

Introduction to Quantitative Research Methods

Undergraduate Course

Fall Semester

Instructor Information

Instructor: Pablo Fernandez-Vazquez

Office hours: T 9-10am, Th 1.30-3pm *or by appointment*

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Course Information

Time: T and Th 10am-Noon

Location: Commons 351

Course Description

This course is an introduction to quantitative research methods for undergraduate students. It provides students with the whole set of basic skills needed to conduct independent quantitative research: the capacity to formulate causal hypotheses that address to normatively-relevant questions, to select the best research design to test an empirical claim, and to draw statistical inferences using statistical software of reference like R. Examples and data will be drawn entirely from the social sciences.

Learning Outcomes

By the end of the course, students who have successfully completed this course will be equipped to::

1. *Formulate a research question, elaborate a testable hypothesis, and specify the empirical predictions that should be observed if the hypothesis is true.*
2. *Put forth a research design that is appropriate to determine whether there is causal relationship between two empirical phenomena.*
3. *Obtain, clean, and manage data.*
4. *Test de hypothesis and draw the appropriate statistical inference.*

Course materials

Readings are assigned each week. The course reference will be

- Paul Kellstedt and Guy Whitten. 2013. *The Fundamentals of Political Science Research: 2nd edition*. Cambridge University Press.

Examples and exercises for take-home assignments will rely on data from the [Quality of Government Institute](#). These data can also be used for the research paper.

Course Assessment

Grades for this course will be assigned according to the following criteria:

In-class participation	10%	<i>Ongoing</i>
Assignments	20%	
Midterm exam	20%	<i>October 21st</i>
Research paper	30%	<i>Due December 2nd</i>
Final exam	20%	<i>December 9th</i>

- ***In-class participation:*** Class participation is different from attendance. Students are encouraged to actively engage in class activities, ask questions and contribute to class discussions. In order to do so effectively, students are expected to do the assigned readings in advance of the class session. Students who do not feel comfortable speaking in class must contact me by the end of the second week of class at the latest.
- ***Assignments:*** Two take-home exercises will be assigned during the course.
- ***Research paper:*** Students will be asked to write an essay (10 pages) that formulates a research question, proposes a hypothesis and tests it with data. The paper should have the following structure: a) formulate a research question that can be addressed with empirical data; b) Elaborate an explanatory hypothesis and put forth two additional hypotheses that identify potential confounding factors; c) Describe the ideal research design to identify the causal relationship and, if this design is not feasible, describe the optimal design among the feasible ones; d) Describe the data to be used and define the relevant variables; e) test the main hypothesis using both a difference-in-means test and multiple regression.
- ***Midterm and final exams:*** Both the midterm and the final exams will contain both multiple-choice and short questions.

The opportunity to take a make-up exam will only be offered in extremely rare circumstances. A doctor's note or a letter from the Dean will be required to be

eligible to take the make-up exam. If an *unanticipated* emergency causes you to miss the exam, please contact me as soon as possible.

Course Schedule

The following course schedule presents the topics that will be discussed each week. Readings are assigned for each session. **All readings are required.** Please do the readings in the order specified.

Week 1. Doing Research

- a) *August 26th*: Description of the course structure, learning goals and student assessment.
- b) *August 28th*: Discussion of what constitutes a research question. Descriptive and explanatory questions. Hypotheses. Operationalizing concepts. Required readings
 - Kellsted & Whitten. *The Fundamentals of Political Science Research*. Chapters 1 and 2.

Week 2. The Fundamental Problem of Causality

- a) *September 2nd and 4th*: The fundamental problem of causality. Counterfactuals and the potential outcomes framework. Required readings:
 - Kellsted & Whitten. *The Fundamentals of Political Science Research*. Chapter 3.

Week 3. Correlation vs Causality

- a) *September 9th*: The difference between correlation and causality. Examples of spurious Correlation. Confounding variables. Required readings:
 - Kellsted & Whitten. *The Fundamentals of Political Science Research*. Chapter 3.
- b) *September 11th*: Simpson's Paradox. Inverted causality.

Week 4. Research design: Experiments

- a) *September 16th*: The principle of random assignment. Treatment and control groups. Average treatment effect. Required readings:
 - Kellsted & Whitten. *The Fundamentals of Political Science Research*. Chapter 4.2

- b) *September 18th*: Types of experimental designs: field, lab, survey. Required readings:
- Rebecca Morton and Kenneth Williams. 2009. “Experimentation in Political Science” in Box-Steffensmeier et al. (eds). *The Oxford Handbook of Political Methodology*. Oxford University Press.

Week 5. Research design with observational data: Controlling for confounders

- a) *September 23rd*: The Comparative Method. Small-N studies. Required readings:
- Arend Lijphart. 1971. “Comparative Politics and the Comparative Method”. *American Political Science Review* 65 (3): 682-693
 - Jasjeet Sekhon. 2004. “Quality Meets Quantity: Case Studies, Conditional Probability, and Counterfactuals”. *Perspectives on Politics*, vol. 2(2) 281-293.
- b) *September 25th*: Controlling for confounders in large-N studies. Required readings:
- Kellsted & Whitten. *The Fundamentals of Political Science Research*. Chapter 4.3

Week 6. Descriptive Statistics.

- a) *September 30th and October 2nd*: Descriptive statistics of central tendency and dispersion. Mean, median, mode; variance, standard deviation, and inter-quartile range. Required readings:
- Kellsted & Whitten. *The Fundamentals of Political Science Research*. Chapter 5

Week 7. Statistical Inference: Sampling Distribution and the Central Limit Theorem.

- a) *October 7th*: Universe vs sample, parameter vs statistic. The sample distribution of a statistic. Required readings:
- Kellsted & Whitten. *The Fundamentals of Political Science Research*. Chapter 6
- b) *October 9th*: The Central Limit Theorem. The standard error of a statistic.

Week 8. FALL BREAK

Week 9. MIDTERM EXAM and review

- a) *October 21st: Midterm exam*
- b) *October 23rd: In-class review of midterm exam.*

Week 10. Statistical Inference: Hypothesis testing

- a) *October 28th: Null hypothesis testing. Types of inference errors (type-I and type-II). The power of a test.* Required readings:
 - Kellsted & Whitten. *The Fundamentals of Political Science Research*. Chapter 7
- b) *November 4th and November 6th. Difference in Means Testing. Controlling for confounders.*

Week 11. Bivariate Regression

- a) *November 11th: The regression equation. The Meaning of regression coefficients.* Required readings:
 - Kellsted & Whitten. *The Fundamentals of Political Science Research*. Chapter 8.
- b) *November 13th: Changing the functional form: squared terms, square roots, and logarithms.*

Week 12. Hypothesis Testing in Regression Models.

- a) *November 11th and 13th: Hypothesis testing in regression models. Analysis of Variance.* Required readings:
 - Kellsted & Whitten. *The Fundamentals of Political Science Research*. Chapter 9.

Week 12. Multiple Regression

- a) *November 18th and November 20th: Controlling for observable confounders with multiple regression. Interpreting changes in coefficients as the new variables are specified.* Required readings:

- Kellsted & Whitten. *The Fundamentals of Political Science Research*. Chapter 10.

Week 13. THANKSGIVING HOLIDAY from November 24th to November 30th

Week 14. Generalized Linear Regression with Limited Dependent Variables.

a) *December 2nd and 4th*: Dummy dependent variables and categorical outcomes. Required readings:

- Kellsted & Whitten. *The Fundamentals of Political Science Research*. Chapter 11.

Week 15.

December 9th: FINAL EXAM