Introduction to Quantitative Methods

Instructors: Jens Wäckerle (Main Course and Lab) and Jasmin Rath (Lab)

Time: Wednesday 16:00-17:30 (Main course), Thursday 10:00-11:30 or 16:00-17:30 (Labs)
Room:

- Lecture: 103 Hörsaal H80 (Philosophikum)
- Lab 1 (10:00): 211 Seminarraum S105
- Lab 2 (16:00): 212 Seminarraum S110

Email
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Office hours
Monday 10:00-12:00 (starting 11. September, 2023). Book through this link:
https://calendly.com/cccp_chair_european_politics/office_jw
For office hours with Jasmin Rath, please contact her via email (jasmin.rath@wiso.uni-koeln.de)
Office
IBW Building, Herbert-Lewin-Str. 2
Note on ILIAS
There are separate platforms for the lecture and the lab on ILIAS. We will ONLY use the ILIAS folder 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 visualization. In the last weeks students will have brief introductions to more advanced topics, including time-series and panel data analysis, multilevel models and interaction effects.

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://www.gesis.org/en/services/finding-and-accessing-data/international-survey-programs/european-election-studies) 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 11th 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. Students can choose between two lab sessions with identical content to be taught Thursday at 10:00 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 (12th 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.
Students can choose many of the mandatory readings from one of two sources provided by the instructor:

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

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

- Field, A. (2016) An adventure in statistics. London: SAGE.
- Diez, David, Mine Cetinkaya-Rundel, and Christopher Barr (2019). OpenIntro Statistics, 4rd edition. Available at https://www.openintro.org.
- 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 portfolio evaluation consisting of five take-home exams during the semester. The posting times as well as the deadlines for all assignments are posted below.

All assignments 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 second part, they also have to interpret the output. Each student has to provide R Code and responses in a Markdown document.

Whether a student passes or fails the course is only determined by the total sum of points achieved in all 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. Assignments that are not handed in on time will be graded as zero points.

Each student must hand in their own assignment. Two (nearly) identical assignments will receive a 0. 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:

Date posted	Deadline	Points
18.10.2023	01.11.2023	15
15.11.2023	29.11.2023	15
06.12.2023	13.12.2023	15
03.01.2024	10.01.2024	25
24.01.2024	07.02.2024	30

Bonus Points
It is possible to increase your grade by up to 10 points in this course, with two bonus point assignments (this means you could improve from a 1.7 to a 1.0!). The maximum number of points (100) can still be reached without bonus points. Each bonus assignment will have a maximum grade of five. They will be posted at the start of the course and after week 3. Bonus points exercises cannot be used as a replacement for one of the mandatory assignments. 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 assignments 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 (04.10.2023): Intro to R

Material:

- Self-learning tutorial for R (strongly recommended for all new R users)

Bonus point assignment #1 (Intro to R) posted on 04.10.2023 (due 08.11.2023)

Week 1 (11.10.2023): Fundamentals of quantitative analysis and intro to the course
Literature:

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

Lab:

- **Thursday 12.10.2023** 10:00-11:30 (Jasmin Rath) and 16:00-17:30 (Jens Wäckerle)

Week 2 (18.10.2023): Distributions, sampling and p-values
Literature:

- Gravetter, F. et al. (2021): Essentials of Statistics for the Behavioral Sciences. Australia; United States: Cengage Learning, Inc: chapters 7 and 8.

Lab:

- **Thursday 19.10.2023** 10:00-11:30 (Jasmin Rath) and 16:00-17:30 (Jens Wäckerle)

Assignment #1 posted on 18.10.2023 (due 01.11.2023)

No class on 25.10.2023
No class on 01.11.2023 (Allerheiligen)

II. Hypothesis Testing

Week 3 (08.11.2023): Statistical significance, testing, and confidence intervals
Literature:

- Gravetter, F. et al. (2021): Essentials of Statistics for the Behavioral Sciences. Australia; United States: Cengage Learning, Inc: chapters 8 (again), 9.

Lab:

- **Thursday 09.11.2023** 10:00-11:30 (Jasmin Rath) and 16:00-17:30 (Jens Wäckerle)

Bonus point assignment #2 (Data Visualization) posted on 08.11.2023 (due 22.11.2024)

Week 4 (15.11.2023): Errors, power, substantive significance, group differences and missings
Literature:

- Gravetter, F. et al. (2021): Essentials of Statistics for the Behavioral Sciences. Australia; United States: Cengage Learning, Inc:: chapter 9 (again), 10.
- 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 16.11.2023** 10:00-11:30 (Jasmin Rath) and 16:00-17:30 (Jens Wäckerle)

Assignment #2 posted on 15.11.2023 (due 22.11.2023)

No class on 22.11.2023

III. Regression

Week 5 (29.11.2023): Correlation, bivariate and multivariable regression
Literature:

- Gravetter, F. et al. (2021): Essentials of Statistics for the Behavioral Sciences. Australia; United States: Cengage Learning, Inc: Chapter 14.

Lab:

- **Thursday 30.11.2023** 10:00-11:30 (Jasmin Rath) and 16:00-17:30 (Jens Wäckerle)

Assignment #3 posted on 29.11.2023 (due 06.12.2023)
No class on 06.12.2023

Week 6 (13.12.2023): Analysis of categorical data and dichotomous dependent variables
Literature:

- Gravetter and Wallnau chapter 15 AND OpenIntro Statistics, chapters 6 and 8 (from p. 386).

Lab:

- **Thursday 14.12.2023** 10:00-11:30 (Jasmin Rath) and 16:00-17:30 (Jens Wäckerle)

Assignment #4 posted on 13.12.2023 (due 10.01.2024)

No class on 20.12.2023
No class on 27.12.2023 (Christmas Break)
No class on 03.01.2024 (Christmas Break)
No class on 10.01.2024

IV. Advanced Issues in Quantitative Analysis

Week 7 (17.01.2024): Interactions and Polynomials
Literature:

- Brambor, T., Clark, W. R., & Golder, M. (2006). Understanding interaction models: Improving empirical analyses. Political analysis, 14(1), 63-82

Lab:

- **Thursday 18.01.2024** 10:00-11:30 (Jasmin Rath) and 16:00-17:30 (Jens Wäckerle)

Week 8 (24.01.2024): Nested observations – cross-sectional time-series and multi-level models
Literature:

- Luke, D. A. (2004). Multilevel Modeling. Thousand Oaks, CA: Sage. Chapter 1 (pp. 1-7).
- Cowpertwait, P. S. P., and Metcalfe, A. V. (2009). Introductory Time Series with R. New York: Springer. Chapter 1 (pp. 1-25).
- Finkel, S. E. (1995). Causal Analysis with Panel Data. Thousand Oaks, CA: Sage. Chapter 1 (Modeling Change with Panel Data).

Lab:

- **Thursday 25.01.2024** 10:00-11:30 (Jasmin Rath) and 16:00-17:30 (Jens Wäckerle)

Assignment #5 posted on 24*.01.2024 (due 07.02.2024)*