

# Syllabus

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## 1 Course Description

This course covers the main statistical tools used to analyze economic data. The first part of the course is about Economic Statistics: summarizing economic data and empirical relationships via exploratory data analysis and flexible regression models. This conveys recently developed nonparametric methods which do not assume data are generated from a particular process or even that they are well-behaved. After that, we transition to the second part of the course about Statistical Economics: stochastic economic models and tests of economic hypotheses. This conveys how to interpret and misinterpret economic data as we begin working on empirical projects. The teaching formats are lectures, readings, computational assignments, presentations, and written reports. The class also imparts the use of the statistical software R, interactive programming via Shiny, and reproducible reporting via R Markdown.

Workload: 4 SWS, 10 ECTS: approximately 50 hours of seminar lectures and assignment-reviews, 250 hours of self-study and homework.

Grading: Final paper.

Prerequisites: Basic knowledge of statistics and econometrics (e.g., passed both “Statistik und Wahrscheinlichkeitsrechnung” and “Oekonometrie”).

Class Size: < 20.

## 2 Assignments

At first, I will provide weekly lectures, homework assignments (which we review together), and interactive labs. After about half way through the course, we transition themes and you will begin working on an empirical project. At this point, the interactive labs will be replaced by you (the student) presenting and discussing your research topic. At the end of the semester, you will write a paper on your research project. Below is a summary and more details will be given in class.

**Readings.** We read articles on econometric methodology as we progress through the course. If time permits, we spend some time in class discussing the ideas in the articles.

**Labs.** We work through some computer applications related to the lecture or to your replication-extension project. You will work on your personal computer (before each lab, verify all R-packages are installed and working on your PC).

**Small Homework Assignments.** You will work through frequent small weekly problem sets for the first part of the semester. An assignment is posted each week and due the following week. These are turned in online *before* the next class as an R Markdown report (`COURSE_ASSIGNMENT_NAME.html`) where we will then review them. For full marks on a question, your answer needs to be correct both quantitatively and qualitatively (e.g., by containing a figure, a statistic, and intuitive explanation).

**Presentation/Poster.** You will summarize and present your progress on your final project (about 30 minutes of slides and poster, but depends on class size).

**Final Paper.** You will write a paper by the end of the semester of about 20 – 30 pages. More details will come, but you will write a clear and concise paper on a topic using the tools you have learned.

### 3 Outline

Our schedule will somewhat mirror a typical applied econometrics research project. I plan on the following timeline but reserve the right to change it any point.

Week	Lecture & Lab	Assignments
1	Introduction to Course & Software	Read <a href="#">Rbooks</a> 1-11
<b>Economic Statistics</b>		
2	Continuous Univariate and Bivariate Data	Problem Set 1
3	Continuous Multivariate Data	Problem Set 2
4	Bandwidths	Problem Set 3
5	Hypothesis Testing	Problem Set 4
6	Discrete and Mixed Data	Problem Set 5
7	Distributional Changes	Problem Set 6
<b>Statistical Economics</b>		
8	<i>Student Proposal and Discussion</i>	Interactive Programming 1
9	Random Continuous Choice	Interactive Programming 2
10	Statistical Equilibria	
11	Discrete Choice and Selection	
12	<i>Student Presentation and Poster</i>	
13	<i>Student Paper Due</i>	

Problem Set posted for Week 2 is discussed during Week 3, et cetera.

**Weekly Reading List.** Readings posted for Week 2 are discussed during Week 3, et cetera.

- 1 J. E. Biddle and D. S. Hamermesh (2016). *Theory and Measurement: Emergence, Consolidation and Erosion of a Consensus*. Working Paper 22253. National Bureau of Economic Research. URL: <http://www.nber.org/papers/w22253>
- 1 M. T. Panhans and J. D. Singleton (2017). “The Empirical Economist’s Toolkit: From Models to Methods”. In: *History of Political Economy* 49.Supplement, 127–157. URL: <https://doi.org/10.1215/00182702-4166299>
- 2 Video of Guido Imbens Nobel Speech (2021) <https://youtu.be/8QWGb-Qu4XY>
- 2 J. D. Angrist and J.-S. Pischke (2010). “The Credibility Revolution in Empirical Economics: How Better Research Design Is Taking the Con out of Econometrics”. In: *Journal of Economic Perspectives* 24.2, 3–30. URL: <https://www.aeaweb.org/articles?id=10.1257/jep.24.2.3>

- 3 Video of Abhijit Banerjee's Nobel Speech (2019) <https://youtu.be/XvyM07CmFlk>
- 3 S. D. Levitt and J. A. List (2008). *Field Experiments in Economics: The Past, The Present, and The Future*. Working Paper 14356. National Bureau of Economic Research. URL: <http://www.nber.org/papers/w14356>
- 4 V. L. Smith (2010). "Experimental Methods in Economics". In: *Behavioural and Experimental Economics*. Ed. by S. N. Durlauf and L. E. Blume. London: Palgrave Macmillan UK,. 120–136. URL: [https://doi.org/10.1057/9780230280786\\_16](https://doi.org/10.1057/9780230280786_16)
- 4 P. Andre and A. Falk (2021). "What's Worth Knowing? Economists' Opinions about Economics". In: *IZA DP Working Paper.14527*. URL: <https://ftp.iza.org/dp14527.pdf>
- 5 R. J. LaLonde (1986). "Evaluating the Econometric Evaluations of Training Programs with Experimental Data". In: *The American Economic Review* 76.4, 604–620. URL: <http://www.jstor.org/stable/1806062>
- 5 E. E. Leamer (1983). "Let's Take the Con Out of Econometrics". In: *The American Economic Review* 73.1, 31–43. URL: <http://www.jstor.org/stable/1803924>
- 6 F. A. von Hayek (1942). "Scientism and the Study of Society. Part I". in: *Economica* 9.35, 267–291. URL: <http://www.jstor.org/stable/2549540>
- 6 M. P. Keane (2010). "A Structural Perspective on the Experimentalist School". In: *Journal of Economic Perspectives* 24.2, 47–58. URL: <https://www.aeaweb.org/articles?id=10.1257/jep.24.2.47>
- 7 A. Brodeur, N. Cook, and A. Heyes (2020). "Methods Matter: p-Hacking and Publication Bias in Causal Analysis in Economics". In: *American Economic Review* 110.11, 3634–60. URL: <https://www.aeaweb.org/articles?id=10.1257/aer.20190687>
- 7 J. A. Weill et al. (2021). *Researchers' Degrees-of-Flexibility and the Credibility of Difference-in-Differences Estimates: Evidence From the Pandemic Policy Evaluations*. Working Paper 29550. National Bureau of Economic Research. URL: <http://www.nber.org/papers/w29550>
- 8 A. Deaton (2010). "Instruments, Randomization, and Learning about Development". In: *Journal of Economic Literature* 48.2, 424–55. URL: <https://www.aeaweb.org/articles?id=10.1257/jel.48.2.424>
- 8 J. J. Heckman and R. Pinto (2022). *Causality and Econometrics*. Working Paper 29787. National Bureau of Economic Research. URL: <http://www.nber.org/papers/w29787>, Ch. 1, 2
- 9 J. Rust (2014). "The Limits of Inference with Theory: A Review of Wolpin (2013)". In: *Journal of Economic Literature* 52.3, 820–50. URL: <https://www.aeaweb.org/articles?id=10.1257/jel.52.3.820>
- 9 P. E. Todd and K. I. Wolpin (2021). "The Best of Both Worlds: Combining RCTs with Structural Modeling". In: *Journal of Economic Literature* Forthcoming. URL: <https://www.aeaweb.org/articles?id=10.1257/jel.20211652>
- 10 Video of Angus Deaton's Nobel Speech (2015) [https://nobelmedia.akamaized.net/flash/content/lecture\\_2015\\_eco\\_deaton\\_01\\_496.mp4](https://nobelmedia.akamaized.net/flash/content/lecture_2015_eco_deaton_01_496.mp4)

- 11 Video of Daniel McFadden’s Nobel Speech (2000) [https://nobelmedia.akamaized.net/flashcontent/lecture\\_2000\\_eco\\_mcfadden\\_01\\_496.mp4](https://nobelmedia.akamaized.net/flashcontent/lecture_2000_eco_mcfadden_01_496.mp4)
- 12 Video of James Heckman’s Nobel Speech (2000) [https://nobelmedia.akamaized.net/flashcontent/lecture\\_2000\\_eco\\_heckman\\_01\\_496.mp4](https://nobelmedia.akamaized.net/flashcontent/lecture_2000_eco_heckman_01_496.mp4)
- 13 Video of Trygve Haavelmo’s Nobel Speech (1989) <https://www.nobelprize.org/prizes/economic-sciences/1989/ceremony-speech/>
- 14 R. Blundell and T. M. Stoker (2005). “Heterogeneity and Aggregation”. In: *Journal of Economic Literature* 43.2, 347–391. URL: <https://www.aeaweb.org/articles?id=10.1257/0022051054661486>

## 4 Reference Material

This course draws mostly from my notes. My notes, however, are based on the following textbooks, and you should use at least the ones with a ★. (I will also provide additional sources in the homeworks for further reading.) This is an applied course, so there will be many concrete applications with actual data. There will be very few theoretical proofs of statistical properties, but instead numerical examples that illustrate the main ideas (e.g., simulations with increasing sample sizes, not deriving an asymptotic distribution). Similarly, there will be “reduced-form” equations we derive from theory, but will not prove the existence or uniqueness of equilibrium. In both cases, the reference materials contain the mathematical derivations (amongst many other things) and are the basis for my lectures.

### Nonparametric Data Analysis.

- ★ E. García-Portugués (2022). *Notes for Nonparametric Statistics*. URL: <https://bookdown.org/egarpor/NP-UC3M/>
- D. Henderson and C. Parmeter (2015). *Applied Nonparametric Econometrics*. Cambridge University Press. URL: <https://www.the-smooth-operators.com/>
- J. S. Racine (2019). *An Introduction to the Advanced Theory and Practice of Nonparametric Econometrics: A Replicable Approach Using R*. Cambridge University Press. URL: <https://doi.org/10.1017/9781108649841>
- L. Chihara and T. Hesterberg (2018). *Mathematical Statistics with Resampling and R*. Wiley. URL: <https://sites.google.com/site/chiharahesterberg/home>

### Data Visualization.

- ★ C. Wilke (2019). *Fundamentals of Data Visualization: A Primer on Making Informative and Compelling Figures*. O’Reilly Media. URL: <https://clauswilke.com/dataviz/>
- [https://www.biostat.wisc.edu/~kbroman/topten\\_worstgraphs/](https://www.biostat.wisc.edu/~kbroman/topten_worstgraphs/)
- E. Tufte (2001). *The Visual Display of Quantitative Information*. 2nd ed. Graphics Press. URL: [https://www.google.de/books/edition/The\\_Visual\\_Display\\_of\\_Quantitative\\_Infor/qmjNngEACAAJ](https://www.google.de/books/edition/The_Visual_Display_of_Quantitative_Infor/qmjNngEACAAJ)

### Introductory Econometrics Textbooks.

- J. Wooldridge (2019). *Introductory Econometrics: A Modern Approach*. South-Western Cengage Learning. URL: [https://economics.ut.ac.ir/documents/3030266/14100645/Jeffrey\\_M.\\_Wooldridge\\_Introductory\\_Econometrics\\_A\\_Modern\\_Approach\\_\\_2012.pdf](https://economics.ut.ac.ir/documents/3030266/14100645/Jeffrey_M._Wooldridge_Introductory_Econometrics_A_Modern_Approach__2012.pdf)

- F. Heiss (2020). *Using R for Introductory Econometrics*. Independently Published. URL: <http://www.urfie.net/>
- C. Hanck et al. (2020). *Introduction to Econometrics with R*. URL: <https://www.econometrics-with-r.org/>
- C. Adams (2020). *Learning Microeconometrics with R*. CRC Press. URL: <https://sites.google.com/view/microeconometricswithr/table-of-contents>

### **Popular Introductions.**

- D. N. McCloskey and S. Ziliak (2008). *The Cult of Statistical Significance: How the Standard Error Costs Us Jobs, Justice, and Lives*. University of Michigan Press. URL: [https://books.google.de/books?id=JWLIRr%5C\\_R0gAC](https://books.google.de/books?id=JWLIRr%5C_R0gAC)
- S. Pinker (2021). In: *Rationality: What It Is, Why It Seems Scarce, Why It Matters*. Penguin Books Limited. URL: <https://books.google.de/books?id=HTONEAAAQBAJ>

### **Advanced Econometrics Textbooks.**

- B. E. Hansen (2022b). *Probability and Statistics for Economists*. Princeton University Press. URL: <https://www.ssc.wisc.edu/~bhansen/probability/>
- B. E. Hansen (2022a). *Econometrics*. Princeton University Press. URL: <https://www.ssc.wisc.edu/~bhansen/econometrics/>
- A. Cameron et al. (2005). *Microeconometrics: Methods and Applications*. Cambridge University Press. URL: <https://books.google.de/books?id=Zf0gCwxC9ocC>
- W. Greene (2018). *Econometric Analysis*. Pearson. URL: <http://people.stern.nyu.edu/wgreene/Microeconometrics.htm>
- R. Davidson and J. G. MacKinnon (2021). *Econometric Theory and Methods: International Edition*. Authors. URL: <http://qed.econ.queensu.ca/ETM/ETM-davidson-mackinnon-2021.pdf>