

National Research University Higher School of Economics
The International College of Economics and Finance
Syllabus

ECONOMETRICS
2019-2020

Lecturers: Sofya Budanova (sbudanova@hse.ru), Anatoly Peresetsky (aperesetsky@hse.ru), and Fabian Slonimczyk (fslonimczyk@hse.ru)

Course Pre-requisites:

Calculus, Probability Theory and Statistics at an intermediate level. Completion of Mathematics for Economics and Finance course is required.

Successful completion of Econometrics I & II will allow students to take the Financial Econometrics class.

Course description:

Econometrics I & II are two semester-long courses designed for master's students at ICEF. Formally, they are considered a single entity.

The main objectives of Econometrics I are to introduce students to basic econometric techniques and to prepare them to do their own applied work. Students are encouraged to think of the course as a preparation toward their thesis research project. The course is taught in English.

The purpose of the course is not only to develop new skills in econometric tools and their application to contemporary economic problems, especially in financial economics, but also to study theoretically econometric methods and to review some sections of econometrics on a solid theoretical background. In the first module of the semester, we cover fundamental topics in time series analysis, such as ARMA models, non-stationary time-series, Brownian motion and unit root tests, cointegration, VAR and VECM. During the second module students study binary choice models (logit, probit, tobit, Heckman) and basic concepts of panel data analysis (pooled regression, fixed and random effects, dynamic panel models, binary choice panel data). All topics are accompanied with real data examples in R, Stata, EViews, and JMulTi. The course is taught in English.

Learning Objectives and Learning Outcomes

During the course students will be introduced to modern approaches in analysing economic and financial data. Upon completion of the course students should be:

- familiar with the basic tools available to economists for testing theories, estimating the parameters of economic relationships in financial markets and forecasting financial and macroeconomic variables;
- able to read, interpret and replicate the results of published papers in economics and finance using standard computer packages and real-world data.

By the end of the course the students should develop the following competencies:

- ability to reflect (evaluate and process) the mastered scientific methods and ways of activity;

- ability to carry out applied and/or fundamental research, using advanced methods of economic analysis, including instrumental;
- ability to use modern information technologies and software in professional activities;
- ability to forecast the main socio-economic indicators of the enterprise, industry, region and the economy as a whole;
- ability to analyse models with discrete dependent variable;
- ability to construct and evaluate models that use panel and time series data.

Methods of Instruction

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

- lectures (2 hours per week) and practice classes (2 hours per week);
- practice in computer labs;
- self-study in computer labs (doing home assignments using econometric software, working with economic data, doing research on the web);
- self-study with literature.

In total, there are 32 hours of lectures and 32 hours of classes. Self-study and home assignments are essential for successful completion of the course.

Essential Reading and Course Materials:

- Econometrics I

Main Readings:

1. Wooldridge J. M. Introductory Econometrics: A Modern Approach. South-Western College Publishing, 2000. (WOO)
2. Johnston J. and DiNardo, J. Econometric Methods. 4th Ed. McGraw-Hill 1997. (JD)
3. Angrist, J. and Pischke, J. Mostly Harmless Econometrics: An Empiricist's Companion. Princeton Univ Press, 2009. (AP)

Additional Readings:

1. Wooldridge J. M. Econometric Analysis of Cross Section and Panel Data. The MIT Press, 2002.
2. Cameron, C.A. and Trivedi, P.K. Microeconometrics: methods and applications. Cambridge U.P., 2005. (CT)
3. Cameron, C.A. and Trivedi, P.K. Microeconometrics Using STATA. STATA Press, 2009.
4. Ruud P.A. An Introduction to Classical Econometric Theory. Oxford U.P., 2000.
5. Greene, W.H. Econometric Analysis. 6th Ed. Prentice-Hall, 2008.
6. Morgan, S.L. and Winship, C. Counterfactuals and Causal Inference: Methods and Principles for Social Research. Cambridge U.P., 2007.
7. Kennedy, P. A Guide to Econometrics. The MIT Press, 2003.

- Econometrics II

Main reading:

1. Johnston J. and J. DiNardo. Econometric Methods. Fourth edition. The McGraw Hill Companies, 2007. (JD)
2. Verbeek, M. A Guide to Modern Econometrics. 2nd ed. Wiley. 2005. (V)

3. Hamilton, J. D. Time Series Analysis. Princeton University Press. 1994 (H)
4. Magnus J., P. Katyshev, and A. Peresetsky. Econometrics: Introductory Course. In Russian. Eight Edition, 2007. (MKP)

Additional reading:

1. Enders, W. Applied econometric time series, Wiley. 2003 (E)
2. Tsay, R. S. Analysis of Financial Time Series. 2002 (T)
3. Wooldridge, J. M. Econometric Analysis of Cross-Section and Panel Data. MIT Press, 2002 (W)
4. Cameron, A. C., and Trivedi, P. K. Microeconometrics. Methods and Applications. Cambridge University Press, 2005.
5. Lütkepohl, H.. New Introduction to Multiple Time Series Analysis. Springer. 2005.

In addition, specific journal articles and useful internet links for particular topics will be distributed in class.

Special Equipment and Software:

Software: The software used in the course includes R, Stata, and JMulti. The students may use other statistical software for solving the problem sets in the first part of the course (EViews, Python, etc.).

Equipment: computer, projector, Internet connection, white board.

Grading System and Examination Type:

- **Econometrics I**

There will be the following forms of evaluation:

1. Homework Assignments
2. Midterm test (80 minutes)
3. Written final exam (120 minutes)

Grade determination:

This course includes a control work and one written final exam. The main form of evaluation is the final exam at the end of the semester, which contributes 55% of the final grade. However, according to university regulations passing the final exam is necessary in order to get a passing mark for the course. The final grade is also partly determined by the midterm test (29%), and the home assignments (16%).

The formula for the final grade for the course G is the following:

$$G = 0.16 * G_{ha} + 0.29 * G_{midterm} + 0.55 * G_{exam}$$

- **Econometrics II**

The course grade consists of the grades for the problem sets in both parts of the course, the midterm test and the final exam. The midterm test covers the material of the first part of the course, while the final covers the material of the whole course. A hand-written two-sided A4 sheet with notes is allowed at the midterm and the final. Sample materials for knowledge assessment are available in ICEF Information system at <https://icef-info.hse.ru>.

The formula for the final grade for the course G is the following:

$$G = 0.1 \cdot G_{PS1} + 0.1 \cdot G_{PS2} + 0.2 \cdot G_{midterm} + 0.6 \cdot \left(\frac{1}{3} \cdot G_{final1} + \frac{2}{3} \cdot G_{final2} \right),$$

where G_{PS1} is the average grade for the problem sets of the first part of the course, where G_{PS2} is the average grade for the problem sets of the second part of the course, $G_{midterm}$ is the grade for the midterm test, G_{final1} is the grade for the first part of the final exam, and G_{final2} is the grade for the second part of the final exam.

Each part contributes weights 50% of the final grade,

$$G_{overall} = 0.5 \cdot G_{partI} + 0.5 \cdot G_{partII}$$

All grades are given initially out of 100 points. The final grades are also converted to 10- and 5-points grades. The conversion scale can be found in the [ICEF grading regulation](#). Note that according to these regulations, a passing total grade can be assigned only if the student receives a passing grade for the final exam.

Information on how the retakes are organized, and how the final grade is determined in case of a retake or a missed midterm can be found in the regulations as well ([HSE Interim and Ongoing Assessment Regulations](#) (incl. Annex 8 for ICEF), [ICEF grading regulation](#)).

Course Plan

- Econometrics I

1. **Introduction to Econometrics.** The FAQs of economics research. Causal Relationships. Experiments and Quasi-experiments. Identification and Statistical Inference. The Selection Problem. Cross Section and Longitudinal Data.
AP, Chapters 1-2. WOO, Chapter 1. JD, Chapter 1.

2. **The Simple Regression Model.** Derivation of OLS estimates. Mechanics and Properties. Units of measurement and functional form. Unbiasedness and efficiency.
WOO, Chapter 2. JD, Chapter 2.

3. **Multi-variate Regression Analysis.** Motivation: multiple sources of variation. Mechanics and interpretation of OLS. The "partialling out" interpretation and linear projections. Unbiasedness and efficiency: the Gauss-Markov Theorem.
AP, Chapter 3. WOO, Chapter 3. JD, Chapter 3.

4. **Inference in the Multi-variate Regression Model.** Sampling distributions of the OLS estimators. Testing Hypothesis. Confidence Intervals.
WOO, Chapter 4. JD, Chapter 4.

5. **Asymptotic Properties of OLS.** Consistency, asymptotic normality and asymptotic efficiency. The LM test. Sources of endogeneity: omitted variables, measurement error, simultaneity.
WOO, Chapter 5.

6. **Further Issues in OLS estimation.** Data scaling and beta scores. Quadratic and interaction terms. Prediction. Dummy Variables. Proxy variables. Missing data and outliers.

WOO, Chapters 6, 7 and 9.

7. **Heteroscedasticity.** Consequences for OLS. Heteroscedasticity-robust inference. Breusch-Pagan and White tests. WLS and FGLS.

WOO, Chapter 8. JD, Chapter 6.

8. **Instrumental Variables and 2SLS.** Instruments as a solution to endogeneity. Reduced form equations. Exclusion restrictions. Rank condition. Two-stage least squares and GMM.

Consistency and other asymptotic properties. Potential pitfalls. Local Average Treatment Effects.

AP, Chapter 4. WOO, Chapter 15. JD, Chapter 5. Angrist, J. and V. Lavy (1999), "Using

Maimonides' Rule to Estimate the Effect of Class Size on Scholastic Achievement," *The*

Quarterly Journal of Economics 114, 533-575. Levitt, S.D. (1996), "The Effect of Prison

Population Size on Crime Rates: Evidence from Prison Overcrowding Litigation," *The Quarterly*

Journal of Economics 111(2), 319-351.

9. **Maximum Likelihood.** ML Estimators. Likelihood ratio, Wald and LM tests. GLS and 2SLS as ML estimators.

JD, Chapter 5.

- Econometrics II

Part 1: Time series analysis

1. **Review of main characteristics of time series** Time series basics. Main characteristics of time series. Autocorrelation and partial autocorrelation. ARMA models: estimation and forecasting. *Readings: H (3, 4), JD (1.1, 2.4, 3.2, 7.1, 7.2), V (8.1), T (1.2, 2.2, 2.3, 2.4, 2.5), E (1.1, 2.5, 2.6, 2.7)*

2. **Nonstationary time series. Spurious regressions** Stationarity and nonstationarity. Random walks. Difference-stationarity and trend-stationarity. Spurious regressions.

Readings: JD (2.5), V (8.3), T (2.7), E(2.3)

3. **Unit roots and tests for stationarity. Structural breaks. ARIMA models. Forecasting** Brownian motion. Testing for stationarity. (Augmented) Dickey-Fuller tests. Other tests of nonstationarity. Parameter instability and structural changes. Testing for structural change. Structural changes and unit roots. ARIMA models. Long memory processes. Forecasting.

Readings: H (17, 4), JD (7.3), V (8.3, 8.4), E (4.3-4.7, 4.9, 4.10), T (2.7, 2.10), "The Great Crash, The Oil Price Shock, And The Unit Root Hypothesis" by P. Perron in Econometrica 57(6).

4. **Vector autoregressive models.** Vector autoregressions. Granger causality. Cointegration. Johansen test on cointegration. Vector error correction models.

Readings: H (11, 19), V (9.1, 9.2, 9.3, 9.4, 9.5), E (5.5, 5.6, 6.1-6.9), T (8.1, 8.2, 8.5, 8.6)

Part 2: Selected topics in Econometrics

1. **Static and dynamic panel data.** Notion of panel data, pooled regression, fixed and random effects, “within” estimator, random effect estimator, “between” estimator, specification tests. Dynamic panel data. Arellano-Bond estimator.
Readings: V (Ch. 10), MKP (Ch. 13)
2. **Discrete choice models.** Modeling multiple and ordered response data, log-Weibull distribution and its application, conditional logit, independence of irrelevant alternatives. Properties of binary data, problems with linear regression, logit, probit, goodness of fit. Censored and truncated observations, Tobit. Sample selection problem, Heckman.
Readings: V (Ch. 10), MKP (Ch. 12)
3. **Discrete choice models in panel data.** Binary models with fixed and random effects, Tobit, discrete dynamic models with panel data, incomplete panel.
Readings: V (Ch. 7), MKP (Ch. 13)
4. **Optional topics.** Could be chosen from the set of topics: quantile regression, nonparametric discrete choice models, stochastic frontier models.

	Topic	Total Hours	Contact hours		Self-study
			Lectures	Seminars	
	Econometrics I				
1	Introduction	11	1	4	6
2	Simple Regression	22	2	8	12
3	Multivariate Regression	22	2	8	12
4	Inference	22	2	8	12
5	Asymptotic Properties	11	1	4	6
6	Further Issues	11	1	4	6
7	Heteroscedasticity	11	1	4	6
8	Instrumental Variables	22	2	8	12
9	Maximum Likelihood	11	1	4	6
	Total	143	13	52	78
	Econometrics II				
1	Time series: review	19	3	3	13
2	Nonstationary time series	30	5	5	20
3	ARIMA models	26	4	4	18
4	Vector autoregression models	20	4	4	12
5	Static and dynamic panel data	28	4	4	20
6	Discrete choice models	32	5	5	22
7	Discrete choice models in panel data	21	3	3	15
8	Optional topics	14	4	4	6
	Total	190	32	32	126