Econometrics 2
module 3, academic year 2023–2024

Sergei Golovan
New Economic School
sgolovan@nes.ru

TA: Artemy Andriyanov (aandriyanov@nes.ru)

Course description

The course "Econometrics 2" is designed to further develop students' skill in statistical, econometric, and programming tools which are widely used in economics, particularly in finance and macroeconomics. The course main topic is the econometrics of time series, the field which is especially useful for financial applications. The course is a compulsory one, and is taught at the third module of the first year. It consists of 14 lectures and 7 seminars.

Course requirements, grading, and attendance policies

The course heavily depends on the other required course Econometrics-1 taught in module 2. Other than that, it 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 20% of the final grade. The final exam will account for the remaining 80%.

Course contents

1. Univariate time series modeling and forecasting
   (a) Autocorrelation functions
   (b) Autoregressive processes
   (c) Forecasting in time series
2. Multivariate models
   (a) Simultaneous equations bias
   (b) Simultaneous equations in finance
   (c) Vector autoregressive models
3. Modeling long-run relationships in finance
   (a) Stationarity and unit root testing

(b) Cointegration, testing for cointegration

(c) Methods of parameter estimation in cointegrated systems

4. Modeling volatility and correlation

   (a) Models for volatility

   (b) ARCH and GARCH models

5. Further topics in regression analysis (in no particular order, if time permits)

   (a) Switching models

   (b) Limited dependent variables

   (c) Simulation methods

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 will be distributed in order to give students an opportunity to practice econometric techniques.

Sample tasks for course evaluation

1. A researcher is asked to estimate an autoregression model for a daily USD/GBP exchange rate return series, denoted x_t. She uses Akaike's information criterion which deems an AR(2) to be optimal. The estimated model is (with standard errors in parentheses)

$$\hat{x}_t = \underset{(0.13)}{0.63} + \underset{(0.04)}{0.17}\, x_{t-1} - \underset{(0.03)}{0.09}\, x_{t-2}.$$

   You are given the following data for time until day z (i.e. $t = z$)

$$x_z = 0.31,\ x_{z-1} = 0.02,\ x_{z-2} = -0.16.$$

   Produce forecasts for the next four days (i.e. for times $z+1, z+2, z+3, z+4$) from the estimated model.

2. Consider the following system of two equations

$$y_{1t} = \alpha_0 + \alpha_1 y_{2t} + \alpha_2 x_{1t} + \alpha_3 x_{2t} + u_{1t},$$
$$y_{2t} = \beta_0 + \beta_1 y_{1t} + \beta_2 x_{1t} + u_{2t}.$$

   (a) Explain, with reference to these equations, the undesirable consequences that would arise if they were estimated separately using OLS.

   (b) What would be the effect upon your answer to (a) if the variable y_{1t} had not appeared in the second equation?

   (c) State the order condition for determining whether an equation which is part of a system is identified. Use this condition to determine whether the first equation, the second equation, or both, or neither are identified.

   (d) Explain whether indirect least squares (ILS) or two-stage least squares (2SLS) could be used to obtain the parameters of the system's equations. Describe how each of these two procedures (ILS and 2SLS) are used to calculate the parameters of an equation. Compare and evaluate the usefulness of ILS, 2SLS and IV.

(e) Explain briefly the Hausman procedure for testing for exogeneity.

3. (a) What kinds of variables are likely to be non-stationary? How can such variables be made stationary?
   (b) Why is it in general important to test for non-stationarity in time series data before attempting to build an empirical model?
   (c) Define the following terms and describe the processes that they represent
      i. Weak stationarity
      ii. Strict stationarity
      iii. Deterministic trend
      iv. Stochastic trend.

4. (a) What stylized features of financial data cannot be explained using linear time series models?
   (b) Which of these features could be modeled using a GARCH(1, 1) process?
   (c) Why, in recent empirical research, have researchers preferred GARCH(1, 1) models to pure ARCH(p)?

Course materials

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

2. Stock J. H., Watson M. W. (2020) Introduction to Econometrics, Fourth Edition, Addison-Wesley.

Academic integrity policy

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