

# POL 9040: Maximum Likelihood Estimation

University of Missouri

Fall 2018

W 3:00-5:30PM, Middlebush Hall 8

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## Course Description

This course introduces you to a variety of statistical techniques relevant to political science that utilize maximum likelihood estimation. Typically, this means predicting outcomes that are binary (logit, probit, scobit), categorical (multinomial logit and multinomial probit), ordered (ordered logit), counts (negative binomial and poisson), and spatially interdependent (spatial econometric models). The objective is for you to become familiar enough with them to understand how, when and why to use them. Emphasis will therefore be on empirical applications. This class requires you to learn how to use Stata since almost all of our applications can be done using it and many of them essentially require it (unless you want to write your own code). There may be instances where we utilize other statistical programs (such as R and QGIS), but the vast majority will focus on Stata.

## Required Books

- Long, J. Scott. 1997. *Regression Models for Categorical and Limited Dependent Variables*. Thousand Oaks, CA: Sage.
- Long, J. Scott and Jeremy Freese. 2006. *Regression Models for Categorical Dependent Variables Using Stata*, 2nd ed. College Station, TX: Stata Press.
- Ward, Michael D. and Kristian Skrede Gleditsch. 2008. *Spatial Regression Models*. Sage Publications.

Other required readings will be available on Canvas ([canvas.missouri.edu](https://canvas.missouri.edu)) or through jstor.

## Recommended Books

- Darmofal, David. 2015. *Spatial Analysis for the Social Sciences*, Cambridge University Press.

## Course Requirements

### Class Participation and Attendance (15%)

The quality of a graduate-level seminar in methodology depends to a large extent on the quality of the students. It is your responsibility, as well as mine, to come to class prepared to discuss the information and

claims found in the readings and explore related research possibilities. If any of us shirk, we all lose. I expect no absences in the course, and I encourage you to discuss any circumstances with me that will preclude you from attending class. I also expect you to arrive on time. If you do need to miss class, please contact me ahead of time to let me know that you will not be able to attend and to make arrangements to complete an alternate assignment. A large portion of my overall evaluation of your performance in the course will depend on the quality of your seminar participation.

Grades for participation will be assigned at the end of the semester, but you may ask for feedback on your performance at any time. If you have concerns about the quality and quantity of your participation in the course, I hope you will speak to me. Remember, this is a seminar, so just showing up to class is not enough. You must come to class prepared to participate in an informed discussion of the issues raised by the week's readings. If you just show up to class every week, but never say a word, you can expect to receive a D or lower for class participation (15% of your grade).

The following general grading scale will be used for participation and preparation:

- A: The student made a very strong contribution to the course. Class discussion, comments, and presentations reflected understanding and analysis of the material, and were constructive. Constructive means that a student does not simply identify a weakness or problem. Rather, constructive comments identify a problem and offer suggestions for how to address the weakness or problem.
- B: The student contributed meaningfully to the course. Class participation and/or presentations went beyond repeating the assigned material, perhaps identifying weaknesses in the current literature, but did not make many constructive suggestions about how weaknesses might be overcome or how the literature might be usefully extended in the future.
- C: The student did not contribute meaningfully to the seminar. Class participation and/or presentations were limited to repeating the assigned material rather than making connections or extensions.
- D or lower: The student attended class, but did not participate in discussions or present meaningful questions for academic debate.

Finally, because we will engage in vigorous academic debate during class, classroom etiquette is vital. Please work to ensure that you make comments in ways that invite discussion. Our classroom contains members with various life experiences, divergent perspectives, varying levels of experience with political science research, and different strategies for defending their views. Please state your opinions constructively and respectfully, listen carefully when your colleagues are speaking, and speak to me if you are offended by something that is said in class. If you do not follow these guidelines, your participation grade will be adversely affected.

## **Homeworks (45%)**

At various times throughout the semester, I will assign homework. This is because the best way to learn the material is to actually use the models. Homeworks must be typed and handed in at the beginning of class. Late homeworks will be deducted 10% for each calendar day that they are late. Homeworks must be completed in  $\LaTeX$ .

## **Research Reports (40%)**

At 4 points throughout the semester, students will prepare research reports. I will provide more description and requirements for these research reports in class.

The paper will be graded on the quality of the empirical analysis, proper interpretation, and exploration of the results in the best manner to test the hypotheses. These papers will be expected to conform to the

submission standards of the *American Journal of Political Science* and research reports must be completed in L<sup>A</sup>T<sub>E</sub>X.

**Grammatical mistakes in any of the assignments will NOT be tolerated. Any student turning in an assignment with grammatical mistakes will have the assignment returned without a grade. The student will have one opportunity to improve and resubmit the work with a grade penalty in a time frame decided by me.**

Final class grades will be assigned with the following grading scale:

**A+ = 97.0 - 100**

**A = 90.0 - 96.99**

**B+ = 87.0 - 89.99**

**B = 80.0 - 86.99**

**C+ = 77.0 - 79.99**

**C = 70.0 - 76.99**

**D+ = 67.0 - 69.99**

**D = 60.0 - 66.99**

**F = 0 - 59.99**

## Other Considerations

### Academic Integrity

Academic integrity is fundamental to the activities and principles of a university. All members of the academic community must be confident that each person's work has been responsibly and honorably acquired, developed, and presented. Any effort to gain an advantage not given to all students is dishonest whether or not the effort is successful. The academic community regards breaches of the academic integrity rules as extremely serious matters. Sanctions for such a breach may include academic sanctions from the instructor, including failing the course for any violation, to disciplinary sanctions ranging from probation to expulsion. Any efforts to pass off someone else's ideas as your own is considered plagiarism! When in doubt about plagiarism, paraphrasing, quoting, collaboration, or any other form of cheating, consult the course instructor.

**Plagiarism (or cheating in any way) will not be tolerated. Any student plagiarizing will receive an automatic "0" for that assignment, no exceptions!**

### ADA Statement

If you anticipate barriers related to the format or requirements of this course, if you have emergency medical information to share with me, or if you need to make arrangements in case the building must be evacuated, please let me know as soon as possible.

If disability related accommodations are necessary (for example, a note taker, extended time on exams, captioning), please register with the Disability Center (<http://disabilitycenter.missouri.edu>), S5 Memorial Union, 573- 882-4696, and then notify me of your eligibility for reasonable accommodations. For other MU resources for persons with disabilities, click on "Disability Resources" on the MU homepage.

## Class Schedule:

We will spend as much time as necessary on each topic for this course. Because I am unable to predict in advance how long each topic will take, the schedule below is only a rough guideline.

### August 22: Overview/Syllabus and Mathematics for Political Scientists

#### Recommended:

- Will H. Moore and David A. Siegel (2013) *A Mathematics Course for Political & Social Research*. Princeton University Press. Chapters 2-3, 5-8

### August 29: Probability Theory & Stata Review

#### Announcements:

- Mathematics for MLE homework is due

#### Required:

- Long and Freese: Chapter 2
- Sean Gailmard (2014) *Statistical Modeling and Inference for Social Science*. Cambridge University Press. Chapter 3.
- Christopher F. Baum (2009) *An Introduction to Stata Programming*. Stata Press. Chapter 3 (all), Chapter 5.3-5.8 (p. 86-111), Chapter 7.1-7.22 (p. 139-142), Chapter 7.3 (p. 154-159), and Chapter 9-9.1 (171-177).

#### Recommended:

- Jeff Gill (2006) *Essential Mathematics for Political and Social Research*. Cambridge University Press. Chapters 7-8

### September 5: Linear Regression Model and Maximum Likelihood Estimation

#### Announcements:

- Stata Programming homework is due
- **Plan on attending Sheena Greitens' workshop: *How to Write a Literature Review***: Wednesday, September 12, 12:00-1:30PM (104 Professional Building).

#### Required:

- Long: Chapters 1-2

#### Recommended:

- Gross, Justin H. 2015. "Testing What Matters (If You Must Test at All): A Context-Driven Approach to Substantive and Statistical Significance." *American Journal of Political Science*. 59.3: 775-788.

## September 12: Binary Dependent Variables I: Linear Probability, Logit and Probit Models

### Required:

- Long: Chapter 3.1-3.6 (p. 34-61)
- Long and Freese: Chapter 3-3.1 (p. 75-98) and Chapter 4-4.2 (p. 131-140)

### Recommended:

- Beck, Nathaniel, Jonathan N. Katz and Richard Tucker. 1998. "Taking Time Seriously: Time-Series-Cross-Section Analysis with a Binary Dependent Variable." *American Journal of Political Science* 42.4: 1260-1288.
- Carter, David B. and Curtis S. Signorino. 2010. "Back to the Future: Modeling Time Dependence in Binary Data." *Political Analysis* 18: 271-292.

### Recommended (Examples):

- Fuhrmann, Matthew and Michael C. Horowitz. 2015. "When Leaders Matter: Rebel Experience and Nuclear Proliferation." *The Journal of Politics* 77.1: 72-87.

## September 19: Binary Dependent Variables II: Logit and Probit Interpretation

### Announcements:

- Linear Regression homework is due

### Required:

- Long: Chapter 3.7-3.10 (p. 61-84)
- Long and Freese: Chapter 3.6-3.8 (p. 113-128) and Chapter 4.6-4.8 (p. 157-181)
- King, Gary, Michael Tomz and Jason Wittenberg. 2000. "Making the Most of Statistical Analyses: Improving Interpretation and Presentation." *American Journal of Political Science*. 44(2): 341-355.

### Recommended:

- King, Gary and Langche Zeng. 2006. "The Dangers of Extreme Counterfactuals." *Political Analysis*. 14: 131-159.
- Berry, William D., Jacqueline H. R. DeMerritt. 2010. "Testing for Interaction in Binary Logit and Probit Models: Is a Product Term Essential?" *American Journal of Political Science* 54.1: 248-266.
- Hanmer, Michael J. and Kerem Ozan Kalkan. 2013. "Behind the Curve: Clarifying the Best Approach to Calculating Predicted Probabilities and Marginal Effects from Limited Dependent Variable Models." *American Journal of Political Science* 57.1: 263-277.
- Williams, Laron K. *Forthcoming*. "Temporal Dependence and the Sensitivity of Quantities of Interest: A Solution for a Common Problem." *International Studies Quarterly*.

## September 26: Binary Dependent Variables III: Hypothesis Testing and Goodness of Fit

### Required:

- Long: Chapter 4
- Long and Freese: Chapter 3.5 (p. 104-113) and 4.3-4.5 (p. 140-157)

### Recommended:

- Herron, Michael C. 1999. "Postestimation Uncertainty in Limited Dependent Variable Models." *Political Analysis* 8.1: 83-98.
- Greenhill, Brian, Michael D. Ward and Audrey Sacks. 2011. "The Separation Plot: A New Visual Method for Evaluating the Fit of Binary Models." *American Journal of Political Science* 55.4: 991-1003.
- Ward, Michael D., Brian D. Greenhill and Kristin M. Bakke. 2010. "The Perils of Policy by p-Value: Predicting Civil Conflicts." *Journal of Peace Research* 47.4: 363-375.

## October 3: Ordinal Dependent Variables: Ordered Logit and Probit

### Announcements:

- Logit/Probit homework is due

### Required:

- Long: Chapter 5
- Long and Freese: Chapter 5

### Recommended (Examples):

- Duch, Raymond M. and Harvey D. Palmer. 2004. "It's Not Whether You Win or Lose, but How You Play the Game: Self-Interest, Social Justice, and Mass Attitudes toward Market Transition." *American Political Science Review*. 98(3): 437-452.

## October 10: Nominal Dependent Variables: Multinomial Logit and Probit

### Announcements:

- Ordered Models homework is due
- **Plan on attending Vanya Kriekhaus' workshop: *Data Management in Stata*:** Friday, October 12, 1:00-4:00PM (104 Professional Building).

### Required:

- Long: Chapter 6.1-6.6 (p. 148-178)
- Long and Freese: Chapter 6-6.7 (p. 223-276)

**Recommended (Example):**

- Whitten, Guy D. and Harvey Palmer. 1996. "Heightening Comparativists' Concern for Model Choice: Voting Behavior in Great Britain and the Netherlands." *American Journal of Political Science*. 40(1): 231-260.

**October 17: Count Models: Poisson and Negative Binomial Models**

**Announcements:**

- **Research Report #1 Is Due**

**Required:**

- Long: Chapter 8
- Long and Freese: Chapter 8-8.3.5 (p. 349-381) and Chapter 8.6-8.8 (p. 394-414)
- King, Gary. 1988. "Statistical Models for Political Science Event Counts: Bias in Conventional Procedures and Evidence for the Exponential Poisson Regression Model." *American Journal of Political Science*. 32(2): 838-863.

**Spatial Econometrics**

**October 24: Spatial Dependence in Theory and Practice**

**Announcements:**

- Categorical Models homework is due

**Required:**

- Ward and Gleditsch: pages 1-13

**October 31: Identifying Neighbors**

**Announcements:**

- **Research Report #2 Is Due**

**Required:**

- Ward and Gleditsch: pages 14-19

- Neumayer, Eric and Thomas Plumper. 2016. “W”. *Political Science and Research Methods*. 4.1: 175-193.

**Recommended:**

- Zhukov, Yuri M. and Brandon M. Stewart. 2013. “Choosing Your Neighbors: Networks of Diffusion in International Relations.” *International Studies Quarterly*. 57: 271-287.
- Plumper, Thomas and Eric Neumayer. 2010. “Model Specification in the Analysis of Spatial Dependence.” *European Journal of Political Research*. 49: 418-422.

**Examples (Recommended):**

- Kayser, Mark Andreas and Michael Peress. 2012. “Benchmarking across Borders: Electoral Accountability and the Necessity of Comparison.” *American Political Science Review*. 106.3: 661-684.
- Fortunato, David, Clint S. Swift and Laron K. Williams. *forthcoming* “All Economics Is Local: Spatial Aggregations of Economic Information.” *Political Science Research and Methods*.
- Beck, Nathaniel, Kristian Skrede Gleditsch and Kyle Beardsley. 2006. “Space Is More than Geography: Using Spatial Econometrics in the Study of Political Economy.” *International Studies Quarterly*. 50: 27-44.

## November 7: Specification of Spatial Dependence

**Required:**

- Ward and Gleditsch: pages 19-34

**Recommended:**

- Vega, Solmaria Halleck and J. Paul Elhorst. 2015. “The SLX Model.” *Journal of Regional Science*. 55.3: 339-363. **Only read pages 339-344.**

## November 14: Estimating Spatial Econometric Models

**Announcements:**

- **Research Report #3 Is Due**

**Required:**

- Ward and Gleditsch: pages 35-44 and 65-76
- Franzese, Robert J. and Jude C. Hays. 2007. “Spatial Econometric Models of Cross-Sectional Interdependence in Political Science Panel and Time-Series-Cross-Section Data.” *Political Analysis*. 15: 140-164.

**Recommended:**



- Vega, Solmaria Halleck and J. Paul Elhorst. 2015. “The SLX Model.” *Journal of Regional Science*. 55.3: 339-363. **Only read pages 345-363.**
- Williams, Laron K. 2015. “It’s All Relative: Spatial Positioning of Parties and Ideological Shifts.” *European Journal of Political Research*. 54: 141-159.

**Recommended (Examples):**

- Williams, Laron K. and Guy D. Whitten. 2015. “Don’t Stand So Close to Me: Spatial Contagion Effects and Party Competition.” *American Journal of Political Science*. 59.2: 309-325. **Only read pages 309-317.**
- Williams, Laron K., Katsunori Seki and Guy D. Whitten. 2016. “You’ve Got Some Explaining to Do: The Influence of Economic Conditions and Spatial Competition on Party Strategy.” *Political Science Research and Methods*. 4.1: 47-63. **Only read 47-56.**

**November 21: Thanksgiving Break (No Class)**

**November 28: Visualizing and Depicting Spatial Dependence**

**Required:**

- Ward and Gleditsch: pages 44-64

**Recommended (Examples):**

- Williams, Laron K. and Guy D. Whitten. 2015. “Don’t Stand So Close to Me: Spatial Contagion Effects and Party Competition.” *American Journal of Political Science*. 59.2: 309-325. **Only read pages 318-325.**
- Williams, Laron K., Katsunori Seki and Guy D. Whitten. 2016. “You’ve Got Some Explaining to Do: The Influence of Economic Conditions and Spatial Competition on Party Strategy.” *Political Science Research and Methods*. 4.1: 47-63. **Only read 57-63.**
- Whitten, Guy D., Laron K. Williams and Cameron Wimpy. *Forthcoming*. “Interpretation: The Final Spatial Frontier.” *Political Science Research and Methods*.

**December 5: Clean Up**

**December 12**

**Announcements:**

- **Research Report #4 Is Due**