Introduction to Quantitative Methods

BAK3 – Winter Semester

Lecturer

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Lectures

Tuesday

13:15–14:45

PC Room 1 UniCampus Courtyard 7 Entrance 7.1, 1st floor (2H-01-13)

Overview

This course aims to equip students with the research design, statistics and coding skills needed to start carrying out quantitative research in political science on their own. The course covers topics in research design, univariate and bivariate descriptive statistics, data visualisation, inferential statistics, and linear regression. The lectures combines face-to-face instruction, which put an emphasis on intuitive and graphical understanding, with practical exercises using the software `R`. This course is complementary to the course VO BAK3 "Quantitative Methoden"; attending the lecture at the same time is therefore strongly recommended. By the end of the course, students should be able to describe and manipulate a dataset, conduct basic inferential tests and implement multiple linear regressions. Students should also be able to develop and answer research questions using quantitative methods, as well as interpreting and presenting appropriately quantitative research findings. The language of instruction is English. This means that class discussions assignments, written tests, and the final paper should be conducted and completed in English.

Learning Objectives

- Gaining an introductory-level understanding of the principles of quantitative research design and data analysis.
- Developing he ability to develop and test simple research questions independently, employing quantitative methods.
- Developing the ability to summarise variables and relationship between variables, and being able to use data visualisation (e.g. histogram, bar chart, boxplot, dot-and-whisker plot) to describe data.
- Understanding hypothesis testing and when to use statistical tests.
- Gaining an intuitive and basic mathematical understanding of core concepts in inferential statistics (standard error, confidence interval, p-value).
- Interpreting the output of a linear regression model.
- Gaining a basic understanding of the mechanics and assumptions of ordinary least squares linear regression.
- Developing confidence writing code in `R`, and being able to discuss and present the results of independent data analysis.

Course Readings

- Alan Agresti (2018). *Statistical methods for the social sciences* (5th edition). Pearson Education International.
- Elena Llaudet and Kosuke Imai (2022). *Data Analysis for Social Science*. Princeton University Press.
- Jane Summer (2025) *R for Political Science Research: An Introduction for Absolute Beginners*. Springer. Available online at `https://link.springer.com/book/10.1007/978-3-031-75853-9`

Assessment Structure

10%	Attendance and Participation
25%	Homework Assignments (five, worth 5% each)
25%	Mid-Term Test (available on 10 and 11 December 2026 online)
40%	Seminar Paper (due on Friday, 27 February 2026)

Each component is graded on a 0–100 scale, where: 87–100 Points is 'Excellent' (1); 75–86 Points is 'Good' (2); 63–74 Points is 'Satisfactory' (3); 50–62 Points is 'Sufficient' (4), and 0–49 Points is 'Insufficient' (5). The overall grade is the weighted average of each component. For a positive completion of this seminar, at least half of the total number of points is required ($\geq$ 50 points).

Assessment Policies

Attendance and Participation: Attendance is a prerequisite for the completion of this seminar, as the evaluation is based on continuous assessments during the semester. This component is evaluated on the basis of: (1) Attendance: for full marks on this component, a maximum of three sessions can be missed. Attendance will be checked every session. Falsification of a signature is equivalent to fraudulent performance. Class starts at 13:15 sharp; (2) Participation: students are expected to participate in class discussions, ask and answer questions, and follow the coding part of the class on their computer/laptop.

Homework Assignments: There will be five short take-home assignments, which aim to test students' understanding of the course content and their ability to use statistical software. The overall grade of this assessment component is calculated as the mean of the sub-grades of each of the five assignments. The homework assignments must be completed by the students independently, subject to the course policies on academic conduct outlined in the next session of the syllabus, and submitted via Moodle by the deadlines. The answer files must be submitted in PDF or Word format as well as the corresponding R script, if applicable. In case of technical problems with the submission on Moodle (then, and only then!), you may send your answer files exceptionally by e-mail. Please note, however, that the set deadlines also apply to this form of submission and that work submitted later will not be considered. All homework assignments will be automatically checked with plagiarism and AI use software.

Mid-Term Test: There will be an online mid-term test on or around Wednesday 10 December 2025, covering all the content of lectures from weeks 1 to 9. Further information on the format and logistics of the test will be provided in class.

Seminar Paper: The final course assessment is a seminar paper, to be submitted via Moodle by 13 March 2026. *Students who require a final grade before the registration deadline for next term should submit the paper by 13 February 2026* (TBC) – if this is your case, please also send me a note by email that you require early marking. In this assessment component, the student must formulate a research question relevant to political science (or more broadly, social sciences), and test it using statistical methods learnt in class. The paper must be 2,500 words *maximum* in length (the word-count excludes the bibliography and the content of tables, but includes everything else: footnotes, title, sub-headings, captions of tables and figures etc.). The paper must be written in English; however, style and grammar are not part of the grading criteria. The research paper must include at least one table and one figure; replication files for the code used should also be included. The seminar paper is evaluated on a 0-100 point scale on the basis of: (1) coherence of the argument, (2) awareness of related literature, (3) clarity of presentation, (4) correctness of the statistical analysis and discussion of the findings, (5) adherence to scholarly writing conventions (references, quotations). More precise instructions on the content and format of the seminar paper will be provided during the semester.

Course Policies

Academic Conduct: Plagiarism (taking someone else's writing, code or ideas and passing them off as your own) and ghost-writing (having someone else do *any* part of *any* assessment component for you) are *strictly forbidden* in all the work you produce for these course. To make sure that these rules are not violated all written work will be cross-checked with plagiarism- and AI-checking software. In addition, students may be required to provide an oral explanation of their written work or R code. If one performance component in a course with continuous assessment is obtained by fraudulent means (e.g., cheating, use of unauthorised means, plagiarism, etc.), the entire course performance is to be considered as obtained by fraudulent means and no assessment will be returned to the student (Statutes of the University of Vienna). Any plagiarism will be reported to the Studienprogrammleitung.

AI policy: The use of Artificial Intelligence tools (e.g. ChatGPT, Gemini, Claude, DeepSeek, Copilot, etc.) to assist with coding up homework assignments, writing the final paper, or otherwise answering *any* part of *any* assessment component is also *strictly forbidden*. Evidence of use of AI tools in any assessment component — ascertained through, e.g. AI writing detection software, or students' inability to explain their code — will be treated as plagiarism, with the same consequences as outlined in the previous section. Note also that feeding to AI tools any part of the content of this course may violate intellectual property rights. I am not a die-hard AI hater, and in fact I believe there is a place for AI as part of a researcher's workflow. But that place is not when someone is learning how to use a statistical software for the first time. In my experience, AI tools are useful only when you know enough about to coding to ask the right questions, and spot the many mistakes and inefficiencies the AI will return. Your homework assignments are designed to give you the time and space for acquiring those coding skills through practical application ('learning by doing'). Occasionally breaking things and going back to fix them is part of this process, and AI assistance completely robs you of this essential learning experience. If you are stuck with an R problem, class handouts and the reference manual (Summer, 2025) are the best place to start. Otherwise, just Google your problem: there is a large community of R users on websites like Stack Overflow who have asked coding and statistics questions, and it's likely that yours will have been answered there before. This takes only marginally longer than asking AI, it is much more likely to return a correct solution, and – most importantly – it will be a solution you understand and can draw on again the next time you face a similar problem.

Deadlines: Late submissions will incur in mark deductions (−10 pts. if submitted 0–24 hours late, −25 pts. if submitted 24-48 hours late). I will not accept any submissions that are over 48 hours late. Extensions of the submission deadline are generally not allowed, outside of agreed accommodations for students with disabilities. Only in exceptional circumstances, extensions

may be granted for students who have a valid excuse, to be notified to me by email in advance of the due date. Approval of extension requests depends on the justification and in any case is not automatic.

Computer devices and software: In the second part of every class, we will be going over some coding tasks together; you can follow along on the university's computers or on your laptop (the latter is recommended). Make sure you have internet access and a charged laptop in class. The classes and some of the assignments in this course require two pieces of statistical software: `R`, a programming language, and `RStudio`, a free software that makes it easier to work in `R` (an 'integrated development environment'). We will work in `RStudio`, but `RStudio` won't work if `R` is not installed, so both these programs should be installed on your device. If you have not already done so, you should make sure that you have installed the latest version of `R` and the latest version of `RStudio`. To download `R`, go to `https://www.r-project.org/` and select the mirror (server) geographically closest to you. To download `RStudio`, go to `https://posit.co/download/rstudio-desktop/`, and select the installation for your system (Mac, Windows, or Linux). Please note that mobile phones and some tablets (e.g. Chromebooks) are not suitable for using `RStudio`.

Communications: Course material and announcements will be made available on Moodle. Class handouts, scripts and data are available there: please make sure you download the ones needed for each class session prior to class.

Class policies: Students are expected to be respectful in their interactions with course-mates at all times. Consuming snacks and drinking coffee or other beverages is allowed, but please do not have full meals in class. If you are a parent and your childcare falls through, you are welcome to bring your child or infant to class.

Accommodations for Students with Disabilities: If you need disability-related accommodations in this class, and/or if you have emergency medical information that you wish to share, and/or if you need special arrangements to participate, please inform me as soon as possible via email or after the first class. I will liaise with the Study Services and follow up with all the necessary information on the logistics on the accommodations. I am happy to provide further training for students with visual impairments on how to integrate the RStudio environment with screen reader software, and on how to use `RBraille`.

Course Enrolment: Attendance is compulsory in the first session: if you can't attend but wish to take the course, please let me know in advance. Students who miss the first class without noticing me will be deregistered from the seminar and, in case the class is fully booked, students from the waiting list will be admitted. Regular de-registration from the course is only possible according to the official deadline. All students who are registered after the official deadline will be graded. This also applies to students who drop out of the seminar during the semester.

Class Schedule and Readings

The main content of this course is the one presented in lecture slides and handouts. Readings are meant to integrate and expand on this content, but you will not be tested on things that are not discussed explicitly in class. That said, you should read, each week, after class *either* the relevant reading from Agresti, A. (2018) "Statistical methods for the social sciences" (available online through the university library) *or* the relevant reading from Llaudet, E. and Imai, K. (2022) "Data Analysis for Social Science" (physical copies available from the library). You can read both, if you're really keen; but you may not choose not to read either; some topics are only covered by one of the textbooks, in which case you should read that one. The only exception to this rule is week 2, where the Kellstedt and Whitten (2018) reading is required, and the Llaudet and Imai reading is optional. Readings from the `R` reference manual Summer, J. (2025) "R for Political Science Research", are optional. In the readings below "up to section X" means "up to section X *inclusive*" (i.e. you should also read section X).

Date	*Topic*	*Readings*
07/10/25	Introduction to the Course and to `R`	Summer, Chapters 3–5. 🔗
14/10/25	Introduction to Research Design	– Kellstedt, P. and Whitten, G. (2018) *The Fundamentals of Political Science Research*. Cambridge University Press. Chapters 1–4. – Llaudet and Imai, Chapter 2. – Summer, Chapters 6 and 7. 🔗
21/10/25	Measurement	– Agresti, Chapter 2 (skim from 2.2 onwards). – Summer, Chapter 9, up to section 9.4; and 12, up to section 12.4. 🔗
	Homework Assignment 1, Due Monday 27/10/25, 11:59pm.	
28/10/25	Univariate descriptive statistics I	– Agresti, Chapter 3, up to 3.2. – Llaudet and Imai, Chapter 3, up to page 73. – Summer, Chapter 9 up to 9.4 and 12 up to 12.5. 🔗

04/11/25	Univariate descriptive statistics II	– Agresti, Chapter 3, up to 3.4. – Llaudet and Imai, Chapter 3, up to 3.4. – Summer, Ch 9 up to section 9.5 and 12 up to section 12.6. 🔗
	Homework Assignment 2, Due Monday 10/11/25, 11:59pm.	
11/11/25	Bivariate descriptive statistics	– Agresti, finish Chapter 3. – Llaudet and Imai, finish Chapter 3. – Summer, finish Chapters 9 and 12. 🔗
18/11/25	Probability and Uncertainty	– Agresti, Chapter 4. – Llaudet and Imai, Chapter 6.
	Homework Assignment 3, Due Monday 24/11/25, 11:59pm.	
25/11/25	Inference	– Agresti, Chapter 5, up to section 5.4 (skim the rest of the chapter). – Llaudet and Imai, Chapter 7 up to 7.2.
02/12/25	Hypothesis Testing I	– Agresti, Chapter 6.
09/12/25	Hypothesis Testing II	– Agresti Chapter 7 up to section 7.4; Chapter 8 up to section 8.2. – Imai, Chapter 7 up to section 7.3.1. – Summer, Chapter 13. 🔗
	Mid-Term Test, due Thursday 11/12/25, 11:59pm – on Moodle from Wednesday 10/12/25, 12:01am	
16/12/25	Simple Linear Regression	– Agresti, Chapter 9 up to 9.4 – Llaudet and Imai, Chapter 4. – Summer, Chapter 14, up to 14.3. 🔗
	Homework Assignment 4, Due Monday 12/01/26, 11:59pm.	
13/01/26	Multiple Linear Regression	– Agresti, Chapter 10 and Chapter 11, up to 11.2. – LLaudet and Imai, Chapter 5.
20/01/26	Inference in Linear Regression	– Agresti, finish Chapters 9 and 11. – LLaudet and Imai, finish Chapter 7. – Summer, finish Chapter 14. 🔗
	Homework Assignment 5, Due Monday 26/01/26, 11:59pm.	
27/01/26	Regression and Research Design	No required readings.
	Seminar Paper, Due Friday 13/03/26, 11:59pm. Early deadline: Friday 13/02/26, 11:59pm.	

Optional Further Readings

More on the statistics part of this course:

- Kellstedt, P. and Whitten, G. (2018) *The fundamentals of political science research*. [similar level as this course]
- Freedman, D., Pisani, R., and Purves, R. (2007) *Statistics*. 4th edition. W.W. Norton & Company. [more formal treatment]
- Keller, K. (2023). *Introduction to regression analysis in R* [advanced, graduate-level, specifically on regression]

More in-depth material on designing social science research:

- Corbetta, P. (2003). *Social Research: Theory, Methods and Techniques*. [very accessible introduction]
- King, G., Keohane, R. and Verba, S. (1994) *Designing Social Inquiry*. [a bit dated but still a classic]
- Blair, G., Coppock, A. and Humphreys, M. (2023) *Research design in the social sciences*. [quite advanced]

Broader overview of R functionalities:

- Wickham, H., Grolemund, G. and Cetinkaya-Rundel, M. (2023). *R for data science*. [learn tidyverse properly]
- Healy, K. (2024) *Data visualization: a practical introduction*. [on data visualization]