The world at the threshold point: CIE with Regression Discontinuity Design The case of the Erasmus programme

Gianluca Mazzarella

Case studies in Microeconomic Evaluation – The Erasmus case
24th November 2020,

Joint Research Centre

Outline

Regression Discontinuity Design : Introduction

The Erasmus Case – Joint with Silvia Granato, Enkelejda Havari and Sylke Schnepf

- Introduction
- Institutional Background and Data
- Empirical Strategy
- Results
- Concluding remarks

Intuition

The method is based on a **selection variable** which has a **discontinuous impact** on the **probability to receive the treatment**:

- A lot of public programs have assignment rules based on "*thresholds*": social benefits based on income, age for pension or unemployment benefits, grades, access to school based on residence, etc.
- Around these thresholds, individuals are "**almost**" **similar**, but only some of them receive the treatment.
- It is then possible to identify the causal impact of the treatment by comparing these two types of individuals
- RDD is a local randomised experiment at the threshold

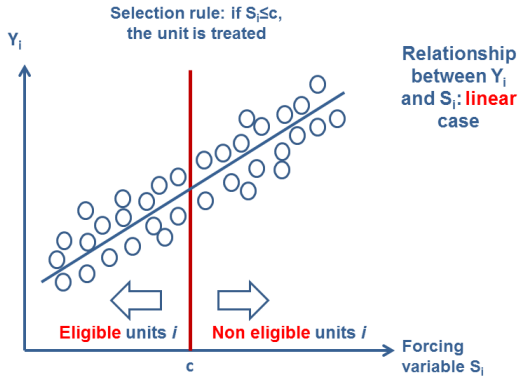
When

- Eligibility for a program is determined by a rule or a threshold defined based on the value of a continuous variable S_i, called forcing variable.
- The eligibility rule, Z_i, creates a discontinuity at a fixed and observable cutoff point c, such that
- The rule Z_i creates a discontinuity in treatment at c:
  - Sharp RDD : all eligible individuals receive the treatment if they are above (below) the threshold.
  - Fuzzy RDD: some individuals do not receive the treatment even if they are above (below) the threshold and some others may receive the treament even if they are below (above) the threshold.

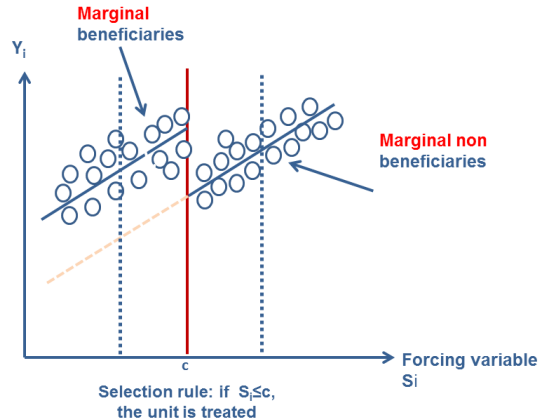
Main conditions for RDD

- Assignment to the program only occurs through a **known** and **measured** decision rule.
- No manipulation of the value of the score in order to become eligible
- No other policies using the **same eligibility criteria** and which will affect the outcome
- Smooth relationship between the outcome and the score

Before the intervention

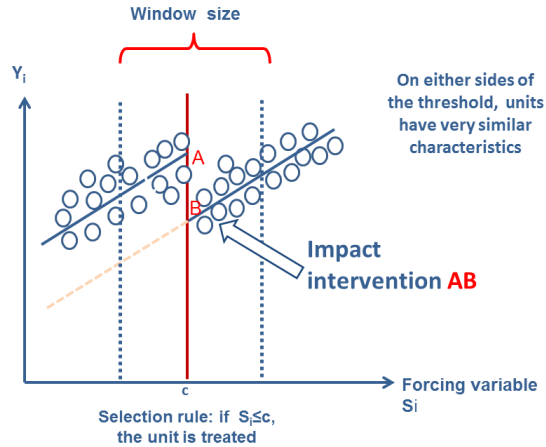


After the intervention



European Commission

After the intervention



RDD pros & cons

Pros

- Internal validity: the RDD design is generally regarded as having the greatest internal validity of all quasi-experimental methods
- Transparency: the RDD design can be illustrated with simple graphs
- Identification strategy which relies on weak conditions that can be checked
- Lower need for additional covariates in estimation relative to other quasi-experimental methods.

Cons

- External validity is limited, since the estimated treatment effect is local to the discontinuity

Outline

Regression Discontinuity Design : Introduction

The Erasmus Case – Joint with Silvia Granato, Enkelejda Havari and Sylke Schnepf

- Introduction
- Institutional Background and Data
- Empirical Strategy
- Results
- Concluding remarks

The Erasmus programme

- The Erasmus programme is one of the oldest and most popular programmes financed by the European Union
- The current Erasmus+ programme (2014-2020) has a budget of €14.7 billion and covers several aspects in the fields of education and training, youth and sport
- Stated aims of the programme: *promoting common European values, foster social integration, enhance intercultural understanding and a sense of belonging to a community*
- Specific objectives for young people:
  - improved learning performance;
  - enhanced employability and improved career prospects;
  - increased motivation for taking part in future education or training
  - improved foreign language competences;
  - development of soft skills

Literature Review

A considerable part of the literature has tried to assess the causal link between studying abroad during higher education and outcomes later on

- impact of study experience abroad on labour market outcomes (Messer and Wolter (2006); Parey and Waldinger (2010);Rodriguez et al. (2013); Di Pietro (2013); Waibel et al. (2018); Schnepf and d'Hombres (2019)
- impact on other skills: Sorrenti (2017) on languages proficiency, Salisbury et al.(2013) on intercultural competence
- impact on probability to live abroad: Oosterbeek and Webbink (2011)

Our contribution

- This study provides novel evidence on the causal effect of studying abroad with an Erasmus scholarship on academic outcomes of higher education students

- We use rich administrative data from one of the biggest public university in Italy and exploit the allocation mechanism of Erasmus scholarships based applications ranking in a fuzzy RD design

- We investigate the heterogeneity of effects according both to characteristics of students and of the Erasmus programme

Preview of preliminary results

- On average the impact is zero on the probability of graduating on time, and positive on the final graduation (for bachelor students only)
- The effect is stronger for students of STEM fields, for programmes of shorter durations and for scholarships obtained in the first year of study.

The Erasmus Programme at the University of Bologna

- Each department establishes agreements with host institutions
- Students' eligibility requirements:
  - minimum language skills
  - compatibility with other Erasmus+ grants received
- For each specific agreement, applications are ranked and the available scholarships awarded to highest ranked
- Acceptance period: students make their decisions and scholarships are re-allocated accordingly

more

Data

- Administrative data from University of Bologna
- All applications to *Erasmus+* made between a/y 2013/2014 and 2019/2020
  - destination, duration, score, outcome of decision
- Administrative data on all students enrolled between a/y 2007/2008 and 2018/2019
  - demographics: gender, municipality of residence, high school track
  - academic career: course of study, number exams/credits and gpa by (calendar) year, career outcome, if graduated date and final graduation grade

Final sample

- We focus on all students who ever applied for an *Erasmus - studio* scholarship in the period considered and for whom we observe academic outcomes
- We restrict to students who have graduated: exclude those still enrolled on time, still enrolled with delay and drop-outs
- We focus on bachelor and master student
- We drop all the rankings in which all the students have been able to take the scholarship (i.e. the last student that has accepted the scholarship is also the last one in the ranking).
- The final sample is made of approximately 7,000 applications from $\sim$2,700 bachelor and $\sim$1,700 master students

Descriptives by treatment status

	Degree Level							
	Bachelor				Master			
Variable	**Mean**	**S.d.**	**Mean**	**S.d.**	**Mean**	**S.d.**	**Mean**	**S.d.**
	No Erasmus		Erasmus		No Erasmus		Erasmus	
Female	.57	.50	.65	.48	.52	.50	.55	.50
Moved from other region	.46	.50	.56	.50	.64	.48	.66	.47
Number exams at year appl	6.37	4.60	4.77	3.29	.66	1.44	.64	1.58
Number credits at year appl	54.21	37.73	41.70	28.06	5.07	10.93	4.77	11.39
Graduated on time	.86	.35	.92	.28	.79	.41	.80	.40
Career delay index	.08	.21	.05	.18	.24	.27	.23	.23
Final graduation grade	100.74	7.93	104.36	6.28	106.38	5.24	107.57	3.99
Distinction	.16	.37	.26	.44	.36	.48	.46	.50
Observations	1,213		1,440		732		926	

The RD design - I

- Our identification strategy takes advantage of the discontinuity in the probability of participating to the Erasmus programme given by the ranking-based allocation mechanism
- Within each ranking, the score of last student who is assigned the scholarship gives a cut-off value around which the allocation to the treatment is “as good as random”
- Characteristics of specific setting:
  - students can submit several applications in different study cycles
  - students can submit several applications within the same study cycle in different years
  - students can submit up to 3 applications in same year
  - students can decide to reject the scholarship
  - each scholarship allocation is based on a different ranking and has its own cut-off

The RD design - II

- We treat separately the sub-populations of bachelor and master students.
- A student is “treated” if she ever participated to an Erasmus programme during her study cycle.
- We focus on the first academic year of participation to a call for applications.
- Within each ranking, the cut-off score is determined by the last student who *accepts* the Erasmus scholarship.
- The running variable is constructed as the individual score normalised to the cut-off score
- For each student with >1 applications within the same year, we take maximum value of running variable
- We exploit only *within-ranking* variation

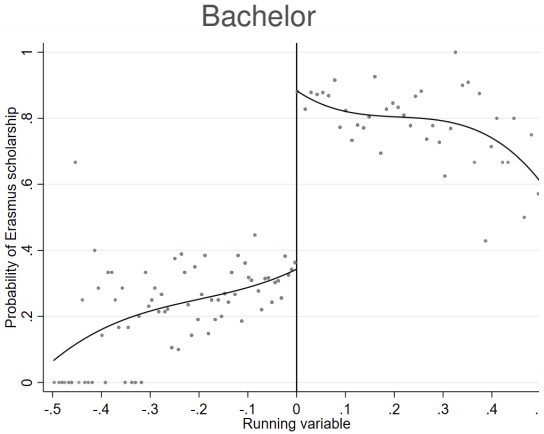
A small digression on causal parameters...

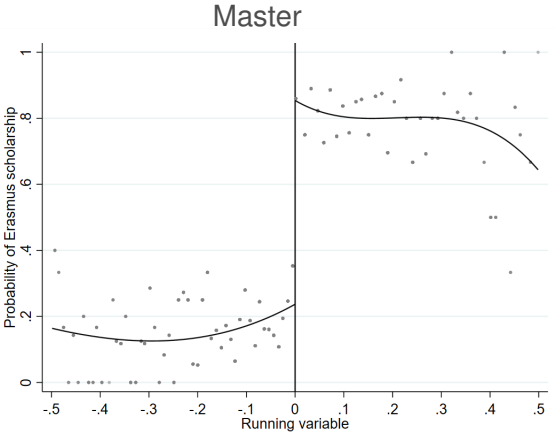
- CIE methods usually pay a price in terms of estimated effect.
- For example, in a RDD setup, we are just able to understand the effect of the treated individuals that are “at the threshold point” and we cannot say anything about individuals that are far away from the threshold point.
- In our case, the effect has to be read as the effect for the student that has obtained the scholarship for one *epsilon*.

Back to Data...

- As said, RDD requires less data with respect to other counterfactual methods (i.e. it requires just the value of the running variable, the treatment status and the outcome of interest).
- However, the precision of the estimates is related (among other things) on the amount of observations in a neighborhood of the threshold point.
- Administrative registries provides information on the **entire population** of Erasmus applicants.
- It is very unlike that reliable estimates can be obtained with survey data.

Probability of obtaining Erasmus scholarship





European Commission

Bachelor sample

VARIABLES	(1) Graduation grade	(2) Laude	(3) Graduated on time	(4) Career delay index
Above cutoff-score	0.7336** (0.3603)	0.0556** (0.0266)	-0.0159 (0.0135)	0.0076 (0.0079)
Observations	3,202	3,202	3,202	3,202
R-squared	0.5595	0.4547	0.4709	0.5305

Master sample

VARIABLES	(1) Graduation grade	(2) Laude	(3) Graduated on time	(4) Career delay index
Above cutoff-score	0.3676 (0.3943)	0.0609 (0.0456)	-0.0195 (0.0296)	0.0062 (0.0171)
Observations	1,753	1,753	1,753	1,753
R-squared	0.4537	0.4660	0.4810	0.5328

Balance checks of covariates

Bachelor

VARIABLES	(1) Female	(2) Different region	(3) No. exams	(4) No. ECTS
Above cutoff-score	-0.0202	-0.0463	0.1656	0.7342
	(0.0354)	(0.0394)	(0.2384)	(2.0556)
Observations	3,202	3,202	3,202	3,202
R-squared	0.3717	0.3421	0.5257	0.5075

Master

VARIABLES	Female	Different region	No. exams	No. ECTS
Above cutoff-score	-0.0720	0.0919	-0.0616	-0.5981
	(0.0652)	(0.0594)	(0.1449)	(1.0724)
Observations	1,753	1,753	1,753	1,753
R-squared	0.4170	0.3890	0.5922	0.5453

Heterogenous Effects – Why they are important

- What are usually called “heterogeneous effects” are not simply a statistical exercise.
- Understanding in which subgroups of the population the treatment has been more effective allows to understand the mechanisms that are behind the estimated effect in the entire population.
- This could be extremely useful also in better targeting the intervention in the future.

Heterogeneity of results across Erasmus programme characteristics

VARIABLES	(1) Graduation grade	(2) Laude	(3) Graduated on time	(4) Career delay index
Below 6 months	0.7155*	0.0788**	-0.0012	0.0048
	(0.4266)	(0.0316)	(0.0155)	(0.0095)
Above 6 months	0.9194	0.0343	-0.0494*	0.0155
	(0.6095)	(0.0390)	(0.0254)	(0.0140)
Observations	2,672	2,672	2,672	2,672
R-squared	0.5558	0.4520	0.4612	0.5284

Heterogeneity of results across students characteristics

VARIABLES	(1) Graduation grade	(2) Laude	(3) Graduated on time	(4) Career delay index
Stem	3.9806***	0.1033*	0.0277	-0.0217
	(0.9021)	(0.0529)	(0.0458)	(0.0286)
Not Stem	0.4333	0.0512*	-0.0200	0.0103
	(0.3677)	(0.0276)	(0.0137)	(0.0079)
Observations	3,202	3,202	3,202	3,202
R-squared	0.5634	0.4549	0.4714	0.5310

Heterogeneity of results across students characteristics

VARIABLES	(1) Graduation grade	(2) Laude	(3) Graduated on time	(4) Career delay index
First year	2.0017***	0.1003***	0.0030	-0.0262***
	(0.4540)	(0.0351)	(0.0167)	(0.0101)
Second year	0.2885	0.0380	-0.0191	0.0172**
	(0.3851)	(0.0275)	(0.0145)	(0.0086)
Third year	-1.5642	0.0368	-0.1604***	0.1405***
	(1.0676)	(0.0678)	(0.0597)	(0.0521)
Observations	3,202	3,202	3,202	3,202
R-squared	0.5649	0.4561	0.4747	0.5412

Conclusions

- This paper assesses the causal impact of participating in an Erasmus program on academic outcomes of higher university students
- The results suggest that spending a period of study abroad does not affect significantly the time to graduation of students at the University of Bologna
- Participation to the programme has a positive effect on the final graduation grade for bachelor students
- The effect varies significantly according to the characteristics of the study experience abroad

Thank you

European Commission

Timeline of application process

Academic year $t/t+1$

- January t: call for application published
- February t: deadline for applications
- March t: rankings published; acceptance period and allocation of scholarships
- April t: new call for applications for scholarships not awarded
- September t to July $t+1$: study periods abroad

Back