly, each student must individually type up or write up each homework assignment and any use of material other than class notes must be cited. Identical assignments will receive a zero score. Anyone committing scholastic dishonesty on an exam will receive an F for the assignment or exam and the incident

will be referred to the Office for Student Conduct and Academic Integrity. Among other things, this includes looking at the exam of another student, communicating with another student via any means during the exam, and continuing to work on the exam when the exam is complete. There is zero tolerance for cheating on exams.

3 Tentative Schedule and Course Content

Subject to change at the discretion of the instructor. References to sections in the textbooks complements (but do not necessarily substitute) well class notes and documents in Moodle.

- Chapter 1: Introduction to Econometric Modeling.
  - Introduction to the Classical Linear Model.
  - Methods of estimation: Ordinary Least Squares, Method of Moments and Maximum Likelihood.
  - Properties of Estimators: Unbiasedness, Consistency and Efficiency.
  - Interpretation of Regression Coefficients.
  - Structural vs. Reduced Form Approach.

  References: Chapter 1 and 10 (sections 10.1 and 10.2) [ETM], Chapter 1, 2 and 14 (up to and including section 14.3) [Greene] and Chapter 1 (sections 1.1 and 1.5, pag 47-49) and pag. 204-205 [Hayashi].

- Chapter 2: Math and Stats Review.
  - Basic concepts in statistics.
  - Basic concepts in linear algebra.

  References: Appendix [Greene]

- Chapter 3: OLS in the Classical Linear Model.

  - Algebra of OLS with K regressors and for the simple linear regression model (K=2).
  - Geometrical interpretation of OLS.
  - Statistical interpretation of OLS.
  - Frisch-Waugh-Lovell Theorem.
  - The variance of OLS.
  - In the CLM: OLS is unbiased, consistent and efficient.
  - Heteroskedasticity-Consistent Standard Errors (White SE).

  References: Chapter 2 and 3 [ETM], Chapter 3 (except section 3.4), Chapter 4 (up to and including 4.4.2, 4.7.1 and 4.7.5) and pag. 63-65 (consistency) [Greene] and Chapter 1 (sections 1.2-1.3) [Hayashi]

  Midterm: Thursday March 9, 2017 during the lecture time.

- Chapter 4: Hypothesis Tests and Confidence Intervals.

  - Basic concepts on hypothesis testing.
  - Some properties of standard distributions.
  - Exact vs. Asymptotic Tests.
  - Testing of multiple restrictions: F-test.

  References: Chapter 4 (sections 4.1-4.5) and Chapter 5 (sections 5.1-5.2 and 5.5) [ETM], Chapter 5 (sections 5.1, 5.2.1 and 5.4.2) [Greene] and Chapter 1 (section 1.4) [Hayashi]

- Chapter 5: Generalized Least Squares.
  - Derivation of the GLS estimator.
  - Efficiency under a known form of heteroskedasticity and serial correlation.
  - Discussion: Weighted Least Squares.

  References: Chapter 7 (sections 7.1-7.2) [ETM], Chapter 9 (sections 9.2.3, 9.3 and 9.6) [Greene], Chapter 1 (section 1.6) [Hayashi].

- Chapter 6: Instrumental Variables.
  - Sources of Endogeneity: omitted variable bias, measurement error, reverse causality, simultaneity and selected sample.
  - Sample selection and Randomized Trials.
  - Derivation of the Instrumental Variables (IV) estimator.
  - Discussion about Instrumental Variables and Causality.
  - Derivation of the Generalized Instrumental Variables Estimator (GIVE) / Two Stages Least Squares (2SLS).
  - Identification.

  References: Chapter 8 (sections 8.1-8.3) [ETM], Chapter 8 (sections 8.1-8.3 and 8.5) [Greene], Chapter 3 (sections 3.1-3.2) [Hayashi] and Chapter 1 [AP].

- Chapter 7: Introduction to Time Series and Panel Data (time permitting)

Final Exam: Thursday May 11, 2017 from 1.30 pm to 3.30 pm.