# 17.803 Political Science Laboratory

## Spring 2018

MIT


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| **Instructor:** | Teppei Yamamoto | **Instructor:** | Nicholas Intscher |
| **Office:** | E53–401 | **Office:** | E53–448 |
| **Email:** | teppei@mit.edu | **Email:** | intscher@mit.edu |
| **Office Hours:** | By Appointment | **Office Hours:** | By Appointment |
| **Class Time:** | T&R 3PM-4:30PM | **Lab Time:** | TBD |
| **Class Room:** | E53–438 | **Lab Room:** | TBD |


## Purpose and Goals

This class introduces undergraduate political scientists to the basic quantitative tools of political science research. In particular, this class explores the key statistical and computational research tools that social scientists use to frame and answer empirical questions. When you finish this subject successfully, you will be able to conduct quantitative research, be better able to read critically much of the professional literature in political science and other statistically-based fields, and have an employable skill. The most important purpose behind the Political Science Laboratory, however, is to help you move from a passive reader of social scientific tomes to a creative producer of new insights.

A particular focus of the class will be on the issue of *causal inference*. The political world is composed of a web of cause-and-effect relationships that are entangled and intertwined. The complex nature of our world makes our life as political scientists tough and challenging, even compared to those of rocket scientists and nuclear physicists. The central theme that runs throughout the course will be: How can we tell causation from mere association? The answer lies in good *research designs* and appropriate *statistical tools*, as you will learn by the end of the semester.

This class emphasizes practical skills and intuition for good quantitative social science, compared to traditional statistics courses. As such, the class will involve lots of hands-on exercises, lab sessions, group work, discussion and presentation sessions, along with more traditional problem sets. Throughout the semester, you will also work on an original research project that involves data collection, analysis with a statistical computing language (R), and a final write-up of your findings. If this subject piques your interest in a more rigorous treatment of statistical methods and perhaps a professional career in quantitative political science, consider taking 17.800 (Quantitative Research Methods I) and 17.802 (Quantitative Research Methods II) in the next year with our first-year graduate students.

## Prerequisites

You need to have taken 17.801 (Scope and Methods) to enroll in this course. We expect no prior specialized training in statistics, probability, or computation (assuming you have successfully made your way through MIT up to this point).

## Organization

The class roughly consists of three components. First, you will learn how to collect, manage, and analyze data using software tools on your computer (R and other packages). You will spend the first two weeks of the semester mostly training yourself up on this dimension. In week two, the class will take a lab style where you will bring your own laptop and work through exercises with help from the instructor and the TA. Your mid-week and weekend assignments will involve watching videos and completing basic tutorials on your own so you can get started right away with those in-class exercises. For the rest of the semester, you will practice and hone those skills through problem sets and data analysis for your final project.

Second, you will spend most of your remaining class time on learning about research designs and statistics. Making a credible causal claim about the social world requires good research designs, and the central goal of this component of the subject is to build your intuition about credible designs. After successfully completing your semester, you will be able to tell well-designed empirical studies from poorly-designed ones with confidence. Specifically, we will cover six different research designs, or *identification strategies*, in this subject. These designs are extremely commonly used in quantitative social science and account for the bulk of what you see in academic journals in political science nowadays. Each design topic will be covered over two separate class meetings. In the first class, the instructor will give a lecture on the conceptual and theoretical underpinnings of the design. Typically after the first class you will be assigned a *design exercise* which will invite you to think harder and more concretely about the design. The second class will usually include a group exercise or discussion session based on the design exercise, may cover more details or extensions, or will give you an opportunity to work with data. In addition to these design-based class meetings, we will also take a short (but important) excursion to the world of statistical inference and learn theories and techniques that are commonly used across all designs.

Third, you will work on a research project of your own making. This is the most exciting part of this subject, but also it is much more challenging than it might first appear to you. You will be responsible for making good and steady progress over the course of the semester, so make sure to spare some time for the project and accomplish something concrete *every week*. To help you on this dimension, we will have several class meetings dedicated to your projects (see the next section). At the end of the semester, you will give an oral presentation on your project, and then submit a final write-up where you will summarize your research question, hypothesis, research design, data, and findings in the style of an academic research paper.

Because of the hands-on nature of this subject, **your individual preparation and participation in each class is mandatory**. Preparation will involve different things for each meeting, so refer to the course calendar below for the specifics. In each class, we will pay attention to who seems prepared and who is not. We will meet twice each week, unless otherwise indicated on the calendar.

## Requirements

The final grades are based on the following items:

- **Class attendance, participation and engagement** (15%)
- **Problem sets** (35%): There will be six problem sets spread throughout the semester. Only the first five are mandatory and equally count towards the final grade. The last one will be optional, and if you complete it, the grade will replace the lowest grade you obtained for the mandatory five. The problem sets will contain conceptual, analytical, computational and data analysis questions. Please note:
  - Neither late submission nor electronic submission will be accepted unless you ask for special permission from the instructor in advance of the deadline. (Permission may be granted or not granted, with or without penalty, depending on specific circumstances.)

- Working in groups is encouraged, but you must submit your own write-up of the solutions. In particular, you must not copy and paste someone else's answers or computer code. *Violation of this policy will be considered an academic integrity issue and processed accordingly to MIT's rules and procedures for such violations.* We also ask you to write down the names of the other students with whom you solved the problems together on the first sheet of your solutions.
- For analytical questions, you should include your intermediate steps, as well as comments on those steps when appropriate. For computing and data analysis questions, include annotated code as part of your answers. All results should be presented so that they can be easily understood.

- **Design exercises** (15%): You will be asked to complete six design exercises, each corresponding to a particular research design covered in the subject. They are either short group projects or individual exercises that are designed to deepen your understanding about the research designs. Each exercise will be assigned at the end of a class and due at the beginning of the next class. We will then collectively discuss your work in the class. Contents will vary so you should follow the instructions on each specific exercise.

- **Final project presentation and write-up** (35%): The final project is the culmination of this subject. You will be responsible for finding an empirical question that interests you and answering it by applying the skills you are going to learn in this subject. This will be a serious research project that will require your constant attention and engagement throughout the semester. Below are the key milestones that will help you move toward the completion of the project by the end of the semester. Performance on each of these points will count toward your final grade.

  - **February**: **Start thinking** about possible topics and exploring data sources. The class on Research Designs Overview (see class calendar) will be particularly helpful for you to think which research design will best fit your question. Look through the examples we will provide on Stellar to guide your thoughts. Within the first two weeks of the semester, we strongly encourage you to **schedule a meeting with the TA** and talk about your ideas. The meeting will be informal and intended to help you transform your nascent thoughts (perhaps derived from your work in 17.801) into something that is "causally well-identified."
  - **March 15**: At the start of class, **submit a 1-2 page memo** summarizing your current ideas. Your memo should consist of at least two potential topics you are considering working on, as well as the research designs that you are going to use for those topics. For each topic, you should clearly state your research question, your working hypothesis, why you think the proposed research design is appropriate for answering the question, and where and how you plan to acquire the necessary data. *It is particularly important that you have done thorough research on data availability by this point.* You are also welcome to visit the instructor and run your ideas (email and make an appointment).

    Within the next two weeks of your project memo submission, **meet with the TA again** to discuss your ideas and decide on a single topic and a research design for the project. Depending on how much work will be involved in the acquisition of the data, you and the TA will decide the scope of the project for the semester (i.e. what must be completed by the end of semester and what can be left for future exploration, possibly as part of your thesis).
  - **April 10–11**: **Meet with the instructor** to discuss your progress on your project. These meetings will be at least 30 minutes, but no more than 1 hour. Before your meeting, **turn in a 1-2 page progress report** on your project. Your progress report should state what you have done so far, what other aspects of the project have yet to be completed, and what challenges you are facing at the moment.
  - **May 3**: We will hold a **project workshop** during the regular class time. This will be an informal discussion session to talk through issues that students have come across in the course of their projects, and engage in peer-to-peer learning. You should bring your own stories and questions to share with others in the class. Be prepared to help the other members of class with anything they are stuck on.

- **May 15** or **May 17**: You will **present your project in front of the class** during the regular class time. The length and format of your presentation will be determined based on the enrolment count. You should prepare electronic slides to accompany your presentation, and practice it in advance. There will be a Q&A and discussion session after each of the presentations. Make final revisions to your paper based on the feedback.
- **May 18**: **Write-up due.** Please turn in your paper by midnight. We will give you more detailed submission instructions via email closer to this date.

## Course Website

You can find the Stellar/LMOD website for this course at:

http://stellar.mit.edu/S/course/17/sp18/17.803

We will distribute course materials, readings (if not in the core books), lecture slides, and problem sets on this website.

## Questions about Course Materials

We will also utilize an online discussion board called *Piazza*. You can sign up here. This is a question-and-answer platform that is easy to use and designed to get you answers to questions quickly. We encourage you to use the Piazza Q & A board when asking questions about lectures, problem sets, and other class materials. There are also free Piazza apps for Android and iOS devices. The Piazza course page is listed below:

piazza.com/mit/spring2018/17803

Using Piazza will allow you to see and learn from questions others have. The instructors will regularly check the board and answer questions posted, although everyone else is also encouraged to contribute to the discussion. Your respectful and constructive participation on the forum will count toward your class participation grade. *Do not email your questions directly to the instructors* (unless they are of a personal nature) — we will not answer them!

## Lab Sessions

Lab sessions will be held on the fourth floor of E53 on Fridays. The room and time will be determined in the first week of class. Sessions will often be your dedicated time to make progress on your project: Bring your laptop. We will also occasionally review class materials and help you with computing issues in problem sets. The TA will run the sessions and can give more details. Attendance is *very strongly* encouraged and participation will count towards your participation grades.

## Books

- **Required books:** We will read chapters from the following book, which we strongly recommend that you purchase (it is relatively cheap). The book will be available for purchase at the COOP and online bookstores (e.g. Amazon) and on reserve in the library.
  - Angrist, Joshua D. and Jörn-Steffen Pischke. 2015. *Mastering 'Metrics: The Path from Cause to Effect.* Princeton University Press.

Additionally, we will take several chapters from the following book as required reading assignments. They will be posted on Stellar and are available on reserve in the library. You do not need to purchase the whole book, though we highly recommend it as your statistics reference book if you are interested in this subject.

  - Freedman, David, Robert Pisani and Roger Purves. 2007. *Statistics.* 4th Ed. W.W. Norton & Company.

We will also assign several video tutorials and exercises. Follow the hyperlinks in the course calendar below to access those materials.

- **Recommended books:** These books cover particular sections of the course more in depth and are recommended for your reference, particularly if the sections are directly relevant for your final project.
  - Teeter, Paul. 2011. *R Cookbook.* O'Reilly Media. (for learning R more broadly and deeply. This book is available as an e-book on the library website.)
  - Angrist, Joshua D. and Jörn-Steffen Pischke. 2009. *Mostly Harmless Econometrics: An Empiricist's Companion.* Princeton University Press. (covers the research designs more in depth and at a more technically advanced level.)

## Course Calendar

Please consult this calendar carefully. Also, note:

You are expected to be in class whenever the calendar is marked in **bold**.

All required readings and video tutorials are indicated with †.

All homework exercises – psets and design exercises – are indicated with •.

All project related deadlines are indicated with ★.

| TUESDAY (CLASS) | MID-WEEK ASSIGNMENT | THURSDAY (CLASS) | FRIDAY (LAB) | WEEKEND ASSIGNMENT |
|---|---|---|---|---|
| Feb 6th<br>**Introduction** | † Read Angrist & Pischke, Introduction | Feb 8th<br>**Research Designs Overview** | Feb 9th<br>**Lab 1** | † Read Freedman et al. Ch. 4 and 5 |
| Feb 13th<br>**Data Description and Visualization** | • Install & set up R on your laptop<br>† Watch Robinson, Lesson 1.1-1.6 | Feb 15th<br>**R Lab**<br>• pset 1 out | Feb 16th<br>**Lab 2** | † Watch Robinson, Lesson 2.1-2.7 |
| Feb 20th<br>*No class (Monday schedule)* | | Feb 22nd<br>**R Lab** | Feb 23rd<br>**Lab 3** | † Complete "Getting and Cleaning Data" exercise |
| Feb 27th<br>**R Lab**<br>• pset 1 due<br>• pset 2 out | † Read Angrist & Pischke Ch.1 | Mar 1st<br>**Randomized Experiments** | Mar 2nd<br>**Lab 4** | • Experiments exercise |

| TUESDAY (CLASS) | MID-WEEK ASSIGNMENT | THURSDAY (CLASS) | FRIDAY (LAB) | WEEKEND ASSIGNMENT |
|---|---|---|---|---|
| Mar 6th<br>**Randomized Experiments**<br>• pset 2 due | † Read Freedman et al.<br>Ch. 16–18 | Mar 8th<br>**Statistical Inference**<br>• pset 3 out | Mar 9th<br>**Lab 5** | † Read Freedman et al.<br>Ch. 21, 23, 26, 27 |
| Mar 13th<br>**Statistical inference** | | Mar 15th<br>**Statistical Inference**<br>★ Project memo due (schedule meeting with Nicholas) | Mar 16th<br>**Lab 6** | † Read Angrist & Pischke Ch.2 |
| Mar 20th<br>**Matching** | • Matching exercise | Mar 22nd<br>**Matching**<br>• pset 3 due | Mar 23rd<br>**Lab 7** | |
| Mar 27th<br>*No class*<br>*(Spring vacation)* | | Mar 29th<br>*No class*<br>*(Spring vacation)* | Mar 30th<br>*No lab*<br>*(Spring vacation)* | |
| Apr 3rd<br>**Regression** | • Regression exercise | Apr 5th<br>**Regression**<br>• pset 4 out | Apr 6th<br>**Lab 8** | ★ Progress report due |
| Apr 10th<br>★ Individual meetings with Teppei | ★ Individual meetings with Teppei | Apr 12th<br>*No class* | Apr 13th<br>**Lab 9** | |
| Apr 17th<br>*No class*<br>*(Patriot's Day)* | † Read Angrist & Pischke Ch.3 | Apr 19th<br>**Instrumental Variables**<br>• pset 4 due | Apr 20th<br>**Lab 10** | • IV exercise |
| Apr 24th<br>**Instrumental Variables**<br>• pset 5 out | † Read Angrist & Pischke Ch.4 | Apr 26th<br>**Regression Discontinuity** | Apr 27th<br>**Lab 11** | • RD exercise |
| May 1st<br>**Regression Discontinuity**<br>• pset 5 due | | May 3rd<br>**Project Workshop**<br>• pset 6 out | May 4th<br>**Lab 12** | † Read Angrist & Pischke Ch.5 |
| May 8th<br>**Difference in Differences** | • DID exercise | May 10th<br>**Difference in Differences**<br>• pset 6 due | May 11th | ★ Prepare project presentation |
| May 15th<br>★ **Project Presentations** | | May 17th<br>★ **Project Presentations** | May 18th<br>★ Project write-up due | |