ECON6120T Applied Micro-econometrics (4 units)

2023/2024 Spring Semester

Department of Economics, Hong Kong University of Science and Technology

Instructor Information

Instructor	Email	Office Location & Office Hours
Kohei KAWAGUCHI (Lecturer)	kkawaguchi@ust.hk	LSK6070, appointment basis

Communication rule

- I set up a discord server for communicating with students. I share the link to the server in the first lecture.
- I post teaching materials and communicate with students on the Discord server.
- Discord should be the primary way of contacting me. If you send me a message by email, I may not respond to you.
- I will be responsive during the day but will be slow in the evening and weekend.
- You can make an appointment to see me in the office or zoom.

General Information

Enrollment requirement

The prerequisite is ECON 5300 Econometrics. The students are also recommended to take ECON4274 Programming Econometrics with R.

Course objectives and intended learning outcomes

This course teaches classical and recent applied econometric methods in empirical microeconomics for Ph.D. students. The learning goal of this course is to be able to understand, design, and implement effective empirical strategies to support empirical claims, particularly causal claims, at the level required for professional researchers of empirical microeconomics. These empirical strategies include randomized experiments with and without compliance, regression discontinuity, the difference-in-difference, and recent techniques such as causal machine learning. In addition, I expect students to understand how to write code in R to perform simulation, estimation, and inference. Finally, I also expect students to learn how to read empirical microeconomics papers critically.

Teaching and leanrning activities

The course adopts the following approaches to meet the objectives:

1. Give lectures on concepts and methods, showcasing the methods with simulated and actual data.
2. Assign homework to replicate and extend analyses and read papers critically.
3. Request students to read and present related literature.

Class Time

Tue & Thu,15:00-16:50. Make sure to have lunch before the class because the school prohibits eating and drinking in the classroom.

Course Materials

I post all teaching materials on the Discord server.

Recommended Materials

I update the reference during the semester.

Randomized experiments

General

Guido W. Imbens and Donald B. Rubin, 2015, Causal Inference for Statistics, Social, and Biomedical Sciences, Cambridge University Press.

Athey, Susan, and Guido Imbens. 2016. "The Econometrics of Randomized Experiments." arXiv [stat.ME]. arXiv. http://arxiv.org/abs/1607.00698.

Duflo, Esther, Rachel Glennerster, and Michael Kremer. 2007. "Chapter 61 Using Randomization in Development Economics Research: A Toolkit." In Handbook of Development Economics, edited by T. Paul Schultz and John A. Strauss, 4:3895–3962. Elsevier.

Papers

Imbens, Guido W., and Joshua D. Angrist. 1994. "Identification and Estimation of Local Average Treatment Effects." *Econometrica: Journal of the Econometric Society* 62 (2): 467.

Angrist, Joshua D., Guido W. Imbens, and Donald B. Rubin. 1996. "Identification of Causal Effects Using Instrumental Variables." *Journal of the American Statistical Association* 91 (434): 444–55.

Heckman, James J., and Edward Vytlacil. 2005. "Structural Equations, Treatment Effects, and Econometric Policy Evaluation." *Econometrica: Journal of the Econometric Society* 73 (3): 669–738.

Abadie, Alberto, Susan Athey, Guido W. Imbens, and Jeffrey M. Wooldridge. 2020. "Sampling-based versus Design-based Uncertainty in Regression Analysis." *Econometrica: Journal of the Econometric Society* 88 (1): 265–96.

Abadie, Alberto, Susan Athey, Guido W. Imbens, and Jeffrey Wooldridge. 2017. "When Should You Adjust Standard Errors for Clustering?" Working Paper Series. National Bureau of Economic Research. https://doi.org/10.3386/w24003.

Applications

Duflo, Esther, Rema Hanna, and Stephen P. Ryan. 2012. "Incentives Work: Getting Teachers to Come to School." *The American Economic Review* 102 (4): 1241–78.

Banerjee, Abhijit V., Shawn Cole, Esther Duflo, and Leigh Linden. 2007. "Remedying Education: Evidence from Two Randomized Experiments in India." *The Quarterly Journal of Economics* 122 (3): 1235–64.

Imbens, Guido W., Donald B. Rubin, and Bruce I. Sacerdote. 2001. “Estimating the Effect of Unearned Income on Labor Earnings, Savings, and Consumption: Evidence from a Survey of Lottery Players.” *The American Economic Review* 91 (4): 778–94.

Angrist, Joshua D. 1990. “Lifetime Earnings and the Vietnam Era Draft Lottery: Evidence from Social Security Administrative Records.” *The American Economic Review* 80 (3): 313–36.

Regression discontinuity

General

Cattaneo, Matias D., Nicolás Idrobo, and Rocío Titiunik. 2020. A Practical Introduction to Regression Discontinuity Designs: Foundations. Cambridge University Press.

Cattaneo, Matias D., Nicolas Idrobo, and Rocio Titiunik. 2020. A Practical Introduction to Regression Discontinuity Designs: Extension. Cambridge University Press.

Papers

Hahn, Jinyong, Petra Todd, and Wilbert Van der Klaauw. 2001. “Identification and Estimation of Treatment Effects with a Regression-Discontinuity Design.” Econometrica: Journal of the Econometric Society 69 (1): 201–9.

McCrary, Justin. 2008. “Manipulation of the Running Variable in the Regression Discontinuity Design: A Density Test.” *Journal of Econometrics* 142 (2): 698–714.

Calonico, Sebastian, Matias D. Cattaneo, and Rocio Titiunik. 2014. “Robust Nonparametric Confidence Intervals for Regression-Discontinuity Designs.” Econometrica: Journal of the Econometric Society 82 (6): 2295–2326.

Calonico, Sebastian, Matias D. Cattaneo, and Rocío Titiunik. 2015. “Optimal Data-Driven Regression Discontinuity Plots.” *Journal of the American Statistical Association*.

Cattaneo, Matias D., Michael Jansson, and Xinwei Ma. 2020. “Simple Local Polynomial Density Estimators.” *Journal of the American Statistical Association* 115 (531): 1449–55.

Calonico, Sebastian, Matias D. Cattaneo, and Max H. Farrell. 2018. “On the Effect of Bias Estimation on Coverage Accuracy in Nonparametric Inference.” *Journal of the American Statistical Association* 113 (522): 767–79.

Calonico, Sebastian, Matias D. Cattaneo, Max H. Farrell, and Rocío Titiunik. 2019. “Regression Discontinuity Designs Using Covariates.” *The Review of Economics and Statistics* 101 (3): 442–51.

Kolesár, Michal, and Christoph Rothe. 2018. “Inference in Regression Discontinuity Designs with a Discrete Running Variable.” *The American Economic Review* 108 (8): 2277–2304.

Dong, Yingying, and Arthur Lewbel. 2015. “Identifying the Effect of Changing the Policy Threshold in Regression Discontinuity Models.” *The Review of Economics and Statistics* 97 (5): 1081–92.

Card, David, David S. Lee, Zhuan Pei, and Andrea Weber. 2015. “Inference on Causal Effects in a Generalized Regression Kink Design.” *Econometrica: Journal of the Econometric Society* 83 (6): 2453–83.

Cattaneo, Matias D., Brigham R. Frandsen, and Rocío Titiunik. 2015. “Randomization Inference in the Regression Discontinuity Design: An Application to Party Advantages in the U.S. Senate.” *Journal of Causal Inference* 3 (1): 1–24.

Application

Meyersson, Erik. 2014. “Islamic Rule and the Empowerment of the Poor and Pious.” *Econometrica: Journal of the Econometric Society* 82 (1): 229–69.

Amarante, Verónica, Marco Manacorda, Edward Miguel, and Andrea Vigorito. 2016. “Do Cash Transfers Improve Birth Outcomes? Evidence from Matched Vital Statistics, Program, and Social Security Data.” *American Economic Journal: Economic Policy* 8 (2): 1–43.

Nielsen, Helena Skyt, Torben Sørensen, and Christopher Taber. 2010. “Estimating the Effect of Student Aid on College Enrollment: Evidence from a Government Grant Policy Reform.” *American Economic Journal: Economic Policy* 2 (2): 185–215.

Dell, Melissa. 2010. “The Persistent Effects of Peru’s Mining ‘Mita.’” *Econometrica: Journal of the Econometric Society* 78 (6): 1863–1903.Keele, Luke J., and Rocío Titiunik. 2015. “Geographic Boundaries as Regression Discontinuities.” *Political Analysis: An Annual Publication of the Methodology Section of the American Political Science Association* 23 (1): 127–55.

Background

Fan, Jianqing, Irene Gijbels, D. R. 1996. *Local Polynomial Modelling and Its Applications: Monographs on Statistics and Applied Probability 66*. 1st ed. Taylor & Francis Group.

Difference-in-difference

Roth, Jonathan, Pedro H. C. Sant’Anna, Alyssa Bilinski, and John Poe. “What’s Trending in Difference-in-Differences? A Synthesis of the Recent Econometrics Literature.” Journal of Econometrics 235, no. 2 (August 1, 2023): 2218–44.

2 x 2 design

Bertrand, Marianne, Esther Duflo, and Sendhil Mullainathan. 2004. “How Much Should We Trust Differences-In-Differences Estimates?” The Quarterly Journal of Economics 119 (1): 249–75.

Heckman, James J., Hidehiko Ichimura, and Petra E. Todd. 1997. “Matching As An Econometric Evaluation Estimator: Evidence from Evaluating a Job Training Programme.” *The Review of Economic Studies* 64 (4): 605–54.

Abadie, Alberto. 2005. “Semiparametric Difference-in-Differences Estimators.” *The Review of Economic Studies* 72 (1): 1–19.

Sant’Anna, Pedro H. C., and Jun Zhao. 2020. “Doubly Robust Difference-in-Differences Estimators.” *Journal of Econometrics* 219 (1): 101–22.

Chaisemartin, C. de, and X. D’HaultfŒuille. 2018. “Fuzzy Differences-in-Differences.” The Review of Economic Studies 85 (2): 999–1028.n-Differences Estimates?” The Quarterly Journal of Economics 119 (1): 249–75.

Multi-period design

Goodman-Bacon, Andrew. 2018. Difference-in-Differences with Variation in Treatment Timing. National Bureau of Economic Research.

Callaway, Brantly, and Pedro H. C. Sant’Anna. 2020. “Difference-in-Differences with Multiple Time Periods.” Journal of Econometrics.

Sun, Liyang, and Sarah Abraham. 2020. “Estimating Dynamic Treatment Effects in Event Studies with Heterogeneous Treatment Effects.” Journal of Econometrics, December.

Chaisemartin, Clément de, and Xavier D’Haultfœuille. 2020. “Two-Way Fixed Effects Estimators with Heterogeneous Treatment Effects.” The American Economic Review, 110 (9): 2964–96.

Athey, Susan, and Guido W. Imbens. 2021. “Design-Based Analysis in Difference-In-Differences Settings with Staggered Adoption.” Journal of Econometrics, April.

Wooldridge, Jeffrey M. 2021. “Two-Way Fixed Effects, the Two-Way Mundlak Regression, and Difference-in-Differences Estimators,” August. https://www.researchgate.net/publication/353938385_Two-Way_Fixed_Effects_the_Two-Way_Mundlak_Regression_and_Difference-in-Differences_Estimators.

Application

Card, David, and Alan B. Krueger. 1994. “Minimum Wages and Employment: A Case Study of the Fast-Food Industry in New Jersey and Pennsylvania.” *The American Economic Review* 84 (4): 772–93.

Meer, Jonathan, and Jeremy West. 2016. “Effects of the Minimum Wage on Employment Dynamics.” *The Journal of Human Resources* 51 (2): 500–522.

Dobkin, Carlos, Amy Finkelstein, Raymond Kluender, and Matthew J. Notowidigdo. 2018. “The Economic Consequences of Hospital Admissions.” *The American Economic Review* 102 (2): 308–52.

Synthetic control

Abadie, Alberto, Alexis Diamond, and Jens Hainmueller. 2010. “Synthetic Control Methods for Comparative Case Studies: Estimating the Effect of California’s Tobacco Control Program.”, Journal of the American Statistical Association.

Firpo, Sergio, and Vitor Possebom. 2018. “Synthetic Control Method: Inference, Sensitivity Analysis and Confidence Sets.” *Journal of Causal Inference* 6 (2). https://doi.org/10.1515/jci-2016-0026.

Abadie, Alberto. 2021. “Using Synthetic Controls: Feasibility, Data Requirements, and Methodological Aspects.” *Journal of Economic Literature* 59 (2): 391–425.

Abadie, Alberto, and Jérémy L’Hour. 2021. “A Penalized Synthetic Control Estimator for Disaggregated Data.” Journal of the American Statistical Association, August, 1–18.

Arkhangelsky, Dmitry, Susan Athey, David A. Hirshberg, Guido W. Imbens, and Stefan Wager. n.d. “Synthetic Difference in Differences.” *The American Economic Review*. Accessed September 2, 2021.

Application

Abadie, Alberto, and Javier Gardeazabal. 2003. “The Economic Costs of Conflict: A Case Study of the Basque Country.” The American Economic Review 93 (1): 113–32.

Cavallo, Eduardo, Sebastian Galiani, Ilan Noy, and Juan Pantano. 2013. “Catastrophic Natural Disasters and Economic Growth.” *The Review of Economics and Statistics* 95 (5): 1549–61.

Marx, Matt, Deborah Strumsky, and Lee Fleming. 2009. “Mobility, Skills, and the Michigan Non-Compete Experiment.” *Management Science* 55 (6): 875–89.

Hinrichs, Peter. 2012. “The Effects of Affirmative Action Bans on College Enrollment, Educational Attainment, and the Demographic Composition of Universities.” *The Review of Economics and Statistics* 94 (3): 712–22.

Shift-share design

Adao, Rodrigo, Michal Kolesár, and Eduardo Morales. 2019. “Shift-Share Designs: Theory and Inference.” *The Quarterly Journal of Economics* 134 (4): 1949–2010.

Goldsmith-Pinkham, Paul, Isaac Sorkin, and Henry Swift. 2020. “Bartik Instruments: What, When, Why, and How.” *The American Economic Review* 110 (8): 2586–2624.

Borusyak, Kirill, Peter Hull, and Xavier Jaravel. 2021. “Quasi-Experimental Shift-Share Research Designs.” *The Review of Economic Studies*, June. https://doi.org/10.1093/restud/rdab030.

Application

Card, David. 2001. “Immigrant Inflows, Native Outflows, and the Local Labor Market Impacts of Higher Immigration.” *Journal of Labor Economics* 19 (1): 22–64.

Autor, David H., David Dorn, and Gordon H. Hanson. 2013. “The China Syndrome: Local Labor Market Effects of Import Competition in the United States.” *The American Economic Review* 103 (6): 2121–68.

Hummels, David, Rasmus Jørgensen, Jakob Munch, and Chong Xiang. 2014. “The Wage Effects of Offshoring: Evidence from Danish Matched Worker-Firm Data.” *The American Economic Review* 104 (6): 1597–1629.

Multiple testing

Anderson, Michael L. 2008. “Multiple Inference and Gender Differences in the Effects of Early Intervention: A Reevaluation of the Abecedarian, Perry Preschool, and Early Training Projects.” Journal of the American Statistical Association 103 (484): 1481–95.

Young, Alwyn. 2019. “Channeling Fisher: Randomization Tests and the Statistical Insignificance of Seemingly Significant Experimental Results.” The Quarterly Journal of Economics 134 (2): 557–98.

List, John A., Azeem M. Shaikh, and Yang Xu. 2019. “Multiple Hypothesis Testing in Experimental Economics.” *Experimental Economics* 22 (4): 773–93.

Other topics

Colin Cameron, A., and Douglas L. Miller. 2015. “A Practitioner’s Guide to Cluster-Robust Inference.” The Journal of Human Resources 50 (2): 317–72.

Wager, Stefan, and Susan Athey. 2018. “Estimation and Inference of Heterogeneous Treatment Effects Using Random Forests.” Journal of the American Statistical Association 113 (523): 1228–42.

R

Garrett Grolemund, Hands-on Programming with R. https://rstudio-education.github.io/hopr/

Hadley Wickham and Garrett Grolemund, R for Data Science. https://r4ds.had.co.nz/

Hadley Wickham, R Packages. https://r-pkgs.org/

Required Software

R with RStudio

Evaluation

Students in Hong Kong are not allowed to attend the class online. Only students outside Hong Kong who got the approval in advance can do so. The online students have to voice up to ask questions and participate in the classroom discussion. I treat in-class and online students equally in the evaluation. Because the contribution to the classroom discussion shares a substantial portion of the evaluation, I recommend online students to do their best to actively participate in the classroom discussion.

Approximately A range for >= 90, B range for >= 80, and C range for >= 50.

1. **Assignment 50%**: I will assign approximately ten pieces of homework. The score is based on the best 5 submissions. Students have to write the solution in Rmarkdown and submit the original Rmd file and the compiled HTML file. I share the submitted solutions with the other students for their reference.
2. **Participation 30%**: Every time you ask a question during the class, you will earn 1 point up to 30 points. To claim a point, you have to note the question and answer in the designated channel of the Discord server.

3. **Presentation 20%**: 10% x 2 Each student picks up an empirical microeconomics paper published in the top 5 journals since 2010 and discusses the article in the classroom. The student summarizes the motivation, questions, and findings of the paper. Then, the student lists up the empirical claims and explains the methods the authors used to support the claims, the assumptions made for the methods, and the arguments to justify the assumptions. Finally, the student critically evaluates the authors' arguments. The time for each presentation depends on the classroom size.

Schedule

The weekly schedule is tentative and may change.

- Potential outcome: Week 1
- Assignment mechanism: Week 2
- Classical randomized experiments
    - Completely randomized experiment: Week 3
    - Stratified randomized experiment: Week 4
    - Clustered randomized experiment: Week 5
- Regular assignment mechanism
    - Without noncompliers: Week 6
    - With noncompliers: Week 7
- Regression discontinuity
    - Basics: Week 8
    - Advanced: Week 9
- Difference-in-difference
    - Basics: Week 10
    - Advanced: Week 11
- Other topics
    - Multiple testing: Week 12
    - Heterogeneous treatment effects: Week 13
- Presentations and discussions

Academic Integrity

Without academic integrity, there is no serious learning. Thus, you are expected to hold the highest standard of academic integrity in the course. You are encouraged to study and do homework in groups. However, no cheating, plagiarism will be tolerated. Anyone caught cheating, plagiarism will fail the course. Please make sure adhere to the HKUST Academic Honor Code at all time (see http://www.ust.hk/vpaao/integrity/).