

Political Science 509: The Linear Model Emory University, Spring 2009

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Course Description & Objectives

This course covers basic techniques in quantitative political analysis. It introduces students to widely-used procedures for regression analysis, and provides intuitive, applied, and formal foundations for regression and more advanced methods treated later in the course sequence. Unlike POLS 508, this course will use rudimentary calculus and matrix algebra rather intensively. The course covers model assumptions and techniques for addressing violations of those assumptions (e.g., heteroskedasticity, autocorrelation, multicollinearity), as well as issues of model specification, functional forms, measurement error, and endogeneity. This course builds on the prior efforts of Chris Zorn (a former faculty member now at Penn State) and Eric Reinhardt.

Requirements

Grades in the course will be based on the following items:

- **50%** — Homework. Eleven equally-weighted assignments, typically with a week from distribution to due date. Turn these in by the start of class. You may *talk* about the problems with your fellow students, but *do not copy* another person's homework; your submission must contain your own work. Please hand in homeworks in hard copy, rather than emailing them, unless otherwise approved.
- **50%** — Methods paper, 15-20 pages. This paper will demonstrate your technical mastery of the practical aspects of OLS regression in the context of a specific research problem of your own formulation. Choose a topic, develop a hypothesis, and test it quantitatively. The only twist here is that your dependent variable should be continuous rather than discrete, so that it is suitable for the kinds of techniques we will be learning in class. The format should be similar to a "research note" in *APSR* or *JOP*, but with greater emphasis on the technical details. A one-page synopsis describing the hypothesis to be tested and the dataset to be used is due on February 5, and you must have data ready to work on in class on March 5. **The final version is due May 6.** Paper guidelines can be found on the course directory.

Course Policies

Late assignments will be penalized. Each day the assignment is late will result in a drop of a letter grade, e.g., A to B, etc.

Reading Materials

Statistics texts are expensive, but they are the kind of book that you'll find yourself referring to frequently throughout your graduate years and beyond. Early on in the course we will use the monograph, Timothy M. Hagle, *Basic Math for Social Scientists: Concepts* (Sage, 1995). For the remainder of the course, I will rely on the textbook by Jeffrey M. Wooldridge, *Introductory Econometrics: A Modern Approach*, 3rd ed. (Thomson South-Western, 2003). This text offers clear step-by-step descriptions and instructions. You may also want to purchase the following two textbooks, to supplement your reading: William Greene, *Econometric Analysis*, 5th ed. (Prentice Hall, 2003), and Damodar N. Gujarati, *Basic Econometrics*, 4th ed. (New York: McGraw-Hill, 2003). The former is quite technical, and a favorite among political methodologists, while the latter is stronger on the intuition. Where possible, I have included the page numbers for these texts relevant to each lecture.

Any other reading on the syllabus can be found in the course's Soc-Sci folder.

This course will rely on *Stata* as our chief statistical software. You can buy your own personal *Stata* license if you wish. Specify that you are part of the "GradPlan III" for Emory University.

Course Outline

Jan 15 & 20: Introduction: Stata tutorial & Math refresher I

- Hagle, 1-71.
- Optional: Wooldridge, 707-777.
- Optional: Greene, 845-890, esp. 885-890.
- Optional: Gujarati, 870-905.

Jan 22,27&29: The regression model: estimation and inference.

- Wooldridge, 23-197, optional 276-7.
- Optional: Gujarati, 58-81, 100-114, 119-147, 175-178, 202-215, 229-232, 294-296 (plus 114-118 optional).
- Optional: Greene, 7-71, optional 940.
- Homework #1 distributed.

Feb 3 & 5: Model fit and outliers.

- Wooldridge, 192-229.
- Michael S. Lewis-Beck and Andrew Skalaban, "When to Use R-Squared," *The Political Methodologist* 3:2 (1990), 9-11.
- Gary King, "When *Not* to Use R-Squared," *The Political Methodologist* 3:2 (1990), 11-12.
- Robert C. Luskin, "R-Squared Encore," *The Political Methodologist* 4:1 (1991), 21-23.
- Optional: Gujarati, 81-87, 217-223, 248-273
- Homework #2 distributed.
- Paper **proposal due**.

Feb 10 & 12: The regression model in matrix form. Estimation and inference.

- Hagle, 71-95.
- Wooldridge, 808-833.
- Optional: Gujarati, 913-949, 335-375.
- Optional: Greene, 803-845, 7-71.

Feb 17: **No Class**

Feb 19 & 24: Dummy variables and interactions. Simulating substantive effects and other estimated quantities.

- Wooldridge, 192-261.
- Thomas Brambor, William Roberts Clark and Matt Golder, “Understanding Interaction Models: Improving Empirical Analyses,” *Political Analysis* 14 (2006), 63-82
- Optional: Gujarati, 297-333.
- Optional: Robert J. Friedrich, “[In Defense of Multiplicative Terms in Multiple Regression Equations](#),” *American Journal of Political Science* 26 (November 1982), 797-833.
- Homework #3 distributed.

Feb 26&Mar 3: Multicollinearity and Heteroskedasticity. The problem & diagnosis. GLS and robust SEs.

- Wooldridge, 101-105, 271-298.
- George W. Downs and David M. Roche, “[Interpreting Heteroscedasticity](#),” *American Journal of Political Science* 23:4 (November 1979), 816-828.
- Optional: Gujarati, 387-440, optional 856-862.
- Optional: Greene, 215-249, 198-211.
- Optional: Jeffrey B. Lewis and Drew A. Linzer, “Estimating Regression Models in Which the Dependent Variable is Based on Estimates,” *Political Analysis* 13 (2005), 345-364.
- Homework #4 distributed.

Mar 5: Lab day to work on papers

- Bring data to class

Mar 17 & 19: Autocorrelation and Intro to Time Series. The problem, diagnosis, techniques, GLS and robust SEs. Non-stationarity and unit roots.

- Wooldridge, 412-442, 363-373, 380-405, 639-645
- Optional: Gujarati, 441-505.
- Optional: Greene, 250-282, 631-649.
- Optional: Jeffrey M. Wooldridge, “Cluster-sample Methods in Applied Econometrics: An Extended Analysis,” Working Paper (June 2006).
- Optional: Frank R. Baumgartner, Bryan D. Jones, and Michael C. MacLeod, “[The Evolution of Legislative Jurisdictions](#),” *Journal of Politics* 62:2 (May 2000), 321-349.
- Homework #5 distributed.

Mar 24 & 26: Model specification.

- Wooldridge, 94-99, 192-205, 304-334.
- Christopher H. Achen, “Let’s Put Garbage-Can Regressions and Garbage-Can Probits Where They Belong,” *Conflict Management and Peace Science* 22 (2005), 327-339.
- Keven A. Clarke, “The Phantom Menace: Omitted Variable Bias in Econometric Research,” *Conflict Management and Peace Science* 22 (2005), 341-352.

- Optional: Kevin A. Clarke, “Nonparametric Model Discrimination in International Relations,” *Journal of Conflict Resolution* 47,1 (Feb. 2003), 72-93.
- Optional: Gujarati, 506-523, 529-548, 556-560.
- Optional: Greene, 116-161.
- Homework #6 distributed.

Mar 31 & Apr 2: Techniques for panel data I. Random effects, fixed effects, FGLS

- Wooldridge, 448-476, 485-501.
- Optional: Gujarati, 636-652, 273-279.
- Optional: Greene, 283-319.
- Homework #7 distributed.

Apr 7 & 9: Techniques for panel data II. PCSEs, spatial econometrics.

- Beck, Nathaniel and Jonathan N. Katz. 1995. What to do (and not to do) with time-series cross-section data. *American Political Science Review* 89 (3): 634-647.
- Nathaniel Beck, Kristian Skredre Gleditsch and Kyle Beardsley, “Space is More than Geography: Using Spatial Econometrics in the Study of Political Economy,” *International Studies Quarterly* 50:1 (2006), 27-44.
- Optional: Greene, 320-338.
- Homework #8 distributed

Apr 14 & 16: Measurement error & endogeneity. Instrumental variables, concepts, adequacy, testing. Two-stage least squares.

- Wooldridge, 310-325, 510-551, optional 552-581.
- Optional: Greene, 83-90, 378-400.
- Optional: Gujarati, 524-529, 717-778.
- Optional: Steven D. Levitt, “[Using Electoral Cycles in Police Hiring to Estimate the Effect of Police on Crime](#),” *American Economic Review* 87:3 (June 1997), 270-290.
- Homework #9 distributed

Apr 21 & 23: Selection bias and the Heckman selection model.

- Wooldridge, 616-623.
- Jeffrey A. Dubin and Douglas Rivers, “Selection Bias in Linear Regression, Logit and Probit Models,” *Sociological Methods and Research* 18 (November 1989/February 1990), 360-390.
- Optional: Greene, 780-789.
- Optional: Kevin B. Grier, Michael C. Munger, and Brian E. Roberts, “The Determinants of Industry Political Activity, 1978-1986,” *American Political Science Review* 88:4 (December 1994), 911-926.
- Optional: Anne E. Sartori, “An Estimator for Some Binary-Outcome Selection Models Without Exclusion Restrictions,” *Political Analysis* 11 (2003), 111-138.
- Homework #10 distributed

May 6: **Paper due by 5:00p.**