

**Event History Analysis (SOC 952)
Fall 2010**

1140 Grainger Hall
WED 8:30-10:45 am

LAB SESSIONS, provisional
8108 Social Science
(Havens Center room)

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or by appointment

COURSE OBJECTIVES

Event history analysis is a special class of statistical techniques devoted to the analysis of duration, survival or time-to-event data. Wherever it is of interest to describe social processes, event history techniques are finding their application, whether in the study of divorce, fertility behavior, job stability, unemployment duration, poverty traps, law adoption or even government failure. Given its practical importance and appeal, the course provides an introduction to event history analysis with social science data. We are going to discuss non-parametric methods for exploratory and descriptive analyses, the Cox regression model, parametric regression models as well as event history regression analysis in discrete time. For each method, the course covers essentials of model formulation, data organization, estimation techniques, model specification, interpretation, hypothesis testing and model diagnostics. Among the more advanced topics, we will treat issues like time-dependent covariates and time-dependent effects, unobserved heterogeneity, competing risk models, models for interdependent processes and treatment of left-truncated cases. Coverage of specific advanced topics will respond to student projects and interest.

Throughout the class, I will emphasize the practical application of event history methods with real-world social science data, drawing on examples from demographic, sociological, economic and political science research. For our own statistical work, I will rely on the STATA package which offers excellent facilities for event history analysis. If you already work on a project using event history data, you will be able to use your data in this class.

COURSE PREREQUISITES

I presume a solid statistical background, notably solid working knowledge of multiple (OLS) regression and, ideally, the logit (logistic regression) model as acquired in Sociology 362 or similar courses. Also, you should be comfortable with the use of one of the major statistical software packages, preferably STATA versions 8 and up. You will be able to replicate most of what this course covers in alternative packages like SPSS, SAS, S-Plus/R, AML, TDA, LIMDEP, GAUSS or SYSTAT, though I might be able to provide less than helpful assistance in these cases, depending on the specific package.

COURSE REQUIREMENTS AND GRADING

Successful completion of the course requires you to attend course sessions and work through the materials before and/or after sessions. In addition, you will have to respond to small weekly problem sets, hand in 4 graded assignments during the course and submit a term paper by exam week. The weekly problem sets will not be graded, but will consist of small questions and/or exercises that invite you to reflect on the material covered in the week's session. The graded assignments will require you to conduct your own small-scale data analysis with publicly available data from the Wisconsin Longitudinal Survey, including data preparation, description of data, estimation of parameters and interpretation of results. There will be 3 such assignments, each following one of the course lab sessions. In addition, a fourth assignment (due by December 8th) will require you to comment on the utility and specific methodology of event history modeling in published research on a specific topic of social science interest (if you are writing a term paper for this class, this essay can be on the same topic, i.e. the assignment essay may be a draft version of the literature/methodology review section(s) of your eventual term paper).

The term paper has to be an empirical research paper that applies event history techniques to a social science issue (broadly defined). The choice of substantive topic is yours. The term paper should be equivalent in style to a journal article, i.e. it should raise a problem, discuss earlier research and results, formulate precise hypotheses to be tested, describe the data and operationalization of concepts and, naturally, present estimates of appropriate statistical models as well as their substantive interpretation. A topic proposal for the paper should be submitted by the end of October. The completed paper should be submitted by exam week but no later than by the end of day, Wednesday, December 22nd. Please submit an electronic copy of the term paper to either the Learn@UW dropbox or mgangl@ssc.wisc.edu directly (pdf, rtf or Word formats acceptable).

Assignments will contribute 25 percent to the final grade and the paper 75 percent. For assignments and the term paper I expect you to do original and individual work. Of course, mutual discussion and consultation among course members is strongly encouraged. However, plagiarism will lead to course failure.

READING LIST

There are many excellent textbooks on event history analysis available. For the course, I am mostly drawing on the following list of books and I strongly suggest that you work through the relevant chapters in at least one of them (the detailed reading list below offers additional readings on specific, typically more advanced topics). In addition, I also list a couple of shorter overview articles that may help you to orient yourself at any point in the seminar.

Textbooks (indicate especially recommended ones available at University Bookstore)*

Allison, Paul D. (1984). *Event History Analysis: Regression for Longitudinal Event Data* (QASS 46). Thousand Oaks: Sage. (AL84)

Allison, Paul D. (1995). *Survival Analysis Using the SAS System: a Practical Guide*. Cary, NC: SAS Institute. (AL95, also serves as an introduction to event history analysis in SAS)

Blossfeld, Hans-Peter, Alfred Hamerle, and Karl-Ulrich Mayer (1989). *Event History Analysis*. Hilldale, NJ: Erlbaum. (BHM)

- Blossfeld, Hans-Peter und Götz Rohwer (2002). *Techniques of Event History Modeling: New Approaches to Causal Analysis*. 2nd edition. Mahwah, NJ: Erlbaum. (BR, also serves as an introduction to the TDA software)
- Box-Steffensmeier, J.M. and Jones, B.S. (2004). *Event History Modeling: A Guide for Social Scientists*. Cambridge: Cambridge University Press.
- Collett, David (2003). *Modelling Survival Data in Medical Research*. 2nd edition. Boca Raton: Chapman & Hall/CRC Press.
- Corgeau, D. and E. Lelievre (1992). *Event History Analysis in Demography*. Oxford: Clarendon Press. (CL)
- *Hosmer, David W., and Stanley Lemeshow (2008). *Applied Survival Analysis: Regression Modeling of Time to Event Data*. 2nd edition. New York: Wiley. (HL)
- Klein, John P. and Melvin L. Moeschberger (2003). *Survival Analysis. Techniques for Censored and Truncated Data*. 2nd edition. New York: Springer. (KM)
- *Singer, Judith D. and John B. Willett (2003). *Applied Longitudinal Data Analysis: Modeling Change and Event Occurrence*. Oxford: Oxford University Press. (Chapters 9-15) (SW)
- Tuma, Nancy B., and Michael Hannan (1984). *Social Dynamics: Models and Methods*. Orlando, FL: Academic Press. (TH)
- Yamaguchi, Kazuo (1991). *Event History Analysis*. Newbury Park: Sage. (YA)

Interpretation of hazard rate models

- Guilkey, D.K., and R.R. Rindfuss (1987). Logistic Regression of Multivariate Life Tables: a Communicable Approach. *Sociological Methods and Research* 16: 276-300.
- Teachman, Jay D., and Mark D. Hayward (1993). Interpreting Hazard Rate Models. *Sociological Methods & Research* 21: 340-371.
- Wolf, Douglas A. (1986). Simulation Methods for Analyzing Continuous-Time Event-History models. *Sociological Methodology* 16: 283-308.

Textbooks / reference manuals for use with STATA

- *Blossfeld, Hans-Peter, Katrin Golsch and Götz Rohwer (2006). *Event History Analysis with Stata*. College Station, TX: Stata Press. (BGR)
- *Cleves, Mario A., William W. Gould, Roberto G. Gutierrez, and Yulia Marchenko (2008). *An Introduction to Survival Analysis Using Stata*. 2nd edition. College Station, TX: Stata Press. (CGGM)
- StataCorp (2005). *Survival analysis and epidemiological tables. Reference manual. Release 9*. College Station, TX: Stata Press. (StataSurv)

Overview papers

- Allison, Paul D. (2004). Event history analysis. In Melissa A. Hardy and Alan Bryman (eds.), *Handbook of Data Analysis*. Thousand Oaks, CA: Sage.
- Kiefer, Nicholas M. (1988). Economic Duration Data and Hazard Functions. *Journal of Economic Literature* 26: 646-679.

- Petersen, Trond (1995). Analysis of Event History Data. Pp. 453-517 in Gerhard Arminger, Clifford C. Clogg and Michael E. Sobel (eds.), *Handbook of Statistical Modeling for the Social and Behavioral Sciences*. New York: Plenum.
- Teachman, Jay (1983). Analyzing Social Processes: Life Tables and Proportional Hazards Models. *Social Science Research* 12: 263-301.
- Wu, Lawrence L. (2003). Event History Models for Life Course Analysis. Pp. 477-502 in Jeylan T. Mortimer and Michael J. Shanahan (eds.), *Handbook of the Life Course*. New York: Kluwer Academic/Plenum.

Advanced statistical/mathematical treatments (optional reading)

- Andersen, P.K., O. Borgan, R. Gill and N. Keiding. 1993. *Statistical Models Based on Counting Processes*. New York: Springer.
- Cox, David R. and D. Oakes (1984). *Analysis of Survival Data*. London: Chapman and Hall.
- Diggle, Peter, Patrick Heagerty, Kung-Yee Liang and Scott Zeger (2002). *Analysis of Longitudinal Data*. 2nd edition. Oxford: Oxford University Press.
- Howard, Ronald A. (1971). *Dynamic Probabilistic Systems*. Volume I+II. New York: Wiley.
- Kalbfleish, John D. and Ross L. Prentice (2002). *The Statistical Analysis of Failure Time Data*. 2nd edition. Hoboken, NJ: Wiley.
- Lancaster, Tony (1990). *The Econometric Analysis of Transition Data*. Cambridge: Cambridge University Press.
- Therneau, Terry M. and Patricia M. Grambsch (2000). *Modeling Survival Data: Extending the Cox Model*. New York: Springer.
- Vermunt, Jeroen (1997). *Log-linear Models for Event Histories*. Thousand Oaks, CA: Sage.

As far as possible, all course readings from the core (starred) textbooks will be put on electronic reserve through the course website on Learn@UW.

COURSE MATERIALS

This course is accompanied by a course web site on the Learn@UW platform at

<https://learnuw.wisc.edu/>

That website is intended as a major resource to the course and provides you with copies of all course materials – lecture notes, assignments, datasets and STATA programs. Also, you will be able to submit assignments and your term paper via the dropbox on our Learn@UW website. In addition, we also have the classlist

soc952-2-f10@lists.wisc.edu

for e-mail communication among class.

Course Schedule

Introduction

- 09/08 Introduction and course organization
- 09/15 Basic concepts of event history modeling:
observation plans, data structure, mathematical fundamentals

Nonparametric (descriptive) methods

- 09/22 Life table estimation 1: the actuarial method
- 09/29 Life table estimation 2: Kaplan-Meier estimator
- 10/06 Lab session 1: Data management and descriptive analyses (I)
- 10/13 --- ATTENTION: WILL BE RESCHEDULED ---
Lab session 2: Data management and descriptive analyses (II)

Regression models

- 10/20 Discrete-time event history modeling 1: basics
- 10/27 Discrete-time event history modeling 2:
Time-dependent effects and time-dependent covariates
- 11/03 Lab session 3: Regression modeling – discrete-time methods

PAPER PROPOSALS DUE

- 11/10 Cox regression 1: basics and interpretation
- 11/17 Cox regression 2: model diagnostics and extensions
- 11/24 Parametric regression models
- 12/01 Lab session 4: Regression modeling – Cox regression and parametric methods

METHODOLOGICAL ESSAY DUE

Advanced topics (TENTATIVE)

- 12/08 Multiple destination states (competing risks models)
- 12/15 Unobserved heterogeneity
Course evaluation and final discussion

EXAM WEEK

- 12/22 style="text-align: center;">TERM PAPER DUE

Course Reading

Introduction

- 09/08 Introduction and course organization
- What is event history analysis?
- 09/15 Basic concepts of event history modeling:
observation plans, data structure, mathematical fundamentals
- Markov processes:
states, transitions, events and waiting times
 - survival functions and the hazard rate
 - data collection through cross-sectional vs. longitudinal designs
 - censoring and truncation
- SW chapter 9; HL chapter 1; BR/BGH chapters 1+2; KM chapters 1-3; AL84 chapter 1;
AL95 chapters 1+2; YA chapter 1
Background reading on Markov processes: Howard 1971, chapters 1-2

Nonparametric (descriptive) methods

- 09/22 Life table estimation 1: the actuarial method
- discrete-time data
 - mathematics of the life table
 - actuarial (life table) estimator of survival and hazard functions
 - statistical inference
- SW chapter 10; BR/BGH chapter 3.1; KM chapter 4; AL95: 41-50
- 09/29 Life table estimation 2: Kaplan-Meier estimator
- continuous-time data
 - Kaplan-Meier and Nelson-Aalen estimators of survival and hazard functions
 - statistical inference
 - comparisons of survival and hazard functions across groups
- SW chapter 13; HL chapter 2; BR/BGH chapter 3.2+3.3; KM chapters 6+7; AL95 chapter 4
- 10/06 Lab session 1: Data management and descriptive analyses (I)
CGGM chapter 5-8; BGH chapter 3
StataSurv: `stset`, `stdes`, `stsum`, `sts list/graph/test`
- 10/13 Lab session 2: Data management and descriptive analyses (II)
CGGM chapter 5-8; BGH chapter 3
StataSurv: `stset`, `stdes`, `stsum`, `sts list/graph/test`

Regression models

- 10/20 Discrete-time event history modeling 1: basics
- episode splitting
 - logit, probit and complementary log-log models
 - the logit model in event history analysis: estimation, hypothesis testing, presentation and interpretation of results
 - modeling duration dependence in the hazard rate
- SW chapter 11; AL84 chapter 2; AL95 chapter 7; YA chapter 3
 Allison, Paul D. (1982). Discrete time methods for the analysis of event histories. *Sociological Methodology* 12: 61-98.
 Jenkins, Stephen J. (1995). Easy ways to estimate discrete time duration models. *Oxford Bulletin of Economics and Statistics* 57: 129-138.
 for background reading on categorical data analysis, esp. on the logit model:
 Long, J. Scott (1997). *Regression Models for Categorical and Limited Dependent Variables*. Thousand Oaks: Sage, chapters 3+4.
- 10/27 Discrete-time event history modeling 2:
 Time-dependent effects and time-dependent covariates
- time-dependent covariates
 - time-varying effects
 - causality and temporal order
 - residuals and model diagnostics
- SW chapter 12; YA chapter 4; BR/BGH chapter 6 (ignore the fact that chapter presumes knowledge of exponential models)
- 11/03 Lab session 3: Regression modeling – discrete-time methods
 AL95 chapter 7
 Long, J. Scott and Jeremy Freese (2006). *Regression Models for Categorical Dependent Variables Using Stata*. 2nd edition. College Station, TX: Stata Press. (chapters 3+4)
 StataRef: `logit`, `probit`, `cloglog`
- 11/10 Cox regression 1: basics and interpretation
- model assumptions: proportional hazards and arbitrary duration dependence in baseline hazard
 - partial likelihood (PL) estimation
 - hypothesis testing
 - presentation and interpretation of results
- SW chapter 14; HL chapters 3+4; BR/BGH chapter 9; AL84 chapter 4; AL95 chapter 5 (pp. 111-137); KM chapter 8; YA chapter 5

- 11/17 Cox regression 2: model diagnostics and extensions
- residuals and model diagnostics
 - time-dependent covariates
 - time-varying effects
 - stratified models
- SW chapter 15.1-15.4; HL chapters 6+7; BR/BGH chapter 9; AL95 chapter 5 (pp. 139-end); KM chapter 9; YA chapter 6
- 11/24 Parametric regression models
- Exponential and piecewise-exponential models: model formulation, estimation, presentation and interpretation of results
 - Alternative proportional hazards models: Weibull and Gompertz distributions
 - Non-proportional hazards models (accelerated failure time models): Log-normal, log-logistic and generalized Gamma models
 - Model diagnostics and statistical inference
- BR/BGH chapters 4-8; HL chapter 8.2-8.5; AL84 chapter 3; AL95 chapter 4; KM chapters 11-13
- 12/01 Lab session 4: Regression modeling – Cox regression and parametric methods
- CGGM chapters 9-11, 12-14; BGH chapters 4-9
StataSurv: `stcox`, `streg`, `stcurve`
- Advanced topics (TENTATIVE)**
- 12/08 Multiple destination states (competing risks models)
- mathematical background
 - model identification
 - estimation and interpretation of results: competing risks models in discrete and continuous time
- SW chapter 15.5; BR/BGH chapter 4.2; AL95 chapter 6
- Allison, Paul D. (1982). Discrete time methods for the analysis of event histories. *Sociological Methodology* 12: 61-98.
- Crowder, Martin J. (2001). *Classical Competing Risks*. Boca Raton: Chapman & Hall/CRC Press.
- Heckman, James J., and Bo E. Honoré (1989). The Identifiability of the Competing Risks Model. *Biometrika* 76: 325–30.
- Hill, Daniel R., William G. Axinn, and Arland Thornton (1993). Competing Hazards with Shared Unmeasured Risk Factors. *Sociological Methodology* 23: 245–77.
- Hougaard, Philip (2000). *Analysis of Multivariate Survival Data*. New York: Springer. (pp. 406-418)
- Kalbfleish, John D. and Ross L. Prentice (2002). *The Statistical Analysis of Failure Time Data*. 2nd edition. Hoboken, NJ: Wiley. (chapter 8)

Martinussen, Torben and Thomas H. Scheike (2006). *Dynamic Regression Models for Survival Data*. New York: Springer. (chapter 10)

Prentice, R. L., J.D. Kalbfleisch, A.V. Peterson, Jr., N. Flournoy, V.T. Farewell, and N.E. Breslow (1978). The Analysis of Failure Times in the Presence of Competing Risks. *Biometrics* 34: 541-554.

12/15

Unobserved heterogeneity

- definition and implications
- model identification
- parametric versus non-parametric approaches
- repeated events or clustered (multilevel) data

HL chapter 9.3; BR/BGH chapter 10; AL95 chapter 8 (pp. 233-246)

Allison, Paul D. (1996). Fixed-Effects Partial Likelihood for Repeated Events. *Sociological Methods & Research* 25: 207-222.

Barber, Jennifer S., Susan A. Murphy, William G. Axinn, and Jerry Maples (2001). Discrete-Time Multilevel Hazard Analysis. *Sociological Methodology* 31: 201-235.

Chamberlain, Gary (1985). Heterogeneity, Omitted Variable Bias, and Duration Dependence. Pp. 3-38 in James J. Heckman and Burton Singer (eds.), *Longitudinal Analysis of Labor Market Data*. Cambridge: Cambridge University Press.

Guo, Guang (1993). Use of Sibling Data to Estimate Family Mortality Effects in Guatemala. *Demography* 30: 15-32.

Heckman, James J. and Burton Singer (1982). The Identification Problem in Econometric Models for Duration Data. Pp. 39-77 in W. Hildebrand (ed.) *Advances in Econometrics*. Cambridge: Cambridge University Press.

Trussell, James and Toni Richards (1985). Correcting for Heterogeneity in Demographic Models using the Heckman-Singer Model. *Sociological Methodology* 15: 242-276.

Vaupel, James, and Andrew Yashin (1985). Heterogeneity's ruses: some surprising effects of selection on population dynamics. *American Statistician* 39: 176-185.

Social Science Applications of Event History Methods

(selected topics only,

choose one of the topics/reading lists for your methodological essay if you do not want to do that essay for a subject of your own choice or if there is too little published research on the topic of your term paper)

Poverty

- Bane, Mary Jo, and David T. Ellwood (1986). Slipping Into and Out of Poverty: The Dynamics of Spells. *Journal of Human Resources* 21: 1–21.
- Devine, Joel A., Mark Plunkett and James D. Wright (1992). The Chronicity of Poverty: Evidence from the PSID, 1968-1987. *Social Forces* 70: 787-812.
- Duncan, G.J., B. Gustafsson, R. Hauser et al. (1993). Poverty Dynamics in 8 Countries. *Journal of Population Economics* 6: 215-234.
- Finnie, Ross and Arthur Sweetman (2003). Poverty Dynamics: Empirical Evidence for Canada. *Canadian Journal of Economics* 36: 291-325.
- Fortin, B., G. Lacroix and S. Drolet (2004). Welfare Benefits and the Duration of Welfare Spells: Evidence from a Natural Experiment in Canada. *Journal of Public Economics* 88: 1495-1520.
- Layte, Richard and Christopher T. Whelan (2003). Moving in and out of Poverty - The Impact of Welfare Regimes on Poverty Dynamics in the EU. *European Societies* 5: 167-191.
- Meyer, D.R. (1993). Child-Support and Welfare Dynamics - Evidence From Wisconsin. *Demography* 30: 45-62.
- O'Neill, J.A., L.J. Bassi and D.A. Wolf (1987). The Duration of Welfare Spells. *Review of Economics and Statistics* 69: 241-248.
- Stevens, Ann H. (1999). Climbing out of Poverty, Falling Back in: Measuring the Persistence of Poverty Over Multiple Spells. *Journal of Human Resources* 34: 557-588.
- Valletta, R.G. (2006). The Ins and Outs of Poverty in Advanced Economies: Government Policy and Poverty Dynamics in Canada, Germany, Great Britain, and the United States. *Review of Income and Wealth* VOL: 261-284.

Divorce

- Brines, Julie and Kara Joyner (1999). Principles of Cohesion in Cohabitation and Marriage. *American Sociological Review* 64: 333-355.
- Diekmann, Andreas and Henriette Engelhardt (1999). Social Inheritance of Divorce in Postwar Germany. *American Sociological Review* 64: 783-793.
- Hannan, Michael T., Nancy B. Tuma and Lyle P. Groeneveld (1977). Income and Marital Events: Evidence from an Income-Maintenance Experiment. *American Sociological Review* 82: 1186-1211.
- Hannan, Michael T., Nancy Brandon Tuma, and Lyle P. Groeneveld (1978). Income and Independence Effects on Marital Dissolution: Results from the Seattle and Denver Income-Maintenance Experiments. *American Journal of Sociology* 84: 611-633.
- Heaton, Tim B., Stan L. Albrecht and Thomas K. Martin (1985). The Timing of Divorce. *Journal of Marriage and the Family* 47: 631-639.

- Hoem, Jan M. (1997). Educational Gradients in Divorce Risks in Sweden in Recent Decades. *Population Studies* 51: 19-27.
- Menken, Jane, James Trussell, Debra Stempel, and Ozer Babakol (1981). Proportional Hazards Life Table Models: An Illustrative Analysis of Socio-Demographic Influences on Marriage Dissolution in the United States. *Demography* 18: 181–200.
- Preston, Samuel H. and John McDonald (1979). The Incidence of Divorce within Cohorts of American Marriages Contracted since the Civil War. *Demography* 16: 1-25.
- South, Scott J. 2001. Time-Dependent Effects of Wives' Employment on Marital Dissolution. *American Sociological Review* 66: 226-245.
- South, Scott J. and Glenna Spitze (1986). Determinants of Divorce over the Marital Life Course. *American Sociological Review* 51: 583-590.
- Teachman, Jay D. (2002). Stability across Cohorts in Divorce Risk Factors. *Demography* 39: 331-351.
- Whittington, Leslie A. and James Alm (1997). 'Til Death or Taxes Do Us Part: The Effect of Income Taxation on Divorce. *Journal of Human Resources* 32: 388-412.

Job mobility

- Booth, Alison L., Marco Francesciani and Carlos Garcia-Serrano (1999). Job Tenure and Job Mobility in Britain. *Industrial and Labor Relations Review* 53: 43-70.
- Buchmueller, Thomas C. and Robert G. Valletta (1996). The Effects of Employer-Provided Health Insurance on Worker Mobility. *Industrial and Labor Relations Review* 49: 439-455.
- Carroll, Glenn R. and Karl Ulrich Mayer (1986). Job Shift Patterns in the Federal Republic of Germany: the Effects of Social Class, Industrial Sectors and Organizational Size. *American Sociological Review* 51: 323-341.
- Eriksson, Göran (1991). Human Capital Investments and Labor Mobility. *Journal of Labor Economics* 9: 236-254.
- Farber, Henry S. (1994). The Analysis of Interfirm Worker Mobility. *Journal of Labor Economics* 12: 554-593.
- Felmlee, Diane H. (1982). Women's Job Mobility Processes Within and Between Employers. *American Sociological Review* 47: 142-151.
- Fujiwara-Greve, Takako and Henrich R. Greve (2000). Organizational Ecology and Job Mobility. *Social Forces* 79: 547-585.
- Gilleskie, Donna B. and Byron F. Lutz (2002). The Impact of Employer-Provided Health Insurance on Dynamic Employment Transitions. *Journal of Human Resources* 37: 129-162.
- Hachen, David S. Jr. (1992). Industrial Characteristics and Job Mobility Rates. *American Sociological Review* 57: 39-55.
- Haveman, Heather H. and Lisa Cohen (1994). The Ecological Dynamics of Careers: the Impact of Organizational Founding, Dissolution, and Merger on Job Mobility. *American Journal of Sociology* 100: 104-152.
- Kandel, Denise B. and Kazuo Yamaguchi (1987). Job Mobility and Drug Use: An Event History Analysis. *American Journal of Sociology* 92: 836-878.
- Magnani, Elisabetta (2001). Risk of Labor Displacement and Cross-Industry Labor Mobility. *Industrial and Labor Relations Review* 54: 593-610.
- Mayer, Karl Ulrich and Glenn R. Carroll (1987). Jobs and Classes: Structural Constraints on Career Mobility. *European Sociological Review* 3: 14-38.

- Neumark, David, Daniel Polsky and Daniel Hansen (1999). Has Job Stability Declined Yet? New Evidence for the 1990s. *Journal of Labor Economics* 17: S29-S64.
- Tuma, Nancy B. (1985). Effects of Labor Market Structure on Job Shift Patterns. Pp. 327-363 in James J. Heckman and Burton Singer (eds.), *Longitudinal Analysis of Labor Market Data*. Cambridge: Cambridge University Press.

Fertility

- Axinn, William G. and Scott T. Yabiku (2001). Social Change, the Social Organization of Families, and Fertility Limitation. *American Journal of Sociology* 106: 1219-1261.
- Bongaarts, John and Griffith Feeney (1998). On the Quantum and Tempo of Fertility. *Population and Development Review* 24: 271-291.
- Bumpass, L., R. Rindfuss and R. Janosik (1978). Age and Marital Status at First Birth and the Pace of Subsequent Fertility. *Demography* 15: 75-86.
- David, Paul A. and Warren C. Sanderson (1990). Cohort Parity Analysis and Fertility Transition Dynamics: Reconstructing Historical Trends in Fertility Control from a Single Census. *Population Studies* 44: 421-445.
- Martin, Steven P. (2000). Diverging Fertility Among U.S. Women Who Delay Childbearing. *Demography* 37: 523-533.
- Michael, Robert T. and Nancy Brandon Tuma (1985). Entry into Marriage and Parenthood by Young Men and Women: The Influence of Family Background. *Demography* 22: 515-544.