



SOCI 620: Quantitative Methods for Causal Inference

Spring 2022

Tuesday/Thursday, 9:25-10:40am

Zoom: <https://tinyurl.com/SOCI620Spring2022>

In-person: Kraft Hall 102 (starting 1/25 at earliest)

Contact Information

Instructor: Brielle Bryan

Office: 265 Kraft Hall

Email: briellebryan@rice.edu

Office Hours: 10:45am-12:30pm, Thursdays (in person starting 1/27 at earliest)

Zoom link: <https://tinyurl.com/DrBryanOfficeHoursSp2022>

Course Objectives and Learning Outcomes

The massive growth in computing power over the last few decades has led to a "causal revolution" as increasingly complex statistical methods have been developed with the goal of identifying causal effects in observational data. This course will provide graduate students with an introduction to the causal inference framework and some of the methods developed for the purpose of estimating causal effects. The course will cover commonly used quasi-experimental methods, including propensity score matching, instrumental variables, and fixed effects. The course will conclude with a critical discussion of the merits of causal inference in the context of studying a complex social world. The goal of the course will be for students to be discerning consumers of social science research employing these methods, as well as discerning users of the quasi-experimental methods packages readily available in statistical software programs.

By the end of the semester, students should be familiar with the assumptions of causal inference and the challenges to identifying causal effects in the social world. They should feel comfortable critically applying a causal framework to their own work and in consuming the work of others. Students are expected to leave the course with a general understanding of the basic mechanics and assumptions upon which common quasi-experimental methods rely, and they will be expected to demonstrate mastery of at least one of the statistical methods introduced in the class in the form of a research paper.

Required Texts

Angrist, Joshua D. and Jörn-Steffen Pischke. 2009. *Mostly Harmless Econometrics: An Empiricist's Companion*. 1 edition. Princeton, NJ: Princeton University Press.

Morgan, Stephen L. and Christopher Winship. 2014. *Counterfactuals and Causal Inference: Methods and Principles for Social Research*. 2 edition. New York, NY: Cambridge University Press.

Other Recommended Texts

Pearl, Judea, Madelyn Glymour, and Nicholas P. Jewell. 2016. *Causal Inference in Statistics: A Primer*. 1 edition. Chichester, West Sussex: Wiley.

- o A good introduction to the graphical approach to causal inference (i.e., “DAGs”) that Judea Pearl has originated. Also a good general introduction to structural equation modelling (SEM).

Pearl, Judea. 2009. *Causality: Models, Reasoning and Inference*. 2nd edition. Cambridge, U.K. ; New York: Cambridge University Press.

- o A deeper dive into all of the above (DAGs, SEM).

Wooldridge, Jeffrey M. 2015. *Introductory Econometrics: A Modern Approach*. 6 edition. Boston, MA: Cengage Learning.

- o An excellent introductory textbook that’s a handy reference to have around for regression, multiple regression, and introductory econometrics methods.

Wooldridge, Jeffrey M. 2010. *Econometric Analysis of Cross Section and Panel Data*. 2 edition. Cambridge, MA: MIT Press.

- o A more advanced, slightly more math heavy (but still very approachable & example-filled) textbook that covers many of the topics covered in this course and goes more in depth into the mechanics of each method than Morgan & Winship and Angrist & Pischke.

Course Requirements

There are no assigned problem sets or tests for this course. This does not mean that you do not have weekly homework, however! Rather than completing problem sets and taking tests, you are asked to practice the concepts and demonstrate your understanding of them – as well as identify where you need clarification – by completing the readings and engaging in the review discussions each week. **Thus, I expect you to devote the time you would have spent on problem sets and test prep in other quant classes to carefully reading all of the assigned materials before each class.** Plan to come to class each week prepared to ask questions and ready to discuss the example papers.

Participation (15%)

Every other class meeting will focus on troubleshooting our understanding of the method(s) covered in the previous class and discussing a paper (or papers) that applies that method. **Students are expected to have done both the textbook/methodological reading and the example paper(s) readings before these discussion sections.** All students should come to class prepared to raise lingering methodological questions and with thoughts on how convincing the application of the method was in the example paper(s). Students are encouraged to submit their remaining questions after completing methods readings (and before class the class discussion meeting) in advance by sending me a message on Canvas (by going to the “Inbox”) or using the Methodological Questions discussion board on Canvas.

Research Paper

In addition to introducing students to causally-motivated statistical methods, a primary goal of this class is for students to produce an original empirical paper suitable for inclusion in their dissertation

and/or submission to a peer-reviewed journal. The paper should employ at least one of the methods covered in class or approved by the instructor.

I strongly encourage all students to use this class as an opportunity to make significant progress on a new paper or chapter. However, it will be crucial for your success and sanity over the course of the semester to already have a good idea of the research question(s) you wish to investigate and access to appropriate data to do so. If you feel the best way to ensure you can successfully complete the research paper by the end of the semester is to expand upon a paper you have previously written, I am open to this option. In this case, I ask that you meet with me to discuss your prior work and your plan for extending the analyses. You will also be expected to submit a current draft of the paper at the beginning of the semester so that I can more accurately assess the progress you make over the course of the semester. Likewise, if you have a co-authored paper upon which you wish to expand in SOCI 620, I am open to this option as long as you (1) discuss it with me, (2) submit a current draft at the beginning of the semester, and (3) provide proof of consent and agreement not to touch the paper for the semester from your co-author(s).

Paper proposal (10%) – due Jan 24th, by 9am

Provide an outline of your proposed research question and the dataset(s) you plan to use to answer your question. Clearly identify the counterfactual and identify any challenges to causal inference that arise with the research question and dataset combination you propose (e.g., do you have pre-treatment observations, was there selection into the sample, etc.). Be sure to include a brief overview of the theoretical motivation and relevant literature.

If you are undecided and want feedback before deciding on a research question/dataset, you may submit two paper proposals. If you are deciding between more than two potential paper topics, please see me in advance to narrow your options.

If you are proposing to expand upon a prior paper you must submit a current draft of the original/inspiration paper with your paper proposal. If you plan to expand upon co-authored work you must also have your collaborators email me personally to confirm that they (1) consent for you to do so and (2) will not be involved with coding data, conducting analyses, or writing any portions of the paper over the fall semester.

Data and descriptive statistics (10%) – due March 4th, by 9am

Provide a full description of the dataset you are using, similar to data descriptions provided in journal articles. Be sure to note sample selection criteria and describe your variable specifications. Also submit and describe one or more illustrative tables or figures of descriptive statistics (for the variables you plan to use in the final analysis) and the bivariate association for your key variables of interest.

You need not have decided on the identification strategy/method you will use by this point in the semester, but you should have the data ready to use – this includes dealing with missing data! Data preparation work always takes longer than anticipated, so be sure to start early to give yourself plenty of time!

Methods and preliminary results (10%) – due March 25th, by 9am

Write up what will be the methods portion of the “data and methods” section of your final paper, describing the method you will use to identify the causal relationship of interest and the assumptions necessary to interpret your findings causally. Be sure to include an equation to make your methodological approach clear to the reader. Create an early draft of the results section of

your paper, providing preliminary results in the form of a table and a brief description of your findings.

First draft of paper (5%) – due April 15th, by 9am

Submit a draft of the full paper. Graded for completion.

Final paper (30%) – due May 2nd, by 9am

Submit your final paper, written in the style of a journal article. The length of the paper is flexible, but a good guideline is about 8,000 words, exclusive of tables and references. You will have a week to incorporate comments from your student reviewer, but it is also expected that you will continue to refine the analysis and revise the paper while waiting for these comments.

Peer Feedback

Comments on other students' proposals (10%) – due February 2nd, by midnight

Read the randomly assigned proposals submitted by two other students and provide constructive reactions, comments, and suggestions for relevant literature.

Comments on one other student's paper (10%) – due April 25th, by midnight

Include comments on all aspects of the paper, including clarity of the exposition, appropriateness of the data and methods (even if the author doesn't have time to change methods and can't change data, this will be great practice for defending the merits of the paper and what *can* be said with the data/methods!), and how convincing you find the argument.

Grade Policies

Late assignments are particularly disruptive when they impede other students' abilities to complete assignments. If extenuating circumstances prevent you from completing an assignment on time, please let me know as soon as possible. Once the assignment deadline has passed, the Canvas dropbox will not accept submissions.

The grading scale is as follows:

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|-----------|----------------|
| A+ 99-100 | C+ 77-79 |
| A 93-98 | C 74-76 |
| A- 90-92 | C- 70-73 |
| B+ 87-89 | D+ 67-69 |
| B 84-86 | D 64-66 |
| B- 80-83 | D- 60-63 |
| | F 59 and below |

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| A range | Excellent work. Demonstrates superior ability to creatively and appropriately organize and express ideas, and provides comprehensive and thoughtful responses. |
| B range | Good work. Demonstrates good organization and expression of ideas, and provides solid responses. |
| C range | Fair work. Demonstrates moderate skill in organization and expression of ideas, and provides acceptable responses. |
| D-F range | Marginal to Unacceptable work. Demonstrates little to no clear ability to organize and express ideas in an understandable manner, and provides incomplete responses. |

Absence Policies

Other students' questions in quantitative methods classes tend to be incredibly helpful in clarifying one's own understanding of the material. Therefore, attendance is expected at all classes. If you are unable to attend class synchronously, please get in touch with me as soon as possible to work out a suitable solution for asynchronous attendance.

If you feel at all ill, please remain home and join remotely if you are able. Absences from class will be excused for medical reasons or for religious observance. Please email the instructor in advance, unless there is a medical emergency, in which case you should contact the instructor as soon as possible.

Disability Support Services

If you have a documented disability or other condition that may affect academic performance you should: 1) make sure this documentation is on file with the Disability Resource Center (Allen Center, Room 111 / adarice@rice.edu / x5841) to determine the accommodations you need; and 2) talk with me to discuss your accommodation needs.

PPE & Physical Distancing

When (or if) we transition to in-person course meetings, every student in the classroom is expected to abide by the current Rice University mask wearing and physical distancing policies (<https://coronavirus.rice.edu/policies>). The professor reserves the right to instruct students to leave the classroom if they are engaging in behavior that places faculty and/or students' health at risk. If students do not comply, the professor may cancel the class meeting and refer the student to Student Judicial Programs and the Dean of Undergraduates or the Dean of Graduate and Postdoctoral Studies.

Syllabus Change Policy

This syllabus is only a guide for the course and is subject to change with advanced notice. It is difficult to know in advance how quickly any given class will feel comfortable moving through methods training, so please keep in mind that dates for lectures and associated readings may need to change. Changes will be announced both in class and online. I will continuously monitor our progress and safety as we advance through the semester and will change course format and timing as necessary to fit our circumstances.

Honor Code

Students are expected to abide by the Rice Honor System (<http://honor.rice.edu/>). Violations include, but are not limited to, cheating on exams, having unauthorized possession of an exam, and submitting the work of another person as your own (aka, plagiarism). When in doubt about what constitutes academic dishonesty, please ask! Ignorance of this policy is not an acceptable excuse for noncompliance.

Sociology Department Guidelines for Paper Format and Citations

While the Honor Code system is designed to enforce rules about what is considered acceptable and honorable behavior, Rice does not have a unified Honor Code policy that *defines* these rules. Therefore, we list below a standard set of rules that will apply to academic writing in sociology classes at Rice. All students must follow this format when citing published works. This includes material drawn from books and journal

articles (including those assigned for the course, and additional readings that you find to include in written assignments), in addition to personal interviews and information obtained online. Information from class lectures does not need to be cited in-text. If you have any questions, please ask!

Unless specified otherwise, ALL paper assignments must be/use:

- ✓ Typed
- ✓ Double-spaced
- ✓ Paginated
- ✓ Stapled
- ✓ 12-point font
- ✓ Times New Roman font
- ✓ "Normal" character spacing (this is the default setting in Microsoft Word)
- ✓ One-inch margins on all sides

Citation Rules for Sociology Classes:

All students are required to follow ASA rules for format and style when writing papers for sociology classes. Below we give examples for both in-text citations and the bibliography page. If you have any questions, please ask -- or you can Google "ASA style guide" to find links to several on-line postings that provide additional detail on rules for citing.

A. In-text citations

You must cite the original author if you pull in either exact phrases or sentences, or if you use essentially the same ideas, concepts, or research findings -- even if paraphrasing. That is, even if you rewrite the author's words, you must still cite the original author as the source of the ideas.

- When referencing work in the body of a paper, you must always include (a) the author name, and (b) the year of publication. Example:

In her study of men in "women's professions," Williams (1995) demonstrates that men are not disadvantaged by their gender minority status in the same way that women often are in predominantly male workplaces.

- You can also cite multiple authors who draw on the same ideas, who have similar findings on similar topic. Example:

Men in "women's professions" often feel their masculinity is called into question by outsiders (Williams 1995; Cross and Bagilhole 2002).

- Whenever you draw on a new idea, concept, or finding, you must use internal citations with author's names and years of publications. However, if you are discussing the same article or author in a series of sentences, you only need to provide a citation the first time. Example:

Miller (1997) demonstrates how the military men in her study engage in gender harassment of their women superiors. She illustrates several forms of this gender harassment, including foot-dragging and rumor spreading.

Note: In the second sentence, there is no citation for the year, as you provided it in the previous sentence. However, if you discuss Miller later in the paper, you will provide the year again to make clear you are discussing the same article.

- When quoting directly, you must also include the page(s) the quote is found on, and enclose the quote in parentheses. Example:

According to Tran (2002:34), the “way of the way is the way.”

- For citations with four or more authors, use “et al.” rather than list all author names in-text. Example:

Research has documented elevated infant mortality rates among children born to teenage mothers (Jackson et al. 1992).

- Do not use titles of books and articles in your paper, or the author’s first name. Rather, use the author’s last name and internal citations to give the year of the publication. Example:

INSTEAD of: *Virginia Valian, in her 1999 book Why So Slow: The Advancement of Women, shows that women in professional occupations often advance more slowly than their men counterparts.*

USE: *Valian (1999) shows that women in professional occupations often advance more slowly than their men counterparts.*

- Common mistakes you should take care to avoid:
 - ✓ In all of these examples listed above, the period comes AFTER the parentheses, NOT before it. Please remember that the author citation is part of the sentence, so it should be listed before you end the sentence with a period.
 - ✓ Many students use too many direct quotes from a book or journal article. Quotes should be used very sparingly, while paraphrasing from the text should be the norm.

B. Bibliography page

A bibliography page lists all sources cited in the paper. The page should follow the basic format of author, year of publication, title of publication, publisher, and if an article, the volume and page numbers. Here are some examples:

Anderson, Maya. 1978. *Ever Heard of Hip Hop?* New York: Oxford University Press.

Centers for Disease Control and Prevention. 2006. “Cigarette Use Among High School Students – United States, 1991-2005.” *Morbidity and Mortality Weekly Reports* 55:724-726.

Cleary, Paul D., Lawrence B. Zaborski, and John Z. Ayanian. 2004. “Sex Differences in Health over the Course of Midlife.” Pp. 37-63 in *How Healthy Are We? A National Study of Well-being in Midlife*, edited by O.G. Brim, C.D. Ryff, and R.C. Kessler. Chicago: University of Chicago Press.

****Note that all authors after the first author have their first names listed first.**

U.S. Census Bureau. 2002. “Hispanics Growing Fast.” Washington, DC: U.S. Department of Commerce. Retrieved March 30, 2007. (<http://www.census.gov/hispanic.html>).

Williams, Genia. 1997. "The Lonely Way." *American Journal of Sociology* 42:37-64.

Zenia, Genco. 2007. Personal Interview. Conducted April 2, 2007.

**Only include if person gives permission to be cited by name.

SOCL 620 Spring 2022 Course Schedule and Readings

Key

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| | = discussion day | M&W = Morgan & Winship textbook |
| | = new method lecture | A&P = Angrist & Pischke book |
| | = textbook/methods reading | |
| | = example/application paper | |

| Date | Topic | Readings | Optional Readings |
|--------|--|--|--|
| 11-Jan | Syllabus review, course expectations, objectives, etc. | Pearl Preface; A&P Chapter 1 | M&W Chap. 1 (through section 1.2.2, stop at top of pg. 14) - brief overview of potential outcomes & history of methods thinking in social sciences |
| 13-Jan | Causal Questions, Potential Outcomes | M&W Chapter 2 | |
| 18-Jan | <i>Causal Questions, Potential Outcomes</i> | Morgan 2001 SOE: 341-343, 348-350 (skim 343 "Regression Estimates..." to top of 348) | |
| 20-Jan | Experimental Ideal (why, how) | A&P Chapter 2 (through p. 19) | |
| 25-Jan | <i>Experimental Ideal</i> | Pager 2003 AJS; Pedulla 2016 ASR | |
| 27-Jan | OLS review & conditioning on observables | A&P Chap. 3 (through top of pg. 80); M&W Chap. 6 (through top of p. 206 - stop at section | Pearl Chap. 1 (probability & OLS review) |
| 1-Feb | <i>OLS review & conditioning on observables</i> | Neal & Johnson 1996 JPE | |
| 3-Feb | Propensity scores, part 1 | A&P Chap. 3, section 3.3.2-3.3.3 (pp. 80-91); M&W Chap. 5 (start it, don't have to finish yet) | |
| 8-Feb | Propensity scores, part 2 | M&W Chap. 5 (if didn't finish last week) | |
| 10-Feb | Spring Recess | | |
| 15-Feb | Stata lab (propensity scores); <i>chatting through methods reading questions</i> ; start of Inverse Probability of Treatment Weights | M&W Chap. 5 (if didn't finish last week) | Harding 2003 AJS (example but also helpful methodological background) |
| 17-Feb | Inverse Probability of Treatment (IPT) Weights continued | Thoemmes & Ong – "A Primer on Inverse Probability of Treatment Weighting and Marginal Structural Models" | |
| 22-Feb | <i>Propensity Score & IPT weighting examples discussion and review</i> | Desmond & Kimbro 2015 SF; Wodtke et al. 2011 ASR | Killewald & Bryan 2016 RSF (another IPT weighting + MSM example) |
| 24-Feb | Difference-in-differences & Fixed Effects | A&P Chap. 5 (warning: LONG read) | |

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| 1-Mar | <i>Diff-in-diff & fixed effects</i> | Diff-in-Diff: Card & Krueger 1994 <i>AER</i> FE: Western 2002 <i>AJS</i> | Isacsson 2004 <i>JAE</i> |
| 3-Mar | Natural Experiments & Regression Discontinuity (RD) | M&W Chap.11 sections 11.1 & 11.2 (p. 354-363); A&P Chap. 6 (skip/skim section 6.2 on fuzzy discontinuity) | |
| 8-Mar | <i>Natural experiments & RD</i> | Ekberg et al. 2013 <i>JPE</i> | |
| 10-Mar | Synthetic Controls | Abadie 2021 <i>JEL</i> | |
| 15-Mar | Spring Break | | |
| 17-Mar | Spring Break | | |
| 22-Mar | <i>Synthetic Controls</i> | Vagni & Breen 2021 <i>ESR</i> | |
| 24-Mar | Instrumental Variables (IV) & 2 Stage Least Squares (2SLS) | M&W Chapter 9 (skip sections 9.3.3 & 9.3.4); A&P pp. 113-121 (top) | |
| 29-Mar | <i>IV & 2SLS</i> | Sharkey et al. 2017 <i>ASR</i> | |
| 31-Mar | Mechanisms & building a case | M&W Chap. 10 | |
| 5-Apr | <i>Mechanisms, etc.</i> | Mechanisms: Turney et al. 2012 <i>JHSB</i> Strategic Comparison Group: Porter & King 2018 (more in depth discussion of approach) | |
| 7-Apr | PAA - no class | | |
| 12-Apr | Falsification tests & getting creative | M&W section 12.3 (pp. 429-434) | Gangl "Partial Identification and Sensitivity Analysis" (skim 'Instrumental Variables' section, focus on 'Sensitivity Analysis' section, skip 'Nonparametric Bounds...' section) Leamer (1983) "Let's Take the Con out of Econometrics" in <i>AER</i> |
| 14-Apr | <i>Falsification tests, etc.</i> | Placebo tests: Wildeman 2010 <i>SF</i> Falsification tests: Weaver & Lerman 2010 <i>APSR</i> | RE-READ the 'Sensitivity Analysis' section (starting on p. 691) in Harding 2003 <i>AJS</i> |
| 19-Apr | Student choice topic | | |
| 21-Apr | Real talk about causal identification & sociological research | M&W section 13.2 (pp. 446-450) Liebersen & Lynn – "Barking up the Wrong Branch: Scientific Alternatives to the Current Model of Sociological Science" Desmond and Western 2018 - "Poverty in America New Directions and Debates" | Maxwell - "Using Qualitative Methods for Causal Explanation" Nagin & Sampson - "The Real Gold Standard: Measuring Counterfactual Worlds That Matter Most to Social Science and Policy" Tavory and Timmermans - "A Pragmatist Approach to Causality in Ethnography" |