

Prof. Rucker Johnson  
Spring Semester 2015

## Quantitative Methods II Public Policy 240B

### Course Overview

In this course, we are going to build on the foundations in statistical theory covered in the first semester to explore in detail the statistics associated with estimating relationships between variables. The primary focus of this course is on the use of regression analysis, a statistical technique for quantifying and making inferences about relationships between variables. Regression analysis is increasingly used to evaluate and provide quantitative assessments of existing public policies and programs. For example, these empirical techniques have been employed to assess the effects of head start on the long term socioeconomic outcomes of children, to test whether lenders racial discriminate against African-Americans seeking mortgages, and to assess the effect of the prison incarceration rate on crime. As policy analysts, you will need to understand these research methods, how to apply them, and how to assess the validity of social scientific research based on these empirical techniques.

While the principal objective of the course is to introduce the statistical models used to measure association between random variables (specifically, linear and non-linear regression analysis), an important sub-theme that will be salient in most of our discussions this semester concerns the issue of actually determining causality. In a nutshell, regression analysis uses data samples to estimate the relationship between dependent and explanatory variables. An important point that should always be kept in mind is that for most empirical studies in the social sciences **correlation does not imply causation no matter how fine the correlation is measured**. When analyzing observational or non-experimental data, there are a number of factors that may lead one to conclude that a given variable causally affects another variable, when in fact, there is no effect. For example, the explanatory variable of interest may not have an effect but may be highly correlated with variables that do. Alternatively, the direction of causation may run in the opposite direction of that which is being hypothesized. Throughout the course, we will be highlighting such problems and presenting statistical techniques designed to address these issues.

This course has several goals. The first is to familiarize you with the vocabulary, methods, and results of econometric theory. We will be mainly concerned with using, rather than proving, the theory. Over the course of the semester, we will study how to address the most important issues that arise when doing an econometric study. These issues include (1) endogeneity of regressors due to omitted variables, simultaneity, or selection, (2) functional form, (3) choice of control variables, (4) measurement error in regressors and handling of outliers, (5) efficient estimation in the presence of heteroskedasticity, (6) appropriate estimation of standard errors and test statistics, and (7) presentation of results.

Second, you should strive to become an educated/critical consumer of empirical research. We will read and critique a number of empirical papers and program evaluations. The usual approach will be to discuss 1) the economic, political, and policy issues that motivate the application, 2) the econometric techniques and issues related to the application (e.g., data, specification, estimation techniques), and 3) the results of the empirical analysis and what we can learn from them.

Your work in this course will be multi-faceted. You will be assigned 5 (depending on how quickly we move through the material) “hands-on” applied problem sets. These frequently will

involve replicating some results from published work. Replicating what others have done is a good way to understand the choices involved in applied work. We will use STATA, the leading computer program for statistical analysis in the social sciences, and by the end of the course you should have acquired a variety of skills that will be useful for doing public policy research. To gain skill as an “educated/critical consumer” you will be required to write a summary and critique of an applied policy research paper. Detailed guidelines on this writing assignment will be given to you early in the semester. There will be three exams.

### *Meeting Times*

The first class section will meet Mondays and Wednesdays from 8:10 to 10:00 am, and the second class section from 10:10am to noon, both in GSPP 250. In addition, there are discussion sections on Fridays where material presented during the week will be reviewed.

### *Grades*

Grades will be based on 3 exams (25 percent each), 5 problems sets (worth a cumulative 15 percent) and a writing assignment (10 percent). Problem sets will be handed out in class and are due a week later (we will then distribute answer keys). Late problem sets are docked 20 percentage points per day.

The writing assignment will involve use of data and regression analysis to write a short empirical paper that answers one of the 5 general questions outlined below using data provided. You are to utilize the techniques we’ve outline in class such as the multivariate regression model, interpreting coefficients, using t and F-tests, the use of dummy variables, etc. when addressing your question. You will work in groups of 3-5.

1. **What is the impact of alcohol consumption on labor market outcomes?**
2. **Has the Affordable Care Act (ACA) Increased Insurance Coverage for Young Adults?**
3. **How does obesity and being overweight impact health care utilization spending among the elderly?**
4. **What are the determinants of test scores for 5<sup>th</sup> grade students?**
5. **How has the college premium changed over time?**

### *Readings*

The required textbook for this class is *Introductory Econometrics*, Jeffrey M. Wooldridge (Southwestern, 5<sup>th</sup> edition, 2013). More than others, this text has lots of examples and is written for students who are or will be doing applied work. The textbook is available at the campus bookstore. There is also a reader for this course. The reader will be available at Vic’s Copies, 2843 Hearst Avenue, Berkeley. The reader is a collection of scholarly articles that we will be reading throughout the semester.

### *STATA*

STATA version 12.0 is available in the computer lab. However, you can buy a one-year license to use STATA at home if you wish, through the STATA website (at <http://www.stata.com/order/new/edu/gradplans/gp2-order.html>). The student rate is \$49 for “small” STATA (a scaled-back version) and \$98 for the standard Intercooled STATA. We will distribute a STATA tutorial guide. (If you prefer SPSS or SAS that is fine too).

*Office Hours*

Johnson's office is on the third floor of the new building, room #347. His office hours for this course are Tuesdays, 1-3pm. Johnson can also be reached by phone at 643-0169 and Email at: [ruckerj@berkeley.edu](mailto:ruckerj@berkeley.edu)

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**Week 1: Introduction**

- W January 21      **TOPIC:** **Course Intro • Review of Syllabus • Overview of Quantitative Program Evaluation • Inferring Causality: experimental vs. non-experimental data analysis**
- READING:**
- Wooldridge Ch 1
  - Freedman, David. 1999. “From Association to Causation: Some Remarks on the History of Statistics,” *Statistical Science*, 14(3), pp. 243—258. [LINK](#)
  - Manski, Charles. 1995. “Introduction,” in *Identification Problems in the Social Sciences*, Harvard University Press, Chapter 1, pp. 1—9.
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**Week 2: Review of Statistical Inference & Introduction to Linear Regression Analysis**

- M January 26      **TOPIC:** **Review of Probability & Distribution (expectation and moments) • Review of Statistical Inference (Point and Interval Estimation—confidence intervals; Hypothesis Testing--testing for differences in means; sampling distributions and inference; approximate asymptotic distribution of the sample mean)**
- READING:**
- W Appendices A, B
  - W Appendix C
  - (mathematics, probability, and statistics review for refreshing memories)
- \* **ASSIGNMENT:** **Hand out first problem set (due Feb.6)**
- W January 28      **TOPIC:** **Introduction to Regression Analysis—Why & How? (Bivariate Regression)**
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**Week 3: Introduction to Linear Regression Analysis & the Two-Variable Model**

- M Feb 2      **TOPIC:** **Introduction to Regression Analysis—Why & How? (Bivariate Regression—Structure of data; Mechanics of OLS, Assumptions required for Unbiasedness, Relationship to Correlation)**
- READING:**
- W Ch 2
- W February 4      **TOPIC:** **The Two Variable Regression Model (cont'd)--Sampling Distribution of Regression Estimates; Residuals, Fitted Values & Goodness of Fit; Hypothesis Tests; Confidence Intervals**
- READING:**
- W Ch 2
- F February 6      \*\* **ASSIGNMENT DUE:** **First Problem set due**
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**Week 4: Multiple Regression Analysis: Estimation**

M February 9      TOPIC: **Motivation for Multiple Regression Analysis • Interpretation of Coefficients • Omitted Variable Bias**

READING:

- W Ch 3

\* ASSIGNMENT: **Hand out second problem set (due Feb. 20)**

W February 11      TOPIC: **Multiple Regression Analysis—Inference & Hypothesis Tests: t-Test, p-value, confidence intervals**

READING:

- W Ch 3, Sections 4.1-4.3
- McCloskey, Deirdre N. and Stephen T. Ziliak. 1996. “The Standard Error of Regressions.” *Journal of Economic Literature*, 34(1), pp. 97—114. [LINK](#)

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**Week 5: Multiple Regression Analysis: Inference & Hypothesis Testing**

M February 16      NO CLASS – Presidents’ Day

W February 18      TOPIC: **Multiple Regression Analysis—Inference & Hypothesis Testing (cont’d) • Multicollinearity**

READING:

- W Ch 3, Sections 4.1-4.3
- W Ch 3 (p.97-100)

READING: Brown, Charles and Mary Corcoran (1997) “Sex-based Differences in School Content and the Male-female Wage Gap” *Journal of Labor Economics*, 15(3): 431-465. [LINK](#)

F February 20      \*\* ASSIGNMENT DUE: **Second Problem set due**

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**Week 6: First Midterm**

M February 23      TOPIC: **Model Specification--Dummy Variables, Interaction terms, & Quadratics • Tests of Joint Hypotheses—Goodness of Fit Measures, Tests involving more than 1 regression coefficient**

READING:

- W Ch 7.1-7.4, 7.6
- W Sections 4.4-4.6

W February 25      *Review for Midterm*

F Feb 27      🌟 **MIDTERM DURING SECTION**

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**Week 7: Application of Multiple Regression Models: Decomposing Group Differences, Specification Choices**

M March 2

Application#1: The Black/White Wealth Gap

READING: J. Altonji, U. Doraszelski and L. Segal, "Black/White Differences in Wealth" Economic Perspectives Federal Reserve Bank of Chicago, Winter 2000 (<http://www.chicagofed.org/publications/economicperspectives/2000/Epart3.pdf>)

Application#2: Racial Disparities in Federal Sentencing

READING: Anwar, S., P. Bayer and R. Hjalmarrsson (2012). "[The Impact of Jury Race in Criminal Trials](#)". *Quarterly Journal of Economics* 127(2), 1017-1055.  
Mustard, David B. (2001), "Racial, Ethnic, and Gender Disparities in Sentencing: Evidence from U.S. Federal Courts," *Journal of Law and Economics*, 44(1): 285-314. [LINK](#)

W March 4

TOPIC: Model Specification—Functional Form and Variable SelectionREADING:

- W Ch 6.1-6.3 (Also p.685-691)
- Leamer, Edward (1983) "Let's Take the 'Con' Out of Econometrics," *American Economic Review* 73, 31-41. [LINK](#)

\* ASSIGNMENT: Hand out third problem set (due March 13)

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**Week 8: STOP THE CLOCK WEEK. "Real World" Issues—Violation of the Basic Assumptions**

M March 9

*SPECIAL GUEST: CONGRESSMAN BARNEY FRANK on The Causes and Consequences of the Sub-Prime Mortgage Crisis*

(assigned reading: Rugh, Jacob and Douglas Massey (2010). "[Racial Segregation and the Home Foreclosure Crisis](#)," *American Sociological Review* 75(5): 629-651)

W March 11

TOPIC: Measurement Error, Missing Data, and Sensitivity of Results to Particular ObservationsREADING:

- W Sections 9.3,9.4
- Hausman, Jerry. 2001. "Mismeasured Variables in Econometric Analysis: Problems from the Right and Problems from the Left." *Journal of Economic Perspectives*, 15(4), pp. 57—68. [LINK](#)

F March 13

ASSIGNMENT DUE: Third Problem Set

\* Handout fourth problem set (due March 20)

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**Week 9: Study Designs to Distinguish Correlation from Causality—Accounting for Omitted Variable Bias**

M March 16

TOPIC: Using Proxy Variables for Unobserved Explanatory Variables to address Omitted Variable BiasTOPIC: Adding Controls to Account for Omitted Variable BiasREADING:

- W Section 9.2

Application: Explaining Black-White Wage Differences

READING: Neal, Derek A. and William R. Johnson (1996), "The Role of Premarket Factors in Black-White Wage Differences," *The Journal of Political Economy*, 104(5): 869-95. [LINK](#)

W March 18      TOPIC: Heteroscedasticity  
READING:  
 • W, Ch 8.1-8.4

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F March 20      ASSIGNMENT: Fourth problem set due

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M March 23      **NO CLASS: Spring Recess**

W March 25      **NO CLASS: Spring Recess**

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**Week 10: Panel Data Techniques**

M March 30      TOPIC: Introduction to Panel Data Techniques (Sources of variation/identification, Difference Estimators)  
READING:  
 • W Ch 13.3-13.5  
TEXT READING: W Ch 13.3-13.5, 14.3  
 Moffitt, Robert (2005). "Remarks on the Analysis of Causal Relationships in Population Research." *Demography* 42(1): 91-108. [LINK](#)

W April 1      **REVIEW FOR MIDTERM**

F April 3      ✪ **MIDTERM EXAM DURING SECTION**

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**Week 11: Panel Data Techniques/Applications and Natural Experiments**

M April 6      Application#1: The Effects of Teenage Pregnancy on Socioeconomic Outcomes  
READING: Geronimus, A.T. and S. Korenman. 1992. "The Socioeconomic Consequences of Teen Childbearing Reconsidered." *Quarterly Journal of Economics* v. 107, pp. 1187-1214. [LINK](#)  
Application#2: The Effects of Head Start on Socioeconomic Outcomes  
READING: Deming, David. "Early Childhood Intervention and Life-Cycle Skill Development: Evidence from Head Start". 2009. *American Economic Journal: Applied Economics*, 1(3): 111-34. [LINK](#)

ASSIGNMENT: Hand out writing assignment (due April 22)

W April 8

**TOPIC: Natural/quasi Experimental Designs: pre-/post-intervention observation with a comparison group (Difference-in-Difference Estimators)**

**TEXT READING:** W Ch 13.1-13.2

**Diff-in-Diff Application: Microeconomic Effects of Disease Eradication**

- Bleakley, Hoyt. Disease and Development: Evidence from Hookworm Eradication in the American South, *Quarterly Journal of Economics*, February 2007, ([available via the MIT Press](#)).

**Application: The Effect of the Minimum Wage**

**READING:** Card, David and Alan B. Krueger (1994), “Minimum Wages and Employment: A Case Study of the Fast Food Industry.” *AER* 84(4): 772-793. [LINK](#)

**Related Application Readings: Community Impacts of Local Economic Development**

- Pat Kline & Matias Busso. 2009. [Do Local Economic Development Programs Work? Evidence from the Federal Empowerment Zone Program](#), *AER* forthcoming.

**Week 12: Empirical Methods for Program Evaluation—Quasi-experimental designs (continued)**

M April 13

**TOPIC: Empirical Methods for Program Evaluation**

**Application#1: The effects of school quality on adult attainments**

**READING:** Johnson, Rucker (2014). “Long-run Impacts of School Desegregation & School Quality on Adult Attainments” NBER working paper #16664. [LINK](#)

**Application #2: Evaluating the Effect of Tuition and Financial Aid Policies**

**READING:** Dynarski, Susan (2003) “Does Aid Matter? Measuring the Effect of Student Aid on College Attendance and Completion.” *AER* 3(1), 279-288. [LINK](#)

W April 15

**TOPIC: Advantage & Disadvantages of Experiments**

**Application#1: Effects of expanding access to public health insurance**

**READING:** Finkelstein, Amy, et al., 2012. “The Oregon Health Insurance Experiment: Evidence from the First Year”. *Quarterly Journal of Economics* 127(3), 1057-1106. [LINK](#)

**Application#2: Neighborhood Effects**

**READING:** Katz, Lawrence, Jeffrey Kling, and Jeffrey Liebman, “[Moving to Opportunity in Boston: Early Results of a Randomized Mobility Experiment](#),” *Quarterly Journal of Economics*, 2001, 116(2), 607-654. HUD [LINK](#) Exec Summary: [LINK](#)

**Application#3: Labor Market Discrimination**

- READING:**
- Marianne Bertrand and Sendhil Mullainathan. 2004. “Are Emily and Greg More Employable than Lakisha and Jamal? A Field Experiment on Labor Market Discrimination.” *American Economic Review* Vol.94(4): [LINK](#)
  - Heckman, James J. and Jeffrey A. Smith. 1995. “Assessing the Case for Social Experiments.” *Journal of Economic Perspectives*, 9(2), pp. 85—110. [LINK](#)

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**Week 13: Randomized Experiments and Instrumental Variables Approaches**

M April 20

**TOPIC: Instrumental Variables Approach/ 2 Stage Least Squares for Omitted-Vars Prob**  
**TEXT READING: W Ch 15**

**Application#1: Long-run Effects of School Spending & Class Size**

**READINGS:** Jackson, Kirabo, Rucker C. Johnson, Claudia Persico (2015). [“The Effects of School Spending on Educational & Economic Outcomes: Evidence from School Finance Reforms”](#). NBER working paper #20847.

Chetty, R., Friedman, J.N., Hilger, N., Saez, E., Schanzenbach, D.W., Yagan, D. (2011). [How does your kindergarten classroom affect your earnings? Evidence from Project STAR](#). *Quarterly Journal of Economics* 126: 1593-1660.

**Application#2: Effect of School Vouchers on Achievement**

**READINGS:** Dobbie, W. and Fryer, R. (2011). [“Are High Quality Schools Enough to Close the Achievement Gap? Evidence from a Social Experiment in Harlem.”](#) *American Economic Journal: Applied Economics*, 3(3): 158-87.

W April 22

**TOPIC: Endogeneity, Instrumental Variables Approach/ 2 Stage Least Squares for Omitted-Variables Problem**

**READING:**

• W Ch 15

• Angrist, Joshua D. and Alan B. Krueger. 2001. [“Instrumental Variables and the Search for Identification.”](#) *Journal of Economic Perspectives* v. 15, pp. 69-86.

IV/2SLS Examples:

**Application: ADHD Diagnosis & (Mis)Treatment among School-age Children**

**READING:** Evans, Williams, Melinda Morrill, and Stephen Parente (2010). [“Measuring Inappropriate Medical Diagnosis and Treatment in Survey Data: The Case of ADHD among School-Age Children.”](#) *Journal of Health Economics*, 29(5): 657-673.

**Application: Effect of Incarceration on Crime**

**READING:** Levitt, Steven (1996). [“The Effect of Prison Population Size on Crime Rates: Evidence from Prison Overcrowding Litigation.”](#) *Quarterly Journal of Economics*, 111(2): 319-51.

**ASSIGNMENT DUE: Writing Assignment**

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**Week 14: Quasi-Experimental Research Designs (cont'd): Regression Discontinuity**

M April 27

**TOPIC: Regression Discontinuity Designs**

**READING:** Class notes; **Health Impacts of Universal Insurance Coverage**

Card, David, Carlos Dobkin and Nicole Maestas, [“Does Medicare Save Lives?”](#) *Quarterly Journal of Economics*, 2009, 124(2), 597-636.

**ASSIGNMENT:** Hand out fifth problem set (due May 6<sup>th</sup>)

W April 29

**TOPIC: *Regression Discontinuity Designs*** (cont)

**Application: Long-run Effects of Head Start Revisited**

**READING:** Ludwig, Jens and Doug Miller (2007). "[Does Head Start Improve Children's Life Chances? Evidence from a Regression Discontinuity Design](#)". *Quarterly Journal of Economics* Vol. 122, No. 1, Pages 159-208.

Matsudaira, Jordan, "Mandatory Summer School and Student Achievement: A Regression Discontinuity Approach." *Journal of Econometrics*, 2008, 142(2): 829-850.

"Mandatory Summer School and Student Achievement: A Regression Discontinuity Analysis." *Journal of Econometrics*, 142(2), 2008: 829-850. [Available here](#)

*(Last day of formal class instruction)*

**Week 15: RRR Week**

M May 4

**REVIEW FOR THE FINAL**

W May 6

**REVIEW FOR THE FINAL** (*Last day of class instruction*), **ASSIGNMENT DUE: Fifth problem set due**

**EXAM WEEK** (exam day may change based on classroom availability, any changes will be published during 1<sup>st</sup> weeks of class)

M May 11

**REVIEW FOR THE FINAL**

W May 13



**FINAL EXAM**