

Quantitative Research Methods

Boston University
Political Science 841
Fall 2011

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Course site: http://blackboard.bu.edu/bin/course.pl?course_id=11fallgrspo841_a1

Course Description

Quantitative research methods are an increasingly important tool that political scientists use to test empirical claims about the world around us. This course offers an introduction to probability, descriptive statistics, hypothesis testing, and regression analysis, the foundations upon which nearly all quantitative analysis in political science builds. We will place emphasis both on theory, i.e., the concepts, logic, and mathematics underlying statistics, and applications, using software to analyze real data and implement the techniques we have learned. We will also learn how to assess work done by other scholars that uses quantitative methods.

I do not assume that students have any prior mathematical background beyond high school algebra. We will invoke calculus at times during lecture, but we will cover what we need to know as we go along, and homework and exams will not test you on calculus. Toward the end of the course, I will introduce matrix algebra, the foundation for more advanced statistics, and some knowledge of matrix algebra will be required for the final exam, but again, we will learn as we go along.

As this is a required course for political science graduate students, it necessarily serves different constituencies. For all students, this course will give you a basic understanding of the tools used for empirical research in much of the discipline, allowing you to better comprehend articles published in top journals. For those who are skeptical of quantitative research, this course will help inform your skepticism, showing explicitly the assumptions required for hypothesis testing and regression analysis, why these assumptions are often not met in practice, and what problems arise as a result. For those who find themselves inclined toward statistical analysis, this course will help teach you how to do good quantitative research rather than simply crunching numbers for numbers' sake. It also will prepare you to go on to PO 843, the summer program at ICPSR, or advanced courses in other departments. For those who are agnostic about quantitative methods, I hope to convince you that they should be part of your research toolkit!

Software

The required computer software for the course is R, an open-source statistical analysis package that is increasingly becoming the standard for quantitative analysis in political science as well as other disciplines. In addition to being available for free (download at <http://www.r-project.org/>), it is powerful, flexible, and has a large user community with plenty of free advice and expertise available on the Internet. It is also the software used in PO 843 and more advanced courses at ICPSR. We will generally devote half of one weekly class session to covering material in R, which will complement lectures and readings. Please download and install R on your laptops and bring them to class so you will be prepared to participate.

Readings

The required textbook for the course is Richard J. Larsen and Morris L. Marx, *An Introduction to Mathematical Statistics and Its Applications*, 5th ed. (Prentice Hall, 2012). Copies are available for purchase at the Boston University Barnes & Noble. Almost nothing has changed in this textbook since the fourth edition, so if you want to save money, you should be able to purchase that one online and use it instead. The same may be true of even earlier editions, but I cannot verify because I have not seen them.

Larsen and Marx is a fairly math-oriented textbook. Depending on your background and learning style, you might want to supplement it by also reading about the topics we are covering in a different book. Here are some options (earlier editions are probably fine for these as well):

David Freedman, Robert Pisani, and Roger Purves, *Statistics*, 4th ed. (W. W. Norton, 2007). Very little math; explains almost everything in words.

Thomas H. Wonnacott and Ronald J. Wonnacott, *Introductory Statistics for Business and Economics*, 4th ed. (John Wiley and Sons, 1980). A bit old, not too difficult.

Damodar N. Gujarati, *Basic Econometrics*, 4th ed. (McGraw Hill, 2002).

Toward the end of the course, we will be using some excerpts from other textbooks for topics not covered in Larsen and Marx; I will distribute these at the appropriate time.

In addition to the assigned readings from the textbook, for most weeks of the course I have listed a political science journal article (indicated with an asterisk) that uses one or more of the techniques being covered that week. These are recommended rather than required readings, but they are valuable because they show you how political scientists actually use the tools we are learning. The political science journal articles are all available electronically on JSTOR.

If, while we are covering topics that invoke calculus or matrix algebra, you would like to do some reading on your own to solidify your knowledge, the following might prove useful:

Daniel Kleppner and Norman Ramsey, *Quick Calculus: A Self-Teaching Guide*, 2nd ed. (John Wiley and Sons, 1985).

Gudmund R. Iversen, *Calculus* (Sage, 1996).

Krishnan Namboodiri, *Matrix Algebra: An Introduction* (Sage, 1984).

And if you want a review of bits of high school algebra you might have forgotten, these books might prove useful:

Timothy M. Hagle, *Basic Math for Social Scientists: Concepts* (Sage, 1995).

Timothy M. Hagle, *Basic Math for Social Scientists: Problems and Solutions* (Sage, 1996).

Assignments

Problem sets (20% of the final grade), consisting of both pencil-and-paper and computer exercises, will be assigned on an almost-weekly basis and will be due the following week. It is impossible to learn statistics without practice, so these problem sets are very important. Working in groups is encouraged and is often the best way to learn; however, each student must turn in their own write-up. If working in a group, make sure you understand all of the answers, because you will be on your own come exam time!

Two midterm exams (20% each) will be held in class, approximately one-third and two-thirds of the way through the course. The final exam (40%) will be held December 16, 3-5 p.m. The exams are closed-book, but you will be allowed to bring in a single page of notes.

Schedule and Readings

Sept. 6, 8: Introduction to Probability

Larsen and Marx, §2-1-§2.5.

* Christopher H. Achen, "Advice for Students Taking a First Political Science Graduate Course in Statistical Methods," *The Political Methodologist* 10, 2 (Spring 2002): 10-12.

Sept. 13, 15: Random Variables and Expectations

Larsen and Marx, §3.1, §3.3, §3.4, §3.5 (skip Example 3.5.2 and Theorem 3.5.2), §3.6 (stop at "Higher Moments").

Sept. 20, 22: Discrete Probability Distributions

Larsen and Marx, §3.2 (Binomial only), §4.1, §4.2 (stop at "Intervals Between Events").

* Robert Weissberg, "Collective vs. Dyadic Representation in Congress," *American Political Science Review* 72, 2 (June 1978): 535-547.

Sept. 27, 29: Continuous Probability Distributions and the Central Limit Theorem

Larsen and Marx, §4.3.

* Donald E. Stokes, "Party Loyalty and the Likelihood of Deviating Elections," *Journal of Politics* 24, 4 (Nov. 1962): 689-702.

Oct. 4: Review

Oct. 6: Midterm Exam

Oct. 11, 13: Confidence and Significance

Larsen and Marx, §5.1, §5.3, §5.4 (sections on "Unbiasedness," 313-316, and "Efficiency," 317-319), §6.1-§6.2.

* Michael Coppedge, "The Dynamic Diversity of Latin American Party Systems," *Party Politics* 4, 4: 547-568.

Oct. 18: No class (instructor out of town)

Oct. 20, 25: Power and Error

Larsen and Marx, §6.4 (skip the "Power Curves" section and everything beginning with "Decision Rules for Nonnormal Data").

* C. F. Larry Heimann, "Understanding the Challenger Disaster: Organizational Structure and the Design of Reliable Systems," *American Political Science Review* 87, 2 (June 1993): 421-435.

Oct. 27, Nov. 1: Inferences for Means

Larsen and Marx, §7.1-§7.2, §7.4 (stop at "When the Normality Assumption Is Not Met"), §9.2.

* Thad Dunning and Lauren Harrison, "Cross-Cutting Cleavages and Ethnic Voting: An Experimental Study of Cousinage in Mali," *American Political Science Review* 104, 1 (Feb. 2010): 21-39.

Nov. 3: Inferences for Variances and Tabular Data

Larsen and Marx, §7.5, §10.5 (skip "Testing for Independence: the General Case" and continue with Case Study 10.5.1).

* Edward D. Mansfield and Jack Snyder, "Democratization and the Danger of War," *International Security* 20, 1 (Summer 1995): 5-38.

Nov. 8: Midterm Exam

Nov. 10, 15, 17, 22: Bivariate Regression

Larsen and Marx, §11.1, §11.2 (stop at "Nonlinear Models"), §11.3 (stop at "Drawing Inferences about $E(Y|x)$ ").

* Jeffrey A. Segal and Albert D. Cover, "Ideological Values and the Votes of U.S. Supreme Court Justices," *American Political Science Review* 83, 2 (June 1989): 557-565.

* Edward R. Tufte, "The Relationship between Seats and Votes in Two-Party Systems," *American Political Science Review* 67, 2 (June 1973): 540-554.

Nov. 24: No class (Thanksgiving)

Nov. 29, Dec. 1: Multiple Regression

John Neter, et al., *Applied Linear Regression Models* (Richard D. Irwin, Inc., 1983). Chapter 6: "Matrix approach to simple regression analysis" (skip material on weighted least squares).

David A. Freedman, *Statistical Models: Theory and Practice* (Cambridge University Press, 2005). Chapter 4: "Multivariate Regression."

* John T. Gaspar and Andrew Reeves, "Make it Rain: Retrospection and the Attentive Electorate in the Context of Natural Disasters." *American Journal of Political Science* 55, 2 (April 2011): 340-355.

Dec. 6, 8: Additional Topics/Review

Reading TBD

Dec. 16, 3-5 p.m.: Final exam