DEPARTMENT OF CITY AND REGIONAL PLANNING
University of North Carolina at Chapel Hill

PLAN 721: Advanced Planning Methods

Professor Todd BenDor
Email: bendor@ unc.edu
Phone: 962-4760
Office Hours: 2:00 – 3:30 T,TH, appointment
Office: New East 307

Spring 2008
5:00 – 6:15 MW
Lecture, New East Rm. 301
3:30 – 4:45 TH
Lab, New East Computer Lab

Teaching Assistant: Lilah Besser
Email: lbesser@email.unc.edu
Office Hours: 1:00 – 2:00 F, 4:00 – 5:00 W
Office: New East Computer Lab (2nd Floor)

http://blackboard.unc.edu

DESCRIPTION

This course is a continuation of PLAN 720 and focuses on improving the analytical repertoire of planning students by examining several advanced statistical techniques and surveying several basic topics in system dynamics computer simulation modeling. The goal of this course is to enhance student knowledge and skills in order to better understand planning problems, properly obtain and analyze data, and correctly interpret and present analysis results. Specifically, this course introduces multiple linear regression, logistic regression, non-normal distributions and count modeling, time series analysis, and dynamic simulation modeling. These topics will serve as important background for future courses in transportation and economic development planning. The course will further familiarize students with the use of Microsoft Excel spread sheets, as well as introduce students to statistical analysis using STATA (http://www.stata.com/), and introduce dynamic modeling through the STELLA system dynamics modeling platform.

After taking the course students should be able to clearly analyze planning problems and issues using sophisticated statistical methods, as well as better understand complex feedback dynamics and their policy implications. Moreover, they should be able to support planning decisions based on empirical data and draw logical conclusions from statistical analysis. Finally, students should have a better understanding of feedback and its non-intuitive effects within social and physical systems, as well as an understanding of how to quantify causal relationships in dynamic, complex systems.

We will maintain a course website that will contain course information, course readings, handouts, data and links to relevant websites. This website can be found at: http://blackboard.unc.edu/.

This course meets from January until March 5 and is 1.5 credits.

There are several articles that you should review at the start of the semester in order to brush up on bivariate linear regression (see outline). More readings might be assigned during the semester.
The following are useful references, on-reserve in the planning library:

- D. Huff. 1993. How to Lie with Statistics. New York, NY: W.W. Norton & Company,
- Berry, William. 1993. Understanding Regression Assumptions. Newbury Park, CA: Sage.
- Ford, A. 1999. Modeling the Environment: An Introduction to System Dynamics Modeling of Environmental Systems. Washington, D.C.: Island Press.

Additionally, available online:

- Kennedy, Peter A. 1998. A Guide to Econometrics, Fourth Edition. Cambridge, MA: MIT Press., Available as e-Book through UNC Libraries. [Online]. Available: http://www.netlibrary.com/AccessProduct.aspx?ProductId=11426
  This is an extremely useful book for understanding the intricacies and assumptions of economic data and regression equations.

- Train, Kenneth. 2003. Discrete Choice Methods with Simulation. Cambridge, England: Cambridge University Press. [Online]. Available: http://elsa.berkeley.edu/books/choice2.html
  This book contains lots of information on discrete choice modeling. This book is particularly useful for transportation modeling.

Prerequisites

This is a required course for first year economic development and transportation planning students (1.5 credits). PLAN 720 (or equivalent training in basic statistics) is a required prerequisite for this course. This course becomes more mathematically intensive than PLAN 720, but all evaluations will focus on the correct interpretation and application of techniques rather than theory.

Approach

Quantitative methods are widely used in both public and private sector planning to inform decisions and build knowledge. This process is important since it helps reduce uncertainty in decision-making. Accordingly, this course emphasizes the following themes that are central to solving quantitative problems:

- Planning problems need to be structured. Structuring a problem means that you must develop a plausible conceptual structure of a problem, usually by hypothesizing ('guess') and operationalizing ('quantify and put into action') the nature of relationships between the variables in a system. Think: "How do things affect each other in systems I am dealing with?"
- Having structured the problem, researchers need to design their investigation and collect data on important variables. The data can be obtained from secondary sources (such as the U.S. Census) or primary sources (e.g. telephone interviews, mail-back surveys of the selected population, or measurements in the landscape).
- The data needs to be described, visualized and presented in a coherent manner.
- Statistical tools are used to understand the nature and properties of specific variables and their inter-relationships. There can be considerable variation in the applicability of specific statistical methods, depending on the definition of the problem and availability of data.
- Planners need to draw logical implications from statistically based studies (for decision-making) and understand a study's contributions to planning knowledge, debate and human progress.

We will strive to help you think about planning issues in rigorous statistical terms. The statistical methodology taught in the class will provide one of the key lenses with which you can view and analyze planning problems and evaluate solutions. You will learn about techniques that can help you make decisions in complex planning situations, where you might have little control but can use powerful methods to develop insights, understand key relationships and predict outcomes. We will emphasize the application of statistical concepts and intuition (rather than mathematics) and the use of the Internet for obtaining data and learning statistical methods.

Requirements
The requirements for the course include:

- Attendance, readings and active class participation (10% of the grade).
- Assignments (45% of the grade; 15% each (3)).
- In-Class Quizzes (25% of the grade; 5% each (5)).
- Final Exam (20% of the grade)

Assignments will include exercises that familiarize you with and the methods of statistical modeling that we will be talking about in class. Assignments are intended to help students understand the class materials and students are thus expected to work on them individually. Students can share ideas, but must ultimately reach a conclusion by themselves and hand back their own answer sheet. Assignments will be handed out (and due back) according to the schedule below.

- Late homework assignments will not be accepted.
- All assignments must be completed individually.
- You are expected to show all work on your assignments.
- Assignments should be turned in to my mail box by 5 pm on the due date.
- Please contact the instructor or TA if you have any questions, problems with the readings (or the course), or issues that you wish to discuss.

Quizzes will be given in class and will consist of several short answer and multiple choice questions on your knowledge of both the readings and the previous lectures. Quizzes will be announced and must be completed individually.

There will be one final exam that will test students' knowledge of how to use and interpret the regression models presented in this course. This exam will take place during the last class period of the semester (March 5).

Administrative Issues

Class Changes

The planned dates of classes and topics are shown in this handout. The class is scheduled to meet generally at the regularly scheduled time. Additionally, we will try to keep on track with the topics in this course, although given the tight time schedule, some dynamic modeling subjects may be left out.

Software and Data

To reinforce course objectives and demonstrate/facilitate statistical analysis required for the class, data and computer software will be required. Unlike some of the work you did in PLAN 720, many of the analyses we will use in this course are nearly impossible to complete by hand and you will not be required to do so. Important statistical software tools that we'll use in the DCRP computer lab include:

- Stata – sophisticated statistical analysis software that is available through the Citrix server on the OASIS website. Free stats analysis in your own home! Tutorials to better acquaint you with Stata are available at:
  http://www.ats.ucla.edu/STAT/stata/
  http://www.cpc.unc.edu/services/computer/presentations/statatutorial
  http://www.stata.com/links/resources1.html
- STELLA – system dynamics modeling software used to graphically represent complex feedback systems (Citrix uses v. 7, which is not backward compatible with v. 8 or 9).

Additional Useful Software Available:

- For those of you who are familiar with it, SPSS (Statistical Package for Social Scientists) is also installed in the lab. To learn this software this you can: 1. Check the course website for tutorials. 2. The help menu in SPSS has a tutorial.
- Vensim PLE (Personal Learning Edition; http://www.vensim.com/) is another sophisticated dynamic modeling package that is freely available online. It is not compatible with STELLA and has a sharper learning curve, but it can perform many of the same (and additional) functions.
- Many interesting, non-spatial analyses can be extracted from GIS data. If you want to do GIS analysis from home, the Quantum GIS application (http://www.qgis.org/) is a free, open source GIS package that allows you to avoid buying or dealing with ArcGIS.

Citrix Server
To use the Citrix web applications, you will need to first install the Citrix client web application onto your computer. For MACs go to: http://oasis.unc.edu/help/documentation/mac/apps/ and for PCs go to: http://oasis.unc.edu/help/documentation/miscellaneous-tasks/cinstall/. Access http://oasis.unc.edu/ through Internet Explorer (can have problems with Firefox!) and click the link for Citrix Applications. You will enter your Onyen and computer lab password – STATA and STELLA. Computer lab sessions will be offered during the semester to help familiarize students with the software packages that will be used in the class. The schedule of these lab sessions is given below.

There are many data sources related to various planning disciplines available for analysis online and on the course website. These datasets may be useful in helping to choose a topic for your class project.

The Honor Code

The University of North Carolina at Chapel Hill has had a student-administered honor systems and judicial system for over 100 years. Because academic honesty and trustworthiness are important to professional planning, this is a significant University and Departmental tradition. Your attention is called to the Instrument of Student Judicial Governance for policies and procedures pertaining to the honor system.

Course Outline

Students should read the assigned material before each class.

Topics and Reading:

Multiple Linear Regression Analysis

Course Introduction and Regression Overview ('Who remembers PLAN 720?')
Required Reading:

- Berman, Evan. 2007. Essential Statistics for Public Managers and Policy Analysts. Chapter 12: Simple Regression. Pgs. 198-210.
- Lewis-Beck, Michael. 1989. Applied Regression: An Introduction. Sage: Newbury Park, CA. Chapters 1 and 2: Bi-Variate Regression. Pgs. 1-47.
- Long, J. Scott and Jeremy Freese. 2001. Regression Models for Categorical Dependent Variables Using Stata. Stata Press: College Station, Texas. Chapter 2: Introduction to Stata. Pgs. 13-61.

Additional Sources:

- Berry, William. 1993. Understanding Regression Assumptions. Sage: Newbury Park, CA. *On Reserve in Chapin Library*.

Multivariate Linear Regression (Including Multicollinearity, Transformations, Cooks D)
Required Reading:

- Lewis-Beck, Michael. 1989. Applied Regression: An Introduction. Sage: Newbury Park, CA. Chapter 3: Multivariate Regression. Pgs. 47-74
- Stata Corporation. Linear Regression Entry. 2005. Base Reference Manual (Release 9), Volume 1. College Station, TX: Stata Press. Pgs. 60-107. Pgs. 35-98.
- Long, J. Scott and Jeremy Freese. 2001. Regression Models for Categorical Dependent Variables Using Stata. Stata Press: College Station, Texas. Chapter 2: Introduction to Stata. Pgs. 13-61. (Continued).

Logistic Regression and Time Series

The Binary Logit Regression

Required Reading:

- Berman, Evan. 2007. Essential Statistics for Public Managers and Policy Analysts. Chapter 14: Logistic Regression. Pgs 235-265.
- Rogerson, Peter A. 2001. Statistical Methods for Geography. London, UK: Sage. Section 7.6 – 7.8: Categorical Dependent Variable. Pgs 140-150.
- Stata Corporation. Logistic and Logic Regression Entries. 2005. Base Reference Manual (Release 9), Volume 2. College Station, TX: Stata Press. Pgs. 60-107.

Additional Reading:

- Long, J. Scott and Jeremy Freese. 2001. Regression Models for Categorical Dependent Variables Using Stata. Stata Press: College Station, Texas. Chapter 4: Models for Binary Outcomes. Pgs. 99-136.
- UCLA Stata Website. Stata Topics: Logistic (and Categorical) Regression. [Online]. Available: http://www.ats.ucla.edu/stat/stata/topics/logistic_regression.htm

Unordered Logit Regression: Nominal Outcomes (Multinomial Logistic)

Required Reading:

- Stata Corporation. Unordered (Multinomial) Logistic Regression and Maximum Likelihood Entries. 2005. Base Reference Manual (Release 9), Volume 2. College Station, TX: Stata Press. Pgs. 186-227.
- Newton, Joseph. 2000. Interpreting logistic regression in all its forms (in Adobe .pdf form) (from Stata STB53, Courtesy of, and Copyright, Stata Corporation). [Online]. Available: http://www.ats.ucla.edu/stat/stata/library/sg124.pdf
- Introduction to Stata. UCLA: Academic Technology Services, Statistical Consulting Group. Stata Data Analysis Examples: Multinomial Logistic Regression. [Online] Available: http://www.ats.ucla.edu/stat/stata/dae/mlogit.htm
- Introduction to Stata. UCLA: Academic Technology Services, Statistical Consulting Group. Stata Annotated Output: Multinomial Logistic Regression. [Online] Available: http://www.ats.ucla.edu/stat/stata/output/stata_mlogit_output.htm

Additional Reading:

- Long, J. Scott and Jeremy Freese. 2001. Regression Models for Categorical Dependent Variables Using Stata. Stata Press: College Station, Texas. Chapter 6: Models for Nominal Outcomes. Pgs. 171-221.
- Hahn, Eugene D. 2005. Probit and Logit Models: Differences in the Multivariate Realm. The Journal of the Royal Statistical Society, Series B (In review): [Online]. Available: http://home.gwu.edu/~soyer/mv1h.pdf

Ordered Logit Regression: Ordinal Outcomes

Required Reading:

- Stata Corporation. Ordered Logistic Regression Entries. 2005. Base Reference Manual (Release 9), Volume 2. College Station, TX: Stata Press. Pgs. 340-350.
- Introduction to Stata. UCLA: Academic Technology Services, Statistical Consulting Group. Stata Annotated Output: Ordered Logistic Regression [Online]. Available: http://www.ats.ucla.edu/stat/stata/output/stata_ologit_output.htm
- Introduction to Stata. UCLA: Academic Technology Services, Statistical Consulting Group. Stata Data Analysis Examples: Ordinal Logistic Regression. [Online]. Available: http://www.ats.ucla.edu/stat/stata/dae/ologit.htm

Additional Reading:

- Long, J. Scott and Jeremy Freese. 2001. Regression Models for Categorical Dependent Variables Using Stata. Stata Press: College Station, Texas. Chapter 5: Models for Ordinal Outcomes. Pgs. 137-170.

Count Modeling
Required Reading:

- Introduction to Stata. UCLA: Academic Technology Services, Statistical Consulting Group. Stata Annotated Output: Poisson Regression. [Online]. Available: http://www.ats.ucla.edu/stat/stata/output/stata_poisson_output.htm
- Stata Corporation. Poisson and Negative Binomial Regression Entries. 2005. Base Reference Manual (Release 9), Volume 2. College Station, TX: Stata Press. Pgs, 246-259, 431-444.

Additional Reading:

- Cameron, Colin A. Count Data Regression Made Simple. [Online]. Available: http://cameron.econ.ucdavis.edu/racd/simplepoisson.pdf
- Long, J. Scott and Jeremy Freese. 2001. Regression Models for Categorical Dependent Variables Using Stata. Stata Press: College Station, Texas. Chapter 7: Models for Count Outcomes. Pgs. 223-262.

Time Series Analysis

Introduction to Time Series Analysis
Required Reading:

- Berman, Evan. 2007. Essential Statistics for Public Managers and Policy Analysts. Chapter 15: Time Series Analysis. Pgs 245-265.
- Meier, Kenneth J. 2002. Applied Statistics for Public Administration. Fort Worth, TX: Harcourt College Publishers. Chapter 22: Interrupted Time Series: Program and Policy Analysis. Pgs. 383—400.
- Stata Corporation. TSSET – Declare Data to be Time Series Data. 2005. Time Series Reference Manual (Release 9). College Station, TX: Stata Press. Pgs. 228-237.

System Dynamics Simulation Modeling

Introduction: Causal Relationships and Policy Dynamics
Required Reading:

- Ford, A. 1999. Modeling the Environment: An Introduction to System Dynamics Modeling of Environmental Systems. Washington, D.C.: Island Press. Chapter 1: Overview. Pgs. 3-13

Additional Reading:

- Sterman, J. D. (1991). A Skeptic's Guide to Computer Models. In Barney, G. O. et al. (eds.), Managing a Nation: The Microcomputer Software Catalog. Boulder, CO: Westview Press, 209- 229.

Positive and Negative Feedback
Required Reading:

- Sterman, J. D. Business Dynamics: Systems Thinking and Modeling for a Complex World. Boston, MA: Irwin McGraw-Hill. Chapter 5: Causal Loop Diagrams. Pgs. 137-190.
- Ford, A. 1999. Modeling the Environment: An Introduction to System Dynamics Modeling of Environmental Systems. Washington, D.C.: Island Press. Chapter 7: Causal Loop Diagrams. Pgs. 69-87

Stocks and Flows
Required Reading:

- Deaton, Michael and James Winebrake. 2000. Dynamic Modeling of Environmental Systems. New York, NY: Springer-Verlag. Chapter 1: Overview of Environmental Systems and Chapter 2: Basic Modeling Concepts in Environmental Systems. Pgs 1-65

Policy Development: Application to *Urban Dynamics*

Required Reading:

- Collins, John F. 1974. Chapter 1: Managing Our Cities – Can We Do Better? In: Readings in Urban Dynamics: Volume 1. Edited by Nathaniel Mass. Cambridge, MA: MIT Press. Pgs 3-11.
- Schroeder III, Walter W. Chapter 3: Urban Management Actions. In: Readings in Urban Dynamics: Volume 2. Edited by Walter W. Schroeder III, Robert E. Sweeney, and Louis Edward Alfeld. Cambridge, MA: MIT Press. Pgs. 31-48

Assignments

HW	Handed Out	Due Date	Topic
1	28-Jan	6-Feb	Multivariate and Logistic Regression
2	6-Feb	18-Feb	Time Series and Count Modeling
3	25-Feb	5-March	Dynamic Modeling

Computer Lab Sessions*

Lab	Date given	Topic
1	17-Jan	Linear Regression (STATA)
2	31-Jan	Logistic Regression (STATA)
3	7-Feb	Time Series (STATA)
4	21-Feb	Dynamic Modeling (STELLA)
5	28-Feb	Dynamic Modeling (STELLA)

***Note:** The Lab sessions will be Thursday 3:30 to 4:45 PM at the New East Computer Lab (2nd Floor).