# PLSC 504: "Topics in Political Methodology"

Fall 2017

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Tuesday & Thursday, 9:30 - 11:00 a.m.
Boucke Building, Room 305

## 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. 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. We will also discuss models for survival (time-to-event) data, models for panel and time-series cross-sectional data, hierarchical ("multilevel") models, and multivariate models for measuring latent concepts.

The models discussed in this course are among the most widely used in the social sciences today. It is not possible to function as an empirical social scientist without at least a passing familiarity with these models; moreover, given the rapid and increasing rate at which more advanced models are being adopted in these fields, these techniques increasingly represent a minimal level of statistical competence necessary to do publishable-quality quantitative work. In other words: knowing these models, and using them appropriately and well, can increase your odds of writing a strong (quantitative) dissertation, landing a job, publishing books and articles, being granted tenure, and generally leading a happier and more fulfilling professional life.

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 required 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*, Greene's *Econometric Analysis*, 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

### Recommended Text/Materials

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

AND/OR

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

AND

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

Additional readings as necessary, all of which will be available on the course github repository (https://github.com/PrisonRodeo and/or through JSTOR.

**A Few Other Potentially Useful Readings**

GLMs, etc.

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

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

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

Cameron, A. Colin, and Pravin K. Trivedi. 2005. *Microeconometrics: Methods and Applications*. 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., and Adrian Barnett. 2008. *An Introduction to Generalized Linear Models*, 3rd Ed. London: Chapman & Hall.

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

Fahrmeier, Ludwig, and Gerhard Tutz. 2010. *Multivariate Statistical Modelling Based on Generalized Linear Models*, 2nd Ed. Berlin: Springer-Verlag.

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

Greene, William H. 2007. *Econometric Analysis*, 6th 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.

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

McCulloch, Charles E., Shayle R. Searle, and John M. Neuhaus. 2008. *Generalized, Linear, and Mixed Models*. New York: Wiley.

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.

Wright, Daniel B., and Kamala London. 2009. *Modern Regression Techniques Using R : A Practical Guide*. Thousand Oaks, CA: Sage.

Survival / Hazard / Event History Models

Beck, Nathaniel. 1998. "Modeling Space and Time: The Event History Approach." In E. Scarbrough and E. Tanenbaum, eds., *Research Strategies in the Social Sciences*. London: Oxford University Press.

Blossfeld, Hans-Peter and Gtz Rohwer. 2001. *Techniques of Event History Modeling: New Approaches to Casual Analysis*, 2nd Ed. Mahwah, NJ: Lawrence Erlbaum.

Box-Steffensmeier, Janet M. and Bradford Jones. 1997. "Time is of the Essence: Event History Models in Political Science." *American Journal of Political Science* 41(October):1414-61.

Chung, Ching-Fan, Peter Schmidt, and Ann D. Witte. 1991. "Survival Analysis: A Survey." *Journal of Quantitative Criminology* 7(March):59-98.

Collett, Dave. 2003. *Modeling Survival Data in Medical Research*, 2nd Ed. London: Chapman & Hall.

Cox, David Roxbee and Dallin Oakes. 1984. *Analysis of Survival Data*. London: CRC/Chapman & Hall.

Fleming, Thomas R., and David P. Harrington. 1991. *Counting Processes and Survival Analysis*. New York: Wiley.

Hosmer, D., and Stanley Lemeshow. 1999. *Applied Survival Analysis: Regression Modeling of Time to Event Data*. New York: Wiley.

Ibrahim, Joseph G., Ming-Hui Chen, and Debajyoti Sinha. 2005. *Bayesian Survival Analysis*. New York: Springer.

Kalbfleisch, J. D. and R. L. Prentice. 2002. *The Statistical Analysis of Failure Time Data*, 2nd Ed. New York: Wiley.

Kiefer, Nicholas M. 1988. "Economic Duration Data and Hazard Functions." *Journal of Economic Literature* 26(June):646-79.

Klein, John P., and Melvin L. Moeschberger. 1997. *Survival Analysis: Techniques for Censored and Truncated Data*. New York: Springer-Verlag.

Lancaster, Tony. 1990. *The Econometric Analysis of Transition Data*. New York: Cambridge University Press.

Lawless, J. F. 2002. *Statistical Methods and Models for Lifetime Data*, 2nd Ed. New York: Wiley.

Le, Chap T. 1997. *Applied Survival Analysis*. New York: Wiley.

Vermunt, Jeroen K. 1997. *Log-Linear Models for Event Histories*. Thousand Oaks, CA: Sage Publications.

Yamaguchi, Kazuo. 1991. *Event History Analysis*. Newbury Park, CA: Sage.

Models for Panel and TSCS Data

Arellano, Manuel. 2002. *Panel Data Econometrics*. Oxford: Oxford University Press.

Baltagi, Badi. 2005. *Econometric Analysis of Panel Data*, 3rd Ed. New York: Wiley.

Diggle, P., P. Heagerty, K-Y Liang, and S. Zeger. 2002. *Analysis of Longitudinal Data*, 2nd Ed. Oxford: Oxford University Press.

Finkel, Stephen E. 1995. *Causal Analysis With Panel Data*. Thousand Oaks, CA: Sage Publications.

Frees, Edward W. 2004. *Longitudinal and Panel Data: Analysis and Applications in the Social Sciences*. New York: Cambridge University Press.

Hand, David and Martin Crowder. 1996. *Practical Longitudinal Data Analysis*. London: Chapman & Hall.

Hsaio, Cheng. 2003. *The Analysis of Panel Data*, 2nd Ed. New York: Cambridge University Press.

Lee, Myoung-Jae. 2002. *Panel Data Econometrics: Methods-of-Moments and Limited Dependent Variables*. Academic Press.

Matyas, Laszlo and Patrick Sevestre, eds. 1996. *The Econometrics of Panel Data: A Handbook of the Theory with Applications*. 2nd Revised Ed. Dordrecht: Kluwer Academic Publishers.

Sayrs, Lois. 1989. *Pooled Time Series Analysis*. Thousand Oaks, CA: Sage Publications.

Singer, Judith D. and John B. Willett. 2003. *Applied Longitudinal Data Analysis: Modeling Change and Event Occurrence*. New York: Oxford University Press (also discusses survival analysis).

Wooldridge, Jeffrey M. 2002. *Econometric Analysis of Cross Section and Panel Data*. Cambridge: MIT Press.

## 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 similar to this one include those taught by:

- Fred Boehmke (University of Iowa).
- John Brehm (University of Chicago).
- James Honaker (Penn State).
- Gary King (Harvard University).
- Andrew Martin (Washington University).
- 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/poster 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 15.0, but previous versions (back to v. 12, 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 , Release 12*. 2011. 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. The current (late August 2017) version of R is 3.4.1. R is an *object-oriented* language; unlike Stata (and most other statistical packages), it operates by assigning values to objects in the workspace. In the notes, handouts, etc., R commands will 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.

As a rule, we will cover one broad topic per week. Readings will be assigned weekly. We will typically spend Tuesday covering statistical / theoretical topics, and Thursday delving into practicalities (software, applications, diagnostics, etc.). It will generally be a good idea to have completed the assigned readings prior to Tuesday's class each week.

#### August 22: Introduction and Overview

- **Readings**
  - *Required*:
    - None.
  - *Recommended*:
    - None. (Read Long, Chapter 1, for background).

**August 24: Maximum Likelihood**

- **Readings**
  - *Required*:
    - Long, Chapter 2 (esp. pp. 25-33), pp. 52-61, and Chapter 4.
    - Faraway, pp. 279-285.
  - *Recommended*:
    - Eliason (1993), pp. 1-28.
    - Greene (2003), §17.4.
    - King (1989), Chapter 4.
    - Breusch, T. S. 1979. "Conflict Among Criteria for Testing Hypotheses: Extensions and Comments." *Econometrica* 47(1):203-07.
    - Buse, A. 1982. "The Likelihood Ratio, Wald, and Lagrange Multiplier Tests: An Expository Note." *The American Statistician* 36(3):153-57.
    - Greene (2003), pp. 484-496.
    - Meeker, William Q. and Luis A. Escobar. 1995. "Teaching About Approximate Confidence Regions Based on Maximum Likelihood Estimation." *The American Statistician* 49(1):48-53.

**August 29-31: Models for Binary Responses**

- **Readings**
  - *Required*:
    - Long, pp. 34-52, 61-112.
    - Faraway, pp. 25-38.
  - *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.
    - Berry, William D., Jacqueline H. R. DeMeritt, and Justin Esarey. 2010. "Testing for Interaction in Binary Logit and Probit Models: Is a Product Term Essential?" *American Journal of Political Science* 54(January): 248-66.
    - 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.
  - *Extensions*:

- 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.
- 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.
- Freedman, David A., and Jasjeet S. Sekhon. 2010. "Endogeneity in Probit Response Models." *Political Analysis* 18(2):138-50.
- Greene (2003) §21.4.4.b; §21.6.1-21.6.3.
- King, Gary and Langche Zeng. 2001. "Explaining Rare Events in International Relations." *International Organization* 55(3):693-715.
- Kosmidis, Ioannis, and David Firth. 2009. "Bias Reduction in Exponential Family Nonlinear Models." *Biometrika* 96:793-804.

**September 5-7: Nominal and Ordinal Responses**

- **Readings**
  - *Required*:
    - Long, pp. 114-186.
    - Faraway, pp. 97-112.
  - *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.
    - 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.
    - Greene (2003), pp. 724-28.
    - 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.
    - 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.
    - 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.
    - Sanders, Mitchell S. 2001. "Uncertainty and Turnout." *Political Analysis* 9(1):45-57.
    - Liao (1994), pp. 25-469.

        - Winship, Christopher, and Robert D. Mare. 1984. "Regression Models with Ordinal Variables." *American Sociological Review* 49(4):512-25.
        - Greene (2003), pp. 723-24.
        - 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.

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

**September 12-14: Event Counts**

- **Readings**
    - *Required*:
        - Long, pp. 217-250.
        - Faraway, pp. 55-66.
        - Zorn, Christopher. 1998. "An Analytic and Empirical Examination of Zero-Inflated and Hurdle Poisson Specifications." *Sociological Methods and Research* 26(3):368-400.
    - *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.
        - 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.
        - Liao (1994), pp. 70-79.
        - 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.

- **Exercise Two: Estimate and compare some event count models.**

**September 19-21: Survival: Parametric 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 Three: Fit some parametric survival models.**

**September 26-28: Survival: Cox and Discrete-Time Models**

- **Readings**
    - *Required*:
        - Box-Steffensmeier, Janet M., and Bradford S. Jones. 2004. *Event History Modeling: A Guide for Social Scientists*, Chapters 4-5 and 8.
        - Box-Steffensmeier, Janet M., and Christopher Zorn. 2001. "Duration Models and Proportional Hazards in Political Science." *American Journal of Political Science* 45(October):951-67.
        - 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).
        - Keele, Luke J. 2010. "Nonproportionally Difficult: Testing for Nonproportional Hazards In Cox Models." *Political Analysis* 18:189-205.
        - Signorino, Curt, and David Carter. 2010. "Back to the Future: Modeling Time Dependence in Binary Data." *Political Analysis* 18(3):271-292. Also read response by Beck and rejoinder by Signorino & Carter.
    - *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.
        - Cox, David Roxbee. 1972. "Regression Models and Life Tables." *Journal of the Royal Statistical Society, Series B* 34(2):187-220.
        - Desmarais, Bruce A., and Jeffrey J. Harden. 2012. "Comparing Partial Likelihood and Robust Estimation Methods for the Cox Regression Model." *Political Analysis* 20(1):113-135. DOI:10.1093/pan/mpr042
        - Grambsch, Patricia M., and Terry M. Therneau. 1994. "Proportional Hazards Tests and Diagnostics Based on Weighted Residuals." *Biometrika* 81(3):515-26.
        - Grambsch, Patricia M., Terry M. Therneau, and Thomas R. Fleming. 1995. "Diagnostic Plots to Reveal Functional Form of Covariates in Multiplicative Intensity Models." *Biometrics* 51(December):1469-82.
        - 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.
        - Idris, Muhammad, and Christopher Zorn. 2015. "Proportional Hazards Analysis of Survival Data with Tied Survival Times: Theory and Best Practices." Working paper: Pennsylvania State University.

- Leung, M. K., D. Rigby, and T. Young. 2003. "Entry of Foreign Banks in the People's Republic of China: A Survival Analysis." *Applied Economics* 35(1):21-31.
- Licht, Amanda A. 2011. "Change Comes with Time: Substantive Interpretation of Nonproportional Hazards in Event History Analysis." *Political Analysis* 19(2):227-243.
- 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.
- Singer, Judith D., and John B. Willett. 1993. "It's About Time: Using Discrete-Time Survival Analysis to Study Duration and the Timing of Events." *Journal of Educational Statistics* 18(Summer):155-95.

- **Exercise Four: Fit Cox models, and test the proportional hazards assumption.**

**October 3-5: Survival Models: Extensions I**

- **Readings**
  - *Required*:
    - Box-Steffensmeier, Janet M., and Bradford S. Jones. 2004. *Event History Modeling: A Guide for Social Scientists*. Chapter 10 and pp. 148-154.
    - Box-Steffensmeier, Janet M., and Christopher Zorn. 2002. "Duration Models for Repeated Events." *Journal of Politics* 46(November):1069-94.
    - Janet M. Box-Steffensmeier, Janet M., Suzanna Linn, and Corwin D. Smidt. 2014. "Analyzing the Robustness of Semi-Parametric Duration Models for the Study of Repeated Events." *Political Analysis* 22:183-204.
    - Zorn, Christopher. 2000. "Modeling Duration Dependence." *Political Analysis* 8(Autumn): 367-380.
  - *Recommended*:
    - Cleves, Mario. 1999. "Analysis of Multiple Failure-Time Data with Stata." *Stata Technical Bulletin* 49:30-39.
    - Crowder, Martin. 2012. *Multivariate Survival Analysis and Competing Risks*. New York: Chapman & Hall/CRC.
    - David, H. A., and M. L. Moeschberger. 1978. *The Theory of Competing Risks*. New York: MacMillan.
    - Diermeier, Daniel, and Randy T. Stevenson. 1999. "Cabinet Survival and Competing Risks." *American Journal of Political Science* 43(4) October: 1051-68.
    - Gordon, Sanford C. 2002. "Stochastic Dependence in Competing Risks." *American Journal of Political Science* 46(January):200-17.
    - Heckman, James J. 1991. "Identifying the Hand of the Past: Distinguishing State Dependence from Heterogeneity." *American Economic Review* 81(May):75-79.
    - Kelly, Patrick J. and Lynette L-Y. Lim. 2000. "Survival Analysis for Recurrent Event Data." *Statistics in Medicine* 19:12-33.
    - Pintilie, Melania. 2007. "Analysing and Interpreting Competing Risk Data." *Statistics in Medicine* 26:1360-67.
    - Warwick, Paul. 1992. "Rising Hazards: An Underlying Dynamic of Parliamentary Government." *American Journal of Political Science* 36(November):857-76.
    - Wei, L. J. and David V. Glidden. 1997. "An Overview of Statistical Methods for Multiple Failure Time Data in Clinical Trials." *Statistics in Medicine* 16:833-39.

- Wolbers, Marcel, et al. 2014. Competing Risks Analyses: Objectives and Approaches. *European Heart Journal*.
- Zorn, Christopher and Steven R. Van Winkle. 2000. "A Competing Risks Model of U.S. Supreme Court Vacancies, 1789-1992." *Political Behavior* 22(June):145-66.

**October 10-12: Survival Models: Extensions II**

- **Readings**
  - *Required*:
    - Banerjee, Sudipto, Melanie M. Wall, and Bradley P. Carlin. 2003. "Frailty Modeling for Spatially Correlated Survival Data, with Application to Infant Mortality in Minnesota." *Biostatistics* 4(1):123-42.
    - Box-Steffensmeier, Janet M., Roman Ivanchenko, and Christopher Zorn. 2006. "Cure Models for Political Science Research." Working paper: Ohio State University.
    - Box-Steffensmeier, Janet M., and Bradford S. Jones. 2004. *Event History Modeling: A Guide for Social Scientists*, Chapters 9 & 11.
    - Omori, Yasuhiro and Richard A. Johnson. 1993. "The Influence of Random Effects on the Unconditional Hazard Rate and Survival Functions." *Biometrika* 80(4):910-14.
  - *Recommended*:
    - Box-Steffensmeier, Janet M., Peter Radcliffe, and Brandon Bartels. 2005. "The Incidence and Timing of PAC Contributions to Incumbent U.S. House Members, 1993-94." *Legislative Studies Quarterly* 30(November):549-79.
    - Bennett, D. Scott. 1997. "Testing Alternative Models of Alliance Duration, 1816-1984." *American Journal of Political Science* 41(July):846-78.
    - Box-Steffensmeier, Janet M., and Suzanna De Boef. 2005. "Repeated Events Survival Models: The Conditional Frailty Model." *Statistics in Medicine* 25(December):3518-33. DOI: 10.1002/sim.2434.
    - Box-Steffensmeier, Janet M., Suzanna L. De Boef and Kyle A. Joyce. 2007. "Event Dependence and Heterogeneity in Duration Models: The Conditional Frailty Model." *Political Analysis* 15(3):237-256.
    - Carpenter, Daniel. 2002. "Groups, the Media, Agency Waiting Costs and FDA Drug Approval." *American Journal of Political Science* 46(July):490-505.
    - Chiozza, Giacomo, and Hein E. Goemans. 2004. "International Conflict and the Tenure of Leaders: Is War Still Ex Post Inefficient?" *American Journal of Political Science* 48(July):604-18.
    - Hettinger, Virginia, and Christopher Zorn. 2005. "Explaining the Incidence and Timing of Congressional Responses to the U.S. Supreme Court." *Legislative Studies Quarterly* 30(February):5-28.
    - Maller, R. A. and S. Zhou. 1996. *Survival Analysis with Long-Term Survivors*. New York: Wiley.
    - Manton, Kenneth G., Eric Stallard and James W. Vaupel. 1981. "Methods for Comparing the Mortality Experience of Heterogeneous Populations." *Demography* 18(August):389-410.
    - Sastry, Naryan. 1997. "A Nested Frailty Model for Survival Data, With an Application to the Study of Child Survival in Northeast Brazil." *Journal of the American Statistical Association* 92(438):426-35.
    - Schmidt, Peter and Anne D. Witte. 1989. "Predicting Recidivism Using 'Split-Population' Survival Time Models." *Journal of Econometrics* 40(1):141-59.

- Tsodikov, A. 1998. "A Proportional Hazards Model Taking Account of Long Term Survivors." *Biometrics* 54:1508 15.
- Vaupel, James W., Kenneth G. Manton, and Eric Stallard. 1979. "The Impact of Heterogeneity in Individual Frailty on the Dynamics of Mortality." *Demography* 16:439-54.

- **Exercise Five: Fit extensions of conventional survival models.**

**October 17-19: Panel/TSCS: Overview and Unit Effects**

- **Readings**
  - *Required*:
    - Hsaio, Cheng. 2003. *Analysis of Panel Data*. Chapters 1 and 3.
    - Stimson, James. 1985. "Regression in Space and Time: A Statistical Essay." *American Journal of Political Science* 29:914-47.
    - Zorn, Christopher. 2001. "Estimating Between- and Within-Cluster Covariate Effects, with an Application to Models of International Disputes." *International Interactions* 27(4):433-45.
  - *Recommended*:
    - Bartels, Larry M. 1996. "Pooling Disparate Observations." *American Journal of Political Science* 40(August):905-42.
    - Finkel, Steven E., and Edward N. Muller. 1998. "Rational Choice and the Dynamics of Political Action: Evaluating Alternative Models with Panel Data." *American Political Science Review* 92(March):37-50.
    - Neuhaus, J. M., and J. D. Kalbfleisch. 1998. "Between- and Within-Cluster Covariate Effects in the Analysis of Clustered Data." *Biometrics* 54:638-45.
    - Nuamah, Nicholas N. N. N. 1986. "Pooling Cross Section and Time Series Data." *The Statistician* 35:345-51.
    - Plumper, Thomas, and Vera E. Troeger. 2007. "Efficient Estimation of Time-Invariant and Rarely Changing Variables in Finite Sample Panel Analyses with Unit Fixed Effects." *Political Analysis* 15(2):124-139.
    - "Symposium on Fixed-Effects Vector Decomposition." 2011. *Political Analysis* 19(2).

- **Exercise Six: Fit and discuss one-way unit effects models.**

**October 24-26: Panel/TSCS: GLS-ARMA and Dynamic Models**

- **Readings**
  - *Required*:
    - 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(September): 634-647.
    - Beck, Nathaniel, and Jonathan N. Katz. 1996. "Nuisance vs. Substance: Specifying and Estimating Time-Series Cross-Section Models." *Political Analysis* 6:1-36.
    - Beck, Nathaniel, and Jonathan Katz. 2011. "Modeling Dynamics in Time-Series-Cross-Section Political Economy Data." *Annual Review of Political Science* 14:331-52.
    - Keele, Luke, and Nathan J. Kelly. 2006. "Dynamic Models for Dynamic Theories: The Ins and Outs of Lagged Dependent Variables." *Political Analysis* 14(2):186-205.
    - Wawro, Gregory. 2002. "Estimating Dynamic Panel Data Models in Political Science." *Political Analysis* 10(Winter):25-48.

- Wilson, Sven E., and Daniel M. Butler. 2007. "A Lot More to Do: The Sensitivity of Time-Series Cross-Section Analyses to Simple Alternative Specifications." *Political Analysis* 15(2):101-123.

- *Recommended*:
  - Achen, Christopher. 2000. "Why Lagged Dependent Variables Can Suppress the Explanatory Power of Other Independent Variables." Presented at the Annual Meeting of the Society for Political Methodology, UCLA. Available here.
  - Anderson, T.W., and C. Hsiao. 1982. "Formulation and Estimation of Dynamic Models Using Panel Data." *Journal of Econometrics* 18:47-82.
  - Beck, Nathaniel. 1991. "Comparing Dynamic Specifications: The Case of Presidential Approval." *Political Analysis* 3:51-87.
  - Beck, Nathaniel. 2001. "Time-Series Cross-Section Data: What Have We Learned in the Past Few Years?" *Annual Review of Political Science* 4:271-293.
  - Blais, Andre, Donald Blake, and Stephane Dion. 1996. "Do Parties Make a Difference: A Reappraisal." *American Journal of Political Science* 40:514-520.
  - Burkhart, Ross E., and Michael S. Lewis-Beck. 1994. "Comparative Democracy: The Economic Development Thesis." *American Political Science Review* 88:903-910.
  - Smith, Mark A. 2001. "The Contingent Effects of Ballot Initiatives and Candidate Races on Turnout." *American Journal of Political Science* 45(3): 700-706.
  - Wawro, Gregory, and Ida Pagter Kristensen. 2006. "Lagging the Dog?: The Robustness of Panel Corrected Standard Errors in the Presence of Serial Correlation and Observation Specific Effects." Working paper: Columbia University. Contact Dr. Wawro (`gjw10@columbia.edu`) if you're interested in this paper.

- **Exercise Seven: Fit models for dynamic panel data.**

**October 31 - November 2: Panel Data Models for Binary, Count, and Other Odd Responses**

- **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.
    - Cameron, A. Colin, and Pravin K. Trivedi. 1998. *Regression Analysis of Count Data*. New York: Cambridge University Press. Chapter 9.
    - Hsaio, Cheng. 2003. *Analysis of Panel Data*. Chapter 7, §7.1-7.3 and Chapter 8.
  - *Recommended*:
    - Green, Donald P., Soo Yeon Kim, and David Yoon. 2001. "Dirty Pool." *International Organization* 55:441-68 (and commentary by Beck & Katz, Oneal & Russett, and King).
    - Katz, Ethan. 2001. "Bias in Conditional and Unconditional Fixed Effects Logit Estimation." *Political Analysis* 9(Autumn):379-84 (and also see Coup'e, Tom (2005) "Bias in Conditional and Unconditional Fixed Effects Logit Estimation: A Correction." *Political Analysis* 13(Summer):292-95).
    - Li, Quan, and Drew Schaub. 2004. "Economic Globalization and Transnational Terrorism: A Pooled Time-Series Analysis." *Journal of Conflict Resolution* 48:230-258.
    - Martin, Andrew D. 2003. "Bayesian Inference for Heterogeneous Event Counts." *Sociological Methods and Research* 32:30-63.

- Wawro, Gregory. 2001. "A Panel Probit Analysis of Campaign Contributions and Roll Call Votes." *American Journal of Political Science* 45(July):563-579.
- Whitford, Andrew B., Jeff Yates, and Holona L. Ochs. 2006. " Ideological Extremism and Public Participation." *Social Science Quarterly* 87(1):36-54.
- Wooldridge, Jeffrey. 1999. "Distribution-Free Estimation of Some Nonlinear Panel Data Models." *Journal of Econometrics* 90(May):77-97.

**November 7-9: Generalized Estimating Equations**

- **Readings**
  - *Required*:
    - Zorn, Christopher. 2001. "Generalized Estimating Equation Models for Correlated Data: A Review with Applications." *American Journal of Political Science* 45(April):470-90.
    - Neuhaus, J. M., J. D. Kalbfleisch, and W. W. Hauck. 1991. "A Comparison of Cluster-Specific and Population-Averaged Approaches for Analyzing Correlated Binary Data." *International Statistical Review* 59(1):25-35.
  - *Recommended*:
    - Baker, Andy, and Kenneth F. Greene. 2011. "The Latin American Left's Mandate: Free-Market Policies and Issue Voting in New Democracies." *World Politics* 63(1):43-77.
    - Ballinger, Gary A. 2004. "Using Generalized Estimating Equations for Longitudinal Data Analysis." *Organizational Research Methods* 7:12750.
    - Caldeira, Gregory A., John R. Wright, and Christopher Zorn. 1999. "Strategic Voting and Gatekeeping in the Supreme Court." *Journal of Law, Economics and Organization* 15(3):549-72.
- **Exercise Eight: Fit and interpret various models for binary panel data.**

**November 14-16: Models for Sample Selection**

- **Readings**
  - *Required*:
    - Berk, R. A. 1983. "An Introduction to Sample Selection Bias in Sociological Data." *American Sociological Review* 48(June):386-398.
    - Heckman, James J. 1979. "Sample Selection Bias as a Specification Error." *Econometrica* 47(January):153-161.
  - *Recommended*:
    - Berinsky, Adam J. 1999. "The Two Faces of Public Opinion." *American Journal of Political Science* Vol. 43(October):1209-1230.
    - Reed, William. 2000. "A Unified Statistical Model of Conflict Onset and Escalation." *American Journal of Political Science* 44(January):84-93.
    - Sartori, Anne E. 2003. "An Estimator for Some Binary-Outcome Selection Models Without Exclusion Restrictions." *Political Analysis* 11(2):111-138.
    - Sigelman, Lee, and Langche Zeng. 1999. "Analyzing Censored and Sample-Selected Data with Tobit and Heckit Models." *Political Analysis* 8(2):167-82.
    - Vella, Francis. 1998. "Estimating Models with Sample Selection Bias: A Survey." *The Journal of Human Resources* 33:127-169.
- **Exercise Nine: Models for Sample Selection.**

**November 21-23: No Class: Thanksgiving Break**

**November 28-30: Item Response Models**

- **Readings**
  - *Required*:
    - Hambleton et al. (1991), pp. 7-46, 53-88, 109-122.
  - *Recommended*:
    - Lord, Frederic M. 1983. "Unbiased Estimates of Ability Parameters, of Their Variance, and of Their Parallel Forms Reliability." *Psychometrika* 48:477-82.
    - 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.
    - 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.
    - Rizopoulos, Dimitris. 2006. "`ltm`: An R Package for Latent Variable Modeling and Item Response Theory Analyses." *Journal of Statistical Software* 17(5).
- **Exercise Ten: Item Response Models.**

**December 5: Wrap-up, Catch-up, And Review**

**December 7: Paper / Poster Presentations**