Applied Statistics: Using Large Databases in Education Research

APSTA.GE.2110
Course Syllabus – Spring 2015

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Course description
This course is designed to serve as a bridge between introductory statistics/econometrics and practical work with real, large-scale databases. Although the focus is mainly on datasets relevant to education and education policy research, the skills taught in the course are broadly transferable across subject areas in social, behavioral, and health sciences. Emphasis throughout the course is on hands-on data preparation, workflow, and modeling using the Stata statistical software package.

Course objectives
Upon completion of this course, students will be able to:

- Identify, acquire, and prepare a large-scale database for use in a research project
- Understand and apply the necessary steps in planning a research project with large data
- Understand and apply principles of dataset preparation and workflow, including cleaning, documentation, automation, and replication
- Create a codebook and other data documentation appropriate for a research project
- Understand statistical sampling distributions and the implications of complex survey designs for statistical inference
- Produce descriptive statistics using data collected under a complex survey design
- Estimate simple cross-sectional and panel regression models of the sort frequently used in analyses of large-scale databases
- Replicate the empirical analysis of an existing piece of published research

Prerequisites
At a minimum, one semester of introductory statistics is required. Topics covered should have included simple linear regression, hypothesis testing, and basic topics in descriptive statistics and probability. The course APSTA.GE.2001 (Statistics for the Behavioral and Social Sciences I) fulfills this requirement, as does Wagner’s CORE.GP.1011 (Statistical Methods for Public, Nonprofit, and Health Management).
In addition, students should have either completed or be concurrently enrolled in a course on multiple linear regression or econometrics, such as APSTA.GE.2002 (Statistics for the Behavioral and Social Sciences II) or PADM.GP.2902 (Multiple Regression and Introduction to Econometrics). No prior experience with Stata is assumed or required. If you have concerns about your prior preparation, please see one of us.

**Books**

The following book by J. Scott Long is required:


Many of the practical topics we will cover in class come from this book. If you are new to Stata, we recommend you buy a guide to Stata for your own reference. There are a number of good books on this topic, all available from the [Stata Press](https://www.stata.com/). From most basic to most advanced, we recommend:

(*) *Getting Started with Stata for Windows*, 2013. *(free)* Also: Mac and Unix versions.


*A Introduction to Modern Econometrics Using Stata* by Christopher Baum, 2006.

*Microeconometrics Using Stata, revised edition* by Cameron and Trivedi, 2010.

We also recommend the UCLA Stata guide, which includes tutorials, references, examples, and useful links ([http://www.ats.ucla.edu/stat/stata/](http://www.ats.ucla.edu/stat/stata/)). We will post other useful Stata references on the class website. For creating graphs in Stata, the following book is indispensable:


Later in the semester, advanced students may find the following books on survey methodology useful. We will make some use of both:

Applied Survey Data Analysis, by Heeringa, West, and Berglund, 2010, CRC Press.


**Computer lab and software**

Successful completion of this course will require the use of Stata (any version 11.0 or later should work, but we recommend the most recent release, 13.0). Access to Stata is possible through any of three methods: (1) the Virtual Computer Lab, (2) the (real) computer labs, and (3) purchase.

(1) NYU operates a service called the Virtual Computer Lab (VCL) which provides access to university-licensed software from anywhere with an NYU student login. You can access the VCL through NYUHome or: [https://vcl.nyu.edu/vpn/index.html](https://vcl.nyu.edu/vpn/index.html). Currently, version 13 of Stata SE is accessible through the VCL. Please note that students have experienced problems with the VCL in the past (e.g. downtime, slow connections). Use at your own risk.
(2) As a student you have access to campus computer labs with your ID. (Click [here](#) for a list of campus labs that offer Stata). Lab attendants are not typically experts in Stata, but they can answer system-level questions about opening files, saving, printing, etc. NYU Data Services, located on the 5th floor of Bobst, offers consulting to students who need assistance with statistical software. Contact them for more information, or to make an appointment. Data Services offers occasional tutorials on Stata, SPSS, and other software.

(3) You may be interested in buying Stata for your own computer. Stata version 13 can be purchased at a discounted student rate (the “Campus GradPlan”). “Small” Stata is the least expensive ($35 for six months or $49 for a year), but is limited in the size of datasets it can manage. “Intercooled” Stata is the next level up ($69 for six months or $98 for a year); it can accommodate most projects, but for very large databases a more expensive version may be needed (e.g., SE or MP, available only in labs). For most purposes, you will notice few differences between versions 11-13. However, be aware that minor differences do exist.

Please bring some form of data storage (e.g. a flash drive) to class each week. A [Dropbox](#) account is another alternative for storing data and working files.

**Viewing PowerPoint slides in class**

Waverly 668, unfortunately, is not a well-designed computer lab for lecture presentations. To benefit students sitting in the back few rows we have set up a screen-sharing solution. You will receive an email invitation to participate in a weekly BlueJeans conference. Click on the “Join Meeting” link in this email to participate in the meeting. This will enable you to view the presentation on your own screen. (Note: there is a maximum of 25 participants, so not everyone will be able to use this service. We do not think it will be necessary for those sitting near the front).

**Course requirements**

Your grade for this course will be based exclusively on 10 problem sets that require the use of Stata and real datasets to complete. Each problem set is weighted equally (10% each) and the dates of assignment and submission are listed in the course outline below. We will assign 11 problem sets over the course of the semester, but only count 10 of these. (We will drop your lowest score).

Unless prior arrangements have been made with the professors, problem sets submitted past the original due date will be penalized at the rate of 10 percentage points per week (approximately one complete letter grade). In addition, each student must hand in his or her own work for each problem set. While we encourage you to work together, duplicate work will not be accepted.

Please submit your completed problem set as a PDF document via email to sean.corcoran@nyu.edu. (The two professors will share grading responsibilities, but all assignments can be sent to Professor Corcoran). Use your last name and problem set number as the filename (e.g., Smith Problem Set 2.pdf). Doing so will allow us to grade your assignment quickly and return it to you electronically.

**Other class information**

1. **NYU Classes**: All materials pertaining to this course (lecture notes, readings, problem sets, data) will be made available via NYU Classes. Enrollment in the course should automatically give you access to the class site. Check in frequently for new materials and announcements.
Lecture notes and other relevant materials will generally be posted in advance of class. However, occasional (hopefully rare) delays are to be expected.

2. **Lab etiquette**: The class is held in a computer lab. To help promote a productive learning environment, please keep all other internet activities (e.g. email) to a bare minimum. Please do not use Facebook, instant messaging, or other such services while in the lab, and do not use class time to work on your problem sets (unless we formally give you class time).

3. **Academic integrity**: NYU Steinhardt policies on academic integrity will be *strictly enforced* in this class. You can find the school’s official statement on academic integrity [here](#). You are encouraged to study and work together on problem sets, but all submitted work must be that of the individual student.

4. **Withdrawal**: If you wish to withdraw from the course, please do so formally with the University Registrar. If you withdraw without authorization, you are at risk for receiving a failing grade for the course. *February 17 is the last day for graduate and undergraduate students to withdraw without receiving a “W” on their transcripts.*

5. **Accommodations**: Any student requiring an accommodation due to a chronic psychological, visual, mobility and/or learning disability, or who is Deaf or Hard of Hearing, should register with and consult with the Moses Center for Students with Disabilities at 212-998-4980, 726 Broadway, 2nd floor ([www.nyu.edu/csd](http://www.nyu.edu/csd)). Of course, we are happy to provide any and all accommodations recommended by the Moses Center.
# CLASS SCHEDULE

<table>
<thead>
<tr>
<th>Date</th>
<th>Week</th>
<th>Topic</th>
<th>Assignments</th>
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<tbody>
<tr>
<td>January 28</td>
<td>WEEK 1:</td>
<td>Introduction to “large” datasets</td>
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<tr>
<td>February 4</td>
<td>WEEK 2:</td>
<td>Programming in Stata</td>
<td>PS1 assigned</td>
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<td>February 11</td>
<td>WEEK 3:</td>
<td>Workflow—organizing and planning a project</td>
<td>PS1 due</td>
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<td>PS2 assigned</td>
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<tr>
<td>February 18</td>
<td>WEEK 4:</td>
<td>Accessing large scale databases</td>
<td>PS2 due</td>
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<td>PS3 assigned</td>
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<td>February 25</td>
<td>WEEK 5:</td>
<td>Workflow—data preparation and cleaning</td>
<td>PS3 due</td>
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<td>PS4 assigned</td>
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<tr>
<td>March 4</td>
<td>WEEK 6:</td>
<td>Workflow—descriptive analysis</td>
<td>PS4 due</td>
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<td>PS5 assigned</td>
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<td>March 11</td>
<td>WEEK 7:</td>
<td>Workflow—automation, documentation and replication</td>
<td>PS5 due</td>
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<td>PS6 assigned</td>
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<tr>
<td>March 18</td>
<td>NO CLASS—SPRING BREAK</td>
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<td>March 25</td>
<td>WEEK 8:</td>
<td>Guest speaker</td>
<td>PS6 due</td>
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<td>April 1</td>
<td>WEEK 9:</td>
<td>Sampling and sampling distributions</td>
<td>PS7 assigned</td>
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<td>April 8</td>
<td>WEEK 10:</td>
<td>Working with complex survey designs</td>
<td>PS7 due</td>
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<td>PS8 assigned</td>
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<td>April 15</td>
<td>WEEK 11:</td>
<td>Multiple regression analysis—applications</td>
<td>PS8 due</td>
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<td>PS9 assigned</td>
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<td>April 22</td>
<td>WEEK 12:</td>
<td>Methods for panel data analysis (I)</td>
<td>PS9 due</td>
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<td>PS10 assigned</td>
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<td>April 29</td>
<td>WEEK 13:</td>
<td>Methods for panel data analysis (II)</td>
<td>PS10 due</td>
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<td>PS11 assigned</td>
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<td>May 6</td>
<td>WEEK 14:</td>
<td>Scale development</td>
<td>PS11 due</td>
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COURSE OUTLINE

(*) = required reading, all others are recommended

WEEK 1: Introduction to “large scale” datasets

(*) Buckley, chapter 1, “Introduction to Large-Scale Education Data”


WEEK 2: Programming in Stata

(*) Long, chapter 3 and Appendix A

Getting Started with Stata for Windows and/or Acock, chapters 1-4

WEEK 3: Workflow—organizing and planning a project

(*) Long, chapters 1-2


WEEK 4:  Accessing large scale databases

(*) Buckley, chapter 2, “Accessing Large-Scale Education Data”


National Longitudinal Survey of Youth: Children and Young Adults. “Introduction to the Sample.” https://www.nlsinfo.org/content/cohorts/nlsy79-children/intro-to-the-sample

National Longitudinal Survey of Youth: Children and Young Adults. “Using and Understanding the Data” https://www.nlsinfo.org/content/cohorts/nlsy79-children/using-and-understanding-the-data

WEEK 5:  Workflow—data preparation and cleaning

(*) Long, chapters 5-6

Getting Started with Stata for Windows and/or Acock, chapter 3

Background on National High School Longitudinal Study of 2009 here: http://nces.ed.gov/surveys/hls09/

WEEK 6:  Workflow—descriptive analysis

(*) Long, chapter 7

(*) Remler and Van Ryzin. 2011. Research Methods in Practice: Methods for Description and Causation, chapter 8, “Making Sense of the Numbers”

Acock, chapters 5-7

WEEK 7:  Workflow—automation, documentation and replication

(*) Long, chapters 2 and 4
WEEK 8: Guest speaker

WEEK 9: Sampling and sampling distributions

(*) Heeringa, West, and Berglund, chapter 1, “Applied Survey Data Analysis: Overview,” and chapter 2, “Getting to Know the Complex Survey Design”


Groves, R.M. et al., chapter 4, “Sample Design and Sampling Error”


WEEK 10: Working with complex survey designs


(*) Buckley, chapter 5, “Analysis of Complex Survey Data”

Heeringa, West, and Berglund, chapter 3, “Foundations and Techniques for Design-Based Estimation and Inference”


WEEK 11: Multiple regression analysis—applications

(*) Buckley, chapters 6-7, “Multiple Linear Regression with Stata,” chapters 8-9, “Multiple Regression Pathologies”

(*) Long, chapter 7

Acock, chapter 8 and 10 and/or Baum chapters 4-5, 7

UCLA webbook Regression with Stata (http://www.ats.ucla.edu/stat/stata/webbooks/reg/)

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**WEEK 12: Methods for Panel Data Analysis—I**

(*) Buckley, chapter 10, “Introduction to Modeling Panel Data”

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**WEEK 13: Methods for Panel Data Analysis—I**

Baum, chapter 9 (section 1) and/or Cameron and Trivedi, chapter 8.


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**WEEK 14: Scale development**


Acock, chapter 12