POL 501: Quantitative Methods for Social Science
University of Washington
Winter 2021

Class Meetings: Wednesdays 4:30-7:30PM

Office Hours: Wednesdays 3PM – 4:15PM in 131 Gowen
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Lab Instructor: Beatrice Magistro, magistro@uw.edu

Course Overview

This course serves as an introduction to quantitative methodology in the social sciences. The methods will primarily apply to political science, but are useful for research in other social sciences such as economics, sociology, and psychology. The goal is for students to come away with the skills needed to quantitatively *measure* social phenomena, and *estimate* descriptive and causal relationships between them.

Quantitative social science is difficult. Unlike the 'hard' sciences, we rarely have the opportunity to run experiments in controlled lab settings. That means we have to use a variety of techniques and pay close attention to the assumptions underlying our methods. We will be methodologically *pluralist* in our pursuit of accurate answers to important research questions.

We will learn about *probability and statistics*: distributions and samples of variables, and the relationships between them. Mostly in lab, we will also learn about *computation*: how to summarize data from the real world. We will use the free programs *R* and *RStudio*. If possible, bring both a computer and a notepad to lecture and lab.

Social science methods are often best learned during the research process. In this course, we will not only learn concepts; we will learn *how* to learn methods on our own—how to ask about and Google for methods information.

Course Texts & Resources

You need two textbooks for this course:

1) Imai, Kosuke. 2017. *Quantitative Social Science: An Introduction*. Princeton, NJ: Princeton University Press (hereafter *QSS*).

2) Wickham, Hadley and Garrett Groleman. 2017. *R for Data Science: Import, Tidy, Transform, Visualize, and Model Data*. Oreilly Media (hereafter *R4DS*). This book is also available at https://r4ds.had.co.nz/

We will also be working with my *Methods Cheat Sheet*, a packet of helpful shortcuts and resources.

Course Assignments & Requirements

Your grade is determined with the following weights:

- Problem sets, assigned most weeks and due in the next lecture (25% in total)
- 24-hour take-home midterm exam (20%)
- 24-hour take-home final exam (25%)
- Data Analysis Project (30%)

Important dates:

- January 27: Data Analysis Project proposal due
- February 10: Midterm exam available
- March 10: Final exam available
- March 17: Data Analysis Project due

In my experience, by far the strongest correlate of doing well in this course is to attend lecture and lab. Additional predictors include dedicating sufficient time to this course, and working collaboratively with classmates.

The UW's policy for accommodation of student absences or significant hardship due to reasons of faith or conscience, or for organized religious activities, including more information about how to request an accommodation, is available here. Accommodations must be requested within the first two weeks of this course using the Religious Accommodations Request form. Infants and small children are allowed in lecture in the case of childcare emergency.

You can collaborate with others on problem sets. Exams and the Data Analysis Project are to be done alone. The usual academic conduct standards apply as defined in UW Student Governance Policy, Chapter 209 Section 7.C.

Course Schedule

UNIT I: Probability and Statistical Notation

- Sets: union, intersection, complement
- Variables
    - Indexing variables
    - Operating on variables (sums, products)
- Independence

UNIT II: Descriptive Statistics

- Mean and median
- Variance and standard deviation
- Skew and kurtosis
- Histograms

- Density plots
- Distributions
    - Continuous, discrete
    - PDFs, CDFs
    - Expectation

UNIT III: Measurement and Sampling

- Sampling bias
    - Non-response
- Clusters, blocks, stratification
- Correlations

Readings for Units I-III:

- Required:
    - Bueno de Mesquita, Ethan. 2013. "The Aims of Public Policy Address: The Perils of Quantification." http://home.uchicago.edu/bdm/PDF/aims.pdf
    - *QSS* Chapters 1, 3, 6
    - *R4DS* Chapters 1, 2
- Recommended:
    - Grinstead, Charles Miller, and James Laurie Snell. *Introduction to probability*. American Mathematical Soc., 2012. Available free at: https://www.dartmouth.edu/~chance/teaching_aids/books_articles/probability_book/amsbook.mac.pdf
    - Chapter 1 of Pearl, Judea, Madelyn Glymour, and Nicholas P. Jewell. *Causal inference in statistics: A primer*. John Wiley & Sons, 2016.

UNIT IV: Causality

- Bias
    - Selection bias
    - OVB and confounding
    - Other forms of bias: collider bias; correlated measurement error
- Reverse causality and endogeneity
- Randomized experiments: the gold standard
- Bias vs. error; the bias-variance tradeoff
- Design vs. model-based inference

Readings for Unit IV:

- Required:
    - *QSS* Chapter 2
    - Freedman, David A. "Statistical models and shoe leather." *Sociological Methodology* (1991): 291-313.
- Recommended:
    - Chapter 2 of Angrist, Joshua D., and Jörn-Steffen Pischke. *Mostly harmless econometrics: An empiricist's companion*. Princeton University Press, 2008.

UNIT V: Regression

- Introduction to regression
- Regression assumptions

UNIT VI: Prediction (vs. Hypothesis Testing)

- "Y-hat"
- Residuals
- Interaction terms
- Logit, Probit, Poisson: Regressions for Other Distributions

UNIT VII: Uncertainty

- Unbiasedness of estimators
- Consistency of estimators
- Inferential statistics (for hypothesis testing)
    - Standard error
    - Confidence intervals
- Inferential statistics in regression
    - Unbiasedness of coefficients
    - Standard errors of coefficients
    - Comparing coefficients

Readings for Unit V-VII:

- Required:
    - *QSS* Chapters 4, 7
- Recommended:
    - Chapter 3 of Angrist, Joshua D., and Jörn-Steffen Pischke. *Mostly harmless econometrics: An empiricist's companion*. Princeton University Press, 2008.