

Программа учебной дисциплины
«EXPERIMENTAL AND QUASI-EXPERIMENTAL DESIGNS IN EDUCATION»

Утверждена
Академическим советом ООП
Протокол № от «28» августа 2018 г.

Автор	Захаров Андрей Борисович
Число кредитов	3
Контактная работа (час.)	42
Самостоятельная работа (час.)	72
Курс	2
Формат изучения дисциплины	без использования онлайн курса

I. LEARNING OBJECTIVES, OUTCOMES AND PRE-REQUISITES

Learning Objectives

This course has two major goals. First, it introduces experimental and quasi-experimental research designs. Second, during this course students will read about contemporary studies that investigate important educational issues such as the effects of class size, different educational resources and school programs on students' outcomes.

Learning Outcomes

By the end of the course students will be aware of what causal analysis is and how to do a randomized experiment. They will understand contemporary methods of quasi-experimental design, their weaknesses and strengths. Students will get some experience in application of these methods in practice with the use of Stata. They will become familiar with contemporary studies of the effects of different policies in education.

Place of the Course in Education Program

This course is based on the following disciplines taking place at the first year of study:

- “Economics of Social Sector”
- “Methods of Quantitative Data Analysis”

During the course, students acquire knowledge and skills they need for successful preparation of their master thesis. Besides that, this course provides a basis for other disciplines such as “Evidence Based Practice in Management”, “Strategic Management in Education”.

Course Pre-requisites

Before the course students should have basic knowledge of statistics and methods of data analysis provided at the first year of the master program. They should have experience in data analysis with Stata and be able to interpret analysis results presented in educational journals.

II. COURSE CONTENT

Topic 1. Introduction to causal analysis

Causal inference. Internal validity. Endogeneity problem. Neuman-Rubin causal model. Counterfactuals and potential outcomes. ATE, ATT, ATU. Assumptions: SUTVA, unconfoundedness. General equilibrium effect.

Topic 2. Randomized Experiment

Experimental designs. Steps to implement RCT. Defining the treatment, the outcome, population, and units of observation. Complete simple, cluster, and stratified randomization. Power and minimal detected effect size. Fidelity. Threats to internal validity, attrition, non-compliance, spillover effect.

Topic 3. Instrumental Variables

Endogeneity and analysis with an instrumental variable. LATE. 2 SLS. Selecting an instrument. Testing an instrument strength. Overidentification. Instrumental variable in RCT.

Topic 4. First difference. Difference-in-difference. Regression Discontinuity

Natural experiments and discontinuity design. First difference. Second difference. Difference-in-difference. Regression discontinuity analysis. Choosing a bandwidth. Several cut-off points. Sharp and fuzzy RD designs.

Topic 5. Propensity Score Matching

Selection bias. Strong ignorability and conditional ignorability assumptions. Matching. Multidimensionality problem. Propensity score. Choosing variables for the propensity score estimation. Estimating the propensity score. Optimal matching, greedy matching (nearest neighbor, caliper), kernel matching, stratification. Common support. Balance test after matching. Estimating ATT.

III. STUDENTS' KNOWLEDGE CONTROL

Type of control	Form of control	2 nd year				Description
		1	2	3	4	
Current (weekly)	Homework assignment	*	*			a) 7-10 min presentations in PowerPoint or similar program based on the articles students read. They will present at seminars. Should be done in groups of 2-3 students b) analysis in Stata. Individual work. Students should send a teacher a do-file and a text with a short description of the method, data and outcomes
Intermediate	Research project	*				10-15 min presentation of the project in PowerPoint. Should be done in groups of 2-3 students
Final	Research project		*			10-15 min presentation of the project in PowerPoint. Should be done in groups of 2-4 students

Assessment criteria

Current Control

A) Presentations of the articles

- Research question is clearly stated. It's importance is shown. (0-1 points)
- Data are described. What is the population? How is sampling done? What variables are used? (0-2 points)
- Assignment of the units to experimental conditions (for the papers on RCT) and the methods of analysis are correctly described (0-2 points)
- Research results and their meaning for further discussion are presented and correctly interpreted (0-2 points)
- Assumptions of the analysis and its limitations for causal inferences are shown. Threats to internal validity and the way authors of the paper answer them are explained (0-2 points)
- Presentation is clear and correct (0-1 points).

B) Analysis in Stata:

- Data are prepared for the analysis (0-2 points)
- Analysis done correctly. All the assumptions are tested (0-3 points)
- Research question, data, descriptive statistics, analytical procedures with analysis assumptions and limitations, and the analysis results are present in the text and described correctly (0-3 points)
- Inferences are correctly done (0-1 points)
- Speech is clear and correct (0-1 points)

Intermediate Control

- Research question is clearly stated. (0-1 points)
- Literature relevant to the research is observed (0-1 points)
- RCT design is described (population and the unit of observation; experimental conditions; outcome; timing and scheme of the RCT) (0-1 points)
- Power analysis is done and sample size is estimated (0-1 points)
- Sampling and the way of units assignment to experimental conditions are described (0-1 points)
- Measurements and methods of data collection are described (0-1 points)
- Plan of RCT is presented (0-1 points)
- Threats to internal validity and the way to answer them are explained (0-1 points)
- Presentation is clear and correct (0-1 points).
- Student's answers to the questions about project are complete and clear (0-1 points)

Final Control

- Research question is clearly stated. (0-1 points)
- Literature relevant to the research is observed (0-1 points)
- Research design is described and the choice of the method of analysis is explained (0-1 points)
- Statistical analysis is correctly done. Assumptions are tested (0-2 points)

- Research results and their meaning for further discussion are presented and correctly interpreted (0-2 points)
- Threats to internal validity and limitations for causal inferences are shown (0-1 points)
- Argumentation is clear (0-1 points).
- Student’s answers to the questions about project are complete and clear (0-1 points)

Grading System

The resulting grade is calculated using the following formula:

$$O_{final} = 0.3 * O_{presentations} + 0.3 * O_{data\ analysis} + 0.2 * O_{project\ 1} + 0.2 * O_{project\ 2}$$

where

$O_{presentations}$ is an average score for articles presentations student done,

$O_{data\ analysis}$ is an average score for homework assignments with data analysis in Stata,

$O_{project\ 1}$ is a score for an intermediate project,

$O_{project\ 2}$ is a score for a final project.

Rounding is to be performed according to arithmetic rules.

IV. EXAMPLES OF KNOWLEDGE CONTROL

Example of a Home Assignments (Current Control)

Topic 1. Introduction to causal analysis

In a group of 2-3 students, prepare a presentation based on one of the following articles:

- Wolf, P. J., Kisida, B., Gutmann, B., Puma, M., Eissa, N., & Rizzo, L. (2013). School Vouchers and Student Outcomes: Experimental Evidence from Washington, DC. *Journal of Policy Analysis and Management*, 32(2), 246-270.
- Duflo, E., Dupas, P., & Kremer, M. (2015). School governance, teacher incentives, and pupil–teacher ratios: Experimental evidence from Kenyan primary schools. *Journal of Public Economics*, 123, 92-110.
- Muralidharan, K., & Sundararaman, V. (2011). Teacher performance pay: Experimental evidence from India. *Journal of political Economy*, 119(1), 39-77.
- Banerjee, A. V., Cole, S., Duflo, E., & Linden, L. (2007). Remediating education: Evidence from two randomized experiments in India. *The Quarterly Journal of Economics*, 122(3), 1235-1264.

Topic 2. Randomized Experiment

- Do complete simple, stratified, and cluster randomization in Stata. Send a do-file and tables with descriptive statistics.
- Estimate a sample size for detecting minimum effect of 0.10, 0.15, and 0.20 of standard deviation ($\alpha=0.05$, $p=0.80$) for a complete simple and cluster RCT (in the latter case assume that ICC equals 0.10-0.15, and a group size is 20 students) with two experimental conditions and optimal balanced design. Send a do-file and graphs.

Topic 3. Instrumental Variables

In a group of 2-3 students, prepare a presentation based on one of the following articles:

- Abdulkadiroğlu, A., Angrist, J. D., Dynarski, S. M., Kane, T. J., & Pathak, P. A. (2011). Accountability and flexibility in public schools: Evidence from Boston's charters and pilots. *The Quarterly Journal of Economics*, 126(2), 699-748.
- Angrist, J. and Krueger, A. (1991). "Does Compulsory School Attendance Affect Schooling and Earnings?" *Quarterly Journal of Economics* 106:4, pp. 979-1014.
- Butcher, K. F., & Case, A. (1994). The effect of sibling sex composition on women's education and earnings. *The Quarterly Journal of Economics*, 109(3), 531-563.
- Currie, J., & Moretti, E. (2003). Mother's education and the intergenerational transmission of human capital: Evidence from college openings. *The Quarterly Journal of Economics*, 118(4), 1495-1532.

Do effect estimates with an instrumental variable using PISA 2009 data. Send a do-file and a short text with a description of data in use, method of analysis, and the results.

Topic 4. First difference. Difference-in-difference. Regression Discontinuity

In a group of 2-3 students, prepare a presentation based on one of the following articles:

- Heissel, J. A., & Ladd, H. F. (2018). School turnaround in North Carolina: A regression discontinuity analysis. *Economics of Education Review*, 62, 302-320.
- Тюменева, Ю. А., & Кузьмина, Ю. В. (2013). Что дает год обучения российскому школьнику. На материалах PISA-2009: грамотность чтения. *Вопросы образования*, (1).
- Ludwig, J., & Miller, D. L. (2007). Does Head Start improve children's life chances? Evidence from a regression discontinuity design. *The Quarterly journal of economics*, 122(1), 159-208.
- Loyalka, P., Song, Y., & Wei, J. (2012). The effects of attending selective college tiers in China. *Social science research*, 41(2), 287-305.

Do the analysis presented in the article of Kuzmina and Tyumeneva (2013). Apply sharp RD design. Send a do-file and a short text with a description of data in use, method of analysis, and the results.

Topic 5. Propensity Score Matching

In a group of 2-3 students, prepare a presentation based on one of the following articles:

- Titus, M. A. (2007). Detecting selection bias, using propensity score matching, and estimating treatment effects: An application to the private returns to a master's degree. *Research in Higher Education*, 48(4), 487-521.
- Kretschmann, J., Vock, M., & Lüdtke, O. (2014). Acceleration in elementary school: Using propensity score matching to estimate the effects on academic achievement. *Journal of educational psychology*, 106(4), 1080.
- Belfi, B., Haelermans, C., & De Fraine, B. (2016). The long-term differential achievement effects of school socioeconomic composition in primary education: A propensity score matching approach. *British Journal of Educational Psychology*, 86(4), 501-525.
- Bartolj, T., & Polanec, S. (2018). Does work harm academic performance of students? Evidence using propensity score matching. *Research in Higher Education*, 59(4), 401-429.

Apply PSM to estimate the effect of study of science as an integrated course (compared to study of physics, geography, biology, and chemistry as separate subjects) on the 8th grade students' scores in TIMSS in 2011 in England. The variable that describes the type of science study

is ITCOURSE. Send a do-file and a short text with a description of data in use, method of analysis, and the results.

Example of the Intermediate Control Assignment

Work out a design of a randomized experiment in education. Choose a research question. Based on a literature review describe why this research question is of importance. Clearly define your treatment, experimental conditions and an outcome. Define a target population and a unit of observation. Randomly assign selected units to experimental conditions. Describe the type of randomisation you use. Find out in the literature what the effect size could be. Calculate sample size you need to estimate the effect of this size and of little larger/smaller effect size ($\alpha=0.05$, power=0.8, ICC =0.10 and 0.15). Describe what contextual information you need to collect. Describe the timeline of your experiment. Describe what threads to internal validity you may meet and how you suggest to solve these problems. Prepare a presentation. Your choice at any step should be clearly explained.

Example of the Final Control Assignment

Possible research questions for a final project are the following:

1. What is the class size effect on the 4th grade students' math literacy in Great Britain? Use TIMSS 2011 data.
2. What is the effect of students' motivation on their reading scores in Germany? Use PISA 2009 data.
3. What is the effect of teaching math practices used by parents before school on the their children scores in math in the 4th grade in Russia? Use TIMSS 2011 data.
4. What is the effect of kindergarten attendance on students reading literacy in the 4th grade in Russia? Use PIRLS 2011 data.

V. EDUCATIONAL RESOURCES

5.1 Required Reading

- Agodini, Roberto and Mark Dynarski (2004). "Are Experiments the Only Option? A Look at Dropout Prevention Programs." *Review of Economics and Statistics* 86:1, 180-194.
- Angrist, J. D., & Lavy, V. (1999). Using Maimonides' rule to estimate the effect of class size on scholastic achievement. *The Quarterly Journal of Economics*, 114(2), 533-575.
- Angrist, J., & Pischke, J. S. (2009). Mostly harmless econometrics: an empiricists guide.

- Cameron, C., Trivedi, P. 2009. *Microeconometrics Using Stata*. A Stata Press Publication.
- Dee, Thomas S. (2004). "Are There Civic Returns to Education?" *Journal of Public Economics* 88:9- 10, pp. 1697-1720.
- Dehejia, R. H., & Wahba, S. (1999). Causal effects in nonexperimental studies: Reevaluating the evaluation of training programs. *Journal of the American statistical Association*, 94(448), 1053-1062.
- Guo, S., Fraser, M.W. (2010). *Propensity score analysis: Statistical methods and applications*. London-Singapore: Sage Publications.
- Howell, W. G., Wolf, P. J., Campbell, D. E., & Peterson, P. E. (2002). School vouchers and academic performance: Results from three randomized field trials. *Journal of Policy Analysis and Management*, 21(2), 191-217.
- Krueger, Alan (1999). "Experimental Estimates of Education Production Functions." *Quarterly Journal of Economics* 114(2): 497-532.
- Niu, S. X., & Tienda, M. (2009). The impact of the Texas top ten percent law on college enrollment: A regression discontinuity approach. *Journal of Policy Analysis and Management* 29(1): 84-110. March 23
- Shadish, W. R., Clark, M. H. & Steiner, P. M. (2008). Can non-randomized experiments yield accurate answers? A randomized experiment comparing random and nonrandom assignments. *Journal of the American Statistical Association*, 103 (484), 1334-1356.
- Shadish, W.R, Cook, T.D., and Campbell D.T. 2002. *Experimental and Quasi-Experimental Designs for Generalized Causal Inference*. Boston, MA: Houghton Mifflin Company.
- Willett, J.B. and Murnane, R.J. (2010). *Methods Matter: Improving Causal Inference in Educational and Social Science Research*. Oxford University Press.

5.2 Optional Reading

- Abdulkadiroğlu, A., Angrist, J. D., Dynarski, S. M., Kane, T. J., & Pathak, P. A. (2011). Accountability and flexibility in public schools: Evidence from Boston's charters and pilots. *The Quarterly Journal of Economics*, 126(2), 699-748.
- Angrist, J. and Krueger, A. (1991). "Does Compulsory School Attendance Affect Schooling and Earnings?" *Quarterly Journal of Economics* 106:4, pp. 979-1014.
- Angrist, J D., Imbens, G W. and D B. Rubin, (1996) " Identification of Causal Effects Using Instrumental Variables," *Journal of the American Statistical Association*, 91: 444-472
- Banerjee, A. V., Cole, S., Duflo, E., & Linden, L. (2007). Remediating education: Evidence from two randomized experiments in India. *The Quarterly Journal of Economics*, 122(3), 1235-1264.
- Bartolj, T., & Polanec, S. (2018). Does work harm academic performance of students? Evidence using propensity score matching. *Research in Higher Education*, 59(4), 401-429.
- Belfi, B., Haelermans, C., & De Fraine, B. (2016). The long-term differential achievement effects of school socioeconomic composition in primary education: A propensity score matching approach. *British Journal of Educational Psychology*, 86(4), 501-525.
- Butcher, K. F., & Case, A. (1994). The effect of sibling sex composition on women's education and earnings. *The Quarterly Journal of Economics*, 109(3), 531-563.
- Currie, J., & Moretti, E. (2003). Mother's education and the intergenerational transmission of human capital: Evidence from college openings. *The Quarterly Journal of Economics*, 118(4), 1495-1532.

- Duflo, E., Dupas, P., & Kremer, M. (2015). School governance, teacher incentives, and pupil–teacher ratios: Experimental evidence from Kenyan primary schools. *Journal of Public Economics*, 123, 92-110.
- Heissel, J. A., & Ladd, H. F. (2018). School turnaround in North Carolina: A regression discontinuity analysis. *Economics of Education Review*, 62, 302-320.
- Kretschmann, J., Vock, M., & Lüdtke, O. (2014). Acceleration in elementary school: Using propensity score matching to estimate the effects on academic achievement. *Journal of educational psychology*, 106(4), 1080.
- Lee, D.S. and Lemieux, T. 2010. Regression discontinuity designs in economics. *Journal of Economic Literature* 48(2), 281-355.
- Loyalka, P., Song, Y., & Wei, J. (2012). The effects of attending selective college tiers in China. *Social science research*, 41(2), 287-305.
- Ludwig, J., & Miller, D. L. (2007). Does Head Start improve children's life chances? Evidence from a regression discontinuity design. *The Quarterly journal of economics*, 122(1), 159-208.
- Muralidharan, K., & Sundararaman, V. (2011). Teacher performance pay: Experimental evidence from India. *Journal of political Economy*, 119(1), 39-77.
- Titus, M. A. (2007). Detecting selection bias, using propensity score matching, and estimating treatment effects: An application to the private returns to a master's degree. *Research in Higher Education*, 48(4), 487-521.
- Wolf, P. J., Kisida, B., Gutmann, B., Puma, M., Eissa, N., & Rizzo, L. (2013). School Vouchers and Student Outcomes: Experimental Evidence from Washington, DC. *Journal of Policy Analysis and Management*, 32(2), 246-270.
- Тюменева, Ю. А., & Кузьмина, Ю. В. (2013). Что дает год обучения российскому школьнику. На материалах PISA-2009: грамотность чтения. *Вопросы образования*, (1).

5.3 Software

№	Software	Access
1.	Microsoft Windows 10	<i>Provided by HSE</i>
2.	Microsoft Office Professional Plus 2010	<i>Provided by HSE</i>
3.	Stata 13	<i>Provided by HSE</i>

5.4 Internet Resources

№	Internet Resources	Access
1.	Open Education	URL: https://openedu.ru/
2.	Biblio-online	URL: https://biblio-online.ru/

5.5 Material and Technical Support of the Course

Computer or laptop, LCD projector, white board and board pens will be used at lectures and seminars.