

Economics 626: Empirical Microeconomics

University of Maryland, Fall 2011

Instructor: Raymond Guiteras
TA: Tara Kaul
Lectures: MW 11:00 a.m.–12:15 p.m., Tydings 2102
Recitation: F 4-6 pm, Tydings 2111
Office Hours: Guiteras: M 6-7 pm, W 8-9 am, Tydings 4118C
Kaul: TBA

This course will cover fundamental methods for analysis of microeconomic data. There will be two brief introductory sections and then four core topics: nonlinear estimators with applications (discrete choice, truncated, censored and selected data, duration models), panel data, IV estimation, and nonstandard standard errors. In addition, we will cover many combinations of these topics, e.g. nonlinear IV, nonlinear panel, etc. Additional topics that may be covered, time permitting, include quantile regression (and instrumental variable quantile regression) and inference with multiple outcomes.

In this course, we will attempt to balance both theory and applications. All students who plan to write dissertations in applied microeconomics are encouraged to take both Econ 722, taught by Prof. Ingmar Prucha and Prof. Francis Vella, and Econ 773, taught by Prof. John Ham. Both are offered in the spring term. Econ 722 covers some of the same topics as Econ 626, but is more weighted towards theory. Econ 773 emphasizes the theory and practice of estimation of treatment effects (e.g. duration models, regression discontinuity, propensity score matching, differences-in-differences). There is some overlap among the three courses but students will benefit from the different perspectives.

Prerequisites: Econometrics I (Econ 623) and Econometrics II (Econ 624) or permission of the instructor. Students without these prerequisites may be admitted to the course subject to the approval of the instructor, but neither the instructor nor the TA will provide remedial instruction. Students are assumed to have basic proficiency with Stata (reading in and manipulating data, obtaining summary statistics and running simple regressions, basic graphics). A mini-course will be offered by the Department of Economics in the first weekend of the semester to provide you with these basic skills. This mini-course is not required but is recommended for students with little experience in Stata. Priority is given to

Economics Ph.D. students but we will try to accommodate students from other departments, space permitting. I plan to offer this every two years, alternating with a more advanced course. MPRC also has an introductory course, although I believe space is limited and priority is given to students whose official adviser is an MPRC affiliate.

Course requirements: The course requirements are satisfactory completion of all problem sets and at least two out of: a midterm exam, a brief term paper and a final exam. There are 6 semiweekly problem sets planned, but this may be adjusted over the course of the semester. You are permitted (indeed, encouraged) to collaborate on problem sets, but each student must write up and submit an individual solution unless specific instruction to the contrary is given on the problem set. Both the midterm and final are takehomes, the format of which will be described thoroughly in class. The midterm is due Wednesday, October 26 in class. The final is due Saturday, December 17 at 10:00 AM. As a substitute for either of the take-home exams, students may submit a brief-but-thorough empirical paper which (a) presents original research in a clear, professional fashion and (b) demonstrates mastery of 626-level tools.

Details on midterm and final: For both the midterm and final, you will be provided a list of interesting econometrics papers, from which you will be asked to choose one and write an 8-10 page exposition from an applied perspective. That is, you will discuss the motivation for the paper, the intuition for the technical advance it provides, an outline of how to implement the methods, and a discussion of the tradeoffs involved in using this technique relative to others. An early draft of the midterm assignment, with more detailed instructions and a preliminary list of papers, has been posted to the course website. More details will be provided later in the term, and I would be happy to take suggestions for additional papers to include on the list. See below for restrictions on contacting authors.

Details on the term paper: this will be due on Friday, December 9 in recitation (4 PM). Students who wish to write a paper must submit a brief (2 pages maximum) description of their topic no later than Monday, September 26 at 11:00 a.m. This is to encourage you to start early – papers always progress more slowly than you expect, even after you have adjusted your expectations to account for this fact. In fact, if you are contemplating this option, you should start looking for an interesting topic and data *now*. Students writing a paper are required to meet with the course TA for 30 minutes in October (any day is fine) to discuss their progress and should submit a brief (1-2 page) progress report on Friday, October 28 by 4:00 PM. This paper must be original work, not a rehashing of another paper you have written. Substantial additions to previous work will be considered, but must be cleared by me before the September 26 deadline.

Details on contacting authors (applies to midterm, final and paper): Although you are allowed to use datasets from other economists' papers, you should not contact them until you have thoroughly exhausted all other avenues for getting the data you need. Students who absolutely must contact other researchers should come talk to me first, and should present a detailed list of the steps they have already taken to try to get the data. This is to prevent a flood of emails from my students to various professors asking for data, which in addition to inconveniencing busy people would adversely affect my reputation in the profession. This is actually not as restrictive as you might think – many people who are willing to share their data have already posted it. Also, many journals now require that data be posted. One exception: if someone has a note on their website or on a paper explicitly inviting readers to contact him or her for a specific dataset, you may do so in the least intrusive way possible. Before doing this, you should provide me with a link to the website, copy of the paper, etc., and I will give you permission. One non-exception: in the interests of fairness, this applies *uniformly*. That is, if your undergrad professor, roommate, mother, whatever, has a dataset you want to use, you must follow the same rules. I will consider granting exceptions involving datasets from Maryland Economics, AREC, Public Policy or Smith School faculty on a case-by-case basis.

Grading: The problem sets (collectively), midterm, final and paper will each receive equal, one-third weight in the course grade. You are only required to submit two of the midterm, final and paper. If you submit all three, I will use the two highest grades out of the three. All problem sets must be completed. Problem sets will be graded on a check-plus, check, check-minus “honest effort” basis. That is, students who, in the judgement of the grader, make a reasonable effort at *all parts of all questions* will receive a check. A check-plus will be awarded for exceptionally good work; a check-minus for barely adequate work. There will be 6 total problem sets, due on September 14, September 28, October 12, November 9, November 23 and December 7.

One lesson I hope to teach via the problem sets is that aesthetics matter. That is, in your professional lives, you will find that clarity of presentation is very important in communicating your ideas. Therefore, problem set grades will reflect the quality of the presentation, in addition to the substance of the work. You are encouraged to learn to produce professional-quality tables and figures quickly, correctly and in a way that allows for easy replication. This this requires some investment in learning up front but will save you untold amounts of time when you write papers. The Stata commands `-estout-`, `-svmat-`, `-sutex-`, `-tabout-`, `-outtable-` and `-file write-` are useful tools.

L^AT_EX is the standard tool for producing written work in economics. It is incredibly useful but there are high startup costs. These startup costs can be reduced somewhat (although

not eliminated) by using a document processor front end. The two most common programs are L^AT_EX and Scientific Workplace; both are installed on the Department's lab PCs. I prefer L^AT_EX for many reasons, one of which is that it is free and works cross-platform. Tips on installing and using L^AT_EX are posted to the course website.

Website: https://elms.umd.edu/bin/common/course.pl?course_id=_694553_1

Texts:

Required:

A. Colin Cameron and Pravin K. Trivedi. *Microeconometrics: Methods and Applications*. Cambridge University Press, 2005. URL <http://cameron.econ.ucdavis.edu/mmabook/mma.html>

Jeffrey M. Wooldridge. *Econometric Analysis of Cross Section and Panel Data*. MIT Press, 2nd edition, 2010. URL <http://mitpress.mit.edu/catalog/item/default.asp?ttype=2&tid=11227&xid=13&xcid=16146>

A. Colin Cameron and Pravin K. Trivedi. *Microeconometrics Using Stata, Revised Edition*. Stata Press, 2nd edition, 2010. URL <http://cameron.econ.ucdavis.edu/musbook/mus.html>

Both Cameron & Trivedi and Wooldridge are excellent textbooks, and I recommend that students read the relevant chapters from both. I have found Cameron and Trivedi to be the best textbook for learning new material, while I find Wooldridge superior as a reference. My recommended strategy for both topics would be to read material from Cameron and Trivedi first to build intuition, then work through the corresponding chapter in Wooldridge to see the same topic from a slightly more detailed, technical perspective. The Cameron & Trivedi Stata book will be used extensively in recitation as a source of hands-on, empirical applications. Be sure to visit the book's website to download the datasets and do-files. I have listed the revised edition (2010) edition here, but my understanding is that there are only very small changes from the 2009 edition having to do with syntax changes between Stata 10 and Stata 11. If you already have the 2009 edition, you probably do not need to buy the new one, but keep in mind that the 2010 edition will be considered canonical for the purpose of this class.

Recommended:

Joshua D. Angrist and Jörn-Steffen Pischke. *Mostly Harmless Econometrics: An Empiricist's Companion*. Princeton University Press, 2009

Peter Kennedy. *A Guide to Econometrics*. Blackwell Publishing, 6th edition, 2008

Whitney K. Newey and Daniel McFadden. Large sample estimation and hypothesis testing. In Daniel McFadden and Robert Engle, editors, *Handbook of Econometrics*, volume 4, chapter 36. Elsevier, North Holland, 1994. URL [http://dx.doi.org/10.1016/S1573-4412\(05\)80005-4](http://dx.doi.org/10.1016/S1573-4412(05)80005-4)

Handbook of Econometrics, Volumes I-VI. Direct access at <http://www.sciencedirect.com/science/handbooks/15734412>.

Christopher F. Baum. *An Introduction to Stata Programming*. Stata Press, 2009. URL <http://www.stata.com/bookstore/isp.html>

J. Scott Long. *The Workflow of Data Analysis using Stata*. Stata Press, 2009. URL <http://www.stata-press.com/data/wdaus.html>

The books by Angrist & Pischke and Kennedy are great sources for intuition and tips on applications. Either or both would make excellent complements to the more technical required textbooks. The Kennedy book has a somewhat broader scope; the A&P book has better jokes. Keep one or both handy for subway / bus / airplane / treadmill / whatever reading (not driving). The Newey & McFadden chapter is one of the key theoretical references for microeconomic estimation. It is suprisingly readable given the level of rigor. While it is an excellent reference, its technical level in parts is probably higher than required for this course. Particularly useful chapters from the *Handbook* will be noted in the course outline.

The Baum Stata book is excellent for learning to write do-files, programs and ado-files, all of which will make your life easier in this course and thereafter. Similarly, the Long book is a helpful guide for how to set up your work process so that you improve reproducibility and clarity, as well as save time in the long run.

Supplementary:

William H. Greene. *Econometric Analysis*. Prentice-Hall, 5th edition, 2003. URL <http://pages.stern.nyu.edu/~wgreene/Text/econometricanalysis.htm>

Paul A. Ruud. *An Introduction to Classical Econometric Theory*. Oxford University Press, 2000. URL <http://elsa.berkeley.edu/users/ruud/cet/>

Fumio Hayashi. *Econometrics*. Princeton University Press, 2000. URL http://fhayashi.fc2web.com/hayashi_econometrics.htm

Takeshi Amemiya. *Advanced Econometrics*. Harvard University Press, 1985

Greene is another standard reference text. I personally prefer C&T for learning and Wooldridge as a reference for most topics in this course, but others swear by Greene. Ruud provides a geometric approach. Hayashi takes a GMM-based approach. The first chapter of Hayashi makes an excellent quick refresher if the first-year sequence has faded for you. This chapter is available online at <http://press.princeton.edu/chapters/s6946.pdf>. The rest of the book is excellent as well. Amemiya is highly technical and recommended for students who are interested in pursuing econometric theory.

Course Outline

Readings are listed in the following order: recommended instructional readings (textbook or Handbook of Econometrics chapters, pedagogically useful journal articles), marked *; supplementary instructional readings, marked **; recommended applied papers, marked #; supplementary applied papers, marked ##.

Core topics:

1. A Brief Survey of Extremum Estimation (Theory and Intuition)

(a) General Theory

* Cameron and Trivedi [2005] Chap. 5, sections 5.1-5.5, 5.10

* Wooldridge [2010] Chap. 12.1-12.6

** Newey and McFadden [1994]

(b) MLE and GMM

* Cameron and Trivedi [2005] Chap. 5, sections 5.6-5.9; Chap. 6, sections 6.1-6.3, 6.6. Sections 6.4 and 6.5 are useful as examples of GMM, but we will come back to these sections later in the course when we cover IV in more detail.

* Wooldridge [2010] Chap. 13.1-13.8; Chap. 14.1-14.2, 14.5

(c) Computation

* Cameron and Trivedi [2005, Chap. 10]

* Wooldridge [2010, Chap. 12.7-12.8]

(d) Nonparametrics and Semiparametrics

* Cameron and Trivedi [2005, Chap. 9]

* Jeffrey S. Racine. Nonparametric econometrics: A primer. *Foundations and Trends in Econometrics*, 3(1):1–88, 2008. doi: 10.1561/08000000009. URL <http://socserv.mcmaster.ca/racine/EC00301.pdf>

* Hidehiko Ichimura and Petra E. Todd. Implementing nonparametric and semiparametric estimators. volume 6, Part 2 of *Handbook of Econometrics*, chapter 74, pages 5369 – 5468. Elsevier, 2007. doi: DOI:10.1016/S1573-4412(07)06074-6. URL <http://www.sciencedirect.com/science/article/pii/S1573441207060746>

2. Nonlinear and maximum likelihood estimation: applications and robust alternatives

(a) Binary choice

* Cameron and Trivedi [2005, Chap. 14]

* Wooldridge [2010, Chap. 15.1-15.7]

** Horowitz, Joel L. and Savin, N. E. Binary response models: Logits, probits and semiparametrics. *The Journal of Economic Perspectives*, 15(4):43–56, 2001. ISSN 0895-3309. URL <http://www.jstor.org/stable/2696515>

** Joel L. Horowitz. Bootstrap critical values for tests based on the smoothed maximum score estimator. *Journal of Econometrics*, 111:141–167, 2002

** Aaron K. Han. Non-parametric analysis of a generalized regression model: The maximum rank correlation estimator. *Journal of Econometrics*, 35:303–316, 1987

(b) Multinomial and ordered choice

* Cameron and Trivedi [2005, Chap. 15]

* Wooldridge [2010, Chap. 16]

** R. W. Klein and R. P. Sherman. Shift restrictions and semiparametric estimation in ordered response models. *Econometrica*, 76:663–692, 2002

(c) Corner solutions, censoring, truncation and selection

* Cameron and Trivedi [2005, Chap. 16]

* Wooldridge [2010, Chap. 17.1-17.6, 19.1-19.7]

* Mitali Das, Whitney K. Newey, and Francis Vella. Nonparametric estimation of sample selection models. *The Review of Economic Studies*, 70(1):33–58, 2003. ISSN 00346527. URL <http://www.jstor.org/stable/3648610>

* Bo E. Honore and James L. Powell. Pairwise difference estimators of censored and truncated regression models. *Journal of Econometrics*, 64(1-2):241 – 278, 1994. ISSN 0304-4076. doi: DOI:10.1016/0304-4076(94)90065-5. URL <http://www.sciencedirect.com/science/article/B6VC0-459B9P0-F/2/4eeced80bbc2b0af463f11379ecb5d4>

Lung fei Lee, Mark R. Rosenzweig, and Mark M. Pitt. The effects of improved nutrition, sanitation, and water quality on child health in high-mortality populations. *Journal of Econometrics*, 77(1):209 – 235, 1997. doi: DOI:10.1016/S0304-4076(96)01813-1. URL <http://www.sciencedirect.com/science/article/pii/S0304407696018131>

(d) Count data

* Cameron and Trivedi [2005, Chap. 20]

* Wooldridge [2010, Chap. 19.1-19.5]

3. Panel Data

(a) Linear Panel Data Models

* Cameron and Trivedi [2005, Chap. 21]

* Wooldridge [2010, Chap. 10]

** Sections 1-2 of Gary Chamberlain. Panel data. In Zvi Griliches and Michael D. Intriligator, editors, *Handbook of Econometrics*, volume II, chapter 22. Elsevier, 1984. URL [http://dx.doi.org/10.1016/S1573-4412\(84\)02014-6](http://dx.doi.org/10.1016/S1573-4412(84)02014-6)

Almond, D., K. Chay, D. Lee, “The Costs of Low Birth Weight,” *Quarterly Journal of Economics*, 120, 2005, 1031-1084.

Douglas Almond. Is the 1918 Influenza pandemic over? Long-term effects of in utero Influenza exposure in the post-1940 U.S. population. *Journal of Political Economy*, 114(4):672–712, 2006. URL <http://www.journals.uchicago.edu/doi/abs/10.1086/507154>

(b) Extensions

* Cameron and Trivedi [2005, Chap. 22]

* Wooldridge [2010, Chap. 11]

** Zvi Griliches and Jerry A. Hausman. Errors in variables in panel data: A note with an example. *Journal of Econometrics*, pages 98–118, 1986. URL <http://papers.nber.org/papers/t0037.pdf>

** Jerry A. Hausman and William E. Taylor. Panel data and unobservable individual effects. *Econometrica*, 49(6):1377–1398, November 1981. URL <http://www.jstor.org/stable/1911406>

(c) Nonlinear Panel Data Models

* Tony Lancaster. The incidental parameters problem since 1948. *Journal of Econometrics*, 95(2):391–413, April 2000. URL [http://dx.doi.org/10.1016/S0304-4076\(99\)00044-5](http://dx.doi.org/10.1016/S0304-4076(99)00044-5)

* Cameron and Trivedi [2005, Chap. 23]

* Wooldridge [2010, Chap. 13.8-13.9, 14.6, 15.8, 17.8, 19.9]

* Manuel Arellano and Jinyong Hahn. Understanding bias in nonlinear panel models: Some recent developments. In R. Blundell, W.K. Newey, and T. Persson, editors, *Advances in Economics and Econometrics*, chapter 12. Cambridge University Press, 2007. URL <ftp://ftp.cemfi.es/wp/05/0507.pdf>

** Victor Chernozhukov, Ivan Fernandez-Val, Jinyong Hahn, and Whitney Newey. Identification and estimation of marginal effects in nonlinear panel models. CEMMAP Working Paper CWP05/09, May 2009. URL <http://www.cemmap.ac.uk/wps/cwp0509.pdf>

** Jinyong Hahn and Whitney Newey. Jackknife and analytical bias reduction for nonlinear panel models. *Econometrica*, 72(4):1295–1319, 2004. ISSN 00129682. URL <http://www.jstor.org/stable/3598786>

** Section 3 of Chamberlain [1984]

** Sections 4-7 of Manuel Arellano and Bo Honore. Panel data models: Some recent developments. In J.J. Heckman and E. Leamer, editors, *Handbook of Econometrics*, volume V, chapter 53, pages 3229–3296. Elsevier, 2001. URL [http://dx.doi.org/10.1016/S1573-4412\(84\)02014-6](http://dx.doi.org/10.1016/S1573-4412(84)02014-6)

Jerry A. Hausman, Bronwyn H. Hall, and Zvi Griliches. Econometric models for count data with an application to the patents-R&D relationship. *Econometrica*, 52(4): 909–938, July 1984. URL <http://www.jstor.org/stable/1911191>

4. Instrumental Variables

(a) Linear IV

* Cameron and Trivedi [2005, Sections 4.7-4.9]

* Wooldridge [2010, Chap. 5-6]

* Angrist and Pischke [2009, Chap. 4.1-4.2]

** Sections 2.2.3-2.3.4 of Joshua D. Angrist and Alan B. Krueger. Empirical strategies in labor economics. In Orley Ashenfelter and David Card, editors, *Handbook of Labor Economics*, volume 3A, chapter 23, pages 1277–1366. Elsevier Science, Amsterdam, 1999. URL [http://dx.doi.org/10.1016/S1573-4463\(99\)03004-7](http://dx.doi.org/10.1016/S1573-4463(99)03004-7)

** Bruce D. Meyer. Natural and quasi-natural experiments in economics. *Journal of Business and Economic Statistics*, 13(2):151–161, 1995. URL <http://www.jstor.org/stable/1392369>

** Joshua D. Angrist and Alan B. Krueger. Instrumental variables and the search for identification: From supply and demand to natural experiments. *Journal of Economic Perspectives*, 15(4):69–87, Fall 2001. URL <http://www.jstor.org/stable/2696517>

Joshua D. Angrist and Alan B. Krueger. Does compulsory school attendance affect schooling and earnings? *Quarterly Journal of Economics*, 106(4):979–1014, November 1991. URL <http://www.jstor.org/stable/2937954>

Esther Duflo. Schooling and labor market consequences of school construction in Indonesia: Evidence from an unusual policy experiment. *American Economic Review*, 91(4):795–813, September 2001. URL <http://www.jstor.org/stable/2677813>

K. Daron Acemoglu, Simon Johnson, and James A. Robinson. The colonial origins of comparative development: An empirical investigation. *American Economic Review*, 91(5):1369–1401, December 2001. URL <http://www.e-aer.org/archive/9105/91051369.pdf>

(b) Heterogeneous Treatment Effects and LATE

* Cameron and Trivedi [2005, Chap. 4.9]

** Angrist and Pischke [2009, Chap. 4.4-4.5]

(c) Weak Instruments and Many Instruments

* Cameron and Trivedi [2005, Chap. 4.9]

* Angrist and Pischke [2009, Chap. 4.6.4]

** John Bound, David A. Jaeger, and Regina M. Baker. Problems with instrumental variables estimation when the correlation between the instruments and the endogenous explanatory variable is weak. *Journal of the American Statistical Association*, 90(430):443–450, 1995. ISSN 01621459. URL <http://www.jstor.org/stable/2291055>

** Hahn, J., and J. Hausman, “Weak Instruments: Diagnosis and Cures in Empirical Econometrics,” *American Economic Review Papers and Proceedings*, May 2003, 93(2), 118–125.

** John Shea. Instrument relevance in multivariate linear models: A simple measure. *The Review of Economics and Statistics*, 79(2):348–352, 1997. ISSN 00346535. URL <http://www.jstor.org/stable/2951471>

** Stock, J. H., J. H. Wright, and M. Yogo (2002), “A Survey of Weak Instruments and Weak Identification in GMM,” *Journal of Business and Economic Statistics*, 20, 518–529.

John Bound and David A. Jaeger. On the validity of season of birth as an instrument in wage equations: A comment on Angrist & Krueger's "Does compulsory school attendance affect schooling and earnings?". Working Paper 5835, National Bureau of Economic Research, November 1996. URL <http://www.nber.org/papers/w5835>

David Card. Using geographic variation in college proximity to estimate the return to schooling. Working Paper 4483, National Bureau of Economic Research, October 1993. URL <http://www.nber.org/papers/w4483>

Jeffrey R. Kling. Interpreting instrumental variables estimates of the returns to schooling. *Journal of Business & Economic Statistics*, 19(3):358–364, 2001. ISSN 07350015. URL <http://www.jstor.org/stable/1392037>

(d) Nonlinear IV and The Forbidden Regression

* Cameron and Trivedi [2005, Chap. 6.5]

* Wooldridge [2010, Chap. 14.2, 15.7]

* Angrist and Pischke [2009, Chap. 4.6.3]

** Joshua D. Angrist. Estimation of limited dependent variable models with dummy endogenous regressors: Simple strategies for empirical practice. *Journal of Business and Economic Statistics*, 19(1):2–16, January 2001. URL <http://www.jstor.org/stable/1392531>

** Takeshi Amemiya. The nonlinear two-stage least-squares estimator. *Journal of Econometrics*, 2(2):105–110, July 1974. URL [http://dx.doi.org/10.1016/0304-4076\(74\)90033-5](http://dx.doi.org/10.1016/0304-4076(74)90033-5)

** Robert W. Blundell and James L. Powell. Endogeneity in semiparametric binary response models. *Review of Economic Studies*, 71:655–679, 2004

(e) Nonparametric IV (time permitting)

* Whitney K. Newey and James L. Powell. Instrumental variable estimation of nonparametric models. *Econometrica*, 71(5):1565–1578, 2003. ISSN 00129682. URL <http://www.jstor.org/stable/1555512>

* Joel L. Horowitz. Applied nonparametric instrumental variables estimation. Manuscript,, June 2009. URL <http://faculty.wcas.northwestern.edu/~jlh951/papers/FSPaper.pdf>

5. Nonstandard standard errors

(a) Robust standard errors

(b) Clustering

* A. Colin Cameron and Douglas L. Miller. Robust inference with clustered data. In A. Ullah and D. E. Giles, editors, *Handbook of Empirical Economics and Finance*. Chapman and Hall, 2010. URL http://www.econ.ucdavis.edu/working_paper_info.cfm?pid=452

* Jeffrey M. Wooldridge. Cluster-sample methods in applied econometrics: An extended analysis. Mimeograph, 2006. URL <https://www.msu.edu/~ec/faculty/wooldridge/current%20research/clus1aea.pdf>

* A. Colin Cameron, Jonah B. Gelbach, and Douglas L. Miller. Robust inference with multi-way clustering. Working Paper, November 2008b. URL http://gelbach.eller.arizona.edu/~gelbach/papers/cgm/mc_jbes_r1_16nov2008.pdf

** A. Colin Cameron, Jonah B. Gelbach, and Douglas L. Miller. Bootstrap-based improvements for inference with clustered errors. *Review of Economics and Statistics*, 90(3):414–427, 2008a. doi: 10.1162/rest.90.3.414. URL <http://www.mitpressjournals.org/doi/abs/10.1162/rest.90.3.414>

** Brent R. Moulton. An illustration of a pitfall in estimating the effects of aggregate variables on micro units. *The Review of Economics and Statistics*, 72(2):334–338, May 1990. ISSN 00346535. URL <http://www.jstor.org/stable/2109724>

(c) Autocorrelation

* Marianne Bertrand, Esther Duflo, and Sendhil Mullainathan. How much should we trust differences-in-differences estimates? *Quarterly Journal of Economics*, 119(1):249–275, 2004. URL <http://dx.doi.org/10.1162/003355304772839588>

* Christian Hansen. Generalized least squares inference in panel and multilevel models with serial correlation and fixed effects. *Journal of Econometrics*, 140:670–694, 2007. URL <http://dx.doi.org/10.1016/j.jeconom.2006.07.011>

* Stephen G Donald and Kevin Lang. Inference with difference-in-differences and other panel data. *Review of Economics and Statistics*, 89(2):221–233, 2007. URL <http://www.mitpressjournals.org/doi/abs/10.1162/rest.89.2.221>

* Jerry Hausman and Guido Kuersteiner. Difference in difference meets generalized least squares: Higher order properties of hypotheses tests. *Journal of Econometrics*, 144(2):371–391, June 2008. URL <http://dx.doi.org/10.1016/j.jeconom.2008.04.003>

Esther Duflo and Rohini Pande. Dams. *Quarterly Journal of Economics*, pages 601–646, May 2007

(d) Bootstrapping

* Cameron and Trivedi [2005, Chap. 11]

* A. Colin Cameron, Jonah B. Gelbach, and Douglas L. Miller. Bootstrap-based improvements for inference with clustered errors. *Review of Economics and Statistics*, 90(3):414–427, 2008a. doi: 10.1162/rest.90.3.414. URL <http://www.mitpressjournals.org/doi/abs/10.1162/rest.90.3.414>

** Brownstone, David and Valletta, Robert. The bootstrap and multiple imputations: Harnessing increased computing power for improved statistical tests. *The Journal of Economic Perspectives*, 15(4):129–141, 2001. ISSN 0895-3309. URL <http://www.jstor.org/stable/2696521>

** Joel L. Horowitz. The bootstrap. In J.J. Heckman and E. Leamer, editors, *Handbook of Econometrics*, volume V, chapter 52, pages 3159–3228. Elsevier, 2001. URL [http://dx.doi.org/10.1016/S1573-4412\(01\)05005-X](http://dx.doi.org/10.1016/S1573-4412(01)05005-X)

(e) Spatial Correlation (time permitting)

* Timothy G. Conley. GMM estimation with cross sectional dependence. *Journal of Econometrics*, 92(1):1–45, September 1999. URL [http://dx.doi.org/10.1016/S0304-4076\(98\)00084-0](http://dx.doi.org/10.1016/S0304-4076(98)00084-0)

Olivier Deschênes and Michael Greenstone. The economic impacts of climate change: Evidence from agricultural profits and random fluctuations in the weather. *American Economic Review*, 97(1):354–385, March 2007

6. Quantile regression and IV quantile regression

* Cameron and Trivedi [2005, Chap. 4.6]

* Wooldridge [2010, Chap. 12.10]

* Koenker, Roger and Hallock, Kevin F. Quantile regression. *The Journal of Economic Perspectives*, 15(4):143–156, 2001. ISSN 0895-3309. URL <http://links.jstor.org/sici?sici=0895-3309%28200123%2915%3A4%3C143%3AQR%3E2.0.CO%3B2-V>

** Victor Chernozhukov and Christian Hansen. An IV model of quantile treatment effects. *Econometrica*, 73(1):245–261, January 2005. URL <http://dx.doi.org/10.1111/j.1468-0262.2005.00570.x>

** Alberto Abadie, Joshua Angrist, and Guido Imbens. Instrumental variables estimates of the effect of subsidized training on the quantiles of trainee earnings. *Econometrica*, 70(1):91–117, 2002. ISSN 00129682. URL <http://www.jstor.org/stable/2692164>

7. Multiple outcomes (SUR, Bonferroni corrections and adjusted p-values)

* Wooldridge [2010, Chap. 7.2-7.3, 7.7]

** Cameron and Trivedi [2005, Chap. 6.9, esp. 6.9.3]

Jeffrey R. Kling, Jeffrey B. Liebman, and Lawrence F. Katz. Experimental analysis of neighborhood effects. *Econometrica*, 75(1):pp. 83–119, 2007. ISSN 00129682. URL <http://www.jstor.org/stable/4123109>

Gunther Fink, Margaret McConnell, and Sebastian Vollmer. Heterogeneous treatment effects and multiple hypothesis testing in field experiments. Working paper, October 2010. URL http://margaretmccconnell.com/papers/Field_Experiments_and_Multiple_Testing_10282010.PDF

John Gibson, David McKenzie, and Steven Stillman. The impacts of international migration on remaining household members: Omnibus results from a migration lottery program. *Review of Economics and Statistics*, 2011. doi: doi:10.1162/REST_a_00129. Forthcoming

Various necessary statements

Academic honesty: you are required to abide by the standards of the University Honor Code, which prohibits students from cheating on exams, plagiarizing papers, submitting the same paper for credit in two courses without authorization, buying papers, submitting fraudulent documents, and forging signatures. For details on the requirements of the Honor Code, see <http://www.shc.umd.edu/code.html>. You are permitted (indeed, encouraged) to collaborate on problem sets, but each student must write up and submit an individual solution unless specific instruction to the contrary is given on the problem set.

Illness: Campus Senate policy (available here) requires students who are absent due to illness/injury to furnish documentary support to the instructor. I require students to contact me by email prior to class time in which you indicate that you have an illness or an injury. You must provide written documentation from a physician or other qualified health professional (e.g. registered nurse, physician's assistant) verifying your illness/injury within one week of your return to class. You will not be allowed to turn in missed assignments or make up quizzes, tests, papers, etc., if you have not provided this documentation. Documentation not presented to the instructor within one week of your return to class will not be accepted unless alternative arrangements have been made with the instructor. In addition, if it is found that you have falsified the documentation provided, you will be referred to the University's Student Conduct Office.

Religious observances: I will make every effort to accommodate students' religious observances. By Wednesday, September 14, 2011, students must provide me in writing a request for accommodation if some requirement of the class will conflict with a specific and required religious observance. Please specify the observance and date. For further details, refer to the Online Undergraduate Catalog Policy on Religious Observance.

Students with disabilities: I will make every effort to accommodate students who are registered with the Disability Support Services (DSS) Office and who provide me with a University of Maryland DSS Accommodation form which has been updated for the Fall 2011 semester. This form must be presented to me no later than Wednesday, September 14, 2011. We are not able to accommodate students who are not registered with DSS or who do not provide me documentation which has been reviewed by DSS after Wednesday, September 14, 2011.

Decorum: Students are expected to treat each other with respect. Disruptive behavior of any kind will not be tolerated. Students who are unable to show civility with one another or with the instructors will be subject to being referred to the Office of Student Conduct or to Campus Police. You are expected to adhere to the Code of Student Conduct at all times.

References

- Alberto Abadie, Joshua Angrist, and Guido Imbens. Instrumental variables estimates of the effect of subsidized training on the quantiles of trainee earnings. *Econometrica*, 70(1): 91–117, 2002. ISSN 00129682. URL <http://www.jstor.org/stable/2692164>.
- K. Daron Acemoglu, Simon Johnson, and James A. Robinson. The colonial origins of comparative development: An empirical investigation. *American Economic Review*, 91(5): 1369–1401, December 2001. URL <http://www.e-aer.org/archive/9105/91051369.pdf>.
- Douglas Almond. Is the 1918 Influenza pandemic over? Long-term effects of in utero Influenza exposure in the post-1940 U.S. population. *Journal of Political Economy*, 114(4): 672–712, 2006. URL <http://www.journals.uchicago.edu/doi/abs/10.1086/507154>.
- Takeshi Amemiya. The nonlinear two-stage least-squares estimator. *Journal of Econometrics*, 2(2):105–110, July 1974. URL [http://dx.doi.org/10.1016/0304-4076\(74\)90033-5](http://dx.doi.org/10.1016/0304-4076(74)90033-5).
- Takeshi Amemiya. *Advanced Econometrics*. Harvard University Press, 1985.
- Joshua D. Angrist. Estimation of limited dependent variable models with dummy endogenous regressors: Simple strategies for empirical practice. *Journal of Business and Economic Statistics*, 19(1):2–16, January 2001. URL <http://www.jstor.org/stable/1392531>.
- Joshua D. Angrist and Alan B. Krueger. Does compulsory school attendance affect schooling and earnings? *Quarterly Journal of Economics*, 106(4):979–1014, November 1991. URL <http://www.jstor.org/stable/2937954>.
- Joshua D. Angrist and Alan B. Krueger. Empirical strategies in labor economics. In Orley Ashenfelter and David Card, editors, *Handbook of Labor Economics*, volume 3A, chapter 23, pages 1277–1366. Elsevier Science, Amsterdam, 1999. URL [http://dx.doi.org/10.1016/S1573-4463\(99\)03004-7](http://dx.doi.org/10.1016/S1573-4463(99)03004-7).
- Joshua D. Angrist and Alan B. Krueger. Instrumental variables and the search for identification: From supply and demand to natural experiments. *Journal of Economic Perspectives*, 15(4):69–87, Fall 2001. URL <http://www.jstor.org/stable/2696517>.
- Joshua D. Angrist and Jörn-Steffen Pischke. *Mostly Harmless Econometrics: An Empiricist’s Companion*. Princeton University Press, 2009.

- Manuel Arellano and Jinyong Hahn. Understanding bias in nonlinear panel models: Some recent developments. In R. Blundell, W.K. Newey, and T. Persson, editors, *Advances in Economics and Econometrics*, chapter 12. Cambridge University Press, 2007. URL <ftp://ftp.cemfi.es/wp/05/0507.pdf>.
- Manuel Arellano and Bo Honore. Panel data models: Some recent developments. In J.J. Heckman and E. Leamer, editors, *Handbook of Econometrics*, volume V, chapter 53, pages 3229–3296. Elsevier, 2001. URL [http://dx.doi.org/10.1016/S1573-4412\(84\)02014-6](http://dx.doi.org/10.1016/S1573-4412(84)02014-6).
- Christopher F. Baum. *An Introduction to Stata Programming*. Stata Press, 2009. URL <http://www.stata.com/bookstore/isp.html>.
- Marianne Bertrand, Esther Duflo, and Sendhil Mullainathan. How much should we trust differences-in-differences estimates? *Quarterly Journal of Economics*, 119(1):249–275, 2004. URL <http://dx.doi.org/10.1162/003355304772839588>.
- Robert W. Blundell and James L. Powell. Endogeneity in semiparametric binary response models. *Review of Economic Studies*, 71:655–679, 2004.
- John Bound and David A. Jaeger. On the validity of season of birth as an instrument in wage equations: A comment on Angrist & Krueger’s “Does compulsory school attendance affect schooling and earnings?”. Working Paper 5835, National Bureau of Economic Research, November 1996. URL <http://www.nber.org/papers/w5835>.
- John Bound, David A. Jaeger, and Regina M. Baker. Problems with instrumental variables estimation when the correlation between the instruments and the endogeneous explanatory variable is weak. *Journal of the American Statistical Association*, 90(430):443–450, 1995. ISSN 01621459. URL <http://www.jstor.org/stable/2291055>.
- Brownstone, David and Valletta, Robert. The bootstrap and multiple imputations: Harnessing increased computing power for improved statistical tests. *The Journal of Economic Perspectives*, 15(4):129–141, 2001. ISSN 0895-3309. URL <http://www.jstor.org/stable/2696521>.
- A. Colin Cameron and Douglas L. Miller. Robust inference with clustered data. In A. Ullah and D. E. Giles, editors, *Handbook of Empirical Economics and Finance*. Chapman and Hall, 2010. URL http://www.econ.ucdavis.edu/working_paper_info.cfm?pid=452.
- A. Colin Cameron and Pravin K. Trivedi. *Microeconometrics: Methods and Applications*. Cambridge University Press, 2005. URL <http://cameron.econ.ucdavis.edu/mmabook/mma.html>.

- A. Colin Cameron and Pravin K. Trivedi. *Microeconometrics Using Stata, Revised Edition*. Stata Press, 2nd edition, 2010. URL <http://cameron.econ.ucdavis.edu/musbook/mus.html>.
- A. Colin Cameron, Jonah B. Gelbach, and Douglas L. Miller. Bootstrap-based improvements for inference with clustered errors. *Review of Economics and Statistics*, 90(3):414–427, 2008a. doi: 10.1162/rest.90.3.414. URL <http://www.mitpressjournals.org/doi/abs/10.1162/rest.90.3.414>.
- A. Colin Cameron, Jonah B. Gelbach, and Douglas L. Miller. Robust inference with multi-way clustering. Working Paper, November 2008b. URL http://gelbach.eller.arizona.edu/~gelbach/papers/cgm/mc_jbes_r1_16nov2008.pdf.
- David Card. Using geographic variation in college proximity to estimate the return to schooling. Working Paper 4483, National Bureau of Economic Research, October 1993. URL <http://www.nber.org/papers/w4483>.
- Gary Chamberlain. Panel data. In Zvi Griliches and Michael D. Intriligator, editors, *Handbook of Econometrics*, volume II, chapter 22. Elsevier, 1984. URL [http://dx.doi.org/10.1016/S1573-4412\(84\)02014-6](http://dx.doi.org/10.1016/S1573-4412(84)02014-6).
- Victor Chernozhukov and Christian Hansen. An IV model of quantile treatment effects. *Econometrica*, 73(1):245–261, January 2005. URL <http://dx.doi.org/10.1111/j.1468-0262.2005.00570.x>.
- Victor Chernozhukov, Ivan Fernandez-Val, Jinyong Hahn, and Whitney Newey. Identification and estimation of marginal effects in nonlinear panel models. CEMMAP Working Paper CWP05/09, May 2009. URL <http://www.cemmap.ac.uk/wps/cwp0509.pdf>.
- Timothy G. Conley. GMM estimation with cross sectional dependence. *Journal of Econometrics*, 92(1):1–45, September 1999. URL [http://dx.doi.org/10.1016/S0304-4076\(98\)00084-0](http://dx.doi.org/10.1016/S0304-4076(98)00084-0).
- Mitali Das, Whitney K. Newey, and Francis Vella. Nonparametric estimation of sample selection models. *The Review of Economic Studies*, 70(1):33–58, 2003. ISSN 00346527. URL <http://www.jstor.org/stable/3648610>.
- Olivier Deschênes and Michael Greenstone. The economic impacts of climate change: Evidence from agricultural profits and random fluctuations in the weather. *American Economic Review*, 97(1):354–385, March 2007.

- Stephen G Donald and Kevin Lang. Inference with difference-in-differences and other panel data. *Review of Economics and Statistics*, 89(2):221–233, 2007. URL <http://www.mitpressjournals.org/doi/abs/10.1162/rest.89.2.221>.
- Esther Duflo. Schooling and labor market consequences of school construction in Indonesia: Evidence from an unusual policy experiment. *American Economic Review*, 91(4):795–813, September 2001. URL <http://www.jstor.org/stable/2677813>.
- Esther Duflo and Rohini Pande. Dams. *Quarterly Journal of Economics*, pages 601–646, May 2007.
- Lung fei Lee, Mark R. Rosenzweig, and Mark M. Pitt. The effects of improved nutrition, sanitation, and water quality on child health in high-mortality populations. *Journal of Econometrics*, 77(1):209 – 235, 1997. doi: DOI:10.1016/S0304-4076(96)01813-1. URL <http://www.sciencedirect.com/science/article/pii/S0304407696018131>.
- Gunther Fink, Margaret McConnell, and Sebastian Vollmer. Heterogeneous treatment effects and multiple hypothesis testing in field experiments. Working paper, October 2010. URL http://margaretmccconnell.com/papers/Field_Experiments_and_Multiple_Testing_10282010.PDF.
- John Gibson, David McKenzie, and Steven Stillman. The impacts of international migration on remaining household members: Omnibus results from a migration lottery program. *Review of Economics and Statistics*, 2011. doi: doi:10.1162/REST_a_00129. Forthcoming.
- William H. Greene. *Econometric Analysis*. Prentice-Hall, 5th edition, 2003. URL <http://pages.stern.nyu.edu/~wgreene/Text/econometricanalysis.htm>.
- Zvi Griliches and Jerry A. Hausman. Errors in variables in panel data: A note with an example. *Journal of Econometrics*, pages 98–118, 1986. URL <http://papers.nber.org/papers/t0037.pdf>.
- Jinyong Hahn and Whitney Newey. Jackknife and analytical bias reduction for nonlinear panel models. *Econometrica*, 72(4):1295–1319, 2004. ISSN 00129682. URL <http://www.jstor.org/stable/3598786>.
- Aaron K. Han. Non-parametric analysis of a generalized regression model: The maximum rank correlation estimator. *Journal of Econometrics*, 35:303–316, 1987.
- Christian Hansen. Generalized least squares inference in panel and multilevel models with serial correlation and fixed effects. *Journal of Econometrics*, 140:670–694, 2007. URL <http://dx.doi.org/10.1016/j.jeconom.2006.07.011>.

- Jerry Hausman and Guido Kuersteiner. Difference in difference meets generalized least squares: Higher order properties of hypotheses tests. *Journal of Econometrics*, 144(2): 371–391, June 2008. URL <http://dx.doi.org/10.1016/j.jeconom.2008.04.003>.
- Jerry A. Hausman and William E. Taylor. Panel data and unobservable individual effects. *Econometrica*, 49(6):1377–1398, November 1981. URL <http://www.jstor.org/stable/1911406>.
- Jerry A. Hausman, Bronwyn H. Hall, and Zvi Griliches. Econometric models for count data with an application to the patents-R&D relationship. *Econometrica*, 52(4):909–938, July 1984. URL <http://www.jstor.org/stable/1911191>.
- Fumio Hayashi. *Econometrics*. Princeton University Press, 2000. URL http://fhayashi.fc2web.com/hayashi_econometrics.htm.
- Bo E. Honore and James L. Powell. Pairwise difference estimators of censored and truncated regression models. *Journal of Econometrics*, 64(1-2):241 – 278, 1994. ISSN 0304-4076. doi: DOI:10.1016/0304-4076(94)90065-5. URL <http://www.sciencedirect.com/science/article/B6VC0-459B9P0-F/2/4eeceed80bbc2b0af463f11379ecb5d4>.
- Joel L. Horowitz. The bootstrap. In J.J. Heckman and E. Leamer, editors, *Handbook of Econometrics*, volume V, chapter 52, pages 3159–3228. Elsevier, 2001. URL [http://dx.doi.org/10.1016/S1573-4412\(01\)05005-X](http://dx.doi.org/10.1016/S1573-4412(01)05005-X).
- Joel L. Horowitz. Bootstrap critical values for tests based on the smoothed maximum score estimator. *Journal of Econometrics*, 111:141–167, 2002.
- Joel L. Horowitz. Applied nonparametric instrumental variables estimation. Manuscript,, June 2009. URL <http://faculty.wcas.northwestern.edu/~jlh951/papers/FSPaper.pdf>.
- Horowitz, Joel L. and Savin, N. E. Binary response models: Logits, probits and semiparametrics. *The Journal of Economic Perspectives*, 15(4):43–56, 2001. ISSN 0895-3309. URL <http://www.jstor.org/stable/2696515>.
- Hidehiko Ichimura and Petra E. Todd. Implementing nonparametric and semiparametric estimators. volume 6, Part 2 of *Handbook of Econometrics*, chapter 74, pages 5369 – 5468. Elsevier, 2007. doi: DOI:10.1016/S1573-4412(07)06074-6. URL <http://www.sciencedirect.com/science/article/pii/S1573441207060746>.
- Peter Kennedy. *A Guide to Econometrics*. Blackwell Publishing, 6th edition, 2008.

- R. W. Klein and R. P. Sherman. Shift restrictions and semiparametric estimation in ordered response models. *Econometrica*, 76:663–692, 2002.
- Jeffrey R. Kling. Interpreting instrumental variables estimates of the returns to schooling. *Journal of Business & Economic Statistics*, 19(3):358–364, 2001. ISSN 07350015. URL <http://www.jstor.org/stable/1392037>.
- Jeffrey R. Kling, Jeffrey B. Liebman, and Lawrence F. Katz. Experimental analysis of neighborhood effects. *Econometrica*, 75(1):pp. 83–119, 2007. ISSN 00129682. URL <http://www.jstor.org/stable/4123109>.
- Koenker, Roger and Hallock, Kevin F. Quantile regression. *The Journal of Economic Perspectives*, 15(4):143–156, 2001. ISSN 0895-3309. URL <http://links.jstor.org/sici?sici=0895-3309%28200123%2915%3A4%3C143%3AQR%3E2.O.CO%3B2-V>.
- Tony Lancaster. The incidental parameters problem since 1948. *Journal of Econometrics*, 95(2):391–413, April 2000. URL [http://dx.doi.org/10.1016/S0304-4076\(99\)00044-5](http://dx.doi.org/10.1016/S0304-4076(99)00044-5).
- J. Scott Long. *The Workflow of Data Analysis using Stata*. Stata Press, 2009. URL <http://www.stata-press.com/data/wdaus.html>.
- Bruce D. Meyer. Natural and quasi-natural experiments in economics. *Journal of Business and Economic Statistics*, 13(2):151–161, 1995. URL <http://www.jstor.org/stable/1392369>.
- Brent R. Moulton. An illustration of a pitfall in estimating the effects of aggregate variables on micro units. *The Review of Economics and Statistics*, 72(2):334–338, May 1990. ISSN 00346535. URL <http://www.jstor.org/stable/2109724>.
- Whitney K. Newey and Daniel McFadden. Large sample estimation and hypothesis testing. In Daniel McFadden and Robert Engle, editors, *Handbook of Econometrics*, volume 4, chapter 36. Elsevier, North Holland, 1994. URL [http://dx.doi.org/10.1016/S1573-4412\(05\)80005-4](http://dx.doi.org/10.1016/S1573-4412(05)80005-4).
- Whitney K. Newey and James L. Powell. Instrumental variable estimation of nonparametric models. *Econometrica*, 71(5):1565–1578, 2003. ISSN 00129682. URL <http://www.jstor.org/stable/1555512>.
- Jeffrey S. Racine. Nonparametric econometrics: A primer. *Foundations and Trends in Econometrics*, 3(1):1–88, 2008. doi: 10.1561/0800000009. URL <http://socserv.mcmaster.ca/racine/EC00301.pdf>.

Paul A. Ruud. *An Introduction to Classical Econometric Theory*. Oxford University Press, 2000. URL <http://elsa.berkeley.edu/users/ruud/cet/>.

John Shea. Instrument relevance in multivariate linear models: A simple measure. *The Review of Economics and Statistics*, 79(2):348–352, 1997. ISSN 00346535. URL <http://www.jstor.org/stable/2951471>.

Jeffrey M. Wooldridge. Cluster-sample methods in applied econometrics: An extended analysis. Mimeograph, 2006. URL <https://www.msu.edu/~ec/faculty/wooldridge/current%20research/clus1aea.pdf>.

Jeffrey M. Wooldridge. *Econometric Analysis of Cross Section and Panel Data*. MIT Press, 2nd edition, 2010. URL <http://mitpress.mit.edu/catalog/item/default.asp?ttype=2&tid=11227&xid=13&xcid=16146>.