

POLS 624 Quantitative Methods and Statistics

Spring 2023

Course and Contact Information

Instructor: Dr. Fatih Erol

Class Hours: Tuesday 04:00 PM to 07:00 PM

Class Location: IIBF B03

Office Hours: Wednesday 01:00 PM to 4:00 PM, or by appointment (on Zoom)

Office Location: IIBF 404

Instructor Email: fatih.erol@yeditepe.edu.tr

Course Description

This course focuses on the statistical analysis of individual level quantitative data (whose insights can also be extended to the other aggregate levels such as districts, provinces, and countries).

Students will be introduced to the logic of scientific inquiry and to basic statistical methods used in the study of politics. We will examine the content of citizens' opinions toward a wide range of political topics, consider the sources of people's opinions, and ponder whether the opinions of the public matter (for policy, for governance, and for democracy). In analyzing individual level data, we will strongly rely on statistics and research methods.

Statistics are an efficient and accepted way of communicating ideas; they are a means of bridging the gap between implication and inference. Contemporary political science research—especially public opinion and policy research—utilizes statistical techniques and, consequently, a basic understanding of these methods is crucial. This course will tackle the subjects related to public opinion and study them with statistical analysis and inference.

The lectures, homework, and final paper are designed to instruct you in the understanding and proper use of social science methods and promote your critical analysis of statistical findings. Students will learn to describe data, understand the impact of randomness in statistical research, conduct statistical tests, and most importantly learn to evaluate the implications of quantitative

results. To that end, you will learn a new programming language named *R* and become familiar with datasets widely used in major fields of the discipline. Ultimately, at the end of this class every student will be able to initiate a quantitative research project in the field of social sciences and become conversant in quantitative research methods.

The course aims to achieve two important goals:

1. This is the class for you to be able to publish papers with quantitative analyses. This course aims to equip each student with the proper quantitative training that will help her/him to conduct relevant research, write up a paper, and get it ready for journal submission.
2. This is the class for you to keep in touch with the scholarly literature. This course aims to teach each student how to keep up with the literature of interest. It is essential that you establish the basis in your domain of interest and be able to use it for the final paper task for this class.

Prerequisites: **1)** Satisfaction of entry-level mathematics proficiency requirement; **2)** Every student in this class should have successfully taken either FEAS 601 (Research Methods and Ethics) or a related course on research methods in social sciences. Without prior knowledge on these prerequisites, success in this class would be slim.

Text and Course Material

We will use the following textbooks in this course:

1. Pollock, P. (2015). *The essentials of political analysis*. CQ Press.
2. Pollock, P. (2017). *An R companion to political analysis*. CQ Press.
3. Levin, J. Fox, J. A., & Forde, D. R. (2017). *Elementary statistics in social research*. Pearson.
4. Imai, K. (2018). *Quantitative social science: An introduction*. Princeton University Press.
5. Kennedy, P. (2003). *A Guide to econometrics*. MIT Press.
6. Jaccard, J., & Turrisi, R. (2003). *Interaction effects in multiple regression*. MIT Press.
7. Johnson, J. B. et al. (2015). *Political Science Research Methods*. CQ Press.
8. Raykov, T., & Marcoulides, G. (2006). *A first course in structural equation modeling*. Lawrence Erlbaum Associates.

If other readings are assigned from online journals and/or other textbooks, they will be made available in the course pack. The important thing is that you have to do the readings prior to class meeting which will significantly make your learning experience easier.

Recommended readings:

- Gujarati, D. (2003). *Basic econometrics*. McGraw Hill.
- Hanushek, E. A. & Jackson, J. E. (1977). *Statistical methods for social scientists*. Academic Press
- Kaplan, D. (2009). *Structural equation modeling: Foundations and extensions*. Sage.
- Wackerly, D., Mendenhall, W., & Scheaffer, R. L. (2008). *Mathematical statistics with applications*. Thompson.
- Wonnacott, T. H. & Wonnacott, R. J. (1972). *Introductory statistics*. John Wiley & Sons.
- Schumacker, R. E. (2015). *Learning statistics using R*. Sage.

YULearn: This class uses the YULearn System. You will be asked to submit your assignments via this platform throughout the term.

Evaluation Criteria

Short Assignments 36%

Research Note 50%

Participation 14%

Short Assignments: There will be 12 short assignments (each worth 3% of the final grade) to be done in *R* for each week. These assignments are designed to take two hours of your time (max.) per week. Consider these assignments and my cheatsheets to be resources for future inquiries (teaching and researching).

Research Note: At the end of the class, each student will submit a short research article in place of a final exam (worth 50% of the final grade). The paper needs to propose a research question, provide a concise and informative literature review on the research question, posit

innovative one or two hypothesis/hypotheses, discuss the operationalization process of the concepts in the proposed hypothesis/hypotheses, offer an overview of the data, provide in-depth analysis of the available (or collected) data, and discuss the findings neatly. It is essential that you allocate enough time to write your final paper. The paper is supposed to be 4.000 words in length (including everything). If there is a need for additional substance, you are more than welcome to include a separate online appendix document. I kindly suggest you write your short research paper in L^AT_EX using [Overleaf](#) (see *American Political Science Review*'s (APSR) submission template, as shared [here](#)). Please refer to these select recent short research notes to mimic in your final assignments: [Abou-Chadi & Stoetzer \(2020\)](#), [Akee et al. \(2020\)](#), [Aytac \(2021\)](#), [Landwehr & Ojeda \(2020\)](#), [Masterson & Yassenov \(2021\)](#), and [Mathisen \(2022\)](#).

Participation: Includes in-class exercise participation, answering questions, and engaging in class debates (equaling to 14% of the final grade). This grade does not include the attendance sheet presence in the class but rather your active participation to class discussion. Per requirements of the university attendance will be taken in each class. If you will be absent in any one of the class meetings, please do let me know beforehand by e-mail.

Grading Scale

Grades	AA	BA	BB	CB	CC	DC	DD	FF
	4.00	3.50	3.00	2.50	2.00	1.50	1.00	0.00
Range	100-90	89-85	84-80	79-75	74-70	69-60	59-50	49-0

Course Policies

- **Be prepared to study hard.** This is **not an easy class and it requires your hard work at every step**. If you are taking too many PhD courses, then I recommend you reconsidering which courses to take. Make sure that you are ready to engage in hard work individually and in a group.
- **Be open to others' ideas.** Throughout the quarter we will be sharing information, new ideas and opinions; therefore, every student is expected to exercise respect toward his/her classmates and the instructor.
- **Class civility** is expected of each student, which entails arriving to class on time and prepared; **turning off cell phones**; sleeping at home not in class; leaving class when dismissed; listening to your classmates and not interrupting others. If you choose to be disrespectful, you will be asked to leave and your total grade will be affected.
- **Reading assignments:** You are required to complete the assigned readings for any given lecture before coming to class. Your comprehension of the readings will be tested on a regular basis, both through discussion/questioning in class.

- **Lecture attendance:** Remember that there is a strong positive relation between class attendance and course grades. If you attend the class and participate, you are more likely to do better. **Lateness:** I expect you to be on time. On the hopefully very rare occasion that circumstances beyond your control prevented you from being on time, I expect you to enter quietly.
- **Late assignment:** 10% of the grade will be deducted from the full grade for that particular assignment for each day the assignment is overdue.
- **Make-up exams** will only be allowed in extraordinary circumstances. Any student that does not show up for an exam must have a documented, serious medical condition that is presented to both the professor and the chair of the department well in advance of the scheduled exam date. Failure to make satisfactory arrangements in advance of exams will result in a zero. No exceptions.
- **Plagiarism:** Academic misconduct will not be tolerated. Any student who chooses to cheat or plagiarize on his or her exams or projects will receive an FF in the course and be turned over to Student Affairs.
- The professor reserves **the right to change the syllabus** after the semester begins.

Course Structure

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Week 1: Introduction to Scientific Method (February 28, 2023)

Mandatory Readings

- Johnson Reynolds, & Mycoff (2015), Chapter 1 (Introduction)
- Wuttke, A. (2019). Why too many political science findings cannot be trusted and what we can do about it. *Politische Vierteljahresschrift*, 60(1), 1-19.
<https://doi.org/10.1007/s11615-018-0131-7>

A Few Errands

- A Brief Introduction to *R*

1. Basic Operators and Functions
2. Data Import and Export
3. Subsetting, Variable Renaming and Ordering, Data Creation, and Mean Calculation and Interpretation

— **FIRST SHORT ASSIGNMENT IS DUE BY MARCH 5, 2023, 08:00 PM** —

Week 2: Nuts-and-Bolts of Research Design (Theory, Hypotheses, and Model) (March 7, 2023)

Mandatory Readings

- Johnson Reynolds, & Mycoff (2015), Chapter 6 (Research Design: Making Causal Inferences)

A Few Errands

- Getting Introduced to the Fundamental Problem of Causal Inference
- Briefly Going Over the Concepts of Mean, Standard Deviation, Standard Error, and Sample Size (to be Discussed Fully in **Week 4**)
- Variable Generation in *R* and Hands-on Difference-in-Means Estimation in a Randomized Experiment using *R* (see [1] for the Statistics to be Generated)

— **SECOND SHORT ASSIGNMENT IS DUE BY MARCH 12, 2023, 08:00 PM** —

Week 3: Concepts, Variables, Measurement, and Levels of Analysis (March 14, 2023)

Mandatory Readings

- Pollock (2015), Chapter 1
- Levin et al. (2017), Chapter 2

A Few Errands

1. Distributions

- Tables of Frequency and Proportions
 - Visualization (Histograms and Barplots)
2. Some Quick Reliability Analyses in *R*:
- Equivalence Reliability (by using Inter-Rater Reliability)
 - Internal Consistency (by using Chronbach's Alpha and Split-half)
 - Stability Reliability (Test-retest)
3. Some Quick Validity Analyses in *R* (by using Pearson's r).
- * Factor analytical methods will be covered in **Week 13**. Computation of the correlation coefficient will be detailed in **Week 8**.
- Convergent and Discriminant Validity
 - Concurrent and Predictive Validity

— **THIRD SHORT ASSIGNMENT IS DUE BY MARCH 19, 2023, 08:00 PM** —

NOTE TO ALL: You can begin experimenting with the R visualizations by using [the R Graph Gallery](#) as of this coming weekend. Please do so in your spare times.

Week 4: Measurement and Constructing Variables: Central Tendency and Dispersion (March 21, 2023)

Mandatory Readings

- Pollock (2015), Chapter 2
- Levin et al. (2017), Chapters 3 to 4

A Few Errands

- *R*-based Practices
 1. Calculation of the Measures of Central Tendency (Mean, Mode, and Median) and Variability (Range, Variance and Standard Deviation)
 2. Density Plot and Boxplot Visualizations
 3. Descriptive Statistics Table Generation
- Introduction to Statistical Analyses and Visualization of Textual Data using [quanteda](#) ([Quantitative Analysis of Textual Data](#))

— **FOURTH SHORT ASSIGNMENT IS DUE BY MARCH 26, 2023, 08:00 PM** —

Week 5: Forming Hypotheses and Comparisons (March 28, 2023)

Mandatory Readings

- Pollock (2015), Chapters 3 to 4

A Few Errands

Advancements in Variable Generation and Transformation using *R*

1. Numeric to Factor and Factor to Numeric Conversion
2. Wide to Long, Long to Wide Dataset Transitions to Create Relatively Complex Constructs (such as a Least Squares Index of Party System Polarization in a Survey Study)
3. Centering and Standardizing
4. Indexing
5. Grouped Barplot with Error Bars (Standard Deviation, Standard Error, and Confidence Interval) and Grouped Boxplot Visualizations

— **FIFTH SHORT ASSIGNMENT IS DUE BY APRIL 2, 2023, 08:00 PM** —

Week 6: Hypothesis Testing, Statistical Differences, and Statistical Inference (April 4, 2023)

Mandatory Readings

- Pollock (2015), Chapter 6
- Levin et al. (2017), Chapters 5 to 6

A Few Errands

Simulations using *R*

1. Sampling Theory and Central Limit Theorem
2. One-sided and Two-sided Tests
3. Multiple Testing (Comparisons) Correction
4. Effect Size and Power
5. Base Rate Fallacy

— **SIXTH SHORT ASSIGNMENT IS DUE BY APRIL 9, 2023, 08:00 PM** —

Week 7: Tests of Significance and Measures of Association; Chi-Square and Analysis of Variance (ANOVA) (April 11, 2023)

Mandatory Readings

- Pollock (2015), Chapter 7
- Levin et al. (2017), Chapters 7 to 9

A Few Errands

- Simulations and Visualizations of Several Association Tests using *R*

— SEVENTH SHORT ASSIGNMENT IS DUE BY APRIL 16, 2023, 08:00 PM —

Week 8: Correlation and Bivariate Linear Regression (April 18, 2023)

Mandatory Readings

- Pollock (2015), Chapter 8 (pp. 300-324)
- Levin et al. (2017), Chapter 10 and Chapter 11 (pp. 202-211)

A Few Errands

- Testing and Reporting (Tables and Figures) using *R*

— EIGHTH SHORT ASSIGNMENT IS DUE BY APRIL 23, 2023, 08:00 PM —

Week 9: Multivariate Linear Regression (April 25, 2023)

Highly Suggested: Please go over PolMeth's collection of political science articles using linear models in cross-sectional datasets to learn the reporting framing (visit [here](#)). Please skim through each select article's data, empirical analysis strategy, and results subsections.

Mandatory Readings

- Pollock (2015), Chapter 8 (pp. 325-335)
- Levin et al. (2017), Chapter 11 (pp. 211-216)

- Skim Through Kennedy (2008), Chapters 6 to 12 (**for an additional subject if time allows: Violating Regression assumptions**)

A Few Errands

- Testing and Reporting (Tables and Figures [Coefficient Plots but Specification Curve Plots in particular for Your Short Research Notes with Several Robustness Checks]) using *R*

— **NINTH SHORT ASSIGNMENT IS DUE BY APRIL 30, 2023, 08:00 PM** —

Week 10: Limited Dependent Variables Regression I (May 2, 2023)

Highly Suggested: Please go over these select articles regarding how to report the binary logit models in political science journal outlets: [Landwehr & Ojeda \(2020\)](#) and [Mathisen \(2022\)](#).

Mandatory Readings

- Pollock (2015), Chapter 9
- Levin et al. (2017), Chapter 11 (pp. 217-220)

A Few Errands

- Testing and Reporting (Tables and Plots) using *R*

— **TENTH SHORT ASSIGNMENT IS DUE BY MAY 7, 2023, 08:00 PM** —

Week 11: Limited Dependent Variables Regression II (May 9, 2023)

Highly Suggested: Please go over these select articles regarding how to report the ordinal and multinomial logit models in political science journal outlets: [Williams et al. \(2022\) Online Appendix \(Tables A3 to A4\)](#) and [Cheema et al. \(2022\)](#)

Mandatory Readings

- Kennedy (2008), Chapter 16

A Few Errands

- Testing and Reporting (Tables and Plots) using *R*

— **ELEVENTH SHORT ASSIGNMENT IS DUE BY MAY 14, 2023, 08:00 PM** —

Week 12: Estimands (Comparisons, Predictions, and Slopes) (May 16, 2023)

Mandatory Readings

- Jaccard & Turrise (2003), Chapters 1 to 2
- Pollock (2015), Chapter 5

A Few Errands

Post-estimation Tools in *R*

1. Computation, Visualization, and Interpretation of the Predictor Variables' Effects
2. Computation, Visualization, and Interpretation of the Interaction Effects (Two-way and [if time permits] Three-way Interactions)
3. Estimation of the Statistical Power to Replicate the Effects

— **TWELFTH SHORT ASSIGNMENT IS DUE BY MAY 21, 2023, 08:00 PM** —

Week 13: Structural Models (Explanatory and Confirmatory Factor Analyses and Path Models) (May 23, 2023)

Mandatory Readings

- Skim through Raykov & Marcoulides (2006), Chapters 1, 3, 4, and 5

A Few Errands

Several Brief Demonstrations using *R*

1. Explanatory Factor Analysis
 2. Confirmatory Factor Analysis
 3. Mediation Analysis
 4. Cross-Lagged Panel Model
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Week 14: Multi-level Analysis (with Post-stratification [MRP]) (May 30, 2023)

Mandatory Readings

- Skim through Kennedy (2008), Chapter 18
- Steenbergen, M. R., & Jones, B. S. (2002) Modeling multilevel data structures. *American Journal of Political Science*, 1(1), 218-237. <https://doi.org/10.2307/3088424>
- Gelman, A., & Little, T. C. (1997). Poststratification into many categories using hierarchical logistic regression. *Survey Methodology*, 23(2), 127-135.
<http://www.stat.columbia.edu/~gelman/research/published/poststrat3.pdf>

A Few Errands

A Couple of Applications using *R*

1. Census Data Creation for the Ideal Demographic Types
2. Modeling and Reporting (of Fixed, Random, and Predicted Effects)

— **FINAL PAPER DUE BY JUNE 6, 2023, 08:00 PM** —