POLI 572B

Michael Weaver

Winter 2020 Term 2

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Lab: TBD on Zoom
Class: M at 14:00 to 17:00 in Zoom
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Canvas: https://canvas.ubc.ca/courses/61293

Teaching Assistant

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Course Description

This course covers the basic principles of ordinary least squares regression as a tool for statistical analysis. Because the primary reason for using regression is to make causal claims, this course focuses on both the mechanics of regression, the assumptions required to make causal claims, and interpretation. The course is broken into four parts. First, we cover the Neyman causal model (potential outcomes) framework. Second, we cover the fundamental matrix algebra behind least squares and its interpretation as a way of estimating the conditional expectation function. Third, we bring these two concepts together to derive the key assumptions required to draw both statistical and causal inferences using regression. Finally, we cover violations of these mathematical assumptions frequently faced in empirical research and discuss solutions. This course assumes completion of POLI 572A (or similar course in basic mathematical statistics). While we will use some basic matrix algebra, the course does not assume prior knowledge of this topic and the course will focus on practical applications of linear regression models.

In a broader sense, this course starts by giving you a grounding in the theory that undergirds statistical analysis and the assumptions that are required to use mathematical statistics to make inferences about the world. Then, in the last third of the course, we turn to applying these models to the real world and address how (1) we evaluate or judge whether the models of the assumption hold and (2) what we do when the assumptions are not reasonable.

Required Purchase

Joshua D Angrist and Jörn-Steffen Pischke. *Mostly Harmless Econometrics: An Empiricist's Companion.* Princeton University Press, 2008

Angrist and Pischke. *Mastering Metrics.*

Only purchase *Mastering Metrics* if you want an even more readable and less technical treatment of the same material in MHE (above).

Other Textbooks

David Freedman, Robert Pisani, and Roger Purves. *Statistics.* W. W. Norton & Company, New York, NY, 3rd edition, 1998

David Freedman. *Statistical Models: Theory and Practice.* Cambridge University Press, New York, NY, 2005

Stephen Morgan and Christopher Winship. *Counterfactuals and Causal Inference: Methods and Principles for Social Research.* Cambridge University Press, New York, NY, 1st edition, 2007

Alan Gerber and Donald P. Green. *Field Experiments: Design, Analysis, and Interpretation.* W. W. Norton & Company, New York, NY, 2012

Thad Dunning. *Natural Experiments in the Social Sciences: A Design-Based Approach.* Cambridge University Press, New York, NY, 2012

Course Policy

Grades

Grades for this course are broken down as follows:

- **6% ∗ 5**: Problem Sets. Problem sets will be due one week from when they are assigned (and will be due on Mondays). For the sake of your TA, please turn these in on time. They will be provided as an .Rmarkdown file, which you will edit and then compile as a .pdf with the following title: `LastnameFirstname_PS1.pdf`. Answer keys with the correct responses will be provided. You may (and it is encouraged) that you work with others, but, for your own sake, attempt to complete the work on your own and work together to understand. Do not merely copy answers from others.
- **35%**: Take-home Midterm Exam. You will receive a midterm exam that you will have 48 hours to complete *on your own.*
- **35%**: Final Project. For the final project, you will be assigned to groups of 2–3. As a group, you will select a peer-reviewed published article that interests you to replicate. Following a series of guidelines that I will provide, you will reproduce the original findings, answer questions about the assumptions, and execute an additional test that probes the validity of those assumptions. I will assign the groups after the fourth problem set is graded. You will need to inform me of your selected article at least 3 weeks prior to the deadline, so we can choose a viable project for you to replicate.

Computers

In this course, we will be using the R statistical programming language. This is a free, open-source programming language. You can download it for your operating system here:

In class, I will be using R with RStudio, which can be downloaded here:

Download R for your OS

Download RStudio Desktop, Open Source Edition

This software cannot be installed on tablets or phones, so please bring your laptop to class. However, please only use your laptop when asked.

Course Schedule

Causal Inference

1/11 Introduction; Potential Outcomes Model and Causal Inference

Alan Gerber and Donald P. Green. *Field Experiments: Design, Analysis, and Interpretation.* W. W. Norton & Company, New York, NY, 2012. **Chapter 2** (focus: 2.1, 2.2, 2.4, 2.6)

Joshua D Angrist and Jörn-Steffen Pischke. *Mostly Harmless Econometrics: An Empiricist's Companion.* Princeton University Press, 2008. **Chapter 2.** (focus: pp. 11–22)

Angrist and Pischke. Mastering Metrics. **Chapter 1** (focus: 1.1, 1.2)

Butler and Mayer. Making Decisions with Data: An Introduction to Causal Inference **(pp. 1–8)**

David Broockman and Joshua Kalla. Durably Reducing Transphobia: A Field Experiment on Door-to-Door Canvassing. *Science*, 352(6282):220–224, 2016.

Optional:

Stephen Morgan and Christopher Winship. *Counterfactuals and Causal Inference: Methods and Principles for Social Research.* Cambridge University Press, New York, NY, 1st edition, 2007. **Chapter 2.** (Focus: 2.2–2.4, 2.6, 2.7.2–2.7.4)

1/18 Sampling Distributions and Hypothesis Testing with causal inference

Alan Gerber and Donald P. Green. *Field Experiments: Design, Analysis, and Interpretation.* W. W. Norton & Company, New York, NY, 2012. **Chapter 3.** (Focus: 3.1–3.5, Summary)

Thad Dunning. *Natural Experiments in the Social Sciences: A Design-Based Approach.* Cambridge University Press, New York, NY, 2012. **Chapter 6. pp. 165–73, 186–95**

Angrist and Pischke. *Mastering Metrics.* **Chapter 1** (Appendix)

Elizabeth Paluck. Reducing Intergrop Prejudice and Conflict Using the Media: A Field Experiment in Rwanda. *Journal of Personality and Social Psychology*, 96(3):574–587, 2009

For Review, if needed:

David Freedman, Robert Pisani, and Roger Purves. *Statistics.* W. W. Norton & Company, New York, NY, 3rd edition, 1998. **13–14: Probability**; **16–18: Law of Averages, Central Limit Theorem**; **20–21: Standard Errors, Confidence Intervals**; **26–27: Hypothesis Testing**

1/25 Non-compliance in experiments: instrumental variables

Problem Set 1 Due

Alan Gerber and Donald P. Green. *Field Experiments: Design, Analysis, and Interpretation.* W. W. Norton & Company, New York, NY, 2012. **Chapter 5** (focus: 5.1–5.5, 5.7) and **Chapter 6** (focus: 6.1–6.2, 6.4)

Thad Dunning. *Natural Experiments in the Social Sciences: A Design-Based Approach.* Cambridge University Press, New York, NY, 2012. **Chapter 5. pp. 135–149**

Example Article TBD

2/1 Conditioning

Butler and Mayer. "Making Decisions with Data: An Introduction to Causal Inference." **pp 8–13.**

Stephen Morgan and Christopher Winship. *Counterfactuals and Causal Inference: Methods and Principles for Social Research.* Cambridge University Press, New York, NY, 1st edition, 2007. **Chapter 3** (focus: 3.1,3.2,3.5); **Chapter 4** (focus: 4.1,4.2,4.3.1,4.3.2,4.4)

Angrist and Pischke. Mastering Metrics. **Chapter 2** (focus: 2.1)

Extending the Mean: The Regression Line

2/8 Bivariate regression

Problem Set 2 Due

Watier, et al. "What does the mean mean?"

David Freedman, Robert Pisani, and Roger Purves. *Statistics.* W. W. Norton & Company, New York, NY, 3rd edition, 1998. **Chapters 10–12** (focus: 10.1–10.3, 10.5, 11.1–11.4, 12.1–12.3)

David Freedman. *Statistical Models: Theory and Practice.* Cambridge University Press, New York, NY, 2005. **Chapter 2** (focus: 2.1–2.4)

Joshua D Angrist and Jörn-Steffen Pischke. *Mostly Harmless Econometrics: An Empiricist's Companion.* Princeton University Press, 2008. **pp. 27–34**

Background

David Freedman, Robert Pisani, and Roger Purves. *Statistics.* W. W. Norton & Company, New York, NY, 3rd edition, 1998 (review on correlation: Chapter 8–9)

2/15 Midterm Break

2/22 Matrix Algebra

David Freedman. *Statistical Models: Theory and Practice.* Cambridge University Press, New York, NY, 2005. **Chapter 3**

Attempt to complete: Exercise Set A; Exercise Set B (2–4, 12–13, 14 a, d, f–k) (don't spend more than three hours; feel free to use solutions at end of book)

3/1 Mechanics of multivariate regression

Problem Set 3 Due

Joshua D Angrist and Jörn-Steffen Pischke. *Mostly Harmless Econometrics: An Empiricist's Companion.* Princeton University Press, 2008. **Chapter 3 pp. 34–41**

Angrist and Pischke. Mastering Metrics. **Chapter 2** (focus: 2.2)

Optional:

David Freedman. *Statistical Models: Theory and Practice.* Cambridge University Press, New York, NY, 2005. **Chapter 4**

3/8 Multivariate regression and inference

Joshua D Angrist and Jörn-Steffen Pischke. *Mostly Harmless Econometrics: An Empiricist's Companion.* Princeton University Press, 2008. **Chapter 3 pp. 41–48**

Angrist and Pischke. Mastering Metrics. **Chapter 2** (focus: Appendix)

David Freedman. *Statistical Models: Theory and Practice.* Cambridge University Press, New York, NY, 2005. **Chapter 4** (focus: 4.2)

3/15 Multivariate regression and causal inference

Problem Set 4 Due

Stephen Morgan and Christopher Winship. *Counterfactuals and Causal Inference: Methods and Principles for Social Research.* Cambridge University Press, New York, NY, 1st edition, 2007. **Chapter 6** (focus: 6.2, 6.3, 6.4, 6.6.1)

Joshua D Angrist and Jörn-Steffen Pischke. *Mostly Harmless Econometrics: An Empiricist's Companion.* Princeton University Press, 2008. **Chapter 3 pp. 48–77**

Gary King and Langche Zeng. When Can History Be Our Guide? The Pitfalls of Counterfactual Inference. *International Studies Quarterly*, 51(2):183–210, 2007

Butler and Mayer. Making Decisions with Data: An Introduction to Causal Inference **(pp. 13–15)**

Optional:

Joshua D Angrist and Jörn-Steffen Pischke. *Mostly Harmless Econometrics: An Empiricist's Companion.* Princeton University Press, 2008. **Chapter 3 pp. 77–91**

3/22 Regression Problems: Standard Errors and Measurement Error

Midterm Exam Due

Joshua D Angrist and Jörn-Steffen Pischke. *Mostly Harmless Econometrics: An Empiricist's Companion.* Princeton University Press, 2008. **Chapter 8** (focus: all except appendix)

Thad Dunning. *Natural Experiments in the Social Sciences: A Design-Based Approach.* Cambridge University Press, New York, NY, 2012. **Chapter 6 (pp. 175–86, 195–201)**

Angrist and Pischke. Mastering Metrics. **pp. 219–222, pp. 240–243**

3/29 Regression Problems: Model Specification and Interaction Effects

Gerber, Alan and Greg Huber. "Partisanship, Political Control, and Economic Assessments."

McGrath, Mary. "Economic Behavior and the Partisan Perceptual Screen."

Fowler, Anthony and Andrew Hall. "Do Shark Attacks Influence Presidential Elections? Reassessing a Prominent Finding on Voter Competence."

Truex, Rory. "The Myth of the Democratic Advantage."

Hainmueller, et al. "How Much Should We Trust Estimates from Multiplicative Interaction Models?"

4/5 Relaxing Assumptions: Differences-in-Differences

Problem Set 5 Due

Joshua D Angrist and Jörn-Steffen Pischke. *Mostly Harmless Econometrics: An Empiricist's Companion*. Princeton University Press, 2008. **Chapter 5** (focus: all but appendix)

Campbell, Donald and Laurence Ross. "The Connecticut Crackdown on Speeding: Time-Series Data in Quasi Experimental Analysis." 1968.

Mummolo, Jonathan. "Modern Police Tactics, Police-Citizen Interaction and Prospects for Reform." 2017.

Butler and Mayer. Making Decisions with Data: An Introduction to Causal Inference **(pp. 15–21)**

4/12 Relaxing Assumptions: Natural Experiments

Thad Dunning. *Natural Experiments in the Social Sciences: A Design-Based Approach*. Cambridge University Press, New York, NY, 2012. **Chapters 2,3,4**

Butler and Mayer. Making Decisions with Data: An Introduction to Causal Inference **(pp. 21–27)**

Example Articles TBD

Final Project Due 4/27