University of Victoria | Economics

ECON 548 A01: Applied Econometric Modelling (CRN: 21058)

Spring Term, Jan-Apr 2026

Instructor Name: Dr. Tao Wang
Office: BEC 392
Class Times: BEC 363, Mondays and Thursdays 08:30 AM-09:50 AM
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Office Hours: Mondays and Thursdays 10:00 AM-11:00 AM and via email appointment

Note: Students are highly encouraged to take full advantage of office hours. This time provides a valuable opportunity not only to ask questions and clarify any doubts related to the lecture material but also to delve deeper into topics of interest and receive personalized feedback.

UVic Land Acknowledgement

We acknowledge and respect the Lək̓ʷəŋən (Songhees and Xʷsepsəm/Esquimalt) Peoples on whose territory the university stands, and the Lək̓ʷəŋən and W̱SÁNEĆ Peoples whose historical relationships with the land continue to this day.

Course Content

Modern econometric methods have revolutionized the way we utilize data, statistics, and research design to move beyond correlation to causation and thoroughly understand the impact of some potential cause on certain outcomes. The objective of this course is to develop your empirical skills (***modern econometric/causal inference methods***) by exploring the properties, applications, and limitations of a variety of reduced form-econometric tools, practicing their implementation, and encouraging you to apply the appropriate tools to analyze your own research question. This course is oriented towards applied practitioners rather than aspiring econometricians, which sets it apart from many other econometrics courses. If you ever want to collect data, analyze data, critically read an article that presents a data analysis, or think about the relationship between theory and the real world, then this course will be beneficial for you. The practical focus of this course ensures you gain hands-on experience with real-world applications of econometric methods. Moreover, it emphasizes the importance of understanding the assumptions behind each method to critically assess their validity and relevance. The core materials cover *experiments (RCT), potential outcomes framework, selection on observables, decomposition in economics, instrumental variables, regression discontinuity designs, fixed effects panel model, differences-in-differences, synthetic control, and (causal) machine learning methods*.

Learning Outcomes

The purpose of this course is to provide you with a solid foundation in applied econometric techniques. Upon successful completion of this course, you will be able to:
(i) Understand the problem of causality in economics in both an intuitive and theoretical manner.
(ii) Recognize how applied econometric techniques are utilized to test and advance economic theory.
(iii) Effectively apply the covered econometrics techniques to evaluate the effectiveness of policy programs.
(iv) Conduct econometric analysis and apply empirical evidence to critically assess economic arguments.

Prerequisites

Willingness to work hard on unfamiliar materials. Understanding of basic econometric methods, linear algebra, calculus, and probability. You typically benefit more from the class if you have taken ECON 545. This course

presupposes that you are familiar with the fundamentals of R (you may also use other software packages that you are very familiar with, i.e., STATA and MATLAB).

Textbook

Recommended paper readings for each section of the course are listed at the end of this syllabus. There is no single textbook for this course, and lecture notes and readings will be available on the Brightspace website. The following four books, however, are highly recommended.

- Angrist, J. D. and J-S. Pischke. *Mostly Harmless Econometrics: An Empiricist's Companion* (Princeton University Press)
- Imbens, G. W. and Donald B. Rubin. *Causal Inference for Statistics, Social, and Biomedical Sciences: An Introduction*. Cambridge University Press, 2015.
- Morgan, S. and Winship, C. *Counterfactuals and Causal Inference: Methods and Principles for Social Research*. Cambridge University Press, 2015. 2nd ed.
- Cunningham, S. *Causal Inference: The Mixtape*. https://mixtape.scunning.com/.

Note: *The materials posted on Brightspace are meant solely for students attending ECON 548 this semester. You do not have the instructor's permission to supply the ECON 548 course materials to any sites.*

Grading

The course involves lectures and presentations. The course grade will base on participation, referee report, in-class presentations, and final project (proposal+final paper). Two copies of the referee report, proposal, and paper must be submitted: (1) a *printed hard copy* submitted in class; and (2) an *electronic pdf copy* submitted through email. All results described in your project must be supported by copies of the data and codes (sent via email) that are used to produce them. Details will be discussed in class.

- **Referee Report (10%)+Presentation (20%):** This is a methodological course, developing skills in understanding and applying econometric methods. You can only learn applied metrics by doing critical judgments and therefore referee report for this course is important. By doing so, you can learn how to provide and respond to constructive criticism. The referee report should summarize and critique the paper you choose. It can be a published paper or a working paper. You will need to submit *one referee report*, with *a minimum length of 2 pages* (12-point font, single spacing, excluding references). Sample referee reports will be discussed in class. You will also give an in-class presentation (25 minutes) to discuss the paper you selected and share the critical evaluations detailed in your referee report.

- **Project Presentation (20%):** You need to develop an empirical project using one of the methods we will learn to answer a causal question of interest. It can be a replication or extension of an existing research paper. Those who choose to replicate a paper must do so without requesting the cleaned version of the data. You need to present your work—*a 20-minute presentation*. You are required to share your slides with the whole class before your presentation. Everyone who is not presenting is expected to have read the slides and to come prepared to ask questions.

- **Final Research Project (Proposal 10%+Paper 30%):** The project should be a short empirical paper that applies methods learned in this class to a research question of your choice. You can work in *a group of maximum 2 students*. You should carefully prepare the proposal since it is the beginning of a proper research project. You are encouraged to discuss with me first. Note that the final project will not be accepted without the approval of the proposal. The proposal should be *no longer than 2 pages* (12-point font, single spacing, excluding references), and it should include information on the nature of the problem, how it might be framed as an economic topic, and how econometric technique works. The final paper should be with *a minimum length of 10 pages* (12-point font, double space, including references and appendix, where the tables and figures should be included). Paper focusing primarily on the techniques that are not covered in this course (i.e., multivariate regression, GARCH models, or VAR models) will not be accepted.

- **Class participation (10%):** This is a graduate course, and I assume that you are interested in learning the materials. You are expected to attend every class and actively participate in class activities.

  Note 1: *It is not appropriate to request grade adjustments or special extra credit chances after presenting unsatisfactory performance or failing to receive the grade you had hoped for. These requests will not be granted. However, I do reserve the right to raise every student's grade by the same amount or offer an opportunity for extra credit to all students if scores on an assignment are low across most or all students (but such events are rare).*

  Note 2: *I strongly encourage you to attend the department seminars. These seminars are usually Wednesdays 12:30-13:20 PM and Fridays 15:00-16:30 PM. Though seminar attendance is not counted in your grade for this class, attending seminars is an excellent way to expose yourself to current research and practically utilize the techniques learned in this course.*

Grading Scale:

A+	A	A-	B+	B	B-	C+	C	D	F or N
90-100	85-89	80-84	77-79	73-76	70-72	65-69	60-64	50-59	0-49

Students should review the University's more detailed summary of grading.

Course Policies

Arriving late for class, sleeping, talking out of turn, using a cell phone or other device, or acting otherwise distraught and disturbing are not permitted in the classroom. Please let me know immediately if you have a health problem or disability that necessitates leaving the room during class time, or if you have a conflict that regularly prevents you from getting to class on time.

Consideration for missed projects or late referee report will be given only on the basis of documented illness (in-line with the University's policies at the time), accident, or family affliction, and for no other reasons. Students are advised not to make work or travel plans during lecture hours to be able to attend all classes and presentations. There will be no special accommodation if travel plans conflict with presentations held during class hours.

I want you to perform well in this class. If you become concerned about your progress, please see me immediately. Please stop by during office hours if you have any questions about the materials covered in this course.

Academic Integrity:

Academic integrity requires commitment to the values of honesty, trust, fairness, respect, and responsibility. Students are expected to observe the same standards of scholarly integrity as their academic and professional counterparts. Review What is Plagiarism for the definition of plagiarism. The University reserves the right to use a plagiarism software to detect violations of academic integrity (including unauthorized use of ChatGPT and other Artificial Intelligence). This applies to all exams and submitted work. Should you violate this rule, you will have violated UVic's academic integrity policy and a complaint against you under this policy will be filed accordingly.

Student Code of Conduct:

We are all responsible for creating a learning environment that is welcoming, inclusive, equitable, and respectful. The Humanities, Science, and Social Sciences Faculties have adopted this Student code of conduct.

University Policy on Human Rights, Equity and Fairness:

The University is committed to promoting, providing and protecting a positive, supportive and safe learning and working environment for all its members. See General University Policies

Resources for Students

UVic Learn Anywhere - UVic Learn Anywhere is the primary learning resource for students that offers many learning workshops and resources to help students with academics and learning strategies.

Centre for Accessible Learning - Students with diverse learning styles and needs are welcome in this course. In particular, if you have a disability/health consideration that may require accommodations, you are free to approach me; however, you must register with the Centre for Accessible Learning (CAL) for formal arrangements to be made. The CAL staff are available by appointment to assess specific needs, provide referrals and arrange appropriate accommodations. The sooner you let us know your needs the quicker we can assist you in achieving your learning goals in this course.

Centre for Academic Communication - Offers coaching on academic integrity, including preventing accidental plagiarism. Provides support to students with time management, reading, writing, speaking, understanding academic expectations, and other aspects of academic communication as well as creating academic posters, blogposts, PowerPoint slides, and e-portfolios.

Health Services - University Health Services (UHS) provides a full service primary health clinic for students, and coordinates healthy student and campus initiatives.

Support Connect - a 24/7 mental health support service for students

•Toll-free (calls from North America): 1-844-773-1427

•International collect calls: 1-250-999-7621

Counselling Services - Counselling Services can help you make the most of your university experience. They offer free professional, confidential, inclusive support to currently registered UVic students.

Indigenous Student Services - Indigenous UVic students have access to many sources of support on campus. Before, during and after your time at UVic, you are encouraged to explore programs and services available to you, such as Indigenous counselling services and the Elders in Residence, as well as non-academic programs that may be of interest to you.

International Student Support - The University of Victoria offers a number of resources to support international students as they pursue their studies. UVic's International Centre for Students is the primary office supporting international students on campus at the university-wide level and provides various supportive program through the UVic Global Community Initiative, including a Mentorship Program and Conversation Partner Program.

Sexualized Violence Prevention & Response

UVic takes sexualized violence seriously, and has raised the bar for what is considered acceptable behaviour. Students are encouraged to learn more about how the university defines sexualized violence and its overall approach by visiting www.uvic.ca/svp . If you or someone you know has been impacted by sexualized violence and needs information, advice, and/or support please contact the sexualized violence resource office in Equity and Human Rights (EQHR). Contact svpcoordinator@uvic.ca.

Brightspace:

Brightspace is used extensively for the course. All students are expected to be fully functional with the system. The lecture notes online are only outlines of the actual lectures, and additional material may be covered during the lectures. All announcements will be posted in *Brightspace*. Students are advised to check it frequently.

Course Experience Survey (CES)

I value your feedback on this course. Towards the end of term you will have the opportunity to complete a confidential course experience survey (CES) regarding your learning experience. The survey is vital to providing

feedback to me regarding the course and my teaching, as well as to help the department improve the overall program for students in the future.

When it is time for you to complete the survey, you will receive an email inviting you to do so. If you do not receive an email invitation, you can go directly to the CES log-in. You will use your UVic NetLink ID to access the survey, which can be completed on your laptop, tablet or mobile device. I will remind you nearer the time, but please be thinking about this important activity, especially the following three questions, during the course.

- What strengths did your **instructor** demonstrate that helped you learn in this course?
- Please provide specific suggestions as to how the **instructor** could have helped you learn more effectively.
- Please provide specific suggestions as to how this **course** could be improved.

E-mail Correspondence

Emails should be limited to critical matters, such as inability to attend class, an exam, or prolonged illness, and should include the course name and number in the subject line. Questions on course materials should be asked during office hours or in class. Should you send an email for whatever reason, please put "ECON 548" in the subject line. I will strive to respond to your course emails within 24 hours.

AI Use Policy

AI tools may be used to clarify modeling concepts or assist with basic editing, but all referee report/presentation slides, empirical analyses, and project writing must be your own work. AI may not be used to draft report/slides, generate interpretations, build models, or produce project results. Any use of AI beyond simple proofreading must be disclosed in a short note. Improper or undisclosed AI use will be treated as an academic integrity violation.

Course Schedule

A tentative session-by-session schedule is below (subject to change).

Topic	Important Dates
Topic 1: The Potential Outcomes Framework	Feb 12nd Referee Report deadline
Topic 2: Selection on Observables	Feb 23rd, 26th, March 2nd Class Presentation
Topic 3: Decomposition in Economics	March 9th Final Paper Proposal deadline
Topic 4: Instrumental Variables	March 23rd Slides Share deadline
Topic 5: Regression Discontinuity Designs	March 26th, 30th, April 2nd Class Presentation
Topic 6: Fixed Effects Panel Model	April 9th Final Paper deadline
Topic 7: Differences-in-Differences	
Topic 8: Synthetic Control	
Topic 9: Machine Learning Methods	
Topic 10: Causal Machine Learning in Economics	

Note: *All deadlines are before the start of class (8:30 AM).*

Introduction and Statistical Inference

Blundell, R. and M. Costa Dias. 2009. "Alternative Approaches to Evaluation in Empirical Microeconomics," *Journal of Human Resources*, 44, 565-640.

Deaton, A. 2010. "Instruments, Randomization, and Learning about Development," *Journal of Economic Literature*, 48, 424–455.

Heckman, J. J. 2010. “Building Bridges between Structural and Program Evaluation Approaches to Evaluating Policy,” *Journal of Economic Literature*, 48, 356-398.

Imbens, G. and J. Wooldridge. 2009. “Recent Developments in the Econometrics of Program Evaluation,” *Journal of Economic Literature*, 47, 5-86.

Causality and Random Experiments

Baranov, V., S. Bhalotra, P. Biroli, and J. Maselko. 2020. “Maternal Depression, Women's Empowerment, and Parental Investment: Evidence from a Randomized Controlled Trial,” *American Economic Review*, 110, 3, 824-59.

Carrell, S. E., M. Hoekstra, and J. E. West. 2011. “Is Poor Fitness Contagious? Evidence from Randomly Assigned Friends,” *Journal of Public Economics*, 95, 657-663.

Fairlie, R. W., and J. Robinson. 2013. “Experimental Evidence on the Effects of Home Computer on Academic Achievement among Schoolchildren,” *American Economic Journal: Applied Economics*, 5, 211-240.

Heckman, J., and J. Smith. 1995. “Assessing the Case for Social Experiments,” *Journal of Economic Perspectives*, 9, 85-110.

Katz, K. F, J. R. Kling, and J. B. Liebman. 2001. “Moving to Opportunity in Boston: Early Results of a Randomized Mobility Experiment,” *Quarterly Journal of Economics*, 116, 607-654.
Kling, J., J. Liebman and L. Katz. 2007. “Experimental Analysis of Neighborhood Effects,” *Econometrica*, 75, 83-119.

Muralidharan, K. and V. Sundararaman. 2011. “Teacher Performance Pay: Experimental Evidence from India,” *Journal of Political Economy*, 119, 1, 39-77.

Oster, E., and R. Thornton. 2011. “Menstruation, Sanitary Products, and School Attendance: Evidence from a Randomized Evaluation,” *American Economic Journal: Applied Economics*, 3, 91-100.

Planas, N. R. 2012. “Longer-Term Impacts of Mentoring, Educational Services, and Learning Incentives: Evidence from a Randomized Trial in the United States,” *American Economic Journal: Applied Economics*, 4, 121-139.

Sacerdote, B. 2007. “How Large Are the Effects from Changes in Family Environment? A Study of Korean American Adoptees,” *Quarterly Journal of Economics*, 122, 119-157.

Selection on Observables

Behncke, S., M. Frölich, and M. Lechner. 2010. “A Caseworker Like Me-Does the Similarity Between the Unemployed and Their Caseworkers Increase Job Placements?” *Economic Journal*, 120, 1430-1459.

Black D., and J. Smith. 2004. “How Robust is the Evidence on the Effects of College Quality? Evidence from Matching,” *Journal of Econometrics*, 121, 99-124.
Caliendo, M. and S. Kopeinig. 2008. “Some Practical Guidance for the Implementation of Propensity Score Matching,” *Journal of Economic Surveys*, 22, 31-72.

Dehejia, R., and S. Wahba. 2002. “Propensity Score Matching Methods for Nonexperimental Causal Studies,” *Review of Economics and Statistics*, 84, 151-161.

Hahn, J. 1998. “On the Role of the Propensity Score in Efficient Semiparametric Estimation of Average Treatment Effects.” *Econometrica*, 66(2): 315-331.

Heckman, J., H. Ichimura, and P. Todd. 1997. “Matching as an Econometric Evaluation Estimator: Evidence from Evaluating a Job Training Program,” *Review of Economic Studies*, 64, 605-654.

Huber, M., M. Lechner and A. Strittmatter. 2018. “Direct and Indirect Effects of Training Vouchers for the Unemployed,” *Journal of the Royal Statistical Society Series A*, 181, 441-463.

Imbens, G. W. 2004. “Nonparametric Estimation of Average Treatment Effects under Exogeneity: A Review,” *Review of Economics and Statistics*, 86, 4-29.

Khalil, U. and Yildiz, N. 2022. “A Test of the Selection on Observables Assumption Using A Discontinuously Distributed Covariate.” *Journal of Econometrics*, 226 (2), 423-450.

Simonsen, M., and L. Skipper. 2006. “The Costs of Motherhood: An Analysis Using Matching Estimators,” *Journal of Applied Econometrics*, 21, 919-934.

Decomposition in Economics

Baum-Snow, N. and Pavan, R. 2013. “Inequality and City Size,” *The Review of Economics and Statistics*, 95 (5), 1535-1548.

Blinder, A. S. 1973. “Wage Discrimination: Reduced Form and Structural Estimates,” *Journal of Human Resources*, 8, 436-455.

Card, D., Cardoso, A. R., and Kline, P. 2016. “Bargaining, Sorting, and the Gender Wage Gap: Quantifying the Impact of Firms of the Relative Pay of Women,” *The Quarterly Journal of Economics*, 131 (2), 633-686.

Cotton, J. 1988. “On the Decomposition of Wage Differentials,” *The Review of Economics and Statistics*, 70, 236 -243.

Fortin, N. M., Oreopoulos, P., and Phipps, S. 2017. “Leaving Boys Behind Gender Disparities in High Academic Achievement,” *Journal of Human Resources*, 50 (3), 549-579.

Gardeazabal, J. and Ugidos, A. 2004. “More on Identification in Detailed Wage Decompositions,” *The Review of Economics and Statistics*, 86 (4), 1034-1036.

Gustafsson, B. and Li, S. 2000. “Economic Transformation and the Gender Earnings Gap in Urban China,” *Journal of Population Economics*, 13, 305-329.

Liu, X., Mazumdar, T., and Li, B. 2014. “Counterfactual Decomposition of Movie Star Effects with Star Selection,” *Management Science*, 61 (7), 1473-1740.

Oaxaca, R. L. 1973. “Male-Female Wage Differentials in Urban Labor Markets,” *International Economic Review*, 14 (3), 693-709.

Oaxaca, R. and Ransom, M. 1998. “Calculation of Approximate Variances for Wage Decomposition Differentials,” *Journal of Economic and Social Measurement*, 24, 55-61.

Instrumental Variables

Aizer, A., and J. Doyle. 2015. “Juvenile Incarceration, Human Capital, and Future Crime: Evidence from Randomly Assigned Judges,” *Quarterly Journal of Economics*, 130, 759-803.

Alesina, A., P. Giuliano and N. Nunn. 2013. “On the Origins of Gender Roles: Women and the Plough,” *Quarterly Journal of Economics*, 128, 469-530.

Card, David. 2001. “Estimating the Return to Schooling: Progress on Some Persistent Econometric Problems,” *Econometrica*, 69, 1127-1160.
Fruehwirth, J. C., S. Iyer, and A. Zhang. 2019. “Religion and Depression in Adolescence.” *Journal of Political Economy*, 127, 1178-1209.

Gordon, B. D., and L. Lochner. 2012. “The Impact of Family Income on Child Achievement: Evidence from the Earned Tax Credit,” *American Economic Review*, 102, 1927-1956.

Heckman, J., S. Urzua, and E. Vytlacil. 2006. “Understanding Instrumental Variables in Models with Essential Heterogeneity,” *Review of Economics and Statistics*, 88(3):389-432.

Imbens G., and J. Angrist. 1994. “Identification and Estimation of Local Average Treatment Effects,” *Econometrica*, 62, 467-475.

Imbens, G., J. Angrist, and D. Rubin. 1996. “Identification of Causal Effects Using Instrumental Variables,” *Journal of Econometrics*, 71, 145-160.

Nunn, N. 2008. “The Long-Term Effects of Africa’s Slave Trades,” *Quarterly Journal of Economics,* 123, 139-176.

Oreopoulos, P. 2006. “Estimating Average and Local Average Treatment Effects of Education when Compulsory Schooling Laws Really Matter,” *American Economic Review*, 96, 152-175.

Regression Discontinuity Designs

Card, D. and C. Dobkin and N. Maestas. 2009. “Does Medicare Save Lives?” *Quarterly Journal of Economics*, 124, 2, 597-636.

Carpenter, C., and C. Dobkin. 2009. “The Effect of Alcohol Consumption on Mortality: Regression Discontinuity Evidence from the Minimum Drinking Age,” *American Economic Journal: Applied Economics*, 1, 164-182.

Carrell, S. E., M. Hoekstra, and J. West. 2011. “Does Drinking Impair College Performance? Evidence from a Regression Discontinuity Approach,” *Journal of Public Economics*, 95, 54-62.

Dahl, Gordon B., K. V. Loken, and M. Mogstad. 2014. “Peer Effects in Program Participation,” *American Economic Review*, 104, 7, 2049-2074.

Hahn, J., P. Todd, and W. van der Klaauw. 2001. “Identification and Estimation of Treatment Effects with a Regression-Discontinuity Design,” *Econometrica*, 69, 201-209.

Lalive, R. 2007. “Unemployment Benefits, Unemployment Duration and Unemployment Jobs: A Regression Discontinuity Approach,” *American Economic Review*, 97, 108-112.

Lee, D. S. 2008. “Randomized Experiments from Nonrandom Selection in US House Elections,” Journal *of Econometrics*, 142(2):675-697.

Lee, D. S. and T. Lemieux. 2010. “Regression Discontinuity Design in Economics,” *Journal of Economic Literature*, 48, 2, 281-355.
Ludwig, J., and D. L. Miller. 2007. “Does Head Start Improve Children’s Life Chances? Evidence from a Regression Discontinuity Design,” *Quarterly Journal of Economics*, 122, 159-208.

Pinotti, P. 2017. “Clicking on Heaven’s Door: The Effect of Immigrant Legalization on Crime,” *American Economic Review,* 107, 138-68.

Fixed Effects Panel Model

Athey, S., Bayati, M., Imbens, G., and Qu, Z. 2019. "Ensemble Methods for Causal Effects in Panel Data Settings," *AEA Papers and Proceedings*, 109, 65-70.

Bojinov, I, Rambachan, A., and Shephard, N. 2021. "Panel Experiments and Dynamic Causal Effects: A Finite Population Perspective," *Quantitative Economics*, 12 (4), 1171-1196.

Chaisemartin, C. and D'Haultfoeuille, X. 2020. "Two-Way Fixed Effects Estimators with Heterogeneous Treatment Effects," *American Economic Review*, 110 (9), 2964-2996.

Frijters, P., Haisken-DeNew, J. P., and Shields, M. A. 2004. "Money Does Matter! Evidence from Increasing Real Income and Life Satisfaction in East Germany Following Reunification," *American Economic Review*, 94 (3), 730-740.

Ferrer-i-Carbonell, A. and Frijters, P. 2004. "How Important is Methodology for the Estimates of the Determinants of Happiness?" *The Economic Journal*, 114 (497), 641-659.

Gangl. M. 2010. "Causal Inference in Sociological Research," *Annual Review of Sociology*, 36 (1), 21-47.

Holmlund, H., Lindahl, M., and Plug, E. 2011. "The Causal Effect of Parents' Schooling on Children's Schooling: A Comparison of Estimation Methods," *Journal of Economic Literature*, 49 (3), 615-651.

Imai, K. and Kim, I. S. 2019. "When Should We Use Fixed Effects Regression Models for Causal Inference with Longitudinal Data?" *American Journal of Political Science*, 63 (2), 467-490.

Imai, K. and Kim, I. S. 2021. "On the Use of Two-Way Fixed Effects Regression Models for Causal Inference with Panel Data?" *Political Analysis*, 29, 405-415.

Mummolo, J. and Peterson, E. 2018. "Improving the Interpretation of Fixed Effects Regression Results," *Political Science Research and Methods*, 6 (4), 829-835.

Differences-in-Differences

Anderson, M. D. 2014. "In School and Out of Trouble? The Minimum Dropout Age and Juvenile Crime," *Review of Economics and Statistics*, 96, 2, 318-331.

Bertrand, M., E. Duflo and S. Mullainathan. 2004. "How Much Should We Trust Difference-in-Difference Estimates?" *Quarterly Journal of Economics*, 119, 249-275.

Besley, T., and R. Burgess. 2004. "Can Labor Market Regulation Hinder Economic Performance? Evidence from India," *Quarterly Journal of Economics*, 113, 91-134.

Card, D., and A.B. Krueger. 1994. "Minimum Wages and Employment: A Case Study of the Fast Food Industry in New Jersey," *American Economic Review*, 84, 772-793.

Currie, J. and R. Walker. 2011. "Traffic Congestion and Infant Health: Evidence from E-ZPass," *American Economic Journal: Applied Economics*, 3, 65-90.

Duflo, E. 2001. "Schooling and Labor Market Consequences of School Construction in Indonesia: Evidence from an Unusual Policy Experiment," *American Economic Review*, 91, 795-813.

Haber, N., Clarke-Deelder, E., Salomon, J. A., Feller, A., and Stuart, E. A. 2021. "COVID-19 Policy Impact Evaluation: A Guide to Common Design Issues," *American Journal of Epidemiology*, 190 (11), 2474-2486.

Hong, S. H. 2013. “Measuring the Effect of Napster on Recorded Music Sales: Difference-in-Differences Estimates under Compositional Changes,” *Journal of Applied Econometrics*, 28, 297-324.

Groen, J. A., M. J. Kutzbach, and A. E. Polivka. 2020. “Storms and Jobs: The Effect of Hurricanes on Individuals’ Employment and Earnings over the Long Term,” *Journal of Labor Economics*, 38, 653-685.

Lovenheim, M. F., and A. Willen. 2019. “The Long Run Effects of Teacher Collective Bargaining,” *American Economic Journal: Economic Policy*, 11, 292-324.

Synthetic Control

Abadie, A. 2021. “Using Synthetic Controls: Feasibility, Data Requirements, and Methodological Aspects,” *Journal of Economic Literature*, 59, 391-425.

Abadie, A., and J. Gardeazabal. 2003. “The Economic Costs of Conflict: A Case Study of the Basque Country,” *American Economic Review*, 93, 113-132.

Abadie, A., A. Diamond, and J. Hainmueller. 2015. “Comparative Politics and the Synthetic Control Method,” *American Journal of Political Science* 59(2): 495-510.
Abadie, A., A. Diamond, and J. Hainmueller. 2010. “Synthetic Control Methods for Comparative Case Studies: Estimataing the Effect of California’s Tobacco Control Program,” *Journal of American Statistical Association*, 105, 493-505.
Amjad, M., Shah, D., and Shen, D. 2018. “Robust Synthetic Control,” *Journal of Machine Learning Research*, 19, 1-51.

Athey, S., and G. W., Imbens. 2017. “The State of Applied Econometrics: Causality and Policy Evaluation,” *Journal of Economic Perspectives*, 31, 3-32.

Billmeier, A., and T. Nannicini. 2013. “Assessing Economic Liberalization Episodes: A Synthetic Control Approach,” *Review of Economics and Statistics* 95(3): 983-1001.

Doudchenko, N., and G. W., Imbens. 2016. “Balancing, Regression, Difference-In-Differences and Synthetic Control Methods: A Synthesis,” *Working Paper 22791. National Bureau of Economic Research*.

Ferman, B., C. Pinto, and V. Possebom. 2020. “Cherry Picking with Synthetic Controls,” *Journal of Policy Analysis and Management*, 39, 510-532.

Machine Learning Methods

Athey, S., and G. W. Imbens. 2019. “Machine Learning Methods That Economists Should Know About,” *Annual Review of Economics*, 11, 685-725.

Belloni, A., V. Chernozhukov, and H. Christian. 2014. “High-Dimensional Methods and Inference on Structural and Treatment Effects,” *Journal of Economic Perspectives*, 28, 29–50.

Chernozhukov, V., Chetverikov, D., Demirer, M., Duflo, E., Hansen, C., Newey, W., and Robins, J. 2018. “Double/Debiased Machine Learning for Treatment and Structural Parameters,” *The Econometrics Journal*, 21, C1-C68.

Mullainathan, S., and J. Spiess. 2017. “Machine Learning: An Applied Econometric Approach,” *Journal of Economic Perspectives*, 87-106.

Varian, Hal R. 2014. “Big Data: New Tricks for Econometrics,” *Journal of Economic Perspectives*, 28, 3–27.