The International College of Economics and Finance

Lecturer: Oleg Zamkov
Class teachers: Vladimir Tcherniak, Dmitriy Malakhov, Nadezhda Kanygina, Alexey Kiselev, Anna Ivanova, Viktoria Silvestrova.

Course Pre-requisites.
Statistics, Mathematics for Economists, Introduction to Economics.

Course description:
The Elements of Econometrics is an introductory full year course for the 3-rd year ICEF students. The course is taught in English and finally examined by the University of London international programme, or by ICEF final exam.
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 the students to understand the principles of econometric theory development. The main attention is paid to the economic interpretations and applications of the econometric models. The first part of the course is devoted to the cross-section econometrics; the second part – to the time series and panel data econometrics.

Course Objectives
The students get in the course basic knowledge and skills of econometric analysis. They should be able to apply it to the investigation of economic relationships and processes, verification of economic theories and models, and also understand the econometric methods, approaches, ideas, results and conclusions met in the majority of economic books and articles. The students should understand essential differences between the time series and cross section data and those specific econometric problems met in the work with these types of data, as well as with panel data, and apply the appropriate econometric methods. The students should get the skills of construction and development of linear 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 sets with modern econometric software.

The Methods
The following methods and forms of study are used in the course:
- lectures (2 hours a week)
- classes (2 hours a week, conducted in the computer room, there are combined theoretical and applied analysis and practical applications of the econometric methods studied in the course)
- home assignments for each topic consisting of theoretical and applied parts
- the applied essay (Semester 2)
- teachers’ consultations
- self study, which can be conducted with the course materials and in a computer room, making home assignments using econometric software, work with economic data bases, with ICEF, UoL, and other course materials through the ICEF and UoL VLE information systems.

In total the course includes: 56 hours of lectures, 56 hours of classes.
Main Reading:

The Fifth or Fourth edition of textbook “Introduction to Econometrics” by Christopher Dougherty is the main textbook for the course (the main difference between the two editions is some notation). The University of London Study Guide (2), Examination papers and Examiners’ Reports are widely used in the course. Another (supplementary) recommended textbook is “Basic Econometrics” by D.N.Gujarati (3) containing some extra course information, derivations, tests, proofs and applications. Useful information for the course can be found in the “Introductory Econometrics” by J.M.Wooldridge (4). The books by Greene (6), Verbeek (8) and Kennedy (7) are recommended as supplementary reading: the first contains deeper presentation of course materials, the others – useful explanations and comments. The ICEF lecture notes (9) may be helpful for reference and topics revision.

The Virtual Learning Environment (VLE, The University of London, I-2), and the ICEF Information System (I-3) are the main information sources for course studies providing various materials (slides, videolectures, lecture notes, former exam papers, home assignments, etc).


Supplementary reading


Internet resources

2. http://my.london.ac.uk/ (I-2)

Software and data bases:

The main software used in the course is Econometric Views (version 10 and earlier ones). The 10 Student Lite version is available at I-4 for free. Network version of EViews 8 is available in ICEF computer classes. The students may also use other Econometric software for doing the assignments; the Data Sets in the UoL VLE (I-2) are available in EViews, Stata, and Gretl formats.
For making class and home assignments the following data bases are used: data prepared by Christopher Dougherty at the University of London (data for estimation of earnings functions based on NLSY survey at the USA; annual data on demand, disposable income and relative prices for aggregated goods and services in the USA - the data is available at I-1, I-2); Data for main macroeconomic indicators for Russia, 1992-2018 (I-5, I-6); Annual data for estimated GNP, labour and capital in USSR economy for 1928-1987; Data on ICEF students’ academic performance.

**Grade determination:**

The students sit two mid-term written exams in October and in March, first semester written exam in December, and University of London International programme exam (or ICEF final exam) in May. October and December exams include multiple choice and free response parts. March and May exams are free response (open questions) exams. The first semester grade is determined as follows: December exam grade gives 50% of the grade, October exam - 25%, and 25% is given for home assignments. In the final course grade the University of London (or ICEF final) exam grade gives 40%, the first semester grade gives 30%, and 30% is given for the second semester (20% - for March exam and 10% for home assignments). In the second semester the applied essay is set with the bonus points given equal to 2 regular home assignments. Additional bonus points can be set by the lecturer for class participation, contests, etc., but not more than 5 points out of 100 in total.

In 2018-2019, December exam and the University of London (or ICEF final) exam have a status of exam in the Curriculum with possible retakes, while October and March mid-term exams have a status of Control Paper (with no retakes).

**The Course Outline.**

1. **Introduction to Econometrics.**
   Main statistical concepts and facts used in the course.
   Data bases. Software. Course materials presentation.
   **Review (CD).**

2. **Simple Linear Regression Model (SLR) with Non-stochastic Explanatory Variables. OLS estimation.**
   SLR model without intercept. OLS-estimation, properties and applications.
3. **Multiple Linear Regression Model (MLR):** two explanatory variables and \( k \) explanatory variables.

Derivation and properties of OLS-estimators of MLR with two explanatory variables.

Determination coefficient \( R^2 \). Adjusted \( R^2 \). Testing hypotheses using \( t \)-tests and \( F \)-tests.

OLS-estimation of the model with \( k \) explanatory variables in vector-matrix form. Properties of coefficients’ estimators. \( F \)-test for groups of variables.

Multicollinearity. Its consequences, detection and remedial measures.

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

Making predictions using Multiple Linear Regression Model. Properties of predictors.

4. **Variables Transformations in Regression Analysis.**


Comparison of the quality of regression relationships: linear and semi-logarithmic functions. Box-Cox transformation.

Models with quadratic and interactive explanatory variables: estimation and interpretation.

5. **Dummy Variables.**


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

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 restrictions on parameters of MLR: single and multiple restrictions, \( F \)-tests and \( t \)-tests. Role and examples of linear restrictions in economic models.

Model reparametrisation: interpretation and examples. Short run and long run effects.

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

Chapter 6 (CD), Chapter 13 (13.3-13.4) (Gu).

Concept, consequences and detection of heteroscedasticity. Goldfeld-Quandt and White tests.
Model correction. Logarithmic regressions. Weighted Least Squares (WLS) method as a special case of GLS. White’s heteroscedasticity-consistent standard errors.
Reasons and examples of heteroscedasticity in economic models.
Chapter 7 (CD), Chapter 11 (Gu).

Measurement errors: reasons and consequences. Milton Friedman’s critique on consumption function estimation: Permanent income hypothesis.
Instrumental variables. Using instrumental variables in M.Friedman’s consumption model and in other economic models. Asymptotic properties of IV estimators.
Durbin-Wu-Hausman (DWH) test.
Chapter 8 (CD), Chapter 13 (13.5-13.6) (Gu).

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.
Testing exogeneity: Durbin-Wu-Hausman test.
Chapter 9 (CD), Chapters 18-20 (Gu).

The idea of maximum likelihood estimation (ML).
SLR and MLR Models Estimation using ML.
ML Estimators’ properties. Test statistics (z-statistics, pseudo- $R^2$, LR-statistic) and statistical tests.
Chapter 10 (10.6) (CD), Chapter 4 (4.4, Appendix 4A) (Gu)

Linear probability model: problems of estimation.

Distributed lag models: geometrically distributed lags, polynomial lags. Koyck transformation and estimation of geometrical lag’s parameters.
Autoregressive Distributed Lag (ADL) models. Interpretation and asymptotic properties.
Vector autoregression. VAR model.
Causality in Economics: Granger test.
Chapter 11, Chapter 12 (CD), Chapters 17, 22 (Gu).

AR(1) and ADL(1,0) models: Common factor test and model selection.
Autocorrelated disturbance term in a model with lagged dependent variable as one of the explanatory variables. Durbin h-statistic and test.
Chapter 12 (CD), Chapter 12 (Gu).

Cointegration. Fitting models with nonstationary time series. Detrending. Error Correction models.
Chapter 13 (CD), Chapter 21 (Gu).

15. Panel Data Models.
Fixed effect regressions. Within-groups regression models. First differences regression models.
Least squares dummy variables (LSDV) regression models.
Random effect regressions.
Fixed effects or random effects: Durbin-Wu-Hausman (DWH) test. Fixed effects or pooled regression: F-test.
Chapter 14 (CD), Chapters 13-14 (W), Chapter 16 (Gu).
### Distribution of hours for topics and types of work

<table>
<thead>
<tr>
<th>No</th>
<th>Topics titles</th>
<th>Contact hours</th>
<th>Lectures</th>
<th>Classes</th>
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<td>1.</td>
<td>Introduction to Econometrics.</td>
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<td>2</td>
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<td>2.</td>
<td>Simple Linear Regression Model (SLR) with Non-stochastic Explanatory Variables. OLS estimation.</td>
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<td>3.</td>
<td>Multiple Linear Regression Model (MLR): two explanatory variables and $k$ explanatory variables.</td>
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<td>4.</td>
<td>Variables Transformations in Regression Analysis.</td>
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<td>5.</td>
<td>Dummy Variables.</td>
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<td>6.</td>
<td>Linear Regression Model Specification.</td>
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<td>7.</td>
<td>Heteroscedasticity.</td>
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<td>8.</td>
<td>Stochastic Explanatory Variables. Measurement Errors. Instrumental Variables.</td>
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<td>9.</td>
<td>Simultaneous Equations Models.</td>
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<td>10.</td>
<td>Maximum Likelihood Estimation.</td>
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<td>11.</td>
<td>Binary Choice Models, Limited Dependent Variable Models.</td>
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<td>13.</td>
<td>Autocorrelated Disturbance Term</td>
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<td>Time Series Econometrics: Nonstationary Time Series.</td>
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<td>15.</td>
<td>Panel Data Models.</td>
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