INTERMEDIATE ECONOMETRICS
(ECONOMETRICS III)

Module 5, 2018–2019

Professor: Stanislav Anatolyev
sanatoly@nes.ru

Course information

Course Website: my.nes.ru

Instructor's Office Hours: any time I am in my office

Class Time: TBA

Room Number: TBA

Teaching Assistants: TBA

Course description

The course is a bridge between introductory econometric knowledge and serious thinking about econometric estimation and inference, when applied in both cross-sectional and time-series setting. Apart from reviewing important econometric notions and inference tools such as asymptotic theory and bootstrap, we concentrate on regression type models, both parametric, including linear and nonlinear, and non-parametric. Home assignments serve as an important ingredient of the learning process.

Course requirements, grading, and attendance policies

- There will be 5 weekly home assignments that account for 10% of the final grade. Home assignments will be posted regularly on my.nes.ru.
- Home assignments will contain analytical problems, as well as computer exercises based on Python.
- Solutions to home assignments may be submitted by one or two students. Student pairs should be formed at the beginning and must not change during the module.
- Any spillovers of solutions among groups, or traces of copying from previous years' materials are considered plagiarism.
- Answer keys (which may not constitute full solutions!) will be posted on my.nes.ru.
- The Problems and Solutions manual contains additional (mostly recycled old exams) problems for independent work and discussion in sections.
- The final exam accounting for 90% of the grade will have a two-sided A4 format.
- Lecture and discussion section attendance of less than 50% immediately leads to denial of admittance to final and makeup exams.

Course contents

I. Econometric concepts and inference tools

1. Econometric concepts
   - Conditional distribution and conditional expectation. Law of iterated expectations.
   - Notion of regression. Mean, median and quantile regressions.
   - Conditional expectation function and best linear predictor. Linear projection.
   - Random sample and non-random sample. Analogy principle.
   - Parametric, nonparametric and semi-parametric estimation.
2. Inference tools: asymptotic theory
   - Approaches to inference: exact, asymptotic, bootstrap. Problems with exact inference.
   - Review of asymptotic tools: convergence, LLN and CLT, continuous mapping theorems, delta-method.
   - Asymptotic confidence intervals and large sample hypothesis testing under random sampling.
   - Asymptotics with time series: stationarity, ergodicity, martingale difference sequence, ergodic theorem, CLT, HAC variance estimators.
3. Inference tools: bootstrap
   - Bootstrap under random sampling: EDF, approximation by bootstrapping and approximation by simulations.
   - Bootstrap bias correction, confidence intervals and hypothesis testing.
   - Bootstrap resampling: non-parametric, residual, wild, block, stationary bootstraps.

II. Parametric Mean Regression

1. Linear mean regression
   - OLS estimator. Asymptotic inference in linear mean regression model.
   - Asymptotic efficiency. GLS estimator its asymptotics.
   - Time series linear regression.
2. Nonlinear mean regression
   - NLLS estimator. Asymptotic inference in nonlinear mean regression model.
   - Computation of NLLS estimate: concentration method.
   - Asymptotic Efficiency and Weighted NLLS estimator. Binary choice model.
   - Inference when nuisance parameters are not identified under null hypothesis.

III. Nonparametric Mean Regression

- Discrete regressors: parametric rate of convergence.
- Continuous regressors: kernel estimator of mean regression and its asymptotics.
- Selection of bandwidth: plug-in, cross-validation.
- Practical aspects of kernel estimation.
- Multivariate kernel regression. Curse of dimensionality.
- Non-kernel nonparametric methods.

Sample tasks for course evaluation

Evaluate the following claims.
1. When one does bootstrap, there is no reason to raise the number of bootstrap repetition too high: there is a level when making it larger does not yield any improvement in precision.
2. The bootstrap estimator of the parameter of interest is preferable to the asymptotic one, since its rate of convergence to the true parameter is often larger.

Consider the equation $y=(\alpha+\beta x)e$, where y and x are scalar observables, e is unobservable. Let $E[e|x]=1$ and $V[e|x]=1$. How would you estimate (α,β) by OLS? How would you construct standard errors?

Suppose we regress y on scalar x, but x is distributed only at one point (that is, $\Pr\{x=a\}=1$ for some a). When does the identification condition hold and when does it fail if the regression is linear and has no intercept? If the regression is nonlinear? Provide both algebraic and intuitive/graphical explanations.

Derive the asymptotic distribution of the Nadaraya–Watson estimator of the density of a scalar random variable x having a continuous distribution, similarly to how the asymptotic distribution of the Nadaraya–Watson estimator of the regression function is derived, under similar conditions. Give interpretation to how your expressions for asymptotic bias and asymptotic variance depend on the shape of the density.

Course materials

Hansen, B. E. (2018) *Econometrics,* selected chapters, University of Wisconsin. Доступно на http://www.ssc.wisc.edu/~bhansen/econometrics

Anatolyev, S. (2009) *Intermediate and Advanced Econometrics: Problems and Solutions, 3rd edition,* sections 1–8 and 14, New Economic School

Goldberger, A. (1991) *A Course in Econometrics,* selected chapters, Harvard University Press

Анатольев, С. (2007) «Основы бутстрапирования», *Квантиль*, №3, сентябрь 2007 г. Доступно на http://quantile.ru/03/N3.htm

Анатольев, С. (2009) «Непараметрическая регрессия», *Квантиль*, №7, сентябрь 2009 г. Доступно на http://quantile.ru/07/N7.htm

(optional) Анатольев, С. (2006) *Курс лекций по эконометрике для продолжающих,* Российская Экономическая Школа

(optional) Härdle, W. and O. Linton (1994) *Applied Nonparametric Methods*, in *Handbook of Econometrics*, volume 4, chapter 38, Elsevier Science

Academic integrity policy

Cheating, plagiarism, and any other violations of academic ethics at NES are not tolerated.