Elements of Econometrics

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Class teachers: Oleg O. Zamkov, Vladimir I. Tcherniak

Course description

The Elements of Econometrics is a two semesters course for the 3-rd year ICEF students. This is an introductory Econometrics course for the students specialized in Economics. Statistics course is a pre-requisite, as well as Economics, Mathematics and Computers courses. The course is taught in English and finally examined by the University of London external programme.

The stress in the course is done on the essence of statements, methods and approaches of econometric analysis. The conclusions and proofs of basic formulas and models are given which allows to the students to understand the principles of econometric theory development. The main accent is done on economic interpretations and applications of considered econometric models. The course is mostly oriented at cross-sections econometrics; some topics of time series and panel data econometrics are also taught in the course.

Teaching objectives

The students should get the basic knowledge and skills of econometric analysis. They should be able to apply it to the investigation of economic relationships and processes, and also understand the econometric methods, approaches, ideas, results and conclusions met in the majority of economic books and articles. In the course the students should study traditional econometric methods developed mostly for the work with cross-sections data. At the same time the students should understand essential differences between the time series and cross sections data and those specific econometric problems met in the work with these types of data, as well as with panel data. The students should get the skills of construction and development of simple and multiple regression models, get acquainted with some non-linear models and special methods of econometric analysis and estimation, understanding the area of their application in economics. The considered methods and models should be mastered practically on real economic data bases with modern econometric software.

Teaching methods

The following methods and forms of study are used in the course:

- lectures
• classes (half of the classes is devoted to theoretical and applied analysis, and another half is conducted in the computer room and is devoted to practical applications of the econometric methods studied in the course)

• home assignments for each topic consisting of theoretical and applied parts

• teachers’ consultations

• self-study, which can be conducted with the course materials and in a computer room, making home assignments using Excel and Econometric Views, work with economic data bases, with ICEF, UoL, LSE and other course materials through the Internet and ICEF information system.

Grade determination

The students sit two mid-term written exams in November and in April, first semester written exam in January, and University of London external exam in May. November and January exams include multiple choice and free response parts. April and May exams are free response (open questions) exams. The first semester grade is determined as follows: January exam grade gives 50% of the grade, November exam — 30%, and 20% is given for home assignments. In the final course grade the University of London exam grade gives 40%, the first semester grade gives 30%, and 30% is given for the second semester (20% — for April exam and 10% for home assignments).

Main reading

The Third edition of textbook “Introduction to Econometrics” by Christopher Dougherty is the main textbook for the course. Its Russian translation can also be used. The University of London Study Guide, Examination papers and Examiners’ Report are also widely used in the course. Another (supplementary) recommended textbook is “Basic Econometrics” by D.N. Gujarati containing some extra course information, derivations, tests, proofs and applications. The book by O. Zamkov and ICEF teaching materials (7–8) are also used in the course. The books by Greene, Verbeek and Kennedy are recommended as supplementary reading: the first contains deeper presentation of course materials, the others — useful explanations and comments.


**Additional reading**

1. Магнус Я.Р., Катышев П.К., Пересецкий А.А. Эконометрика. Начальный курс. Изд. 7. М., Дело, 2005 (МКР).

2. Econometric Views 5.1 User’s Guide. Quantitative Micro Software, LLC.


**Internet resources and databases**

1. http://econ.lse.ac.uk/ie/ (I-1)


Software and databases

The main software used in the course is Econometric Views (version 5.1 and later ones). Spreadsheet Excel is also used in the course.

For making class and home assignments the following data bases are used:

- data prepared by Chr. Dougherty at the LSE (data for estimation of earnings functions based on NSLY survey at the USA; annual data on demand, disposable income and relative prices for aggregated goods and services in the USA, for 1959–2003 — the data is available at I–1);

- Monthly data for main macroeconomic indicators for Russia, 1992–2009 (I–6, I–7);


Course outline

1. Introduction to Econometrics


   Main statistical concepts and facts used in the course.

   Data bases. Software. Course materials presentation.

   Review (CD), L.1 (OZ)

2. Simple Linear Regression Model (SLR) with Non-stochastic Explanatory Variables. OLS estimation


   SLR model without intercept. OLS-estimation, properties and applications.

   Ch. 1, Ch. 2 (CD), Ch. 3, Ch. 6 (6.1, Appendix 6A.1) (Gu), L.2 (OZ)
3. Multiple Linear Regression Model (MLR): two explanatory variables and k explanatory variables


Multicollinearity. Its consequences, detection and remedial measures.

Estimation of production functions in volumes and growth rates’ forms as multiple regression models.

*Ch. 3 (CD), L.2,4 (O3), Ch. 3 (MKP)*

4. Variables Transformations in Regression Analysis


*Ch. 4 (CD), Ch. 6 (6.5-6.7) (Gu), L.4 (O3)*

5. Dummy Variables


Dummy variables in economic models: earnings functions, production functions. Dummy variables in seasonal adjustment.

*Ch. 5 (CD), Ch. 9 (Gu)*

6. Linear Regression Model Specification

Consequences of Incorrect Specification. Omitting significant explanatory variable. Including unnecessary explanatory variable in the model. Monte-Carlo method in econometric analysis: general principles, areas of application and examples. Proxy Variables.

Testing of linear constraints on parameters of MLR. $F$-test and $t$-tests. Role and examples of linear constraints in economic models.

Lagged Variables in economic models.

SLR model assumptions’ violation. General principles of consequences’ analysis, detection and correction. Generalised Least Squares (GLS).

*Ch. 6 (CD), Ch. 13 (13.3-13.4) (Gu)*

7. Heteroscedasticity

Concept, consequences and detection of heteroscedasticity. Goldfeld-Quandt, White, Spearman, Glejzer tests. Model Correction. Weighted Least Squares
(WLS) method as a special case of GLS. White’s heteroscedasticity-corrected standard errors.

Reasons and examples of heteroscedasticity in economic models.

Ch. 7 (CD), Ch. 11 (Gu)

8. Stochastic Explanatory Variables


Ch. 8 (CD), Ch. 13 (13.5–13.6) (Gu)

9. Simultaneous Equations Models

Concept of simultaneous equations model. Exogenous and endogenous variables. Predetermined variables.

The simultaneous equations bias. Inconsistency of OLS estimators. Structural and reduced forms of the model. Model of demand and supply and simple Keynesian equilibrium model as simultaneous equations models.


Ch. 9 (CD), Ch. 18–20 (Gu), L.6 (O3)

10. Maximum Likelihood Estimation

The idea of maximum likelihood estimamion (ML). SLR and MLR Models Estimation using ML. ML Estimators’ properties. Test statistics (z-statistics, pseudo- $R^2$, LR-statistic) and statistical tests.

Ch. 10 (10.6) (CD), Ch. 4 (4.4, Appendix 4A) (Gu)


Ch. 10 (CD), Ch. 15 (Gu)


Autoregressive Distributed Lag (ADL) model. Common factor test.


Causality in Economics: Granger test.

Ch. 11, Ch. 12 (12.6-12.8) (CD), Главы 17, 22 (Gu), L.5 (OЗ)

13. Autocorrelated disturbance term


Autocorrelated disturbance term in a model with lagged dependent variable as one of the explanatory variables. Durbin h-statistic and test.

Autoregressive Conditional Heteroscedasticity (ARCH) model.

Ch. 12 (12.1-12.5, CD), Ch. 12 (Gu), L.3 (OЗ)


Ch. 13 (CD), Ch. 21 (Gu)

15. Panel Data Models


Ch. 14 (CD), Ch. 13 (MKP). Ch. 16 (Gu)

Distribution of hours

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<td>Binary Choice Models, Limited Dependent Variable Models</td>
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