Syllabus for Topics in Econometrics and Statistics

Course URL: https://ecampus.uni-bonn.de/

Instructor: Joachim Freyberger, Institute for Finance and Statistics, freyberger@uni-bonn.de.

Lectures: Tuesdays from 2:00 pm – 4:00 pm. Room TBA.

Office Hours: Please feel free to ask questions during the lectures or after class. Also feel free to email me to set up an appointments.

Course Description: The course treats topics in nonparametric statistics, model selection and regularization, and semiparametric inference. It covers technical results, tools that are useful for applied work, and recent developments in the field, including:

- Nonparametric regression

- Model selection

- Shrinkage methods

- Uniformity

- Inference in semiparametric models

- Debiased machine learning

The course is designed for students with interests in theoretical econometric and those who want use sophisticated methods in applied research.

Prerequisites: The class requires a rigorous background in probability theory, statistics, and the linear regression model at a level that is similar to the material taught in the first semester of the first year of the PhD sequence.

Readings: Two useful textbooks are:

- Econometrics by Hansen.

- The Elements of Statistical Learning: Data Mining, Inference, and Prediction by Hastie, Tibshirani, and Friedman.

Both books can be downloaded free of charge. We will also discuss research papers, including

- Ai and Chen (2003), "Efficient Estimation of Models with Conditional Moment Restrictions Containing Unknown Functions", *Econometrica*.

- Belloni, Chernozhukov, and Hansen (2014), "Inference on Treatment Effects after Selection among High-Dimensional Controls", *REStud*.

- Chernozhukov et al. (2018), "Double/debiased machine learning for treatment and structural parameters", *Econometrics Journal*.

- Leeb and Pötscher (2005), "Model Selection and Inference: Facts and Fiction", *Econometric Theory*.

- Robinson (1988), "Root-N-Consistent Semiparametric Regression", *Econometrica*.

- Zou (2006), "The Adaptive Lasso and Its Oracle Properties", *JASA*.

Evaluation: Students will be required to present parts of the class material in the second half of the semester. They can choose between theoretical topics (either a chapter from a book or a recent research paper) and empirical applications. Students will also be required to complete a project, where the main focus will be on implementing some of the methods discussed in class.