CEU Department
of Economics
and Business

CENTRAL
EUROPEAN
UNIVERSITY

The Public Defense

of the Doctoral Thesis in Economics

by

Ágoston Reguly

on

THREE ESSAYS ON ECONOMETRICS

will be held on

Wednesday, 6th of October, 2021 at 15:30

online via Zoom

(registration: szimlerk@ceu.edu)

Central European University
Doctoral School of Economics

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Supervisors:

Róbert Lieli

László Mátyás

Examiners:

Michael Knaus, Assistant Professor, University of St. Gallen, Swiss Institute for
Empirical Economic Research (External examiner)

Gábor Békés, Assistant Professor, Central European University, Department of
Economics and Business (Internal examiner)

The doctoral thesis is available for inspection

at the CEU Department of Economics and Business.

Abstract

The thesis consists of three chapters: the first, single-authored chapter proposes a supervised machine learning algorithm to discover heterogeneous treatment effects in regression discontinuity designs. The second and third chapter, co-authored with László Mátyás and Felix Chan proposes a new data gathering method, which allows the identification and consistent estimation of parameters in the linear regression model when variables are observed through a discretization process. The second chapter discusses the so called split sampling data gathering method in detail and investigates the properties of the least squares estimator when the discretized variable is on the right hand side. Chapter 3 discusses the identification and estimation when the discretized variable is on the left hand side.

Chapter 1: Heterogeneous Treatment Effects in Regression Discontinuity Designs

The paper proposes a supervised machine learning algorithm to uncover treatment effect heterogeneity in classical regression discontinuity (RD) designs. Extending Athey and Imbens (2016), I develop a criterion for building an honest "regression discontinuity tree", where each leaf of the tree contains the RD estimate of a treatment (assigned by a common cutoff rule) conditional on the values of some pre-treatment covariates. It is *a priori* unknown which covariates are relevant for capturing treatment effect heterogeneity, and it is the task of the algorithm to discover them, without invalidating inference. I study the performance of the method through Monte Carlo simulations, and apply it to the data set compiled by Pop-Eleches and Urquiola (2013) to uncover various sources of heterogeneity in the impact of attending a better secondary school in Romania.

Chapter 2: Modelling with Discretized Continuous Covariate

with Felix Chan and László Mátyás

The paper proposes a new data gathering method, called split sampling, which allows the identification and consistent estimation of parameters in a linear regression model with discretized covariates. This situation is common when modelling with survey data where continuous random variables, such as income or expenditure, are being transformed into a set of intervals. Such discretization prevents point-identification and least squares type estimators are inconsistent. Split sampling method resolves these problems by improving the design of the survey without creating additional disincentives for respondents and additional complexity on the design of the survey questions. The proposed methods can consistently reconstruct the distribution of the underlying random variables, which leads to the consistent estimation of the parameters. Since the solution resides in the data collection stage, the proposed methods should also be applicable for the identification of parameters in non-linear models.

Chapter 3: Modelling with Discretized Continuous Dependent Variable

with Felix Chan and László Mátyás

The paper deals with econometric models where the dependent variable is continuous but cannot be observed directly. Instead, it is observed through intervals or discretized ordered choice windows. Manski and Tamer (2002) show that the parameters in the conditional expectation cannot be point-identified using these discretized observations. Here we introduce a new sampling design, the so-called *split sampling*, which makes the point-identification of the parameters in regression models feasible. Split sampling yields point-identification through the way information is collected. The target sample set is split into multiple parts and data is collected in a differentiated way. We explore how split sampling affects statistical inference, and further Monte Carlo evidence is provided about its effect on estimation. Finally, we propose a simple formulation to deal with an eventual perception effect.

Bibliography

Athey, S. and Imbens, G. (2016). Recursive partitioning for heterogeneous causal effects. *Proceedings of the National Academy of Sciences*, 113(27):7353–7360.

Manski, C. F. and Tamer, E. (2002). Inference on regressions with interval data on a regressor or outcome. *Econometrica*, 70(2):519–546.

Pop-Eleches, C. and Urquiola, M. (2013). Going to a better school: Effects and behavioral responses. *American Economic Review*, 103(4):1289–1324.

Ágoston Reguly

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Research Interest

Econometrics with special attention on using machine learning methods to identify heterogeneous treatment effects in potential outcome framework. Currently I am working on bandwidth selection with causal trees to estimate heterogeneous treatment effects in regression discontinuity designs.

Research Experience

Research Assistant   Budapest, Hungary and London, UK
Central European University, collaborating with University of College London   *Oct. 2018 – Feb. 2019*

- Conducted research on econometric theory and applications of models where the dependent or explanatory variables are discretized due to surveys, but in fact, they are continuous. During the research, I have collaborated with MaaSLab at the University of College London, a research group focusing on public transportation and faces challenges due to discretization when modeling.

Working Papers

Heterogeneous Treatment Effects in Regression Discontinuity Designs   2021
Job market paper - Advisor: Róbert Lieli

- The paper proposes a causal supervised machine learning algorithm to uncover treatment effect heterogeneity in classical regression discontinuity designs. Extending Athey and Imbens (2016) with leaf-by-leaf regression, I develop a criterion for building an honest "regression discontinuity tree", where each leaf of the tree contains the RD estimate of treatment conditional on the values of some pre-treatment covariates.

Modelling with Discretized Continuous Dependent Variable   2021
Joint work with Felix Chan and Mátyás László

- Extends the split sampling methodology of Reguly et. al. (2020) to linear models, when the outcome variable is observed through a discretization process.

Modelling with Discretized Ordered Choice Covariates   2020
Joint work with Felix Chan and Mátyás László

- Introduces a new data gathering method the so-called 'split sampling', which allows point identification and consistent estimation of parameters via least squares, when the covariates are discretized interval data.

Conferences

EEA-ESEM 2021 Summer Conference   Copenhagen, Denmark
European Economic Association (EEA) and Econometric Society European Meeting (ESEM)   *expected: Aug. 2021*

- Accepted my two recent working papers for presentation in EEA and ESEM section.

IAAE 2021 Annual Conference at Erasmus School of Economics   Rotterdam, The Netherlands
International Association for Applied Econometrics (IAAE)   *June 2021*

- Presented my working paper on Heterogeneous Treatment Effects in Regression Discontinuity Designs

IAAE, 2019 Annual Conference at University of Cyprus   Nicosia, Cyprus
International Association for Applied Econometrics (IAAE)   *June 2019*

- Presented the working paper on Modelling with Discretized Ordered Choice Covariates

Administrative Experience

Organizer of the Econometrics Reading Group   Budapest, Hungary
Department of Economics and Business at CEU   *2019*

- Organized reading group events for Ph.D. students and faculty members, covering various papers from the field of econometrics. We held meetings in two weeks frequency.

Teaching Experience

Data Analysis	2018 – 2021

MS in Business Analytics at CEU

- 2020/21 Fall: **Lecturer** for Data Analysis 1 and 2
- 2018/19 Winter: Teaching Assistant for Data Analysis 3 and 4. (lecturer: Gábor Békés)

Coding 1: Data Management and Analysis with R	2020 – 2021

MS in Business Analytics at CEU

- 2020/21 Fall: **Lecturer**

Data course	2020 – 2021

Executive Master of Business Art (EMBA) at CEU

- 2020/21 Fall: **Joint lecturer** with Anand Murugesan

Mathematics and Advanced Excel Pre-session	2019 – 2021

MS in Finance at CEU

- 2019/20 and 2020/21 Fall: **Lecturer**

Mathematical Methods for Economists	2017 – 2018

MA in Economics at CEU

- 2017/18 Fall: Teaching Assistant

Education

Central European University	Budapest, Hungary
Ph.D. in Economics	*Sept. 2016 – expected: Sept. 2021*

- Advisors: Róbert Lieli and László Mátyás
- PhD Thesis: *Three Essays on Econometrics*, based on the three working papers.

Budapest University of Technology and Economics (BME)	Budapest, Hungary
MA in Economic Analysis	*2012 – 2015*

Otto-Friedrich University of Bamberg	Bamberg, Germany
Erasmus scholarship	*Sept. 2012 – Feb. 2013*

Budapest University of Technology and Economics	Budapest, Hungary
BA in Management and Business Administration	*2009 – 2012*

Awards

Doctoral Research Study Grant	2021

CEU's grant for finishing PhD students

Award for Advanced Doctoral Studies	2019

CEU's rector award for outstanding Ph.D. students

Pro Scientia Golden Medal (Hungarian Academy of Sciences)	2013

Academic award for young scholars from the Hungarian Academy of Sciences

National Scientific Students' Association Conference Awards (OTDK)

- 2015 and 2011 1st prize in economics section
- 2012 2rd prize in economics section
- 2011 Award of the Hungarian Economic Review (top Hungarian economic journal)

Other Awards

- 2014 Academic award of Rector Magnificus (BME)
- 2013 Economist's Forum's Young Scientist Award for the best article of the year
- 2013 Felkai András Memorial Scholarship for support training of young talents
- 2013 Outstanding students' award at the Budapest University of Technology and Economics
- 2012 Hungarian Republic Fellowship (József Nádor)

Publications

Constructing Hungarian Zero-Coupon Yield Curve Models   2015
National Scientific Students' Association Conference (in Hungarian)

Forecasting the Hungarian Nelson-Siegel Yield Curve with Mixed Factor Model 2014
Conference Paper: Hungarian Society of Economist Yearly Conference (in Hungarian)

Happiness of Economic Man - joint with: K. Martinás, Zs. Gilányi and V. Poór 2014
In Francesco Sarracino (Eds): The Happiness Compass, Chapter 19 Nova Science Publishers

Reappraisal of Rational Choice Theory - joint with K. Martinás   2013
Interdisciplinary Description of Complex Systems (INDECS), 11(1)

Behavioral models of pension systems, part I. and II.   2012, 2013
Economists' Forum, 2012. February and 2013. April (in Hungarian)

Additional Working Experience

Hungarian State Treasury   2019
Consultancy   *Budapest, Hungary*
- Analysis on government security market

Hungarian Government Debt Management Agency   2013 − 2016
Expert Economic Analyst   *Budapest, Hungary*
- I was responsible for periodical reports of the government security market and developing new methodologies for analyzing and forecasting the Hungarian government yield curve. Furthermore, I have contributed to the development of the new portfolio model.

Skills

Languages: Hungarian (native), English (fluent), German (intermediate)
IT skills:
  Proficient: MatLab, R, Microsoft Excel
  Familiar with: Python, Stata, Eviews, SPSS, Mathematica
Driving licence: A and B categories
Hobbies: I have been sailing for fourteen years, and achieved 1st award in the National Competition of Jolle 25 class in 2007, 2009 and 2010. Recently I have turned to mountaineering and rock climbing. Among many peaks in the Tatras and the Austrian Alps, in 2018 I have climbed Mount Blanc via the Cosmiques route.