PL SC 597C: "Advanced Topics in Statistical Methods"

Fall 2008

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E-mail: zorn@psu.edu
T-Th 1:00-2:15 p.m.
Pond Lab, Room 101

Course Description

This is the third (full) course in quantitative methods in Penn State's political science Ph.D. program. The course is – mostly – an overview of regression-like statistical methods, with an emphasis on likelihood-based models. Most of our attention will be given to models where the traditional assumptions of ordinary least-squares regression are violated, primarily in a cross-sectional context and because the dependent variable is non-continuous. The course will focus on maximum likelihood estimation of models of various kinds of limited-dependent and qualitative response variables. Topics covered in-depth will include binary logit and probit, multinomial logit and probit, ordered logit and probit, Poisson and other models for event counts, and models for survival (time-to-event) data. We will also briefly discuss measurement (item-response) models, and approaches for causal inference with observational data.

Much of the material in this course is fairly technical. While I have chosen readings that present the models as clearly and with as little jargon as possible, most of the material will still require several readings to fully comprehend. A solid understanding of scalar and linear algebra is strongly recommended for this class, and the course assumes familiarity with linear regression at the level of PLSC 503 (that is, at the level of Fox's *Applied Regression Analysis*, Gujarati's *Basic Econometrics*, or the like). Students are also expected to have at least a nodding acquaintance with basic differential and integral calculus, probability theory, and statistical inference.

This syllabus is designed to provide an overview to the course. Clickable links are printed in Penn State blue.

Course Readings

Required Text/Materials

Long, J. Scott. 1997. *Regression Models for Categorical and Limited Dependent Variables.* Thousand Oaks, CA: Sage Publications.

Additional readings as necessary, all of which will be available on ANGEL and/or through JSTOR.

Strongly **Recommended**

Either:

Long, J. Scott, and Jeremy Freese. 2006. *Regression Models for Categorical Dependent Variables Using Stata*, 2nd Ed.. College Station, TX: Stata Press.

or:

Faraway, Julian J. 2006. *Extending the Linear Model with R: Generalized Linear, Mixed Effects and Nonparametric Regression*. London: Chapman & Hall.

A Few Other Useful/Recommended Readings

Agresti, Alan. 2002. *Categorical Data Analysis*, 2nd Ed. New York: Wiley.

Aldrich, John H., and Forrest D. Nelson. 1984. *Linear Probability, Logit and Probit Models*. Beverly Hills, CA: Sage.

Altman, Micah, Jeff Gill and Michael McDonald. 2003. *Statistical Computing for the Social Scientist*. New York: Wiley.

Borooah, Vani K. 2001. *Logit and Probit: Ordered and Multinomial Models*. Newbury Park, CA: Sage.

Box-Steffensmeier, Janet M., and Bradford S. Jones. 2004. *Event History Modeling: A Guide for Social Scientists*. New York: Cambridge University Press.

Cameron, A. Colin, and Pravin K. Trivedi. 1998. *Regression Analysis of Count Data*. New York: Cambridge University Press.

Cramer, J. S. 1986. *Econometric Applications of Maximum Likelihood Methods*. New York: Cambridge.

De Boeck, Paul, and Mark Wilson, Eds. 2004. *Explanatory Item Response Models: A Generalized Linear and Nonlinear Approach.* New York: Springer.

Dobson, Annette J. 2001. *An Introduction to Generalized Linear Models*, 2nd Ed. London: Chapman & Hall.

Eliason, S. R. 1993. *Maximum Likelihood Estimation: Logic and Practice*. Newbury Park, CA: Sage.

Evans, Merran, Nicholas Hastings and Brian Peacock. 2000. *Statistical Distributions*, 3rd Ed. New York: Wiley.

Fahrmeier, L., and G. Tutz. 2000. *Multivariate Statistical Modelling Based on Generalized Linear Models*. Berlin: Springer-Verlag.

Gill, Jeff. 2000. *Generalized Linear Models: A Unified Approach*. Thousand Oaks, CA: Sage Publications.

Gourieroux, Christian. 2000. *Econometrics of Qualitative Dependent Variables*. New York: Cambridge University Press.

Greene, William H. 2003. *Econometric Analysis*, 5th Ed. Upper Saddle River, NJ: Prentice-Hall.

Hambleton, Ronald K., H. Swaminathan, and H. Jane Rogers. 1991. *Fundamentals of Item Response Theory*. Newbury Park CA: Sage Publications.

Hardin, James W., and Joseph W. Hilbe. 2007. *Generalized Linear Models and Extensions*, 2nd Ed. College Station, TX: Stata Press.

Hosmer, David W. Jr., and Stanley Lemeshow. 2000. *Applied Logistic Regression*, 2nd Ed. New York: Wiley.

King, Gary. 1989. *Unifying Political Methodology: The Likelihood Theory of Statistical Inference*. Ann Arbor: University of Michigan Press. Originally published by Cambridge University Press.

Liao, Tim Futing. 1994. *Interpreting Probability Models: Logit, Probit and Other Generalized Linear Models*. Thousand Oaks, CA: Sage.

Lindsey, James K. 2002. *Modelling Frequency and Count Data*. New York: Oxford University Press.

Maddala, G. S. 1983. *Limited-Dependent and Qualitative Variables in Econometrics*. New York: Cambridge University Press.

McCullagh, P., and J. A. Nelder. 1989. *Generalized Linear Models*, 2nd Ed. New York: Chapman and Hall.

Morgan, Stephen L., and Christopher Winship. 2007. *Counterfactuals and Causal Inference: Methods and Principles for Social Research.* New York: Cambridge University Press.

Powers, Daniel, and Yu Xie. 1999. *Statistical Methods for Categorical Data Analysis*. San Diego, CA: Academic Press.

Simonoff, Jeffrey S. 2006. *Analyzing Categorical Data*. New York: Springer.

Venables, W. N., and B. D. Ripley. 2002. *Modern Applied Statistics with S*, 4th Ed. Berlin: Springer-Verlag.

Winkelmann, Rainer. 2005. *Econometric Analysis of Count Data*, 4th Ed. Berlin: Springer-Verlag.

Some Other Useful Resources

The **Political Methodology Section** of the American Political Science Association was created to provide APSA members with an interest in political methodology with a forum in which to meet and discuss ideas. The section publishes a quarterly newsletter (*The Political Methodologist*), a quarterly journal on political methodology (*Political Analysis*), conducts a discussion list on topics relating to political methodology, and maintains an extensive electronic archive of papers, accessible via their homepage.

Also, the **Inter-University Consortium for Political and Social Research** (ICPSR), at the University of Michigan, maintains an extensive archive of data in the social and behavioral sciences. Much of it is accessible via their homepage.

Finally, a sample of courses (somewhat) similar to this one include those taught by:

- Fred Boehmke (University of Iowa).
- John Brehm (University of Chicago).
- Matt Golder (Florida State).
- Simon Jackman (Stanford University).
- Brad Jones (UC-Davis).

- Luke Keele (Ohio State).
- Gary King (Harvard University).
- Andrew Martin and Robert Walker (Washington University).
- Shawn Trier (University of Minnesota).
- Mike Ward (University of Washington).
- Greg Wawro (Columbia University).

Grading

Grading will be based on ten more-or-less weekly homework exercises (50 points each) and a final paper/poster presentation (500 points). In most instances, exercises will be due five days from being assigned (that is, they will be assigned on Thursday and due the following Tuesday). Homework exercises will generally involve estimation and interpretation of models on real/existing data, using statistical computer software (see below). Feel free to work on the assignments in groups of two or three, but you must write up all assignments individually. Details for the homework assignments and the final project will be announced in class.

Also, note that homework exercises and the final paper should be submitted as hard (paper) copies. In the exceptional circumstance that you need to submit something electronically, **only PDF files will be accepted**, without exception. If you do not know how to create a PDF file, go learn. Now.

Software, Statistical and Otherwise

You are welcome to make use of whatever statistical software you choose to complete the homework exercises, so long as the manner by which your results are generated and conclusions reached are transparent. However, due to the limits of instructor and TA time and patience, we will support only two software packages. Both are available on the machines in the political science computing labs.

Stata

At the present time, Stata is probably the most widely-used statistical package in the social sciences. It is a powerful tool for data management, analysis, and display, and boasts some of the best manuals and on-line help of any existing software package. Stata is commercial software; the current version of Stata is 10.0, but previous versions (back to v. 8, at least) can also be used for the class. In the class notes, handouts, etc., Stata commands will appear in a fixed-width font and will be preceded by a period (“.”):

```
. regress Y X
```

Stata newbies may want to check out:

Getting Started with Stata for Windows, Release 10. 2007. College Station, TX: Stata Press.

Beyond this, the Stata homepage is a valuable resource for questions about the Stata statistical software. There are a number of useful Stata references on the web, including Scott Long's page at IU and an excellent Stata "help page" sponsored by UCLA.

R

R is a statistical environment and high-level programming language for data analysis and display. It is effectively the GNU version of the S language; as such, it is free (both as in speech and as in beer) and open source. R is an *object-oriented* language; unlike Stata (and most other statistical packages), it operates mostly by assigning values to objects in the workspace. In the notes, handouts, etc., R commands will generally be preceded by a caret ("**>**"):

```
> my.results<-lm(Y~X)
```

The Comprehensive R Archive Network (CRAN) is the go-to spot for all things R-related. I cannot begin to list all the R-related resources available on the web; for newbies, however, it might be useful to check out the Introduction to R, this page in getting data into R, and the various R "cheat sheets" here, here, and here. Stata users who are interested in learning R should check out the Moving from Stata to R page at the R Project's wiki.

Other Considerations

In no particular order:

- Your instructor does not have a formally-stated preference for either Stata or R. My recommendation would be to learn to use both, as each has its strengths and weaknesses. Stata has a far flatter learning curve than R, which means students tend to gravitate toward it given a choice. But R is far more flexible and powerful, and will likely be more useful to you in the long run.
- Learn to use LaTeX, now, while you have the time. You will be glad you did.
- If you insist on using Microsoft Word (or any other WYSIWYG program) for writing assignments, papers, etc., **do not under any circumstances cut and paste graphs from Stata and R into those programs**. Save whatever figures you want to use as `.png`, `.tif`, or `.jpg` files, and import them into the software.

Academic Dishonesty

The Department of Political Science, along with the College of the Liberal Arts and the University, takes violations of academic dishonesty seriously. Observing basic honesty in one's work, words, ideas, and actions is a principle to which all members of the community are required to subscribe.

All course work by students is to be done on an individual basis unless an instructor clearly states that an alternative is acceptable. Any reference materials used in the preparation of any assignment must be explicitly cited. In an examination setting, unless the instructor gives explicit prior instructions to the contrary, whether the examination is in-class or take-home, violations of academic integrity shall consist of any attempt to receive assistance from written or printed aids, or from any person or papers or electronic devices, or of any attempt to give assistance, whether the one so doing has completed his or her own work or not.

Other violations include, but are not limited to, any attempt to gain an unfair advantage in regard to an examination, such as tampering with a graded exam or claiming another's work to be one's own. Violations shall also consist of obtaining or attempting to obtain, previous to any examinations, copies of the examination papers or the questions to appear thereon, or to obtain any illegal knowledge of these questions. Lying to the instructor or purposely misleading any Penn State administrator shall also constitute a violation of academic integrity.

In cases of a violation of academic integrity it is the policy of the Department of Political Science to impose appropriate penalties that are consistent with University guidelines. See here for more details.

Course Schedule

Readings should be completed prior to coming to class on the assigned day. Note that we will not, in general, hew closely (or at all) to the readings themselves, other than topically. Links are generally to DOIs or to stable PDFs at JSTOR. I won't assign readings from either Long and Freese (2006) or Faraway (2006), but students should consult the relevant parts of those texts for software guidance (depending on whether they are using Stata or R, respectively).

August 26: Overview, Notation, and an Introduction to Estimation

- **Readings**
    - *Required*:
        - None.
    - *Recommended*:

- None. (Read Long, Chapter 1, for background).

August 28: No Class: APSA in Boston

September 2: Maximum Likelihood: Derivation and Properties

- **Readings**
  - *Required*:
    - Long, Chapter 2 (esp. pp. 25-33).
  - *Recommended*:
    - Eliason (1993), pp. 1-28.
    - Greene (2003), §17.4.
    - King (1989), Chapter 4.

September 4: Maximum Likelihood: Estimation and Inference

- **Readings**
  - *Required*:
    - Long, pp. 52-61.
  - *Recommended*:
    - Greene (2003), §E6.

September 9: Binary Response Models, I

- **Readings**
  - *Required*:
    - Long, pp. 34-52.
  - *Recommended*:
    - Aldrich and Nelson (1984), pp. 9-30.
    - Eliason, pp. 39-45.
    - Greene (2003), pp. 665-680.
    - Griffiths, William E., R. Carter Hill, and Peter J. Pope. 1987. "Small Sample Properties of Probit Model Estimators." *Journal of the American Statistical Association* 82(399):929-37.
    - King (1989), pp. 97-114.
    - Nagler, Jonathan. 1994. "Scobit: An Alternative Estimator to Logit and Probit." *American Journal of Political Science* 38(1):230-55.

September 11: No Class – CELS Conference in Ithaca, NY

September 16: Binary Response Models, II

- **Readings**
  - *Required*:
    - Long, pp. 61-112.
  - *Recommended*:
    - Hagle, Timothy M., and Glenn E. Mitchell. 1992. "Goodness of Fit Measures for Probit and Logit." *American Journal of Political Science* 36(3):762-84.
    - Herron, Michael C. 2000. "Postestimation Uncertainty in Limited Dependent Variable Models." *Political Analysis* 8(1):83-98.
    - 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):347-61.
    - Liao (1994), pp. 10-25.

September 18: Binary Response Models, III

- **Readings**
  - *Required*:
    - Greene (2003) §21.4.4.b.
    - Greene (2003) §21.6.1-21.6.3.
    - King, Gary and Langche Zeng. 2001. "Logistic Regression in Rare Events Data." *Political Analysis* 9(2): 137-63.
    - Zorn, Christopher. 2005. "A Solution to Separation in Binary Response Models." *Political Analysis* 13(2):157-70.
  - *Recommended*:
    - Alvarez, R. Michael and John Brehm. 1995. "American Ambivalence Toward Abortion Policy: A Heteroskedastic Probit Method for Assessing Conflicting Values." *American Journal of Political Science* 39(4):1055-82.
    - Ashford, J. R. and R. R. Sowden. 1970. "Multi-variate Probit Analysis." *Biometrics* 26(3):535-46.
    - King, Gary and Langche Zeng. 2001. "Explaining Rare Events in International Relations." *International Organization* 55(3):693-715.
    - Kosmidis, Ioannis, and David Firth. 2008. "Bias Reduction in Exponential Family Nonlinear Models." CRiSM Working Paper No. 08-05, University of Warwick.

        - Zorn, Christopher. 2002. "U.S. Government Litigation Strategies in the Federal Appellate Courts." *Political Research Quarterly* 55(1):145-66.

- *Exercise One: Estimate and interpret binary logit and probit models.*

September 23: Ordered Response Models, I

- **Readings**
    - *Required*:
        - Long, pp. 114-127.
    - *Recommended*:
        - Liao (1994), pp. 25-41.
        - Winship, Christopher, and Robert D. Mare. 1984. "Regression Models with Ordinal Variables." *American Sociological Review* 49(4):512-25.

September 25: Ordered Response Models, II

- **Readings**
    - *Required*:
        - Long, pp. 127-145.
    - *Recommended*:
        - Alvarez. R. Michael, and John Brehm. 1998. "Speaking in Two Voices: American Equivocation about the Internal Revenue Service." *American Journal of Political Science* 42(2):418-52.
        - Gelpi, Christopher. 1997. "Crime and Punishment: The Role of Norms in Crisis Bargaining." *American Political Science Review* 91(2):339-60.
        - Jones, Bradford S., and Michael E. Sobel. 2000. "Modeling Direction and Intensity in Semantically Balanced Ordinal Scales: An Assessment of Congressional Incumbent Approval." *American Journal of Political Science* 44(1):174-85.
        - Liao (1994), pp. 41-47.
        - Sanders, Mitchell S. 2001. "Uncertainty and Turnout." *Political Analysis* 9(1):45-57.

- *Exercise Two: Estimate and interpret ordered logit and probit models.*

September 30: Multinomial Choice Models, I

- **Readings**
  - *Required*:
    - Long, pp. 148-182.
  - *Recommended*:
    - Greene (2003), pp. 723-24.
    - Liao (1994), pp. 48-69.
    - Maltzman, Forrest, and Paul J. Wahlbeck. 1996. "May it Please the Chief? Opinion Assignments in the Rehnquist Court." *American Journal of Political Science* 40(2):421-43.
    - Sellers, Patrick. 1998. "Strategy and Background in Congressional Campaigns." *American Political Science Review* 92(1):159-71.
    - Whitten, Guy B., and Harvey Palmer. 1996. "Heightening Comparativists' Concerns for Model Choice: Voting Behavior in Great Britain and the Netherlands." *American Journal of Political Science* 40(1):231-60.

October 2: Multinomial Choice Models, II

- **Readings**
  - *Required*:
    - Long, pp. 182-186.
    - Dow, Jay K., and James W. Endersby. 2004. "Multinomial Probit and Multinomial Logit: A Comparison of Choice Models for Voting Research." *Electoral Studies* 23(1):107-22.
    - Glasgow, Garrett. 2001. "Mixed Logit Models for Multiparty Elections." *Political Analysis* 9(2):116-36.
    - Greene (2003), pp. 724-28.
  - *Recommended*:
    - Alvarez, R. Michael, and Jonathan Nagler. 1998. "When Politics and Models Collide: Estimating Models of Multiparty Elections." *American Journal of Political Science* 42(1):55-97.
    - Fry, Tim R., and Mark N. Harris. 1998. "Testing for Independence of Irrelevant Alternatives: Some Empirical Results." *Sociological Methods and Research* 26(3):401-23.
    - Quinn, Kevin M., Andrew D. Martin, and Andrew B. Whitford. 1999. "Voter Choice in Multi-Party Democracies: A Test of Competing Theories and Models." *American Journal of Political Science* 43(4):1231-47.

        - Rudolph, Thomas J. 2003. "Who's Responsible for the Economy? The Formation and Consequences of Responsibility Attributions." *American Journal of Political Science* 47(4):698-713.

- *Exercise Three: Estimate and interpret some multinomial choice models.*

October 7: Event Count Models, I

- **Readings**
    - *Required*:
        - Long, pp. 217-230.
    - *Recommended*:
        - Cameron and Trivedi (1998), Chapter 3.
        - Gowa, Joanne. 1998. "Politics at the Water's Edge: Parties, Voters and the Use of Force Abroad." *International Organization* 52(2):307-24.
        - 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(3):838-63.
        - Liao (1994), pp. 70-79.

October 9: Event Count Models, II

- **Readings**
    - *Required*:
        - Long, pp. 230-238.
    - *Recommended*:
        - King, Gary. 1989. "Variance Specification in Event Count Models: From Restrictive Assumptions to a Generalized Estimator." *American Journal of Political Science* 33(3):762-84.
        - King, Gary, and Curtis Signorino. 1996. "The Generalization in the Generalized Event Count Model, With Comments on Achen, Amato, and Londregan." *Political Analysis* 6(1):225-52.

- *Exercise Four: Estimate and compare Poisson and negative binomial models.*

October 14: Event Count Models, III

- **Readings**
  - *Required*:
    - Long, pp. 239-250.
    - Zorn, Christopher. 1998. "An Analytic and Empirical Examination of Zero-Inflated and Hurdle Poisson Specifications." *Sociological Methods and Research* 26(3):368-400.
  - *Recommended*:
    - King, Gary. 1989. "Event Count Models for International Relations: Generalizations and Applications." *International Studies Quarterly* 33:123-47.
    - Sheingate, Adam D. 2006. "Structure and Opportunity: Committee Jurisdiction and Issue Attention in Congress." *American Journal of Political Science* 50(October):844-59.

October 16: No Class: ICPSR Council

October 21: Generalized Linear Models, I

- **Readings**
  - *Required*:
    - Long, pp. 257-58.
    - McCulloch, Charles E. 2000. "Generalized Linear Models." *Journal of the American Statistical Association* 95(452):1320-24.
  - *Recommended*:
    - Gill (2000), pp. 1-38.
    - McCullagh and Nelder (1989), pp. 26-43.
    - Nelder, J. A. and R. W. M. Wedderburn. 1972. "Generalized Linear Models." *Journal of the Royal Statistical Society, Series A (General)* 135(3):370-84.

October 23: Generalized Linear Models, II

- **Readings**
  - *Required*:
    - Fox (2008), pp. 404-417.
  - *Recommended*:
    - Gill (2000), pp. 39-68.

- *Exercise Five: Estimate a generalized linear model on proportions data.*

October 28: Introduction to Survival Models

- **Readings**
  - *Required*:
    - Hosmer, David W., and Stanley Lemeshow. 1999. *Applied Survival Analysis: Regression Modeling of Time to Event Data*, pp. 27-84 and Appendix 1.
    - Box-Steffensmeier, Janet M., and Bradford S. Jones. 2004. *Event History Modeling: A Guide for Social Scientists*, Chapters 1-2.
  - *Recommended*:
    - Cioffi-Revilla, Claudio. 1984. "The Political Reliability of Italian Governments: An Exponential Survival Model." *American Political Science Review* 78(2):318-37.
    - Zelditch, Morris Jr. and Joan Butler Ford. 1994. "Uncertainty, Potential Power, and Nondecisions." *Social Psychology Quarterly* 57(1):64-73.

October 30: Parametric Survival Models

- **Readings**
  - *Required*:
    - Box-Steffensmeier, Janet M., and Bradford S. Jones. 2004. *Event History Modeling: A Guide for Social Scientists*, Chapter 3.
    - Alt, James, and Gary King. 1994. "Transfers of Governmental Power: The Meaning of Time Dependence." *Comparative Political Studies* 27(2):190-210.
  - *Recommended*:
    - Bennett, D. Scott, and Allan C. Stam III. 1996. "The Duration of Interstate Wars." *American Political Science Review* 90(June):239-57.
    - Bueno de Mesquita, Bruce, and Randolph M. Siverson. 1995. "War and the Survival of Political Leaders: A Comparative Study of Regime Types and Political Accountability." *American Political Science Review* 89(2):841-55.
    - McCarty, Nolan and Rose Razaghian. 1999. "Advice and Consent: Senate Responses to Executive Branch Nominations." *American Journal of Political Science* 43(October):1122-43.
    - Teachman, Jay D., and Mark D. Hayward. 1993. "Interpreting Hazard Rate Models." *Sociological Methods and Research* 21(February):340-71.
- *Exercise Six: Estimate and interpret a parametric survival model.*

November 4: Cox's Proportional Hazards Model

- **Readings**
  - *Required*:
    - Box-Steffensmeier, Janet M., and Bradford S. Jones. 2004. *Event History Modeling: A Guide for Social Scientists*, Chapters 4-5.
  - *Recommended*:
    - Box-Steffensmeier, Janet M., Laura W. Arnold, and Christopher Zorn. 1997. "The Strategic Timing of Position Taking in Congress: A Study of the North American Free Trade Agreement." *American Political Science Review* 91(June):324-38.
    - Cox, David Roxbee. 1972. "Regression Models and Life Tables." *Journal of the Royal Statistical Society, Series B* 34(2):187-220.
    - Hegre, Havard, Tanja Ellingsen, Scott Gates, and Nils Petter Gleditsch. 2001. "Toward a Democratic Civil Peace? Democracy, Political Change, and Civil War, 1816-1992." *American Political Science Review* 95(March):33-48.
    - Lindsey, J. K. 1998. "Counts and Times to Events." *Statistics in Medicine* 17:1745-51.
    - Pevehouse, Jon. 2002. "With a Little Help from My Friends? Regional Organizations and the Consolidation of Democracy." *American Journal of Political Science* 46(July):611-26.

November 6: Survival Analysis: Discrete-Time Alternatives

- **Readings**
  - *Required*:
    - 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(October):1260-88 (and erratum).
  - *Recommended*:
    - 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(Winter):21-44.
    - Singer, Judith D., and John B. Willett. 1993. "Its About Time: Using Discrete-Time Survival Analysis to Study Duration and the Timing of Events." *Journal of Educational Statistics* 18(Summer):155-95.
- *Exercise Seven: Estimate and interpret Cox and discrete-time hazard models.*

November 11: Item Response Models, I

- **Readings**
  - *Required*:
    - Hambleton et al. (1991), pp. 7-46.
  - *Recommended*:
    - Lord, Frederic M. 1983. "Unbiased Estimates of Ability Parameters, of Their Variance, and of Their Parallel Forms Reliability." *Psychometrika* 48:477-82.
    - Rasch, Georg. 1961. "On General Laws and the Meaning of Measurement in Psychology." *Proceedings of the IV Berkeley Symposium on Mathematical Statistics and Probability* 4:321-333.

November 13: Item Response Models, II

- **Readings**
  - *Required*:
    - Hambleton et al. (1991), pp. 53-88, 109-122.
  - *Recommended*:
    - Martin, Andrew D., Kevin M. Quinn, and Jong Hee Park. "`MCMCpack`: Markov Chain Monte Carlo Package."
    - Poole, Keith, and Howard Rosenthal. 1985. "A Spatial Model of Legislative Roll Call Analysis." *American Journal of Political Science* 29(2):357-384
    - Poole, Keith. 2005. *Spatial Models of Parliamentary Voting.* New York: Cambridge University Press.
    - Rizopoulos, Dimitris. 2006. "`ltm`: An R Package for Latent Variable Modeling and Item Response Theory Analyses." *Journal of Statistical Software* 17(5).
- *Exercise Eight: Simple item-response models.*

November 18: Item Response Models, III

- **Readings**
  - *Required*:
    - Clinton, Joshua D., Simon D. Jackman, and Douglas Rivers. 2004. "The Statistical Analysis of Roll Call Data: A Unified Approach." *American Political Science Review* 98:355-370.

        - Clinton, Joshua D., and Adam Meirowitz. 2003. "Integrating Voting Theory and Roll Call Analysis: A Framework." *Political Analysis* 11:381-396.
        - Londregan, John B. 1999. "Estimating Legislators' Preferred Points." *Political Analysis* 8:35-36.
    - *Recommended*:
        - Jackman, Simon. 2001. "Multidimensional Analysis of Roll Call Data via Bayesian Simulation: Identication, Estimation, Inference, and Model Checking." *Political Analysis* 9:229-240.

November 20: Item Response Models, IV

- **Readings**
    - *Required*:
        - Bafumi, Joseph, Andrew Gelman, David Park, and Noah Kaplan. 2005. "Practical Issues in Implementing and Understanding Baysian Ideal Point Estimation." *Political Analysis* 13:171-187.
        - Martin, Andrew D. and Kevin M. Quinn. 2002. "Dynamic Ideal Point Estimation via Markov Chain Monte Carlo for the U.S. Supreme Court, 1953-1999." *Political Analysis* 10:134-153.
    - *Recommended*:
        - Jackman, Simon. 2004. "What Do We Learn from Graduate Admissions Committees?: A Multiple-Rater, Latent Variable Model with Incomplete Discrete and Continuous Indicators." *Political Analysis* 12(4): 400-424.
        - Schrodt, Philip. 2007. "Inductive Event Data Scaling using Item Response Theory." Paper prepared for delivery at the Summer Meeting of the Society for Political Methodology, Pennsylvania State University.
        - Weisberg, Herbert F. 1974. "Dimensionland: An Excursion into Spaces." *American Journal of Political Science*, 18:743-776.
- *Exercise Nine: More item-response models.*

November 25 & 27: No Class – Thanksgiving Break

December 2: Causal Inference, I

- **Readings**
    - *Required*:

- Little, Roderick J. A., and Donald B. Rubin. 2000. "Causal Effects in Clinical and Epidemiological Studies via Potential Outcomes: Concepts and Analytical Approaches." *Annual Review of Public Health* 21:121-145.

- *Recommended*:
  - Pearl, Judea. 2000. *Causality*. New York: Cambridge University Press.
  - Sekhon, Jasjeet S. 2004. "Quality Meets Quantity: Case Studies, Conditional Probability and Counterfactuals." *Perspectives on Politics* 2(2):281-293.

December 4: Causal Inference, II

- **Readings**
  - *Required*:
    - Ho, Daniel E., Kosuke Imai, Gary King, and Elizabeth A. Stuart. 2007. "Matching as Nonparametric Preprocessing for Reducing Model Dependence in Parametric Causal Inference." *Political Analysis* 15:199-236.
    - Imbens, Guido. 2004. "Nonparametric Estimation of Average Treatment Effects Under Exogeneity: A Review." *The Review of Economics and Statistics* 86(1):4-29
    - Rosenbaum, Paul and Donald B. Rubin. 1983. "The Central Role of the Propensity Score in Observational Studies for Causal Effects." *Biometrika* 70:41-55.
  - *Recommended*:
    - Rubin, Donald B. 1973. "Matching to Remove Bias in Observational Studies." *Biometrics* 29(1):159-183.
    - Rubin, Donald B., and Neal Thomas. 1996. "Matching Using Estimated Propensity Scores: Relating Theory to Practice." *Biometrics* 52(1):249-264.
    - Sekhon, Jasjeet S. 2007. "Matching: Multivariate and Propensity Score Matching with Automated Balance Search." *Journal of Statistical Software.*
- *Exercise Ten: Estimate causal effects on observational data, using matching techniques.*

December 9: Causal Inference, III

- **Readings**
  - *Required*:
    - Angrist, Joshua D., Guido W. Imbens, and Donald B. Rubin. 1996. "Identication of Causal Effects Using Instrumental Variables (with discussion)." *Journal of the American Statistical Association* 91(434):444-472.

- Butler, Daniel M., and Matthew J. Butler. 2006. "Splitting the Difference? Causal Inference and Theories of Split-party Delegations." *Political Analysis* 14:439-455.
- Lee, David S. 2008. "Randomized Experiments from Non-Random Selection in U.S. House Elections." *Journal of Econometrics* 142(2):675-697.

◦ *Recommended*:

- Gordon, Sandy, and Greg Huber. 2007. "The Effect of Electoral Competitiveness on Incumbent Behavior." *Quarterly Journal of Political Science* 2(2):107-138.
- Simmons, Beth A., and Daniel J. Hopkins. 2005. "The Constraining Power of International Treaties: Theory and Methods." *American Political Science Review* 99(4):623-631.
- Thistlethwaite, D., and D. Campbell. 1960. "Regression-Discontinuity Analysis: An Alternative to the Ex Post Facto Experiment." *Journal of Educational Psychology* 51: 309-317.

December 11: Wrap up, Catch up, and Review