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DISCUSSION PAPER SERIES

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ABSTRACT

Looking for a Star: Evaluating the Effect of the Cohesion Policy on Regional Well-Being*

This paper presents new evidence on the last concluded wave (2007-2013) of the EU cohesion policy. We depart from the broadly used GDP-growth approach and evaluate the impact of EU Structural Funds (SFs) on a battery of regional well-being indicators including economic, educational, health, and demographic outcomes. We exploit the SFs assignment rule to construct a fuzzy RDD. Our results reveal an overall null effect of the policy. We further identify how regional (i) quality of government (ii) human capital and (iii) urbanization impact the policy's effectiveness. We conclude that these characteristics affect the relationship between SFs and economic outcomes only.

JEL Classification: C21, H51, H52, I31, R11

Keywords: cohesion policy, regional well-being, Fuzzy RDD

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1 Introduction

The cohesion policy represents the main pillar of the European Union's development strategy. The policy aims to promote and support the overall harmonious development of the EU Member States by speeding up the convergence process and closing the economic and social gaps across regions. Its declared goals are to "pursue job creation, education, skills, social inclusion and equal access to healthcare, sustainable development, and, on the whole, to improve citizens' quality of life"[1].

The first wave of funding date back to thirty years ago. Since then, the EU has invested more than 1,000 billion euros into the policy[2]. However, after more than thirty years and the large amount of money spent, the debate on the merits of the cohesion policy is still burgeoning and there are contrasting views on whether the policy is successfully bridging the socio-economic gap between EU regions. Starting from Sala-i Martin (1996) who finds that EU Structural Funds (SFs) did not deliver regional growth in Europe, an increasing amount of papers aimed to evaluate the effectiveness of the EU cohesion programs. In general, the early studies conclude that the EU cohesion policy has not fostered regional growth (Boldrin and Canova (2001); Ederveen et al. (2002) and Ederveen et al. (2006); Beugelsdijk and Eijffinger (2005)), or find a very small and negligible effect on the catching up process of poorer regions (Dall'Erba and Le Gallo (2008); Mohl and Hagen (2010); Esposti and Bussoletti (2008)). In contrast, more recent literature finds positive effects of EU funds on regional development (Becker et al. (2010); Becker et al. (2012); Pellegrini et al. (2013); Gagliardi and Percoco (2017); Becker et al. (2018)). A likely driver of these positive results may be identified in favorable regional characteristics such as the level of human capital and quality of the institutions (Becker et al. (2013), Crescenzi and Giua (2020)).

Most of the cited studies are focused on the EU budgeting periods between 1989 and 2006 and assess the convergence process of the GDP per capita only. In this paper, we analyze the effectiveness of the cohesion policy on thirteen indicators of well-being measured between 2006 and 2015. They span from economic-related outcomes (GDP, employment rate, female active population rate, share of young people who are not in employment, education or training), to educational and human-capital (tertiary education and adult participation rate in education and training), and demographic and health outcomes (population and fertility rate, life expectancy and infant mortality rate). This selection is guided by an extensive literature showing a close relationship between this set of indicators and the degree of development at the country-level[3]. Notably, we also find that these indicators are highly correlated with GDP per capita in 2006 (our first year of analysis) at the regional level.

Therefore, the contribution of our paper to the literature is twofold. First, we provide fresh evidence on the last concluded wave of policy (2007-2013). Second, and more importantly, we deliver new results on the effects of SFs on regional well-being growth. Indeed, quite surprisingly, even though the declared goal of the cohesion policy is to bridge the gap in well-being across regions, only very few papers departed from GDP to evaluate the

[1] https://ec.europa.eu/regional_policy/en/policy/what/investment-policy/

[2] https://ec.europa.eu/regional_policy/en/policy/what/history/

[3] See: Preston (1975) for the relation between life expectancy and country's income; Romer (1989) for the relation between human-capital and development; Adelman (1963) for the impact of fertility, mortality and population trends on country's development; Krueger and Lindahl (2001) for the relation between education and income.

effectiveness of the EU cohesion policy. Rodríguez-Pose and Fratesi (2004) examine the return of investments in specific fields, finding only those in education and human capital to have medium-term positive and significant returns. Ferrara et al. (2017) show the positive impact of the cohesion policy on R&D and transportation infrastructures. However, to the best of our knowledge, our study is the first in which economic, educational, health and demographic outcomes are pieced together to provide an extensive understanding of the EU fund's effectiveness. Only recently, Ferrara et al. (2020) analyze the relation between funding intensity and regional well-being. Nevertheless, our study differs from theirs in both data and methods. Ferrara et al. (2020) use a dose-response function approach for the period 2000-2006, and find a heterogeneous, but overall positive, effect of the EU funds in the short term, while we exploit an RD design for the period 2007-2013 and prove a basic ineffectiveness of the policy in the medium term. Yet, they use a single composite index of well-being, while we consider separately its different dimensions and find somewhat mixed results.

Our approach builds on relevant contributions that emphasize the key role of cross-cutting indicators in the evaluation of a country's well-being (i.e. Stiglitz et al. (2009); Fleurbaey (2009); Costanza et al. (2009)). Following Stiglitz et al. (2018) *"One can't imagine flying a plane without a dashboard of instruments, so too we can't imagine steering an economy without a dashboard of indicators"*. The latter also links the present work to the debate around the correct measurement of policy success. Indeed, policy evaluation should not be focused only on productivity but should also encompass broad measures of well-being in order to derive more accurate measures of the economic performance (Stiglitz et al. (2009)).

We find a set of new results that contribute to the debate around the effectiveness of the EU cohesion policy in several ways. We first presents a descriptive analysis of the convergence process after 2007 among advanced and lagging EU regions. We show that some of the indicators converged in the more recent years while others diverged. In particular, we find a modest growth trajectory among the economic outcomes, mostly driven by country-specific characteristics. On the other hand, we observe divergence or steadiness among the socio-demographic indicators. Second, the European Union allocates SFs among regions using their GDP per capita level as a signal of regional development. A region is considered less developed when its GDP per capita lies below the 75% of the EU average. Thus, we exploit this fund's assignment rule in a fuzzy Regression Discontinuity Design (RDD) to perform a precise causal analysis. We find a modest impact of the policy on two economic (young employment and female activity rate) and one educational (tertiary education) outcomes. However, these findings are not robust to different specifications. Further, we do not find any effect of the policy on the remainder of the well-being outcomes. Finally, we study how regional characteristics influence the results. In particular, we show that (i) quality of institutions, (ii) human capital and (iii) urban density affect the capacity of the policy to determine significant effects on GDP and employment, in line with Becker et al. (2013). However, the effect of these three idiosyncratic characteristics on the other components of well-being (e.g health and education) remain not significant everywhere. Overall, our findings on the economic outcomes are close to Becker et al. (2018), documenting a decline in the effectiveness of the cohesion policy during the crisis. Further, the heterogeneity analysis confirms that those regions with idiosyncratic favorable characteristics benefited more of the SFs. On the other hand, our findings on the ineffectiveness of the policy on other socio-demographic indicators leave room for a new policy debate.

The remainder of the paper is organized as follow: in Section 2 we briefly describe the basic mechanism of the EU Regional Policies. In Section 3, data and outcomes are presented. Section 4 reports the results of the Convergence Analysis. In Section 5 we present the fuzzy RDD, its results and perform robustness checks. In Section 6 the scope of our findings is investigated with a Heterogeneous $LATE$ approach. Finally, we draw conclusions and policy implications in Section 7.

2 The EU cohesion policy

Regional policies have been enacted since 1975. However, in early programming periods only a small percentage of the total Community budget was devoted to regional development. Starting from 1989, the intervention's mechanism was converted into a more complex one with the aim of funding regional development programs according to specific rules. In subsequent years the budget was increased reaching about one third of the total Community budget. As a consequence, in 2009, the Treaty of Lisbon acknowledged regional cohesion as one of the key goals of the EU (art. 174 of the Treaty).

The EU cohesion policy is based on three funds: ERDF (European Regional Development Fund), ESF (European Social Fund) and CF (Cohesion Fund). In this work we focus on ERDF and ESF for two reasons. First, we can exploit the assignment rule below their allocation to pursue a clean identification strategy.[4] Second, ERDF and ESF account for most of the EU regional policy budget (80 percent in terms of 2007-2013 funding), playing a key role in EU regional development. In particular, the ERDF promotes balanced development in the EU regions; the ESF supports employment-related projects throughout Europe and invests in human capital.

The cohesion policy targets all regions according to their level of per capita GDP and accordingly allocates a certain percentage of the total funds.[5] In particular, regions with a per capita GDP below the threshold of 75% of EU average are classified as "Convergence Objective" (Objective-1 in the previous programming periods), receiving the larger share of the total available policy budget. In line with other studies (Becker et al. (2010); Pellegrini et al. (2013); Becker et al. (2018)),we will exploit this assignment rule in our RDD exercise presented in Section 5. However, this is not a sharp cutoff given that the same status is attributed (on the basis of the so-called "phasing-out" mechanism) to regions previously financed by the Objective-1 and with a GDP per capita ratio above 75% only due to the statistical effect of the EU enlargement.[6] We incorporate this imperfect compliance with the 75% rule in our empirical framework using a fuzzy RDD.

[4] The CF is allocated at national level and reserved to those countries with a gross national income per capita lower than 90 percent of the EU average. In the programming period 2007–2013, there were 15 member states receiving financial aid from the CF: Portugal, Cyprus, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia, Slovenia, Bulgaria and Romania (plus Greece and Spain on a transitional basis).

[5] Over the course of the years regions have been identified through a common nomenclature of territorial units for statistics (NUTS). The latter was created by the European Office for Statistics (Eurostat) in order to apply a common statistical standard across the European Union. In particular, the object of the cohesion policy are European regions at NUTS-2 level.

[6] In fact, the entrance of 10 new countries in 2004 (Cyprus, Czechia, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia, Slovenia) and 2 in 2007 (Bulgaria and Romania) required a re-adjustment of the statistics.

Figure 1 reports the distribution of EU funds intensity among regions. As shown, all the NUTS-2 received a part of the policy budget, even if there is a large increase associated with the assignment to "Convergence Objective".[7] Accordingly, with respect to our identification strategy, it is important to note that the causal effects we estimate have to be interpreted as the difference between being in "Convergence Objective" versus receiving the less generous treatment implied by "Competitiveness and Employment Objective" (Objective-2 in the previous programming periods).[8] In Figure 2 we show the map of Europe where NUTS are distinguished according to their treatment (belonging to "Convergence Objective") and eligibility (GDP per capita below 75% of EU average) status.

[FIGURES 1-2 ABOUT HERE]

3 Data and Outcomes

Our database combines several sources. Outcome data are stem from the Eurostat regional database, while information on EU transfers are gathered from the European Structural and Investment funds Data.[9] Finally, GDP and population data are sourced from the ARDECO database of the European Commission.[10] Since 2003, NUTS have undergone many adjustments. Indeed, over the years, some regions have merged, others have split into smaller entities and others were renamed or had new codes assigned to them. This might create some issue in data analysis because of a mismatch of NUTS versions between 2003 and 2016. In 2006 Convergence and phasing-out regions were classified according to their 2003-NUTS-version, while data available on Eurostat today recall the 2016-version. Hence, to construct a coherent database, the first step is to make a backward reconstruction of the NUTS-2, following RHOMOLO model (López-Cobo et al. (2016)). This first crucial step allows us to construct a coherent and precise cross-section dataset on 270 European NUTS-2 regions.

Our set of outcomes comprises thirteen indicators of well-being between 2006 and 2015. We can group these into two major classes. First, economic-related outcomes: (1) per capita GDP; (2) three indicators of employment rate (employment in total, young and female population); (3) female active population rate; (4) NEET rate (the rate of young people neither in employment nor in education or training). Second, demographic, health and education outcomes: (1) population and fertility rate; (2) three health indicators (life expectancy at 1 and 85 years old and infant mortality rate); (3) two indicators on human-capital development (tertiary education and adult participation rate in education

[7] On average, the expenditure of EU funds in "Convergence Objective" and "Competitiveness and Employment Objective" is respectively equals to 1,471 and 235 euros per capita. Using our baseline fuzzy RDD model (see Section 5), the estimated difference between treated and control regions is 1,898.93 (S.E. 496.63).

[8] Part of the variability in funding intensity within the "Competitiveness and Employment Objective" is related to the application of another transitory status, the so-called "phasing-in", including regions which were covered by the former Objective-1 but whose GDP exceeds now the 75% of the EU average (both with and without enlargement). We will deal with this aspect later when we consider the EU funds intensity as the treatment variable instead of the binary status.

[9] https://cohesiondata.ec.europa.eu/Other/Historic-EU-payments-regionalised-and-modelled/tc55-7ysv

[10] https://knowledge4policy.ec.europa.eu/territorial/ardeco-online_en

and training).[11]

As a preliminary check, we first show in Table 1 the statistical correlations between the level of per capita GDP and each other indicator (in 2006). We both compute the correlations with the EU15 and EU27 samples. We find a high correlation between per capita GDP and all the other outcomes in the EU27 sample.[12] The same evidence is confirmed also in the EU15 sample, except for life expectancy. This proves that in 2006 poorer regions had gaps in almost every aspect of well-being, leaving room for policy intervention.

[TABLE 1 ABOUT HERE]

4 Convergence analysis

In the first instance, we perform a descriptive analysis to emphasize the socio-economic framework into which SFs were allocated starting from 2007. In particular, at least two major events might have modified the process of convergence in EU regions. First, Europe - as well as the rest of the world - suffered a double recession due to the economic and financial crisis which began in September 2008, with a differential impact across states and regions (Crescenzi et al. (2016)). Second, the EU enlargement, that took place between 2004 and 2007, brought the number of EU official members to 27 by including mostly east-European countries that were far below the EU15 average level of development from both a social and economic perspective. Yet, this process could have produced different effects among regions in new and old member states (Caliendo et al. (2021)). In Tables 2-3 we report the estimate of the following Equation:

$$\Delta Y_{i,t,t+T} = \alpha + \beta GDP_{i,t} + \gamma X_{i,t} + \varepsilon_{i,t} \tag{1}$$

Where, $\Delta Y_{i,t,t+T}$ is defined as the percentage change in outcome between t (initial value) and $t+T$ (final value) in region i.[13] Then, $GDP_{i,t}$ is the per capita GDP level and $X_{i,t}$ contains a set of control variables. Finally, $\varepsilon_{i,t}$ is the error term.

Tables 2-3 report the results for two samples (EU27 and EU15). The outcome difference is measured for two end periods (2015 and 2018), that correspond respectively to the effective final year of expenditure in the programming period 2007-2013 and the last year of data availability (the initial value is always 2006). Yet, we present results with robust and clustered errors at the country level. Table 2 shows a significant GDP per capita growth when the full sample (EU27) is considered, while for the pre-enlargement sample (EU15) we find a null effect. In particular, we find a GDP growth of 2% between 2006 and 2015 and of 3% between 2006 and 2018. Further, the significance level in these results is affected by the choice of clustering at the country level. This evidence suggests that the catching-up process slowed down in the period of analysis. The overall small GDP growth seems to be driven by the less developed regions. Further, this confirms that the double recession which occurred in Europe from 2008 has hampered the growth process among

[11] Unfortunately, there are not enough data available in the official statistics at NUTS-2 level in order to take into account other dimensions such as poverty, social exclusion or environmental features. Though their inclusion appears to be an obvious extension of our analysis, a reconstruction of a large regional database including these aspects is out of the scope of this paper.

[12] This aggregate includes the European Union in the period between 2007 and 2013, before Croatia joined.

[13] We re-coded all variables so that a negative (positive) sign reads as convergence (divergence) effect.

European regions. The remainder of table 2 confirms this evidence across labor-market indicators. In Table 3 demographic, health and educational outcomes are reported. The analysis shows a consistent divergence of demographic dynamics. The latter is linked to the divergence of life expectancy indicators but is slightly contrasted with fertility rate convergence. Yet, it is likely related to more sustained migration flows towards richer regions (De Giorgi and Pellizzari (2009), Mitze (2019)). In relation to the indicators of human-capital development we also find a significant divergence. A possible mechanism might be identified in the vicious circle of the so-called "brain drain" that decreases the ability of regions to attract clusters of skilled innovative activities (Berry and Glaeser (2005); Davis and Dingel (2020)). Labor mobility may be one of the main drivers. Even though public policy can intervene to correct this distortion in the labor market, it might be the case that it was precisely the policy on housing costs and social benefits which have worsened the situation (Floerkemeier et al. (2021)).

On the whole, tables 2-3 provide evidence of an arrest of the catching up process of less developed regions, documented in the previous years (Neven and Gouymte (1995); Persson (1997); De la Fuente (2002)). In the light of this evidence, the aim of the next sections is to analyze which role the cohesion policy played in this process.

[TABLES 2-3 ABOUT HERE]

5 The role of the cohesion policy

5.1 Fuzzy Regression Discontinuity Design

To estimate the impact of the cohesion policy, we implement a fuzzy RDD. We mostly follow Lee and Lemieux (2010) and Imbens and Lemieux (2008) indications. Further, this method has already been successfully applied to the evaluation of the cohesion program (Becker et al. (2010); Pellegrini et al. (2013); Becker et al. (2018)). A main advantage of RDD is that it requires seemingly milder assumptions compared to those needed for other quasi-experimental approaches (Hahn et al. (2001)). Before we proceed deeply into some technical aspects of our empirical analysis, it is worthwhile reminding the reader of the mechanism behind funds assignment. A region is treated (i.e. belonging to "Convergence Objective") if its per capita GDP is below 75% of the European GDP average.[14] Then, in principle, regions on the right of the threshold are used as controls for the treated regions. Further, with the cohesion policy assignment mechanism, we can rule out the possibility that regions can manipulate the forcing variable. With these two insights, a discontinuity in the conditional expectation of the outcome at the cut-off point can be interpreted as evidence of a causal effect of the treatment. However, at least in the 2007-2013 policy wave, there are some non-compliance regions. In fact, our sample comprises one non-treated but eligible region (Madeira),[15] as well as some regions with a per capita $GDP \geqslant 75\%$ that are assigned to the treatment (mostly due to the so-called "phasing-out" status; see Section 2). This gives rise to a fuzzy RDD. Hence, we distinguish between two variables: D_i is the actual treatment and T_i is the eligibility for treatment. In a fuzzy

[14] Following the eligibility rules for the programming period 2007-2013, in this Section we measure it as the average GDP inhabitant in purchasing power standard for the years 2000-2002.

[15] The reason is that this region did not qualify for Convergence status based on the data available at the time when regional funds were assigned, but turned out to be eligible when GDP figures were revised. More in general, this is an additional source of imperfect compliance that we also deal with our fuzzy RDD strategy.

RDD the treatment D_i is not a deterministic function of the forcing variable x_i. Then, D_i does not jump from 0 to 1 at the threshold. Thus, we define the probability of treatment $P(D_i)$ as follow:

$$P[D_i = 1 \mid x_i] = \begin{cases} g_0(x_i) & \textit{if} \quad x_i \geqslant x_0 \\ g_1(x_i) & \textit{if} \quad x_i < x_0 \end{cases} \tag{2}$$

Where $g(x_i)$ is a function of the forcing variable and $g_0(x_i) \neq g_1(x_i)$. In our study we assume that $g_0(x_i) < g_1(x_i)$ because a region is more likely to be treated if $x_i < x_0$. Then, the relationship between the probability of treatment $D_i = 1$ and x_i is given by:

$$\mathbb{E}[D_i \mid x_i] = P[D_i = 1|x_i] = g_0(x_i) + [g_1(x_i) - g_0(x_i)]T_i \tag{3}$$

Where T_i (eligibility) is a dummy defined as: $T_i = 1(x_i < x_0)$. The aim is to estimate the impact of the binary treatment D_i on $\mathbb{E}[Y_i \mid x_i]$. With $\mathbb{E}[Y_i \mid x_i] = f_0(x_i) + [f_1(x_i) - f_0(x_i)]D_i$. More formally, we estimate:

$$\Delta Y_i = \theta + \rho D_i + f(x_i) + \varepsilon_i \tag{4}$$

Where, the parameter ρ measures the local average treatment effect ($LATE$) of binary treatment D_i. In Equation (4) ΔY_i is the percentage change of the outcome in region i whose treatment status is D; $f(x_i)$ is a polynomial function of the forcing variable. Following the suggestion by Gelman and Imbens (2019), $f(x_i)$ is taken to be a quadratic function of the difference between the GDP per capita ratio in region i and the threshold (75%). Lastly, ε_i is the error term. As discussed before, in equation (4), the threshold does not perfectly determine treatment exposure, but it creates a discontinuity in the probability of treatment exposure. Accordingly, we proceed to a $2SLS$ estimation, where in the 1^{st} *Stage* D_i is instrumented with T_i, as follow:

$$\tilde{D}_i = \alpha + \gamma T_i + g(x_i) + \eta_i \tag{5}$$

The fitted value of Equation (5) are substituted in Equation (4) to get an unbiased estimates of ρ. Accordingly, in our baseline estimates, the LATE measures the (average) effect of receiving the actual treatment for those regions whose GDP per capita is between the 25% and the 75% of the EU average.

5.2 RDD results

In this section we present the results of our fuzzy RDD model with robust and clustered errors at the country level. Our reference period is from 2006 (the year before the start of programming period) to 2015 (the last year of operation according to the so-called "n+2 rule", which implies that funds are spent within two years from the end of the programming period). First, in table 4 we report the summary statistics for each outcome in NUTS-2 regions according to their actual treatment status. Figures 3-5 also report a graphic representation of the relation between the percentage change in outcomes (between 2006-2015) and the initial level of per capita GDP (expressed as a % of the EU average). These first sets of descriptive statistics suggest that there is no clear evidence of a general process of convergence in well-being outcomes. In what follows, by means of our model, we verify whether the results change when looking for treatment effects at the discontinuity border.

[TABLE 4 ABOUT HERE]; [FIGURES 3-5 ABOUT HERE]

Table 5 reports economic outcomes, while in Table 6 the other well-being indicators are shown. In order to exclude extreme outliers, our baseline sample of NUTS-2 regions include those within ± 50% from the threshold.[16] On the whole, our results show a general ineffectiveness of the cohesion policy during the 2007-2013 programming period. A few exceptions, although not robust to all alternative specifications, register a significant negative impact on young employment rate (-2.9%) and a positive impact on tertiary education rate (+3.1%). Taken together, this evidence may suggest a shift of young people away from a premature entry into the labor market to higher education due the policy support. Yet, there is mild evidence of a positive and significant effect on female work participation growth rate (+0.8%).

Tables 7-12 present an extensive battery of robustness checks. In Panel A we include the set of covariates already used in the convergence analysis: initial population, a dummy for capital regions, employment rate, dependency ratio, sectoral shares, latitude and longitude. This procedure allows us to mitigate a small sample bias and improve the precision of estimates (Black et al. (2007); Imbens and Lemieux (2008)). In Panel B we extend our time span to 2018, to take into account likely lagged effects of the policy. In Panel C we use the continuous treatment measured as the total expenditure by SFs (in per capita terms). Yet, we verify the robustness of results to different sample sizes. Indeed, Panel D shows the estimates without any bandwidth restriction. In panel E we restrict the sample according to the average of the three optimal bandwidths suggested by Ludwig and Miller (2007), Imbens and Kalyanaraman (2012), Calonico et al. (2014).[17] Panel F restricts the sample to EU15 regions. Finally, we consider alternative specifications of the model. In Panels G and H we use respectively a linear and spline specification of $f(x_i)$.[18] Finally, in Panel I we use only regions that comply with the eligibility rule and accordingly estimate a sharp RD. Overall, previous results are qualitatively confirmed, even though the effect of the cohesion policy on young employment, tertiary education and female activity rate seem to be not robust to all specifications. More in general, there is scant evidence that the cohesion policy has fostered convergence in regional well-being during the last programming period.

[TABLES 5-12 ABOUT HERE]

6 Heterogeneity of the results

In the previous section we have proved the general ineffectiveness of the cohesion policy on regional well-being. In this section, we aim to explore some potential mechanisms behind our findings. Notably, we exploit three relevant regional characteristics to ponder how these are related to the policy's effectiveness. Hence, following Becker et al. (2013) we provide a quantitative analysis of the heterogeneous effect of the treatment ($HLATE$). We consider three variables and their interactions with our Treatment variable (D_i): (i) Quality of institutions, (ii) Human capital and (iii) Urban density. To measure them, we use respectively: (i) the quality of government (QoG) index from Charron et al. (2014), measuring the local quality of government (understood as low corruption, impartial public

[16]The restriction of the sample implies an exclusion of 8 NUTS-2 regions within the left tail of the distribution and 35 NUTS-2 within the right tail.

[17]Table A1 in the Appendix displays the optimal bandwidths retrieved using the three procedure and their average. Results (available upon request) are similar when we consider them one by one.

[18]Tables A2-A3 in the Appendix report also the results obtained by applying a non-parametric fuzzy RDD model. As shown, the evidence remains unchanged, though estimates are more imprecise

services and rule of law) for EU regions; (ii) the share of people aged 25-64 with at least upper-secondary education (from Eurostat); (iii) population density per square kilometer (from Eurostat). A growing body of literature now shows how human capital and the quality of local institutions may undermine or enhance the effectiveness of European Funds (Becker et al. (2013), Aiello et al. (2019), Rodríguez-Pose and Garcilazo (2015)). Further, Gagliardi and Percoco (2017) and Albanese et al. (2020) provide some useful insights on the different trends of local productivity between urban and rural areas, with a gap in favor of the former group. Precisely, it seems that EU funds, in more urbanized areas, deliver a larger productivity gain than that devoted to less urbanized areas. With these insights in mind we provide an estimation of the Heterogeneous LATE (in Equation 10).

From a technical point of view, the empirical setting is very close to those presented in section 5. As before, assume we want to estimate the effect of a binary treatment (D_i) on $\mathbb{E}[Y_i \mid x_i]$. However, now our outcome of interest (ΔY_i) depends on the treatment indicator (D_i), the forcing variable (x_i) and the variable z_i. The latter is a vector capturing the interaction variables that render the treatment more or less effective ($Z_i = [QoI,\ HC,\ Urb]$). Importantly, z_i affects the outcome but not the treatment. As a consequence, the probability of treatment can be written as follows:

$$P[D_i = 1 \mid x_i] = \begin{cases} g_0(x_i) & if \quad x_i \geqslant x_0 \\ g_1(x_i) & if \quad x_i < x_0 \end{cases} \tag{6}$$

Then, the relationship between the probability of treatment $D_i = 1$ and x_i is given by:

$$\mathbb{E}[D_i \mid x_i] = P[D_i = 1|x_i] = g_0(x_i) + [g_1(x_i) - g_0(x_i)]T_i \tag{7}$$

Where T_i (eligibility) is a dummy variable defined as: $T_i = 1(x_i < x_0)$. Hence, the aim is to estimate the impact of D_i on $\mathbb{E}[Y_i \mid x_i, z_i]$. With:

$$\mathbb{E}[Y_{0i} \mid x_i, z_i] = \alpha + f_0(x_i) + h_0(\widetilde{z}_i) \tag{8}$$

$$\mathbb{E}[Y_{1i} \mid x_i, z_i] = \mathbb{E}[Y_{0i} \mid x_i, z_i] + \rho + f_1(x_i) + h_1(\widetilde{z}_i) \tag{9}$$

With $f(x_i)$ being a quadratic function of the deviation from the threshold $(x_i - c)^2$ and $h(\widetilde{z}_i)$ being a function of the deviation from the sample mean $(z_i - \widetilde{z}_i)$. From Equations 8-9 we get:

$$\Delta Y_i = \alpha + f_0(x_i) + h_0(\widetilde{z}_i) + D_i[\rho + f_1(x_i) + h_1(\widetilde{z}_i)] \tag{10}$$

The parameter of interest is now $\rho + h(\widetilde{z}_i)$ that exactly represents the *Heterogeneous Local Average Treatment Effect*. As with $LATE$ estimation we need to address the endogeneity of Y_i. Now, using T_i and its interaction with z_i as instruments we compute the 1^{st} stage as follow:

$$D_i = g_0(x_i) + l_0(\widetilde{z}_i) + T_i[\delta + g_1(x_i) + l_1(\widetilde{z}_i)] + \omega_i \tag{11}$$

By substituting Equation 11 in 10 we obtain the reduced form through which we can compute an unbiased estimator of the $HLATE(x_0, z_i)$.

In tables 13-16 the results of the estimation are presented. Firstly, on the positive side, tables 13-16 confirm the results of previous studies, suggesting the presence of a systematic heterogeneity in the regional response to funding. Tables 13-14 show that the quality of institutions, the endowment of human capital and the urbanization level simultaneously affect the magnitude of treatment effects for 5 economic outcomes out of 6 (the only exception is the NEET rate, for which the only significant interaction term is human capital). Accordingly, these forces seem to be crucial determinants of the capacity of the cohesion policy to spur GDP and employment growth, also in more recent years. Nevertheless, on the negative side, tables 15-16 suggest that these results are not confirmed with regard to socio-demographic outcomes. In this case, our interaction terms are largely not significant. We find evidence of a significant role of the endowment of human capital to turn the Social Funds into well-being growth in terms of fertility and life expectancy. Again, interestingly, the effect of the policy on population growth varies significantly with the level of urbanization to possibly reinforce agglomeration trends.

[TABLES 13-16 ABOUT HERE]

7 Conclusions

After more than thirty years and a large amount of money spent into the EU cohesion policy, the debate around its effectiveness to bridge the socio-economics gap between regions is still open. In this paper, we analyze the last concluded policy wave (2007-2013) to contribute to the ongoing debate on the cohesion programs effectiveness. In particular, we provide fresh evidence on the effects of SFs on regional well-being using a battery of thirteen economic, educational, health and demographic outcomes. Our approach builds on the relevant literature advocating the use of cross-cutting well-being indicators in the evaluation of economic performance (Stiglitz et al. (2009)). Accordingly, we perform a policy evaluation exercise that better matches with the declared goals of the policy that are, ultimately, to improve "citizens' quality of life".

First, we depict the challenging framework into which the cohesion policy operated between 2007 and 2015. We show that the catching-up process slowed down in the crisis period. On the one hand, we find a small growth among economic outcomes (GDP per capita and employment rate), mostly driven by the less developed countries. On the other hand, we report a consistent divergence of socio-demographic dynamics, linked to the divergence of life expectancy indicators but slightly contrasted by fertility rate convergence. With these insights in mind, we perform a causal analysis to address the role of the cohesion policy in sustaining well-being growth. We use a fuzzy RDD which exploits the SFs assignment rule. We find a significant (but small) reduction in the employment rate of the young population and a slight increase in tertiary education rate. Taken together, these two results can be interpreted as a shift of young people from an early entrance into the job market to higher level of education. Yet, we find only moderate evidence that the policy increased the female labor market participation. On the reminder of well-being indicators we find a null effect of the policy. However, while the latter results resist all different specifications, the significant effects on young employment, female activity rate and tertiary education mostly vanish when robustness checks are performed. As it is well-known, RDD identification strategy allows to retrieve only "local" average treatment effects. Thus, the extent to which our results can be extended to the regions far from the eligibility threshold is unclear. However, combining RDD evidence with the convergence analysis, our findings offer an overall negative view about the effectiveness of EU cohesion policy to close the gap in well-being between regions during the period 2007- 2015. This evidence suggests a rethink of the policy itself. Indeed, while previous evidence points to a convergence on GDP growth in treated regions, our analysis shows that the well-being gap between richer and poorer regions is still far from being closed in the EU.

A further insight of our work comes from the analysis of the heterogeneity of the policy impact. In particular, we exploit three regional variables that may affect the treatment effect magnitude, namely (i) quality of local institutions (ii) human capital and (iii) urbanization and we find that these characteristics affect the relation between SFs and economic outcomes only. These results suggest at least two sets of policy implications. One the one hand, the fact that regional characteristics are relevant for the success of the cohesion policy in terms of pure economic outcomes suggest to investigate on the rooted mechanisms that hamper the region's capacity to totally exploit the funds they receive. This finding is in line with previous evidence by Becker et al. (2013), and it is consistent with the well-known Deaton's criticism of the use of financial aid to promote development (Deaton (2013)). Indeed, in our study a low quality of the institution seems to be associated with lower effect of the policy on GDP and employment. Then, giving money to less developed EU regions might be quite ineffective where their institutional settings do not guarantee the best utilization of the received funds. On the other hand, we find that the same result does not extend to others well-being dimensions, where we always find only scant evidence of a positive effect of the cohesion policy. This calls for a second set of implications. First, this result could merely suggest that the cohesion policy was overall ineffective in supporting the convergence process of the non-economic dimensions of well-being. Thus, future research might explore the reasons why the EU cohesion policy performs so badly in terms of closing the well-being gap across the regions. Second, it could be also possible that lagging regions devoted a very small part of the received funds to these aspects with respect to GDP and employment related projects. Even if we are not able to distinguish these circumstances, due to the lack of detailed data on the regional distribution of funds by category of expenditure, it follows that tackling this issue may require a complete refocusing of the intervention itself, from a mere GDP-focused perspective to a well-being approach in line with the declared goals of the cohesion policy.

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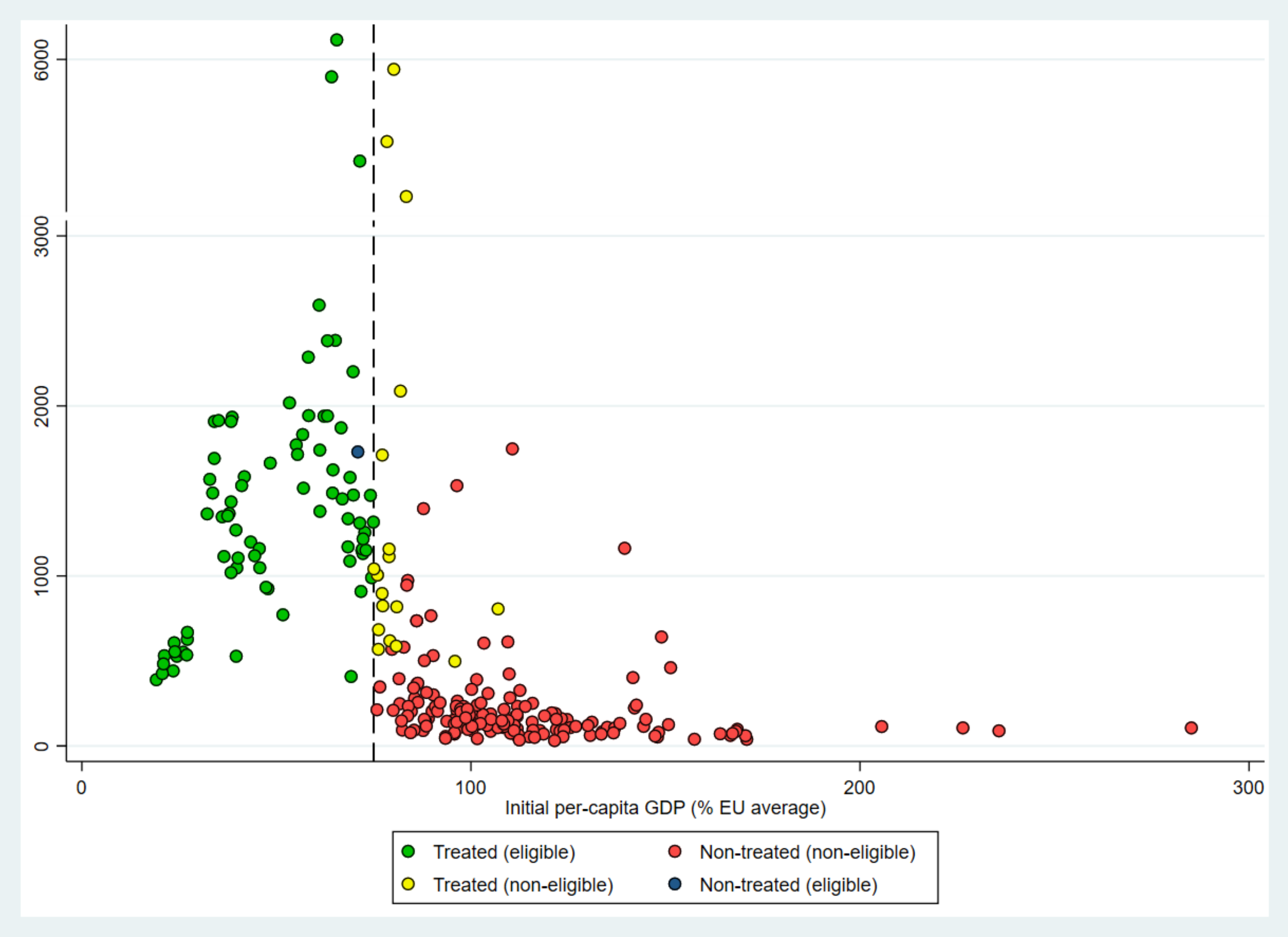
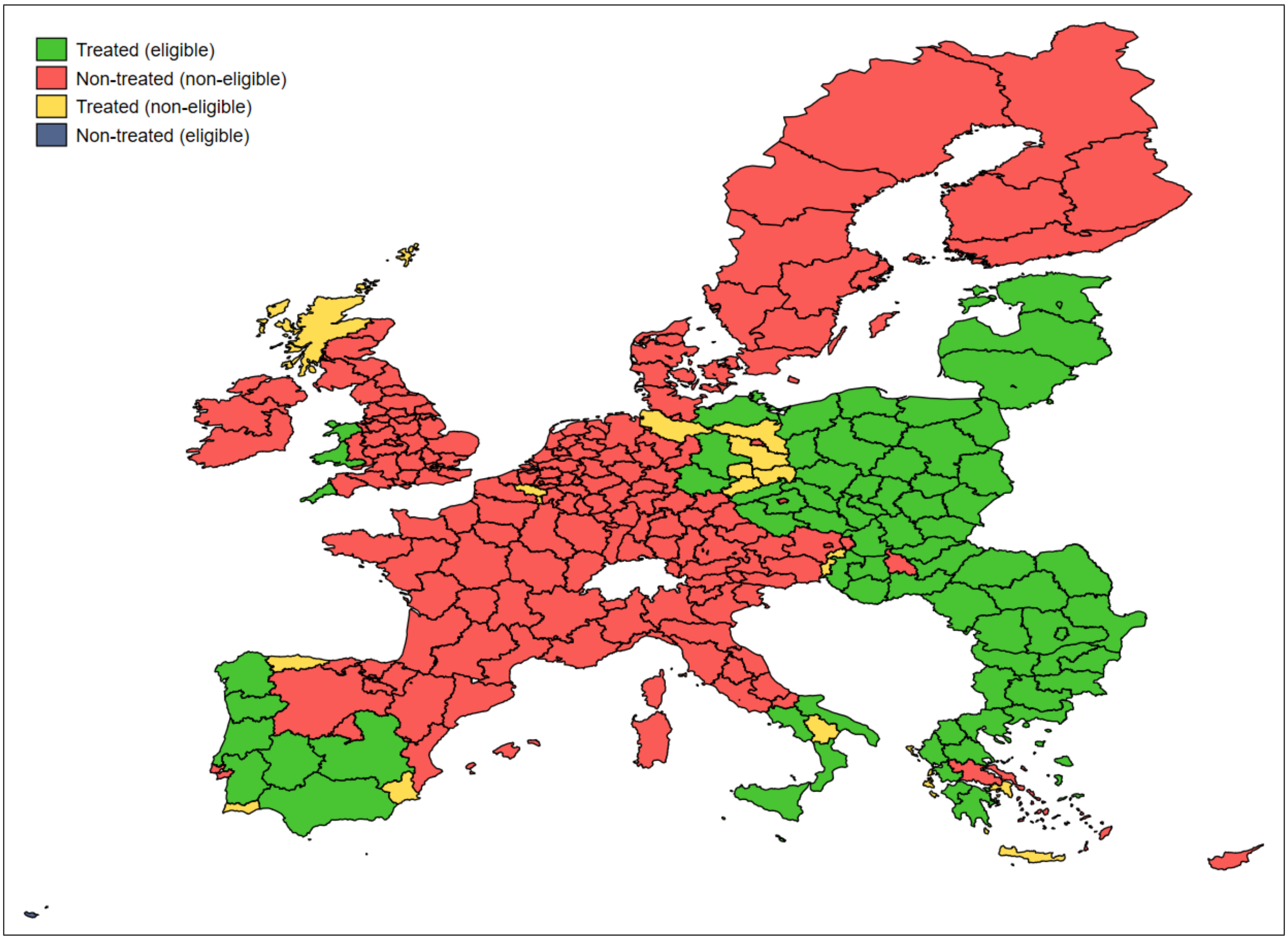
FIGURES

Figure 1: Total per capita Expenditure by treatment status



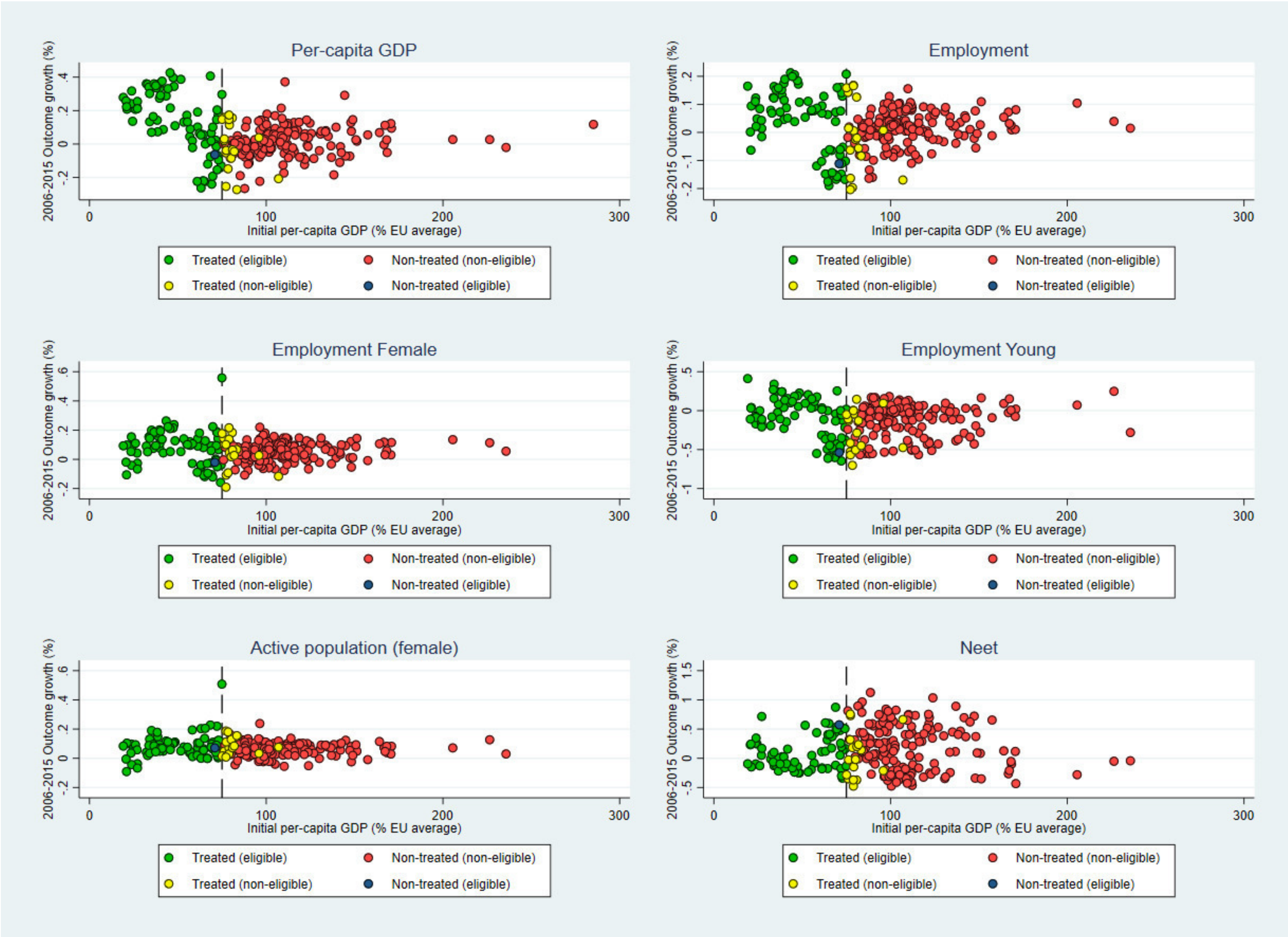
Note: In figure we plot the per capita expenditure (ESF and ERDF) against the initial per capita GDP expressed as a % of EU average. The dashed vertical line is set at the 75%, the cut-off point in the fuzzy RDD. Each point represents a region (NUTS-2) according to its treatment and eligibility status in the cohesion policy wave 2007-2013.

Figure 2: The cohesion policy 2007-2013. Treatment status by NUTS-2.



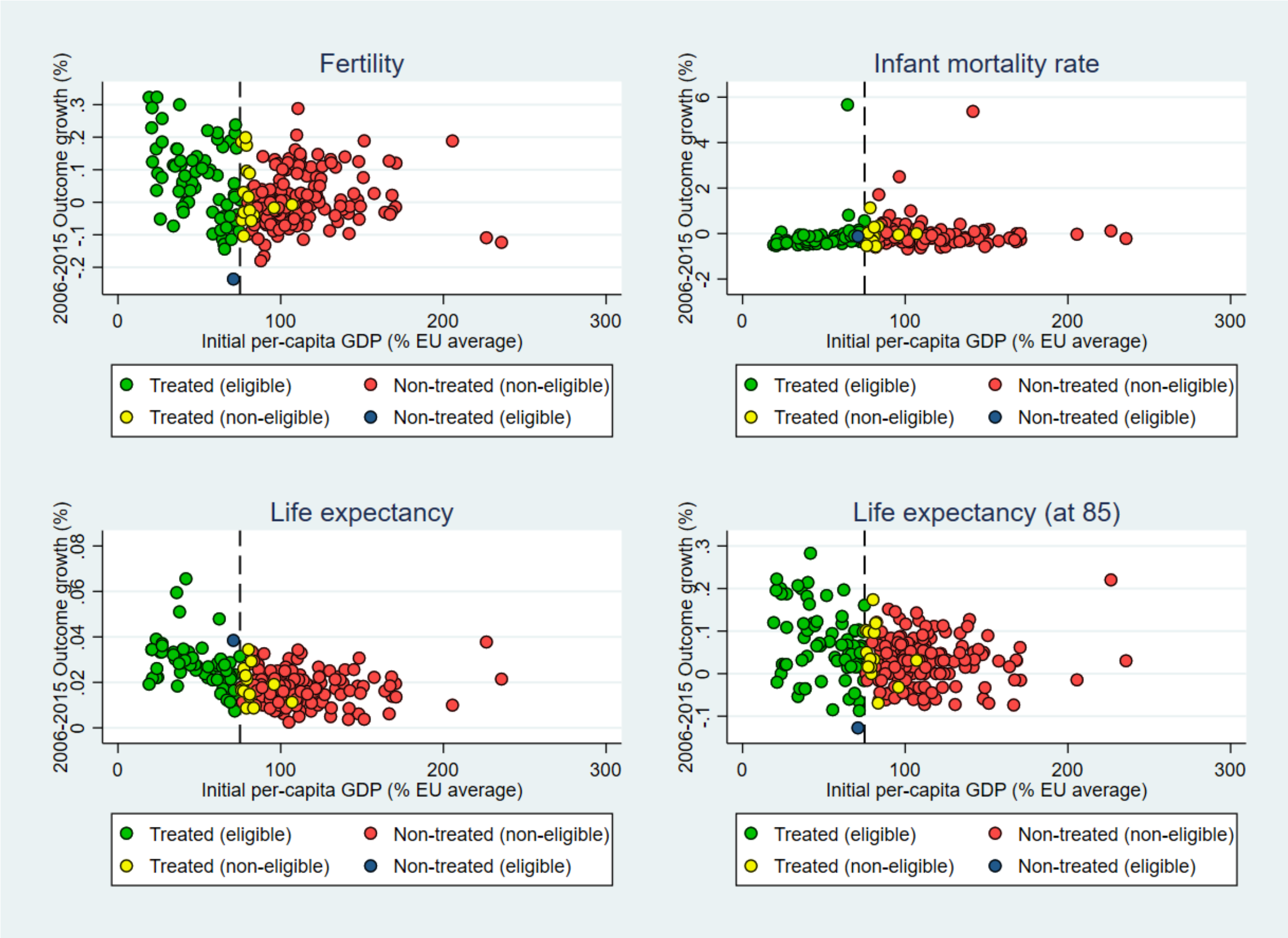
Note: NUTS-2 are reported according to 2006 nomenclature. Treated regions are those belonging to "Convergence Objective". Eligible regions are those with GDP per capita less than 75% of the EU average. Six regions do not appear in the figure: Guadeloupe (FR91), Martinique (FR92), Guyane (FR93), Réunion (FR94) and Açores (PT20) were eligible and treated; Canaries (ES70) were not-treated and not-eligible.

Figure 3: Relation between growth in Outcomes (2006-2015) and GDP per capita. Economic Outcomes



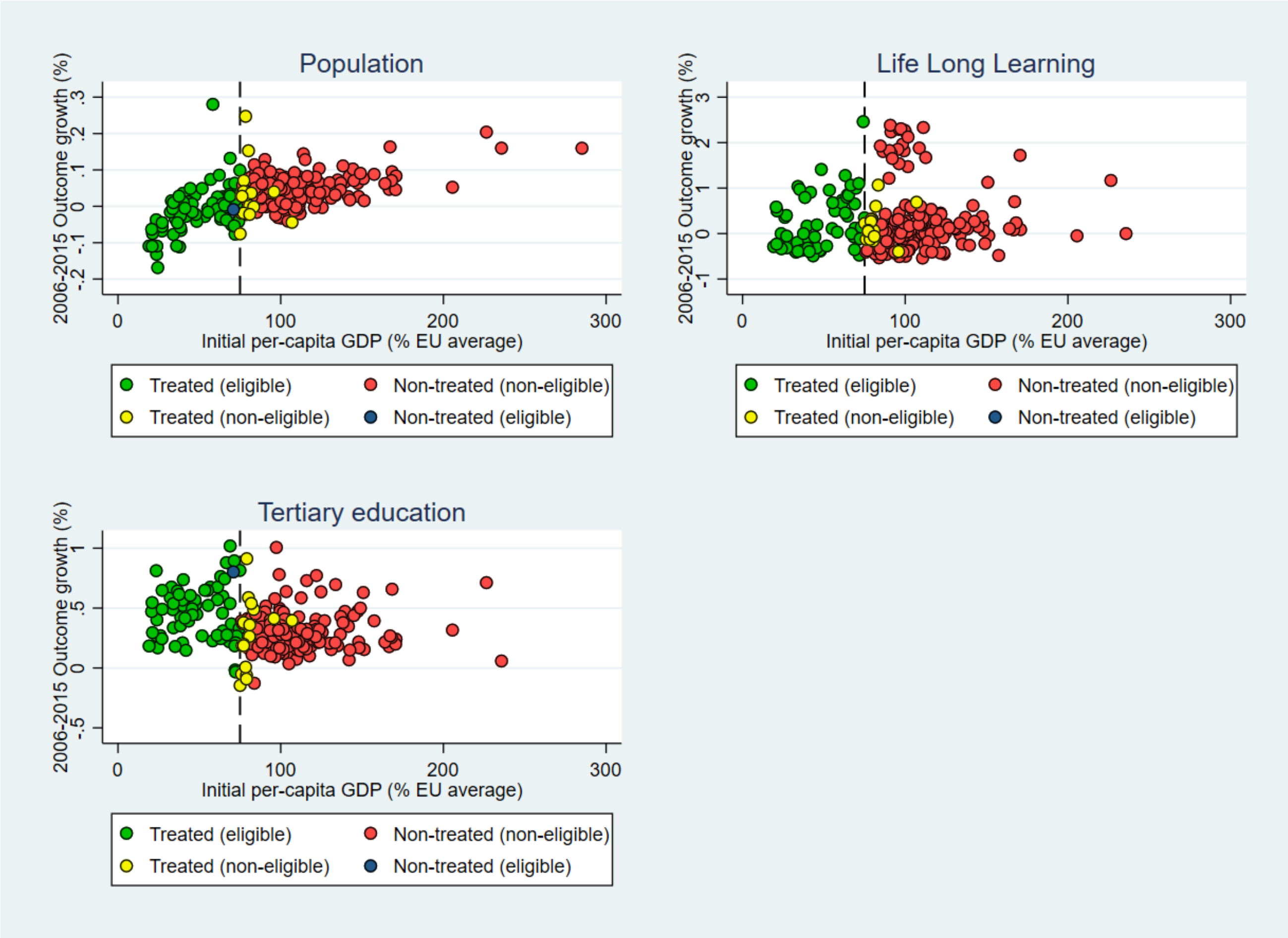
Note: In figure we plot the percentage change in the outcome (2006-2015) against the initial per capita GDP expressed as a % of EU average. The dashed vertical line is set at the 75%, the cut-off point in the fuzzy RDD. Each point represents a region (NUTS-2) according to its treatment and eligibility status in the cohesion policy wave 2007-2013.

Figure 4: Relation between growth in Outcomes (2006-2015) and GDP per capita. Socio-demographic Outcomes I



Note: see figure 3

Figure 5: Relation between growth in Outcomes (2006-2015) and GDP per capita. Socio-demographic Outcomes II



Note: see figure 3

TABLES

Table 1: Correlation between GDP per capita and Outcomes

	GDP per capita EU27	**GDP per capita EU15**
Employment	0.606***	0.490***
	258	209
Fem. Employment	0.568***	0.532***
	258	209
Young Employment	0.566***	0.394***
	256	207
Fem. act. pop	0.524***	0.456***
	258	209
Neet	-0.590***	-0.484***
	252	203
Fertility	0.318***	0.140*
	254	206
Life exp (yge1)	0.641***	0.110
	253	205
Life exp (yge85)	0.514***	0.060
	253	205
Infant mort.	-0.473***	-0.139*
	254	206
Ter. Edu	0.566***	0.439***
	254	205
Lifelong Learning	0.558***	0.417***
	249	201

Note: The table reports the correlation (ρ) between our dependent variables and GDP per capita in 2006. For each variable the first row reports ρ, while the second contains the number of observations. In the first (second) column, observations for EU27 (EU15) regions are shown. *Neet* is the rate of people neither in employment nor in education and training. *Lifelong learning* is the participation of adults aged 25-64 in education and training.

Table 2: Convergence of Economic Outcomes

	GDP per capita	**Employment**	**Employment Female**	**Employment Young**	**Active Pop. Female**	**Neet**
			PANEL A: EU27 (2006-2015)			
GDP pc (Lag)	-0.002	-0.002	-0.002	-0.001	-0.000	-0.008
	(0.001)*	(0.001)	(0.001)	(0.004)	(0.001)	(0.005)
	[0.001]	[0.001]	[0.001]	[0.004]	[0.001]	[0.007]
N	270	258	258	256	258	252
			PANEL B: EU27 (2006-2018)			
GDP pc (Lag)	-0.003	-0.003	-0.003	-0.003	-0.001	-0.012
	(0.001)**	(0.001)**	(0.001)**	(0.004)	(0.001)	(0.005)**
	[0.002]*	[0.001]**	[0.002]*	[0.004]	[0.001]	[0.007]*
N	270	258	258	256	258	252
			PANEL C: EU15 (2006-2015)			
GDP pc (Lag)	0.000	-0.002	-0.002	0.002	-0.001	-0.013
	(0.001)	(0.001)	(0.001)	(0.003)	(0.001)	(0.007)*
	[0.002]	[0.002]	[0.002]	[0.005]	[0.001]	[0.011]
N	215	209	209	207	209	203

Note: The table reports the estimates of convergence of *Outcome* on the per capita GDP in 2006. In Panels (A) and (C) the *Outcome* is defined as percentage change of the outcome between 2006 and 2015. In Panel (B) the *Outcome* is defined as percentage change of the outcome between 2006 and 2018. In each regression the following covariates are added: Capital, Population at 2006, Employment rate, Dependency ratio, Latitude, Longitude and Sectoral shares. In (.) brackets Robust SE. In [.] brackets Clustered SE at country level. Errors are significant at the 1%***, 5%** and at the 10%* level.

Table 3: Convergence of Socio-demographic Outcomes

	Population	**Fertility**	**Lifexp (yge1)**	**Lifexp (yge85)**	**Infant mortality**	**Tertiary education**	**Lifelong learning**
				PANEL A: EU27 (2006-2015)			
GDP pc (Lag)	0.002	-0.003	-0.000	0.002	-0.003	0.004	0.004
	(0.000)***	(0.001)***	(0.000)	(0.001)**	(0.006)	(0.002)**	(0.007)
	[0.001]***	[0.001]*	[0.000]	[0.001]	[0.005]	[0.005]	[0.010]
N	270	254	253	253	253	254	249
				PANEL B: EU27 (2006-2018)			
GDP pc (Lag)	0.003	-0.006	0.000	0.002	0.000	0.004	-0.002
	(0.000)***	(0.001)***	(0.000)	(0.001)**	(0.007)	(0.002)	(0.008)
	[0.001]***	[0.002]**	[0.000]	[0.001]*	[0.006]	[0.005]	[0.012]
N	270	254	253	253	253	254	249
				PANEL C: EU15 (2006-2015)			
GDP pc (lag)	0.003	-0.004	0.000	0.002	-0.000	0.009	0.017
	(0.000)***	(0.001)***	(0.000)***	(0.001)***	(0.008)	(0.002)***	(0.009)*
	[0.001]***	[0.002]*	[0.000]**	[0.001]**	[0.008]	[0.005]*	[0.014]
N	215	206	205	205	205	205	201

Note: see Table 2.

Table 4: Summary Statistics

Year	**2006**		**2015**	
	Non-treated	**Treated**	**Non-treated**	**Treated**
GDP per capita (in thous. euros)	31.168	15.027	31.744	15.802
	(5.304)	(6.724)	(6.486)	(6.549)
N	137	90	137	90
Employment	67.815	58.627	68.626	60.555
	(5.340)	(7.499)	(6.744)	(9.771)
N	132	85	137	88
Employment Female	61.111	50.061	64.257	54.219
	(6.939)	(9.650)	(7.539)	(11.920)
N	132	85	137	88
Employment Young	43.280	28.506	39.135	24.663
	(12.245)	(10.439)	(14.682)	(11.561)
N	131	85	137	88
Active pop. Female	65.992	57.906	69.890	62.753
	(6.263)	(9.441)	(5.660)	(9.082)
N	132	85	137	88
Neet	10.905	17.140	12.706	18.712
	(3.473)	(5.456)	(5.182)	(7.973)
N	131	81	137	88
Population (in mil. inhabitants)	1.665	1.684	1.732	1.679
	(1.197)	(1.346)	(1.267)	(1.372)
N	137	90	137	90
Fertility	1.646	1.441	1.650	1.497
	(0.283)	(0.358)	(0.240)	(0.329)
N	133	80	135	88
Lifexp (yge1)	80.130	77.290	81.536	79.213
	(1.322)	(3.056)	(1.228)	(2.509)
N	133	79	135	88
Lifexp (yge85)	6.454	5.862	6.651	6.304
	(0.444)	(0.647)	(0.554)	(0.793)
N	133	79	135	88
Infant mortality	3.837	5.182	3.265	4.093
	(1.106)	(2.615)	(0.928)	(1.795)
N	133	80	135	88
Tertiary education	24.447	18.196	31.806	24.561
	(6.642)	(6.773)	(8.019)	(6.543)
N	132	81	137	88
Lifelong Learning	13.582	5.732	13.941	6.214
	(8.415)	(4.812)	(6.534)	(3.504)
N	130	79	137	88

Note: The table reports the mean of the dependent variables for two groups of regions (treated and non-treated) before (2006) and after (2015) the implementation of the policy. Standard deviations are in parentheses. The sample contains the regions with a $+/-50$ distance from the threshold (75% of EU average for GDP per capita).

Table 5: RDD Estimates Economic Outcomes (2006-2015)

	GDP per capita	**Employment**	**Employment Female**	**Employment Young**	**Active Pop. Female**	**Neet**
Treatment	-0.008	-0.008	-0.002	-0.029	0.008	0.002
	(0.008)	(0.006)	(0.007)	(0.014)**	(0.005)	(0.020)
	[0.010]	[0.008]	[0.009]	[0.017]*	[0.004]*	[0.024]
N	227	217	217	216	217	212

Note: The Table reports the *LATE* estimation. The estimates are based on a two-stage least square approach using eligibility as the instrument. $f(x_i) = f(X - 75\%)$ is a quadratic polynomial. Distance from the threshold is fixed to be $\leqslant$ 50%. In each column, the *Outcome* is the percentage change of the outcome between 2006 and 2015. In (.) brackets Robust SE. In [.] brackets Clustered SE at country level. Errors are significant at the 1%***, 5%** and at the 10%* level.

Table 6: RDD Estimates Socio-demographic Outcomes (2006-2015)

	Population	**Fertility**	**Lifexp (yge1)**	**Lifexp (yge85)**	**Infant mortality**	**Tertiary education**	**Lifelong learning**
Treatment	-0.002	-0.000	-0.000	-0.002	0.040	0.031	0.047
	(0.003)	(0.005)	(0.000)	(0.003)	(0.037)	(0.016)*	(0.035)
	[0.003]	[0.007]	[0.000]	[0.004]	[0.035]	[0.025]	[0.064]
N	227	213	212	212	213	213	209

Note: see Table 5.

Table 7: RDD Robustness Check Economic Outcome I

	GDP per capita	**Employment**	**Employment Female**	**Employment Young**	**Active Pop. Female**	**Neet**
			PANEL A			
Treatment	-0.001	-0.001	0.002	-0.007	0.005	-0.008
	(0.006)	(0.004)	(0.006)	(0.009)	(0.004)	(0.018)
	[0.007]	[0.005]	[0.007]	[0.013]	[0.004]	[0.017]
N	227	217	217	216	217	212
			PANEL B			
Treatment	-0.006	-0.006	-0.000	-0.025	0.006	-0.008
	(0.007)	(0.004)	(0.006)	(0.011)**	(0.005)	(0.013)
	[0.010]	[0.006]	[0.008]	[0.015]	[0.005]	[0.017]
N	227	217	217	216	217	212
			PANEL C			
Treatment	-0.006	-0.006	-0.000	-0.025	0.006	0.008
	(0.007)	(0.004)	(0.006)	(0.011)**	(0.005)	(0.013)
	[0.005]	[0.004]	[0.005]	[0.007]*	[0.003]	[0.012]
N	227	217	217	216	217	212

Note: In Panel A, we add the following control variables: Capital, Population at 2006, Employment rate, Dependency ratio, Latitude, Longitude and Sectoral shares. In Panel B, we consider the percentage change in the outcome between 2006 and 2018. In Panel C, the variable *Treatment* corresponds to the sum of EU funds received (*ESF* and *ERDF*). See also the notes of Table 5 for remaining details.

Table 8: RDD Robustness Check Economic Outcome II

	GDP per capita	**Employment**	**Employment Female**	**Employment Young**	**Active Pop. Female**	**Neet**
			PANEL D			
Treatment	-0.000	-0.004	0.001	-0.021	0.007	-0.002
	(0.006)	(0.005)	(0.005)	(0.011)*	(0.004)**	(0.016)
	[0.010]	[0.008]	[0.008]	[0.015]	[0.004]**	[0.022]
N	270	258	258	256	258	252
			PANEL E			
Treatment	-0.022	-0.024	-0.008	-0.109	0.008	0.162
	(0.061)	(0.026)	(0.026)	(0.608)	(0.007)	(0.308)
	[0.062]	[0.029]	[0.025]	[0.834]	[0.007]	[0.450]
N	97	108	111	79	165	89
			PANEL F			
Treatment	-0.019	-0.029	-0.025	-0.026	0.003	-0.085
	(0.035)	(0.042)	(0.037)	(0.069)	(0.016)	(0.162)
	[0.023]	[0.042]	[0.037]	[0.058]	[0.013]	[0.122]
N	181	177	177	176	177	172

Note: In Panel D we consider the full sample of NUTS-2 (no bandwidth restriction). In Panel E we select the sample using the average of the optimal bandwidths suggested by Ludwig and Miller (2007), Imbens and Kalyanaraman (2012), Calonico et al. (2014). In Panel F the sample includes only EU15 regions. See also the notes of Table 5 for remaining details.

Table 9: RDD Robustness Check Economic Outcome III

	GDP per capita	**Employment**	**Employment Female**	**Employment Young**	**Active Pop. Female**	**Neet**
			PANEL G			
Treatment	0.002	-0.004	-0.000	-0.023	0.007	-0.006
	(0.008)	(0.006)	(0.007)	(0.014)	(0.005)	(0.022)
	[0.012]	[0.008]	[0.009]	[0.018]	[0.004]*	[0.026]
N	227	217	217	216	217	212
			PANEL H			
Treatment	-0.007	-0.007	-0.002	-0.030	0.007	0.002
	(0.007)	(0.006)	(0.007)	(0.013)**	(0.005)	(0.019)
	[0.010]	[0.008]	[0.009]	[0.016]*	[0.004]*	[0.023]
N	227	217	217	216	217	212
			PANEL I			
Treatment	-0.004	-0.004	-0.000	-0.023	0.005	-0.013
	(0.004)	(0.003)	(0.004)	(0.008)***	(0.003)*	(0.012)
	[0.008]	[0.006]	[0.007]	[0.009]**	[0.003]	[0.018]
N	208	199	199	198	199	194

Note: In Panel G $f(x_i)$ is a linear polynomial. In Panel H $f(x_i)$ is a linear spline. In Panel I we perform a sharp RDD. See also the notes of Table 5 for remaining details.

Table 10: RDD Robustness Check Socio-demographic Outcome I

	Population	**Fertility**	**Lifexp (yge1)**	**Lifexp (yge85)**	**Infant mortality**	**Tertiary education**	**Lifelong learning**
				PANEL A			
Treatment	-0.002	0.002	-0.000	-0.002	0.049	0.019	-0.013
	(0.003)	(0.005)	(0.000)	(0.003)	(0.041)	(0.013)	(0.033)
	[0.003]	[0.004]	[0.000]	[0.004]	[0.032]	[0.014]	[0.059]
N	227	213	212	212	213	213	209
				PANEL B			
Treatment	-0.002	0.005	0.000	0.003	0.069	0.035	0.033
	(0.003)	(0.005)	(0.000)	(0.003)	(0.062)	(0.016)**	(0.029)
	[0.003]	[0.008]	[0.000]	[0.003]	[0.052]	[0.022]	[0.051]
N	227	213	212	212	213	213	209
				PANEL C			
Treatment	-0.001	-0.000	-0.000	-0.001	0.021	0.016	0.031
	(0.002)	(0.003)	(0.000)	(0.002)	(0.020)	(0.008)**	(0.022)
	[0.001]	[0.004]	[0.000]	[0.002]	[0.017]	[0.010]*	[0.040]
N	227	213	212	212	213	213	209

Note: In Panel A, we add the following control variables: Capital, Population at 2006, Employment rate, Dependency ratio, Latitude, Longitude and Sectoral shares. In Panel B, we consider the percentage change in the outcome between 2006 and 2018. In Panel C, the variable *Treatment* corresponds to the sum of EU funds received (*ESF* and *ERDF*). See also the notes of Table 5 for remaining details.

Table 11: RDD Robustness Check Socio-demographic Outcome II

	Population	**Fertility**	**Lifexp (yge1)**	**Lifexp (yge85)**	**Infant mortality**	**Tertiary education**	**Lifelong learning**
				PANEL D			
Treatment	-0.000	-0.002	0.000	-0.002	0.040	0.031	0.032
	(0.002)	(0.005)	(0.000)	(0.003)	(0.032)	(0.013)**	(0.028)
	[0.003]	[0.007]	[0.000]	[0.004]	[0.029]	[0.019]	[0.062]
N	270	254	253	253	253	254	249
				PANEL E			
Treatment	-0.008	-0.006	-0.001	-0.006	0.070	0.042	0.114
	(0.006)	(0.010)	(0.001)	(0.006)	(0.050)	(0.028)	(0.078)
	[0.008]	[0.010]	[0.001]	[0.008]	[0.051]	[0.038]	[0.091]
N	151	148	140	148	160	155	126
				PANEL F			
Treatment	-0.040	-0.009	-0.004	-0.023	0.088	0.093	0.461
	(0.034)	(0.028)	(0.003)	(0.028)	(0.107)	(0.186)	(0.472)
	[0.054]	[0.020]	[0.004]	[0.037]	[0.109]	[0.246]	[0.653]
N	181	174	173	173	174	173	169

Note: In Panel D we consider the full sample of NUTS-2 (no bandwidth restriction). In Panel E we select the sample using the average of the optimal bandwidths suggested by Ludwig and Miller (2007), Imbens and Kalyanaraman (2012), Calonico et al. (2014). In Panel F the sample includes only EU15 regions. See also the notes of Table 5 for remaining details.

Table 12: RDD Robustness Check Socio-demographic Outcome III

	Population	**Fertility**	**Lifexp (yge1)**	**Lifexp (yge85)**	**Infant mortality**	**Tertiary education**	**Lifelong learning**
				PANEL G			
Treatment	-0.003	0.004	-0.000	-0.000	0.026	0.036	0.030
	(0.003)	(0.005)	(0.000)	(0.003)	(0.036)	(0.017)**	(0.036)
	[0.003]	[0.007]	[0.000]	[0.005]	[0.035]	[0.025]	[0.078]
N	227	213	212	212	213	213	209
				PANEL H			
Treatment	-0.002	0.001	-0.000	-0.001	0.035	0.030	0.037
	(0.003)	(0.005)	(0.000)	(0.003)	(0.035)	(0.015)**	(0.034)
	[0.003]	[0.007]	[0.000]	[0.004]	[0.034]	[0.024]	[0.068]
N	227	213	212	212	213	213	209
				PANEL I			
Treatment	-0.001	0.004	-0.000	0.001	0.023	0.012	0.015
	(0.002)	(0.003)	(0.000)	(0.002)	(0.023)	(0.008)	(0.024)
	[0.002]	[0.005]	[0.000]	[0.002]	[0.022]	[0.014]	[0.060]
N	208	197	196	196	196	195	192

Note: In Panel G $f(x_i)$ is a linear polynomial. In Panel H $f(x_i)$ is a linear spline. In Panel I we perform a sharp RDD. See also the notes of Table 5 for remaining details.

Table 13: Heterogeneous LATE Economic Outcomes I

	GDP per capita	**Employment**	**Employment Female**	**Employment Young**	**Active Pop. Female**	**Neet**
			PANEL A: Quality of Governments			
Treatment	-0.005	-0.004	0.002	-0.026	0.010	-0.006
	(0.006)	(0.005)	(0.006)	(0.013)**	(0.005)*	(0.019)
	[0.006]	[0.006]	[0.007]	[0.016]	[0.005]**	[0.019]
Treat. *X* QoG	0.005	0.007	0.007	0.009	0.003	-0.010
	(0.003)	(0.002)***	(0.002)***	(0.004)**	(0.001)**	(0.005)*
	[0.004]	[0.003]***	[0.002]***	[0.005]	[0.002]	[0.008]
N	225	215	215	214	215	210
			PANEL B: Human Capital			
Treatment	-0.032	-0.028	-0.018	-0.077	0.012	0.041
	(0.011)***	(0.008)***	(0.011)	(0.017)***	(0.008)	(0.021)**
	[0.016]**	[0.009]***	[0.013]	[0.012]***	[0.009]	[0.025]*
Treat. *X* HC	0.001	0.000	0.000	0.001	-0.000	-0.001
	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)	(0.000)***
	[0.000]***	[0.000]***	[0.000]**	[0.000]***	[0.000]	[0.000]***
N	222	212	212	211	212	211
			PANEL C: Urbanization			
Treatment	-0.004	-0.006	0.002	-0.026	0.010	0.001
	(0.011)	(0.008)	(0.010)	(0.016)	(0.006)	(0.020)
	[0.016]	[0.010]	[0.014]	[0.021]	[0.008]	[0.023]
Treat. *X* Urban	0.033	0.017	0.027	0.029	0.015	-0.004
	(0.005)***	(0.007)**	(0.016)*	(0.008)***	(0.013)	(0.025)
	[0.008]***	[0.009]**	[0.016]*	[0.010]***	[0.013]	[0.027]
N	226	216	216	215	216	212

Note: The table shows the estimation of $HLATE$ with a quadratic polynomial ($(f(x_i)^2)$). The distance from the threshold is set $\leqslant 50$ and $Treatment$ is the treatment variable (D_i). QoG is a measure of the quality of local institutions (Charron et al. (2014)). HC measures the endowment of Human Capital (percentage of people aged 25-64 with at least upper-secondary education). $Urban$ is the urbanization level (population density per square kilometer). In (.) brackets Robust SE. In [.] brackets Clustered SE at country level. Errors are significant at the 1%***, 5%** and at the 10%* level.

Table 14: Heterogeneous LATE Economic Outcomes II

	GDP per capita	**Employment**	**Employment Female**	**Employment Young**	**Active Pop. Female**	**Neet**
Treatment	-0.035	-0.027	-0.017	-0.080	0.012	0.035
	(0.007)***	(0.005)***	(0.005)***	(0.014)***	(0.006)**	(0.022)
	[0.011]***	[0.005]***	[0.006]***	[0.008]***	[0.008]	[0.023]
Treat. X QoG	0.006	0.007	0.009	0.007	0.004	-0.007
	(0.002)***	(0.001)***	(0.002)***	(0.003)**	(0.002)***	(0.006)
	[0.003]*	[0.002]***	[0.002]***	[0.004]*	[0.002]**	[0.008]
Treat. X HC	0.000	0.000	0.000	0.001	-0.000	-0.001
	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)*	(0.000)***
	[0.000]***	[0.000]***	[0.000]***	[0.000]***	[0.000]	[0.000]***
Treat. X Urban	0.038	0.022	0.034	0.034	0.019	-0.010
	(0.005)***	(0.007)***	(0.013)***	(0.011)***	(0.009)**	(0.030)
	[0.007]***	[0.007]***	[0.013]***	[0.011]***	[0.009]**	[0.031]
N	220	210	210	209	210	209

Note: see Table 13.

Table 15: Heterogeneous LATE Socio-demographic Outcomes I

	Population	**Fertility**	**Lifexp (yge1)**	**Lifexp (yge85)**	**Infant mortality**	**Tertiary education**	**Lifelong learning**
				PANEL A: Quality of Governments			
Treatment	-0.001	0.003	-0.000	-0.002	0.036	0.031	0.037
	(0.003)	(0.005)	(0.000)	(0.003)	(0.028)	(0.017)*	(0.032)
	[0.003]	[0.007]	[0.000]	[0.004]	[0.026]	[0.024]	[0.061]
Treat. X QoG	-0.000	0.003	0.000	-0.002	-0.013	0.002	-0.004
	(0.001)	(0.002)*	(0.000)	(0.001)	(0.015)	(0.005)	(0.011)
	[0.001]	[0.003]	[0.000]	[0.002]	[0.017]	[0.008]	[0.017]
N	225	211	210	210	211	211	207
				PANEL B: Human Capital			
Treatment	-0.005	-0.019	-0.000	-0.008	0.071	0.034	0.072
	(0.003)*	(0.006)***	(0.000)	(0.005)	(0.053)	(0.020)*	(0.038)*
	[0.003]	[0.005]***	[0.001]	[0.005]	[0.049]	[0.037]	[0.075]
Treat. X HC	0.000	0.000	-0.000	0.000	-0.001	-0.000	-0.001
	(0.000)	(0.000)***	(0.000)	(0.000)**	(0.000)*	(0.000)	(0.000)
	[0.000]	[0.000]***	[0.000]	[0.000]**	[0.000]	[0.001]	[0.001]
N	222	209	209	209	209	212	209
				PANEL C: Urbanization			
Treatment	-0.001	0.000	-0.000	-0.000	0.038	0.034	0.039
	(0.002)	(0.005)	(0.000)	(0.004)	(0.036)	(0.018)*	(0.035)
	[0.002]	[0.007]	[0.000]	[0.005]	[0.034]	[0.026]	[0.066]
Treat. X Urban	0.005	0.002	0.001	0.009	-0.023	0.016	-0.059
	(0.002)**	(0.003)	(0.000)***	(0.003)***	(0.040)	(0.017)	(0.024)**
	[0.002]**	[0.004]	[0.000]***	[0.003]***	[0.040]	[0.018]	[0.028]**
N	226	213	212	212	213	213	209

Note: see Table 13.

Table 16: Heterogeneous LATE Socio-demographic Outcomes II

	Population	**Fertility**	**Lifexp (yge1)**	**Lifexp (yge85)**	**Infant mortality**	**Tertiary education**	**Lifelong learning**
Treatment	-0.005	-0.017	-0.000	-0.011	0.068	0.031	0.075
	(0.002)**	(0.005)***	(0.000)	(0.005)**	(0.046)	(0.020)	(0.037)**
	[0.003]	[0.004]***	[0.000]	[0.005]**	[0.039]*	[0.037]	[0.073]
Treat. X QoG	-0.000	0.002	0.000	-0.002	-0.014	0.003	-0.006
	(0.001)	(0.001)*	(0.000)	(0.001)	(0.017)	(0.005)	(0.011)
	[0.001]	[0.001]	[0.000]	[0.002]	[0.018]	[0.008]	[0.017]
Treat. X HC	0.000	0.000	-0.000	0.000	-0.000	-0.000	-0.001
	(0.000)	(0.000)***	(0.000)	(0.000)**	(0.000)*	(0.000)	(0.000)
	[0.000]	[0.000]***	[0.000]	[0.000]***	[0.000]	[0.001]	[0.001]
Treat. X Urban	0.007	0.004	0.001	0.007	-0.034	0.020	-0.065
	(0.002)***	(0.003)	(0.000)***	(0.005)	(0.054)	(0.014)	(0.026)**
	[0.002]***	[0.004]	[0.000]***	[0.005]	[0.049]	[0.015]	[0.027]**
N	220	207	207	207	207	210	207

Note: see Table 13.

A Appendix

Table A1: Optimal bandwidths choice

Outcome	Ludwig and Miller (2007)	Imbens and Kalyanaraman (2012)	Calonico et al. (2014)	Average
GDP per capita	16.6	27.7	13.7	19.3
Employment	24.3	27.9	13.7	22.0
Employment Female	24.3	30.9	13.9	23.0
Employment Young	17.0	18.7	11.1	15.6
Active Pop. Female	55.8	32.8	16.3	35.0
Neet	24.3	21.6	13.8	19.9
Population	43.5	25.4	21.3	30.1
Fertility	55.8	22.7	15.3	31.3
Lifexp (yge1)	43.7	25.2	18.9	29.3
Lifexp (yge85)	55.8	25.5	14.4	31.9
Infant mortality	55.8	35.7	10.4	34.0
Tertiary education	53.4	27.0	21.0	33.8
LifeLong Learning	31.6	24.6	24.0	26.7

Note: the table reports the optimal bandwidth for each dependent variable. LLP is the participation of adults aged 25-64 in education and training.

Table A2: Non-parametric RDD Estimates Economic Outcomes (2006-2015)

	GDP per capita	**Employment**	**Employment Female**	**Employment Young**	**Active Pop. Female**	**Neet**
Estimates	-0.011	-0.012	-0.005	-0.034	0.009	0.004
	(0.011)	(0.009)	(0.011)	(0.018)*	(0.008)	(0.026)
	[0.020]	[0.018]	[0.017]	[0.034]	[0.009]	[0.054]
N	227	217	217	216	217	212

Note: Estimates obtained using a local linear polynominal. See also the notes of Table 5 for remaining details.

Table A3: Non-parametric RDD Estimates Socio-demographic Outcomes (2006-2015)

	Population	**Fertility**	**Lifexp (yge1)**	**Lifexp (yge85)**	**Infant mortality**	**Tertiary education**	**Lifelong learning**
Estimates	-0.005	-0.002	-0.001	-0.004	0.057	0.037	0.085
	(0.004)	(0.007)	(0.001)	(0.004)	(0.042)	(0.021)*	(0.043)**
	[0.005]	[0.012]	[0.001]	[0.008]	[0.049]	[0.044]	[0.079]
N	227	213	212	212	213	213	209

Note: Estimates obtained using a local linear polynominal. See also the notes of Table 5 for remaining details.