POLI 644 – Research Methods (Quantitative Analysis)
Fall 2025

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Class Time: Tuesdays from 17:45-20:15
Class Location:

- Lectures: H-511 SGW
- Labs: H-527 SGW

COURSE DESCRIPTION

This course provides graduate students with a rigorous introduction to **quantitative research methods** as they are used in political science, public policy, and related social science fields. The course is designed to equip students with the conceptual foundations, practical skills, and analytical judgment required to **design, conduct, interpret, and communicate quantitative research** in a professional and methodologically sound manner.

The course proceeds in two broad stages that reflect the logic of the research process itself. In the first part of the course, students focus on the **scientific foundations of social inquiry**, including theory construction, concept formation and measurement, research design, and causal inference. Emphasis is placed on understanding how research questions are formulated, how hypotheses are derived from theory, and how different research designs enable—or limit—causal claims. By the end of this stage, students will be able to critically assess quantitative research designs and articulate a feasible research plan of their own.

The second part of the course focuses on **quantitative data analysis and statistical reasoning**, with an emphasis on applying statistical tools to answer substantive research questions. Students are introduced to data management, visualization, and statistical modeling using the R programming language and RStudio. Rather than emphasizing mathematical derivations, the course prioritizes **conceptual understanding, interpretation of results, and substantive inference**. Students learn how to describe data, assess uncertainty, test hypotheses, and estimate regression models—including multiple regression and logistic regression—while critically evaluating the assumptions and limitations of each approach.

Throughout the course, lectures are closely integrated with **hands-on lab work**, allowing students to immediately implement analytical techniques and interpret statistical output in context. Students work with real-world datasets drawn from political science and public policy research, and they develop skills in reproducible research practices and transparent data analysis workflows.

The course culminates in a **group-based applied research project**, in which students design a research question, analyze quantitative data, and present their findings in a professional presentation format. This project emphasizes collaborative research, clear communication of results, and thoughtful discussion of uncertainty, limitations, and methodological choices.
By the end of the course, students will be able to:

- Design and evaluate quantitative research projects grounded in theory and sound research design;
- Critically consume and assess quantitative research in political science and public policy;
- Manage, analyze, and visualize quantitative data using R;
- Apply and interpret core statistical methods commonly used in social science research; and
- Communicate quantitative findings clearly and responsibly to academic and non-academic audiences.

This course assumes no prior background in statistics or programming, but it is taught at a graduate level and moves at an accelerated pace. The emphasis is on **learning how to think with data**, rather than on advanced mathematical techniques.

COURSE FORMAT

The course will be held in-person. Since this course is a seminar, attendance is required.

COMMUNICATIONS POLICY

For emails with the instructor, every effort will be made to respond within 24 hours on weekdays. On weekends, the delay may be longer. For emails, you are expected to:

1. Include the course number and purpose of the email in the email subject.
2. Do not send follow-up emails within 24 hours or on weekends. If you do, both the original and follow-up emails will be ignored.
3. If your email is asking about facts found directly in the syllabus, it will be ignored (for example, asking about the date of the midterm). The syllabus is made available to all students, and it is disrespectful to expect the instructor to look up something when you are unwilling to do so.
4. Do not send messages through Moodle. I almost never check Moodle messages.

COURSE MATERIALS

Required Materials

The following materials are required for this course.

Primary Textbook

- **The Fundamentals of Political Science Research**
  Paul M. Kellstedt and Guy D. Whitten.
  Cambridge University Press.

- I will be using the Third Edition for lectures, which is available as an E-book at https://www.cambridge.org/ca/academic/subjects/politics-international-relations/research-methods-politics/fundamentals-political-science-research-3rd-edition?format=AR
- If you prefer a print version, the Second Edition can often be found at a lower price. The content is very similar.

This textbook provides the core conceptual framework for the course, including the scientific method, research design, measurement, statistical inference, and regression analysis. The emphasis of the text aligns with the course's focus on understanding, interpretation, and application of quantitative methods rather than advanced mathematical derivations.

Online Textbook and Tutorials

- **Statistical Inference via Data Science** (ModernDive)
  Chester Ismay and Albert Y. Kim
  Available online at: https://moderndive.com

ModernDive serves as the primary practical companion to the course, particularly for data analysis, visualization, statistical inference, and regression using R. Readings from this resource are assigned throughout the second half of the course and are closely integrated with lab work.

Software

Students are required to install and use the following free and open-source software:

- **R (**https://cran.r-project.org**)**
- **RStudio (**
- https://posit.co/download/rstudio-desktop/)

R and RStudio will be used for all data management, visualization, and statistical analysis in the course. No prior experience with R is assumed.

Suggested and Supplementary Resources

The following resources are **not required**, but they are highly recommended for students who would like additional depth, alternative explanations, or support while working on labs and the final project. These resources are grouped by theme.

Research Design & Causal Inference

- **Experimental and Quasi-Experimental Designs for Generalized Causal Inference**
  William R. Shadish, Thomas D. Cook, and Donald T. Campbell
- **The Effect**
  Nick Huntington-Klein
- **Designing Social Inquiry**
  Gary King, Robert O. Keohane, and Sidney Verba

- **Mostly Harmless Econometrics**
  Joshua D. Angrist and Jörn-Steffen Pischke

These works are especially useful for students interested in causal inference, identification strategies, and the logic linking research design to statistical analysis.

Statistics and Data Analysis

- **Introduction to Modern Statistics**
  Mine Çetinkaya-Rundel and Johanna Hardin (OpenIntro)
- **Applied Regression and Generalized Linear Models**
  John Fox
- **Categorical Data Analysis**
  Alan Agresti
- **Modern Applied Statistics with S**
  W. N. Venables and B. D. Ripley

These texts provide additional perspectives on statistical modeling, regression, and categorical data analysis. They are particularly useful for students planning more advanced quantitative work beyond this course.

Robust Statistics and Alternatives

- **Introduction to Robust Estimation and Hypothesis Testing**
  Rand R. Wilcox
- **Modern Statistics for the Social and Behavioral Sciences**
  Rand R. Wilcox

These resources introduce robust statistical approaches that relax some of the assumptions underlying classical methods and are valuable for students interested in methodological alternatives.

R, Programming, and Practical Support

- **R for Data Science**
  Hadley Wickham, Mine Çetinkaya-Rundel, and Garrett Grolemund
  https://r4ds.hadley.nz
- **UCLA Statistical Consulting**
  https://stats.oarc.ucla.edu/r/
- **Stack Overflow (***Particularly useful for troubleshooting R errors.)*
  https://stackoverflow.com
- **RStudio Community**
  https://community.rstudio.com

Students are encouraged to consult these resources when encountering technical issues in R. Learning to diagnose and resolve errors is a normal and expected part of the data analysis process.

Use of External Resources

Students are encouraged to make active use of supplementary resources while completing labs and the final project. However, all submitted work must reflect the student's own understanding and interpretation of the material. Appropriate citation and academic integrity standards apply to all work in the course.

Use of Generative AI Tools

Generative artificial intelligence (AI) tools (e.g., ChatGPT and similar systems) may be used selectively and responsibly in this course as learning aids, particularly for troubleshooting and clarifying technical issues related to R, data management, and error messages encountered during lab work.

Appropriate uses of generative AI tools include:

- Helping interpret and understand R error messages;
- Suggesting general strategies for debugging code;
- Clarifying statistical concepts or terminology encountered in readings or lectures;
- Assisting with high-level planning or organization of work (e.g., outlining steps in an analysis).

However, the use of generative AI tools is not permitted for the following purposes:

- Generating code that is submitted as part of lab assignments or the final project;
- Writing or substantially rewriting analytical text, interpretations, or explanations that are submitted for grading;
- Producing statistical analyses, results, or interpretations that the student does not independently understand and cannot explain.

These restrictions are in place for two reasons. First, submitting AI-generated code or analysis as one's own work constitutes a violation of academic integrity. Second, and equally important, reliance on AI-generated solutions undermines the learning objectives of the course. Developing proficiency in quantitative methods requires active engagement with data, code, and interpretation; outsourcing these tasks prevents students from building the skills the course is designed to develop.

Students should assume that they may be asked to explain, in plain language, any code, output, or interpretation they submit. If a student cannot explain their own work, this will be treated as evidence that the work does not reflect their independent understanding.

When in doubt about whether a particular use of AI is appropriate, students should consult the instructor before submitting the work.

ASSESSMENT AND EVALUATIONS

Student performance in this course is evaluated through a combination of individual and group assignments designed to assess understanding of research design, statistical reasoning, data

analysis, and the ability to communicate quantitative findings clearly and responsibly. The assessment structure reflects the logic of the research process itself, moving from research design to data analysis and applied interpretation.

1. Design Assignment (Individual) — 15%
Due: Week 5 (February 10, at the start of class)
This short individual assignment focuses on the foundations of research design. Students are required to articulate a clear research question, situate it conceptually, and discuss issues of measurement, data, and causal inference. The emphasis is on translating theoretical ideas into a feasible quantitative research design, rather than on data analysis.
This assignment ensures that students develop a solid understanding of research design principles before moving into statistical analysis.

2. Final Project Proposal (Group) — 15%
Due: Week 5 (February 10, at the start of class)
Working in small groups, students submit a proposal outlining their final research project. The proposal builds on the design principles covered in the first part of the course and includes:

- a research question and motivation,
- proposed hypotheses,
- identification of relevant variables,
- a description of the dataset to be used, and
- an initial discussion of the analytical approach.

The proposal is intended to ensure that projects are well-defined, feasible, and appropriately matched to the methods taught in the course.

3. Laboratory Assignments (R and Statistics) — 40% total
Laboratory assignments are designed to develop practical skills in data management, visualization, and statistical analysis using R. With the exception of the first lab, all lab assignments are completed individually. Emphasis is placed on correct implementation, interpretation of results, and clarity of presentation rather than on mathematical derivations.

- Lab 1 (Group, low-stakes): R Basics and Workflow — *5%*
  Due: Week 6 (February 17)
- Lab 2 (Individual): Descriptive Statistics and Visualization — *10%*
  Due: Week 7 (February 24)
- Lab 3 (Individual): Bivariate Relationships and Hypothesis Testing — *10%*
  Due: Week 10 (March 17)
- Lab 4 (Individual): Multiple Regression and Controls — *7.5%*
  Due: Week 11 (March 24)
- Lab 5 (Individual): Regression Extensions and Logistic Regression — *7.5%*
  Due: Week 12 (March 31)

Laboratory work must be submitted in the specified format and reflect the student's own understanding. Students should be able to explain and interpret any code or output they submit.

4. Final Applied Research Project (Group Presentation) — 30%
Due: Week 13 (April 7)

The final project is a group-based applied quantitative research project. Students analyze real-world data to answer a substantive research question using the methods covered in the course. Rather than a traditional research paper, the final output takes the form of a professional presentation (slides and oral presentation).
The project emphasizes:

- appropriate use of quantitative methods,
- clear interpretation of statistical results,
- effective visual presentation of findings,
- discussion of uncertainty, limitations, and methodological choices.

All group members are expected to contribute substantively to the project and to participate in the in-class presentation. Students may be required to submit a brief individual reflection or contribution statement.

Summary of Assessment Weighting

Component	Weight
Design Assignment (Individual)	15%
Final Project Proposal (Group)	15%
Lab Assignments (1–5)	40%
Final Applied Research Project (Group Presentation)	30%
Total	100%

LATE POLICY

Papers must be submitted by the end of class on August 16. Papers that are not turned in on time will be penalized 5% per day. Late papers will not receive any comments and will not be accepted more than a week late. If you are having any problems in handling the course load, please speak to me ASAP. There are more solutions available if you approach me early.

RE-GRADES

If you believe that your grade on an assignment does not reflect the quality of your work, it is your right to request a re-grade. However, you must follow these steps:

1. You must wait 7 days before requesting a re-grade.
2. You must submit a written statement detailing why you believe your grade should be changed. You should point to specific areas of your exam/paper that you believe were graded unfairly AND explain why.
3. I will then re-grade your ENTIRE assignment. I reserve the right to RAISE or LOWER your grade.
4. After the re-grade, if you still believe that your grade is unfair, you must then follow the Department's procedures for re-grades.

CHANGES TO THE SYLLABUS

I reserve the right to amend the schedule of meetings and assignments listed in this syllabus as might become necessary based on events throughout the semester. Any changes to the syllabus

will be announced and students will receive an amended syllabus in writing. Copies of the most up to date syllabus can be found on the course website on Moodle.

COURSE SCHEDULE

Week 1 — January 13
Topic: Introduction · Science, Theory, and Explanation

- **Required readings**
  - Kellstedt and Whitten. Chapter 1: *The Scientific Study of Politics* (entire chapter)
    Kellstedt and Whitten. Chapter 2: *The Art of Theory Building* (entire chapter)
- **Lecture topics**
  - What counts as scientific explanation?
  - Description vs explanation
  - Theory, hypotheses, and models
  - Causality and inference in political science
  - Examples from published quantitative research
- **Lab topics**
  - *None (lecture only)*
- **Assignments (in progress)**
  - Thinking about possible research interests and questions
- **Assignments due**
  - None

Week 2 — January 20
Topic: Concepts, Measurement, and Data

- **Required readings**
  - Kellstedt and Whitten. Chapter 3: *Evaluating Causal Relationships* (entire chapter)
    Kellstedt and Whitten. Chapter 5: *Measuring Concepts of Interest* (entire chapter)
- **Lecture topics**
  - Concepts vs indicators
  - Operationalization
  - Measurement error
  - Validity and reliability
  - Levels of measurement
  - Implications of measurement choices for analysis
- **Lab topics**
  - *None (lecture only)*
- **Assignments (in progress)**
  - Thinking about potential variables related to research interests
- **Assignments due**
  - None

Week 3 — January 27
Topic: Research Design and Causal Inference

- **Required readings**

    - Kellstedt & Whitten. Chapter 4: *Research Design* (entire chapter)
- **Lecture topics**
    - Causality vs correlation
    - Internal vs external validity
    - Confounding and selection bias
    - Experimental vs observational designs
    - Threats to inference in quantitative research
- **Lab topics**
    - *None (lecture only; practical examples embedded in lecture)*
- **Assignments (in progress)**
    - Design Assignment (individual)
    - Final Project Proposal (group)
- **Assignments due**
    - None

Week 4 — February 3
Topic: From Research Design to Data: Project Development & Data Reconnaissance

- **Required readings**
    - ModernDive, Chapter 1 – *Introduction to Data Science*
    - ModernDive, Chapter 2 – *Getting Started with R and RStudio*
- **Lecture topics**
    - Overview of the final project
    - Linking research questions to data
    - Translating hypotheses into measurable variables
    - Anticipating appropriate statistical tools
- **Lab topics**
    - Exploring candidate datasets
    - Inspecting variable availability
    - Initial data import in R
    - Group work on project ideas and hypotheses
- **Assignments (in progress)**
    - Design Assignment (individual)
    - Final Project Proposal (group)
- **Assignments due**
    - None

Week 5 — February 10
Topic: Introduction to R, Data Management, and Reproducible Workflows

- **Required readings**
    - ModernDive, *Getting Started with R*
    - ModernDive, *Data Import and Tidy Data*
    - ModernDive, *Data Wrangling and Workflow Basics*
- **Lecture topics**
    - Reproducible research principles
    - R projects and file structure
    - Overview of tidy data

    - Introduction to R Markdown / Quarto
- **Lab topics**
    - Installing and configuring R/RStudio
    - Importing datasets
    - Cleaning and restructuring data
    - Creating a reproducible document
- **Assignments (in progress)**
    - Lab 1 (group)
- **Assignments due**
    - **Design Assignment (Individual) – Due at the start of class on Moodle**
    - **Final Project Proposal (Group) – Due at the start of class on Moodle**

Week 6 — February 17
Topic: Describing Variables and Visualizing Data

- **Required readings**
    - Kellstedt & Whitten. Chapter 6: *Getting to Know Your Data* (entire chapter)
    - ModernDive – *Data Visualization*
- **Lecture topics**
    - Distributions and summary statistics
    - Measures of central tendency and dispersion
    - Principles of effective data visualization
- **Lab topics**
    - Creating tables and graphs in R
    - Histograms, boxplots, scatterplots
    - Interpreting descriptive output
- **Assignments (in progress)**
    - Lab 2 (individual)
    - Final Project
- **Assignments due**
    - **Lab 1 (Group) – Due at the start of class on Moodle**

Week 7 — February 24
Topic: Probability, Sampling, and Statistical Uncertainty

- **Required readings**
    - Kellstedt & Whitten. Chapter 7: *Probability and Statistical Inference*
    - ModernDive – *Confidence Intervals and Sampling*
- **Lecture topics**
    - Sampling logic
    - Sampling distributions
    - Confidence intervals
    - Why statistical inference is necessary
- **Lab topics**
    - Simulation-based demonstrations
    - Sampling variability
    - Interpreting confidence intervals
- **Assignments (in progress)**

    - Final Project
- **Assignments due**
    - **Lab 2 (individual) – Due at the start of class on Moodle**

Week 8 — Reading Week (No Class)

Week 9 — March 10
Topic: Bivariate Relationships and Hypothesis Testing
- **Required readings**
    - Kellstedt & Whitten. Chapter 8: *Bivariate Hypothesis Testing* (entire chapter)
    - ModernDive – *Hypothesis Testing*
- **Lecture topics**
    - Difference of means
    - Chi-square tests
    - Correlation
    - Interpreting statistical evidence
- **Lab topics**
    - Implementing t-tests, chi-square tests, and correlations in R
    - Substantive interpretation of results
- **Assignments (in progress)**
    - Lab 3 (individual)
    - Final Project
- **Assignments due**
    - **None**

Week 10 — March 17
Topic: Regression I: OLS Logic and Controls
- **Required readings**
    - Kellstedt & Whitten. Chapter 9: *Two-Variable Regression Models* (entire chapter)
    - Kellstedt & Whitten. Chapter 10: *Multiple Regression: The Basics*
        - Sections introducing:
            - multiple regression logic
            - control variables
    - ModernDive – *Linear Regression*
    - ModernDive – *Multiple Regression*
- **Lecture topics**
    - Regression as a modeling strategy
    - Interpreting coefficients
    - "Holding other things constant"
    - Introducing controls
- **Lab topics**
    - Estimating multiple regression models
    - Comparing bivariate and controlled results
    - Interpreting coefficients
- **Assignments (in progress)**
    - Lab 4 (individual)

    - Final Project
- **Assignments due**
    - **Lab 3 (Individual) – Due at the start of class on Moodle**

Week 11 — March 24
Topic: Regression II: Assumptions, Omitted Variables, and Logistic Regression

- **Required readings**
    - Kellstedt & Whitten. Chapter 10: *Multiple Regression: The Basics*
        - Remaining sections
    - Kellstedt & Whitten. Chapter 11: *Multiple Regression Model Specification*
        - Sections on:
            - omitted variable bias
            - model specification
            - diagnostics (conceptual)
    - Kellstedt & Whitten. Chapter 12: *Limited Dependent Variables and Time-Series Data*
        - Sections on:
            - Sections on logistic regression only *(Exclude time-series material)*
    - ModernDive – *Inference for Regression*
    - ModernDive – *Logistic Regression*
- **Lecture topics**
    - Omitted variable bias
    - Model assumptions (intuition)
    - Predicted values
    - Binary outcomes and logistic regression
- **Lab topics**
    - Extending multiple regression models
    - Logistic regression
    - Interpreting predicted probabilities
- **Assignments (in progress)**
    - Lab 5 (individual)
    - Final Project
- **Assignments due**
    - **Lab 4 (Individual) – Due at the start of class on Moodle**

Week 12 — March 31
Topic: Project Work and Open Lab

- **Required readings**
    - None
- **Lecture topics**
    - Interpreting and presenting results
    - Communicating uncertainty and limitations
    - Effective presentation of quantitative findings
- **Lab topics**
    - Open project work
    - Model refinement

  - Figure and slide preparation
  - Individual and group feedback
- **Assignments (in progress)**
  - Final Project (group)
- **Assignments due**
  - **Lab 5 (Individual)**

Week 13 — April 7
Topic: Final Project Presentations

- **Required readings**
  - None
- **Lecture topics**
  - Group presentations
  - Methodological discussion
  - Interpretation and limitations
- **Lab topics**
  - None
- **Assignments (in progress)**
  - None
- **Assignments due**
  - **Final Project (Group Presentation & Slides)**

INTELLECTUAL PROPERTY

Content belonging to instructors shared in online courses, including, but not limited to, online lectures, course notes, and video recordings of classes remain the intellectual property of the faculty member. It may not be distributed, published or broadcast, in whole or in part, without the express permission of the faculty member. Students are also forbidden to use their own means of recording any elements of an online class or lecture without express permission of the instructor. Any unauthorized sharing of course content may constitute a breach of the Academic Code of Conduct and/or the Code of Rights and Responsibilities. As specified in the Policy on Intellectual Property, the University does not claim any ownership of or interest in any student IP. All university members retain copyright over their work.

PLAGIARISM

Department of Political Science Statement on Plagiarism

The Department of Political Science has zero tolerance for plagiarism.

1. What is plagiarism? The University defines plagiarism as "the presentation of the work of another person, in whatever form, as one's own or without proper acknowledgement" (Concordia Undergraduate Calendar 2020-2021, section 17.10.3 (https://www.concordia.ca/academics/undergraduate/calendar/current/17-10.html). Plagiarism is an academic offence governed by the Code of Conduct (Academic). To find out more about how to avoid plagiarism, see the Concordia University Student Success Centre at: https://www.concordia.ca/students/success.html

2. What are the consequences of being caught? Students caught plagiarizing are subject to the following sanctions: (a) a written reprimand; (b) a piece of work be re-submitted; (c) an examination be taken anew; (d) a grade reduction or grade of zero for the piece of work in question; (e) a grade reduction or failing grade for the course; (f) a failing grade and ineligibility for a supplemental examination or any other evaluative exercise for the course; (g) the obligation to take and pass courses of up to twenty-four (24) credits in addition to the total number of credits required for the student's program; (h) suspension for a period not to exceed six (6) academic terms. Suspensions shall entail the withdrawal of all University privileges, including the right to enter and be on University premises; (i) expulsion from the University. Expulsion entails the permanent termination of all University privileges. In the case of a student who has already graduated, the only two available sanctions are (i) a notation on the student's academic record that he or she has been found guilty of academic misconduct; or (ii) a recommendation to Senate for the revocation of the degree obtained. (Undergraduate Calendar, p. 58). Complete regulations can be found in section 17.10.3 of the Undergraduate Calendar.
3. See also The Political Science Department's "Resources on Avoiding Plagiarism" at: https://www.concordia.ca/artsci/polisci/student-life/students.html#plagiarism and the full (and updated) Academic Code of Conduct here: http://www.concordia.ca/content/dam/common/docs/policies/official-policies/Academic-Code-Conduct-2015.pdf.

EXTRAORDINARY CIRCUMSTANCES

For undergraduate courses & courses that are cross-listed with graduate courses:

In the event of extraordinary circumstances and pursuant to the Academic regulations - Concordia University - Concordia University, the University may modify the delivery, content, structure, forum, location and/or evaluation scheme. In the event of such extraordinary circumstances, students will be informed of the changes.

STUDENTS WITH DISABILITIES

Concordia University is working to create inclusive learning environments. Please notify me if there are aspects of the instruction or design of this course that result in disability-related barriers to your participation. You are also encouraged to contact the Access Centre for Students with Disabilities (ACSD) as soon as possible so that this office can assist with the necessary accommodations.

SEXUAL HARASSMENT

As a professor, one of my responsibilities is to help create a safe learning environment for my students and for the campus as a whole. If you have experienced sexual harassment, sexual violence or discrimination, Concordia's Sexual Assault Resource Centre provides information available resources: https://www.concordia.ca/students/sexual-assault.html.