METHODS COURSE DESCRIPTIONS

Bayesian Methods

Bayesian methods provide a flexible and powerful approach to complex statistical models and have a theoretical elegance and clarity that is impressive. Bayesian models inherently recognize and incorporate subjective judgments of the researcher, which is the source of both their great power the controversy surrounding their use. The course covers some of the epistemological issues raised by Bayesian methods, their application, and basic concepts of Bayesian statistical inference. There are several sets of tools needed to do applied Bayesian modeling, including reviewing some probability theory, developing the fundamental notion of Bayes' theorem as a foundation for statistical inference, and seeing how likelihood is incorporated within the Bayesian framework. Finally, the course explore the world of applied Bayesian modeling. This includes learning some new software tools using WinBugs and S-Plus/R. The main focus of the course is on application of Bayesian models to cutting edge issues in social science modeling. This includes a number of applied readings, including discussing these applications in class in order to develop a feel for what research that takes a Bayesian approach "feels" like.

Texts:

Gelman, Andrew, John B. Carlin, Hal S. Stern and Donald B. Rubin. 2003. *Bayesian Data Analysis* (2nd Edition). New York: Chapman & Hall.

Gill, Jeff. 2002. *Bayesian Methods for the Social and Behavioral Sciences*. New York: Chapman & Hall/CRC.

Applications:

Western, Bruce, and Simon Jackman. 1994. "Bayesian Inference for Comparative Research." *American Political Science Review* 88:412-23.

Jackman, Simon. 2000. "Estimation and Inference are Missing Data Problems: Unifying Social Science Statistics via Bayesian Simulation." *Political Analysis* 8:307-32.

Cross-Level Inference
The course introduces the identification problem inherent in data gathered at one level of aggregation to infer processes at another level of aggregation. The main emphasis is on inference from geographically aggregated data to processes at the individual level. The course presents the fundamentals of the problem, reviews various techniques that have been proposed to address it, and discusses the main issues that arise in estimation.

Texts:
Achen, Christopher, and W. Phillips Shively. 1992. *Cross-Level Inference.* University of Chicago Press.

King, Gary. 1997. *A Solution to the Ecological Inference Problem.* Princeton University Press.

Applications:
Burden, Barry C., and David Kimball. 1998. "A New Approach to the Study of Ticket Splitting." *American Political Science Review* 92:533-44.

Burden, Barry C., and David Kimball. 2002. *Why Americans Split Their Tickets*. Ann Arbor: University of Michigan Press.

Event History Analysis
Social science theories are increasingly focused on change processes and temporal data are becoming widely available. Yet the vast majority of empirical research focuses on static relationships, i.e., at one point in time, typically cross-sectional studies. Even when time series or panel data are analyzed, the temporal structure is often ignored and the data are treated as though they are cross-sections with some additional methodological complications involving autocorrelations. Event history methods are ideal for studying temporal change. They address not only whether an event occurred, but when the event occurred. For many research questions in social science, the timing or history of social change is at least as interesting as understanding the culminating event. Research designs incorporating "history" into the analysis promises greater analytical leverage than designs ignoring history, such as cross-sectional designs. Event history analysis is clearly longitudinal and involves the statistical examination of longitudinal data collected on a set of observations. While a wide variety of statistical models may be constructed for event history data, at the most basic level, all event history models have some common features. The dependent variable measures the duration of time that units spend in a state before experiencing some event. Generally, a researcher knows when the observations enter the process, i.e., when the history begins, and when, and whether or not, the process ends (with the occurrence or nonoccurrence of some event). Analysts are typically interested in the relationship between the length of the observed duration and independent variables, or covariates, of theoretical interest. A statistical model can then be constructed to link the dependent variable to the covariates. Inferences can be made regarding the influence of the covariates on the length of the duration and the occurrence (or nonoccurrence) of some event. As scholars are beginning to recognize, these methods have many advantages and allow new questions to be addressed. Event history data are becoming more and more available in all areas of empirically oriented political science. Applications include the duration of peace, the duration of unemployment, the length of

time a cabinet is in place, when a challenger enters a congressional race, the duration of congressional careers, when a policy is likely to be adopted by the states, or how long it takes to complete a dissertation. The course thoroughly describes different models for different kinds of duration data, documents the assumptions underlying these different models, and considers goodness-of-fit indices and diagnostic techniques, i.e., residual and specification analysis.

Texts:

Box-Steffensmeier, Janet M., and Bradford S. Jones. 2003. *Event History Modeling: A Guide for Social Scientists*. Cambridge University Press.

Blossfeld, Hans-Peter & Gotw Rohwer. 2002. *Techniques of Event History Analysis*. 2nd edition. Lawrence Erlbaum Publishers.

Hougaard, Philip. 2000. *Analysis of Multivariate Survival Data*. Springer-Verlag.

Applications:

Balla, Steven J., and John R. Wright. 2003. "Consensual Rulemaking and the Time it Takes to Develop Rules." In *Politics, Policy, and Organizations*, eds. George A. Krause and Kenneth J. Meier. Ann Arbor: University of Michigan Press.

Box-Steffensmeier, Janet M. 1996. "A Dynamic Analysis of the Role of War Chests in Campaign Strategy." *American Journal of Political Science* 40:352-71.

Box-Steffensmeier, Janet M., Laura Arnold, and Christopher J.W. Zorn. 1997. "The Strategic Timing of Position-Taking in Congress: A Study of the North American Free Trade Agreement." *American Political Science Review* 91:324-38.

Box-Steffensmeier, Janet M., and Christopher Zorn. 2002. "Duration Models for Repeated Events." *Journal of Politics* 64:1069-94.

King, Gary, James Alt, Nancy Burns, and Michael Laver. 1990. "A Unified Model of Cabinet Dissolution in Parliamentary Democracies." *American Journal of Political Science* 34:847-71.

Experimental Design and Analysis

Students gain: (1) exposure to the diversity of research in politics that uses experimental methods; (2) a solid theoretical background in the scientific and philosophical foundations of modern experimental methods in psychology; and (3) the practical skills and folk wisdoms essential for conducting methodologically sound experiments in political psychology. The course considers basic issues in research design, methodologies both simple and esoteric, and ethical concerns for human subjects research. In addition to standard laboratory experiments, the course explores field, quasi-experimental, and survey-experimental methods. Numerous examples are drawn from the social psychology and political science literatures. During the quarter, students are expected to design an experiment, collect data, and write a research report. Aside from keeping up with the reading, students' primary responsibility are on the implementation of their

experiment. Students work in groups with common interests, and significant amounts of class time are devoted to the design of the research project.

Applications:

Lodge, Milton, Kathleen M. McGraw, and Patrick Stroh. 1989. "An Impression-Driven Model of Candidate Evaluation." *American Political Science Review* 83:399-419.

McGraw, Kathleen M. 1991. "Managing Blame: An Experimental Test of the Effects of Political Accounts." *American Political Science Review* 85:1133-57.

Nelson, Thomas E., Rosalee A. Clawson, and Zoe M. Oxley. 1997. "Media Framing of a Civil Liberties Conflict and its Effect on Tolerance." *American Political Science Review* 91:567-83.

Maximum Likelihood Estimation

The course covers the following maximum likelihood statistical models: (1) logit and probit for binary, or dichotomous, dependent variables, (2) ordered probit and logit for ordinal dependent variables, (3) event count (poisson and negative binomial) models for dependent variables that include a count of some sort (such as wars in a decade, or coups in a year, or Supreme Court appointments in a presidential term, or incumbents defeated in an election), (4) discrete choice models for dependent variables that do not possess a natural ordering (such as voting for Bush, Gore, or Nader) using multinomial logit and multinomial probit, and (5) selection models where the dependent variable is not necessarily random.

Texts:

Long, J. Scott. 1997. *Regression Models for Categorical and Limited Dependent Variables*. Sage.

Greene, William H. 2002. *Econometric Analysis,* 5th Edition. Prentice Hall.

King, Gary. 1998. *Unifying Political Methodology: The Likelihood Theory of Statistical Inference*. Ann Arbor, MI: University of Michigan Press.

Eliason, Scott R. 1993. *Maximum Likelihood Estimation: Logic and Practice*. Sage.

Aldrich, John and Forrest Nelson. 1984. *Linear Probability, Logit and Probit Models.* Sage.

Logit and Probit Applications:

Caldeira, Gregory A., and John R. Wright. 1988. "Organized Interests and Agenda Setting in the United States Supreme Court." *American Political Science Review* 82:1109-27.

Sanbonmatsu, Kira. 2002. "Gender Stereotypes and Vote Choice." *American Journal of Political Science* 46:20-34.

Weisberg, Herbert F. 2002. "Partisanship and Incumbency in Presidential Elections." *Political*

Behavior 24:339-360.

Count Models:

Anderson, William D., Janet M. Box-Steffensmeier, and Valeira Sinclair-Chapman. 2003. "The Keys to Legislative Success in the U.S. House of Representatives." *Legislative Studies Quarterly* 28:357-86.

Multinomial Logit and Probit

Lacy, Dean, and Barry C. Burden. 1999. "The Vote-Stealing and Turnout Effects of Ross Perot in the 1992 U.S. Presidential Election." *American Journal of Political Science* 43:233-55.

Sanbonmatsu, Kira. 2002. "Gender Stereotypes and Vote Choice." *American Journal of Political Science* 46:20-34.

Selection Models

Sweeney, Kevin, and Paul Fritz. 2004. "Jumping on the Bandwagon: An Interest Based Explanation for Great Power Alliances." *Journal of Politics* (forthcoming).

Measurement Models

The conceptual and statistical analysis of measurement is considered from the psychometric tradition. Topics include reliability and validity, exploratory factor analysis, confirmatory factor analysis, and structural equations with latent variables. Assignments include analyzing your own data using some of these techniques with SPSS and AMOS.

Texts:

Carmines, Edward, and Richard Zeller, *Reliability and Validity Assessment.* Sage.

Kim, Jae-on, and Charles Mueller, *Introduction to Factor Analysis* and *Factor Analysis* Sage.

Kenneth Bollen, *Structural Equations with Latent Variables*. New York: Wiley.

Applications:

Craig, Stephen C., Richard G. Niemi, and Glenn E. Silver. 1990. "Political Efficacy and Trust: A Report on the NES Pilot Study Items." *Political Behavior* 3:289-314.

Green, Donald Philip. 1990. "The Effects of Measurement Error on Two-Stage, Least-Squares Estimates." In James A. Stimson, ed., *Political Analysis*, v.2. Ann Arbor: University of Michigan Press.

Green, Donald Philip, and Bradley Palmquist. 1990. "Of Artifacts and Partisan Stability." *American Journal of Political Science* 34:872-902.

Judd, Charles M., and Michael A. Milburn. 1980. "The Structure of Attitude Systems in the General Public: Comparisons of a Structural Equation Model" *American Sociological Review* 45:627-643.

Panel Data and Time Series, Cross Section Analysis

There is a very large and rapidly growing statistical literature on analyzing data in which observations are a cross section of some units (e.g. individuals, countries, states, firms) over multiple time periods. "Panel data," in a broad sense, means any data spanning multiple dimensions, usually (but not necessarily) time and space, but the focus is mostly on cases in which we have much larger Ns than Ts. In general terms, the advantage to having time and space variance is that one can avoid inferring that inter-personal differences across units are equivalent to inter-temporal differences within units. For instance, in a cross-section if we find that age is a significant predictor of voting, we often infer that this result implies a forecast that all members of the relevant population will vote with increasing probability as they age. From a time series on just one unit, we might make the companion inference: that an observed life-cycle change in one unit implies across-age variation in a population that is heterogeneous in age in any given time period. With data that vary on both dimensions, one can better disentangle inter-unit and inter-temporal variance, and thus, in many contexts, adjudicate between rival behavioral theories. The increasing availability of large data sets and powerful computers has made panel models more and more prominent in econometrics.

Texts:

Hsiao, Cheng. 2003. *Analysis of Panel Data*. Cambridge University Press.

Applications:

Beck, Nathaniel. 2001. "Time-Series Cross-Section Data: What Have We Learned in the Past Few Years?" *Annual Review of Political Science* 4:271-93.

Beck, Nathaniel, and Jonathan Katz. 1995. "What to Do (and Not to Do) With Time-Series, Cross-Section Data." *American Political Science Review* 89:634-47.

Stimson, James A. 1985. "Regression in Space and Time: A Statistical Essay." *American Journal of Political Science* 29:914-47.

Scaling and Dimensional Analysis

This course covers the methodology of dimensional analysis – the scaling techniques and their philosophical implications. The dimensional approach is based in geometry, so visual displays are emphasized. Theoretical perspectives on methods, scaling, and dimensions are also presented. The methods presented are a variety of techniques for scaling, broadly defined, including unfolding analysis, proximity scaling, Guttman scaling, cluster analysis, factor analysis, and multidimensional scaling. These methods provide means for: (1) data reduction (reducing a large number of variables into a smaller set of composites), (2) examining dimensionality (representing the data in terms of the smallest possible number of unobserved underlying factors), and (3) measurement (scoring cases on the underlying dimensions and using those scores in further analysis).

Texts:

Abbott, *Flatland*.

Jacoby, *Data Theory and Dimensional Analysis* (Sage #78).

McIver & Carmines, *Unidimensional Scaling* (Sage #24).

Kruskal & Wish, *Multidimensional Scaling* (Sage #11).

Kim & Mueller, *Introduction to Factor Analysis* (Sage #13).

Kim & Mueller, *Factor Analysis* (Sage #14).

Long, *Confirmatory Factor Analysis* (Sage #33).

Aldenderfer & Blashfield, *Cluster Analysis* (Sage #44).

Applications:

Jacoby, William G. 1995. "The Structure of Ideological Thinking in the American Electorate." *American Journal of Political Science* 39:314-35.

Weisberg, Herbert F. "Dimensionland: An Excursion into Spaces." *American Journal of Political Science* 1980:743-76.

Weisberg, Herbert F. 1980. "A Multidimensional Conceptualization of Party Identification." *Political Behavior* 2:33-60.

Statistical Computing

Modern statistical packages provide many tools for analyzing data. One purpose of this course is to take a behind-the-scene look at some of these tools in an effort to move away from a simple point-and-click environment to a better understanding of some of these powerful tools. In addition, the course examines how advances in computing have led to advances in statistical analysis through tools such as simulation. A variety of statistical methods will be discussed in the context of specific data analysis problems. Topics may include distributions and random data, numerical methods, Monte Carlo experiments, and optimization (via e.g., maximum likelihood). Although there are no formal prerequisites for this course, students should be comfortable using computers and should be conversant with some statistical software package. You are welcome to work in either a UNIX environment or a windows environment. This course also emphasizes the S-plus statistical package primarily through its free counterpart, R. Students should feel free to use and complete assignments using any package that is appropriate for the tasks.

Time Series Analysis

This is a two-course sequence that considers statistical techniques to evaluate social processes occurring through time. Students are introduced to time series methods and to the applications of these methods in political science. After a brief review of the calculus of finite differences and

other estimation techniques, stationary ARMA models are examined. In the next section of the course, a number of important topics in time series analysis are examined including "reduced form" methods (granger causality and vector autoregression), unit root tests, near-integration, fractional integration, cointegration, and error correction models. Time series regression is also discussed (including pooling cross-sectional and time series data). We learn not only how to construct these models but also how to use them in policy analysis. Students are expected to have a firm grounding in probability and regression analysis and to bring to the course some interesting questions about the dynamics of political processes. The emphasis throughout the course is on application, rather than on statistical theory. However, the focus of most lectures is on statistical theory. Homework revolves as much as possible around the time series you are interested in understanding. To that end, students need to gather time serial data for analysis during the first week of class (this data need not be used throughout the term, though that would make your life easier). The length of the series should be at least 40 time points; longer series are better than shorter ones. Students are strongly encouraged to take both parts of the course.

Texts:
Enders, Walter. 1995. *Applied Econometric Time Series*. New York: Wiley.

Enders, Walter. 1996. *RATS Handbook for Econometric Time Series*. New York: Wiley.

Applications:
Alt, James. 1986. "Political Parties, World Demand, and Unemployment." *American Political Science Review* 79:1016-1040.

Box-Steffensmeier, Janet M., and Renee M. Smith. 1996. "The Dynamics of Aggregate Partisanship" *The American Political Science Review* 90: 567-80.

Freeman, John. 1983. "Granger Causality and the Time Series Analysis of Political Relationships." *American Journal of Political Science* 327-358.

Freeman, John, John Williams, and Tse-min Lin. 1989. "Vector Autoregression and the Study of Politics." *American Journal of Political Science* 842-877.

Wood, B. Dan and R. W. Waterman. 1991. "The Dynamics of Control of Bureaucracy." *American Political Science Review* 85:801-828.

USEFUL COURSES OFFERED OUTSIDE THE DEPARTMENT

Economics 742 – Econometric Analysis
Note: You will need the instructor's permission to sign up for this course. Topics covered in the course include models for panel data, simultaneous equations models, and duration models.

Sociology 707 – Structural Equation Modeling
Note: You will need the instructor's permission to sign up for this course. The course examines structural equation models (SEMs) and introduces students to the specification, estimation, and

assessment of various types of SEM models, including recursive and nonrecursive econometric models, confirmatory factor analysis, and general structural equation models with latent and observed variables. More advanced topics may include: multiple group analysis, estimation with categorical variables, analysis with missing data, addressing outliers and influential cases, interactions in latent variables, alternative estimation methods, and other topics. Students program in both LISREL and AMOS.

Statistics 641 – Design and Analysis of Experiments
Note: You will need the instructor's permission to sign up for this course. Topics covered in the course include: the linear model for experimental designs, analysis of variance, factorial experiments, and block designs.

Summer Program in Applied Statistical Methods – Center for Biostatistics
This program is offered every Summer in June with a number of one-week courses offered, including Applied Logistic Regression, Applied Duration Modeling, and Experimental Design and Analysis. See the following website for more details: http://www-biostat.med.ohio-state.edu/summer_2004/summer_program.htm.

ICPSR SUMMER PROGRAM IN QUANTITATIVE METHODS – UNIVERSITY OF MICHIGAN

For a listing and description of courses, see: http://www.icpsr.org/training/summer/courses.html.