

# Econometrics 1

## module 2, academic year 2024–2025

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### Course description

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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

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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

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1. Introduction
  - (a) Economic questions and data
2. Fundamentals of regression analysis
  - (a) Linear regression with one regressor
  - (b) Hypothesis testing and confidence intervals in a simple regression
  - (c) Linear regression with multiple regressors
  - (d) Hypothesis testing and confidence intervals in a 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

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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

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

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

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

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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**

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