

**Санкт-Петербургский филиал федерального государственного
автономного образовательного учреждения высшего профессионального
образования «Национальный исследовательский университет
«Высшая школа экономики»**

Факультет Санкт-Петербургская школа экономики и менеджмента
Департамент экономики

Рабочая программа дисциплины
Эконометрика (продвинутый уровень)
(читается на английском языке)

для образовательной программы «Прикладная экономика и математические методы»
направления подготовки 38.04.01 «Экономика»
уровень магистратура

для образовательной программы «Финансы»
направления подготовки 38.04.08 «Финансы и кредит»
уровень магистратура

Разработчик программы:
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Согласована начальником ОСУП
« ____ » _____ 2019 г.
М.А.Неклюдова _____

Академический руководитель ОП «Прикладная экономика и математические методы»
Ф.А.Ущев _____

Академический руководитель ОП «Финансы»
Е.М. Рогова _____

Санкт-Петербург, 2019

*Настоящая программа не может быть использована другими подразделениями
университета и другими вузами без разрешения кафедры-разработчика программы.*

Course Syllabus

Title of the course	Advanced Econometrics		
Title of the Academic Programme	Master's programs "Applied economics and mathematical methods" and "Finance"		
Type of the course	Obligatory		
Prerequisites	Students' knowledge of the foundations of statistics and econometrics is a key prerequisite for the successful completion of the course.		
ECTS workload	6		
Total indicative study hours	Directed Study	Self-directed study	Total
	46	182	228
Course Overview	<p>The course is designed for first-year graduate (Master) students following the programs "Finance" and "Applied Economics and Mathematical Methods". Its main goal is to familiarize the students with advanced methods of econometric research in economics and finance. In particular, the course accentuates the problem of endogeneity and the ways to address it in the analysis of cross-sectional and panel data. The course is of applied nature: The material is presented, whenever possible, in a non-technical way, examples of empirical studies published in leading international economics and finance journals are discussed, and the lectures are supplemented by exercises in the computer lab.</p> <p>The topics covered include: A review of the classical linear regression model; Causes and consequences of endogeneity; Instrumental variables methods; Key panel data techniques; Difference-in-difference estimation techniques; An overview of the matching models and regression discontinuity designs. Computer exercises using the statistical software package "Stata" are an integral part of the course, which ensures that the students get hands-on experience of analyzing real world data.</p>		
Intended Learning Outcomes (ILO)	<ul style="list-style-type: none"> • Know key methods of econometric research, understand the causes and consequences of endogeneity, know the main methods for addressing this problem, • Understand endogeneity as a key issue affecting causal inference; be able to critically examine existing research from this angle, • Be able to apply the methods learnt when conducting own empirical analysis, • Be familiar with and be able to use key capabilities of the statistical package "Stata", including its programming options (the so-called do-files), • Understand the limits of interpreting regression results in most settings (the ceteris paribus clause). 		
Teaching and Learning Methods	The course consists of lectures (26 hours) and computer labs (20 hours). The main teaching and learning methods include lectures, reading, exercises in the computer lab and an empirical project.		

Content and Structure of the Course											
№	Topic / Course Chapter	Total	Directed Study		Self-directed Study						
			Lectures	Tutorials							
1	Overview of the classical linear regression model	45	8	2	35						
2	Introduction to econometric package Stata	26	0	6	20						
3	Endogeneity. Instrumental variables methods	31	4	2	25						
4	Analysis of panel (longitudinal) data	54	6	6	42						
5	Estimation of treatment effects. The difference-in-difference estimator	36	4	2	30						
6	Propensity score matching and regression discontinuity models	36	4	2	30						
Total study hours		228	26	20	182						
Indicative Assessment Methods and Strategy		<p>Students' progress is monitored during the course by four home assignments (two problem sets, one computer exercise in Stata and one empirical project).</p> <p>The assignments will be distributed in class and will be due in approximately two weeks. Homework assignments (only paper versions!) are to be handed in before class on the day they are due. No late homework will be accepted. The weights of the four homeworks in the final grade are 6%, 6%, 6% and 12% for homeworks 1, 2, 3 and 4, respectively.</p> <p>After the first seven classes, there is a closed book, closed notes mid-term written test that accounts for 20% of the final grade.</p> <p>At the end of the course there is a final exam, which is a closed book, closed notes test to be held in the classroom. The duration of the final exam is two academic hours. It accounts for 50% to the final grade.</p> <p>The final grade consists of the following elements:</p> <table style="margin-left: 40px;"> <tr> <td>Four home assignments</td> <td>30% of the final grade</td> </tr> <tr> <td>Mid-term test</td> <td>20% of the final grade</td> </tr> <tr> <td>Final exam</td> <td>50% of the final grade</td> </tr> </table> <p>In order to pass the course, students should get a passing mark (at least 4 out of 10) at the final exam. Failure at the final exam implies failure at the whole course regardless of the performance during the course.</p>				Four home assignments	30% of the final grade	Mid-term test	20% of the final grade	Final exam	50% of the final grade
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Mid-term test	20% of the final grade										
Final exam	50% of the final grade										
Readings / Indicative Learning Resources		<p><u>Mandatory</u></p> <ul style="list-style-type: none"> • Wooldridge, J.M. Introductory econometrics: a modern approach / J.M. Wooldridge. – 6th ed. – Boston : Cengage Learning, 2016. – 789 p. – На англ. яз. - ISBN 978-1-3052-7010-7 • Cerulli, Giovanni (2015) Econometric evaluation of socio- 									

	<p>economic programs. Advanced Studies in Theoretical and Applied Econometrics Series, 49, Springer (available online from the campus via Springer).</p> <ul style="list-style-type: none"> • Stata Manual (2015). Stata Corporation. (available online at https://www.stata-press.com/manuals/documentation-set/) <p><u>Optional</u></p> <ul style="list-style-type: none"> • Atanasov, Vladimir A. and Black, Bernard S. (2015) Shock-based Causal Inference in Corporate Finance and Accounting Research. Critical Finance Review, 11-08. (available on the journal's web-site: http://cfr.ivo-welch.info/readers/pub/cfr-0036.pdf). • Hansen, Bruce E. (2017) Econometrics (Draft available online at https://www.ssc.wisc.edu/~bhansen/econometrics/Econometrics.pdf). • Roberts, Michael R. and Whited, Toni M. (2013) Endogeneity in Empirical Corporate Finance, In: George M. Constantinides, Milton Harris and Rene M. Stulz, Editor(s), Handbook of the Economics of Finance, Elsevier, Volume 2, Part A, Pages 493-572 (available online from the campus via ScienceDirect). 																										
Indicative Self- Study Strategies	<table border="1"> <thead> <tr> <th data-bbox="529 909 1139 965">Type</th> <th data-bbox="1139 909 1291 965">+/-</th> <th data-bbox="1291 909 1461 965">Hours</th> </tr> </thead> <tbody> <tr> <td data-bbox="529 965 1139 1055">Reading for seminars / tutorials (lecture materials, mandatory and optional resources)</td> <td data-bbox="1139 965 1291 1055">+</td> <td data-bbox="1291 965 1461 1055">70</td> </tr> <tr> <td data-bbox="529 1055 1139 1106">Assignments for seminars / tutorials / labs</td> <td data-bbox="1139 1055 1291 1106">+</td> <td data-bbox="1291 1055 1461 1106">40</td> </tr> <tr> <td data-bbox="529 1106 1139 1196">E-learning / distance learning (MOOC / LMS)</td> <td data-bbox="1139 1106 1291 1196">-</td> <td data-bbox="1291 1106 1461 1196">0</td> </tr> <tr> <td data-bbox="529 1196 1139 1247">Fieldwork</td> <td data-bbox="1139 1196 1291 1247">-</td> <td data-bbox="1291 1196 1461 1247">0</td> </tr> <tr> <td data-bbox="529 1247 1139 1299">Project work</td> <td data-bbox="1139 1247 1291 1299">+</td> <td data-bbox="1291 1247 1461 1299">50</td> </tr> <tr> <td data-bbox="529 1299 1139 1350">Other (please specify)</td> <td data-bbox="1139 1299 1291 1350">-</td> <td data-bbox="1291 1299 1461 1350">0</td> </tr> <tr> <td data-bbox="529 1350 1139 1411">Preparation for the exam</td> <td data-bbox="1139 1350 1291 1411">+</td> <td data-bbox="1291 1350 1461 1411">22</td> </tr> </tbody> </table>	Type	+/-	Hours	Reading for seminars / tutorials (lecture materials, mandatory and optional resources)	+	70	Assignments for seminars / tutorials / labs	+	40	E-learning / distance learning (MOOC / LMS)	-	0	Fieldwork	-	0	Project work	+	50	Other (please specify)	-	0	Preparation for the exam	+	22		
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Reading for seminars / tutorials (lecture materials, mandatory and optional resources)	+	70																									
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Fieldwork	-	0																									
Project work	+	50																									
Other (please specify)	-	0																									
Preparation for the exam	+	22																									
Academic Support for the Course	Academic support for the course is provided via LMS, where students can find: guidelines and recommendations for doing the course; guidelines and recommendations for self-study; samples of assessment materials.																										
Facilities, Equipment and Software	Stata 14.0/15.0																										
Course Instructor	Alexander A. Muravyev, PhD, Associate Professor of the Department of Economics.																										

Intended Learning Outcomes (ILO) Delivering

Programme ILO(s)	Course ILO(s)	Teaching and Learning Methods for delivering ILO(s)	Indicative Assessment Methods of Delivered ILO(s)
LO2 Demonstrate deep knowledge and critical understanding of theories, principles, concepts and methodologies in finance	Know key methods of econometric research, understand the causes and consequences of endogeneity, know the main methods for addressing this problem.	Lectures Reading Exercises in the computer lab	Problems sets Empirical project Test Exam
LO3 Use strong analytical skills and apply them to solve practical problems	Be able to apply the methods learnt when conducting own empirical analysis.	Lectures Reading Exercises in the computer lab Empirical project	Problems sets Empirical project
LO4 Examine and critically appraise research methods and tools relevant for research in economics and finance	Understand endogeneity as a key issue affecting causal inference; be able to critically examine existing research from this angle.	Reading Empirical project	Empirical project
LO9 Demonstrate a range of generic skills including information and time management, team and project work, computing and autonomous learning, digital skills	Be familiar with and be able to use key capabilities of the statistical package “Stata”, including its programming options (the so-called do-files).	Exercises in the computer lab Empirical project	Computer exercise in Stata Empirical project
LO10 Demonstrate an innovative, open and ethical mindset	Understand the limits of interpreting regression results in most settings (the ceteris paribus clause).	Empirical project	Test Exam Empirical project

Annex 1

Course Content

<p>Lecture 1. Overview of the classical linear regression model CLRM (8 hours). L1.1. The classical linear regression model. OLS estimation. L1.2. Inference in the CLRM. L1.3. OLS asymptotics. L1.4. Specification and data issues. Reading: Wooldridge (2016), chapters 3-7; Hansen (2017), chapter 4, 7; Lecture notes.</p>
<p>Computer lab 1. Introduction to econometric package Stata (6 hours). CL1.1. Basic capabilities of Stata. Basic commands. Do and log files. CL1.2. The grammar of Stata. CL1.3. Creating and changing variables in Stata. Reading: Stata manual (2015); Lecture notes.</p>
<p>Computer lab 2. CLRM in Stata (2 hours). CL2.1. Key commands of regression analysis. Hypothesis testing and model diagnostics. Reading: Stata manual (2015); Lecture notes.</p>
<p>Lecture 2. Endogeneity. Instrumental variables methods (4 hours). L2.1. Mains sources of endogeneity: omitted variables, reversed causality, measurement error. L2.2. The IV method. Tests for instrument validity. The problem of weak instruments. Limitations of the IV methods. Reading: Wooldridge (2016), chapter 9; Hansen (2017), chapter 11.</p>
<p>Computer lab 3. Instrumental variables (IV) methods (2 hours). CL3.1. Commands of the IV methods. Diagnostic tests. Reading: Stata manual (2015); Lecture notes.</p>
<p>Lecture 3. Analysis of panel (longitudinal) data (6 hours). L3.1. Examples of panel data. L3.2. Fixed and random effects models. L3.3. Model diagnostics (the Hausman test, etc.). L3.4. Two-way fixed effects models. L3.5. Endogenous explanatory variables. L3.6. The Hausman-Taylor model. L3.7. Dynamic panel data models. Reading: Wooldridge (2016), chapters 13-14.</p>
<p>Computer lab 4. Analysis of panel (longitudinal) data (6 hours). CL4.1. Fixed- and random-effects models in Stata. CL4.2. Model diagnostic (the Hausman test, etc.).</p>

CL4.3. The Hausman-Taylor model.
CL4.4. Dynamic panel data models.
Reading:
Stata manual (2015); Lecture notes.

Lecture 4. Estimation of treatment effects. The difference-in-difference estimator DiD (4 hours).

L4.1. Statistical setup. Selection on observables and selection on unobservables. Characterizing selection bias.
L4.2. The difference estimators and the DiD.
L4.3. Testing the key assumption of the DiD.
Reading: Cerulli (2015), chapter 1, 3.4; Roberts and Whited (2013), chapter 4 (стр. 520-531).

Computer lab5. The difference-in-difference estimator (2 hours).

CL5.1. Applying the DiD estimator using Stata.
Reading:
Cerulli (2015), chapter 3.6; Stata manual (2015); Lecture notes.

Lecture 5. Propensity score matching models. Regression discontinuity models (4 hours).

5.1. Matching models. Treatment effects and necessary identifying assumptions. Propensity score matching.
5.2. Regression discontinuity (RD) models. Sharp and fuzzy regression discontinuity designs. Identification of treatment effects in the sharp RD.
Reading:
Cerulli (2015), chapter 2.3 and 4.3; Roberts and Whited (2013), chapters 5 (pp. 531-549) and 6 (pp. 549-557).

Computer lab 6. Overview of the matching and regression discontinuity models (2 hours).

CL6.1. Estimation of matching models in Stata
CL6.2. Estimation of regression discontinuity models in Stata
Reading:
Cerulli (2015), chapters 2.7 and 4.4.2; Stata manual (2015); Lecture notes.

Assessment Methods and Criteria

Assessment Methods

Types of Assessment	Forms of Assessment	Modules			
		1	2	3	4
Formative Assessment	Test		*		
	Essay				
	Report/Presentation				
	Project			*	
	In-class Participation				
	Other – problem sets		*		
Interim Assessment (if required)	Assignment (e.g. written assignment)				
Summative Assessment	Exam			*	

Assessment Criteria

In-class Participation

Grades	Assessment Criteria
«Excellent» (8-10)	A critical analysis which demonstrates original thinking and shows strong evidence of preparatory research and broad background knowledge.
«Good» (6-7)	Shows strong evidence of preparatory research and broad background knowledge. Excellent oral expression.
«Satisfactory» (4-5)	Satisfactory overall, showing a fair knowledge of the topic, a reasonable standard of expression. Some hesitation in answering follow-up questions and/or gives incomplete or partly irrelevant answers.
«Fail» (0-3)	Limited evidence of relevant knowledge and an attempt to address the topic. Unable to offer relevant information or opinion in answer to follow-up questions.

Project Work

Grades	Assessment Criteria
«Excellent» (8-10)	A well-structured, analytical presentation of project work. Shows strong evidence and broad background knowledge. In a group presentation all members contribute equally and each contribution builds on the previous one clearly; Answers to follow-up questions reveal a good range and depth of knowledge beyond that covered in the presentation and show confidence in discussion.
«Good» (6-7)	Clearly organized analysis, showing evidence of a good overall knowledge of the topic. The presenter of the project work highlights key points and responds to follow up questions appropriately. In group presentations there is evidence that the group has met to discuss the topic and is presenting the results of that discussion, in an order previously agreed.
«Satisfactory» (4-5)	Takes a very basic approach to the topic, using broadly appropriate material but lacking focus. The presentation of project work is largely unstructured, and some points are irrelevant to the topic. Knowledge of the topic is limited and there may be evidence of basic misunderstanding. In a group presentation, most of the work is done by one or two students and the individual contributions do not add up.
«Fail» (0-3)	Fails to demonstrate any appropriate knowledge.

Written Assignments (Essay, Test/Quiz, Written Exam, etc.)

Grades	Assessment Criteria
«Excellent» (8-10)	Has a clear argument, which addresses the topic and responds effectively to all aspects of the task. Fully satisfies all the requirements of the task; rare minor errors occur;

«Good» (6-7)	Responds to most aspects of the topic with a clear, explicit argument. Covers the requirements of the task; may produce occasional errors.
«Satisfactory» (4-5)	Generally addresses the task; the format may be inappropriate in places; display little evidence of (depending on the assignment): independent thought and critical judgement include a partial superficial coverage of the key issues, lack critical analysis, may make frequent errors.
«Fail» (0-3)	Fails to demonstrate any appropriate knowledge.

Recommendations for students about organization of self-study

Self-study is organized in order to:

- Systemize theoretical knowledge received at lectures;
- Extending theoretical knowledge;
- Learn how to use legal, regulatory, referential information and professional literature;
- Development of cognitive and soft skills: creativity and self-sufficiency;
- Enhancing critical thinking and personal development skills;
- Development of research skills;
- Obtaining skills of efficient independent professional activities.

Self-study, which is not included into a course syllabus, but aimed at extending knowledge about the subject, is up to the student's own initiative. A teacher recommends relevant resources for self-study, defines relevant methods for self-study and demonstrates students' past experiences. Tasks for self-study and its content can vary depending on individual characteristics of a student. Self-study can be arranged individually or in groups both offline and online depending on the objectives, topics and difficulty degree. Assessment of self-study is made in the framework of teaching load for seminars or tests.

Special conditions for organization of learning process for students with special needs

The following types of comprehension of learning information (including e-learning and distance learning) can be offered to students with disabilities (by their written request) in accordance with their individual psychophysical characteristics:

- 1) *for persons with vision disorders*: a printed text in enlarged font; an electronic document; audios (transferring of learning materials into the audio); an individual advising with an assistance of a sign language interpreter; individual assignments and advising.
- 2) *for persons with hearing disorders*: a printed text; an electronic document; video materials with subtitles; an individual advising with an assistance of a sign language interpreter; individual assignments and advising.
- 3) *for persons with muscle-skeleton disorders*: a printed text; an electronic document; audios; individual assignments and advising.

Sample interim exam (test) questions

Problem 1 (25 points)

- (a) Derive the OLS estimator $\hat{\beta}_{OLS}$ (formulate and solve the relevant minimization problem) for the simple linear regression model $y_i = \alpha + \beta x_i + e_i$.

Problem 2 (15 points, 5:5:5)

- (a) What is endogeneity?
 (b) What are the main sources of endogeneity in econometrics?
 (c) Which of these can be addressed by panel data techniques (e.g., the fixed-effects estimator)? Explain.

Problem 3 (20 points, 5:5:5:5)

- (a) Which threats to internal validity (consistency) can be addressed by using IV techniques?
 (b) What does it mean that coefficients $\beta_1, \beta_2, \dots, \beta_k$ are exactly identified? Overidentified?
 (c) What are the two main assumptions regarding instrumental variables that are required for the use of IV methods?
 (d) Can these assumptions be tested? Explain.

Problem 4 (40 points, 5:5:5:5:5:15)

We have a study of the “gender gap”, which compares total compensation among top executives in a large set of US public corporations in the 1990s. Let Female be an indicator variable that is equal to 1 for females and 0 for males. A regression of earnings on Female yields:

$$\ln(\text{Earnings}) = 6.48 - 0.44\text{Female} \quad \text{Standard errors are in parentheses.}$$

(0.01) (0.05)

- a) The estimated coefficient on Female is -0.44. Explain what this value means.
 b) Does this regression suggest that female top executives earn less than male executives?
 c) Does this regression suggest that there is gender discrimination? Explain.

You find another data set which has two new variables, the market value of the firm (a measure of firm size, in millions of dollars) and stock return (a measure of firm performance in percentage points), and so you run a regression of Earnings on the three variables:

$$\ln(\text{Earnings}) = 3.86 - 0.28\text{Female} + 0.37\ln(\text{MarketValue}) + 0.004\text{Return} \quad \text{St. errors are in } ()$$

(0.03) (0.04) (0.004) (0.003)

- d) The coefficient on $\ln(\text{MarketValue})$ is 0.37. Explain what this value means.
 e) The coefficient on Female is now -0.28. Explain why it has changed from the previous regression.
 f) Are large firms more likely to have female top executives than small firms? Explain based on the regression results.

Аннотация на русском языке**Эконометрика (продвинутый уровень)**

Курс предназначен для студентов первого курса магистратуры, обучающихся по программам «Финансы» и «Прикладная экономика и математические методы». Его главная цель - ознакомить студентов с современными методами эконометрических исследований в области экономики и финансов. В частности, курс акцентирует внимание на проблеме эндогенности и способах ее решения при анализе пространственных и панельных данных. Курс носит прикладной характер: материал представляется, по возможности, максимально нетехнически, обсуждаются примеры эмпирических исследований, опубликованных в ведущих международных журналах по экономике и финансам, а лекции дополнены упражнениями в компьютерном классе.

Охватываемые темы включают: обзор классической модели линейной регрессии; причины и следствия эндогенности; методы инструментальных переменных; методы анализа панельных данных; метод разности разностей; модели матчинга и разрывного дизайна. Компьютерные упражнения с использованием статистического программного пакета «Stata» являются неотъемлемой частью курса, который обеспечивает студентам практический опыт анализа реальных данных.

По завершении курса студенты должны:

- знать основные методы эконометрических исследований, понимать причины и последствия эндогенности, знать основные методы решения этой проблемы,
- понимать эндогенность как ключевую проблему, влияющую на установление причинно-следственных связей; быть в состоянии критически оценивать существующие исследования с этой точки зрения,
- уметь применять изученные методы при проведении собственного эмпирического анализа,
- знать и уметь использовать ключевые возможности статистического пакета «Stata», включая его возможности программирования (так называемые do-файлы),
- Понимать пределы интерпретации результатов регрессии в большинстве случаев (оговорка «при прочих равных условиях»).

Курс состоит из лекций (26 часов) и компьютерных классов (20 часов). Основные методы преподавания и обучения включают лекции, чтение, упражнения в компьютерной лаборатории и эмпирический проект.

Усвоение материала курса оценивается с помощью четырех домашних заданий, промежуточного экзамена (теста) и итогового экзамена.