AEDE 7140

APPLIED ECONOMETRICS II

SPRING 2020

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ZOOM OFFICE HOURS: Mondays 11 AM – 3 PM

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ZOOM OFFICE HOURS: T, Th 4:10 – 5:10 PM

LECTURE TIME: T-Th 2:20 AM – 3:40 PM
LAB TIMES: F 9:35 AM – 10:55 AM

LECTURE HALL: Ag Admin 246
LAB LOCATION: Ag Admin 005

COURSE DESCRIPTION: This course will provide an overview of both traditional and cutting-edge econometric tools for causal inference. We will begin with the potential outcomes framework and an overview of regression, omitted variable bias and causality. Then we'll examine the Local Average Treatment Effect (LATE) estimated by Two Stage Least Squares (2SLS). We'll move to work that evaluates the plausibility of the exclusion restriction for 2SLS, and estimation strategies that identify partial effects in situations where strict IV exogeneity does not hold. Then we'll explore quasi-experimental techniques that essentially matching on observables --- and through that, ideally, unobservables. But quasi-experimental methods are not plausible in all datasets or for all questions. We'll next explore the literature on coefficient sensitivity to unobservables, and review a number of sensitivity tests that seek to provide bounds around likely causal effects for non-causal estimates. We'll briefly examine the way that weather shocks are used to identify causal effects and also review the R packages that help us work with weather data. We'll spend a day examining new innovations in mediation analysis, which seeks to uncover causal mechanisms underlying the ATE. We'll end by reviewing machine learning tools for estimating heterogeneous causal effects.

COVID UPDATES: All lectures for the remainder of the class will be via Zoom. To make these virtual lectures as interactive as possible, please do ask questions through chat or "raise your hand" through the raise hand option. I will also shorten all lectures to 1 hour, so that we use the last 20 minutes for discussion (of class material, problem sets, or anything else). Lectures will be posted on Carmen for folks who cannot make class in real time. I have also extended my virtual (zoom) office hours on Monday, and --- as always --- I'm available by appointment. My cell is 614.288.4008, for urgent (or even not-that-urgent) matters. Please, please reach out if you need anything, including groceries, moral support, information or medical help.

REQUIRED TEXTBOOK: [AP] Angrist, Joshua and Jorn-Steffen Pischke (2009). Mostly Harmless Econometrics: An Empiricists Companion.

SUPPLEMENTARY TEXTBOOKS: [W1] Wooldridge, Jeffrey M. Econometric Analysis of Cross Section and Panel Data, 2nd Edition. [W2] Wooldridge, Jeffrey M. Introductory Econometrics: A Modern Approach, 6th Edition. [G] Greene, William H. Econometric Analysis 7th Edition.

COURSE STRUCTURE

Every lecture has required **reading** to be done prior to class, and some have optional readings listed too. Occasionally I tell you to pick one of two articles to read; in such cases I will usually have students summarize the articles for one another in class. For some topics I assign only articles, as no classic textbook chapter yet covers the topic. These articles are posted by module on Carmen. Note that I do not expect that you will always, fully understand 100% of the assigned readings. But reading them ahead of time will help you to engage in class, ask questions, and absorb the material.

I will try to post weekly beamer **presentations** to the server every Monday evening. It's possible that sometimes this won't happen, but most Tuesday and Thursday mornings you'll be able to examine the presentations prior to class. I urge you to print these slides or have them on a ipad/laptop that allows scribbling, as this will help you with note-taking. No point writing down a slew of equations that can be easily accessed via the slides.

Most Mondays I will teach a **lab** where we run through Stata code or R code, estimating the models that we discussed in class. Sometimes I will put move lab to Friday, if that works better for the material being covered. Those instance are noted with stars in the schedule.

Each of you will be assigned an OSU **server** for this class, so we don't have to worry about personal access to software. This server will hold the problem set data and some sample code in Stata and R, from lectures and labs. You can access the server from any computer through Desktop Remote Connect or Microsoft Remote Desktop — both freely available online. You do need to have an internet connection to do so, however.

Each of three **problem set** asks you to work through questions regarding a particular dataset, related to (an) existing, published paper(s). Assignment data will be made available on your personal server, and both Stata and R are available on the server for analysis. I don't mind if you collaborate as you work on the problem sets — in fact, I encourage it, with the cautionary note that free riders learn less and suffer during the final replication project (and more importantly in their later research). However, you must each turn in your own, individual results/answers and the code that you used to procure those results. These answers may not

be identical across students, though I realize that you'll likely give similar answers to the other people in your group. All problem set will be handed in via Carmen.

Problem sets will be given at the beginning of 3 modules: Potential Outcomes and Causality, When Exogeneity Fails, and Sensitivity Tests. The first problem set is based on the paper Grandmothers and Granddaughters, by Duflo (2003), and explores multiple strategies for procuring causal identification via OLS and 2SLS regression. **Given on February 27, Due March 17.** The second problem estimates multiple LATEs, uses non-compliers to test the exogeneity assumption, and then employs various strategies for partial identification of the LATE, using the high school dataset employed by Altonji, Elder & Taber 2005 JHR and others. Given on March 24, Due April 7. The last problem set explores the use of sensitivity tests to examine causal bounds around non-causal coefficients. Given on April 7, Due April 21.

If you need an **extension** for a problem set, please let me know at least 3 days in advance.

Rather than a final exam, I require you to complete a **final replication project**. To do this, you must choose a paper for which the data are available. You may NOT procure the code from the author. (If you do this and we catch you, you will fail the course.) You will submit the paper and the data to me by the evening of March 14th; if it's not too simple or too complex, I'll approve it. Ideally, you should choose a paper focused on causal identification; in certain cases I may waive this restriction. Do NOT wait until week 6 to begin your project; ideally you want at least one month to work on it. The replication is due on May 1.

Emergencies and other extenuating circumstances affecting your ability to turn in work on time will be considered on a case-by-case basis. Overall, communication with me in advance of the due date will be rewarded, while lack of communication is likely to result in a zero.

EVALUATION AND PARTICIPATION

Grades will be based primarily on the problem sets (20% each, 60% total) and your final replication (30%), but also on class participation (10%). By class participation, I mean questions, article summaries and discussion. I add in a grade for this because everyone learns econometrics better when questions, confusions and ideas are freely and openly offered. If you are a shy person, try to ask a question at least once a week. If you are a verbose person, try to ask your peers questions, or sometimes just listen — that's also a form of participation. I realize we are all coming from different backgrounds, and some of us may be more comfortable with open discussion than others. That's ok. Find a way to participate that feels comfortable for you, and the entire class will be better for it. And talk to me if that feels onerous. We'll find a way for you to participate comfortably.

GENERAL SCHEDULE

The schedule below is subject to slight changes as the semester progresses.

Week	Date	Topics	Readings
Potential Outcomes and Causality			
1	Feb 27	• Potential Outcome Framework • Regression and Causality • Omitted Variables Bias • Bad Controls	• [AP] Chapters 1, 2, 3.1, 3.2
	Feb 28 (Fri)*	• Lab: Interfacing Stata, Latex	• Leah's Stata-Latex Materials
Better LATE than Never?			
2	March 2	• Lab: Interfacing R, Latex	• Jiwon's R-Latex Materials
	March 3	• The LATE (2SLS)	• [AP] Chapter 4.1-4.5 • Opt: Angrist & Imbens 1994 *Econometrica*
	March 5	• Bias in LATE • Bad IVs	• [AP] Chapter 4.6 • One of: Bound and Jaeger 1996 NBER, Christian and Barrett 2018
When Instrument Exogeneity (Sort of) Fails			
3	March 24	• ``Testing'' exogeneity using non-compliers	• Bound & Jaeger 2000 RLE, Altonji, Elder & Taber 2005 JHR, Angrist et al. 2010 JLE
	March 26	• Partial identification under semi-exogenous IVs	• Conley, Hansen & Rossi 2012 REStat, Nevo and Rosen 2012 REStat, Kippersluis & Rietveld 2018 EJ
	March 27 *on own*	• Lab: CHR, RV commands • Do individually; Leah available for questions 3:30-5.	• Skim posted Stata article on plausexog and imperfectiv
Matching on Observables (and Hopefully Unobservables)			
4/5	March 30	• Lab: Problem Set Help	
	March 31	• Matching; Propensity scores • Fixed Effects	• [AP] Chapter 3.3, 5.1
	April 2	• Differences and Differences	• [AP] Chapter 5.2 • Opt: [W1] 6.5 (on DD),

			• Opt: Ravallion et al. 2005 JHR (on DDD)
	April 3 *on own*	• Lab: Regression Discontinuity • Do individually; Leah available for questions 3:30-5.	• [AP] Chapter 6 • Alix-Garcia et al. 2013 REStat
Sensitivity Tests (The Power of Unobservables)			
5/6	April 7	• Quantifying the power of unobservables	• Altonji, Elder & Taber 2005 JPE • Optional: Bellows and Miguel 2009 (inc. appendix)
	April 9	• Causal bounds / bias-adjusted estimates, building on Rosenbaum tests	• Harada 2013 • Oster 2017 JBES • Optional: Imbens 2003, Kosec et al. (2018), Bevis & Barrett 2019
	April 13 *on own*	• Lab: Oster's bounds, Harada sensitivity test, both Stata • Do individually; Leah available for questions 3:30-5.	
Mediation Analysis			
6	April 14	• Mediation Analysis • DAGS	• Acharya et al. 2016 APSR • Opt: Imai et al. 2011 APSR
	April 16	• Mediation Analysis with IV	• Dippel et al. NBER • Opt: Bevis and Villa 2020
What Can We Learn from the Weather?			
7	April 21	• Weather data in R	
	April 23	• Random weather shocks in OLS and IV • Common pitfalls • Measurement error	• Dell et al. 2014 JEL, Aufhammer et al. 2013 REEP
Machine Learning and Causality			
8	Readings will be posted; No class	• Briefly: Covariate selection w/ LASSO, Reweighting • Machine learning for heterogenous causal effects	• One of: Athey EconTalk interview, Athey and Imbens 2017 JPE "Machine Learning and Econometrics" section • One of: Belloni et al. 2013 *Econometrica*, Athey and Imbens 2016 PNAS

INSTITUTIONAL POLICIES AND RESOURCES:

COVID19 RESPONSE AND RESOURCES: Please see updated information and resources related to Covid on the AEDE website. This information changes quickly. Please contact Tim Haab, Sarah Cole, me, Zoë Plakias, or really any other AEDE professor with questions.

ACADEMIC ACCESSIBILITY: The University strives to make all learning experiences as accessible as possible. If you anticipate or experience academic barriers based on your disability (including mental health, chronic or temporary medical conditions), please let me know immediately so that we can privately discuss options. To establish reasonable accommodations, I may request that you register with Student Life Disability Services. After registration, make arrangements with me as soon as possible to discuss your accommodations so that they may be implemented in a timely fashion. SLDS contact information:slds@osu.edu; 614-292-3307; slds.osu.edu; 098 Baker Hall, 113 W. 12th Avenue.

TITLE IX AND SEXUAL MISCONDUCT: At Ohio State University, we strive to foster relationships based upon mutual respect, honesty, integrity, and trust. As such, we are committed to providing an educational, living, and working environment free from all forms of harassment and discrimination for all members of our community. The university prohibits all forms of sexual or gender-based discrimination, harassment or misconduct, including sexual harassment, sexual violence, relationship violence, stalking, or violations of consent.

If you or someone you know has experienced sexual misconduct, you may find information about resources and contact information OSU's Sexual Misconduct Policy. For instance, on-campus confidential resources are available, including the counselors at the Counseling and Consultation Service (614-292-5766) and attorneys at Student Legal Services (614-247-5853). More information about on- and off-campus confidential resources, as well as medical treatment, law enforcement, and other support services, may be found at the Student Advocacy Center.

EMOTIONAL AND MENTAL SUPPORT: The Counseling and Consultation Service provides support for students suffering emotionally and mentally. Any students can schedule an appointment with a counselor by calling 614-292-5766 during business hours. On most Thursdays you can also drop into "Let's Talk" for a free, informal and confidential mental health consultation

called with a staff member from Counseling and Consultation Service, from 6-8 PM in the Multicultural Room at the Ohio Union. No appointment or paperwork is needed, and services are available in Mandarin Chinese, Cantonese Chinese, Korean, Hindi, and Spanish. Consultation dates are listed on the "Let's Talk" website.