
PSC 505
MLE (+ Other Topics)

Fall 2014
10:30-12:00 T/Th, Hark 329

Professor Curtis C. Signorino
303 Harkness Hall
Office Hours: by appointment
curs@signorino@rochester.edu

TA: Casey Crisman, Co-
Office hours: TBD
ccrisman@rochester.edu

COURSE DESCRIPTION: This course builds upon the analytical and applied foundations of PSC 404 and 405, taking the latter's emphasis on the classical linear model as its point of departure. Because the classical linear regression model is inappropriate for data that arise in many interesting areas of political science, students will learn methods to analyze models and data for count outcomes, durations, and other words, all the other data out there. From time to time, we will also venture into semi-parametric methods, nonparametric methods, and machine learning, especially when those topics complement the MLE techniques we are studying.

A major goal of the course will be to teach students how to develop new models and techniques for analyzing issues they encounter in their own research. "Canned" statistical routines are often not appropriate for most of the misspecified models we develop as political science researchers. Students will therefore be required to program their own statistical routines (primarily in R).

PREREQUISITES: PSC 404 and 405, or the equivalent.

COURSE REQUIREMENTS: Course grades will be based on a series of homeworks (45%), a course paper (50%), and participation (5%). The exercises will consist primarily of programming and data analysis. Students can work in groups or have group assignments, but no group is no greater than two.

READINGS: Students are responsible for keeping up with the reading each week. I post my lecture notes and will provide links or copies of articles from time to time. In addition, students should read the appropriate chapters in the following, many of which are available in the star lab:

- Gary King, 1998. *Unifying Political Methodology*. Michigan
Cambridge.
- William H. Greene, 1991. *Econometric Analysis*, 5th edition. Prentice Hall.
- Peter Kennedy, 1998. *A Guide to Econometrics*, 4th edition. MIT
- The star lab introduction to R.
- Patrick Burns, 2011. *The R Inferno*.
- W. N. Venables and R. D. Ripley, *Modern Applied Statistics with S*. Springer.

COURSE OUTLINE:

1. R Programming and Monte Carlo Simulation

- W. John Braun & Duncan J. Murdoch. *A First Course in Statistical Programming with R*.
- Burns, Patrick. 2011. *The R Inferno*. Manuscript.

2. Maximum Likelihood Estimation

- King, Gary. 1998. *Unifying Political Methodology*. Chapters 1-4.
- Rodriguez G. 2001. "Appendix A: Review of Likelihood Theory."

3. Count Models and Issues in Nonlinear Models

Count Data

- King, Gary. 1998. *Unifying Political Methodology*. Chapter 5. Sections 6-10.
- King, Gary and Curtis S. Signorino. 1996. "The Generalization in the Generalized Event Count Model, with Comments on Achen, Amato and Londegren." *Political Analysis* 6: 225-252.
- Prentice, R. L. 1986. "Binary Regression Using an Extended Beta-Binomial Distribution; With Discussion of Correlation Induced by Covariate Measurement Errors." *Journal of the American Statistical Association* 81: 321-327.

Standard Errors and Confidence Intervals

- King, Gary. 1991. "Calculation of Standard Errors Based on Nonlinear Functional Forms." *The Political Methodologist* 4(2).
- Efron, Bradley and Gail Gong. 1983. "A Leisurely Look at the Bootstrap, the Jackknife, and Cross-Validation." *The American Statistician*. 37(1):36-48.

Interaction Terms

- Norton Edward C., Hua Wang, and Chunrong Ai. "Computing Interaction Effects and Standard Errors in Logit and Probit Models." *The Stata Journal* 4: 103-116.
- Ai, Chunrong and Edward C. Norton. 2003. "Interaction Terms in Logit and Probit Models." *Economics Letters* 80:123-129.
- Braumoeller, Bear F. 2004. "Hypothesis Testing and Multiplicative Interaction Terms." *International Organization* 58: 807-820.
- Brambor, Thomas and William Thaler, and Charles F. Wooldredge. 2006. "Improving Empirical Analyses." *Political Analysis*. 14:63-82.

Homework Reading

- Martin, Lisa. 1992. *Coercive Cooperation*. Chapters 2 – 4.
- Chang, Eric C. 2005. "Electoral Incentives for Political Corruption under Open-List Proportional Representation." *Journal of Politics* 87: 716-730.

4. Duration Models

Parametric Models

- Box-Steffensmeier, Janet and Bradford S. Jones. 2004. *Event History Modeling: A Guide for Social Scientists*. Chapters 2 – 8.
- Alt, James E., Gary King, and Curtis S. Signorino. 2001. "Aggregation among Binary, Count, and Duration Models: Estimating the Same Quantities from Different Levels of Data." *Political Analysis* 9: 1-24.

- King, Gary, James E. Alt, Nancy Elizabeth Burns, and Michael Laver. 1990. "A Unified Model" 846-871.

Cox Proportional Hazard Models

- Roxy-Steffensmeier, Janet M. and Christopher J. W. Zorn. 2001. "Duration Models and Proportional Hazards in Political Science." *American Journal of Political Science* 45: 972-988.
- Pletcher, Hans-Dieter and Gary King. 2000. *Time-Dependent Data: A Practical Approach to Causal Analysis*. Chapters 1, 3, 8 – 10.
- Koller, J. D. and R. L. Prentice. 1999. *The Statistical Analysis of Failure Time Data*. Chapter 4.

Grouped Binary Duration Data

- Beck, Nathaniel, Jonathan N. Katz, and Richard T. Froyen. 1998. "Taking Time Seriously: Time Series Cross Section Analysis with a Discrete Dependent Variable." *American Journal of Political Science* 42: 1260-1288.
- Carter, David B. and Curtis S. Signorino. 2009. "Back to the Future: Modeling Time Dependence in Binary Data." *Political Analysis* 18: 392-397.
- Oneal, John R. and Bruce M. Russett. 1997. "The Classical Liberals Were Right: Democracy, Interdependence, and Conflict, 1950-1985." *International Studies Quarterly* 41:267-293.

Supplemental Reading on Splines

- Ruppert, David, M. P. Wand, and R. J. Carroll. 2003. *Semiparametric Regression*. Chapter 3.
- Fox, John. 2000. *Nonparametric Simple Regression: Smoothing Scatterplots*. Chapter 6.

5. Censoring and Truncation

- Sigelman, Lee and Langche Zeng. 1999. "Analyzing Censored and Sample-Selected Data with Tobit and Heckit Models." *Political Analysis* 8. Read pages 167-177.
- King, Gary. 1998. *Unifying Political Methodology*. Chapter 9.
- Krashinsky, Keith and Douglas R. Bunn. 1999. "The Political Economy of the Minimum Wage." *American Journal of Political Science* 37: 1151-1174.
- Smith, Alastair. 1999. "Testing Theories of Strategic Choice: The Example of Crisis Escalation." *American Journal of Political Science* 43: 1254--1283.

Recommended

- Amemiya, Takeshi. 1984. "Tobit Models: A Survey." *Journal of Econometrics* 24: 3-60
- Maddala, G. S. 1983. *Limited-Dependent and Qualitative Variables in Econometrics*. Chapter 5.
- Heckman, James J. 1979. "Sample Selection Bias as a Specification Error." *Econometrica* 47: 153-162.
- Meng, Chun-Lo and Peter Schmidt. 1985. "On the Cost of Partial Observability in the Bivariate Probit Model." *International Economic Review* 26(1): 71-85.
- Reed, William. 2000. "A Unified Statistical Model of Conflict Onset and Escalation." *American Journal of Political Science* 44: 84-93.

Recommended:

- Heckman, James J. 1976. "The Common Structure of Statistical Models of Truncated, Censored, and Limited-Dependent Variables and a Simple Estimator for Such Models." *Journal of Economic and Social Measurement* 5: 475-492.
- Dubin, Jeffrey A. and Douglas Rivers. 1989. "Selection Bias in Linear Regression, Logit, and Probit Models." *Sociological Methods* 18: 260-290.

Homework Reading:

- Toomet, Ott and Arne Henningsen. 2011. "Sample Selection Models in R: Package sampleSelection." Manual.
- Mroz, Thomas A. 1987. "The Sensitivity of an Empirical Model of Married Women's Hours of Work to Economic and Statistical Assumptions." *Econometrica* 55(4): 765-799.

7. Categorical Data and Random Utility Models

- King, Gary. 1999. *Uniting Political Methods*. Chapter 5, Section 4.
- Amemiya, Takeshi. 1981. "Qualitative Response Models: A Survey." *Journal of Economic Surveys* 1(1): 1-64.
- So, Ling. "A Tutorial on Logistic Regression." SAS Institute, Inc.
- Maddala, G. S. 1983. *Limited-Dependent and Qualitative Variables in Econometrics*. Chapter 5.

8. Strategic Models, part I

Bounded Rationality and the Quantal Response Equilibrium (QRE)

- McKelvey, Richard D. and Thomas R. Palfrey. 1996. "An Experimental Study of the Constant Sum Centipede Game." *The Japanese Economic Review* 47: 186-209.
- McKelvey, Richard D. and Thomas R. Palfrey. 1995. "An Experimental Study of the Centipede Game." *Experimental Economics* 1: 9-41.
- Fey, Mark, Richard D. McKelvey, and Thomas Palfrey. 1996. "An Experimental Study of the Constant Sum Centipede Game." *International Journal of Game Theory* 25: 269-287.

Private Information, Regression, and Misspecification

- Signorino, Curtis S. 1999. "Strategic Interaction and the Statistical Analysis of International Conflict." *American Political Science Review* 93: 279-297.
- Signorino, Curtis S. 2003. "Structure and Uncertainty in Discrete Choice Models." *Political Analysis* 11: 316-344.
- Signorino, Curtis S. and Robert W. Walker. 2007. "Statistical Inference for Regression Models." *American Journal of Political Science* 47: 551-566.
- Bas, Muhammet, Curtis S. Signorino, and Robert W. Walker. 2008. "Statistical Backwards Induction: A Simple Method for Estimating Strategic Models." *Political Analysis* 16: 21-40.

Recommended:

- Signorino, Curtis S. and Ahmer Tarar. 2006. "A Unified Theory and Test of Extended Immediate Determination in International Science." *Journal of International Politics* 50: 586-605.
- Plaxina, Elena. 2003. "An Evaluation of the Effectiveness of Financial Transfer Institutions for the Environment: The Global Environment Facility's Role." World Bank. University of Rochester. Working Paper.

9. Model Discrimination

- Signorino, Curtis S. 2002. "Statistical Inference in International Politics." *Journal of International Politics* 46: 103-125.
- Signorino, Curtis S. 2002. "Statistical Inference in International Politics." *Journal of International Politics* 46: 103-125.
- Signorino, Curtis S. 2002. "Statistical Inference in International Politics." *Journal of International Politics* 46: 103-125.

Interactions 28: 93-115.

- Clarke, Kevin A. and Curtis S. Signorino. 2010. "Discriminating Methods: Tests for Non-nested Discrete Choice Models." *Political Studies* 58: 368—388.
- Clarke, Kevin A. 2001. "Testing Nonnested Models of International Relations: Reevaluating Realism." *American Journal of Political Science* 45: 724-744.
- Clarke, Kevin A. 2003. "Nonparametric Model Discrimination in International Relations." *Journal of Conflict Resolution* 47: 72-93.

10. Strategic Models, part II

Bargaining Models

- Ramsay, Kristopher and Curtis S. Signorino. 2010. "A Statistical Model of the Ultimatum Game." Working Paper.
- Hantonstahl, Stephen. 2009. "Bargaining Under Uncertainty: a Strategic Statistical Model of the Ultimatum Game." Working paper.

Signaling Models

- Lewis, Jeffrey B. and Kenneth A. Schultz. 2003. "Revealing Preferences: Empirical Estimation of a Crisis Bargaining Game with Incomplete Information." *Political Analysis* 11: 345—367.
- Wang, Jonathan. 2005. "Comparing Models of Strategic Choice: The Role of Uncertainty and Signaling." *Political Analysis* 14: 101—120.
- Bas, Muhammet, Curtis S. Signorino, and Taehae Whang. 2013. "Knowing One's Future Preferences: A Correlated Agent Model with Decision Updating." *International Journal of Political Science*.

11. Machine Learning and Flexible Functional Form Estimation

- Penalized Estimators: Ridge Regression, LASSO, Adaptive LASSO.
- Kenkel & Signorino working papers.
- Das, Mitali, Whitney K. Newey, & Francis Vella. "Nonparametric Estimation of Sample Selection Models." *Review of Economic Studies*. 70:55—56.
- Neural nets
- Recursive Partitioning and Regression Trees
- Random Forests

12. Parallel Computing in R

Important Dates:

- Topic and Data OK'd Nov 6 (One paragraph)
- Rough Draft Due Nov 25 (Tuesday before Thanksgiving Break)
- Comments Returned Dec 2 (Tuesday after Thanksgiving Break)
- In-Class Presentations Dec 9, 11 (Randomly assigned)
- Final Paper Due 10:30am, Thursday, Dec 18