

**Advanced Topics in Maximum Likelihood Estimation:
Duration Analysis/Event History Analysis
Professor Brad Jones
University of Arizona
Weeks 2—3: August 1—12.**

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Course Description

This section of the advanced MLE course will cover methods and models for duration data. Duration data record the length of time until some event occurs, for example, the termination of a cabinet government or the time until an unemployment spell ends. Because time-to-event occurrence is an important feature of these kinds of data, methods suitable to duration data are often referred to as event history analysis. In this course, we will consider a wide variety of event history modeling methods. Students will be asked to complete some problem sets that will involve estimating and interpreting event history models. “Tutorials” will be available to students that describe some implementation issues pertinent to these models. Additionally, some lecture notes will be available as well. Any material necessary for downloading will be available at my website: <http://www.u.arizona.edu/~bsjones>. From here, you will be able to follow a link to this course to access tutorials, lecture notes, and article manuscripts.

Readings

The primary text will be Box-Steffensmeier and Jones’ *Event History Modeling: A Guide for Social Scientists* (Cambridge University Press, 2004). In the daily itinerary of topics, several articles will also be listed. Many of these articles include applications. As I am a Political Scientist, many of the applications will be from Political Science, although I have identified several works from Sociology, Economics, and Demography. Regardless of the field, however, the core issues relevant to application and interpretation will be/should be transparent in these articles.

Requirements

Students are expected to do the assigned readings and pay attention in class. There will be two or three short problem sets. The problem sets will entail estimation and interpretation of a variety of duration models. Finally, students will be asked to turn in a short (1-2 page) research prospectus that outlines a research question(s) and hypotheses that could be appropriately tested using duration modeling techniques. I will discuss this in more detail on day one.

Itinerary

My principal goal is to give you an introduction to the fundamental elements of duration modeling and then consider in some detail parametric, non-parametric (via the Cox model), and “discretized” duration models for single-event and multi-event duration data. I do not assume any prior knowledge of event history modeling, though I obviously will assume knowledge of the basic principals of maximum likelihood estimation as well as a thorough understanding of the classical linear model and traditional binary link models (like logit or probit).

The following gives you the day-by-day itinerary of topics. There are two “classes” of readings each day: core and application. It is important that the core readings be completed in their entirety. Several applications are listed for each day's topics. You will not have time to read each application; I recommend choosing a couple that may be of interest to you. Just about all of the application readings (as well as the core articles) are available from J-Stor (<http://www.jstor.org>). Applications are highly useful to read and I encourage you to read as many of these as you can. On my website, I have a working bibliography that includes references to the fundamental statistics papers and texts that you would absolutely need to become familiar with if you continued studying these kinds of models. The readings below are primarily drawn from the social sciences.

DAY 1: Monday, August 1

Preliminaries: Event History Data and the “Moving Parts” of Event History Analysis and an Introduction to Modeling Strategies

Core Readings:

- Box-Steffensmeier and Jones, Chapters 1—2.
- 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: 21--44.

Applications:

- Berger, Mark C. and Dan A. Black. 1998. “The Duration of Medicaid Spells: An Analysis Using Flow and Stock Samples.” *The Review of Economics and Statistics*. 80(4): 667--675.
- Diermeier, Daniel and Randolph T. Stevenson. 2000. “Cabinet Terminations and Critical Events.” *The American Political Science Review*. 94(3): 627--640.
- Johnson, Richard W. and Julie DaVanzo. 1998. “Economic and Cultural Influences on the Decision to Leave Home in Peninsular Malaysia.” *Demography*. 35(1): 97--114.
- Zelditch, Mooris Jr., and Joan Butler Ford. 1994. “Uncertainty, Potential Power, and Nondecisions.” *Social Psychology Quarterly*. 57(1): 64--73.

DAY 2: Tuesday, August 2

Describing and Modeling Duration Data: The Kaplan-Meier Estimator (and related estimators) and Parametric Models

Core Readings:

- Box-Steffensmeier and Jones, Chapter 3.
- Teachman, Jay D. and Mark D. Hayward. 1993. "Interpreting Hazard Rate Models." *Sociological Methods and Research*. 21: 340--371.

Applications:

- Barron, David. N. 1999. "The Structuring of Organizational Populations." *American Sociological Review*. 64(3): 421--445.
- Bennett, D. Scott and Allan C. Stamm III. 1996. "The Duration of Interstate Wars." *American Political Science Review*. 90: 239--257.
- Carpenter, Daniel P. 2002. "Groups, the Media, Agency Waiting Costs, and FDA Drug Approval." *American Journal of Political Science*. 46(3): 490-505.
- Kadera, Kelly M., Mark J.C. Crescenzi, and Megan L. Shannon. 2003. "Democratic Survival, Peace, and War in the International System." *American Journal of Political Science*. 47: 234—247.
 - King, Gary, James E. Alt, Nancy E. Burns, and Michael Laver. 1990. "A Unified Model of Cabinet Dissolution in Parliamentary Democracies." *American Journal of Political Science*. 34: 846--871.
- Siegfried, John J. and Wendy A. Stock. 2001. "So You Want to Earn a Ph.D. in Economics?: How Long Do You Think It Will Take?" *The Journal of Human Resources*. 36(2): 364--378.
- Strang, David. 1991. "Global Patterns of Decolonization, 1500--1987." *International Studies Quarterly*. 35(4): 429-454.
- Werner, Suzanne. 1999. "The Precarious Nature of Peace: Resolving the Issues, Enforcing the Settlement, and Renegotiating the Terms." *American Journal of Political Science*. 43: 912--934.

DAY 3: Wednesday, August 3

Estimation and Model Selection Issues in the Application of Parametric Duration Models

Core Readings:

- Box-Steffensmeier and Jones, Chapter 3.

Applications

- Bennett, D. Scott. 1997. "Testing Alternative Models of Alliance Duration, 1816-1984." *American Journal of Political Science* 41: 846-78.
- Bergstrom, R. and P.-A. Edin. 1992. "Time Aggregation and the Distributional Shape of Unemployment Duration." *Journal of Applied Econometrics* 7: 5-30.
- Ruhil, Anirudh V.S. 2003. "Urban Armageddon or Politics as Usual? The Case of Municipal Service Reform." *American Journal of Political Science*. 47: 159—170.

DAY 4: Thursday, August 4

The Cox Proportional Hazards Model

Core Readings:

- Box-Steffensmeier and Jones, Chapter 4.

Applications (Cox Model):

- Bennett, Paul, Richard Peach, Stavros Peristiani. 2001. "Structural Change in the Mortgage Market and the Propensity to Refinance." *Journal of Money, Credit and Banking*. 33(4): 955--975.
- Binder, Sarah A. and Forrest Maltzman. 2002. "Senatorial Delay in Confirming Federal Judges, 1947--1998." *American Journal of Political Science*. 46(1): 190--199.
- Box-Steffensmeier, Janet M. 1996. "A Dynamic Analysis of the Role of War Chests in Campaign Strategy." *American Journal of Political Science*. 91: 324--338.
- Katz, Jonathan N. and Brian R. Sala. 1996. "Careerism, Committee Assignments, and the Electoral Connection." *American Political Science Review* 90:21-33.
- Pevehouse, Jon. 2002. "With a Little Help from My Friends? Regional Organizations and the Consolidation of Democracy." *American Journal of Political Science*. 46: 611--626.
- Shipan, Charles R. and Megan L. Shannon. 2003. "Delaying Justice(s): A Duration Analysis of Supreme Court Confirmations." *American Journal of Political Science*. 47: 654--688.
- Teachman, Jay D. 2002. "Stability Across Cohorts in Divorce Risk Factors." *Demography*. 39: 331--351.

DAY 5: Friday, August 5

The Proportional Hazards Property and other Cox Model Diagnostics

Core Readings:

- Box-Steffensmeier and Jones, Chapter 8.
- Box-Steffensmeier, Janet M. and Christopher J.W. Zorn. 2001. "Duration Models and Proportional Hazards in Political Science." *American Journal of Political Science*. 45: 951--967.
- Grambsch, Patricia M. and Terry M. Therneau. 1994. "Proportional Hazards Tests and Diagnostics Based on Weighted Residuals." *Biometrika*. 81: 515--526.

Applications:

- Bhattacharya, Jayanta, William B. Vogt, Aki Yoshikawa and Toshitaka Nakahara. 1996. "The Utilization of Outpatient Medical Services in Japan." *The Journal of Human Resources*. 31: 450--476.
- Box-Steffensmeier, Janet M., Dan Reiter, and Christopher J.W. Zorn. 2003. "Nonproportional Hazards and Event History Analysis in International Relations." *Journal of Conflict Resolution*.

- Colaresi, Michael. 2001. "Shocks to the System: Great Power Rivalry and the Leadership Long Cycle." *The Journal of Conflict Resolution*. 45: 569—593.

DAY 6: Monday, August 8

"Discretized" Duration Data and Associated Models

Core Readings:

- Box-Steffensmeier and Jones, Chapter 5.
- 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: 1260--1288.

Applications:

- Berry, Frances Stokes and William D. Berry. 1990. "State Lottery Adoption as Policy Innovations: An Event History Analysis." *American Political Science Review*. 84: 395--415.
- Fernandez, Roberto M., Emilio J. Castilla, and Paul Moore. 2000. "Social Capital at Work: Networks and Employment at a Phone Center." *American Journal of Sociology*. 105(5): 1288--1356.
- Graefe, Deborah Roempke and Daniel T. Lichter. 2002. "Marriage Among Whites, Blacks, and Latinos Compared." *Perspectives on Sexual and Reproductive Health*. 34: 286—293.
- Mooney, Christopher Z., and Mei-Hsien Lee. 1995. "Legislative Morality in the American States: The Case of Pre-Roe Abortion Reform." *American Journal of Political Science* 39: 599-627.
- Reagan, Patricia B. and Randall J. Olsen. 2000. "You Can Go Home Again: Evidence from Longitudinal Data." *Demography*. 37(3): 339--350.
- Sorenson, Jesper B. 2000. "The Longitudinal Effects of Group Tenure Composition on Turnover." *American Sociological Review*. 65(2): 298--310.
- Volden, Craig. 2002. "The Politics of Competitive Federalism: A Race to the Bottom in Welfare Benefits." *American Journal of Political Science*. 46: 352—363.

DAY 7: Tuesday, August 9

Model Selection Issues and Time-Varying Covariates

Core Readings:

- Box-Steffensmeier and Jones, Chapters 6—7.
- Buckley, Jack and Chad Westerland. 2004. "Duration Dependence, Functional Form, and Correct Standard Errors: Improving EHA Models of State Policy Diffusion." *State Politics and Policy Quarterly*.
- Zorn, Christopher J.W. 2000. "Modeling Duration Dependence." *Political Analysis*. 8: 367--380.

Applications:

- Bennett, D. Scott. 1999. "Parametric Models, Duration Dependence and Time-Varying Data Revisited." *American Journal of Political Science*. 43(1): 256--270.

- Golub, Jonathan. 1999. “In the Shadow of the Vote? Decision-Making in the European Community.” *International Organization*. 53: 733—764.
- Hartzell, Caroline and Matthew Hoddie. 2003. “Institutionalizing Peace: Power Sharing and Post-Civil War Conflict Management.” *American Journal of Political Science*. 47: 318—332.
- Teachman, Jay D. 2002. “Stability Across Cohorts in Divorce Risk Factors.” *Demography*. 39: 331—351.

DAY 8: Wednesday, August 10
Complicated Events Structures: Part 1

Core Readings:

- Box-Steffensmeier and Jones, Chapters 9—10.
- 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--454.

Applications:

- Murphy, Mike and Duolao Wang. 1998. “Family and Sociodemographic Influences on Patterns of Leaving Home in Postwar Britain.” *Demography*. 35: 293—305.
- Sastry, Narayan. 1997. “A Nest Frailty Model for Survival Data, with an Application to the Study of Child Survival in Northeast Brazil.” *Journal of the American Statistical Association*. 92: 426—435.
- Swaim, Paul and Michael Podgursky. 1994. “Female Labor Supply Following Displacement: A Split-Population Model of Labor Force Participation and Job Search.” *Journal of Labor Economics*. 12: 640—656.

DAY 9: Thursday, August 11
Complicated Events Structures: Part 2

Core Readings:

- Box-Steffensmeier and Jones, Chapters 9—10.
- Box-Steffensmeier, Janet M. and Christopher J.W. Zorn. 2002. “Duration Models for Repeated Events.” *Journal of Politics*. 46: 1069--1094.
- Cleves, Mario. 1999. “How Do I Analyze Multiple Failure-Time Data?” (From Stata FAQ; available on website).
- Jones, Bradford S. and Regina P. Branton. 2005. “Beyond Logit and Probit: Cox Duration Models of Single, Repeating, and Competing Events for State Policy Analysis.” *State Politics and Policy Quarterly*.

Applications:

- Diermeier, Daniel and Randy T. Stevenson. 1999. “Cabinet Survival and Competing Risks.” *American Journal of Political Science*. 43(4): 1051--1068.
- DeGraaf, Paul M. and Matthijs Kalmijn. 2003. “Alternative Routes in the Remarriage Market: Competing-Risk Analysis of Union Formation after Divorce.” *Social Forces*. 81(4): 1459—1498.

- Luoh, Ming-Ching and A. Regula Herzog. 2002. "Individual Consequences of Volunteer and Paid Work in Old Age: Health and Mortality." *Journal of Health and Social Behavior*. 43: 490—509.
- Myers, Daniel J. 1997. "Racial Rioting in the 1960s: An Event History Analysis of Local Conditions." *American Sociological Review*. 62: 94--112.
- Zorn, Christopher and Steven R. VanWinkle. 2000. "A Competing Risks Model of U.S. Supreme Court Vacancies, 1789--1992." *Political Behavior*. 22: 145--166.

DAY 10: Friday, August 12

Synthesis and Wrap-Up

- Box-Steffensmeier and Jones, Chapters 11.