The Economics of European Regions: Theory, Empirics, and Policy

Dipartimento di Economia e Management

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RDD at work: Becker et al. (2010)

Becker, S. O., Egger, P. H., and Von Ehrlich, M. (2010). **Going NUTS: The effect of EU Structural Funds on regional performance**. *Journal of Public Economics*, 94(9), 578-590

- The European Union provides grants to disadvantaged regions to allow them to catch up with the EU average.
- **Objective 1**: promoting the development and structural adjustment of regions whose development was lagging behind, i.e. **GDP per capita lower than 75% of EU average**.
- This rule gives rise to a **Regression Discontinuity Design** that exploits the **jump** in the probability of receiving EU funds at the 75% threshold for identification of causal effect of Objective 1 treatment on economic growth.

Objective 1 Regions
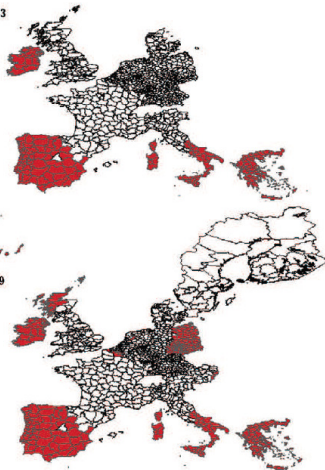
Table 3. Objective 1 recipient vs. non-recipient regions

	Mean recipient (1)	Mean non-recipient (2)	Difference col.(1)–col.(2) (3)	Std. Err. of col.(3) (4)
EU12				
GDP per capita 1988	8586.20	13634.19	−5047.99	478.23
No. of observations	52	134		
EU15				
GDP per capita 1993	10795.99	16298.13	−5502.14	536.56
No. of observations	58	151		
EU25				
GDP per capita 1999	11157.73	21251.68	−10093.94	556.27
No. of observations	123	156		

Notes: The table shows differences in GDP per capita (PPP) of recipient and non-recipient regions at the NUTS2 level. We miss information on the four French overseas-departments and the two autonomous Portuguese regions Madeira and Azores for all three periods. For the Dutch region Flevoland we miss information for the first period only. Regarding the East-German NUTS2 regions we calculated GDP per capita growth for the years 1989 and 1990 using information from the GDR's statistic yearbook.

- Regional initial pc GDP is the only official criterion for Ob 1 status
- The average difference between recipient and non-recipient increases after enlargements
- Problem: pc GDP determines **both** the probability of *treatment* and the growth rate (*convergence*)

Disentangle the impact of initial pc GDP on growth from the discontinuity related to being Ob 1 recipient!

	Recipients NUTS2	Non-recipients NUTS2	Recipients NUTS3	Non-recipients NUTS3
1989–1993 EU12				
Eligible	43	4	246	98
Non eligible	9	130	34	631
1994–1999 EU15				
Eligible	44	3	260	108
Non eligible	14	148	43	674
2000–2006 EU25				
Eligible	111	4	345	95
Non eligible	12	152	66	701

Notes: Eligible regions are characterized by a GDP per capita of less than 75% of EU average in the qualifying years of each programming period (3-year average over the years preceding the start of a new programming period). Recipient regions are those that did effectively receive Objective 1 status. We miss information on the four French overseas-departments and the two autonomous Portuguese regions Madeira and Azores for all three periods. For the Dutch region Flevoland we miss information for the first period only. Regarding the East-German NUTS2 and NUTS3 regions we calculated GDP per capita growth for the years 1989 and 1990 using information from the GDR's statistic yearbook.

- Some regions got treated even though the were too rich
- Others were not treated although poor enough

Partial non-compliance ⇒ **Fuzzy** RDD.

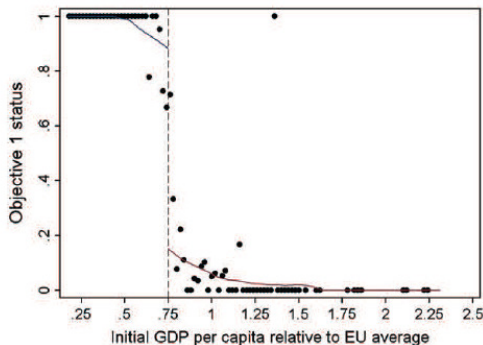# Figure 2. Objective 1 status and the 75% GDP threshold.

Fig. 2. Objective 1 status and the 75% GDP threshold. *Note*: The figure shows average treatment rates in equally sized bins of 2% which are plotted against the per capita GDP that applied in the years relevant for the decision about Objective 1 status. The graph represents a local polynomial smooth; based on Epanechnikov kernel with rule-of-thumb bandwidth. Note that the outlier at about 1.3 times the EU average which received treatment represents only one observation, namely Berlin in the 1989–1993 programming period. All results are robust to the exclusion of Berlin.

- Discontinuity in the relationship between *treatment D*, i.e. Objective 1 status, and the *forcing variable X* , i.e. the initial pc GDP relative to EU average.
- Fuzzy RDD: the discontinuity in the treatment probability is smaller than unit.
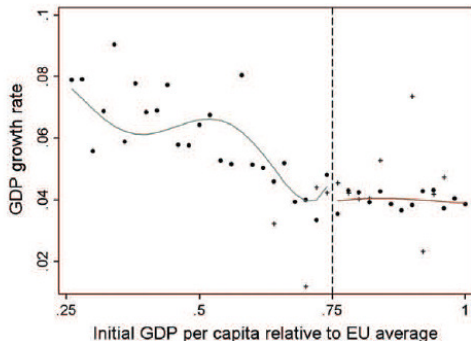
Figure 3. Growth and the 75% GDP threshold.

Fig. 3. Growth and the 75% GDP threshold. *Note*: The figure shows averages of GDP per capita growth in equally sized bins of 2% which are plotted against the per capita GDP that applied in the years relevant for the decision about Objective 1 status. Diamonds represent correctly classified observation according to the 75% rule while crosses mark incorrectly classified observations. The graph represents a 5th order polynomial function.

- Discontinuity in the relationship between outcome variable Y, i.e. GDP growth rate, and the *forcing variable X* , i.e. the initial pc GDP relative to EU average.
- Fuzzy RDD: crosses indicate non-compliers.
- The majority of crosses are generally positioned *below* the local polynomial to the left of the threshold but *above* the local polynomial to the right of the threshold.
- The treatment effect is **underestimated** by the discontinuity at the threshold

A consistent estimate of the discontinuity can, however, be obtained by IV estimation when using the (Objective 1) treatment eligibility rule as an instrument.

The structural model is given by:

$$Growth_{it} = \theta_t + \rho\, Treat_{it} + f\left(Force_{it}\right) + \lambda_i + \mu_{it} \tag{1}$$

and the first-stage is given by:

$$Treat_{it} = \alpha_t + \beta Rule_{it} + f\left(Force_{it}\right) + \kappa_i + \epsilon_{it} \tag{2}$$

or

$$P\left(Treat_{it}\right) = f\left(\delta_t + \psi Rule_{it} + f\left(Force_{it}\right) + \kappa_i + \xi_{it} + \nu_{it}\right) \tag{3}$$

Results

Table 6

RDD NUTS2—Objective 1 and GDP per capita/employment growth (symmetric polynomials on both sides of the threshold).

	3rd order polynomial		4th order polynomial		5th order polynomial	
	Pooled OLS	FE	Pooled OLS	FE	Pooled OLS	FE
	(1)	(2)	(3)	(4)	(5)	(6)
GDP per capita growth						
Objective 1	.020(.002)***	.019(.004)***	.019(.002)***	.020(.004)***	.019(.002)****	.020(.004)***
Const.	.046(.010)***	.070(.015)***	.068(.016)***	.088(.023)***	.109(.026)***	.113(.043)***
Obs.	674	674	674	674	674	674
R^2	.16	.18	.17	.18	.17	.18
Employment growth						
Objective 1	.002(.002)	−.004(.003)	.002(.002)	−.003(.003)	.003(.002)	−.001(.003)
Const.	−.017(.009)*	.019(.015)	−.011(.018)	.023(.026)	.051(.030)*	.086(.052)*
Obs.	674	674	674	674	674	674
R^2	.03	.06	.03	.07	.05	.08

Notes: ***, **, *, # denote statistical significance at the 1%, 5%, 10%, and 15% level, respectively. Standard errors are clustered at the NUTS2 level. First-stage regressions are probit models. The polynomial functions are forced to have identical parameters to the left and the right of the threshold. The sample consists of the EU12 NUTS2 regions for the first period, the EU15 NUTS2 regions for the second period and the EU25 NUTS2 regions for the third programming period. We miss information on the four French overseas-departments and the two autonomous Portuguese regions Madeira and Azores for all three periods. For the Dutch region Flevoland we miss information for the first period only. Regarding the East-German NUTS2 regions we calculated GDP per capita growth for the years 1989 and 1990 using information from the GDR's statistic yearbook.