Syllabus

Measuring Innovation: Experimental Design

Course 1327
7.5 ECTS
Fall 2022 Period 2

Overview

When a leader touts firm performance indicators and changes over recent years, what can you attribute those changes to? How much stock can you place in evidence from an employee survey? When you learn that a new digital initiative might transform a firm or an industry, what tools do you have to evaluate that claim? There are several naïve approaches to address these questions, including the reliance on past experiences, heuristics, and intuitions.

Field experiments in management research and in practice are usually encouragement designs, where the treatment is not always delivered to subjects randomly assigned to the treatment condition, while some subjects not assigned to treatment manage to receive the treatment. In order to explicitly account for this kind of non-compliance a new modeling approach is warranted. Anyone designing a field experiment must anticipate two-sided non-compliance and four defined subject types: Compliers, NeverTakers, AlwaysTakers, and Defiers. By anticipating non-compliance, we can estimate effects where subjects actually comply with the training courses, interface redesigns, and other treatments.

Purpose

Integrating these straightforward procedures into existing methods adds precision and credibility to practical and academic research in management,including innovation, leadership, and entrepreneurship.

Prerequisites

The course is intended for graduate students: MSc and PhD. The course is open to students from all MSc programs, including CEMS. Participants need to have taken and understood undergraduate statistics. Participants should be curious about experiments and the methodical practices and innovations at the vanguard of social science.

Course structure

1327 stands apart from most MSc courses in its emphasis on individual and not group assessments. It is acceptable and encouraged to collaborate on homework assignments, but each assignment will be graded individually.

Intended Learning Outcomes (ILOs)

The overall intended learning outcome (ILO) for the course is that upon completion, course participants should be able to understand and apply experiments as tools to address business problems using the scientific method. Successful participants will have at their disposal a set of experimental tools useful in executing business projects, as well as conducting and assessing research reports. More specifically, after completing the course students should be able to:

1. Reinforce the fundamentals of data analysis and experimentation strategies using the statistical software R with the help of R Studio. Students should download both of these (free) software programs and open them before starting the course. Students will be able to fit regression models, interpret main effects, interpret covariate coefficients, fit interaction models, and use an instrumental variable in order to account for non-compliance. Students will compare different regression models and interpret metrics of model fit.

2. R will be used every week to generate randomly assigned variables, and then to model potential causal relationships. Instructors are available for R guidance; some working knowledge of R is preferred prior to the course. This course fulfills introduction to R requirements, and further resources are made available throughout the course and in the course "Downloads" to allow students to progress with R. Students will leave the course with a foundational set of R skills, and will be well-poised to progress afterwards.
3. Acquire tools and methods to facilitate research that can show deeper understanding of organizational mechanisms that restrict or promote firm performance, entrepreneurial success, or .
4. Advanced ability to identify causal factors in management and organizational settings, accounting for non-compliance and attrition.

Assessment activities

Homework: Six homework assignments are due throughout the period. The assignments described below will start out easy and become progressively more difficult. At the end of the course, a final exam will test the skills, methods, and theories drilled in all of the lectures and all of the homework assignments. The exam may require students to replicate and extend previous published research findings. The test is lengthy.

Assessment Activity	Score	Weight
Homework 1	10 pts	10%
Homework 2	10 pts	10%
Homework 3	10 pts	10%
Homework 4	10 pts	10%
Homework 5	10 pts	10%
Homework 6	10 pts	10%
Final Exam	100 pts	40%
All		100%

A final grade (Pass, Good, Very Good, Excellent) will be awarded to each course participant based on that person's performance across all assessment activities. In accordance with school policy, a grade of "Excellent" is available only for approximately 25% of students enrolled.

Assignment 1: Design an experiment where some participants are randomly assigned a treatment while some are assigned to a control condition (between-subjects experiment). Defend the dimensions of external validity we will have discussed: the participants, the setting, the manipulation, and the outcome. Be certain not to describe an observational study. Defend the need for an experiment versus an observational study; in other words, *Why does this question merit an experimental design?*

Assignment 2: Building off assignment 1, conduct a power analysis and report how many subjects are needed to detect the effect you are seeking with this experiment. Design a *new* experiment that addresses the same research question using a within-subjects design, where all subjects receive both the treatment and some control, but the order in which they receive each is randomized. *Why is a within-subjects design appropriate for this research? What does this approach offer that a between-subjects design does not?*

Assignment 3: The participants in the proposed experiments certainly have individual characteristics (demographic factors, previous experiences, psychological makeup) that affect outcomes in addition to the experimental manipulation. Using previous literature and guided hypotheses, suggest some (2-5) prognostic covariates that could reasonably affect outcomes, and can reasonably be observed/collected prior to randomization. Create data in R that includes a randomly assigned manipulation, a dependent variable, and covariates. Analyze and interpret the coefficients associated with each independent variable. Report the results of this mock data in a simple table.

Assignment 4: Design an experiment that encounters Attrition. Calculate extreme value bounds. Determine if attrition appears to be at random. Discuss who this estimand (EVB) describes and the necessary assumptions to report it. *How likely is attrition in this design? Why analyze for attrition? Is it possible to coarsen your DV?*

Assignment 5: Design an experiment in anticipation of 1-sided non-compliance. Simulate data in R that includes random assignment, outcomes, and another binary measure of whether each subject actually received the treatment (1) or not (0). Calculate the effect among compliers using two methods: a ratio estimator and instrumental variables regression. Compare the estimands and discuss their differences. *How feasible is non-compliance in this design? Why analyze for non-compliance?*

Assignment 6: Design an experiment in anticipation of 2-sided non-compliance. Simulate data in R that includes random assignment, outcomes, and another binary measure of whether each subject actually received the treatment (1) or not (0). Again, calculate the effect among Compliers using two methods: a ratio estimator and instrumental variables regression. *How feasible is 2-sided non-compliance in this design? Justify why you can rule out Defiers under your proposed design.*

Attendance

Much of what is taught in 1327 is confined to technical journals or advanced textbooks; that information will be packaged and presented in lectures. It is not reasonable that any student can expect to earn a grade of Excellent without attending almost every class.

Literature

The lectures follow articles and one book listed below. Mandatory readings are available in the downloads folder. Much of the teaching will follow the textbook "Field Experiments." The textbook is not mandatory, but it is highly recommended that students own this inexpensive paperback book for this course and beyond.

Gerber, A. and Green, D. (2012) Field Experiments: design, analysis, and interpretation, New York: Norton & Company.

Mandatory readings

Week 1: Intro and Between-Subjects Experiments

Cialdini, R. B. (2009). We have to break up. *Perspectives on psychological science*, *4*(1), 5-6.

Bertrand, M., & Mullainathan, S. (2004). Are Emily and Greg more employable than Lakisha and Jamal? A field experiment on labor market discrimination. *American Economic Review*, 94(4), 991-1013.

Glaub, M. E., Frese, M., Fischer, S., & Hoppe, M. (2014). Increasing personal initiative in small business managers or owners leads to entrepreneurial success: a theory-based controlled randomized field intervention for evidence-based management. *Academy of Management Learning & Education*, 13(3), 354-379. (keep this reading in mind for week 5 and 6)

Week 2: Power and Within-Subjects Experiments

Kanze, D., Huang, L., Conley, M. A., & Higgins, E. T. (2018). We ask men to win and women not to lose: Closing the gender gap in startup funding. *Academy of Management Journal*, *61*(2), 586-614.

Week 3: Covariate Adjustment

Montgomery, J. M., Nyhan, B., & Torres, M. (2018). How conditioning on posttreatment variables can ruin your experiment and what to do about it. *American Journal of Political Science*, 62(3), 760-775.

Week 4: Attrition

Ditlmann, R. K., & Lagunes, P. (2014). The (Identification) Cards You Are Dealt: Biased Treatment of Anglos and Latinos Using Municipal-Issued versus Unofficial ID Cards. *Political Psychology*, *35*(4), 539-555.

Week 5: 1-sided Non-Compliance

Brooks, W., Donovan, K., & Johnson, T. R. (2018). Mentors or teachers? Microenterprise training in Kenya. *American Economic Journal: Applied Economics*, 10(4), 196-221.

Camuffo, A., Cordova, A., Gambardella, A., & Spina, C. (2020). A scientific approach to entrepreneurial decision making: Evidence from a randomized control trial. *Management Science*, 66(2), 564-586. (this reading is also helpful for week 6)

Week 6: 2-sided Non-Compliance

Bradlow, E. (1998). Encouragement designs: an approach to self-selected samples in an experimental design. *Marketing Letters*, *9*(4), 383-391.

Albertson, B., & Lawrence, A. (2009). After the credits roll: The long-term effects of educational television on public knowledge and attitudes. *American Politics Research*, 37(2), 275-300.

General Readings (not mandatory)

Levitt, S. D., & List, J. A. (2007). What do laboratory experiments measuring social preferences reveal about the real world?. *Journal of Economic Perspectives*, 21(2), 153-174.

Eden, D. (2017). Field experiments in organizations. *Annual Review of Organizational Psychology and Organizational Behavior*, 4, 91-122.

Conley, M. A., & Higgins, E. T. (2018). Value from fit with distinct motivational field environments. *Basic and Applied Social Psychology*, *40*(2), 61-72.

Faul, F., Erdfelder, E., Lang, A. G., & Buchner, A. (2007). G* Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior research methods*, *39*(2), 175-191.