

## Econometrics

MIT (14.32)  
Spring 2001

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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 (E51-057): Two lectures (TTH 10:30-12:00), weekly recitation (F 10:00).

Other work: In addition to the readings, there are 6 graded problem sets, an empirical project, 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 SAS on Athena workstations. Help for new SAS users will be given in recitation. The empirical project consists of an attempt to replicate and extend a published empirical study.

### Grades

Grades will be computed as follows: a total of 100 points, 5 points for each of the 5 best problem sets, 25 points for the midterm, 10 points for the project, and 40 points for the final.

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

### Texts and readings

J.M. Wooldridge, *Introductory Econometrics*, South-Western (1999).  
A.S. Goldberger, *A Course in Econometrics*, Harvard University Press (1991).  
M. H. DeGroot, *Probability and Statistics*, Addison-Wesley (1975).

Wooldridge is the basic text. The material in Goldberger is more advanced and optional. Both books are available at the Coop. DeGroot is a recommended statistics text for review. Novice SAS users may find *The Little SAS Book* helpful. It is also available at the Coop.

Other readings (published journal articles) are as indicated on the course outline. These are available in a reading packet. The class project also draws on material from the book,

D. Card and A. Krueger, *Myth and Measurement: The New Economics of the Minimum Wage*, Princeton University Press (1995).

Course outline for 14.32

A. Review of probability and distribution

**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, September 1987, 513-530.

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*, February 1993.

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.

D. Card and A. Krueger, "Minimum Wages and Employment: A Case Study of the Fast-Food Industry in New Jersey and Pennsylvania," *American Economic Review* 84 (1994), 772-93.

L. Katz and A. Krueger, "The Effect of the Minimum Wage on the Fast Food Industry," *Industrial and Labor Relations Review* 46 (1992), 6-21.

E. Inference problems -- autocorrelation and heteroscedasticity

**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*, Spring 1995.

F. Instrumental variables

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

**Lecture Note 14b: IV and measurement error**

Wooldridge, Chapter 15.  
Goldberger, Chapter 31.

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

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

H. 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, "Non-Parametric Demand Analysis with an Application to the Demand for Fish," *Review of Economic Studies*, July 2000.

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### Empirical Project

A controversial issue in economics today is whether legal minimum wages reduce employment. Until recently, the consensus among professional economists, based on theoretical reasoning and empirical research, was that minimum wages cost jobs. Beginning in 1992, however, this consensus came under attack in a series of empirical studies that failed to find negative effects of minimum wages on employment. In some cases, these new estimates even suggested that increases in the minimum wage caused an increase in employment (something noted by president Clinton in his 1996 State of the Union Address). The project asks you to re-estimate the results from one of the most influential recent minimum wage studies.

#### A. Background readings:

Chapters 1-4 and 6 in: *Myth and Measurement: The New Economics of the Minimum Wage*, Princeton University Press, 1995 (Chapter 2 was originally published as Katz and Krueger [1992] and Card and Krueger [1994]).

Ronald G. Ehrenberg, editor, "Review Symposium," in *The Industrial and Labor Relations Review* 48 (July 1995), pp. 828-849.

Taeil Kim and Lowell J. Taylor, "The Employment Effect in Retail Trade of California's 1988 Minimum Wage Increase," *Journal of Business and Economic Statistics* 13, No. 2 (April 1995), 175-182

D. Deere, K.M. Murphy, and F. Welch, "Employment and the 1990-91 Minimum-Wage Hike," *American Economic Review* 85 (May 1995), 232-237.

This material is on reserve. The journal articles are in the reading packet. The Coop also has copies of the Card and Krueger book for sale.

#### B. Assess the controversy

Write a 3-4 paragraph summary of the minimum wage controversy.

What are the questions being tackled in this literature? Why are they so difficult? Why are they important? Why have they drawn special attention in the last 10 years? What empirical strategies have been used to answer the questions of interest?

#### C. Conduct a replication study

Pick a study from one of the 6 below, then pick two tables in your study containing the most important findings regarding the effects of minimum wages on employment. Replicate these tables using the authors' data. Briefly describe your replication effort. Was it successful? If not, what do you think the problem is? If successful, did you have any special difficulties? Attach SAS logs showing your work. Report replication results in tables comparing your results with the original.

## Replication selections

From *Myth and Measurement*:

1. Chapter 2, “Evidence from the Fast Food Industry,” the New Jersey study (employment effects only).
2. Chapter 2, “Evidence from the Fast Food Industry,” the Texas study.
3. Chapter 4, “The Effect of the Federal Minimum on Low-wage Workers: Evidence from Cross-State Comparisons,” The study of Effects of the Minimum Wage on Teenagers
4. Chapter 4, “The Effect of the Federal Minimum on Low-wage Workers: Evidence from Cross-State Comparisons,” The study of Effects on the Retail-Trade and Restaurant Industries
5. Chapter 6, “Evaluation of Time-Series Evidence”

Data from these studies may be obtained from:

<ftp://irs.princeton.edu/MINIMUM/>

From the *Journal of Business and Economic Statistics* (a slightly more technical study):

6. David Neumark and William Wascher, “Minimum Wage Effects on Employment and School Enrollment,” Volume 13, No. 2 (April 1995), 199-206.

Data from:

[ftp://www.amstat.org/JBES\\_View/95-2-APR/neumark\\_wascher/](ftp://www.amstat.org/JBES_View/95-2-APR/neumark_wascher/)

D. Extend the empirical work you have replicated (up to 5 points extra credit)

This can be done by estimating specifications that the authors did not report; adding additional variables to the models using information that you have collected; updating the authors’ sample; or by using a different sample to estimate similar models. Explain the motivation for your extension and write up your findings.