Econometrics 1

module 3, 2024-2025

Instructor: Aleksey Kolokolov
Akolokolov@NES.ru

Course information

Course Website: my.nes.ru

Instructor's Office Hours: see my.nes.ru

Class Time: see my.nes.ru

Room Number: 427

TAs: Попов Иван Дмитриевич (ipopov@nes.ru), Селенов Егор Сергеевич (eselenov@nes.ru)

Course description

The objective of the course is to familiarize students with basic concepts of econometric analysis. During the course students learn how to apply basic econometric models to cross-sectional data. Also the participants of the course will study basic commands in Python and will do practical exercises.

Course requirements, grading, and attendance policies

Students are assumed to have sufficient background in statistics, calculus and matrix algebra. There are 14 lectures and 6 seminars. During first six weeks each week a problem set will be distributed. Best 5 problem sets will be counted for 30% of the final grade. The 3-hour-long final written format A4 exam will give 70% of the final grade.

Course contents

Week 1: Introduction. Conditional expectation function vs. best linear predictor. Simple regression model. Ordinary least squares. (Ch. 1, 2)

Week 2: Multiple regression analysis: Goodness of fit. Irrelevant variables. Omitted variable bias. Multicollinearity. Misspecified models. Gauss-Markov theorem. (Ch. 3)

Week 3: Multiple regression analysis: Testing hypotheses. Confidence intervals. Testing multiple linear restrictions. F and t statistics. (Ch. 4)

Week 4: Multiple regression analysis: Consistency. Asymptotic normality. Asymptotic efficiency. Langrange multiplier statistic. (Ch. 5)

Week 5: Multiple regression analysis: Goodness of fit and selection of regressors. Prediction. Dummy variables. Linear probability model. (Ch. 6, 7)

Week 6: Heteroskedasticity. Testing for heteroskedasticity. White test. Generalized least squares. Heteroskedasticity-robust inference. Functional form misspecification. Proxy variables. Measurement error. Missing data. (Ch. 8, 9)

Week 7: Regression analysis with time-series data. Stationarity. Forecasting using AR and ADL models. Estimation of dynamic causal effects. Heteroskedasticity-and-autocorrelation–consistent (HAC) standard errors. (Ch. 10, 11, 12, 18)

Sample tasks for course evaluation

Problem 1. Consider the standard simple linear regression model under the Gauss-Markov assumptions. When n = 3, is it possible that the data point with maximal value of dependent variable is located below the regression line? If answer is yes, provide an example, if, no, provide a proof.

Problem 2. Consider the simple linear regression model. The independent variable is endogenous and positively correlated with error term.

(a) We estimate the value of $\beta_0 + \beta_1 E[x]$ as $b_0 + b_0$[sample mean of x], where b_0 and b_1 are OLS estimates. Compute the sign of the asymptotic bias.

(b) Suppose you know that corr(x,u) = 1 and all random variables are normally distributed. Can you provide asymptotically consistent estimate for β1?

Problem 3. (Y_i, X_{1i}, X_{2i}) satisfy the four least squares assumptions for causal inference in the multiple regression model that we discussed in class; in addition, $var(u_i|X_{1i}, X_{2i}) = 4$ and $var(X_{1i}) = 6$. A random sample of size n = 400 is drawn from the population.

(a) Assume that X_1 and X_2 are uncorrelated. Compute the (asymptotic unconditional) variance of the OLS estimate of $\beta 1$.

(b) Assume that $\text{corr}(X_1,X_2) = 0.5$. Compute the (asymptotic unconditional) variance of the OLS estimate of $\beta 1$.

(c) Comment on the following statements: "When X_1 and X_2 are correlated, the variance of the OLS estimate of $\beta 1$ is larger than it would be if X_1 and X_2 were uncorrelated. Thus, if you are interested in $\beta 1$, it is best to leave X_2 out of the regression if it is correlated with X_1."

Course materials

Required textbooks and materials

Wooldridge, J.M., *Introductory Econometrics: A Modern Approach* (6th edition), South-Western Cengage Learning, 2016.

Additional materials

Angrist, J.D., and J.-S. Pischke, *Mostly Harmless Econometrics: An Empiricist's Companion*, Princeton University Press, 2009.

Academic integrity policy

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