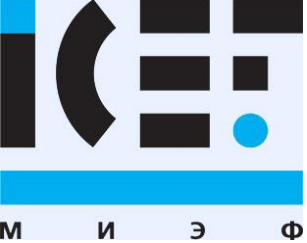


Elements of Econometrics. Lecture 1. Introduction.

ICEF, 2015-2016

The Subject of Econometrics

Econometrics is the application of statistical methods to the quantification and critical assessment of hypothetical economic relationships using data.

The Art of Econometrician: Finding the set of assumptions which are sufficiently specific and realistic in order to take the best possible advantage from the data available. (E.Malinvaud).

The Aims and Approaches of the Course

The aims of the course are:

- To develop an understanding of the use of regression analysis for quantifying economic relationships and testing economic theories.
- To equip for reading and evaluation of empirical papers in professional journals.
- To provide practical experience of using econometric software to fit economic models (Econometric Views will be used).

Methodology of Econometrics:

1. Statement of Theory or Hypothesis
2. Specification of Mathematical Model
3. Specification of Econometric Model
4. Obtaining the Data
5. Estimation of the Parameters
6. Hypothesis Testing
7. Forecasting or Prediction
8. Using the Model for Control or Policy Purposes

Economic Relationships and Models Considered in the Course

- Demand and Supply functions;
- Earnings functions;
- Production functions;
- Cost functions;
- Economic growth models;
- Educational attainment functions;
- Consumption functions;
- Investment functions;
- Macroeconomic equilibrium models;
- Academic success functions.

Econometric Analysis of ICEF Students UoL Exams Results

Elements of Econometrics, 2012-2014

The model specification for 2012:

EOE_UOL = 4.01 + 0.51 EOE_ICEF + 0.38 MACMIC_UOL + e
(1.01) (6.96) (4.09)

(t-statistics are in parentheses; R^2 = 0.76; 92 observations in the sample).

The model specification for 2013:

EOE_UOL = 7.79 + 0.44 EOE_ICEF + 0.56 MACMIC_UOL + e
(2.31) (7.16) (5.80)

(t-statistics are in parentheses; R^2 = 0.70; 132 observations in the sample).

The model specification for 2014:

EOE_UOL = 6.36 + 0.35 EOE_ICEF + 0.59 MACMIC_UOL + e
(1.51) (3.52) (5.68)

(t-statistics are in parentheses; R^2 = 0.61; 114 observations in the sample).

EOE_UOL – UoL exam grade in Econometrics,
EOE_ICEF – the average of ICEF Econometrics exams grades in October, December and March,
MACMIC_UOL – the average of UoL grades in Micro- and Macroeconomics.

The Questions on the Model to be answered in the Course

Is the model specification reliable? How to interpret it?

How to interpret the explanatory variables? Why and how do they influence the UoL grades?

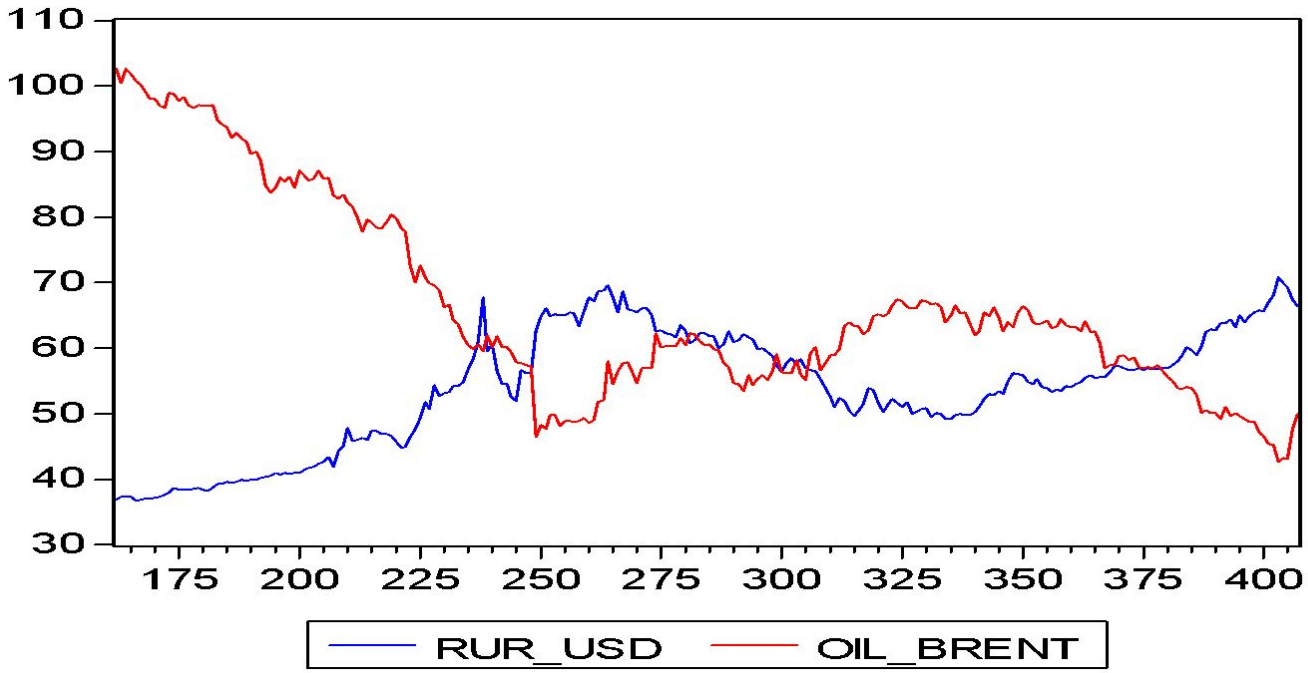
Does the model stay the same year by year? How to test this?

Are there other factors missing, which ones, and how does this influence the outcome?

Are there other links between the model variables? Does it influence the conclusions?

Can we use the model for predictions?

Time Series Example: Price of Oil (Brent) and RuR/USD Exchange Rate (01/09/14-31/08/15)



The relationship is available but there are questions to answer:

- Were there other factors to be included in the model?
- What was the time structure of the relationship (lags, trends, autocorrelations, etc)?
- Was the reaction the same or changed in time?
- Could the behaviour of the series in time (e.g. stationarity) influence the conclusions?

Reading

Main Textbook:

Dougherty, Christopher. Introduction to Econometrics. Oxford University Press, 2011, 2006 (4th or 3rd edition). Russian translation: Доугерти Кр. Введение в эконометрику. Изд.3. М., ИНФРА-М, 2009.

Student resources for the book (Data sets, slides, Study Guide): VLE

Additional Textbooks:

Gujarati D.N. Basic Econometrics.

Wooldridge J.M. Introductory Econometrics. A modern approach.

Study Guides:

Dougherty, Christopher. Elements of econometrics. Study Guide. University of London. 2014.

ICEF materials: Lecture Notes, Slides, Class Notes, Exam Materials (ICEF Information System).

Other reading: see the Course Syllabus, ICEF.

Main Electronic Resources:

ICEF Information System: **http://icef-info.hse.ru**

University of London site:
http://www.londoninternational.ac.uk/community/students
VLE Student Portal: **http://my.londonexternal.ac.uk/london/portal**
Course **EC2020 Elements of econometrics**

Oxford University Press: www.oup.com/uk/orc/bin/9780199567089

http://crow.academy.ru/econometrics - many useful materials

ICEF Computer Classes (desktops): «Хрестоматия по Эконометрике»

Statistical Glossary for Econometrics:

- **Descriptive statistics:** Mean, variance, standard deviation, covariance, correlation
- **Random variables, Probability distributions:** Discrete and Continuous, Uniform, Normal, t-, F-, χ^2 - distributions. Expected value, population variance and covariance. Independence.
- **Sampling :** Population, sample. Sample selection.
- **Estimation:** Estimator, estimate. Unbiasedness (expected value), consistency (probability limit), efficiency. Central limit theorem.
- **Statistical Inference:** Hypothesis testing. Significance tests, significance levels. Power of a test, Type I and Type II errors. t-tests, F-tests. Confidence intervals. P-values. One-sided and two-sided tests.
- **Data types:** Cross-section, time series, panel.
- **Rules:** variance, covariance and probability limit rules.

Example: Plim rules

- ***Plim rule 1*** $\text{plim}\,(X + Y) = \text{plim}\,X + \text{plim}\,Y$
- ***Plim rule 2*** $\text{plim}\,bX = b\,\text{plim}\,X$
- ***Plim rule 3*** if b is a constant, $\text{plim}\,b = b$
- ***Plim rule 4*** $\text{plim}\,Z = (\text{plim}\,X)(\text{plim}\,Y)$
- ***Plim rule 5*** $$\text{plim}\,Z = \frac{\text{plim}\,X}{\text{plim}\,Y}$$
- ***Plim rule 6*** $\text{plim}\,f(X) = f(\text{plim}\,X)$

Notation in the course (examples)

Greek letters – true values, latin (or greek with hats) - estimators

var(X) = σ_x^2 – population variance of X

Var(X)= $\frac{1}{n}\sum_{i=1}^{n}\left(X_i - \overline{X}\right)^2$ - sample variance

$S_x^2 = \frac{1}{n-1}\sum_{i=1}^{n}\left(X_i - \overline{X}\right)^2$ - unbiased estimator of population variance

Types of Data and of Regression Model

Data: cross-sections, time series, panel data.

Model A: cross-sectional data with **nonstochastic regressors**. Their values in the observations are fixed and do not have random components.

Model B: cross-sectional data with **stochastic regressors.** The regressors' values are drawn randomly and independently from defined populations.

Model C: time series data. The regressors' values may exhibit persistence over time

Regressions with **panel data** will be treated as an extension of **Model B**.

Some issues which are important in applied analysis

- ***Correct specification (functional form, regressors availability)***
- ***Endogeneity***
- ***Sample selection***
- ***Sample size***
- ***Multicollinearity***
- ***Nonstationary Time Series***
- ***Unobserved Heterogeneity***

Types of Relationships in the Course

- Linear relationships $$Y = \beta_1 + \beta_2 \cdot X_2 + \ldots + \beta_m \cdot X_m + u$$
- Non-linear relationships $$Y = f(X) + u$$
- Semi-logarithmic relationships $$\left.\begin{aligned} Y &= \beta_1 + \beta_2 \cdot \log X_2 + u \\ \log Y &= \beta_1 + \beta_2 \cdot X_2 + u \end{aligned}\right\}$$
- Double-logarithmic relationship $$\log Y = \beta_1 + \beta_2 \cdot \log X_2 + u$$
- Polynomial relationship $$Y = \beta_1 + \beta_2 \cdot X_2^{k_2} + \ldots + \beta_m \cdot X_m^{k_m} + u$$
- Inverse Relationship $$Y = \beta_1 + \beta_2 \cdot \left(\frac{1}{X_2}\right) + u$$