

Doctoral Seminar on Advanced Quantitative Methods

COMM-627

Martin Schulz
with *Pre-Olympic Special Guest: Nikolaus Beck*
Sauder School of Business
University of British Columbia
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~ Draft ~

Course web page: http://ob_courses.sauder.ubc.ca/c627/

Classroom:	HA 328	Class Hours:	W 14:00 to 17:00
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Overview

This course provides an introduction to selected quantitative approaches currently prominent in organizational research. The main focus will be on dynamic models – models that describe how units (e.g., individuals, organizations, rules, networks, systems, populations, social institutions, groups, industries, communities, societies) undergo change (e.g. of their characteristics or outcomes or components). Many studies of change use event history models – a group of models that capture change of discrete outcomes in continuous time. Event history models have become the model of choice in organization studies because they overcome limitations inherent in older models (cross-sectional models, panel models) and because they provide a rich set of tools to model many different types of change. These models, though in principle rather elegant, are sometimes difficult to apply, and this course will help students develop an appreciation for the pitfalls of dynamic analysis, the data requirements involved, and the interpretation of estimation results. The course is not limited to event history analysis – neighboring models will be explored, in particular, Logit and Probit models which allow analysis of discrete outcomes in discrete time, and models of counting processes which allow analysis of event count data in discrete time.

Objectives

The main objective of this course is to introduce students to “state of the art” dynamic models currently used in the fields of organizational theory and organizational behavior. Students taking this course should expect to:

- Develop the capability to formulate dynamic models that relate to relevant theoretical hypotheses.
- Gain the capability to compare and choose appropriate models and estimate their parameters.
- Learn to use state-of-the-art statistic programs, such as SAS and STATA.
- Gain a thorough understanding of the mathematical foundations of dynamic models currently in use in the organization sciences.
- Learn to collect, transform, and explore complex, longitudinal data.
- Develop an appreciation for the potential and pitfalls of dynamic analysis.

Course Description

Change is a key characteristic of the empirical world. Individuals, organizations, and societies – be it in part or whole – experience various degrees of change. Change is not only omnipresent, it is also puzzling. Why do some things change fast and others at a much slower pace? Which events at which place and time trigger which other events? Why does history proceed in the way it does? Such questions are not entirely futile. The subject of change is at the heart of many theories and disciplines. In the organization sciences, change has found attention under such labels as “inertia”, “advantage”, “learning”, “momentum”, “newness”, “fairness”, “exchange”, “escalation”, “deviance”, “entrepreneurship”, “transaction”, “differentiation” “innovation” – just to name a few.

This course offers a chest of tools that can help us to crack the puzzles of change in organization sciences and related fields. It rests on the potentially useful fiction that change is produced by units that experience ‘events’ as they flow through networks of states. It offers tools that estimate, analyze, and predict the intensities at which units flow between states. It can model how units act (e.g., ‘comply’, ‘decide’), change (e.g., ‘mature’, ‘adapt’), and interact with other units (e.g., ‘infect’, ‘compete with’) as they travel through time and different states. It provides techniques to study how units emerge (e.g., ‘birth’, ‘founding’), transform (‘revisions’), and die (‘suspensions’). And it allows us to study how different units act and react in different ways during their life history.

Of course, this fiction is not without difficulties. How do we specify the units and states? Which characteristics of units and states do we need to consider? Which can we ignore? Which behavioral mechanisms do we include in our models? Guidance for such questions can be gleaned from theories of change and empirical research that has tackled puzzles of change in organizations. For these reasons, this seminar puts emphasis on both, the mastery of the statistical tools and on reflection on the structures and processes that give rise to change. Most of the reading materials of this course present theories and research on change alongside applications of the statistical tools. By combining the technical aspects of dynamic models with their theoretical background, students will gain a deeper understanding of dynamic phenomena, learn to avoid common pitfalls of dynamic analysis, and develop an appreciation of the enormous potential that these approaches offer.

We will use several common statistical packages in this course. STATA is a very prominent data analysis program that has found wide use in the social sciences and organization studies. It offers a broad array of advanced statistical procedures, many of which are not (yet) available in other programs. SAS is a very powerful, multi-purpose package for data handling and data analysis. It offers quite convenient (and fairly portable) routines to transform data into structures that facilitate dynamic modeling. It also includes several robust statistics procedures that we will rely on to estimate parameters of large data sets. Several copies of these programs (along with auxiliary programs such as TextPad) will be made available.

At a number of times during this course, we will engage in data analysis. During these in-class practice sessions we will learn how to use the statistics programs. Moreover, several assignments (in particular, the term paper) involve empirical data analysis. Although the instructor can provide data sets that can be used to practice dynamic modeling, students are encouraged to bring their own data sets to this course.

Requirements

Participation [20%]. Students are expected to always come to class prepared to participate in a discussion of all the required readings for that class. Each student should be prepared to a) summarize the main ideas in the assigned readings, b) summarize the data and models used in the assigned readings, and c) to discuss the methodological limitations of the research presented in the assigned reading materials. Emphasis is on mastering and responding critically and creatively to the seminar's material.

Memos [15%]. Each student prepares brief memos relating to the assigned reading for the week. The memo should contain summaries of main ideas, reflections on ideas in the reading, and questions that you had while reading the material. For each article or chapter of the assigned reading, students prepare one page (max) of notes.

Memos are due at the beginning of each class session.

Technical Report [20%] During our Olympic study break, students will produce a technical report about a statistical analysis they conduct during that time. The technical report describes in detail how the empirical analysis was performed, and discusses the meaning of the program output and estimates. It also includes all program files plus program output. THIS IS DUE in Session 7 (March 3).

Term Paper [45%]. Students write a quantitative, empirical research paper (10 to 15 pages double spaced twelve point type, not counting figures and tables). The paper should explore at least one causal relationship using longitudinal data. It is advisable to start thinking about the term paper early in the semester. So please feel free to come and discuss your ideas whenever you feel you are ready to do so. I may be able to provide some suggestions which you'd find useful. The term paper is due on the last day of classes. Note, the term paper must be accompanied by a Technical Appendix that describes in detail how the empirical analysis was performed and that includes all program files plus program output.

Readings

A) REQUIRED TEXTS (available at the University Bookstore):

- Mario Cleves, William W. Gould, Roberto G. Gutierrez, and Yulia Marchenko “An Introduction to Survival Analysis Using Stata”, 2nd Edition, Stata Press, 2008, ISBN-10: 1-59718-041-6
- Blossfeld, Hans Peter; Golsch, Katrin; and Rohwer, Götz “Event History Analysis with Stata”, Lawrence Erlbaum, 2007, ISBN-10: 0-8058-6047-9
- James Jaccard and Robert Turrisi “Interaction Effects in Multiple Regression”, Second Edition, SAGE Publications, Inc, Series: Quantitative Applications in the Social Sciences, Volume 72, ISBN: 9780761927426 =09

B) READING PACKET:

- A reading packet with articles will be available from the instructor

C) RECOMMENDED TEXTS:

- William E. Griffiths, R. Carter Hill, George G. Judge “Learning and Practicing Econometrics”, Wiley, 1993, ISBN: 978-0-471-51364-3
- Box-Steffensmeier, Janet and Jones, Bradford S. “Event History Modeling” Cambridge Univ Press 2004.
- Yamaguchi, Kazuo “Event History Analysis” Sage 1991
- Cox, D.R. and Oakes, D. “Analysis of Survival Data” Chapman and Hall, 1984
- Tuma, Nancy B. and Hannan, Michael T. “Social Dynamics. Models and Methods” 1984 Academic Press: Orlando.
- Long, Scott “Regression Models for Categorical and Limited Dependent Variables”, Sage 1997.
- Greene, William H. “Econometric Analysis” Prentice Hall, Inc, 1993
- Rabe-Hesketh, Sophia and Everitt, Brian “A Handbook of Statistical Analyses using Stata”, Chapman & Hall 2004 (third edition)
- Allison, Paul D. “Survival Analysis Using SAS” SAS Press 2005
- Babbie, Earl: “Survey Research Methods”, Wadsworth Publishing, 1990.

Class Schedule

Note:

- ◆ indicates required reading materials.
- ❖ indicates optional reading materials for further study.

A: Statistical Models – Introduction

Session 1: Review: Probability Distributions, Estimation

We will start out this course with a quick refresher on statistical concepts. We will read and discuss “Appendix C” from John Fox classic on linear models. Please read his Appendix C carefully before coming to class. We will discuss it in class, and help each other understanding it. It will provide a nice background for the rest of the course.

- ◆ John Fox “Linear Statistical Models & Related Methods” (Wiley), “Appendix C”

Session 2: Linear Models, Variable Selection, Dummy Variables, Interaction Effects

In this session we will review fundamental features and pitfalls of linear models, model specification, variable selection, dummy variables, and interaction effects.

- ◆ James Jaccard and Robert Turrissi “Interaction Effects in Multiple Regression”, Second Edition, SAGE Publications, Inc, Series: Quantitative Applications in the Social Sciences, Volume 72
- ◆ ROSE, BRIGID M. M.A.; HOLMBECK, GRAYSON N. Ph.D.; COAKLEY, RACHAEL MILLSTEIN M.A.; FRANKS, ELIZABETH A. M.A. 2004, "Mediator and Moderator Effects in Developmental and Behavioral Pediatric Research" *Journal of Developmental & Behavioral Pediatrics*, February 2004 - Volume 25 - Issue 1 - pp 58-67

Session 3: Models of Change: Theoretical Relevance and Empirical Context

How can we understand change in organizations? Can we understand it as a transformation along a prescribed path? Perhaps even a path that is directed towards an ultimate end? Or is it an ecology of units that compete for survival? Does change occur through failure of old and founding of new organizations, or does it occur via adaptation of existing organizations?

- ◆ Van De Ven, Andrew H. and Poole, Marshall Scott “Explaining Development and Change in Organizations”, *Academy of Management Review*, Vol 20, No 3, July 1995, 510-540
- ◆ Carroll, Glenn R. 1983. "The analysis of discrete dependent variables: A didactic essay." *Quality and Quantity*, 17: 425-460.
- ◆ Blossfeld, Golsch, & Rohwer, Chapter 1
- ❖ Raftery, Adrian E. “Statistics in Sociology, 1950-2000: A Selective Review” *Sociological Methodology* Vol 31, 2001: 1-45

B: Continuous Time Models of Discrete Outcomes: Event History Models

B1: Descriptive Event History Methods

Session 4: Life Tables and Related Descriptive Methods

In this session, we explore descriptive approaches to event histories. Many of them originate in Demographics, and we will draw on ideas from that field. We also will familiarize ourselves with data structures and data management that are needed in this context.

- ◆ Blossfeld, Golsch, & Rohwer, Chapters 2 & 3
- ◆ Brüderl, J. & Schüssler, R. 1990. "Organizational mortality: The liabilities of newness and adolescence". Administrative Science Quarterly, 35: 530-547.
- ◆ Brüderl, J., Preisendörfer, P., & Ziegler, R. 1992. "Survival chances of newly founded business organizations". American Sociological Review, 57: 227-242.
- ❖ Wu, L. L. 1990. "Simple graphical goodness-of-fit tests for hazard rate models". In K.U.Mayer & N. B. Tuma (Eds.), Event History Analysis in Life Course Research 184-199. Madison: University of Wisconsin Press.
- ❖ Tolbert, P. S. & Zucker, L. G. 1983. "Institutional sources of change in the formal structure of organizations: The diffusion of civil service reform, 1880-1935". Administrative Science Quarterly, 28: 22-39.

B2: Basic Event History Models

Session 5: The Exponential Model and the Proportional Hazard Model

The exponential is the most basic hazard rate model. At the same time it turns out to be surprisingly flexible (and allows for a number of elaborations, including piecewise constant exponential). The proportional hazard model is a little more advanced., but makes less assumptions about the underlying hazard rate function and offers a flexible approach when hazard baselines are variable but unknown.

- ◆ Blossfeld, Golsch, & Rohwer, Chapters 4 & 5 & 9
- ◆ Dobrev, S. D., Kim, T.-Y., & Hannan, M. T. 2001. "Dynamics of niche width and resource partitioning". American Journal of Sociology, 106: 1299-1337.
- ◆ Davis, G. F. 1991. Agents without principles? The spread of the poison pill through the intercorporate network. Administrative Science Quarterly, 36: 583-613.
- ❖ Zhou, X., Tuma, N. B., & Moen, P. 1997. "Institutional change and job-shift patterns in urban China, 1949 to 1994". American Sociological Review, 62: 339-365.
- ❖ Paik, M. C. & Tsai, W.-Y. 1997. On using the Cox proportional hazards model with missing covariates. Biometrika, 84: 579-593.
- ❖ Marsden, P. V. & Podolny, J. M. 1990. Dynamic analysis of network diffusion processes. In H.Flapp & J. Weesie (Eds.), Social networks through time 197-214. Utrecht, The Netherlands: ISOR, University of Utrecht.
- ❖ Halliday, T. C., Powell, M. J., & Granfors, M. W. 1993. After Minimalism - Transformations of State Bar Associations from Market Dependence to State Reliance, 1918 to 1950. American Sociological Review, 58: 515-535.

Session 6: Practice Session

Data structures for life table analysis and event history models

Producing life tables, survival plots, and hazard plots with popular statistics programs

Estimating parameters of proportional hazards and exponential models with popular statistics programs.

Working on student's projects

[[THE OLYMPIC BREAK]]

Session 7: Time-varying Covariates [Note, the Tech Report is DUE today]

Time-varying covariates are variables that change during the observation period. One of the greatest strengths of event history models is that they allow the integration of such covariates, giving rise to some of the most powerful and flexible models of change.

- ◆ Blossfeld, Golsch, & Rohwer, Chapter 6
- ◆ Gaynor, J. J. 1987. "The Use of Time Dependent Covariates in Modeling Data from an Occupational Cohort Study". Applied Statistics, 36: 340-351.
- ◆ Lounsbury, Michael "Institutional Sources of Practice Variation: Staffing College and University Recycling Programs" Administrative Science Quarterly, Vol. 46, No. 1. (Mar., 2001), pp. 29-56.
- ❖ Rotolo, Thomas "A Time to Join, A Time to Quit: The Influence of Life Cycle Transitions on Voluntary Association Membership" Social Forces, Vol. 78, No. 3. (Mar., 2000), pp. 1133-1161.
- ❖ Pennings, Johannes M.; Barkema, Harry; Douma, Sytse "Organizational Learning and Diversification" The Academy of Management Journal, Vol. 37, No. 3. (Jun., 1994), pp. 608-640.
- ❖ Amburgey, T. L., Kelly, D., & Barnett, W. P. 1993. "Resetting the clock: The dynamics of organizational change and failure". Administrative Science Quarterly, 38: 51-73.
- ❖ Meyer, J. W., Frank, D. J., Hironaka, A., Schofer, E., & Tuma, N. B. 1997. "The structuring of a world environmental regime", 1870-1990. International Organization, 51: 623-651.

B3: Advanced Event History Models

Session 8: Parametric Duration Dependence (including Mixture Distributions)

Duration dependence is a common phenomenon. For example, it is well known that new firms initially face elevated risks of failure (called “liability of newness”) that subside as the firms age. Another example is honeymoons – dissolution rates are initially low and increase with the duration of the marriage. Event history models can consider many forms of duration dependence, including spurious duration dependence.

- ◆ Blossfeld, Golsch, & Rohwer, Chapters 7 & 8 & 10
- ◆ Singh, Jitendra V.; House, Robert J.; Tucker, David J. “Organizational Change and Organizational Mortality” Administrative Science Quarterly, Vol. 31, No. 4. (Dec., 1986), pp. 587-611.
- ◆ Levinthal, Daniel A. “Random Walks and Organizational Mortality” Administrative Science Quarterly, Vol. 36, No. 3. (Sep., 1991), pp. 397-420.
- ❖ Levinthal, Daniel A.; Fichman, Mark “Dynamics of Interorganizational Attachments: Auditor-Client Relationships” Administrative Science Quarterly, Vol. 33, No. 3. (Sep., 1988), pp. 345-369.
- ❖ Li, B. & Walder, A. G. 2001. “Career advancement as party patronage: Sponsored mobility into the Chinese administrative elite”, 1949-1996. American Journal of Sociology, 106: 1371-1408.
- ❖ Spurr, S. J. & Sueyoshi, G. T. 1994. “Turnover and Promotion of Lawyers: An Inquiry into Gender Differences”. Journal of Human Resources, 29: 813-842.
- ❖ Fujiwara-Greve, T. & Greve, H. R. 2000. “Organizational ecology and job mobility”. Social Forces, 79: 547-568.

Session 9: Diffusion Models

Diffusion models describe the adoption of innovations by members of a population over time. Recently, event history models have been introduced that analyze adoption events on individual level while considering the social structure within which members are embedded. In event history models of diffusion, the probability of adoption by an individual is a function of prior adoption events of other units in the population. Elaborations of the models capture infectiousness of spreaders, susceptibility of adopters, and proximity between both. In a way one can consider event history models of diffusion as the natural successors of social network models.

- ◆ Strang, D. & Tuma, N. B. 1993. “Spatial and temporal heterogeneity in diffusion”. American Journal of Sociology, 99: 614-639.
- ◆ Davis, G. F. & Greve, H. R. 1997. “Corporate elite networks and governance changes in the 1980s”. American Journal of Sociology, 103: 1-37.
- ❖ Soule, S. A. & Zylan, Y. 1997. “Runaway train? The diffusion of state-level reform in the ADC/AFDC eligibility requirements, 1950-1967”. American Journal of Sociology, 103: 733-762.
- ❖ Greve, H. R. 1998. “Managerial cognition and the mimetic adoption of market positions: What you see is what you do”. Strategic Management Journal, 19: 967-988.

Session 10: Practice Session

Data structures event history models with dynamic covariates
Estimating and interpreting parameters of models with dynamic covariates
Estimating parameters of parametric duration models.
Working on student's projects

C: Discrete Time Models of Discrete Outcomes

Session 11: Logit and Probit Models for the Analysis of Event Histories

What do we do when our data do not contain exact dates? When event dates are rough (e.g., give the year of the events only) Logit and Probit models provide a robust and surprisingly flexible alternative. We start out with a general introduction to logit and probit models, and then explore their use in the event history context.

- ◆ Long, Scott , Chapters 3 & 4, in “Regression Models for Categorical and Limited Dependent Variables”, Sage 1997.
- ◆ Allison, Paul. 1982. "Discrete-time methods for the analysis of event histories." Sociological Methodology: 61-98.
- ◆ Kim, Dong-Jae; Kogut, Bruce “Technological Platforms and Diversification” Organization Science, Vol. 7, No. 3, Special Issue Part 1 of 2: Hypercompetition. (May - Jun., 1996), pp. 283-301.
- ◆ Burns, L. R. & Wholey, D. R. 1993. “Adoption and abandonment of matrix management programs: Effects of organizational characteristics and interorganizational networks.” Academy of Management Journal, 36: 106-138.
- ❖ Henisz, W. J. & Delios, A. 2001. “Uncertainty, imitation and plant location: Japanese multinational corporations, 1990-1996”. Administrative Science Quarterly, 46: 443-475.
- ❖ Palmer, D., Jennings, P. D., & Zhou, X. 1993. “Late adoption of the multidivisional form by large U. S. corporations: Institutional, political, and economic accounts.” Administrative Science Quarterly, 38: 100-131.
- ❖ Hachen, D. S. Jr. 1988. “The competing risks model: A method for analyzing processes with multiple types of events”. Sociological Methods and Research, 17: 21-54.
- ❖ Petersen, T. 1991. “Time-aggregation bias in continuous-time hazard-rate models.” In P.V.Marsden (Ed.), Sociological Methodology 263-290. Cambridge, MA: Basil Blackwell.
- ❖ Petersen, T. & Kopus, K. W. 1992. “Time-aggregation bias in hazard-rate models with covariates”. Sociological Methods and Research, 21: 25-51.

Session 12: Models of Counts

How do we model the emergence of new units? Standard event history (and logit and probit) models work only on units that already exist. Models of counts have been developed to address this situation. They can model the number of births per unit of time in a time series setting.

- ◆ Scott Long, Chapter 8, in “Regression Models for Categorical and Limited Dependent Variables”, Sage 1997.
- ◆ Carroll, Glenn R. And Swaminathan, Anand. “Why the microbrewery movement? Organizational dynamics of resource partitioning in the U.S. brewing industry”. American Journal of Sociology. Chicago: Nov 2000. Vol.106, Iss. 3; pg. 715, 48 pgs
- ◆ Faria, Ana, Fenn, Paul, Bruce, Alistair. “A Count Data Model of Technology Adoption”, Journal of Technology Transfer. Indianapolis: Jan 2003. Vol.28, Iss. 1; pg. 63
- ❖ Lomi, Allesandro 1995 “The population ecology of organizational founding: Location dependence and unobserved heterogeneity.” Administrative Science Quarterly, 40: 111-144.
- ❖ Schulz, Martin 1998, “Limits to Bureaucratic Growth: The Density Dependence of Organizational Rule Births” in: Administrative Science Quarterly, Vol 43, No 4. 845-876
- ❖ Shiferaw Gurmu; Pravin K. Trivedi “Excess Zeros in Count Models for Recreational Trips” Journal of Business & Economic Statistics, Vol. 14, No. 4. (Oct., 1996), pp. 469-477.
- ❖ A. Colin Cameron; Pravin K. Trivedi “Econometric Models Based on Count Data: Comparisons and Applications of Some Estimators and Tests”. Journal of Applied Econometrics, Vol. 1, No. 1. (Jan., 1986), pp. 29-53.
- ❖ Diane Lambert “Zero-Inflated Poisson Regression, with an Application to Defects in Manufacturing”, Technometrics, Vol. 34, No. 1. (Feb., 1992), pp. 1-14.
- ❖ Paul D. Allison; Richard P. Waterman “Statistical Methods Fixed-Effects Negative Binomial Regression Models” Sociological Methodology, Vol. 32. (2002), pp. 247-265.

Session 13: Practice Session and Wrap-Up

Data Structures for Logit and Counting Models

Estimating Logit and Counting models with popular statistics programs.