Introduction to Quantitative Methods in Political Science
Government 653

Ryan T. Moore*

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Course Information

Government GOVT 653
Introduction to Quantitative Methods in Political Science
Section 001: Tuesday, 17:30–20:00 Eastern
Location: Kerwin Hall 104

Instructor Information

Ryan T. Moore, Ph.D.
Associate Professor of Government
Office: Kerwin Hall 234
Telephone: +1 202 885 6470
Homepage: `http://www.ryantmoore.org`
Email: `rtm` (at) `american` (dot) `edu`
Office Hours: Monday 16:00-18:00, or by appointment

Teaching Assistant Information

Ehsan Habibpour
Ph.D. Student, Department of Government
Email: `eh1156a@american.edu`
Office Hours: Thursday 12:00-13:00 and by appointment
Location: On Zoom. See Slack for the link.

Course Description

This course equips political science graduate students to analyze quantitative data to answer central questions in political science. Students will learn to answer questions such as "How confident can we be in our measurement of constructs?", "How certain can we be in the relationships among

*Department of Government, American University, Kerwin Hall 234, 4400 Massachusetts Avenue NW, Washington DC 20016-8130. tel: +1 202 885 6470; `rtm` (at) `american` (dot) `edu`; `http://www.ryantmoore.org`.

constructs?", "How do we assess and evaluate quantitative models that are applications of empirical theories?", "How can we evaluate the causal nature of claims?" This course will teach students how to address these and other social science questions through the analysis of quantitative data. The course introduces basic principles of statistical inference and programming skills for data analysis. The course provides a foundation to first, enable students to conduct their own data analyses for their own research, and, second, make students critical consumers of statistical claims both inside and outside the academic literature.

We will review foundational topics in probability and hypothesis testing, discuss measurement, data visualization, examine the linear model and linear regression in detail, and learn how to preprocess data for analysis. Throughout, we will work to adopt state-of-the-art workflow practices.

Prerequisites: GOVT-650 Political Analysis.

Acknowledgments: This syllabus draws from recent versions of the course, particularly from Andrew Flores, and, thus, Kosuke Imai.

Learning Objectives

- Identify, solve, and make decisions on problems based on relevant analytic skills.
- Apply in-depth quantitative analytics across policy areas.
- Communicate research findings following professional standards.
- Analyze and interpret quantitative data and the results from analyses of data.

Learning Strategies

Readings

Readings should be completed before the course meeting under which they are listed below. The required and recommended textbooks engage with some of the most recent, most interesting research in political science and cognate social sciences. When you read about a study or method that's interesting to you, find the original paper and read it, too.

The primary textbook for the course, *ROS*, is

> Gelman, Andrew, Jennifer Hill, and Aki Vehtari. *Regression and Other Stories*. Cambridge University Press, New York, NY, 2021.

Recommended readings frequently come from *QSS*:

> Imai, Kosuke and Nora Webb Williams. *Quantitative Social Science: An Introduction in tidyverse*. Princeton University Press, Princeton, NJ, 2022.

Computers and Notes in Class

For most class meetings, we will focus our attention on statistical concepts and implementation of methods in R. You should bring to class a computer on which you can run R, including the installation of packages from CRAN and GitHub.

However, it is also wise to take hand-written notes. Although the experiments are relatively small, longhand writing appears to be a superior strategy for taking notes under some conditions. See http://j.mp/2uJAp6z for a summary brief. At least, there is no evidence that note-taking via laptop is beneficial in

Mueller, Pam A. and Daniel M. Oppenheimer. The Pen is Mightier than the Keyboard: Advantages of Longhand Over Laptop Note Taking. *Psychological Science*, 25(6):1159–1168, 2014.

Requirements and Evaluation

Students are required to do the weekly reading, attend class, complete all assignments, and contribute significantly to course discussions about the material. A summary of the course assessments is in Table 1.

Assignment	Weight
Problem Sets	20%
R Exercises	10%
Midterm Exam	15%
Final Presentation	5%
Final Exam	15%
Final Paper and Code	25%
Participation	10%
(Attendance, discussion, Slack, etc.)	

Table 1: Course Assessment Summary

If you cannot submit an assignment on time, arrange to submit it early. We encourage you to use office hours to discuss any specific assignments, difficulties, or questions about the course.

Problem Sets

The four problem sets should be completed outside of class. You should submit your solutions to the course Canvas site.

You may work with others on the problem sets, but every keystroke and interpretation in your submission must be your own. You may not copy code or answers from others, but you may develop your code with classmates. This includes all support from resources outside of class (StackOverflow, ChatGPT, etc.). You are responsible for understanding and being able to explain every line of code you submit.

Final Project

For the final project, you will engage in original political science research. You will define your own research question, with attention to the intellectual or policy contribution that you will make by answering it.

You will select data sets, pose an appropriate political research question that the data can answer with quantitative methods, analyze the data, write a paper, and present your research. The paper must provide appropriate political, social, and intellectual context for the question you pose. Projects that connect otherwise disconnected data sets often emerge as the most innovative social science work.

Your project should represent original data analysis, and should address a question of interest to the research community, and perhaps, policymakers. It should represent quantitative political science at the highest level you can muster.

To start finding data, see the resources for papers on my webpage, our Canvas, or the page prepared by our librarian here. Another option is to use data that policymakers want to learn about. In conjunction with The Lab @ DC, a research arm of the Executive Office of the Mayor, our Canvas includes a handful of data sets pertaining to policies and programs of Washington, DC. Topics will include campaign finance and expenditures, ANC budgets, public goods and the 311 request system, transit, and affordable housing. The data are available at http://opendata.dc.gov.

Software, Statistics, Data, and Literature Support

The primary statistical software for the course is R. See https://t.ly/0Q6VH for help getting started. Additional support for statistical software is available through CTRL and the library. See https://bit.ly/3ABF1w4 for tutorials. See https://www.american.edu/provost/academic-access/quantitative.cfm to get individual help.

The library itself offers support for various software. Our librarian is Olivia Ivey, whom I recommend reaching out to as you formulate a question, search for data, and try to put your question in a larger intellectual or policy context. You can book an appointment with Olivia at https://aulib.info/oivey.

Intellectual Property

Course content is the intellectual property of the instructor or student who created it, and may not be recorded or distributed without consent. You may not donate others' intellectual property to the builders of LLM's.

Students are not permitted to make visual or audio recordings, including live streaming, of classroom lectures or any class related content, using any type of recording devices (e.g., smart phone, computer, digital recorder, etc.) unless prior permission from the instructor is obtained, and there are no objections from any of the students in the class.

Course Evaluation

The course evaluation will take place online towards the end of the semester. Please take time to provide this important feedback.

Replication Policy

Students must retain copies of all `.R` and `.qmd` files that include their data processing and analysis for problem sets, exercises, and the final project. In keeping with standard practice in the discipline, these files should be able to be run by others, and should reproduce all results the student submits. Students must submit a replication code file with the final project.

Academic Integrity

Academic integrity is a core value of institutions of higher learning. It is your responsibility to avoid and report plagiarism, cheating, and dishonesty. Please (re-)read the University policy on academic integrity at `http://www.american.edu/academics/integrity/code.cfm`, particularly Sections I and II.

The University Provost and Office of Academic Integrity recently sent out this guidance:

> Dishonesty in papers/exams: our Code requires that all work submitted by students is their own unless otherwise acknowledged. If a student is using AI generated material to substitute for work that is expected to be entirely their own, this could be a violation.

Further Information for American University Students

For further detailed information on the important issues of academic integrity, emergency preparedness, academic support, discrimination, and use of social media, please see here.

Calendar

Part I: Introduction to Quantitative Methods

13 January

Introduction to quantitative methods. Data and measurement.

- ☐ Required reading: This syllabus.
- ☐ Recommended reading: *ROS* Ch. 1-2, Appendix A
- ☐ Recommended reading: *QSS* Ch. 1, 2.1-2.4, 3.5-3.7

20 January

Mathematics and probability.

- ☐ Required reading: *ROS* Ch. 3 - Ch. 4.2
- ☐ Recommended reading: *QSS* Ch. 6

27 January

Statistical inference and simulation.

- ☐ Required reading: *ROS* Ch. 4.3 - 5
- ☐ Recommended reading: *QSS* Ch. 7

Part II: Linear Regression

3 February

Bivariate regression models.

- ☐ Required Problem Set 1 due
- ☐ Required reading: *ROS* Ch. 6-7
- ☐ Recommended reading: *QSS* Ch. 4.2

10 February

Bayesian models and predictions.

- ☐ Required reading: *ROS* Ch. 8-9
- ☐ Recommended reading: *QSS* Ch. 7.3

17 February

Multiple regression.

- ☐ Required reading: *ROS* Ch. 10
- ☐ Recommended reading: *QSS* Ch. 4.3, 7.3

20 February

Midterm exam posted.

24 February

Regression assumptions and diagnostics.

- ☐ Required reading: *ROS* Ch. 11

3 March

Transformations. Binary outcomes.

- ☐ Midterm exam due
- ☐ Required reading: *ROS* Ch. 12
- ☐ Recommended reading: *ROS* Ch. 13

10 March

No class meeting. (Spring Break)

17 March

Generalized linear models. Bayesian inference. (*Dr. Jeff Gill*)

- ☐ Required research paper draft due

Part III: Data Wrangling

24 March

Tidy data. Data wrangling. Cleaning and coarsening data.

- ☐ Required Problem Set 2 due
- ☐ Required reading: *R for Data Science (2e)* Ch. 3, 5 at https://r4ds.hadley.nz

Part IV: Causal Inference

31 March

Randomized experiments and regression

- ☐ Required reading: *ROS* Ch. 18-19
- ☐ Recommended reading: *QSS* Ch. 2.1-2.4, 4.3

7 April

Observational studies. Assumptions, subclassification, matching, the propensity score. Causal identification strategies.

- ☐ Required Problem Set 3 due
- ☐ Required reading: *ROS* Ch. 20
- ☐ Required reading: *ROS* Ch. 21
- ☐ Recommended reading: *QSS* Ch. 2.5, 4.3.4

Part V: Research Paper Workshop and Presentation

14 April

Research paper workshop.

- ☐ Required Problem Set 4 due
- ☐ Bring your paper draft, data, and analyses

21 April

Research paper presentations.

30 April

Final exam week begins. Final exam posted.

- ☐ Final paper due to Canvas by 23:59.

5 May

Final exam scheduled, 17:30-20:00.
No class meeting, no in-person exam.

- ☐ Final exam due to Canvas by 20:00.