Introduction to Data Analysis and Econometrics
Yale University, Summer 2020

Updated on: March 13, 2020

ADMINISTRATIVE

INSTRUCTOR
Jaehee Song (jaehee.song@yale.edu)
Office Hours: TBD

TIME AND LOCATION
Lecture Time: MWF 9:00am-11:15am
Lecture Location: TBD

TUTORS AND OTHER RESOURCES
The Yale Summer Session offers Economics and Writing tutoring (https://summer.yale.edu/admitted-students/summer-session-tutoring).

Economics Tutoring Time: W 4:00pm-5:30pm
Economics Tutoring Location: SML 116D

Writing Tutoring Time: Th 11:00am-1:00pm
Sat 1:00pm-3:00pm
Tue 5:30pm-7:30pm
Writing Tutoring Location: Poorvu Center for Teaching and Learning

WEBSITE
On Canvas at: TBD
On Piazza at: TBD
ABOUT THE COURSE

This course will teach you how to judge quantitative information and how to use data to answer economic and social questions. We will cover five areas:

1. **Probability**: the study of uncertainty, such as the uncertainty faced by investors, insurers, and people in everyday life.
2. **Statistics**: the science of analyzing and interpreting data, such as what a marketing department might know about past consumer purchases.
3. **Linear regression**: a statistical method used to estimate the relationship between two or more variables.
4. **Causality**: when can statistical analysis make a claim about causation?

The prerequisites for this course are introductory microeconomics and familiarity with single variable calculus. This course fulfills the Econometrics requirement for the economics major.

In most Econometrics classes, mathematical methods are introduced and then, some time later, applied to a few examples. This class turns that around. We will focus on substantive questions from the start, and gradually introduce mathematical methods that will help us answer them.

By the end of the class, you will have gained several skills:

1. Be able to choose appropriate statistical methods to answer real-world questions.
2. Understand both the math and the intuition behind methods like linear regression and hypothesis testing.
3. Be able to apply these methods to analyze real data with a powerful statistical analysis package (R).

We will apply our skills to a range of topics in Economics, including intergenerational mobility, discrimination, development economics and finance.

GRADES

**Introductory Economics Curve**

The course follows the department-mandated curve set for all introductory courses in the Economics Department.

**Grade Components**

I reserve the right to change this breakdown. Your grade will be based on the following components:

1. **Online Quizzes (10%)**
   
   You will have three short on-line quizzes, two before the midterm and one after. The quizzes are meant as a quick review and generally quiz questions will be less difficult than exam questions.
The quizzes are open book/open notes, but you cannot collaborate with other students on
the quizzes or discuss the quizzes with other students before their deadlines. Therefore, do
not post on Piazza about the quiz before their deadline. The quizzes’ solutions will not be
posted, but there will be ungraded versions of all quizzes that can be taken as many times
as you want. You should use them to review the material.

Quizzes will be posted on Fridays after class and must be submitted through the course
web site by 5:00pm on the next Monday. Any quiz not submitted by 5:00pm on the due
date will not be accepted without a written explanation emailed to the instructor. The
instructor may or may not accept a late quiz depending on the student’s explanation.

• Quiz 1: posted TBD, due TBD
• Quiz 2: posted TBD, due TBD
• Quiz 3: posted TBD, due TBD

2. Problem Sets (30%)
There will be 3 problem sets during the semester. These problem sets will be primarily
empirical and based on research papers.

You may work in groups of up to four people on the problem sets, but you must turn
in your own individual assignment. If you work in a group you must indicate on your
submission the other members of your group. Your problem set with the lowest grade will
be dropped.

The problem sets will be assigned on Fridays after class and must be submitted through
the course web site by 9:00am on the defined due date. Any problem set not submitted by
9:00am on the due date will not be accepted without a written explanation emailed to the
instructor. The instructor may or may not accept a late quiz depending on the student’s
explanation.

We will grade a randomly selected subset of the problems from each assignment, check for
completion of the other parts of the assignment, and post suggested solutions after the
problem sets are due.

• PS 1: posted TBD, due TBD
• PS 2: posted TBD, due TBD
• PS 3: posted TBD, due TBD

3. Midterm Exam (30%)
The midterm will be in-class on June 12th. Exams are closed book, but you may bring
one double-sided page of notes for the midterm.

4. Final Exam (30%)
The final exam is cumulative and is scheduled for June 28th. Exams are closed book, but
you may bring two double-sided page of notes for the final.
Errors in Grading
If students believe that there has been a mistake in their grading, the student must prepare a written statement describing in detail the mistake, which then should be emailed to us.

Changing assigned grades is extremely unlikely and reserved for clear errors made by ourselves. Re-grading will not be considered unless submitted in writing via email as described above.

LECTURES

Lectures will be interactive. Lecture slides will be posted on the course webpage, but are not designed as a substitute for attending lecture. If you cannot attend a particular lecture, please augment the lecture slides with the notes from a student who did attend the lecture.

If students choose to use laptops or tablets to take notes, they may not use them to access non-course-related websites, Apps, or email during class.

SECTIONS/LABS

Discussion sections are an important piece of this course and are designed to provide deeper understanding of many of the key topics covered in the course. In sections, you will be using the methods you learned in lecture to analyze real data and answer real research questions. The sections are designed to help you with your problem sets and to review key concepts likely to show up on exams.

ACCEPTABLE USE POLICY

You are free to use any published materials (e.g., a textbook), in preparing Econ 117 assignments or for learning the material more generally. Similarly, you are free to use online resources such as stackoverflow questions or R tutorials. You are also strongly encouraged to work with others in your class. This is particularly helpful for learning to program. Each person must turn in their own assignment.

The use of any solution materials prepared in a previous year for Econ 117 or Econ 131, other than materials distributed this academic year by the course faculty, is strictly prohibited and constitutes cheating. This includes 1) any notes, spreadsheets, or handouts distributed in a prior term of Econ 117 or Econ 131; and 2) any notes, solutions, or spreadsheets prepared by former students of Econ 117 or Econ 131, in either written or electronic form.

This policy means you should not solicit or use solutions to previous years’ problem sets. The reason for this policy is that access to previous year’s materials can create serious inequities between fellow students, and jeopardize the integrity of the academic environment. Any violation of this policy will be reported.

We do not tolerate cheating and plagiarism. Cheating or plagiarism will result in a 0 on the assignment and will be reported to the department. You are welcome to work together in groups up to 4, but you are required to submit your own write-up and your own code.
Please take precautions to avoid putting us in a situation where we are forced to decide if two documents are “too similar”. As future researchers, consultants, bankers, entrepreneurs, etc, learning to do honest work in a timely manner is more important than getting everything correct.

If you are uncertain, please add proper citation. For example, if you relied heavily on a group-member’s code for one part of an assignment, then you should make a footnote highlighting this fact. This may result in a slightly lower grade, but as long as proper credit is clearly given, it does not constitute cheating. The one exception to this rule is using past material from any previous version of this course.

SOFTWARE

Much of the course work in Econ 117 will involve analysis of data using R, an open source implementation of the object-oriented programming language S. It is widely used by applied statisticians and its libraries implement a wide variety of statistical and graphical techniques with applications to a range of disciplines, such as the agricultural and biological sciences, genetics, neuroscience and economics.

R can be downloaded from https://cran.r-project.org. We will provide some handouts on the use of R, the TFs will help you with R in sections, and the program documentation is excellent. There are also many excellent and free R references available online, for example, *Econometrics in R* by G. Farnsworth that is available for free. If your time permits and you want to dig deeper, there are also more programming oriented references such as *An Introduction to R* by W. N. Venables, D. M. Smith and the R Core Team. However, I recommend learning by trial and error, as it is the most time efficient approach and sufficient for the type of coding problems that we will consider.

If you have never used R (and have never used another programming language), I recommend introducing yourself to some basics through these online introduction tutorials:

- www.datacamp.com This tutorial is free.
- https://swirlstats.com/ This is an interactive tutorial that runs inside R. The link also provides installation instructions.
- https://www.computerworld.com/article/2497143 This is not an interactive tutorial, but provides a good written introduction of the basics, including installation, keyboard shortcuts, installing packages, etc., before then getting into intermediate topics. Can download 30 page pdf.

TEXTBOOKS

There is no required textbook for this course.

While there is no required textbook, you may consider some optional textbooks if you are having trouble following the material. An excellent Econometrics textbook is *Introduction to Econometrics, 2nd or 3rd edition*, by Stock and Watson (Addison-Wesley, 2010). Its coverage of probability and statistics is somewhat rudimentary, but its treatment of regression methods is excellent and the book should serve you well as a reference in the
future. An alternative with less math but more intuition is Mastering Metrics by Angrist and Pischke (Princeton University Press, 2014).

For students without a strong mathematical background, you may also find the following (optional) text useful: Probability and Statistical Inference, 8th or 9th ed., by Robert Hogg, Elliot Tanis, and most recently Dale Zimmerman (Pearson, 2010 or 2015). Hogg et al. provides much deeper coverage of the concepts covered in the first half of the course than does Stock and Watson. The most important method we will cover during the course is linear regression and I highly recommend Paul Allison’s Multiple Regression: A Primer. The writing is extremely clear and he covers both the intuition and mathematics behind the method.

Moreover, I will recommend chapters from Introduction to Econometrics with R by Christoph Hanck, Martin Arnold, Alexander Gerber and Martin Schmelzer as optional reading for each lecture.

CLASSROOM POLICIES

- Students with disabilities should contact the Resource Office on Disabilities, 203-432-2324 or talk to me during the beginning of the course to make sure all needs are accommodated.

- This class is committed to an inclusive learning environment. All students, teaching staff, and the professor are expected treat each other with respect and dignity at all time. This includes posts on Piazza.

- All community members should enjoy an environment free of any form of harassment, sexual misconduct, discrimination, or intimate partner violence. If you encounter sexual harassment, sexual misconduct, sexual assault, or discrimination based on race, color, religion, age, national origin, ancestry, sex, sexual orientation, gender identity, or disability please contact the Title IX Coordinator, Stephanie Spangler, at stephanie.spangler@yale.edu (203-432-4446) or any of the University Title IX Coordinators, who can be found at: http://provost.yale.edu/title-ix/coordinators.

- Attendance is mandatory. Even one absence can significantly affect the student’s ability to keep up. However, the instructor can grant excuses if the student emails me with a reasonable explanation. If there is any doubt as to the student’s absence or reason given, I will ask the student to see the dean. If a student has multiple absences, it may be necessary for the dean to impose a cut restriction. Any further absences might result in the student’s involuntary withdraw from the course.

ACKNOWLEDGEMENTS

This class was developed jointly with Edward Vytlacil, John Eric Humphries, Nicholas Ryan and Daniela Morar, building in large part from the course Douglas McKee taught at Yale in Fall 2015, which in turn was heavily influenced by the course Professor Lanier Benkard taught at Yale in Fall 2010.

The course structure, slides, and problem sets are also influenced by discussions with Dr Rebecca Toseland and the course material from Professor Raj Chetty’s Econ 45 at Stanford.
University and Professor Esther Duflo’s 14.310 at MIT. Thank you also to Professor Lisa Kahn from Yale School of Management. We are extremely grateful to them for sharing their syllabus, lecture slides, assignments, handouts, exams, and advice. In addition, Majed Dodin and Eduardo Fraga prepared the data sets for this course and helped tremendously with the construction of the problem sets and revisions to the slides.

Do not redistribute any of these materials without written permission.

**CIP Code**

Note that the economics program has changed its CIP code. The new CIP code (for Classification of Instructional Programs) by the National Center for Education Statistics at the Department of Education is 45.0603 (Econometrics and Quantitative Economics) rather than the old one 45.0601 (Economics, General).