Brown University

Department of Economics

Spring 2015

ECON 1620-S01 Introduction to Econometrics

Course Syllabus

Course Instructor: Dimitra Politi

Office hour: Mondays 1-2pm (and by appointment)

Office location: 70 Waterman Street 303

Email: dimitra_politi@brown.edu

Teaching Fellow: Daniela Scida

Office hour: Tuesdays 9-10am

Office location: 70 Waterman Street 208

Email: daniela_scida@brown.edu

Teaching Assistants:

Philipp Ketz

Office hour and location:

Thursdays 11:00am-12:00pm

at Robinson Hall basement

Email: philipp_ketz@brown.edu

Simon Freyaldenhoven

Office hour and location:

Wednesdays 11:00am-12:00pm

at Robinson Hall basement

Email: simon_freyaldenhoven@brown.edu

Course Logistics:

Lecture times: Mondays, Wednesdays, Fridays 10:00-10:50am

Lectures location: Salomon 001 (except for 02/18 and 02/20, when we meet at List Art Center 120)

Computer conferences location (starting week 2): CIT Center (Thomas Watson CIT) 265

Computer conferences times:

C01	Mondays 12:00-12:50pm
C02	Tuesdays 12:00-12:50pm
C03	Tuesdays 6:00-6:50pm
C04	Wednesdays 6:00-6:50pm
C05	Thursdays 12:00-12:50pm
C06	Fridays 3:00-3:50pm

Course Description

ECON 1620 is an introductory course in statistics and econometrics offered by the Economics Department at Brown. Econometrics is the application of statistical methods to quantify economic theory. Economists use statistical tools to collect, analyse and interpret economic data. Econometrics is used to estimate economic relationships, test the validity of competing theories, forecast economic variables, and evaluate government and business policies.

The course starts with an exposition of descriptive statistics. Then, starting from the definitions of probability and random variables, students will be introduced to the concept of probability distributions and random sampling. Special emphasis will be placed on the distribution of the sample average. Students will also explore the Central Limit Theorem and its consequences for large sample approximations. Students will also be introduced to the concepts of statistical inference, estimation and hypothesis testing, as well as regression analysis.

Theory will always be illustrated with examples, and emphasis will be placed on the connection between the theory and actual data processing. Substantial class time will be spent on short in-class exercises. This practice will be reinforced by compulsory, weekly computer lectures in small groups, where students will go over homeworks, and familiarize themselves with Stata, a computer programme commonly used by economists for data analysis. There will also be three Stata-based empirical projects, where students will use their knowledge to analyse real-world data.

Aims and Objectives

Intelligent data processing is a skill that is becoming increasingly important in today's world. The abundance of information available makes it essential that students develop the tools to both extract knowledge and understand the limitations of data presented to them both in and outside of the workplace. This class aims to equip students with the necessary tools for the analysis of "raw" information. By the end of the course, students will have a greater understanding of the use of statistics which they encounter in non-classroom contexts.

This course will also provide students with the theoretical background and practical skills needed to understand current empirical studies, as well as to carry out their own empirical work in economics, with real-world data. After attending these lectures, students should be familiar with basic concepts in probability, statistics, and econometrics, and be ready to take higher-level economics courses in Econometrics or other applied fields.

Course Prerequisites

ECON 0110 or advanced placement[1], or ECON 1110 or ECON 1130; and MATH 0060, 0070, or 0090. No background in statistics is necessary. Economics majors should take this course as early as possible, because it is a prerequisite for many upper-level empirical Economics courses (e.g. Labor, Health, Urban, and Development Economics).

Note on ECON 1630: Both ECON 1620 and ECON 1630 satisfy the econometrics requirement for standard economics or business economics concentrations. However, **Mathematical Economics or Applied Math Economics concentrators who have already taken APMA 1650 must take ECON 1630, not this course.** Economics concentrators can take ECON 1630 as a successor to ECON 1620, and we advise students who wish to take advanced empirical classes and/or write an empirical thesis to take both ECON 1620 and ECON 1630, even though only ECON 1620 is strictly required for upper level empirical courses.

Readings and learning resources:

We will draw on a number of textbooks for this course. As this is an Introductory Econometrics course, any textbook on Introductory Statistics and Econometrics covers the material that we will go over in class. Students should consult the course slides and their notes, in conjunction with the textbooks.

The main textbooks for this course are:

1. [LM] Mathematical Statistics and its Applications, by Richard J. Larsen and Morris L. Marx, 5th edition (Pearson)
2. [SW] Introduction to Econometrics, by James M. Stock and Mark W. Watson, 3rd edition (Pearson)

Other textbooks which might be useful are:

1. [ASW] Statistics for Business and Economics, by David R. Anderson, Dennis J. Sweeney, Thomas A. Williams, Jeffrey D. Camm and James J. Cochran, 12th edition (Cengage Learning)
2. [W] Introductory Econometrics: A modern approach, by Jeffrey Wooldridge, 5th edition (Cengage Learning)

[1] Please see http://www.brown.edu/Departments/Economics/ugrad/placement.php

Students are also encouraged to explore free online resources and tutorials, such as videos on Probability and Statistics by the Khan Academy (www.khanacademy.org), to complement their understanding of the material.

Course Organization

There are 3 weekly lectures and 1 **compulsory** weekly computer conference (starting on week 2), the content of which is testable material. There will be no computer lectures on the weeks of February 16th (Presidents' Day long weekend) and March 16th (midterm week). Lecture slides will be available ahead of the lecture on Canvas. There will be 6 homework assignments, published on Canvas on Friday at 4pm, and due the following Friday by 4pm. Solutions to homeworks will be posted on Canvas past their due date. There will also be 3 empirical projects. Submission of problem sets and projects is done electronically and individually. Homeworks must be submitted through a Google form, the link to which will be posted on Canvas. The empirical projects must be submitted by email to econ1620project@gmail.com one week after they have been published on Canvas. Please check Canvas for additional readings and course-related announcements during the course of the semester.

Class exams, Assessment, and Grading

There will be one midterm exam and one final exam for this class. The exam dates are:

1. Midterm exam: Wednesday
2. Final exam: Friday May 15th at 2pm, exam group 03.

Assessment is based on your performance in the midterm exam (30% of final grade), the final exam (40% of final grade), 6 homework assignments (10% of final grade), and 3 empirical projects (20% of final grade). The lowest homework score will be dropped when calculating your overall grade.

Lectures outline

Week 1: Introduction and descriptive statistics

Week 2: A primer on probability

Week 3: Random variables

Week 4: Sampling distributions

Week 5: Introduction to statistical inference: estimation

Weeks 6: Statistical inference: confidence intervals

Week 7: Statistical inference: hypothesis testing

Weeks 8-10: Simple linear regression

Week 9: Midterm

Weeks 10-11: Multiple linear regression

Weeks 11-12: Topics in regression analysis: model specification

Weeks 12-13: Topics in regression analysis: violations of the basic assumptions

Rules, advice, and class etiquette (aka The 10 Commandments of Econ 1620)

1. Attendance in lectures is not compulsory. That said, the slides are not a substitute for attendance, and **you will be responsible for all the material covered in lectures**, whether it is on the slides or not.
2. Lecture attendance is not compulsory, so please do not interrupt class by leaving unless it is an emergency. Silence your cell phones during the lecture. Behave, please.
3. Attendance in computer conferences is compulsory, and the content of these computer lectures is part of homework assignments and exams.
4. You must submit all homeworks and projects electronically. Late homeworks and projects are not accepted. You are allowed and encouraged to work in groups, but the final submission should be entirely your own.
5. Email policy: any questions on homeworks and projects must be posted on Canvas, and not sent via personal email. The instructor will not answer any questions on the material via email. You must come to office hours.
6. If you need any accommodations, as a result of a documented disability, you must register with the Student and Employee Accessibility Services (SEAS) in the beginning of the semester.
7. If you are excused from taking the midterm, its weight in your assessment will be transferred to the final exam.

8. Absences from the final exam will only be granted for serious family and medical emergencies, and the request **must** be accompanied by a letter from the Dean. No alternate arrangements will be made.
9. If you disagree with your grade in an assignment/exam, you may submit it for review **within 7 days** of having the assignment/exam returned to you. Your request **must** be made in writing, be attached to the exam, and provide a clear description of what the problem is and why you think a different grade is warranted. By requesting a review you understand and accept that the whole exam will be re-graded, not just the part identified in your request.
10. By taking this course, you explicitly pledge that you will not cheat or help others to cheat in any way during the exams. Any violations will result in an NC, and will be reported to the Dean.

Tentative class schedule (subject to change)

Week 1: No computer conferences this week	
Jan 21st	Introduction and descriptive statistics
Jan 23rd	Descriptive statistics (continued)
Week 2: Computer conferences start, HW 1 published on Friday	
Jan 26th	A primer on probability theory
Jan 28th	Probability, Conditional probability, and Independence
Jan 30th	Bayes' Theorem
Week 3: HW1 due and HW 2 published on Friday	
Feb 2nd	Random variables and probability distributions
Feb 4th	Statistical independence
Feb 6th	Characteristics of Probability Distributions
Week 4: HW2 due and Empirical Project 1 published on Friday. CL3 goes over HW1	
Feb 9th	Random sampling and some sample statistics

Feb 11th	Large sample approximations and the Law of Large Numbers
Feb 13th	The Central Limit Theorem
Week 5: No computer conferences this week, no class on Monday (Presidents' Day long weekend). Empirical Project 1 due and HW3 published on Friday	
Feb 18th	Introduction to statistical inference
Feb 20th	Estimation
Week 6: HW3 due and HW4 published on Friday, CL4 goes over HW2	
Feb 23rd	Confidence Intervals
Feb 25th	The t-statistic
Feb 27th	Sample size calculations
Week 7: HW4 due and Empirical Project 2 published on Friday, CL5 goes over HW3	
Mar 2nd	Introduction to Hypothesis testing
Mar 4th	Hypothesis testing (continued): significance levels and the p-value
Mar 6th	Hypothesis testing (continued): one- and two-tailed tests, and statistical power
Week 8: Empirical Project 2 due on Friday, CL6 goes over HW4	
Mar 9th	Approaches to estimation: Least Squares, Method of Moments, Maximum Likelihood
Mar 11th	Simple linear regression: assumptions
Mar 13th	Simple linear regression: estimation
Week 9: No computer conferences, midterm exam on Wednesday.	
Mar 16th	Q & A session, midterm prep
Mar 18th	**MIDTERM EXAM**
Mar 20th	Simple linear regression: estimation (continued)
March 21st-29th SPRING BREAK, WHOO HOO!	
Week 10: HW5 published on Friday	
Mar 30th	Simple linear regression: the coefficient of determination

Apr 1st	Simple linear regression: inference
Apr 3rd	Multiple linear regression: Introduction
Week 11: HW5 due and HW6 published on Friday	
Apr 6th	Multiple linear regression: estimation and inference
Apr 8th	Model specification: non-linear regression models
Apr 10th	Model specification: dummy variables
Week 12: HW6 due and Empirical Project 3 published on Friday, CL9 goes over HW5	
Apr 13th	Model specification: interaction terms
Apr 15th	Violations of the basic assumptions: heteroscedasticity and robust standard errors
Apr 17th	Violations of the basic assumptions: omitted variables bias
Week 13: Empirical Project 3 due on Friday, CL10 goes over HW6	
Apr 20th	Violations of the basic assumptions: endogeneity
Apr 22nd	Conclusion and wrap-up
May 15th	**FINAL EXAM, 2pm, Exam Group 03.**