

# POLI706: Advanced Methods of Political Analysis

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## Course Description

POLI706 Advanced Methods of Political Analysis is a graduate-level course aimed at equipping students with advanced statistical methodologies and techniques essential for political analysis. The curriculum covers theoretical foundations and practical applications of causal inference, regression models, diagnostics, and cutting-edge statistical methods. Students will apply these techniques using statistical software to conduct sophisticated analyses relevant to modern political science research, enhancing their ability to interpret complex data and make substantive contributions to the field.

## Course Objectives

Upon completing this course, students will achieve the following learning outcomes:

1. *Develop a Sophisticated Grounding in World Affairs*

Students will deepen their understanding of statistical methodologies as they apply to global political dynamics, enhancing their expertise in a specialized field relevant to international affairs.

2. *Critically Analyze International Policies and Quantitative Data*

Through rigorous training in causal inference, regression analysis, and advanced statistical methods, students will learn to critically assess and interpret international policies and quantitative data within the framework of political science.

3. *Effectively Communicate Discipline-Specific Knowledge*

The course will equip students with the necessary skills to clearly articulate findings from their analyses of international affairs, aiding them in their professional development. This includes preparing them to search for, identify, and apply for career opportunities such as internships and employment positions in the field of international affairs, utilizing their analytic skills and substantive knowledge.

## Prerequisites

Prior to enrolling in POLI706, students must fulfill the following prerequisites:

- Successful completion of POLI502 or an equivalent course is required. For example, students are expected to have a comprehensive knowledge of probability, distributions, and the relationships between samples and populations, as covered in POLI502 or a similar course. This prerequisite ensures that students grasp essential statistical concepts that are crucial for advanced academic pursuits and have a fundamental understanding of using R for statistical analysis.

- A high level of proficiency in R programming is essential. Students must have prior experience in data manipulation, analysis, and visualization using R to successfully engage with the coursework in POLI706.

## Required Materials

The course requires regular access to a computer and focuses on programming in R.<sup>1</sup> It primarily follows the material in three texts (strongly recommended):

- Fox Jr., John. 2016. *Applied Regression Analysis and Generalized Linear Models*, Third Edition. Thousand Oaks, CA: SAGE Publications (Hereafter **FOX** ).
- Fox Jr., John and Sanford Weisberg. 2019. *An R Companion to Applied Regression*, Third Edition. Thousand Oaks, CA: SAGE Publications (Hereafter **R Companion** ).
- Ismay, Chester and Albert Y. Kim. 2024. *Statistical Inference via Data Science: A ModernDive into R and the Tidyverse*, First Edition. Chapman and Hall. You can access it at <https://moderndive.com/> (Hereafter **Moderndive** ).

The instructor will post additional reading materials on Blackboard.

## Course Requirements

### Course Formats

This is a fully online course. Online classes are not easier than face-to-face lecture classes. To succeed in an online class, you must be extremely motivated and well-organized. You must purchase the required textbook listed above by the first day of the course. Other course materials are available via Blackboard ("Bb"). Regular internet access is essential for successful completion of the course.

1. *Problem sets/do-file* (12 × 4% each = 48%, due by 11:59 PM on Friday of the assigned week)
  - Following each class, students must complete the corresponding problem set and submit it through Blackboard before 11:59 PM on Friday the same week. Submissions must include both 1) descriptions of the commands and interpretations of the output and 2) the code necessary to complete each exercise in R. The assignment will be graded based on the correctness of the code as well as on the thoroughness of description and interpretation.
  - The document must be created in **L<sup>A</sup>T<sub>E</sub>X**, though there are no restrictions on the layout of the document. The notes must incorporate descriptions of the commands and interpretations of the output, accompanying tables and figures, and the code necessary to complete each exercise in R, for that week's problem set (which counts for the above assignment for that week). Students may incorporate content from outside sources. The assignment will be graded based on the thoroughness of the submission.
2. *Quizzes* (12 × 1% each = 12%, due by 11:59 PM on Friday of the assigned week)
  - Following each class, students must complete the corresponding quizzes on the Blackboard before 11:59 PM on Friday the same week. The quizzes will feature theory-based questions to check whether students have thoroughly read the reading materials.
3. *Midterm/Final Exams* (2 × 20% each = 40%)

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<sup>1</sup>R is a programming language/environment for statistical computing and graphics that is available here: <https://www.r-project.org/>. Students may also wish to download and use the RStudio software application, available here: <https://rstudio.com/products/rstudio/download/>

- Students will assemble and analyze data in accordance with instructions, producing a detailed discussion (including visualizations) of results. All graphs need to be perfectly labeled, and all discussions need to be at journal-quality level. The document must be created in L<sup>A</sup>T<sub>E</sub>X, though there are no restrictions on the layout of the document. Screenshots are unacceptable.

This is an entirely Web-based course. We have no face-to-face class meetings, and you will complete your work asynchronously – which simply means that you will be working on it at different times than your colleagues. You can log into the class to do your work at whatever time is convenient for you as long as you are meeting class deadlines.

It is important to understand that this is not a self-paced class or an independent study. You will have assigned deadlines, and work must be submitted on time. You may not save up your assignments to complete in the last weeks or days of the semester. One critical part of this class is regular interaction with other students and with me, your instructor. Each assignment sequence must be completed on schedule – you can't work ahead or get behind and be successful.

## Rubric

The following grading scale maps the final grade-points to letter grades. A: 90-100; B+: 87-89; B: 80-86; C+: 77-79; C: 70-76; D+: 67-69; D: 60-66; F: 0-59. Standard rounding rules apply. Late work will lose ten points for every six hours that it is turned in late. Further, tests may be curved, but this is at the discretion of the instructor.

## Other Grading Matters

Most likely, there will be very few opportunities for extra credit. An extra point may be awarded for each of the two student evaluations if more than half of the class completes them: one evaluation is conducted at the midpoint, and the other at the end of the semester. Also, if you consent to let researchers use your data anonymously and complete baseline surveys on Blackboard, you may receive one extra point. In addition, you will get one extra credit point for participating in the survey experiment conducted by the Laboratory for Sociological Research at the University of South Carolina. You may receive one extra point for participating in their experiments at the end of the semester. Finally, you have an additional discussion post. There is a new post under “Discussions” that you can complete by 11:59 p.m. on April 19 2024. If you complete it, I will give you an extra credit. You will receive two extra credits for participating in ‘discussion’ through posts (replying to others and adding comments). If you don’t, you won’t receive any extra credit. Thus, the maximum extra credits available for POLI105 in Spring 2024 is six. However, there will be no opportunities for extra credit based on individual student requests. All extra credit opportunities will be available to every student equally, so please do not ask for personal exceptions.

## Course Communication and Feedback

I will communicate with you regarding grades and assignments. If you need to get in touch with me, the best method is via email. Generally, I will reply to emails within 24 hours and will provide feedback on assignments within 72 hours. You may also post questions pertaining to the course on the Blackboard Discussion Board. These questions will be answered within 24 hours.

If you are having trouble with this course or its material, you should contact me via email to discuss the issues.

Announcements will be posted to this course whenever necessary. If there is any other information that I think is important, then I will send it to your email address listed in Blackboard. It is your responsibility to ensure that your email account works properly in order to receive email.

Below is how you check your email address in Blackboard:

- Access [blackboard.sc.edu](http://blackboard.sc.edu)

- Click your name on the main Blackboard navigation panel on the left
- Review your email address. By default, Blackboard uses your university-issued email address

Your email address in Blackboard coincides with your preferred university email. If you are unsure of your preferred email, [check your account](#) (myaccount.sc.edu). For more information on setting your preferred university email, please see the [How To Change Your Primary University Email Address](#) Knowledge Base article ([https://scprod.service-now.com/sp?id=kb\\_article\\_view&sysparm\\_article=KB0011464](https://scprod.service-now.com/sp?id=kb_article_view&sysparm_article=KB0011464)).

## Technology Requirements

Online lectures will be provided through Panopto. Therefore, you must have access to the internet to view/hear lectures.

The lecture slides and links to articles, assignments, quizzes, and rubrics are located on the Blackboard site for the course. To participate in learning activities and complete assignments, you will need daily access, preferably at home, to:

- The internet and a computer which can be used at any time, controlled and configured as required for assignments, access to resources, and for communication. The computer should have a current operating system with updates installed, plus speakers or headphones to hear lecture presentations (transcripts provided);
- USC email account;
- A current web browser that is compatible with Blackboard (Google Chrome is the recommended browser for Blackboard)
  - macOS: Apple Safari, Google Chrome, Mozilla Firefox.
  - Windows: Google Chrome, Microsoft Edge, Mozilla Firefox;
  - Blackboard Learning Management System

All computers that connect to a university network must have current, up-to-date **antivirus software**. Antivirus software is included with Microsoft Windows; however, it is not included on Macs. If your computer does not have antivirus software, the [Carolina Tech Zone](#) can assist you.

If you have further questions or need help with the software, please contact the Division of Information Technology's [Service Desk](#).

## Additional Technical Skills Needed

*R, RStudio, and Quarto*

- Install latest version of R (version 4.0 or later).
- Install latest version of RStudio ([v2024.04.2+764 or later](#))
- Install Quarto ([v1.5.34 or greater](#))
  - See this [guide](#) for details on using the terminal
  - Install/Update TinyTeX for PDFs with `quarto install tool tnytex`
  - Install/Update Chromium with `quarto install tool chromium`

## Technical Support

If you have questions or problems related to your computer, software, or need technical support (including Blackboard support), please contact the Division of Information Technology (DoIT) Service Desk at (803) 777-1800, submit an online request through the [Self-Service Portal](#) or visit the [Carolina Tech Zone](#). The

Service Desk is open Monday – Friday from 8:00 AM – 6:00 PM (Eastern Time). You may also visit DoIT's website for [available technology resources](#).

If you have computer issues/problems, then there is a computer lab available at the Thomas Cooper Library and in certain campus classroom buildings. If you are not located in the Columbia, SC area, then most regional campuses and public libraries have computers for public use.

## **Accommodations**

If you are a person with a disability and anticipate needing any type of accommodation in order to participate in this class, please advise me and make appropriate arrangements with the Student Disability Resource Center. All disability accommodations must be approved through the Office of Student Disability Services. For more information, see [Student Disability Resource Center](#). Special accommodations are also available for veterans on duty and for parents.

### *Late Work/Make-up Policy*

All weekly assignments and exams are due by the deadline, as posted on the course schedule. Please plan accordingly and complete these assignments in advance of their deadlines to ensure any unanticipated circumstances do not result in a missed assignment.

## **Academic Dishonesty Policy**

I will enforce rigorous standards of academic integrity in all aspects of this course. For the detailed policy of the University of South Carolina regarding the definitions of acts considered to fall under academic dishonesty and possible ensuing sanctions, see the University Honor Code: [Academic Responsibility – The Honor Code](#). Should you have any questions about possibly improper research citations or references, or any activity that may be interpreted as academic dishonesty, please see me before the assignment is due to discuss the matter.

## **Personal Integrity**

I am committed to creating and fostering a positive learning and working environment based on open communication, mutual respect, and inclusion. I will not tolerate discrimination and harassment on the basis of identity or status, including race, color, national origin, religion, sex, gender, age, disability, sexual orientation, genetics, or veteran status. For more information on the University Student Non-Discrimination and Non-Harassment Policy, see [Student Non-Discrimination and Non-Harassment Policy](#). If you want to speak to someone about an incident involving harassment, sexual assault, or interpersonal violence, you can call 803-777-8248 to talk to a trained interpersonal violence advocate.

## **Additional Information**

Students are responsible for knowing both university and course schedules.

The academic calendar is available at: [University Registrar](#).

For undergraduate academic regulations, see: [Undergraduate Academic Regulations](#).

## Module Schedule

All course deadlines are listed in Eastern Time Zone. Blackboard will record all deadlines in this time zone. If you are in a different time zone, then plan accordingly. Each week will begin on a [insert day of week] and will end on [insert day of week].

In order to complete all of the module assignments, you will spend about 9 hours per week on the course material for a total of approximately 145 hours of course-related activities using Blackboard, discussion boards and blogs, and reading and reflecting on the texts. A list of weekly responsibilities/deadlines follows:

- Monday/Tuesday: Read assigned text(s) for week.
- Wednesday/Thursday: Watch lecture online.
- Friday midnight: Weekly assignment due dates

Students must complete all assigned readings and provide a brief response to the weekly discussion question. : book, : journal article or manuscript, : hyperlink, : video, and : weekly assignments.

### Module 1. Introduction

*Pre-test: What do you know and do not know?*

*Overview of the course, requirements, and outline*

*Introduction to statistical analysis in political science*

- "Chapter 1. Statistical Models and Social Science." in .

### Module 2. Review of Basics

- "Chapter 2. What Is Regression Analysis?" in .
- "Chapter 3. Examining Data." in .
- "Chapter 4. Transforming Data." in .
- "Chapter 7. Sampling" in : <https://moderndive.com/7-sampling.html>

### Module 3. Causal Inference Fundamentals

- [Brady Neal - Causal Inference](#)
  1. 1.3 - Correlation Does Not Imply Causation and Why (7:16)
  2. 1.4 - What Does Imply Causation? Randomized Control Trials (8:30)
  3. 2.2 - The Fundamental Problem of Causal Inference (4:10)
  4. 2.3 - Association is Not Causation and Why (7:21)
- King, Gary, Robert O. Keohane, and Sidney Verba. 1995. "Chapter 1. The Science in Social Science." In *Designing Social Inquiry: Scientific Inference in Qualitative Research*.
- King, Gary, Robert O. Keohane, and Sidney Verba. 1995. "Chapter 3. Causality and Causal Inference." In *Designing Social Inquiry: Scientific Inference in Qualitative Research*.
- Assignment 1 (due by 11:59 PM on Friday)

## Module 4. Randomization

► [Mastering Econometrics with Joshua Angrist](#)

1. Econometrics: The Path from Cause to Effect (4:21)
2. Ceteris Paribus: Public vs. Private University (6:17)
3. Selection Bias: Will You Make More Going to a Private University? (9:33)
4. Randomized Trials: The Ideal Weapon (10:01)
5. How to Read Economics Research Papers: Randomized Controlled Trials (RCTs) (12:40)

💡 Assignment 2 (due by 11:59 PM on Friday)

## Module 5. Randomized Experiments and Observational Studies

► [Research Channel | Observational and Experimental Studies \(4:37\)](#)

► Simplified version of the above: [Whats Up Dude | What Are Observational And Experimental Studies In Statistics - Types Of Studies Explained \(1:24\)](#)

► Rosenbaum, Paul R. 2017. "Chapter 3. Causal Inference in Randomized Experiments." *Observation and Experiment: An Introduction to Causal Inference*. Harvard University Press, Cambridge, MA, pp. 30-52.

► Rosenbaum, Paul R. 2017. "Chapter 5. Between Observational Studies and Experiments." *Observation and Experiment: An Introduction to Causal Inference*. Harvard University Press, Cambridge, MA, pp. 65-99.

💡 Assignment 3 (due by 11:59 PM on Friday)

## Module 6. Ordinary Least Squares I: Theory

► "Chapter 5. Linear Least-Squares Regression." in [FOX](#).

► "Chapter 6. Statistical Inference for Regression." in [FOX](#).

💡 Assignment 4 (due by 11:59 PM on Friday)

## Module 7. Ordinary Least Squares II: Application

► "Chapter 4. Fitting Linear Models." in [R Companion](#).

► "Chapter 5. Basic Regression" in [Moderndive](#) : <https://moderndive.com/5-regression.html>

► "Chapter 6. Multiple Regression" in [Moderndive](#) : <https://moderndive.com/6-multiple-regression.html>

► "Chapter 5. Coefficients, Standard Errors, Confidence Intervals, and Hypothesis Tests." in [R Companion](#).

💡 Assignment 5 (due by 11:59 PM on Friday)

## Module 8. Ordinary Least Squares III: Matrix Algebra

► "Chapter 9. Statistical Theory for Linear Regression." in [FOX](#).

💡 Assignment 6 (due by 11:59 PM on Friday)

## Module 9. Generalized Linear Modeling and Maximum Likelihood I : Introduction

- ▶ [Probability is not Likelihood. Find out why!!! from StatQueest with Josh Starmer \(5:00\)](#)
- ▶ Etz, Alexander. 2018. "Introduction to the Concept of Likelihood and Its Applications." *Advances in Methods and Practices in Psychological Science*, 1(1): 60-69.
- ▶ ["Chapter 14. Logit and Probit Models for Categorical Response Variables." in \*FOX\*.](#)

## Module 10. Generalized Linear Modeling and Maximum Likelihood II

- ▶ ["Chapter 15. Generalized Linear Models." in \*FOX\*.](#)
- ▶ ["Chapter 6. Fitting Generalized Linear Models." in \*R Companion\*.](#)
- 💡 Assignment 7 (due by 11:59 PM on Friday)

## Module 11. Type of Variables and Relationships

- ▶ ["Chapter 7. Dummy-Variable Regression." in \*FOX\*.](#)
- ▶ ["Chapter 8. Analysis of Variance." in \*FOX\*.](#)
- 💡 Assignment 8 (due by 11:59 PM on Friday)

## Module 12. Interactions and Marginal Effects

*Interactions between qualitative or/and quantitative variables*

- ▶ Brambor, Thomas, William Clark, and Matt Golder, 2006. "Understanding Interaction Models: Improving Empirical Analyses." *Political Analysis*, 14(1): .63-82.

*How can we show the substantive implication of interactions?*

- ▶ King, Gary, Michael Tomz, and Jason Wittenberg. 2000. "Making the Most of Statistical Analyses." *American Journal of Political Science*, 44(2): 347-361. *Re-read*.
- ⌚ Arel-Bundock Vincent, Noah Greifer and Andrew Heiss. "How to Interpret Statistical Models Using marginaleffects in R and Python." *Journal of Statistical Software*. Forthcomming from [Marginal Effect Zoo](#).

*Assumptions on Interactions*

- ▶ Hainmueller, Jens, Jonathan Mummolo, and Yiqing Xu. 2019. "How Much Should We Trust Estimates from Multiplicative Interaction Models? Simple Tools to Improve Empirical Practice." *Political Analysis*, 27(2): 16392.
- ▶ Beiser-McGrath, Janina, and Liam F. Beiser-McGrath. 2023. "The Consequences of Model Misspecification for the Estimation of Nonlinear Interaction Effects." *Political Analysis*, 31(2): 27887.
- 💡 Assignment 9 (due by 11:59 PM on Friday)

## Module 13. Inference and Prediction I: Non-Parametric Bootstrapping

- ▶ ["Chapter 6. Statistical Inference for Regression." in \*FOX\*. \*Re-read\*.](#)
- ⌚ ["Chapter 8. Bootstrapping and Confidence Intervals" in \*Moderndive\* : <https://moderndive.com/8-confidence-intervals.html>](#)

- 💡 Assignment 10 (due by 11:59 PM on Friday)

## Module 14. Inference and Prediction II: Parametric Bootstrapping

- ✍ King, Gary, Michael Tomz, and Jason Wittenberg. 2000. "Making the Most of Statistical Analyses." *American Journal of Political Science*, 44(2): 347-361.
- ⌚ "Chapter 9. Hypothesis Testing" in *Moderndive* : <https://moderndive.com/9-hypothesis-testing.html>
- ⌚ "Chapter 10. Inference for Regression" in *Moderndive* : <https://moderndive.com/10-inference-for-regression.html>
- 💡 Assignment 11 (due by 11:59 PM on Friday)

## Module 15. Diagnostics

*Model fit, checking models. All models are wrong, some are useful.*

- 📘 "Chapter 11. Unusual and Influential Data." in *FOX*.
- 📘 "Chapter 12. Diagnosing Non-Normality, Nonconstant Error Variance, and Nonlinearity." in *FOX*.
- 📘 "Chapter 13. Collinearity and Its Purported Remedies." in *FOX*.
- 📘 "Chapter 22. Section 22.1. Model Selection." in *FOX*.
- ✍ Clarke, Kevin A. 2007. "A Simple Distribution-Free Test for Nonnested Model Selection." *Political Analysis*, 15(3): 34763.

- 💡 Assignment 12 (due by 11:59 PM on Friday)

## Module 16. And Beyond

*Extensions; Summary and conclusion*

*Introduction to Non-linearity*

- 💡 Final Exam (due by 11:59 PM on Sunday)