SPRING 2017

STANFORD
GRADUATE SCHOOL OF BUSINESS

INSTRUCTOR

Professor David Broockman
Faculty E215
dbroockman@stanford.edu
Office hours: Use dbroock.youcanbook.me to book a time at your convenience. E-mail me if no time that works well for you is available there.

Assistant: Giselle Agredano
Faculty E372D
gisellea@stanford.edu

COURSE ASSISTANTS

General Questions
Kirk Bansak
kbansak@stanford.edu

Problem Set and Grading Questions
Senem Onen
senem@stanford.edu

Lab Sessions
Alejandra Gimenez
agimenez@stanford.edu

MGTECON 383 - MEASURING IMPACT IN PRACTICE

This course introduces students to measuring impact in practice. This topic has increased considerably in importance over the last decade, as entrepreneurs have learned to think creatively about how to generate data in more rigorous ways, and as developments in information technology have facilitated the development of better data gathering. Key to this area is the insight that correlations do not imply causality and, in almost all cases, cannot measure impact. In this course, we learn how to use experiments and natural experiments to measure impact, and how to be appropriately skeptical of findings that claim to measure impact. The class will assume no prior knowledge.

WHY MEASURE IMPACT?

Nearly every decision managers and entrepreneurs (and humans more generally) make involve making best guesses about counterfactuals. Examples include:

- If I advertise more, will my sales be higher than if I did not advertise more? If so, by how much?

- If I introduce a new website design, will user retention be higher than if I keep the current design?
- Will raising my product's price increase my profits relative to keeping my product at its current price?
- Will I live longer if I drink a glass of red wine with dinner every night than if I don't?
- If I change my firm's logo, will sales be higher than if I keep it?
- Does a social enterprise's program make people's lives better than they would be if that program did not exist?
- Will student test scores improve if I introduce this new education policy?
- Will my health be better if I take this pill or don't?
- If I introduce a new feature to my product, will my profits be higher?
- If I introduce a new bonus program, will my employees work harder?

All these questions represent counterfactuals: "will my goals be met more effectively if I choose option A or B (or C, etc.)?" At the GSB, almost every class you take attempts to prepare you to make better guesses about what courses of action will lead to more desirable results in a variety of domains. In this class, you will learn how to generate data to guide such decisions -- and how to evaluate others' claims that they've generated data that should guide your decisions, too. The big picture goal is that you *learn how to learn* more about the likely impact of your decisions before you have to make them.

COURSE GOALS

My goals for each student in the course are:

- Become skeptical about claims of causality and impact. In particular, by the end of the course, you should be able to identify possible flaws in others' claims that they have measured impact and effectively communicate alternative explanations for their claims.
- Understand why experimentation - generating one's own data by doing deliberate interventions - solves the basic causal-inference problem. You should be able to describe several examples of successful experiments and what makes you feel confident about their results.
- Appreciate how information systems and websites can be designed to make experimentation easy in the modern online world.
- Understand how to quantify uncertainty, using confidence intervals and statistical power calculations.
- Be able to analyze an experiment using R and interpret the results.
- Understand the importance of control groups and placebos.
- Design, implement, and analyze your own field experiment.
- Appreciate what can go wrong when measuring impact and what to do about it. Examples we will cover include when an experiment is not implemented as intended, when effects on one subject "spill over" onto other subjects, and when outcomes cannot be measured for some subjects.

Course Philosophy

I want to make this course interesting and thought-provoking, and one from which you will remember and be able to apply important lessons even after the quarter is over.

Research shows that you will be more likely to remember the content of this course in the years to come the more you actively participate in activities and problem solving. Therefore, half of this class will take place in interactive lab sessions where you will primarily work in small groups on illustrative problems.

Overall, my goal is to coach you through this learning process in a way that maximizes understanding and retention with as little frustration and wasted time as possible.

Course materials

- You do not need to buy a textbook. There will be several short readings that I excerpt from various textbooks, but I will distribute these PDFs on the Canvas site.
    - *Optional:* However, if you would like a textbook to use as a resource throughout the class, the best resource is *Field Experiments: Design, Analysis, and Interpretation* by Alan Gerber and Don Green. **If you want a resource to turn to for questions about homework, additional study material, etc., I recommend you buy this book.** Let me know if you do, and I will let you know to which chapter each session corresponds.
- You should download the free software RStudio Desktop ("Open Source License") at https://www.rstudio.com/products/rstudio/download/.
- In addition to the required readings, I will also maintain a list of Suggestions for Further Reading, which I hope will be useful to you after the course is over. This list contains a number of interesting and useful books and articles that I didn't have room to cover during the course.

Course Requirements and Grading

Grading Overview

- Participation in Classroom Sessions: 10%
- Participation in Lab Sessions: 5%
- One-Page Essay: 5%
- Short Problem Sets (5): 45%
- Final Project: 35%

The planned due dates for the Essay and Problem Sets are below, but **the information in Canvas will be the final arbiter of when the assignments are due.**

Readings

In advance of most of the classroom sessions and before some of the lab sessions, I will ask you to "skim" a reading or two that describes an experiment. Many of the most interesting

experiments we will discuss this quarter are described in academic papers written by economists, psychologists, etc. who have partnered with firms (such as eBay, Virgin Atlantic, utility companies, and others) to conduct experiments. We will discuss these experiments as motivating examples in each class, seeing how the concept we are learning each day is important for understanding the experiment(s) described in the reading.

In order to save class time and so that you have time to think of questions and comments, I would like you to come to class with a basic understanding of what the experiment is we will be talking about that day. Unfortunately, the academic papers these interesting experiments are described in are often over 50 pages long, and one does **not** need (and I will not expect you) to read every word of these papers to understand the motivation for the experiments and design. Therefore, I will point you to specific sections of each paper I will encourage you to read most closely before class.

I will distribute a course pack PDF before the first day of class.

Participation in Class
I expect students to be prepared for class and remain engaged in class activities and discussions. You can miss two sessions without impacting your grade.

Laptop use is not permitted in the classroom or lab sessions. If you have a documented disability and need to use a laptop as a special accommodation, please follow the steps described below. I may revise this policy for the lab sessions.

Please bring paper and pencil to class for use in in-class exercises. (Given the laptop policy, this is also probably a good idea so that you can take notes.)

Short Essay
You will be asked to write one short essay (one page single spaced).

Problem Sets
You will be assigned five short problem sets. I anticipate these will take about 4-5 hours each, and I will give you about 2 weeks to complete each of them.

You may discuss the problem sets with each other and help each other, but the assignments are individual and I expect you to do your own work. I reserve the right to revoke the permission to help each other if I sense that students are relying on others for answers without putting in their own work.

Final Project
For your final project, you will run your own experiments in small groups (of 3-5 people [individual final projects are allowed but highly discouraged]). You will write a short report about your project. You will also be expected to produce a 5 minute presentation for the class.

Late Policy

I will lower an assignment grade by 15 points (out of 100) if it is turned in up to 24 hours after the due date/time and 30 points (out of 100) if it is turned in between 24 and 48 hours after the due date/time. Assignments will not be accepted more than 48 hours after the due date/time except if express written permission is given. (Reasoning: I can't post the solution sets until all the assignments are in. I like to get the grades out and the solution sets distributed ASAP after the due date so everyone can review their grades and examine the solution set while the problem set is still fresh in their minds.)

Class Sessions

The course will alternate between Classroom and Lab sessions.

- In the Classroom sessions, held on Tuesdays in **P107**, I will introduce key concepts and give examples of their use in the real world. Copies of the day's slides will be posted to Canvas after class. However, given our heavy emphasis on in-class activities and discussion, if you miss a class it may be difficult to glean all the material from the slides I post.
- The Lab sessions, held on Thursdays in the **B312** computer lab, will help you practice applying these concepts in R and prepare you to complete the problem sets.

We will also have one day of final project presentations and one day reserved for a guest speaker, David Reiley, the Chief Economist at Pandora.

Students with Documented Disabilities

Students who may need an academic accommodation based on the impact of a disability must initiate the request with the Office of Accessible Education (OAE). Professional staff will evaluate the request with required documentation, recommend reasonable accommodations, and prepare an Accommodation Letter for faculty. For students who have disabilities that don't typically change appreciably over time, the letter from the OAE will be for the entire academic year; other letters will be for the current quarter only. Students should contact the OAE as soon as possible since timely notice is needed to coordinate accommodations. The OAE is located at 563 Salvatierra Walk (phone: 723-1066, URL: http://oae.stanford.edu).

Course Outline

Below is an overview of the class sessions and assignments for each. However, **the information in Canvas will be the final arbiter of what reading is due when and when the assignments are due.**

Thursday, April 6: CLASSROOM: Why measure impact? The importance of experimentation and intervention

Assignments

- Fill Out Pre-Class Survey
- Read this Syllabus
- Reading: *NYT Magazine* on HRT Studies
- One-Page Essay Assigned (critique an observational study; full assignment to be provided)

Tuesday, April 11: CLASSROOM: What is "Impact"? Why is it hard to measure?

Assignments

- Reading: *Uncontrolled*, p. 132-146 (PDF on Canvas)
- Reading: Skim Police Raids on Crack Houses, esp p. 759-776
- Reading: Skim Search Ad Effectiveness, esp. Sections 2, 3, and 4
- Problem Set 1 Assigned

Thursday, April 13: LAB: Getting Started in R / Why impact is hard to measure

- This lab session will include a crash course in R.
- Suggested Resource to Review: R Tutorials from OIT 367: R 1.1- 2.4
- In this lab session, we will examine fake data we have generated patterned after the KwikMart example from the *Uncontrolled* reading.

Tuesday, April 18: CLASSROOM: Quantifying Uncertainty: Have you measured actual impact or just noise?

Assignments

- One-Page Essay Due
- Reading: Skim Virgin Atlantic Field Use Field Experiment, p. 7-9, 12-30

Thursday, April 20: LAB: Quantifying Uncertainty

- FYI, Data Used in Lab From: Impact of the Hajj

Assignments

- *Optional* Suggested Resource to Review: R Tutorials from OIT 367: R 3.2, 4.1
- Problem Set 1 Due
- Problem Set 2 Assigned

    - Data used in Problem Set from: Demand Reduction in Multi-Unit Auctions
    - Article Discussed in Problem Set: Near Impossibility of Measuring Online Advertising, Section 3

Tuesday, April 25: CLASSROOM: Blocking and Clustering: How to make experiments more precise

Assignments

- Reading: Skim Teacher Performance Pay, Sections II - IV.D
- Reading: Skim Intergroup Contact and Exclusionary Attitudes
- Submit Final Project Preferences Survey

Thursday, April 27: LAB: Blocking and Clustering

- FYI, Data Used in Lab From: Durably Reducing Transphobia

Tuesday, May 2: CLASSROOM: How to analyze experiments with regression

Assignments

- Problem Set 2 Due
- Reading: Skim Incentives for Public Service Delivery, Sections 2, 4 - 4.2
- Reading: Skim OPower's Effects on Energy Consumption, Sections II - III

Thursday, May 4: LAB: Analyzing experiments with regression

- FYI, Data Used in Lab From: Consumer Demand and the Fair Trade Label, Sections II - IV

Assignments

- Problem Set 3 Assigned
    - Data used in Problem Set from: Encouraging Recycling in Peru
    - Data used in Problem Set from: Does Working from Home Work?
    - Data used in Problem Set from: Social Pressure and Voter Turnout, p. 36 - 40

Tuesday, May 9: CLASSROOM: How to find where impact is largest ("Heterogenous effects")

Assignments

- Reading: Skim Repetition and Proximity Increase [Online] Advertising Effectiveness, Sections 2, 3, and 4.3
- *Optional* Reading: Re-Skim Teacher Performance Pay (assigned previously), now Section V.E

Thursday, May 11: LAB: Heterogenous Effects

- FYI, Data Used in Lab From: Racial Discrimination in Politics, p. 468-470

- FYI, Data Used in Lab From: Racial Discrimination in Hiring, Section II - III.B

Tuesday, May 16: CLASSROOM: What can go wrong: What to do about failure to deliver treatment

Assignments

- Reading: Phone Calls and Voter Turnout, p. 142-149
- *Optional* Reading: Cautionary Note on Using Matching
- Problem Set 3 Due
- Problem Set 4 Assigned
    - Article discussed in problem set: Voter Mobilization in State-Controlled Elections

Thursday, May 18: LAB: Failure to treat

- FYI, Data Used in Lab From: Voter Mobilization Phone Calls, Section 4

Guest Speaker for first half of class: Randall Lewis, Economic Research Scientist, Netflix

- *Optional* Reading: Skim Ghost Ads

Tuesday, May 23: CLASSROOM: Finding "natural" experiments when experimentation is impossible

Assignments

- Reading: Skim Does the Market Reward Corporate Social Responsibility?
- Reading: Skim Do Succession Taxes Depress Firm Investment?

Thursday, May 25: LAB: "Natural" Experiments

- FYI, Data Used in Lab From: Extending Benefits and Unemployment Duration

Assignments

- Problem Set 4 Due
- Problem Set 5 Assigned
    - Article discussed in problem set: Natural Experiment on Yahoo! Homepage

Tuesday, May 30: CLASSROOM: GUEST SPEAKER: David Reiley, Pandora

Assignments

- Reading: How Many Audio Advertisements Should Pandora Play? (by our guest speaker)
- Reading: *Uncontrolled*, p. 158-167 (PDF provided) - Building a Culture of Experimentation

Thursday, June 1: CLASSROOM: Final Project Presentations

Assignments

- Reading: Freedman: Statistical Models and Shoe Leather, Section 2 (p. 293-300)
- Final Project Slides Due 30 minutes before class begins

TUESDAY, JUNE 6: CLASSROOM: COMMON PROBLEMS: ATTRITION, SPILLOVERS, GENERALIZABILITY, PUBLICATION BIAS

Assignments

- Problem Set 5 Due
- Reading: OPower Generalizability Across Areas, Section TK
- *Optional* Reading: Worms, Section TK

Your final project write-ups will be due June 8 at 11:59 PM.