Carnegie Mellon University
Heinz College

94-834 Applied Econometrics I
Course Syllabus
Fall Semester 2017, Mini 1

INSTRUCTOR

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COURSE ORGANIZATION

Class meets for lecture and discussion (or an exam) each Tuesday and Thursday, August 29 through October 17. Classes are scheduled 9:00 – 10:20 in Hamburg 2003. Most Fridays there is a review session, scheduled 1:30 – 2:50 in Hamburg 1006.

Teaching assistants will hold regular office hours, conduct review sessions, and assist in grading assignments and exams. TAs will also be available for appointments at your mutual convenience. We will announce office hours and locations during the first week of class.

Ciprian Domnisoru (cdomniso@andrew.cmu.edu) is the head TA, and will be holding all review sessions. Kevin Paul (kpaul@andrew.cmu.edu) will be providing additional assistance.

PREREQUISITE

You are presumed to have a solid grounding in basic statistics, at the level of 90-711 (Empirical Methods for Public Policy and Management), 90-786 (Intermediate Empirical Methods) or 95-796 (Statistics for IT Managers). We will make good use of the material covered in those courses.

READINGS

There is a set of readings from *Mastering Metrics: The Path from Cause to Effect* by Joshua D. Angrist and Jorn-Steffen Pischke (Princeton University Press, 2015). This is a relatively straightforward but quite sophisticated book. It is fun to read, it is very short, and it is inexpensive! If you like the style of the book you may want to follow up with a

more advanced book by the same authors, *Mostly Harmless Econometrics* (Princeton University Press, 2009).

We will also be assigning papers from the academic literature for you to read. Some of these are listed below. Other papers may be added as the course progresses. You will be kept up to date on the course web page.

You will likely find it useful to have a basic statistics textbook at hand. The book you used in your preparatory statistics class (90-711, 90-786, 95-796, or similar course) will be fine. In addition, many of you may find it helpful to have a standard econometrics textbook available to provide additional material on the topics we are covering. One good choice is *Introduction to Econometrics* by James H. Stock and Mark W. Watson (Pearson). You can buy a used version of the 1st or 2nd edition, which should be quite inexpensive at this point.

COURSE CONTENT AND OBJECTIVES

Econometrics has an important place in the data sciences. As your textbook authors say, the purpose of econometrics is to "untangle cause and effect in human affairs." Econometrics is essential for advancing understanding in the social sciences, conducting public policy evaluation, and assessing the impact of business practice.

Applied Econometrics I is the first course in a two-course sequence designed to teach the essentials of econometric methodology. **You should plan to take *both* courses.**

During the first course you will:

- Learn why *random assignment* is so useful for the purpose of sorting out cause and effect.
- Develop a clear understanding of *bivariate* and *multiple regression*, and come to appreciate the value and limitations of regression methods.
- Acquire an appreciation for the use of *instrumental variables* for the purpose of evaluating causality in complex real-world applications.

Applied Econometrics II follows up by pursuing those same topics in additional depth, and by treating other topics and applications. For instance, in that course you will:

- Learn how *regression discontinuity* is used to draw inferences about causal effects.
- Use *differences in differences* – an important method for studying causality.
- Learn how econometric methods typically differ from *statistical learning* (i.e., *machine learning, ML*), and see how ideas from ML are incorporated in recent work in econometrics.

Both *Applied Econometrics I* and *Applied Econometrics II* are "hands on" courses in which you will not only learn to read and interpret existing studies, but will also conduct econometric analyses of your own. The goal is to help you take your first few steps toward becoming a "Metrics Master"!   One of those steps is becoming competent and confident in the use of Stata to conduct empirical analyses.

GRADING AND ACADEMIC INTEGRITY

Your grade depends on the extent to which you demonstrate the capacity to solve problems and think critically about econometric practice.

There will be five graded problem sets. You are encouraged to work in groups on the problem sets (and to visit TAs in groups). While the problems may be worked on in groups, you should hand in paper copies of the answers written *in your own words*. Problem sets are due at the beginning of the class on assigned due dates. I anticipate that assignments will be due September 5, 12, and 26, and October 5 and 12. Only assignments that are submitted on time will be graded.   However, as an accommodation, the lowest assignment grade will be dropped when calculating your final grade.

The final grade is based on two exams (30 percent for the first exam, 38 percent for the final exam), and problem sets (32 percent).

Class attendance at *all lectures and review sessions* is expected. Please let me know in advance if you are unable to attend. Exams are scheduled for September 19 and October 17. Students may be excused from taking exams on those dates only if arrangements are made in advance or in the event of an emergency.

A grade of 0 is assigned for any unexcused missed assignment or grade. A grade of 0 will also be assigned for any assignment or exam that does not conform to University policies regarding academic integrity, and other penalties may also pertain, including termination from enrollment at Carnegie Mellon.   See the Heinz College Student Handbook.

CLASS POLICY ON LAPTOPS

Please do not use laptops, cell phones, or other electronic communication devices during class. For those of you who like to have typed material, we will provide all lecture slides on Blackboard.

THOUGHTS FOR THE SEMESTER

I hope that your graduate-school experience proves to be mostly enjoyable and carefree, but it is likely to entail stress as well. The University Provost provides the following thoughts for students. They seem very important to me:

Take care of yourself. Do your best to maintain a healthy lifestyle this semester by eating well, exercising, avoiding drugs and alcohol, getting enough sleep and taking some time to relax. This will help you achieve your goals and cope with stress.

All of us benefit from support during times of struggle. You are not alone. There are many helpful resources available on campus and an important part of the college experience is learning how to ask for help. Asking for support sooner rather than later is often helpful.

If you or anyone you know experiences any academic stress, difficult life events, or feelings like anxiety or depression, we strongly encourage you to seek support. Counseling and Psychological Services is here to help: call 412-268-2922 and visit their website at http://www.cmu.edu/counseling/. Consider reaching out to a friend, faculty or family member you trust for help getting connected to the support that can help.

TENTATIVE COURSE OUTLINE AND SCHEDULE

You should read the textbook carefully, and may find the following papers useful.

Topic 1. The Potential Outcomes Framework and Randomized Trials (August 29 – September 5)

Core Ideas

- Angrist and Pischke, Introduction, Chapter 1, and Appendix to Chapter 1.[1]

Applications

- Robert H. Brook, et al., 1983, "Does Free Care Improve Adults' Health? Results from a Randomized Controlled Trial," *New England Journal of Medicine,* 309(23), 1426-1434.

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[1] You may want to supplement the Appendix to Chapter 1 with corresponding material in your basic statistics textbook. Also, you may find material from Stock and Watson useful.

- Aviva Aron-Dine, Liran Einav, and Amy Finkelstein, 2013, "The RAND Health Insurance Experiment, Three Decades Later," *Journal of Economic Perspectives,* 27, 197-222.

- Katherine Baicker, et al., 2013, "The Oregon Experiment – Effects of Medicaid on Clinical Outcomes," *New England Journal of Medicine*, 368(18): 1713-1722.

- Bertrand, M. and Mullainathan, S., 2004, "Are Emily and Greg more Employable than Lakisha and Jamal? A Field Experiment on Labor Market Discrimination," *American Economic Review*, 94(4), 991-1013.

Topic 2. Regression Analysis (September 7 – 26)

Core Ideas

- Angrist and Pischke, Chapter 2 and Appendix to Chapter 2.[2]

Applications

- Dale, S. and Krueger, A., 2002, "Estimating the Payoff to Attending a More Selective College: An Application of Selection on Observables and Unobservables," *Quarterly Journal of Economics*, 1491-1527.

- Ashenfelter, O., 2008, "Predicting the Quality and Prices of Bordeaux Wine," *Economic Journal*, 118(529).

- Ferraro, P. J., Miranda, J. J. and Price, M. K., 2011, "The Persistence of Treatment Effects with Norm-Based Policy Instruments: Evidence from a Randomized Environmental Policy Experiment," *American Economic Review*, 101(3), 318-322.

- Neal, D. A. and Johnson, W. R., 1996, "The Role of Premarket Factors in Black-White Wage Differences," *Journal of Political Economy*, 104(5), 869-895.

- Deschênes, Olivier and Michael Greenstone, 2007, "The Economic Impacts of Climate Change: Evidence from Agricultural Output and Random Fluctuations in Weather," *American Economic Review*, 97(1): 354-385.

Topic 3. Instrumental Variables (September 28 – October 12)

Core Ideas

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[2] Again, you may find it helpful to supplement material from the Appendix with the treatment in a basic statistics textbook.

- Angrist and Pischke, Chapter 3 and Appendix to Chapter 3.[3]

Applications

- Angrist, J.D., 2006, "Instrumental Variables Methods in Experimental Criminological Research: What, Why and How," *Journal of Experimental Criminology*, 2(1), 23-44.

- Angrist, J.D., Dynarski, S.M., Kane, T.J., Pathak, P.A. and Walters, C.R., 2010, "Inputs and Impacts in Charter Schools: KIPP Lynn," *American Economic Review*, 100(2), 239-243.

- Angrist, J.D., Dynarski, S.M., Kane, T.J., Pathak, P.A. and Walters, C.R., 2012. "Who Benefits from KIPP?" *Journal of Policy Analysis and Management,* 31(4), 837-860.

- Black, Dan, Seth Sanders, Evan Taylor and Lowell Taylor, 2015. "The Impact of the Great Migration on Mortality of African Americans: Evidence from the Deep South," *American Economic Review*, 105(2): 477-503.

- Angrist, J., Lavy, V. and Schlosser, A., 2010. "Multiple Experiments for the Causal Link between the Quantity and Quality of Children," *Journal of Labor Economics*, 28(4): 773-824.

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[3] In addition, there are many good econometrics textbooks that treat instrumental variables thoroughly, including the book mentioned above by Stock and Watson.