RUTGERS UNIVERSITY
Bloustein School of Planning and Public Policy

Course 34:970:630 Discrete Methods
Spring 2006

Professor: Michael Lahr
CSB Room 442
Phone: 932-3133 x 546
Email: lahr@rci.rutgers.edu

Class Meetings: CSB 113
Tuesdays 1:10 – 3:50 pm.

Office Hours: Tuesdays 4:00 – 6:00 pm and by appointment

COURSE DESCRIPTION

Many research interests of planners and policy analysts have a qualitative nature. Despite the sometimes soft, fuzzy nature of the measures that are obtained in the course of such research, the scientific rigor of statistical techniques can still be applied. The **purpose** of this course is to:

1. Introduce students to a broad array of techniques that can handle dependent variables that are either qualitative and limited in value,
2. Acclimatize students to pertinent available statistical software, and
3. Enable students to be able to interpret the results from this statistical software.

The classical linear regression (CLR) model is often unsuited for the analysis of dependent variables that are qualitative or at least limited in value. This is because the assumptions required for CLR's implementation are often violated when analyzing such variables. In particular we will have a closer look at the following models: Logit, probit, ordinal logit/probit, multinomial logit/probit, hazard/duration models, truncated and censored distributions (tobit), and count models (Poisson and negative binomial regression models). We will learn how to test for violations of CLR assumptions in the context of both qualitative and limited dependent variables. Solutions to the violations will be suggested and discussed.

While theoretical and statistical underpinnings of these methods will be discussed in class, the emphasis of the course will be on the application and interpretation of the techniques covered. Thus, the typical in-class approach will be

1. A brief lecture on the motivation for using a particular statistical technique
2. A demonstration of the technique including how to prepare the data, specifying the model, and
3. Interpretation and assessment of the model results.

We will use Stata and SPSS software. Other software may be used in one or two sessions, however. Applications and readings will focus upon the interests of class members.

GENERAL COURSE INFORMATION

Pre-requisites

This course assumes that the student has a working knowledge of multivariate regression techniques and SPSS software.

Objectives

1. To introduce the student to a set of statistical techniques and software that will facilitate analysis of categorical and limited dependent variables.
2. To provide the student with hands-on experience using these statistical techniques.
3. To enable the student in conducting his/her own empirical analysis of a categorical/limited dependent variable and to use and evaluate the work of others.

Basis for Grades

The course grade will be computed as follows:

Problem sets	50 percent
Presentation of final paper	10 percent
Final paper	30 percent
Class participation	10 percent

The Final Paper

For the final paper, students will be expected to complete a journal-length research paper (approximately 15-20 pages). Given the time constraints of the course, I will assume you will use a cleaned public use data set (examples include General Social Survey, Current Population Survey, American Housing Survey, the Census, etc.) that is readily accessed and pertinent to a topic of your choosing. The data set must contain categorical or limited variables that can be conceptually defended as outcome measures or dependent variables. The paper should follow APA guidelines and contain at least a modest literature review. I recommend using alternative techniques when possible so that you can compare their results. For example, when analyzing a binomial outcome, you can use the linear probability model, the logit model, and the probit model: this will permit you to compare and discuss results from each. Another example might be a contrast of multinomial, ordered and conditional logit models. Detailed guidelines for the final paper appear on the last page of this syllabus.

TEXTS

Class Assigned

Long, J. Scott. 1997. *Regression Models for Categorical and Limited Dependent Variables* (Thousand Oaks, CA: Sage). **[Long] (Required)**

Long, J. Scott and Jeremy Freese. 2005. *Regression Models for Categorical Dependent Variables Using Stata*, 2nd edition. **[Long & Freese] (Required)**

Liao, Tim Futing. 1994. *Interpreting Probability Models: Logit, Probit, and Other Generalized Linear Models*. (Thousand Oaks, CA: Sage). **[Liao] (Recommended)**

Kennedy, Peter. 2003. *A Guide to Econometrics*, 5th edition. (Cambridge, MA: The MIT Press). **[Kennedy] (Recommended)**

Remedial

Gujurati, D.N. 1995. *Basic Econometrics*, 3rd edition. (New York: McGraw-Hill).

Other Core Lecture References

Greene, William. 1995. *Econometric Analysis* (NY: Macmillan).

Madalla, G.S. 1983. *Limited Dependent and Qualitative Variables in Econometrics*. (Cambridge, UK: Cambridge University Press).

Powers, Daniel A. and Yu Xie. 1999. *Statistical Methods for Categorical Data Analysis.* (NY: Academic Press).

Train, Kenneth. 2003. *Discrete Choice Methods with Simulation*. (Cambridge, UK: Cambridge University Press).

Students may also refer to the University of Indiana's URL on the Analysis of Categorical Dependent Variables with SAS and SPSS
< http://www.indiana.edu/~statmath/stat/all/cat/index.html>

COURSE OUTLINE AND READINGS

1. **Review of Linear Regression: Basic interpretation, criteria for good estimators, model specification, and internal & external validity** **[JANUARY 17]**

   Long, Chapters 1 & 2 (pages 11-20)

   Kennedy, Chapters 1-5, (don't bother with the technical notes)

2. **Dichotomous Dependents: Linear probability, logit, and probit models** **[JANUARY 24 & 31]**

   Long, Chapters 3-4 & Liao, Chapters 1-3.

   Kennedy, Chapters 6-11 (don't bother with the technical notes), Section 15.1 and associated notes.

   Kim, Chung-Ho and Kyung-Hwan Kim. 2002. "Compensation for Regulatory Takings in the Virtual Absence of Constitutional Provision: The Case of Korea," *Journal of Housing Economics*, 11, 108-124.

   Carrión-Flores, Carmen and Elena G. Irwin. 2004. "Determinants of Residential Land-Use Conversion and Sprawl at the Rural-Urban Fringe," *American Journal of Agricultural Economics*, 86, 889.

3. **Exercises with the Logit, Probit, and LPM (Lab)** **[FEBRUARY 7]**

4. **Polytomous Dependents: Multinomial & conditional logit** **[FEBRUARY 14]**

   Long, Chapter 6 & Liao, Chapter 6-7.

   Kennedy, Section 15.2 and associated notes.

Camasso, Michael J. and Radha Jagannathan. 2001. "Flying Personal Planes: Modeling the Airport Choices of General Aviation Pilots Using Stated Preference Methodology," *Human Factors*, 43, 392-404.

Daponte, Beth Osborne. 2000. "Private versus Public Relief: Utilization of Food Pantries versus Food Stamps among Poor Households," *Journal of Nutrition Education,* 32, 72-83.

Guimarães, Paulo, R. Rolfe, and Douglas Woodward. 1998. "Regional Incentives and Industrial Location in Puerto Rico," *International Regional Science Review*, 21(2), 119-138.

Lahr, Michael L. and Robert M. Gibbs. 2002. "Mobility of Alameda County Section 8 Families," *Journal of Housing Economics*, 11(2), 187-213.

5. Polytomous Dependents: Nested logit & multinomial probit [FEBRUARY 21]

Gangrade, Sachin, Ram M. Pendyala, and Robert G. McCullough. 2002. "A Nested Logit Model of Commuters' Activity Schedules," *Journal of Transportation and Statistics,* 5(2/3), http://www.bts.gov/publications/journal_of_transportation_and_statistics/volume_05_number_23/html/paper_02/.

Stern, Steven N. 1989. "Rules of Thumb for Comparing Multinomial Logit and Multinomial Probit Coefficients," *Economics Letters*, 31(3): 235-238.

6. Exercises with Multinomial, Conditional, and Nested Logits/Probits (Lab) [FEBRUARY 28]

7. Polytomous Dependents: Ordered logit/probit models [MARCH 7]

Long, Chapter 5 & Liao, Chapter 4-5.

Kennedy, Section 15.3 and associated notes.

Greenwald, Michael J. and Marlon G. Boarnet. 2001. "The Built Environment as a Determinant of Walking Behavior: Analyzing Non-Work Pedestrian Travel in Portland, Oregon," *Transportation Research Record*, 1780, 33-42.

White, Michael J. and Lori M. Hunter. 2005. "Public Perception of Environmental Issues in a Development Setting," unpublished paper from the Sociology Department, Brown University, May. Also http://www.colorado.edu/ibs/pubs/eb/eb2005-0003.pdf.

SPRING BREAK [MARCH 14]

8. Limited Dependents: Tobit, truncated, & interval regression [MARCH 21]

Long, Chapter 7.

Clark, David E., Robert Giffin, and Vladamir Novoty. 2005. "Assessing the Determinants of Willingness to Pay for Urban Flood Control: The Role of Locational, Demographic, and Attitudinal Factors," *Department of Economics Working Paper No. 503*, Marquette University.

Agostini, Claudio and Soraphol Tulayasathien. 2003. "The Impact of State Corporate Taxes on FDI Location," Economic Series Working Paper I-146, Universidad Alberto Hurtado, Santiago, Chile.

9. Count Dependents: Poisson & negative-binomial regression [MARCH 28]

Long, Chapter 8 & Liao, Chapter 8.

Guimarães, Paulo, Octávio Figueiredo, and Douglas Woodward. 2003. "A Tractable Approach to the Firm Location Decision Problem," *Review of Economics and Statistics*, 85, 201-204.

Zhao, Yong and Kara Kockelman. 2002. "Household Vehicle Ownership by Vehicle Type: Application of a Multivariate Negative Binomial Model," Paper # 02-2631, Annual Meeting of the Transportation Research Board.

10. Exercises with Limited and Count Dependent variables (Lab) [APRIL 4]

11. Hazard/Duration Models [APRIL 11]

Irwin, Elena G. and Nancy E. Bockstael. 2004. "Land Use Externalities, Open Space Preservation, and Urban Sprawl," *Regional Science and Urban Economics*, 34, 705-725.

Metraux, Stephen & Dennis P. Culhane. 1999. "Family Dynamics, Housing and Recurring Homelessness among Women in New York City Homeless Shelters," *Journal of Family Issues,* 20, 371-398.

12. Topic to Be Determined [APRIL 18]

13. Presentation of Class Paper [APRIL 25]

FINAL PAPER DUE [MAY 9]

Guidelines for Writing the Final Paper

The final paper should be 12-20 pages in length, typed and double spaced. Tables and Figures should be attached as separate pages. The paper should contain the following components – other components can be added as the student views necessary:

1. Title Page – lists paper title, author's name, date submitted, acknowledgements.

2. Introduction/Problem Statement – In one to two pages tell us the motivation for your research? Why is it important? This is where you establish the focal variable relationship of interest and what others have said about it.

3. Theoretical Framework – Here describe theory that guides your empirical analysis. For example, rational choice theory is often used to guide empirical analysis of marriage, crime, childbearing, etc. Any hypotheses that you have generated from the theory specified should be stated here. Have others led you to these hypotheses?

4. Research Design – The focus here is how the observations have been collected. That is, were observations collected through a randomized experiment or an observational study? Are the data cross-sectional, longitudinal (time series or panel)?

5. Data and Measures – Describe the sample, data sources, key variables, how variables are measured, and distributions of respondents on these variables. Use tables to show the means, standard deviations, etc. for these key variables. The reader needs to know who you are studying, what specifically about the respondents you are studying, and what variability exists.

6. Analytic Strategy – Tell the reader what statistical procedures you are using, the rationale for the use of such procedures, and any assumptions you are making about the procedures and the data. You should pay special attention to this component of the paper since it forms the crux of the course.

7. Results – Describe what you have found. Tables/Figures are very important here.

8. Discussion and Conclusions – Describe how this research has advanced our knowledge of your focal variable relationship. Have any hypotheses been rejected (accepted)? Why do you think your results are what they are? Did they confirm (deny) what others have found? Any research limitations? Any suggested further research? (two to four pages)

9. Attach Relevant Output as Attachment 1