AEDE 8102

ADVANCED APPLIED ECONOMETRICS

SPRING 2024

PROFESSOR: Anne Fitzpatrick **OFFICE:** Ag Admin 324
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LECTURE TIME: Tues/Thurs 9:05 – 10:55 AM **LECTURE HALL:** Kottman Hall 333

OFFICE HOURS: Mondays/Wednesdays 2:00 – 3:00 PM or by appointment
COURSE ZOOM

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, through the lens of randomized controlled trials. Then we'll examine techniques commonly seen in natural experiments, including instrumental variables, matching, differences in differences, and regression discontinuity. We will end the course by studying a series of cutting edge econometric topics: mediation analysis, dimensionality reduction in high-dimensional data settings, identification on time-varying shocks, machine learning, when to cluster standard errors, and multi-level modeling, as well as other topics as time permits.

COVID UPDATES: Course attendance must generally in person, in accordance with university policy. However, exceptions are made for a number of circumstances, including for disability accommodations or health concerns. Second, students who have been recently exposed to Covid or for any other reason suspect that they may have Covid should skip in-person attendance. If possible, I will provide a virtual option in those extreme circumstances.

REQUIRED TEXTBOOK: [AP] Angrist, Joshua and Jorn-Steffen Pischke (2009). Mostly Harmless Econometrics: An Empiricists Companion.
REQUIRED SOFTWARE: Stata SE is recommended, and I will provide support for Stata programming. All problem set solutions will include Stata do files.
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. [HJTW] Hastie, T., James, G., Tibshirani, R., and Witten, D. An Introduction to Statistical Learning with Applications in R, New York Springer, 2013. (I do require HJTW readings, but these sections will be posted to Carmen.)

COURSE STRUCTURE

Every lecture has required **reading** to be done prior to class, and some have optional readings listed too. 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 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. To incentivize careful reading, I may ask students to summarize articles or textbook chapters in class, and/or highlight questions from the reading.

There will be a **problem set** for each topic, and you will have approximately one week to do each problem set. Each problem set asks you to work through questions regarding a particular dataset, related to (an) existing, published economics paper(s). Assignment data will be made available on the course website. 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. 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 gradescope (please tag your page for full credit) with do files submitted via Canvas. I will grade only select questions on each problem set, with the assumption that you will check your own work, (the remaining questions will be marked "correct").

If you need an **extension** for a problem set, please let me know in advance. Unless you have an extreme circumstance, you will receive a 10 point reduction per day.

Rather than a final exam, we will do a final project. For those doing empirical second-year papers, you will present your empirical strategy for your second year paper. You will be matched with another classmate who will be a "discussant" and critique your work. If you are not a second-year AEDE grad student, we will find an analogous exercise for you to partake in. For example, perhaps you will use another non-faculty coauthored paper or some other paper by mutual agreement.

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 (60% total) and your final project (30%), but also on class participation (10%).

- Each problem set (estimated: 8) will count equally, totalling 60% of your grade. I will allow you to drop your lowest problem set.
- Your final project will count for 30% of your final grade. Additional guidelines will be distributed later on in the semester.
- Class participation will be 10% of your grade. 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 and allow others a chance to speak — 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 and readings below is subject to change as the semester progresses.

Week	Date	Topics	Readings
1. Potential Outcomes Framework: OLS and Causality			
1-2	Jan 9	• Potential Outcome Framework • Potential Outcomes and OLS	• [AP] Chapters 1, 2, 3.1
	Jan 11	• Regression and Causality • Omitted Variables Bias • Bad Controls	• [AP] Chapter section 3.2
		• *Skills to Learn: Interfacing Stata and R with Latex*	• Leah's Stata-Latex materials & Jiwon's R-Latex materials, found at bottom of https://leahbevis.com/teaching/
2. Randomized Experiments			
3	Jan 16	• Selection Bias • Attrition	• Duflo, Esther, Rachel Glennerster, and Michael Kremer. "Using randomization in development economics research: A toolkit." *Handbook of development economics* 4 (2007): 3895-3962. (Posted on Carmen) • Finkelstein, A., Taubman, S., Wright, B., Bernstein, M., Gruber, J., Newhouse, J. P., ... & Oregon Health Study Group. (2012). The Oregon health insurance experiment: evidence from the first year. The Quarterly journal of economics, 127(3), 1057-1106. (Posted on Carmen)
	Jan 18	• Statistical power • MHT	• Gelman, A. (2018). You need 16 times the sample size to estimate an interaction than to estimate a main effect. *Statistical Modeling, Causal Inference, and Social Science*. (Posted on Carmen) • Muralidharan, Karthik, Mauricio Romero, and Kaspar Wüthrich. "Factorial designs, model selection, and (incorrect) inference in randomized experiments." *Review of Economics and Statistics* (2023): 1-44. (Posted on Carmen) • Black, Bernard, et al. "Simulated power analyses for observational studies: An application to the affordable care act medicaid expansion." *Journal of Public Economics* 213 (2022): 104713. (Posted on Carmen)
3. Better LATE than Never?			
4	Jan 23	• The LATE (2SLS) • ITT vs TOT	• [AP] Chapter 4.1-4.5 • Opt: Angrist & Imbens 1994 *Econometrica*
	Jan 25	• Forbidden Regressions • Weak Instruments: Consequences & Testing	• [AP] Chapter 4.6 • Opt on Weak IVs: Andrews, Stock & Sun 2018

4. When Instrument Exogeneity (Sort of) Fails			
5	Jan 30	• Bad IVs: Examples and Consequences • Testing the exclusion restriction using non-compliers	• Altonji, Elder & Taber 2005 JHR, • Skim: Angrist et al. 2010 JLE • Opt: Angrist, Imbens and Rubin 1996 • Opt on Bad IVs: Bound and Jaeger 2000 RLE, Christian & Barrett 2018
		• *Skills to Learn: CHR, RV commands in Stata*	• Stata article on plausexog and imperfectiv
5. Sensitivity Tests (The Power of Unobservables)			
5-6	Feb 1	• Quantifying the power of unobservables	• Altonji, Elder & Taber 2005 JPE • Opt: Bellows & Miguel 2009, (inc. appendix), Gonzalez & Miguel 2015
	Feb 6, 8	• Probability of null effect • Causal bounds	• Imbens 2003, Oster 2017 JBES, • Optional: Harada 2013, Kosec et al. (2018), Bevis et al. 2021
6. Matching on Observables (and Hopefully Unobservables), and Diff-in-Diff			
7-9	Feb 13, 15	• Matching; Propensity scores	• [AP] Chapter 3.3
	Feb 20	• Fixed Effects in Panel Data	• [AP] Chapter 5.1 • Opt: [AP] 5.3, 5.4
	Feb 22	• Differences and Differences	• [AP] Chapter 5.2, • Opt: [W1] 6.5, Ravallion et al. 2005 JHR (on DDD)
	Feb 27, 29	• Event Studies and Diff-in-Diff Extensions	• Coding guide from Princeton • Miller, Douglas L. "An Introductory Guide to Event Study Models." *Journal of Economic Perspectives* 37.2 (2023): 203-230.
7. Regression Discontinuity			
10	March 5,7	• Regression Discontinuity	• [AP] Chapter 6 • Opt: Alix-Garcia et al. 2013 REStat
Spring Break (March 11-15)			
8. Mediation Analysis			
11	March 19	• Mediation Analysis	• Acharya et al. 2016 APSR • Opt: Imai et al. 2011 APSR
	March 21	• Mediation Analysis with IV	• Dippel et al. NBER • Opt: Bevis and Villa 2020
9. Reducing Data Dimensionality			
12	March 26	• Subsetting • Regularization and Shrinkage (Ridge Regression and LASSO)	• [HJTW] Chapter sections 6.1, 6.2 • Opt: Belloni, Chernozhukov & Hansen 2014 JEP

	March 28	• Linear combination (PCA and SVA)	• [HJTW] Chapter sections 6.3 • Opt: Bai and Ng 2010, Bai and Ng 2009
		• *Skills to Learn: Subsetting, LASSO, PCA in R and Stata*	
10. Clustering and Other Topics			
13	April 2	• When to cluster standard errors	• Abadie et al. 2017 NBER • https://blogs.worldbank.org/impactevaluations/when-should-you-cluster-standard-errors-new-wisdom-econometrics-oracle
	April 4	• Graphically presenting data	• TBA
11. Machine Learning and Causality			
14	April 9	• Cross-validation • An overview of supervised and unsupervised machine learning methods	• [HJTW] Chapter 2 • One of: Athey EconTalk interview, Athey and Imbens 2017 JPE "Machine Learning and Econometrics" section
	April 11	• Machine learning for heterogenous causal effects	• Athey and Imbens 2016 PNAS,
12. Applying your Knowledge			
15	April 16	Presentation Day 1	
	April 18	Presentation Day 2	

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, 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.

LAUREN'S PROMISE (AND MY PROMISE TO YOU): I will listen and believe you if someone is threatening you, and I will help you find help – immediately.

Lauren McClusky, a 21-year-old honors student athlete, was murdered on October 22, 2018 by a man she briefly dated on the University of Utah campus. We must all take actions to ensure this never happens again.

If you are in immediate danger call 911. Do not hesitate.

If you experiencing sexual assault, domestic violence, or stalking please seek help from the police whether or not you are in immediate danger.

- Campus police: (614) 292-2121 (for things that happen on campus)
- Columbus Police: (614) 645-4545 (for things that happen off campus)

You can also seek help specific to sexual or domestic violence from (24/7):

- Sexual Assault Response Network of Central Ohio (SARNCO) Rape Helpline: 614-267-7020
- Rape, Abuse and Incest National Network Sexual Assault Hotline: 800-656-4673
- Lutheran Social Services Choices Domestic Violence Hotline: 614-224-4663
- LGBT National Health Center Hotline: 888-843-4564

Medical providers can conduct forensic evaluations within 120 hours of an assault

- Wexner Medical Center: 614-293-8333
- Wilce Student Health Center: 614-292-4321

Confidential support services:

- Sexual Assault Response Network of Central Ohio (SARNCO), on campus: 614-688-2518
- Counseling and Consultation Services: After-hours helpline: 614-292-5766, choose option 2
- Stress, Trauma and Resilience (STAR) Trauma Recovery Center: 614-293-7827