

POLI 8130-001: Quantitative Methods
Fall 2023 | T 3:30 PM - 6:00 PM | Haley 3218

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Office Hours: TR 11:00 AM - 12:15 PM; Appointment (email me; Zoom ID: 7720942787)

Overview, Objectives, and Outcomes

All of our knowledge of the social world is quite literally *produced*. One way of producing this knowledge is systematically collecting scored observations about the world around us and using those scores to derive conclusions about patterns. To do this requires knowledge of both specific methods, as well as a background in a probabilistic way of thinking about the world. We'll develop both in this class.

Even if you plan on using a different type of analysis primarily in your own research, *you cannot choose to ignore quantitative methods*. You must have a basic fluency in a variety of methods so that you can engage with the literature that your fellow scientists are producing.

Student Learning Outcomes:

1. Students will be able to solve basic conditional probability problems.
2. Students will be able to describe and implement basic dataset structure and operations.
3. Students will be able to describe and execute classic frequentist statistical significance tests.
4. Students will be able to execute, interpret, and diagnose OLS models in their preferred statistics software.
5. Students will be able to identify and explain common pitfalls in econometric models.

Official catalog description: Research Design and Analysis. (3). LEC. 3. In-depth analysis of the use of quantitative methods in political science research.

Prerequisites

Graduate classification.

Expectations

Graduate courses, especially graduate courses for research design and methods, are intended to lay the foundation for your future as a researcher. Each one of you have elected to be here and to pursue a graduate degree, so it is to your benefit to attend class, do the outside readings, complete the homework assignments, and, most importantly, *come to class prepared to discuss the material*. Graduate courses are built around an exchange of ideas, so come prepared with your ideas! I refuse to enable anyone to actively seek out a “C” grade in this class, and if you plagiarize any portion of any assignment (including plagiarizing a fellow student’s answers), it’s an automatic zero.

I also expect that you make a reasonable effort to maintain classroom decorum by refraining from reading newspapers, doing crossword puzzles, sleeping, texting, or playing on Facebook (or whatever social network/game/trend that I’m oblivious to). Please silence all cell phones. These ideas are formally outlined in the Auburn University Classroom Behavior policy: see tinyurl.com/au-st-pol for more details. Consistent with Auburn University policy, I encourage class attendance from all students.

Text

There is one required book for this class.

Gujarati, Damodar N. and Dawn C. Porter. 2009. *Basic Econometrics: Fifth Edition*. Boston: McGraw Hill.

There are two recommended books.

Kellstedt, Paul M. and Guy D. Whitten. 2018. *The Fundamentals of Political Science Research: Third Edition*. Cambridge: Cambridge University Press.

Kennedy, Peter. 2003. *A Guide to Econometrics: Fifth Edition*. Cambridge, MA: MIT Press.

These books are available at the Auburn University Bookstore, as well as the internet. There are multiple versions of all three; get a relatively recent one and match the chapters. I just listed the versions that I’ll be working from (i.e. the ones I have in my office). None of the versions listed are the most recent, so they should be somewhat inexpensive. I highly recommend owning them. Econometrics books are reference texts that you’ll revisit for the life of your career.

All of other texts are articles available from the Auburn University Library. I will not post the articles to Canvas unless the library doesn’t provide access; learning how to acquire the full text of an article is an essential skill in graduate school. I included the DOI of every article: it will point you to the article’s website if you “resolve” it at www.doi.org. All of the articles are ungated if you access them on Auburn’s Wifi network. If you’re at home, you can still get the full text by logging into the library and searching for the journal. If you cannot find one of the articles, let me know, and I’ll make it available on Canvas or email.

You must obtain a copy of R (available from <https://cran.revolutionanalytics.com/>). You will probably hate, then maybe learn to love, using R. We will use it because it is (a) free and (b) flexible enough to test most theories of political science. You're free to use another analysis software if you like. I'll devote minimal in-class time to answering questions in other software programs. Full disclosure: the only other software I even have on my computer is **Stata**, so it will be difficult for me to answer in-class questions on **SAS**, **SPSS**, or any other program. We will devote an extensive amount of class time to learning to use R effectively.

Assignments

The course is divided into the following components:

Class participation	10%
Homework assignments	30%
Midterm	25%
Final	35%
<hr/> Total	<hr/> 100%

In order, those components are ...

Class participation: Do. The. Reading. It is literally that simple. Do the reading and come to class prepared to discuss that reading. I know it can feel weird to read a chapter of a methods textbook, but try to read for ideas instead of for statistical content. When I ask questions of the class, please answer the questions and contribute to the lecture. When you have questions, please ask them. Also, be prepared to be randomly called on to answer questions during lectures.

Homework assignments: There will be five homework assignments throughout the semester. You'll be asked to use R plus a variety of political science data to practice using statistics to come to empirical conclusions. Each assignment will be worth 100 points. Each assignment is due electronically. Specific due dates will be announced in class. Except in extraordinary cases, you will have two weeks to complete each homework assignment. Usually, they will be assigned on a class day and due the day before class, two weeks later.

Midterm examination: this will be a take home exam during Week 8. It will be an open-book exam. We will discuss the midterm exam as the middle of the semester approaches.

Final examination: this will be a take home exam. It will be an open-book exam. The only limitation is that you are not allowed to consult with your classmates on the exam. We will discuss final exam as the end of the semester approaches.

Makeups and Grades

Makeup assignments/examinations will only be offered to those with a University excused absence, which can be found at tinyurl.com/au-st-pol. It is your responsibility to ensure that your absence is covered by the University, and it is your responsibility to comply with all policies.

These policies require that you notify me of your absence prior to the date of absence if such notification is feasible, but within one week from the missed class. Your makeup examination must be scheduled within two weeks of this notification (though I recommend much, much earlier). If I need additional information on your absence (doctor's notes, for instance), you must provide this additional documentation within one week of the last date of the absence. Note that this policy also allows for makeup examinations for reasons deemed appropriate by the instructor. If you do not have a University excused absence, and you are going to miss an examination, it is much easier for me to work with you if you notify me promptly, especially if you can provide some sort of documentation.

89.5-100:	A
79.5-89.49:	B
69.5-79.49:	C
59.5-69.49:	D
59.49↓:	F

I use the standard Auburn University grading scale. To maintain fairness, I do not change grades under any circumstances except when I make a mathematical error in computing your grade. There is no extra credit. All grades will be posted to **Canvas**.

Contacting Me

I'm in Haley every day, but especially during my listed office hours. I check my email very, very regularly. If you want to get in touch with me through email, I ask that follow three guidelines when attempting to contact me. First: include the course number and section number [8130-001] in the subject of your email. Your email will almost certainly get lost in the abyss if it missing this information. Second: wait at least 48 hours, not including weekends, to send a second email. I promise I will get to it, but it may not be immediate. Third: email me only from your Auburn University official email address. In the event that I need to contact you, it will almost certainly be at your @auburn.edu email address. You should check this email often!

Student Academic Honesty

Auburn University is a institution committed to integrity and honor. It is your job as a University citizen to uphold those values. I will not tolerate any cheating or plagiarism, broadly defined as using unauthorized aids during examinations or attempting to represent someone else's work as your own. You are not as sly as you think you are. Be aware that academic dishonesty can lead directly to failing the course and being referred to the Academic Honesty Committee. Penalties include expulsion from Auburn, as per Chapter 1202 of Title XII. For additional information visit tinyurl.com/au-st-pol.

Emergency Contingency

If normal class is disrupted due to illness, emergency, or crisis situation, the syllabus and other course plans and assignments may be modified to allow completion of the course. If this occurs, an addendum to your syllabus and/or course assignments will replace the original materials.

Students with Disabilities

The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please electronically submit your approved accommodations through AU Access and make an individual appointment with me during the first week of classes (or as soon as possible if accommodations are needed immediately). If you have not established accommodations through the Office of Accessibility, but need accommodations, make an appointment with the Office of Accessibility, 1228 Haley Center, 844-2096 (V/TT).

Any requests or arrangements made with the instructor in person must be followed up with an official email request for documentation. If you believe you may need an accommodation, it is your responsibility to secure it before the first exam.

Copyrighted Materials

The lectures, presentations (including slides), readings, and exams for this course are copyrighted, so you do not have the right to copy and distribute them. This includes recording class lectures.

Important Dates

- August 22 (Tuesday): Last day to add course.
- August 29 (Tuesday): No in-person class.
- September 6 (Wednesday): 15th Class Day (last day to drop with no grade assignment).
- October 4 (Wednesday): Mid-semester grades posted.
- October 12 (Thursday): 41st Class Day (deadline to request moving final exam).
- October 13 (Friday): Fall Break (no class).
- November 17 (Friday): Last day to withdraw with no grade penalty (W).
- December 5 (Tuesday): Final Exam.

Course Outline

Week 1 (August 22): Hello! First Meeting! Descriptive Statistics and Probability

- Jordan, Soren. 2022. "Data Basics for Graduate Students." In *Teaching Graduate Political Methodology*, eds. Mitchell Brown, Shane Nordyke, and Cameron G. Thies. Northampton, MA: Edward Elgar Publishing, pp. 125-133. DOI: 10.5281/zenodo.7151133
- Nagler, Jonathan. 1995. "Coding Style and Good Computing Practices." *PS: Political Science and Politics* 28 (3): 488-492. DOI: 10.2307/420315
- Conditional probability. mathsisfun.com/data/probability-events-conditional.html
- Univariate statistics. *Kellstedt and Whitten*, Chapter 5.

Week 2 (August 29): No Class: Soren in Orlando.

- **Use this week to download R and practice!**

Week 3 (September 5): Frequentist Statistics and the Central Limit Theorem

- The Central Limit Theorem and inference. *Kellstedt and Whitten*, Chapters 6 and 7.
 - “Getting to Know Your Data”
 - “Probability and Statistical Inference”

Week 4 (September 12): Bivariate Statistics and Introduction to Linear Regression

- Bivariate hypothesis testing. *Kellstedt and Whitten*, Chapters 8-9.
 - “Bivariate Hypothesis Testing”
 - “Two-Variable Regression Models”
- Regression basics. *Gujarati and Porter*, Chapters 1-3.
 - “The Nature of Regression Analysis”
 - “Two-Variable Regression Analysis: Some Basic Ideas”
 - “Two-Variable Regression Model: The Problem of Estimation”

Week 5 (September 19): Linear Regression, Inference about the Estimator, and Model Fit

- *Gujarati and Porter*, Chapters 4-5.
 - “Classical Normal Linear Regression Model (CNLRM)”
 - “Two-Variable Regression: Interval Estimation and Hypothesis Testing”
- Gross, Justin H. 2015. “Testing What Matters (If You Must Test at All): A Context-Driven Approach to Substantive and Statistical Significance.” *American Journal of Political Science* 59(3): 775-788. DOI: 10.1111/ajps.12149

Week 6 (September 26): Multivariate Regression and Omitted Variables Bias

- *Gujarati and Porter*, Chapters 6-8.
 - “Extensions of the Two-Variable Linear Regression Model”
 - “Multiple Regression Analysis: The Problem of Estimation”
 - “Multiple Regression Analysis: The Problem of Inference”
- Multivariate regression. *Kellstedt and Whitten*, Chapters 9-10.
 - “Multiple Regression: the Basics”
 - “Multiple Regression Model Specification”
- Gelman, Andrew and Hal Stern. 2006. “The Difference Between ‘Significant’ and ‘Not Significant’ is Not Itself Statistically Significant.” *The American Statistician* 60 (4): 328-331. DOI: 10.1198/000313006X152649

- Achen, Christopher H. 2002. “Toward a New Political Methodology: Microfoundations and ART.” *Annual Review of Political Science* 5: 423-450. DOI: 10.1146/annurev.polisci.5.112801.080943

Week 7 (October 3): General Extension: Basic Visualization, Resampling, and “Quantities of Interest”

- King, Gary, Michael Tomz, and Jason Wittenberg. 2000. “Making the Most of Statistical Analyses: Improving Interpretation and Presentation.” *American Journal of Political Science* 44(2): 345-355. DOI: 10.2307/2669316

Week 8 (October 10): Midterm Exam (no in-person class)

Week 9 (October 17): OLS Extension I: Collinearity, Leverage, and Influence

- *Gujarati and Porter*, Chapters 10 and 13.
 - “Multicollinearity: What Happens If the Regressors Are Correlated?”
 - “Econometric Modeling: Model Specification and Diagnostic Testing”

Week 10 (October 24): OLS Extension II: Homoscedasticity and Non-linearity

- *Gujarati and Porter*, Chapter 11.
 - Heteroscedasticity: What Happens If the Error Variance is Nonconstant?”
- White, Halbert. 1980. “A Heteroskedasticity-Consistent Covariance Matrix Estimator and a Direct Test for Heteroskedasticity.” *Econometrica* 48(4): 817-838. DOI: 10.2307/1912934

Week 11 (October 31): OLS Extension III: Categorical Predictors

- *Gujarati and Porter*, Chapter 9.
 - “Dummy Variable Regression Models”

Week 12 (November 7): OLS Extension IV: Interactions

- Brambor, Thomas, William Clark, and Matt Golder. 2006. “Understanding Interaction Models: Improving Empirical Analysis.” *Political Analysis* 14(1): 63-83. DOI: 10.1093/pan/mpi014
- Berry, William D., Matt Golder, and Daniel Milton. 2012. “Improving Tests of Theories Positing Interaction.” *The Journal of Politics* 74(3): 653-671. DOI: 10.1017/S0022381612000199

Week 13 (November 14): General Extension: Fixed and Random Effects

- Bell, Andrew, Malcolm Fairbrother, and Kelvyn Jones. 2019. “Fixed and random effects models: making an informed choice.” *Quality and Quantity* 53: 1051-1074. DOI: 10.1007/s11135-018-0802-x
- Bell, Andrew, and Kelvyn Jones. 2015. “Explaining Fixed Effects: Random Effects Modeling of Time-Series Cross-Sectional and Panel Data.” *Political Science Research and Methods* 3(1): 133-153. DOI: 10.1017/psrm.2014.7

- *Gujarati and Porter*, Chapter 16.

- “Panel Data Regression Models”

Week 14 (November 21): No Class (Thanksgiving Break)

Week 15 (November 28): General Extension: Limited Dependent Variables and MLE

- *Gujarati and Porter*, Chapter 15.

- “Qualitative Response Regression Models”

- Jordan, Soren. 2022. “Extending Regression to Binary (and More!) Outcomes.” In Teaching Graduate Political Methodology, eds. Mitchell Brown, Shane Nordyke, and Cameron G. Thies. Northampton, MA: Edward Elgar Publishing, pp. 169-181. DOI: 10.5281/zenodo.7151147
- *Kellstedt and Whitten*, Chapter 12.

- “Limited Dependent Variables and Model Specification”

- Rainey, Carlisle. 2016. “Compression and Conditional Effects: A Product Term Is Essential When Using Logistic Regression to Test for Interaction.” *Political Science Research and Methods* 4(3 September): 621-639. DOI: 10.1017/psrm.2015.59