Econometrics 1
module 2, academic year 2023–2024

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Course description

The course "Econometrics 1" is designed to introduce the students to statistical, econometric, and programming tools which are widely used in economics, particularly in finance and microeconomics. The course is a compulsory one, and is taught at the first module of the first year. It consists of 14 lectures and 7 seminars.

Course requirements, grading, and attendance policies

The course doesn't have any special prerequisites except for the standard calculus, linear algebra, and probability courses.

There will be 4 home assignments which will constitute 40% of the final grade. The final exam will account for the remaining 60%.

Course contents

1. Introduction
   (a) Economic questions and data
2. Fundamentals of regression analysis
   (a) Linear regression with one regressor
   (b) Regression with a single regressor: hypothesis tests and confidence intervals
   (c) Linear regression with multiple regressors
   (d) Hypothesis tests and confidence intervals in multiple regression
   (e) Nonlinear regression functions
   (f) Assessing studies based on multiple regression
3. Further topics in regression analysis
   (a) Instrumental variables regression
   (b) Regression with panel data

Description of course methodology

Lectures will proceed from motivating examples and sample models in economics to general principles of statistical and econometric modeling. Also, a number of computer exercises using the Python programming languages and its excellent statistical libraries will be distributed in order to give students an opportunity to practice econometric techniques.

Sample tasks for course evaluation

1. Suppose that a researcher, using wage data on 250 randomly selected male workers and 280 female vorkers, estimates the OLS regression

$$\widehat{Wage} = \underset{(0.23)}{12.52} + \underset{(0.36)}{2.12} \times Male, \quad R^2 = 0.06, \quad SER = 4.2,$$

   where *Wage* is measured in dollars per hour and *Male* is a binary variable that is equal to 1 if the person is a male and 0 if the person is a female (standard errors are in parenthesis). Define the wage gender gap as the difference in mean earnings between men and women.

   (a) What is the estimated gender gap?

   (b) Is the estimated gender gap significantly different from zero? (Compute the p-value for testing the null hypothesis that there is no gender gap.)

   (c) Construct a 95% confidence interval for the gender gap.

   (d) In the sample, what is the mean wage of women? Of men?

   (e) Another researcher uses these same data but regresses *Wages* on *Female*, a variable that is equal to 1 if the person is female and 0 if the person a male. What are the regression estimates calculated from this regression?

2. A researcher plans to study the causal effect of police on crime using data from a random sample of U.S. counties. He plans to regress the county's crime rate on the (per capita) size of the county's police force.

   (a) Explain why this regression is likely to suffer from omitted variable bias. Which variables would you add to the regression to control for important omitted variables?

   (b) Use your answer to (2a) and the expression for omitted variable bias

$$\hat{\beta}_1 \xrightarrow{p} \beta_1 + \text{corr}(X, u)\frac{\sigma_u}{\sigma_X}$$

   to determine whether the regression will likely over- or underestimate the effect of police on the crime rate. (That is, do you think that $\hat{\beta}_1 > \beta_1$ or $\hat{\beta}_1 < \beta_1$?)

3. Evaluate these statements: "Measurement error in the X's is a serious problem. Measurement error in Y is not."

Course materials

1. Stock J. H., Watson M. W. (2013) Introduction to Econometrics, Fourth Edition, Addison-Wesley.

2. Brooks C. (2014) Introductory Econometrics for Finance, Third Edition, Cambridge University Press.

Academic integrity policy

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