Carnegie Mellon University
Heinz College

94-834 Applied Econometrics I
Course Syllabus
Spring Semester 2021

INSTRUCTOR

Akshaya Jha, Assistant Professor of Economics and Public Policy
Office: 2218 Hamburg Hall (HBH)
Office Hours: Thursday 5PM-6:30PM, Friday 1:30-3pm and by appointment
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COURSE ORGANIZATION

Class meets for lecture and discussion each Monday and Wednesday, February 1 through March 17. Classes are scheduled 1:30pm-2:50pm in HBH A301 or on Zoom. Recitations are scheduled for Fridays 3:10pm-4:30pm on Zoom.

If you are planning on coming in, please email Alejandro (axa@andrew.cmu.edu) at least two days in advance. I plan on allowing up to 20 students to attend each lecture in person (HBH A301 is an auditorium), with the first two rows empty. We will allow the first 20 students who email to attend the lecture, giving the remaining students priority to attend the next lecture.   To make it easier on Alejandro, please have the subject of the email be: "[94-834 ATTENDANCE: <NAME> <DATE OF LECTURE>]"

Teaching assistants will hold regular office hours, conduct recitations, and assist in grading assignments and exams. TAs will also be available for appointments at your mutual convenience.

TAs:
        Xiaochen Sun (xiaoches@andrew.cmu.edu), Head TA
        Graham Andrews (gandrews@andrew.cmu.edu)
        Alejandro Alvarez Gutierrez (axa@andrew.cmu.edu)

Office Hours:

(Xiaochen) 10:30 am - 12:00 pm on Monday

(Alejandro) 12:00 pm - 1:30 pm on Friday

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 simple but sophisticated book. It is fun to read and is also very short (and inexpensive!). If you like the style of the book we suggest you follow up with a more advanced book by the same authors, *Mostly Harmless Econometrics* (Princeton University Press, 2009).

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 from rules constraining human behavior.
- Use *difference-in-differences techniques* to study causality when experiments happen naturally in society.
- Apply *event study analysis* and *synthetic control methods* to tackle causal questions when there are multiple natural experiments, or small sample sizes.

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 submit electronic copies of the answers written *in your own words* to Canvas. Problem sets are due by 11:59pm on the due date. 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 recitations* is expected. Please let your instructor know in advance if you are unable to attend.

Exams are scheduled for February 24 and March 17. Students may be excused from exams only if arrangements are made in advance or in the event of an emergency.

A grade of 0 will 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 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 Canvas.

THOUGHTS FOR THE SEMESTER

Your graduate-school experience might prove 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 sensible to us:

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 (3 lectures)

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, I will be discussing some material from Stock and Watson.

- 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 (5 lectures)

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.

Topic 3. Instrumental Variables (4 lectures)

Core Ideas

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

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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.

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.