Introduction to Quantitative Methods

This version: 8 October 2025

Instructors: Jens Wäckerle (Main Course) and Helena Heberer (Labs)

Time: Wednesday 16:00-17:30 (Main course), Thursday 12:00-13:30 or 16:00-17:30 (Labs)
Room:

- Lecture: H114 (IBW Gebäude)
- Labs: 211 Seminarraum S101 (12:00) or S105 (16:00) (IBW Gebäude)

Email
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Office hours
Wednesday 10:00-12:00. Book through this link:
https://calendly.com/cccp_chair_european_politics/office_jw
For office hours with Helena Heberer please contact her via email (heberer@wiso.uni-koeln.de)
Office
IBW Building, Herbert-Lewin-Str. 2
Note on ILIAS
There are separate ILIAS courses for the lecture and the lab on ILIAS. We will ONLY use the ILIAS course for the lecture, so we will have all information on one ILIAS page.

Registration
Registration for the course and the exam in KLIPS2.
Please also regularly check the CCCP information on teaching:
http://www.cccp.uni-koeln.de/en/public/teaching/

Course description
This course is open to MA and PhD students and provides an introduction to quantitative analysis in political science using R. Topics include the essential elements of sampling, statistical inference, the estimation and interpretation of the linear regression model and data visualisation.

Data and empirical applications that we will use in class primarily focus on political science. Most of the class will use the European Election Study (https://search.gesis.org/research_data/ZA7581) and the European Social Survey (https://www.europeansocialsurvey.org/) as a running example. Throughout the course, students will become familiar with the statistical programming language R as a means to conduct a quantitative analysis. The goal is to prepare students to critically interpret and conduct quantitative studies in political science.

The first session of the course will take place on the 15th of October, the labs start the following day. There are breaks throughout the semester in which other courses take place and students work on the assignments. Depending on the class schedule, students will have either one or two weeks to complete assignments and will receive feedback on their

assignments before the next one is posted, if possible. The course also includes one written in-person exam in January. Students can choose between two lab sessions with identical content to be taught Thursday at 12:00 and 16:00.

Learning Objectives/General Skills:

- Students develop an understanding of quantitative methods, including hypothesis testing, empirical findings and analytical tools.
- Students develop a general literacy in quantitative methods, which allows them to critically evaluate existing literature in the field.
- Students learn to use quantitative methods to empirically test theoretical relationships in political science.
- Students are prepared to complete their own research projects autonomously with the help of the software R.

Prerequisites

Students should have a basic understanding of descriptive statistics (i.e., can you calculate an average?). No prior knowledge of R is required.

Software

The open-source statistical programming language R is particularly suited for carrying out state-of-the- art computer-based simulations and data exercises. It also generates really nice publication-quality graphics. The software runs under a wide array of operating systems. R can be downloaded for free at http://www.r-project.org/. Learning R might seem a bit challenging at first, but you will realise that it is incredibly powerful. The lab sessions will be devoted to learning data management and analysis techniques using R.

In addition, we will use RStudio. This is a more user-friendly interface for R with integration to other packages we will use throughout the course. RStudio is available for free at https://www.rstudio.com/. In order to avoid spending too much time on installing the programmes in the beginning, students must have installed R and RStudio before the first lab session (16th of October). If you are running into errors when installing, contact the instructor before the first session.

Course Materials

The course is structured as an applied introduction to quantitative analysis.
The course will be structured around the free-to-purchase book OpenIntro Statistics, which gives a very basic introduction into the topics discussed in the course. Generally, we will talk about most of the chapter content indicated in the syllabus for that week, although you can skim or skip the material indicated as “special topic” in each chapter. The exercises and case studies in each chapter are also not required but are good material to test understanding and develop the skills learned in each chapter. In some weeks, additional readings are indicated.

- Diez, David, Mine Cetinkaya-Rundel, and Christopher Barr (2019). OpenIntro Statistics, 4rd edition. Available at https://www.openintro.org/book/os/ .

The following materials provide alternative coverage for topics in this course:

- Gravetter, F. et al. (2021): Essentials of Statistics for the Behavioral Sciences. Australia; United States: Cengage Learning, Inc. 10th edition.
- Field, A. et al (2012): Discovering Statistics using R. London: SAGE.

- Field, A. (2016) An adventure in statistics. London: SAGE.
- Fox, John (2016). Applied Regression Analysis and Generalized Linear Models, 3rd edition. Los Angeles: Sage.
- Fox, John and Harvey S. Weisberg (2019). An R Companion to Applied Regression, 4th edition. Thousand Oaks: Sage.

Course Requirements
This course will have a combined examination consisting of a final paper and one written in-person exam during the semester. The dates as well as the deadlines for both are below.

The final paper will take the form of a take-home assignment and will have a theoretical component in which students are asked about key concepts from the course and an empirical section in which they apply the course content to real-life datasets. In this part, they also have to interpret the output. Each student has to provide R Code and responses in a Markdown document.

The exam will feature a mix of single-choice questions, definitions and short conceptual questions.

Whether a student passes or fails the course is only determined by the total sum of points achieved in both assignments. Not all assignments have to be passed in order to pass the course, rather the total number of points has to be at least fifty. Bonus points (see below) are not counted for determining whether the course is passed or not, only to improve grades. Final papers that are handed in after the deadline without prior proof of extension eligibility (e.g. due to sickness) are subject to a points deduction.

Each student must write and submit their own individual answers. Submitting the exact same answers as your colleague but with different formatting does not count as an individual answer and both will receive zero points.

Assignments must be handed in through Ilias, with the following deadlines and weights towards the final grade:

Total number of points and final grade

Points	**Grade**
0 - 49	5,0
50 - 54,5	4,0
55 - 59,5	3,7
60 - 64,5	3,3
65 - 69,5	3,0
70 - 74,5	2,7

75 - 79,5	2,3
80 - 84,5	2,0
85 - 89,5	1,7
90 - 94,5	1,3
95 - 100	1,0

Assignment schedule:

Assignment	Date	Points
Bonus	19.12.2025, 16:00	7 Bonus points
Exam Sign-up	09.01.2026	Mandatory
Exam	17.01.2026, 10:00	30
Final paper	Deadline: 27.02.2026, 16:00	70

Bonus Points
It is possible to increase your grade by up to 7 points in this course, with a bonus point assignment. The maximum number of points (100) can still be reached without bonus points. The bonus assignment will be posted after week 2. Bonus points cannot be used to pass the course, in other words, they will only be added, if the student passes the course based on the main assignments alone. More details on the form and content of the bonus point assignment will be given in the lectures.

R Markdown | A Note on Professional Presentation
RStudio comes with a powerful authoring format called R Markdown. R Markdown documents look like a mix of a text document and R code. They enable easy creation of data analysis reports directly from R. Rather than copying and pasting into Word, your report is created automatically. R Markdown combines the core syntax of markdown (an easy-to-write plain text format) with embedded R code chunks that are run so their output can be included in the final document. R Markdown documents are fully reproducible (they can be automatically regenerated whenever underlying R code or data changes). Markdown is simple to use as it enables the use of a syntax like plain-text.

1. To use R Markdown, simply create a new R Markdown document in RStudio. This will load a sample document. Select \Knit PDF" to produce a PDF output file with the write up and the code output.
2. More information on the R Markdown syntax is available here: http://rmarkdown.rstudio.com/.

Schedule

I. Basic understanding of quantitative analysis and R

Week 0: Intro to R
Material:

- Self-learning tutorial for R (strongly recommended for all new R users)
- No in-class course, only self-learning.

Week 1 (15.10.2025): Fundamentals of quantitative analysis and intro to the course
Literature:

- Diez, David, Mine Cetinkaya-Rundel, and Christopher Barr (2019). OpenIntro Statistics, 4rd edition. **Chapters 1 and 2**

Additional Literature:

- Gravetter, F. et al. (2021): Essentials of Statistics for the Behavioral Sciences. Australia; United States: Cengage Learning, Inc. 10th edition: **Chapters 1 - 4**.

Lab:

- **Thursday 16.10.2025** 12:00-13:30 and 16:00-17:30

No class on 22.10.2025

Week 2 (29.10.2025): Distributions, sampling, confidence intervals
Literature:

- Diez, David, Mine Cetinkaya-Rundel, and Christopher Barr (2019). OpenIntro Statistics, 4rd edition. **Chapters 4.1, 5.1, and 5.2**

Additional Literature:

- Gravetter, F. et al. (2021): Essentials of Statistics for the Behavioral Sciences. Australia; United States: Cengage Learning, Inc. 10th edition: **Chapters 5 and 7**.

Lab:

- **Thursday 30.10.2025** 12:00-13:30 and 16:00-17:30

Sign-up for taking part in the examination on 31 October 2025.
No class on 05.11.2025

II. Hypothesis Testing

Week 3 (12.11.2025): Statistical significance, hypothesis testing, categorical data
Literature:

- Diez, David, Mine Cetinkaya-Rundel, and Christopher Barr (2019). OpenIntro Statistics, 4rd edition. **Chapters 5.3, 6.1, 6.2**

Additional Literature:

- Gravetter, F. et al. (2021): Essentials of Statistics for the Behavioral Sciences. Australia; United States: Cengage Learning, Inc. 10th edition: **Chapters 8 and 15.**

Lab:

- **Thursday 13.11.2025** 12:00-13:30 and 16:00-17:30

Week 4 (19.11.2025): Numerical data and t-tests
Literature:
- Diez, David, Mine Cetinkaya-Rundel, and Christopher Barr (2019). OpenIntro Statistics, 4rd edition. **Chapter 7.1, 7.3, 7.4**

Additional Literature:
- Gravetter, F. et al. (2021): Essentials of Statistics for the Behavioral Sciences. Australia; United States: Cengage Learning, Inc. 10th edition: **Chapters 9, 10, and 11**.

Lab:
- **Thursday 20.11.2025** 12:00-13:30 and 16:00-17:30

Bonus point assignment posted on 19.11.2025 (due 19.12.2025)

No class on 26.11.2025
No class on 03.12.2025

III. Regression

Week 5 (10.12.2025): Correlation and Regression
Literature:
- Diez, David, Mine Cetinkaya-Rundel, and Christopher Barr (2019). OpenIntro Statistics, 4rd edition. **Chapters 8**

Additional Literature:
- Gravetter, F. et al. (2021): Essentials of Statistics for the Behavioral Sciences. Australia; United States: Cengage Learning, Inc. 10th edition: **Chapters 14**.

Lab:
- **Thursday 11.12.2025** 12:00-13:30 and 16:00-17:30

Week 6 (17.12.2025): Multiple Regression
Literature:
- Diez, David, Mine Cetinkaya-Rundel, and Christopher Barr (2019). OpenIntro Statistics, 4rd edition. **Chapters 9.1, 9.2, 9.3**

Additional Literature:
- Schafer, J. L., and Graham, J. W. (2002). Missing Data: Our View of the State of the Art, Psychological Methods, 7(2):147-177.

Lab:
- **Thursday 18.12.2025** 12:00-13:30 and 16:00-17:30

No class on 24.12.2025 (Christmas Break)
No class on 31.12.2025 (Christmas Break)
No class on 07.01.2026
No class on 14.01.2026

Exam on 17.01.2026, 10:00

IV. Advanced Issues in Quantitative Analysis

Week 7 (21.01.2026): Logistic Regression, Interactions, Polynomials
Literature:

- Diez, David, Mine Cetinkaya-Rundel, and Christopher Barr (2019). OpenIntro Statistics, 4rd edition. **Chapter 9.4**
- Brambor, T., Clark, W. R., & Golder, M. (2006). Understanding interaction models: Improving empirical analyses. Political analysis, 14(1), 63-82

Additional Literature:
Lab:

- **Thursday 22.01.2026** 12:00-13:30 and 16:00-17:30

Week 8 (28.01.2026): Multilevel Modelling and Wrap-up
Literature:

- Alastair H. Leyland, Peter P. Groenewegen, *Multilevel Modelling for Public Health and Health Services Research*, Cham: Springer, 2020. Chapter 3: What Is Multilevel Modelling?
- Schmidt-Catran, A.W., Fairbrother, M. and Andreß, H.J., 2019. Multilevel Models for the Analysis of Comparative Survey Data: Common Problems and Some Solutions. *Kölner Zeitschrift für Soziologie und Sozialpsychologie (KZfSS)*, *71*.

Lab:

- **Thursday 29.01.2026** 12:00-13:30 and 16:00-17:30