Econometrics

MIT (14.32) **J. Angrist (angrist@mit.edu)**
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This course covers the statistical tools needed to understand empirical economic research and to plan and execute independent research projects. Topics include statistical inference, regression, generalized least squares, instrumental variables, simultaneous equations models, and the evaluation of government policies and programs.

Prerequisites

14.30 or equivalent. Students should be familiar with basic concepts in probability theory and statistical inference. The course includes a brief statistics review.

Course requirements

Classroom work: Two lectures (TTH 10:30-12:00; E51-151), weekly recitation (F 9:00 E51-372).

Other work: In addition to the readings, there are 6 graded problem sets and ungraded review problem sets at the beginning and end of the course. The graded problem sets have both analytical and computer-exercise components. The statistical analysis is to be done using Stata on Athena workstations or PCs. Help for new Stata users will be given in recitation.

Grades

Grades will be computed as follows: a total of 100 points, 5 points for each problem set, 30 points for the midterm, and 40 points for the final.

Problem sets are mandatory and solutions should be submitted on time to receive credit. Stata logs should be submitted with solution sets. A grade of 50% or better on at least 5 problem sets is required in order to be eligible to take the final. Consult with classmates on problem sets if you get stuck, but written solution sets should be your own work.

Texts and readings

J.M. Wooldridge, *Introductory Econometrics*, 3rd Edition, South-Western (2006).
A.S. Goldberger, *A Course in Econometrics*, Harvard University Press (1991).
M. H. DeGroot and M.J. Schervish, *Probability and Statistics*, 3rd edition, Addison-Wesley (2002).

Wooldridge is the main text. The material in Goldberger is more advanced and optional. Both books are available at the Coop. DeGroot and Schervish is a recommended text for statistics review.

Other readings (published journal articles) are indicated on the course outline. These are available on our Stellar web site (http://stellar.mit.edu/S/course/14/sp07/14.32/).

Course outline for 14.32

A. Probability review

Lecture Note 1: **Probability and Distribution**
Lecture Note 2: Expectation and Moments

Wooldridge, Appendices A and B
Goldberger, Chapters 1-7
DeGroot, Chapters 1-5

B. Review of statistical inference (point and interval estimation; hypothesis testing)

Lecture Note 3: Sampling Distributions and Inference
Lecture Note 4: **Approximate [Asymptotic] Distribution of the Sample Mean**
Lecture Note 5: **Confidence Intervals**

Wooldridge, Appendix C
Goldberger, Chapters 8-10
DeGroot, Chapters 6-8

S.A. Woodbury and R. Spiegelman, "Bonuses to Workers and Employers to Reduce Unemployment: Randomized Trials in Illinois," *American Economic Review* 77[4], September 1987.

C. Regression I -- Why and How?

Lecture Note 6: **Bivariate Regression**
Lecture Notes 7, 8: Sampling Distribution of Regression Estimates
Lecture Note 9: Residuals, Fitted Values, and Goodness of Fit
Lecture Note 10 : Introduction to Multivariate Regression
Lecture Note 11: Multivariate Regression (cont.)

Wooldridge, Chapters 1-5
Goldberger, Chapters 13-16

D. Regression II -- Using multiple regression

Lecture Note 12a: Using Multivariate Regression
Lecture Note 12b: Regression analysis of "natural experiments" -- the minimum wage controversy

Wooldridge, Chapter 6-7, 19
Goldberger, Chapters 17-24

A. Krueger, "How Computers Have Changed the Wage Structure: Evidence from Micro Data," *Quarterly Journal of Economics*108[1], February 1993, 33-60.

DiNardo, J. and J.S. Pischke, "The Returns to Computer Use Revisited: Have Pencils Changed the Wage Structure Too?," *The Quarterly Journal of Economics* 112 [1], February 1997, 291-303.

A. Krueger and S.B. Dale, "Estimating the Payoff to Attending a More Selective College: An Application of Selection on Observables and Unobservables," *The Quarterly Journal of Economics* 117, November 2002, 1491-1529.

Chapters 1-4 in D. Card and A. Krueger, *Myth and Measurement: The New Economics of the Minimum Wage*, Princeton University Press, 1995.

E. Inference problems -- heteroscedasticity and autocorrelation

Lecture Note 13a: **Heteroscedasticity**, **Linear Probability Models**
Lecture Note 13b, 13c: **Serial Correlation**

Wooldridge, Chapter 8, 12
Goldberger, Chapters 27-28

R. Freeman and A. Castillo-Freeman, "When the Minimum Wages Really Bites: The Effect of the US-Level Minimum on Puerto Rico," in G. Borjas and R. Freeman, eds., *Immigration and the Work Force*, Chicago: University of Chicago press, 1992.

K. Graddy, "Testing for Imperfect Competition at the Fulton Fish Market," *RAND Journal of Economics* 26[1], Spring 1995, 75-92.

F. Instrumental variables

Lecture Note 14a: Instrumental Variables for omitted-variables problems

Wooldridge, Chapter 15.
Goldberger, Chapter 31.

J. Angrist, "Lifetime Earnings and the Vietnam Era Draft Lottery: Evidence from Social Security Administrative Records," *American Economic Review* 80[3], June 1990, 313-336.

J. Angrist and W.E. Evans, "Children and Their Parents' Labor Supply: Evidence from Exogenous Variation in Family Size," *American Economic Review* 88, June 1998, 450-477.

J. Angrist and A. Krueger, "Does Compulsory School Attendance Affect Schooling and Earnings?," *Quarterly Journal of Economics* 106, November 1991.

Lecture Note 14b: IV and measurement error

O. Ashenfelter and A. Krueger, "Estimates of the Economic Returns to Schooling from a New Sample of Twins," *American Economic Review* 84[5], December 1994, 1157-1174.

Lecture Note 14c: regression-discontinuity

J. Angrist and V. Lavy, "Using Maimonides Rule to estimate the Effects of Class Size on Scholastic Achievement," *Quarterly Journal of Economics*, May 1999.

G. Simultaneous-equation models

Lecture Note 15: Simultaneous Equations Models -- Motivation and Identification
Lecture Note 16: Simultaneous Equations Models -- Estimation

Wooldridge, Chapter 16.
Goldberger, Chapters 32-34

J. Angrist, G. Imbens, K. Graddy, "The Interpretation of Instrumental Variables Estimators in Simultaneous Equations Models with an Application to the Demand for Fish," *Review of Economic Studies* 67[3], July 2000, 499-257(29).