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ABSTRACT

Impact of European Cohesion Policy on regional growth: does local economic structure matter? *Regional Studies*. A growing body of literature has analysed the effect of European Cohesion Policy on regional gross domestic product (GDP) growth. The paper contributes to this literature by discussing Structural Funds and assigning an explicit role to the choice of strategy and the economic structure of regions. In particular, adopting a regression discontinuity design with heterogeneous treatment and using data on NUTS-3 regions makes it possible to identify the causal impact of Structural Funds on regional growth according to the size of the service sector, a sector that accounts for a large share of total Structural Funds expenditure. The paper shows that the larger the sector, the greater the amount of financial resources directed to services and the slower is growth. The interpretation pertaining to policy implications is that higher growth rates can be obtained by promoting the service sector at its early stages, i.e., when it is comparatively small and its potential for productivity growth is higher.

KEYWORDS

regional growth; Cohesion Policy; service sector

摘要

欧盟凝聚政策对区域成长的影响：地方经济结构有关系吗？区域研究。有越来越多的文献，分析欧盟凝聚政策对于区域的国内生产毛额（GDP）成长之影响。本文透过探讨结构基金，并指派明确的角色给策略选择和区域经济结构，对该文献作出贡献。采取具有异质方法的回归断点设计，并运用NUTS-3的区域数据，特别能够使得根据估总体结构基金支出绝大部份的服务部门之规模，指认结构基金对于区域成长所导致的影响变得可能。本文显示，当该部门越大时，导入服务部门的财政资源量便越大，而成长也越加缓慢。有关政策意涵的诠释是，在早期阶段提倡服务部门，例如当服务部门相对而言较小，且其对生产力成长的潜力较高时，将可获得更高的成长率。

关键词

区域成长；凝聚政策；服务部门

RÉSUMÉ

L'impact de la politique européenne de cohésion sur la croissance régionale: la structure économique locale, importe-t-elle? *Regional Studies*. Une documentation de plus en plus abondante a analysé l'impact de la politique européenne de cohésion sur la croissance du produit intérieur brut (PIB) régional. En discutant des Fonds structurels et en attribuant un rôle explicite au choix de stratégie et à la structure économique des régions, l'article contribue à cette documentation. En particulier, en adoptant le concept de discontinuité par régression comme méthode conjointement avec un traitement hétérogène et en employant des données auprès des régions NUTS-3, on peut identifier l'impact causal des Fonds structurels sur la croissance régionale en fonction de la taille du secteur des services, un secteur qui explique une part non-négligeable des dépenses globales des Fonds structurels. L'article démontre que plus grand est le secteur, plus important est le montant des ressources financières allouées aux services et moins rapide est la croissance. Quant aux conséquences pour la politique, l'interprétation laisse supposer que l'on peut atteindre des taux de croissance plus élevés par la promotion du secteur des services à ses premières phases, c'est-à-dire au moment où il est relativement petit et où le potentiel de croissance de la productivité est plus élevé.

MOTS-CLÉS

croissance régionale; politique de cohésion; secteur des services

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ZUSAMMENFASSUNG

Auswirkung der europäischen Kohäsionspolitik auf das regionale Wachstum: Kommt es auf die lokale Wirtschaftsstruktur an? *Regional Studies*. In der Literatur wird zunehmend die Auswirkung der europäischen Kohäsionspolitik auf das Wachstum des regionalen Bruttoinlandsprodukts untersucht. Dieser Artikel leistet einen Beitrag zu dieser Literatur durch eine Erörterung von Strukturfonds und Zuweisung einer expliziten Rolle für die Strategiewahl und Wirtschaftsstruktur von Regionen. Insbesondere ermöglichen der Einsatz eines Regressions-Diskontinuitäts-Aufbaus mit heterogener Behandlung sowie die Verwendung der Daten von NUTS-3-Regionen eine Identifizierung der kausalen Auswirkung von Strukturfonds auf das Regionalwachstum je nach Größe des Dienstleistungssektors, auf den ein Großteil der Gesamtausgaben von Strukturfonds entfällt. Der Beitrag verdeutlicht: Je größer der Sektor, desto größer der Umfang an Finanzressourcen, die für Dienstleistungen aufgewendet werden, und desto langsamer das Wachstum. Die Interpretation hinsichtlich der politischen Konsequenzen lautet, dass sich höhere Wachstumsraten erzielen lassen, wenn der Dienstleistungssektor in seinen frühen Stadien gefördert wird, also wenn er noch vergleichsweise klein ausfällt und ein höheres Potenzial für Produktivitätswachstum aufweist.

SCHLÜSSELWÖRTER

regionales Wachstum; Kohäsionspolitik; Dienstleistungssektor

RESUMEN

Impacto de la política europea de cohesión en el crecimiento regional: ¿importa la estructura económica local? *Regional Studies*. En cada vez más materiales publicados se analiza el efecto de la política europea de cohesión en el crecimiento del producto interno bruto (PIB) regional. En este artículo se contribuye a esta bibliografía al analizar los fondos estructurales y asignar un papel explícito a la elección de estrategia y la estructura económica de las regiones. En concreto, un diseño de regresión descontinuada con un tratamiento heterogéneo junto con datos de las regiones NUTS-3 nos permite identificar el impacto causal de los fondos estructurales en el crecimiento regional en función del tamaño del sector de servicios, que representa una gran parte del gasto de los fondos estructurales. En el artículo se demuestra que cuanto más grande es el sector, mayor es la cantidad de los recursos financieros dirigidos a los servicios y menor es el crecimiento. La interpretación con referencia a las repercusiones políticas es que se obtienen mayores índices de crecimiento al fomentar el sector de servicios en sus primeras etapas, es decir, cuando es comparativamente pequeño y su potencial de crecimiento de productividad es mayor.

PALABRAS CLAVES

crecimiento regional; política de cohesión; sector de servicios

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INTRODUCTION

European Cohesion Policy is likely the largest of all development programmes whose objective is to promote the development of lagging regions and, hence, long-run convergence. Its effectiveness, however, has been scrutinized by scholars who have questioned its impact on growth. Most studies in this area have sought to answer the question about whether or not Cohesion Policy is effective, but they have not fully addressed the most fundamental question of where and when it delivers its positive outcomes. In other words, most of the results proposed in the literature to date may have been affected by hidden heterogeneity generated by two main sources. First, the development strategies adopted by regional governments may differ significantly (Percoco, 2013). Second, the impact of those programmes may vary across space due to different local conditions and economic structures that characterize regions.

This paper focuses on the second source of heterogeneity and studies how local economic structure may influence the sign and magnitude of policy outcomes. There

is in fact abundant literature on the strict link between the structure of local economies (Almeida, 2007; Combes, 2000; Paci & Usai, 2008). Cohesion Policy is primarily devoted to sustaining long-run economic growth so that its outcome in terms of growth rate is likely to depend on the underlying economic structure of the region. To verify this hypothesis, this paper considers the service sector as a possible source of heterogeneity. The rationale for such a further hypothesis resides on the increasing centrality of the service sector in Organisation for Economic Co-operation and Development (OECD) regions, as well as in the strategies of development promoted by local policy-makers (Cuadrado-Roura, 2013). Furthermore, the role of the sector in promoting cumulative growth has also been highlighted (Dall'Erba, Percoco, & Piras, 2009). For these reasons, this paper considers the service sector as one of the sources of heterogeneity in the policy outcome. Services, especially in their business services form, play a pivotal role across sectors. This centrality is also clearly present in the general goals of Cohesion Policy, as for decades the European Commission has promoted the efficiency of the transport service industry,

whereas in more recent years cultural and knowledge-intensive services have been preferred.

From a methodological point of view, the role of the service sector is estimated on the basis of a flexible regression discontinuity design (RDD), which allows for a fixed but arbitrary number of variables with which treatment interacts, thus determining its heterogeneity. This paper adopts a RDD formulation for the heterogeneous local average treatment effect (HLATE) proposed by Becker, Egger, and von Ehrlich (2013) and the analysis was performed here at a level of data aggregation lower than that adopted by any previous study on Cohesion Policy. Indeed, although the eligibility for Objective 1 was assigned to NUTS-2 regions, data used in this study were at the NUTS-3 level. This afforded a better understanding of the effects generated by the transfers to Objective 1 regions for the programming period 2000–06.

The results showed Cohesion Policy as mildly effective in promoting regional growth. However, this effect was attenuated when an economy was characterized by a large service sector. This result was interpreted as evidence of an over-investment in services and immaterial factors in lagging European Union regions which conflicts with the principle of the concentration of funds.

The remainder of the paper is organized as follows. The second section reviews the primary literature and states the paper's main argument. The third section presents the methodology, while data and descriptive evidence are set out in the fourth section. The fifth section contains the estimates of HLATE. The sixth section concludes the paper.

LITERATURE REVIEW

Given the substantial amount of financial resources devoted to Cohesion Policy and its long-lasting implementation period, it is not surprising that an increasing number of studies have addressed the issue of its effectiveness.

This paper builds on Becker et al. (2013) and proposes the hypothesis that the effect of Structural Funds on growth is heterogeneous and depends on the economic structure of the regions. In adopting this approach, spatial spillover effects were not taken into account, with the advantage of identifying the causal effect of Structural Funds on growth. In particular, it is hypothesized that the effect of Structural Funds depends on the size of the service sector. This hypothesis is justified by the fact that more than 60% of total Structural Funds expenditure in Objective 1 regions is devoted to service sector development.

That services are important for development is now a widely accepted notion. The rationale for this view was put forward in a seminal work by Clark (1940), who maintained that services satisfy higher needs than goods and that the bulk of per capita income is devoted to the purchase of services. Baumol (2001) argued for an alternative explanation, since he assumed that the demand for services and goods was independent of income. If service productivity has a lower growth rate than manufacturing, then the share of employment in the service sector should

be larger in high-income economies. The impact of services on regional growth is, however, a little-debated issue in the regional science literature. Recently, Dall'Erba et al. (2009) found that service productivity growth accounts for a significant portion of regional productivity differentials and that its potential for stimulating convergence may be significant.

Recent evidence proposed by Capello and Fratesi (2013) points to the crucial role of services for regional growth. In particular, they show that global regions in Western countries are the only ones where a significantly higher specialization in advanced service sectors is associated with positive economic performance. In all other cases, the association of virtuous patterns of growth is associated with manufacturing specialization and/or low service specialization. Cohesion Policy is devoted to promoting regional growth, which an extensive amount of literature has demonstrated to be dependent on economic structure (Almeida, 2007; Combes, 2000; Paci & Usai, 2008). The aforementioned literature provides evidence of the centrality of the service sector for the growth of regional economies; for this reason, the author believes that differences among regions in terms of economic structure and a shared service sector may account for differences in terms of policy outcomes.

The general argument here is that regional governments choose a development strategy within the framework of Cohesion Policy consistent with the local economic structure, which, in turn, may influence the effectiveness of interventions in terms of growth rate. In other words, different regions, possibly with different strategies for promoting development, will have – all things being equal – different outcomes, depending on local economic structure. This paper will not consider strategies explicitly, as in the case of Percoco (2013); rather, it will focus on local economic conditions as a source of heterogeneity within policy impact. It is particularly noted that the service sector has been considered as a main source of growth for (relatively) developed economies by the literature reviewed above, as well as a sector with a pivotal role in Cohesion Policy.

Providing incentives to transport service firms has been at the core of Cohesion Policy during the past decades. The reduction of transport costs is a primary goal of the European Union, as they constitute a major barrier to trade and to the integration of regions and countries. In particular, in recent years, considerable efforts have been directed towards incentivizing forms of efficient and sustainable freight and people transport across Europe. Investment in new and green technologies has been subsidized by regional governments in order to improve mobility, especially in urban and cross-border areas (European Commission, 2010).

Similarly, tourism and cultural activities have attracted the interest of policy-makers across the entire continent. According to the European Commission (n.d.), €6.14 billion was allocated to cultural and creative industries in regional operating programmes over the 2007–13 programming period, corresponding to 2% of the total Cohesion Policy budget. Those resources were conceived for

developing cultural services and to protect cultural heritage. Other (not quantified) resources were allocated for promoting sustainable tourism and innovation in the management of amenities.

Recently, the concept of smart specialization has gained increasing policy attention. It has also become a major flagship issue for European Cohesion Policy, which identifies smart specialization as a key driver for tackling economic disparities across European regions (European Commission, 2010). Indeed, in its initial declination, the term ‘smart specialization’ was coined in a sectoral, a-spatial perspective and based on a strong focus on research and development (R&D) as a primary source of knowledge and innovation, with high-tech sectors as a key driver of economic performance in core regions. In its original declination, smart specialization was presented as an ‘innovative policy concept which emphasizes the principle of prioritization in a vertical logic’ (Foray & Goenaga, 2013, p. 1), with the aim of favouring some technologies, fields and populations of firms. More recently, the Regional Innovation Smart Specialization Strategy (RIS3) has evolved into a key pillar of Cohesion Policy, claiming for the identification of sectors and, in particular, knowledge-intensive business services and technological domains on which investments need to be targeted to incentivize specialization in these fields (European Commission, 2010).

To highlight the role of the service sector (in its different forms) in the context of Cohesion Policy, this paper will adopt the HLATE technique, which allows for heterogeneity of treatment. This means that when one considers the discontinuity of treatment and of outcomes brought about by Cohesion Policy, one will be able to account for whether a bigger or smaller importance to the tertiary sector within the regional economies amplifies or reduces the treatment effect, i.e., economic growth and the reduction of regional disparities.

The interaction variable of the model is the importance of the service industry within the NUTS-3 region. This variable was measured as the share of the service sector gross value added (GVA) at basic prices, observed the year prior to the region being declared an Objective 1 region. GVA is defined as the value of output less the value of intermediate consumption. The adjective ‘gross’ means that the consumption of fixed capital has not been deducted. This is the most reliable figure, because the consumption of fixed capital is difficult to define conceptually and to estimate in practice. GVA at basic prices is defined as output valued at basic prices, less intermediate consumption valued at purchasers’ prices, that is, the difference between the prices actually paid and received by the producers. This is the relevant variable for producers, who consider this difference upon making new investment decisions, which in turn makes gross domestic product (GDP) grow.

It should be mentioned that the analysis was not limited to the case of a single variable measuring the share of the service sector. Rather, a series of robustness checks and insights were provided by also using a more disaggregated NACE classification of sectors, as well as the OECD estimates of the share of knowledge-intensive services in NUTS-3 regions.

METHODS

The analysis adopts an HLATE estimation procedure based on an RDD and a local average treatment effect (LATE) estimator. RDD allows one to take into account observed as well as unobserved heterogeneity in the estimation of the treatment effect when there is an eligibility rule for the treatment based on an observable variable x . Indeed, the principle underlying this strategy is that observations just below and above the threshold are likely to be very similar to each other with respect to observed and unobserved characteristics, except for the outcome. Therefore, the mean difference in the outcomes can be attributed to the treatment effect. This average treatment effect (ATE) sacrifices external validity by focusing only on observations close to the cut-off point.

Regression discontinuity can be sharp if the eligibility rules are strictly adhered, so that given the threshold level x_0 , the probability of treatment T is:

$$P(T = 1|x < x_0) = 1$$

$$P(T = 1|x > x_0) = 0$$

Whenever the rules are not followed imperatively, RDD is said to be fuzzy. In what follows the paper will focus on the effect of Objective 1 transfers, so that the eligibility rule confirms all regions with a per capita GDP lower than 75% of the European Union average as eligible. However, this rule has been dispensed with for some regions, so that a fuzzy RDD was applied to the present case.

More formally, let y_0 and y_1 denote the counterfactual outcomes without and with treatment T ; let x be the forcing variable and consider the following assumptions:

A1: $E(y_g|T, x) = E(y_g|x)$, $g = 0, 1$.

A2: $E(y_g|x)$, $g = 0, 1$ is continuous at $x = x_0$.

A3: $P(T = 1|x) \equiv F(x)$ is discontinuous at $x = x_0$, i.e., the propensity score of the treatment has a discrete jump at $x = x_0$.

In the fuzzy RDD the discontinuity is used as an instrumental variable for treatment status. Following Imbens and Lemieux (2008), the goal is to estimate the parameter ρ on the treatment of this form:

$$y_{i,T} = \theta + \rho T_i + f(\tilde{x}_{i,T}) + \eta_i \quad (1)$$

where $y_{i,T}$ is the GDP growth of region i , whose treatment status is T (i.e., being Objective 1 or not); θ is a constant; and $\tilde{x}_{i,T}$ is the forcing variable properly normalized. In the present case, $x_{i,T}$ is per capita GDP at purchasing power standards (PPS) averaged over 1996–98 and is normalized with respect to 75% of the European Union average, that is, one considers a variable in the form $x_{i,T} - x_0$ so that at $x_{i,T} = x_0$ one has $\tilde{x}_{i,T} = 0$ and $f(\tilde{x}_{i,T}) = 0$. Consequently, ρ expresses the impact of the treatment at $x_{i,T} = x_0$. The $f(\tilde{x}_{i,T})$ term is a p th-order parametric polynomial, whose parameters are allowed to differ on the left and on the right of the cut-off point (Angrist & Pischke,

2009) in order to account for non-linearity of the relationship between growth and initial GDP, thus ensuring that the jump is not due to an unaccounted non-linearity, while distinct sets of parameters allow different trend functions. It should be noted that the rationale for including a polynomial of the forcing variable is also to mimic the behaviour of covariates around the threshold. Finally, η_i is an error term.

Given assumptions A1–A3, it is possible to prove that (Angrist & Pischke, 2009):

$$\begin{aligned} E[y(0)|\tilde{x} = x_0] &= \lim_{\tilde{x} \rightarrow x_0^-} E[y(0)|\tilde{x} = x] \\ &= \lim_{\tilde{x} \rightarrow x_0^-} E[y(0)|T] \\ &= 0; \tilde{x} = x] \\ &= \lim_{\tilde{x} \rightarrow x_0^-} E[Y|\tilde{x} = x] = \mu_s \end{aligned}$$

and as

$$E[y(1)|\tilde{x} = x_0] = \lim_{\tilde{x} \rightarrow x_0^+} E[y|\tilde{x} = x] = \mu_d, \text{ for } \tilde{x} = x_0 \text{ we have:}$$

$$\rho = \mu_d - \mu_s \quad (2)$$

Equation (2) indicates that under assumptions 1–3, ρ is an unbiased estimate of the ATE only in a narrow interval of $\tilde{x} = x_0$, that is, ρ provides a reliable estimate of the effect of Cohesion Policy only in an interval around the 75% threshold. In other words, the policy parameter identifies the ATE in an interval defined by the right and the left limit around the threshold. Given this definition, it was impossible to identify precisely the number of regions falling in such an interval. However, the condition for the identification of the effect of the policy implies that the precision of the estimate is higher the closer to the threshold a region is.

Applying ordinary least squares (OLS) estimation to equation (1) will lead to a biased estimate of the treatment effect due to the fuzziness of the treatment variable (Imbens & Lemieux, 2008; Lee & Lemieux, 2010). The treatment dummy T can be instrumented by a first-stage regression, which takes either of the forms:

$$T_i = \alpha + \beta R_i + f(\tilde{x}_i) + \varepsilon_i \quad (3)$$

$$P(T_i = 1) = f(\delta + \zeta R_i + f(\tilde{x}_i) + v_i) \quad (4)$$

where α , β , δ and ζ are unknown parameters; and ε_i and v_i are disturbances. The variable R_i denotes the treatment that the region would have been assigned had the eligibility rule been strictly followed. The fitted values obtained from the first regression will be replaced in equation (2) and an OLS estimate of the second-stage equation will without bias estimate the treatment effect.

In order to have a causal interpretation of the 2SLS, the instrument R_i must affect the treatment ($\text{Cov}(R_i, T_i) \neq 0$), and it must fulfil the exclusion restriction $\text{Cov}(R_i, \eta_i) = 0$. The final assumption is that the instrument R_i must be independent of the vector of potential outcomes and potential treatment assignments, formally:

$$\{[y_i(T, R) \forall T, R], T_{i,0}, T_{i,1}\} R_i$$

It should be noted that the heterogeneity of treatment effects is allowed to vary alongside variables that do not affect treatment status. The variables that amplify or reduce the treatment effects causing the heterogeneity are called interaction variables and are denoted by z_i .

More formally, HLATE is defined as:

$$\begin{aligned} \text{HLATE}(x_i = x_0, z_i) &= \text{HLATE}(x_0, z_i) \\ &= E[y_{i,1}|x_0, z_i] - E[y_{i,0}|x_0, z_i] \end{aligned} \quad (5)$$

where the notation is the same as introduced at the beginning of this section. The identification of the HLATE in (4) required two further assumptions:

A4: The interaction variables z_i must be continuous at x_0 , the threshold.

A5: The interaction variables z_i must be uncorrelated with the error term in the outcome equation, conditional on x_i .

Assuming that the conditional expectation function $E[y_i|x_i, z_i]$ follows an additive process based on the columns of x_i and z_i , one can express the two potential outcomes as follows:

$$E[y_{i,0}|x_i, z_i] = \alpha + f_0(\tilde{x}_i) + b_0(z_i) \quad (6)$$

$$E[y_{i,1}|x_i, z_i] = E[y_{i,0}|x_i, z_i] + \beta + f_1^*(\tilde{x}_i) + b_1^*(z_i) \quad (7)$$

where α is a constant; β is the coefficient of the treatment dummy; \tilde{x}_i , as previously, is the deviation from the threshold GDP of region i 's GDP; while z_i is the deviation from the sample mean of region i 's interaction variable. The functions $f_0(\tilde{x}_i)$, $b_0(z_i)$, $f_1^*(\tilde{x}_i)$ and $b_1^*(z_i)$ are sufficiently smooth polynomials. They define $f_1(\tilde{x}_i)$ and $b_1(z_i)$ analogously to $f_0(\tilde{x}_i)$ and $b_0(z_i)$, but with the treatment switched on. In addition, it is evident that:

$$f_1^*(\tilde{x}_i) = f_1(\tilde{x}_i) - f_0(\tilde{x}_i)$$

$$b_1^*(z_i) = b_1(z_i) - b_0(z_i)$$

The equation for generic treatment status can be written as:

$$\begin{aligned} E[y_i|x_i, z_i] &= E[y_{i,0}|x_i, z_i] + T_i[\beta + f_1^*(\tilde{x}_i) \\ &\quad + b_1^*(z_i)]. \end{aligned} \quad (8)$$

With this specification, the LATE is given by β , whereas the HLATE is given by $\beta + b_1^*(z_i)$.

If the RDD is sharp, then simple OLS can indeed estimate the parameters, without bias, using the following specification:

$$\begin{aligned} y_i &= \alpha + f_0(\tilde{x}_i) + b_0(z_i) + T_i[\beta + f_1^*(\tilde{x}_i) + b_1^*(z_i)] \\ &\quad + \varepsilon_i. \end{aligned} \quad (9)$$

If the RDD is fuzzy the treatment dummy must be instrumented, for the reasons already mentioned, against the *rule* dummy indicating whether or not region i satisfies the eligibility criteria, and the exogenous variables of the

model, therefore the first stage of the 2SLS is given by:

$$T_i = g_0(\tilde{x}_i) + l_0(z_i) + R_i[\delta + g_1^*(\tilde{x}_i) + l_1^*(z_i)] + \nu_i \quad (10)$$

where all the variables have the same notation and the polynomial functions are defined as above. Substituting (10) in (9) one obtains the reduced form for the fuzzy RDD.

In other words, the estimation framework combined a 2SLS estimate with an RDD with heterogeneous effect where in the first stage one makes use of an instrument identified as a dummy variable taking the value of 1 if the NUTS-3 region has a GDP per capita below 75% of the European Union average, and 0 otherwise.

DATA AND DESCRIPTIVE STATISTICS

The analysis was confined to Objective 1 treatment for two reasons. First, the explicit purpose of Objective 1 transfers is to reduce the gap in per capita GDP between ‘rich’ or ‘non-treated’ (by Objective 1 payments) regions and ‘poor’ or ‘treated’ regions. Second, Objective 1 transfers make up the largest part of the expenditure devoted to Cohesion Policy budget. The author focused only on Structural Funds expenditure and on the programming period that began in the year 2000 and ended in 2006, using data from 1997 to 2008.

The data were collected from EUROSTAT databases publicly available online. As already stated, the observations were at NUTS-3 level, even though Objective 1 eligibility is measured on a NUTS-2 basis. A more disaggregate level of observation yields a better understanding of the processes triggered by the payments. In other words, the unit of observation was the NUTS-3 region, whereas the treatment was assigned at the NUTS-2 level. This decision was made in order to increase the number of observations, but also because by doing so treatment status can be conceived as mildly exogenous. Furthermore, it should be noted that adopting this scheme introduced further fuzziness, since some NUTS-3 regions with a relatively high GDP per capita could also be treated because they belonged to Objective 1 NUTS-2 regions; conversely, NUTS-3 regions with a GDP per capita below the threshold level could not be treated if they belonged to non-Objective 1 NUTS-2 regions.

The data relative to GDP figures spanned from 1997 to 2008. The upper bound did not coincide with the end of the programming period, because of the $n + 2$ rule, which states the obligation to spend the funds allocated annually by the end of the second year following the end of the programming period (i.e., 2006). As for the allocation of Structural Funds expenditure across items, the key data at one’s disposal were those pertaining to the breakdown of Structural Funds Objective 1 actual expenditure by NUTS-3 and by sector, provided by the Directorate General for Regional Policy of the European Commission (DG REGIO).

During the programming period 2000–06 there were 257 NUTS-2 regions divided into 1233 NUTS-3 regions.

Table 1 presents summary statistics for per capita GDP in purchasing power parity (PPP) terms at NUTS-3 level

Table 1. Summary statistics for per capita gross domestic product (GDP) (€ purchasing power parity (PPP)) at the time of the Commission decision by the country.

Country	Average	Minimum	Maximum	SD
AT	20,048.6	13,000	33,300	5446.2
BE	18,211.4	9400	44,600	5884.7
CY	18,400	18,400	18,400	.
CZ	14,342.9	11,700	31,900	5129.7
DE	20,222.8	10,000	60,700	8129.7
DK
EE	9460	6900	17,400	4453.4
ES	16,152.5	10,900	24,600	3687.6
FI	19,225	6300	49,700	8806.0
FR	18,053	10,900	58,600	5814.8
GR	13,998.0	9300	36,800	4050.1
HU	11,135	7200	26,800	4299.5
IE	19,850	13,500	30,500	5499.4
IT	19,599.1	9600	33,000	5334.0
LT	8770	5300	14,900	2652.9
LU	42,500	42,500	42,500	.
LV	7450	4600	15,900	4293.6
MT	14,550	12,500	16,600	2899.1
NL	21,570	14,800	35,700	4108.4
PL	9350	5800	30,100	3775.2
PT	11,953.3	6600	23,500	3525.1
SE	20,114.3	17,100	31,500	2889.2
SI	15,358.3	11,800	24,900	3473.9
SK	11,850	7000	25,900	5849.1
UK	19,322.1	10,600	103,900	8860.5

Note: No data are available for Denmark.

by country for the year before Objective 1 status had been assigned, namely 1999 for the EU-15 and 2003 for the EU-10. All the EU-10 countries except Cyprus have an average per capita GDP level below €15,000, while all the EU-15 countries, except Portugal and Greece, had an average GDP above €15,000.

Naïve estimates of the impact of Objective 1 transfers were obtained by combining the results of two statistics. Panel A in Table 2 presents the average GDP before and after the treatment together with its difference, whereas panel B shows the per-capita GDP average growth rate over the years. Each of these statistics was broken down into recipient and non-recipient NUTS-3 regions and different levels of aggregation were considered, namely the entire European Union, old member states and new member states.

The statistics in panel A show that Objective 1 transfers have had a negative impact on the GDP per capita because all differences increased rather than decreased from 1999 to 2008. It should be noted that reducing this gap is the explicit aim of the Objective 1 transfers. Failure of the policy therefore seems apparent. At the same time, however, the statistics in panel B indicate that recipient regions have grown faster than non-recipient regions, on average by more than 1.5%, implying that there may have been β -convergence.

Table 2. Naive estimates: pre- versus post-treatment average gross domestic product (GDP) per capita (€ PPP).

	Mean recipient (1)	Mean non-recipient (2)	Difference (1) – (2)
Panel A			
<i>EU-25</i>			
GDP per capita in 1999	13,272.52	21,121.42	–7848.9
GDP per capita in 2008	18,651.05	28,040.05	–9398.0
<i>EU-15</i>			
GDP per capita in 1999	14,426.89	21,118.66	–6691.77
GDP per capita in 2008	20,505.42	28,026.68	–7521.26
<i>EU-10</i>			
GDP per capita in 1999	10,581.69	22,150	–11,568.31
GDP per capita in 2008	14,315.49	33,100	–18,784.51
Panel B			
EU-25 GDP per capita growth	4.773052	3.258494	1.514558
EU-15 GDP per capita growth	4.091797	3.245973	0.845824
EU-10 GDP per capita growth	6.365844	7.997639	–1.631795

Panel B also highlights that both groups of NUTS-3 regions of the EU-10 have grown faster than the corresponding groups of the EU-15. Nonetheless, the difference within the EU-10 is negative given the extraordinary performance of non-Objective 1 EU-10 regions. The EU-10 results for non-recipient regions may suffer from slight sample bias because there are only two NUTS-3 regions that were not eligible, namely Cyprus and Bratislava.

ESTIMATES OF HLTE

Preliminaries

The assumptions behind the identification of the HLTE were presented above. This subsection will verify the most important of these assumptions. It will first show graphically that there is a discontinuity in the growth rate around the threshold; following on, it will

show that this discontinuity was not present in other relevant control variables.

In order to perform the graphical analysis, following Lee and Lemieux (2009), the forcing variable was divided into equally sized bins of 1.5 percentage points in width to the left and the right of the threshold level. The outcome, interaction variable and treatment status were grouped and averaged by bin.

Figure 1 plots the outcome variable (i.e., the average growth rate for NUTS-3 regions) against the forcing variable (i.e., per capita GDP in PPP for NUTS-2 regions). Furthermore, a fifth-order polynomial was added in order to remark on the discontinuity. The jump of the outcome variable at the threshold level is evident and amounts to about 0.8%. This result suggests that the RDD is a sound approach for disentangling the effectiveness of Structural Funding for promoting the growth of GDP in relatively poorer regions of the European Union.

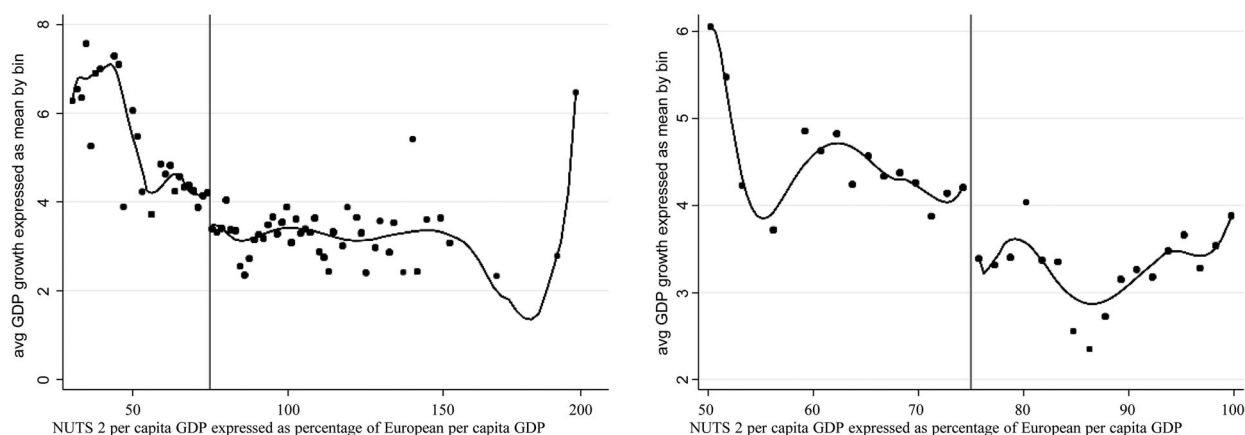


Figure 1. Discontinuity of outcome at the threshold level: (a) whole sample and (b) NUTS-3 regions with a forcing variable between 50 and 100.

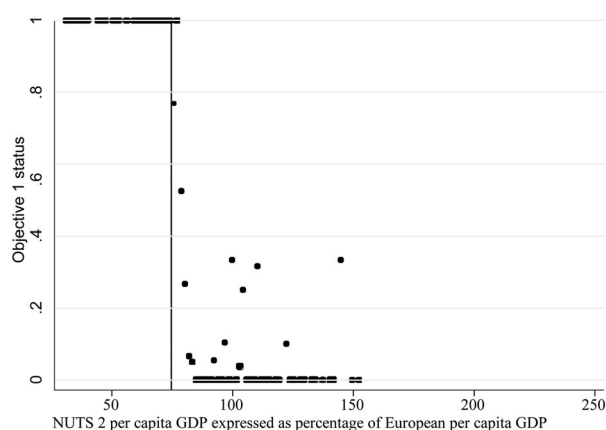


Figure 2. Discontinuity of treatment status at the threshold level.

The second assumption required is the jump at the threshold of the treatment status. Figure 2 shows the average treatment status plotted against the forcing variable. The design is fuzzy, because 21 NUTS-2 regions, amounting to 59 NUTS-3 regions, did not meet the requirements for Objective 1 status, but were nonetheless granted funds. Had there been a sharp RDD, all observations to the right of the threshold would have been zero.

Table 3 shows the summary statistics of the interaction variable. The first three rows present similar means and standard deviations, although one subsample is double the size of the other, whereas the two other subsamples have similar sizes but different means.

RESULTS

Table 4 reports estimates of simple RDD regressions across regions with a share of service below and above the European Union average with different polynomial specification in the forcing variable. As can be seen, estimates point at an heterogeneity characterizing estimates of a LATE depending on the size of the tertiary sector, with magnitude of the difference varying across specifications, but always sizeable.

Results for the heterogeneous effect are shown in Table 5, where columns refer to the degree of the polynomial in the forcing variable, initial per capita GDP in PPP, while in the horizontal dimension there are the three different specifications of the polynomial in the interaction variable, the regional GVA coming from the tertiary sector as share of the total regional GVA (SERV). Recall that both variables have been previously centred first at

Table 4. Local average treatment effect (LATE) estimates of heterogeneity.

Sample	Service below average	Service above average
Third-order polynomial	0.865** (0.43)	0.653 (0.22)
Fourth-order polynomial	1.077*** (0.40)	0.571** (0.26)
Fifth-order polynomial	1.609*** (0.62)	0.568* (0.30)
Observations	556	677

Notes: Robust standard errors are shown in parentheses.

*** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

the threshold level while the latter at the sample mean. Estimates of the parameters of the forcing variable polynomials were omitted for the sake of clarity and simplicity.¹

The first striking result is that the treatment, Object1, is not significant per se; instead, its interactions with SERV and SERV3 were very significant, implying that there is indeed an heterogeneity of the treatment according to the level of the SERV variable. The results for Object1 and its interactions remained similar across the columns, which represent the different specification of the polynomial in the forcing variable. Hence, a higher order of initial GDP cannot explain the impact of the service share of GVA on the economic growth of the regions treated. The other striking result is that the interactions have negative sign, meaning that a tertiary GVA above the mean, centred at zero, reduces the impact of the transfers on the per capita GDP growth, whereas a service GVA below the mean, i.e., a negative value of SERV, makes the transfers more effective.

Finally, it should be noted that assumption A5 is crucial for the identification of the HLATE and its violation may produce biased estimates of the policy impact. To deal with this issue, this section considers only regions with a GDP per capita in the interval 60–90% of the European Union average and controls also for population density and for the share of population living in urban areas. Both variables, measured as in 1999, i.e., before treatment, were meant to capture eventual residual selection into treatment (around the threshold) not captured by the forcing variable (Gagliardi & Percoco, 2016). Results are shown in the fourth column of Table 6 and present point estimates very similar to regressions in the third column. In addition

Table 3. Summary statistics of service gross value added (GVA) share at the time of the Commission decision.

Sample	Observations	Mean	SD	Minimum	Maximum
Whole	1080	0.653	0.096	0.226	0.935
Below threshold	365	0.644	0.093	0.405	0.883
Above threshold	715	0.658	0.097	0.226	0.935
Below sample mean	556	0.579	0.059	0.226	0.653
Above sample mean	524	0.732	0.057	0.653	0.935

Table 5. Objective 1 and tertiary sector: heterogeneous local average treatment effect (HLATE) (instrumental variables (IV) estimates).

	Third-order polynomial	Fourth-order polynomial	Fifth-order polynomial	Fifth-order polynomial with controls on the subsample	Panel with fixed effects
<i>linear SERV</i>	(1)	(2)	(3)	(4)	(5)
Object1	0.371 (0.226)	0.407 (0.271)	0.534* (0.301)	0.501* (0.277)	0.499* (0.223)
Object1 × SERV	−2.43*** (0.812)	−2.392*** (0.812)	−2.396*** (0.803)	−2.391*** (0.788)	−2.001*** (0.234)
SERV	−0.948* (0.573)	1.302** (0.590)	−1.561** (0.609)	−1.483 (0.442)	−1.001 (0.487)
Constant	3.627*** (0.197)	3.639*** (0.250)	3.848*** (0.290)	3.798*** (0.301)	3.101* (1.534)
Observations	1080	1080	1080	657	2022
R ²	0.349	0.354	0.368	0.312	0.566
<i>quadratic SERV</i>	(1)	(2)	(3)	(4)	(5)
Object1	0.476** (0.228)	0.436 (0.285)	0.355 (0.318)	0.322 (0.401)	0.211 (0.922)
Object1 × SERV	2.466*** (0.803)	−2.366*** (0.806)	−2.241*** (0.805)	−2.301*** (0.667)	−2.004** (0.998)
Object1 × SERV2	−7.134 (5.747)	−7.696 (5.764)	−7.719 (5.774)	−6.981 (4.332)	−5.442 (5.666)
SERV	−0.960 (0.624)	−1.242* (0.635)	−1.781*** (0.663)	−1.710*** (0.333)	−1.562** (0.725)
SERV2	−0.844 (6.240)	−5.333 (6.453)	−17.69** (7.609)	−16.54** (6.778)	−14.33** (5.638)
Constant	3.606*** (0.201)	3.637*** (0.264)	3.824*** (0.308)	3.776*** (0.312)	2.911*** (0.455)
Observations	1080	1080	1080	657	2022
R ²	0.350	0.354	0.358	0.401	0.573
<i>cubic SERV</i>	(1)	(2)	(3)	(4)	(5)
Object1	0.426* (0.227)	0.417 (0.286)	0.332 (0.318)	0.301 (0.422)	0.219 (0.555)
Object1 × SERV	−5.457*** (1.383)	−5.194*** (1.390)	−5.316*** (1.388)	−5.233*** (1.229)	−5.221** (1.223)
Object1 × SERV2	−1.305 (6.221)	−2.178 (6.241)	−1.771 (6.228)	−1.801 (4.223)	−1.766 (5.938)
Object1 × SERV3	118.4** (46.44)	110.4** (46.60)	122.4*** (46.67)	119*** (35.992)	117.4*** (32.887)
SERV	−0.787 (0.864)	−0.949 (0.858)	−0.550 (0.856)	−0.605 (0.726)	−0.710 (0.947)
SERV2	−1.573 (7.033)	−3.722 (7.181)	−21.38** (8.663)	−19.99* (8.102)	−18.22 (9.22)
SERV3	−15.03 (28.16)	−12.57 (27.66)	−52.51* (28.84)	−49.33* (22.44)	−51.11* (25.66)
Constant	3.624*** (0.201)	3.615*** (0.263)	3.801*** (0.306)	3.812*** (0.234)	3.776** (1.599)
Observations	1080	1080	1080	657	2022
R ²	0.354	0.357	0.362	0.377	0.601

Notes: Estimates are reported where the forcing variable is gross domestic product (GDP) per capita in 1999. The fourth column reports regressions controlling for population density and the share of population in urban agglomerations. The fifth model reports estimates considering a panel of NUTS-3 regions. Robust standard errors are shown in parentheses.

*** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

Table 6. Comparison between Objective 1 regions.

	Average expenditure in the service sectors	Average growth rate
Below the European Union mean ($N = 234$)	0.696 (0.143)	5.160 (0.135)
Above the European Union mean ($N = 240$)	0.713 (0.159)	4.395 (0.114)
Test of equality (p -value)	0.289	0.012

to this robustness test, model (5) in Table 5 reports estimates of a panel model in which two different programming periods, i.e., 1994–99 and 2000–06, were considered. This model is important since fixed effects at regional level have been used in order to have a better identification in the interaction variable since this can be driven by unobserved factors. Also, in this case results are qualitatively unchanged, although with a lower precision because the variable indicating the treatment has a low variation across time. Further estimates in the supplemental data online corroborate these findings.

To put the estimates into perspective, consider the case in column (3) with a cubic SERV polynomial for a treated region whose level of SERV is 0.1, roughly the sample standard deviation. This means that the share of GVA is 10 percentage points higher than the sample mean causing a disadvantage given by $-5.316 \cdot 0.1 - 1.771 \cdot 0.1^2 + 124.4 \cdot 0.1^3 = -0.42491$, which is not offset by the positive effect of the treatment alone resulting in a negative growth of $0.332 - 0.425 = -0.93$ percentage points, which represents the HLATE. This case might appear a bit extreme as the sample average is 0.653, which becomes 0.753 with the additional 10 percentage points. This leaves only roughly 25% of regional GVA to the other two sectors, but confronting the data 119 NUTS-3 regions out of 474 treated regions were found above such a level, and among those 119 regions 98 comply with the 75% rule. Nevertheless even with a smaller but positive amount of SERV, the effect is still negative but it might be offset by the treatment itself.

If the treated region is below the sample mean, the low level of services amplifies the treatment effect, using the same figure but with opposite sign one obtains $-5.316 \cdot (-0.1) - 1.771 \cdot (-0.1)^2 + 124.4 \cdot (-0.1)^3 = 0.3895$ as the effect of being treated and having $SERV = -0.1$, which must be added to the treatment effect providing a HLATE equal to 0.7215, i.e., the region will experience an additional growth rate amounting to 0.72% because of the treatment and the low level of service development. From the data, 66 treated regions are below -0.01 .

These results seem to point to a decreasing impact of the tertiary sector on growth, at least for values above the average, meaning that the higher the initial level of the tertiary sector, the lower the subsequent growth of the economy induced by that sector. By contrast, the effect on the growth is higher the lower, with respect to the mean, the initial level of service development. This evidence implies that investments in the tertiary sector have a positive impact on regional economic growth only if the sector is relatively less developed, while the same investments reduce the growth if the sector is already well established. Although

there is no evidence for the channels of transmission of this effect, it can be speculated that it is probably due to an over-investment in the service industries.

Let one measure the expenditure on the service sector as the expenditure on transport plus investments in tourism and R&D. Table 6 shows the mean of Objective 1 regions divided into two groups: those with a tertiary sector below the European mean and those whose service sector is above the European average. The share of funds allocated to the enhancement of the tertiary sector is very similar, as also highlighted by the p -value of the difference in means. However, the average rates are different between the two groups, with the lower growth for the group above the mean. Although only descriptive, this evidence is suggestive of excessive spending in services for regions above the European Union average, probably leading to a misallocation of financial resources. Overall, these findings are in line with the ‘cost disease’ view proposed by Baumol (2001), where the resistance to standardization and labour intensity make service productivity growth modest. Uppenberg and Strauss (2010) found that a large share of aggregate growth in European Union countries is due to manufacturing productivity growth, whereas the growth in service sectors is considerably less pronounced. In Baumol’s (2001) view and according to the present results, a shift of employment from manufacturing to services, possibly driven by public resources allocated to the latter ones, will decrease the productivity growth of regional economies and result in a lower impact of Cohesion Policy.

CONCLUSIONS

This paper analysed the effect of Cohesion Policy on regional growth in Objective 1 NUTS-3 regions by assigning an explicit role to heterogeneity in terms of economic structure, as well as to the development strategy adopted by regional governments. In particular, by using an RDD with heterogeneous treatment, evidence that the heterogeneity of the regions, when treated with respect to the development level of their service sector, matters a great deal has been provided. Indeed, regions with a below-mean level of services benefited more from the transfers than did above-mean regions, i.e., the former presented a higher growth rate than the latter. This may be due to the fact that a not-yet-developed service sector has the capacity, when developed, to boost economic growth not only because of its own expansion but also because it has a supplementary role for the two other sectors of the economy, boosting their growth as well. Furthermore, as from the results, a significant sensitivity of the estimates to the

statistical definition of the service sector is detected, in line with existing literature.

Results presented in this paper are in line with the smart specialization approach to regional development policy currently being discussed within the European Commission, as they show that development policies neglecting the life cycle and the strategic role of sectors have a detrimental or null impact on economic growth.

DISCLOSURE STATEMENT

No potential conflict of interest was reported by the author.

SUPPLEMENTAL DATA

Supplemental data for this article can be accessed at <http://dx.doi.org/10.1080/00343404.2016.1213382>

NOTE

1. Moran's I over the residuals to test for spatial autocorrelation is always below 0.2 and never significant. This is probably due to the fact that most of the spatial autocorrelation is absorbed by NUTS-2-level treatment and country fixed effects.

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