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The regional effects of a place-based policy – Causal evidence from Germany

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A B S T R A C T

The German government provides discretionary investment grants to structurally weak regions in order to reduce regional inequality. We use a regression discontinuity design that exploits an exogenous discrete jump in the probability of regional actors to receive investment grants to identify the causal effects of the policy. We find positive effects of the programme on district-level gross value-added and productivity growth, but no effects on employment and gross wage growth.

1. Introduction

Place-based policies – commonly designed to increase employment, income and productivity, particularly in lagging regions – are an integral part of the policy mix in many countries. In the United States, approximately USD 95 billion per year have been spent on place-based policies in the first decade of the 21st century (Kline and Moretti, 2014a). The same priority can be found in the European Union (EU). Here, the Structural Funds are the main instrument for implementing the EU's economic and social cohesion policy. In the recent programming period, expenditures amounted to € 278 billion (i.e. € 39.7 billion per annum, or 28 percent of the EU budget) to support lagging regions in their economic development and to reduce regional inequality in the EU (Ciani and de Blasio, 2015).

Despite the omnipresence of place-based policies, econometric evaluations of their causal regional effects are rather rare (Criscuolo et al., 2019). This is very problematic from the point of view of assessing the achievement of the programme objectives. Many OECD countries are characterised by currently rising regional disparities (OECD, 2016). Hence, a large number of lagging regions are struggling to increase productivity and employment. Enhancing the understanding of what policies work to reduce regional inequalities is, therefore, important to provide policy advice for improved social coherence within and across countries (Neumark and Simpson, 2015).

This paper presents causal estimates of the regional effects of the most important place-based policy in Germany. The Joint Task for 'Improving the Regional Economic Structure' (GRW[1]) aims to reduce regional inequality within Germany. The GRW provides discretionary investment grants to firms and municipalities in economically lagging regions. The grants are intended to stimulate capital accumulation with positive effects on output and employment in the subsidised firms and regions. Although GRW has existed for a relatively long time, Germany is no exception to the general trend of increasing regional disparities in OCED countries. Dauth et al. (2018) document a rising income inequality between German labour market regions in the period 1985 to 2014. However, this development does not allow any direct conclusions to be drawn concerning the (non)effectiveness of the GRW. As Rodrik (2007) emphasises, programmes like the GRW are generally aimed at firms and regions that would be in even greater difficulty without the programme.

Our dataset combines district-level panel data for West German regions with information on the eligibility of a district and its use of funding. We analyse the effects of GRW funding in the programming period 2000–2006. Our analysis focuses on growth in the key components of the production function: output (gross value-added [GVA], pro-

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[1] GRW is the acronym used in this paper with reference to this instrument. The full German term is as follows: Gemeinschaftsaufgabe 'Verbesserung der regionalen Wirtschaftsstruktur'.

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ductivity [GVA per worker]), labour input and its compensation (number of employees, and gross wages and salaries).[2]

We find positive effects of GRW funding on the GVA growth and district productivity, but no effect on employment growth and district gross wages. Consequently, GRW support contributes partly to reducing regional disparities in Germany through its impact on district productivity growth. Our study makes two contributions to the literature on the analysis of the causal effects of place-based policies. First, by analysing the effects of GRW funding at district level for Germany, we provide indications of how investment grants for lagging regions affect regional inequality in Germany. While simple OLS estimates may produce biased estimates of programme effects (see also Criscuolo et al., 2019), we address identification issues by developing a quasi-experimental research design that exploits an exogenously determined discontinuity in the definition of district funding eligibility in the GRW programme. Using a regression discontinuity design (RDD), we compare the economic development of districts that are positioned closely on either side of the eligibility threshold to estimate the causal effect of the GRW. This allows novel insights into the general discussion on the regional impact of public investment grants, as such schemes may operate differently in different contexts (Neumark and Simpson, 2015). By comparing output and employment growth rates, we can conclude whether the substitution effect outweighs the scale effect in the districts under consideration. Second, in contrast to broader assessments of programme families such as the overall set of EU Structural Funds (see Becker et al., 2010, 2012, 2013), evaluating a specific program like the GRW gives us a deeper understanding of what particular features of these programs matter, and can help us better disentangle mechanisms behind observed effects.

The remainder of the paper is organised as follows: the next section presents a brief literature overview of empirical findings concerning the effectiveness of investment grants as a regional policy instrument. Section 3 describes the GRW allocation procedure in detail and presents the identification strategy that allows the application of an RDD to identify causal effects of the GRW funding. In section 4, we present our data and selected descriptive statistics. Section 5 discusses the main results of the regression analysis. In section 6, we present sensitivity and robustness checks. Section 7 concludes the paper.

2. Review of the empirical literature

Place-based policies include a variety of measures ranging from enterprise zones (Neumark and Kolko, 2010; Hanson and Rohlin, 2013; Reynolds and Rohlin, 2014; Mayer et al., 2015) and cluster policies (Falck et al., 2010; Martin et al., 2011) to large-scale regional development programmes such as the Tennessee Valley Authority (Kline and Moretti, 2014b). We limit our literature survey to evaluation studies of discretionary investment grants that are comparable to the GRW. These examples include the Italian Law 488/1992, the British 'Regional Selective Assistance' (RSA) or the Belgian (Flanders) 'Groeipremie', which provide investment grants to firms in a pre-defined set of regions of a nation, as well as the policy efforts under the EU's regional policy system (Becker et al., 2010, 2012, 2013).

The primary focus of counterfactual impact evaluation studies of these selected programmes so far has been the micro-level (e.g. Bronzini and de Blasio, 2006; Bernini and Pellegrini, 2011; Cerqua and Pellegrini, 2014 for the Law 488/1992; Decramer and Vanormelingen, 2016 for the Flemish Groeipremie; Brachert et al., 2018 for the GRW; Devereux et al., 2007, Moffat, 2015, Criscuolo et al., 2019 for the RSA), but the identification of their regional effects remains scarce. This runs counter to the actual goal of the programmes which is to promote territorial cohesion in the subsidised regions. The first studies that directly address the spatial effects are de Castris and Pellegrini (2012) and Criscuolo et al. (2019). In a joint evaluation of the effects of the Italian Law 488/1992 and the Contratti di Programma, de Castris and Pellegrini (2012) develop a spatial difference-in-differences model to confirm that the policy had a positive employment impact in the 1996–2001 period. While their results indicate low spatial displacement effects with subsidised regions attracting employment from neighbouring regions, the increase in the number of employees in the subsidised regions exceeds those in the other regions. Criscuolo et al. (2019) present area-level findings for the RSA in the UK. As part of an IV approach, they exploit exogenous changes in the area-specific eligibility criteria in their identification strategy to show that the RSA has led to an increase in regional employment that is not due to displacement effects between eligible and non-eligible regions. In addition, their study finds positive effects of the programme on net firm entry and firm investment, but no effects on total factor productivity. Further evidence on the regional effects of place-based policies can be found in Becker et al. (2010), who analyse the causal effects of EU Structural Funds on regional performance indicators. With the help of an RDD, Becker et al. (2010) estimate positive effects of the EU Structural Funds on GDP per capita growth, but do not identify effects on employment growth. A follow-up study by Becker et al. (2012) uses generalised propensity score methods to demonstrate that EU transfers allow faster growth in the recipient regions, but that for a number of regions, a reduction in transfers would not contribute to a reduction in growth. Finally, Becker et al. (2013) stress that the effect identified in the RDD design is highly heterogeneous across regions and depends strongly on the absorptive capacity of the region, measured by human capital and the quality of institutions.

Ehrlich and Seidel (2018) provide the first study addressing regional outcomes of a place-based policy in Germany. They examine the effect of a policy that supported West German regions located near the border with the former German Democratic Republic and Czechoslovakia (the so-called Zonenrandgebiet [ZRG]). This policy measure (which was applied between 1971 and 1994) consisted of five different funding lines: i) regional economic activities; ii) public transport infrastructures; iii) housing; iv) social housing and daycare centers; and v) education and cultural activities. Using a spatial RDD, the authors find significant long-term effects of the programme on different regional outcomes. Although the GRW was part of the ZRG programme family, the analysis of Ehrlich and Seidel (2018) does not allow direct conclusions to be drawn about the effects of the GRW. Similar to the studies of Becker et al. (2010, 2012, 2013), the complex nature of the ZRG makes it impossible to draw direct conclusions about the impact of certain elements of this policy mix. Therefore, a separate analysis of GRW is of crucial importance, as this programme was assigned not only to ZRG areas but also to a significant number of regions outside this area and later on became the main instrument of regional development in reunified Germany (see the maps in Fig. A.1 of the Appendix).

3. Institutional details and identification strategy

3.1. Institutional details

The Joint Task for 'Improving Regional Economic Structures' is the most important political instrument for reducing regional disparities in Germany.[3] The GRW was introduced in 1969 and has continued ever

[2] We cannot analyse the effects of the GRW on the stock of physical capital, as German official statistics do not provide data on regional capital stock or regional investment activities.

[3] 3In Germany, regional policy remains the responsibility of the federal states (Article 30 of German Basic Law). However, the constitution permits Federation support for the federal states in establishing, implementing and funding regional policy schemes. The Coordination Committee that consists of members of the federal states and the government agrees on the general rules for the provision of investment grants on the basis of the GRW-law (Bundesregierung, 1969).

since. Within the framework of the GRW, the government primarily supports small and medium-sized firms (classified according to the EU definition) and municipalities in their investment activities. The (non-repayable) grants to firms account for up to 50 percent of eligible cost. Public infrastructure measures can be supported with up to 90 percent of the eligible costs. Investment projects usually involve the construction of new businesses or the expansion of existing ones. For a more detailed description of the legal framework for GRW support and the general funding rules, see Table A.1 and A.2 in the Appendix.

Access to the GRW is restricted to actors (firms and municipalities) in structurally weak regions. This restriction makes GRW a place-based policy. The formal eligibility status of a region is determined on the basis of a composite score. The elements of the score reflect the multidimensional definition of structural weakness by the German government and are subject to change over time. In the case of the GRW, usually four single indicators are used to develop the measure of regional structural weakness. The single indicators are standardised and a weighted average (with varying weights in the different programming periods) is used to calculate the composite score (Schwengler and Binder, 2006).

The score is calculated at the level of local labour market regions, which consist of several districts. In a local labour market region, all districts have the same score value. However, since local labour market regions have no administrative power and because the peculiarities of certain local labour market regions (e.g. strong subsidy gaps) need to be taken into account, formal eligibility remains tied to the administrative unit, the district. Calculating the score at the level of local labour market regions has several advantages. Firstly, it enables the consideration of strong interdependencies (e.g. commuting flows) of districts across space. Secondly, calculating the components of the score at the level of local labour market regions reduces the risk that score elements may be manipulated by individual districts.

The continuous score allows a ranking of German regions based on the degree of structural weakness. However, the government still needs to determine the number of benefiting districts. This is done in accordance with the EU legislation.[4] For each programming period, the EU sets a ceiling for the total population living in assisted areas. This general share is distributed among the EU Member States. The combination of the composite score and the population threshold results in a regional aid map that reflects regionally differentiated access to the GRW funding. We use this information to identify the effects of GRW funding on regional development.

GRW funding reduces the effective capital costs of actors in eligible districts. This should lead to a higher capital input for the supported actors. The extent to which the capital input increases depends on suitable monitoring of the projects by the governments (e.g. their ability to target marginal investment projects) and the financial constrains of the subsidised actors (see Criscuolo et al., 2019 for a detailed discussion). For the government, the decisive factor in assessing the success of the GRW is the labour market effect of the programme. Here, the theoretical literature emphasises that although capital may increase, capital grants could even have negative effects on labour input. The level of employment effect depends on whether the scale effect (elasticity of labour in relation to the cost of capital) is greater than the substitution effect (elasticity of substitution between labour and capital). If this is the case, the GRW support will have a positive effect on employment. If this is not the case, the support reduces the labour input (Criscuolo et al., 2019). In the empirical part of the paper, we will assess which of the mentioned effects predominates in the West German districts.

[4] The actual eligibility status is reported in the annually published Coordination Frameworks (volumes 29–35), which is edited by the German parliament (see also Tables A.1 and A.2 of the Appendix for details).

Table 1
GRW in West German districts (2000–2006).

	Average annual amount	
Treated districts	(number)	96
Subsidy per capita, per district	(€)	135.2
Subsidy per district	(million €)	3.1
Total amount of subsidy	(million €)	295.6

Source: BAFA (2015); raw data. Own calculations.

3.2. The programming period 2000–2006

Our study focuses on the effects of the GRW in the 2000–2006 programming period. In the 2000–2006 period, composite scores are calculated separately for West and East Germany (including Berlin). Since there is no variation in treatment for East Germany (the region as a whole has access to GRW funding), we identify the effects of GRW funding from the performance of West German districts. In this programming period, the government used four indicators to calculate the composite score of regional structural weakness. The single indicators were the regional unemployment rate (with a weight of 40 percent), the regional income per employee (40 percent), the quality of infrastructure (10 percent) and the results of an employment projection model for the region (10 percent). The EU set the ceiling for the population share living in assisted regions in Germany at 40.7 percent. The regional aid map can be found in Fig. A.1 of the Appendix. Table 1 depicts average annual figures with respect to GRW funding received by the districts under analysis.[5] In the 2000–2006 programming period, the maximum aid intensity for firm investment projects in West German districts was 28 percent of eligible costs for small and medium firms and 18 percent for large firms (Schwengler and Binder, 2006; coordination frameworks [see Table A.2 of the Appendix]). 29.5 percent of the West German districts received GRW subsidies. The average annual amount of GRW subsidies is € 295.6 million for all West German districts and € 3.1 million per district. The GRW per capita and district amounts to an annual value of € 135.2.

Fig. 1 shows all 325 West German districts ranked in ascending order of their respective scores in this period.[6] The vertical red line represents the EU population threshold. All actors in districts with a score below this threshold are formally eligible for GRW funding (i.e. on the left-hand side of the red line in Fig. 1). The values of the score describe a smooth trend around the threshold.

Fig. 2 compares the formal eligibility status with the actual treatment status for all the 325 districts under analysis. We define a district as treated if an actor in the district received GRW funding in the programming period 2000–2006.[7] The dots represent the average treatment rates of districts with similar values in the eligibility score, namely values in equally sized bins of 0.05.[8] Again, the vertical red line represents the population threshold. Were the connection between eligibility and treatment status perfect, we would observe two lines: to the left of the cut-off, the treatment rate would be one, and to the right, the treatment rate would be zero. However, we observe districts which do not receive grants despite the low score of the district (so-called ‘never

[5] Statistics on annual GRW grants at the district level are provided by the German Federal Office for Economic Affairs and Export Control (BAFA).

[6] The score values for the 2000–2006 programming period are taken from Koller et al. (2000). Some districts have exactly the same score, since the structural weakness score is calculated at the level of labour market regions and some labour market regions consist of several districts.

[7] The spatial allocation of the different regional types regarding treatment and eligibility status is presented in the map in Fig. A.1 of the Appendix.

[8] The picture serves as illustration of the above mentioned relationship. For the sake of clarity we summarize similar values in bins.

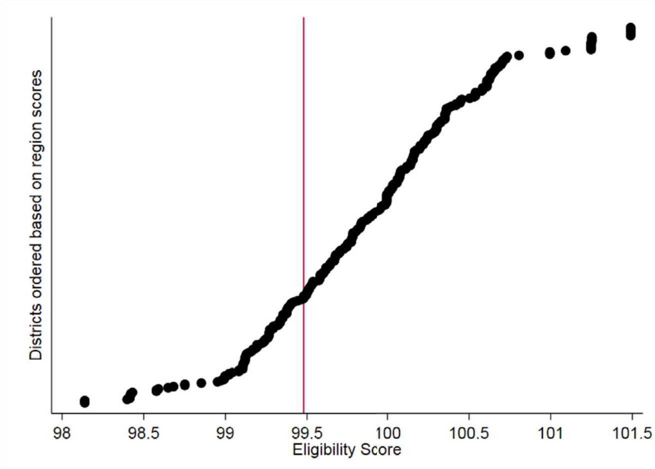

Fig. 1. *Slope of the eligibility score.* Note: The vertical red line represents the score of the 'last' eligible district. The next district in this ranking is the first district that is not eligible for GRW grants. (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)
Sources: scores: Koller et al. (2000); formal eligibility status: coordination frameworks (see Tables A.1 and A.2 of the Appendix). Own illustration.

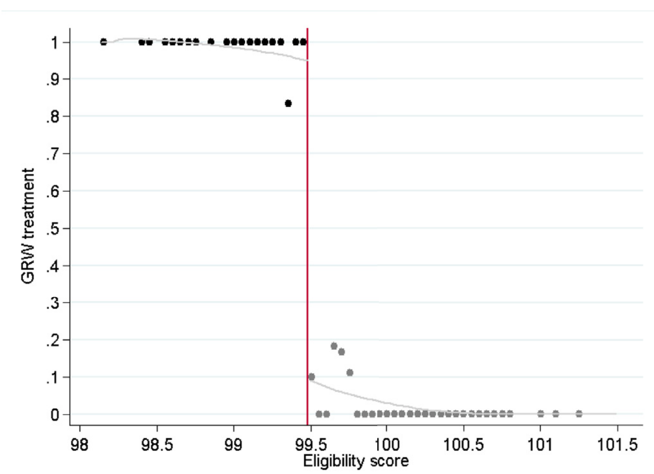

Fig. 2. *Treatment and assignment status.* Note: The figure shows the average treatment rates of districts in equally sized bins of 0.05. The fitted lines represent a local polynomial smoothing of the treatment rates based on an Epanechnikov kernel with rule-of-thumb bandwidth.
Sources: scores: Koller et al. (2000); treatment status: BAFA (2015). Own calculations and illustration.

takers' to the left of the cut-off value),[9] and we find districts which do receive funding although they are formally not assigned to treatment (so-called 'always takers' right of the cut-off).[10]

Deviations from the allocation procedure result from decisions made by the GRW Coordination Committee. A deviation from the general allocation rule is justified when districts face local dis- advantages within labour market regions that are not eligible for GRW. In the respective funding period, this applies to five districts that are located at the former inner-German or Czech border and are surrounded by formally eligible districts. The general rule regarding the population share remains unaffected by these decisions. However, despite the presence of exceptions from the general allocation procedure, we observe a considerable jump in the treatment status in the period under analysis. This jump gives rise to the use of a regression discontinuity design (RDD) for evaluation purposes. By comparing districts lying closely on either side of the population threshold, we estimate the local average treatment effect of the GRW funding on the treated districts.

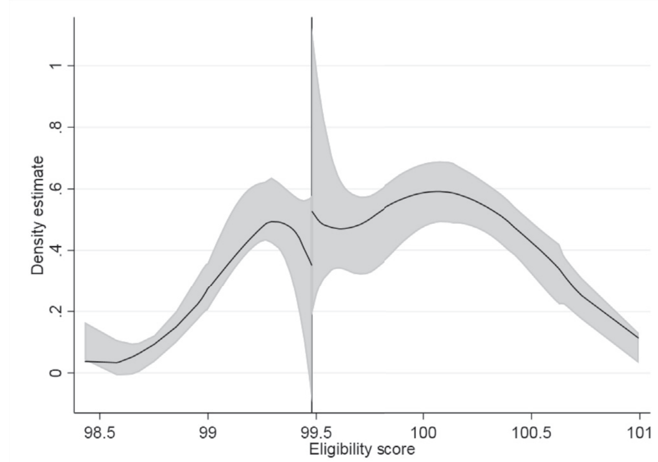

Fig. 3. *Density test of the eligibility score.* Note: robust test statistic of the continuity density test: 0.1713, p-value: 0.8640.
Sources: scores: Koller et al. (2000); illustration: Cattaneo et al. (2018).

3.3. Identification strategy

The crucial question for RDD is whether the assignment to treatment is exogenous to the districts in the vicinity of the population threshold. The assignment status of each district consists of two elements – the population threshold by the EU, and the eligibility status according to the structural weakness score. Hereby, it seems obvious that a single district cannot influence the EU population limit. Regarding the second element, Lee and Lemieux (2010) argue that in an RDD, the assumption of exogeneity is fulfilled – at least in the vicinity of the cut-off value – if the actors have imprecise control over the forcing variable, i.e. the eligibility score. We argue that this assumption is fulfilled for three reasons. First, the score is defined at the level of labour market regions (which consists of sets of districts), and not at the single district level. Second, the score is calculated with the help of four indicators that measure each labour market region's degree of structural weakness. All of these indicators are beyond the control of a single actor. Third, the indicators are measured at different points in time prior to the programming period. For these reasons, we assume the actors to have imprecise control over the forcing variable.

In addition, a review of the density continuity test by Cattaneo et al. (2018) gives no hint of manipulation (see Fig. 3).[11] The idea behind the test is that if manipulation were possible, we should observe a density jump at the cut-off value. In our study, the density on the left-hand side should be much higher with districts seeking to enter GRW-funding. For the 2000–2006 programming period, however, we do not observe a higher density to the left of the cut-off value. Moreover, the test statistic of the continuity density test is 0.17, while the corresponding p-value is 0.86.[12]

[9] This applies to two districts, namely Bad Kissingen and Rhoen-Grabfeld, the Type 1 districts in Fig. A.1 of the Appendix.

[10] We observe five 'alwaystaker districts', namely Duchy of Lauenburg, Fulda, Coburg, Schwandorf and Neustadt a.d. Waldnaab, the Type 2 districts in of the Appendix.

[11] The test is conducted at the district level. The corresponding test at the level of labour market regions can be found in Fig. A.2 in the Appendix.

[12] The density continuity test is conducted at the level of districts. Since the eligibility score is determined at the labour market regions level, we additionally present the test at the level of labour market regions in Fig. A.2.

For our analysis, the key conditions of the RDD are fulfilled: a smooth forcing variable, here the eligibility score (see Fig. 2), an exogenous cut-off value – in our study the combination of the score and the population threshold imposed by the EU –, and a jump in the treatment rate at the cut-off (see Fig. 2). Since we do not have a deterministic relationship between the score and the treatment variable in our design, we estimate the treatment effect of GRW funding within a fuzzy RDD framework. We use the following model:

$$y_i = \alpha_0 + \tau D_i + f(x) + u_i, \tag{1}$$

where τ is the parameter of interest and D_i denotes the treatment status of district i. The function $f(x)$ is a polynomial function of the eligibility score. We apply a model without constraints – that is to say, we allow for different functional forms to the left and right of the cut-off: $f(x) = \beta_0(x_i - x_c) + \delta D_i(x_i - x_c)$.[13]

Within a fuzzy RDD, estimations of an ordinary least squares (OLS) regression in equation (1) would be biased (Imbens and Lemieux, 2008). Hahn et al. (2001) first showed the connection between a fuzzy RDD and the IV approach, and suggested the use of a two-stage least squares regression (TSLS). We follow this approach and estimate IV instead of OLS, where treatment is instrumented by the assignment status Z_i:

$$D_i = \eta + \gamma Z_i + f(x) + \phi_i. \tag{2}$$

This TSLS can be estimated by applying the usual heteroscedasticity-robust IV standard error terms (Imbens and Lemieux, 2008; Wooldridge, 2010). The estimator of τ in equation (1) can be interpreted as the local average treatment effect (Hahn et al., 2001).

4. Data: sources and descriptive statistics

4.1. Treatment and outcomes

Our dataset consists of district-level information on West Germany for the period 2000–2006 (i.e. one full programming period). We focus on four outcomes: the period growth rates of i) gross value added (GVA); ii) productivity (GVA per employee); iii) employment; and iv) gross wages and salaries between 2000 and 2006. The data is provided by the German statistical offices of the Federation and the Laender.

Fig. 4 illustrates the distribution of GRW funds per capita for the whole programming period. The dots represent the average treatment dose of districts with similar values in the eligibility score, namely values in equally sized bins of 0.05.[14] Again, the vertical red line represents the population threshold. In line with the basic idea of the programme, the intensity of the treatment is higher (in terms of GRW per capita) in districts with higher degrees of regional structural weakness. So within the framework of the RDD analysis, we compare the performance of the less treated districts with the performance of districts without GRW treatment.

Table 2 compares the mean outcomes of the treated districts with those of the non-treated districts. What is apparent is, first, that the mean level values of all four outcomes in the year 2000 are higher in the non-treated districts than in the treated ones. This is in line with

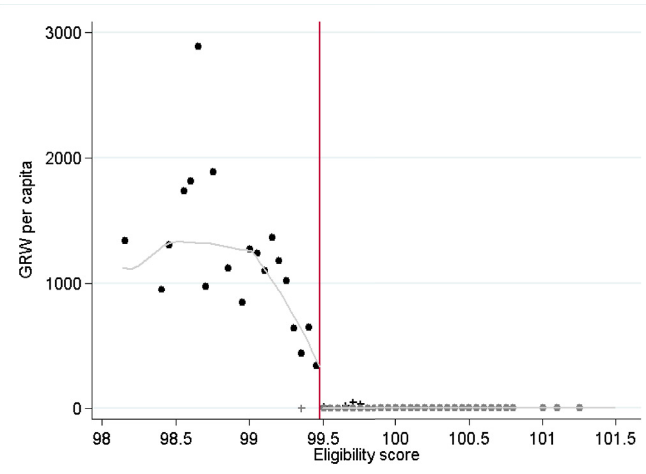

Fig. 4. *GRW funds per capita in the districts (in €).* Note: The figure shows the average treatment dose of districts in equally sized bins of 0.05; dots: districts where assignment = treatment; crosses: assignment ≠ treatment.. The fitted lines represent a local polynomial smoothing of the treatment based on an Epanechnikov kernel with rule-of-thumb bandwidth for the dotted districts. Sources: scores: Koller et al. (2000); GRW funds: BAFA (2015). Own calculations and illustration.

the intention of the GRW as a place-based policy. Second, also the mean growth rates of employment, wage sum, GVA and productivity are – at least slightly – higher in the non-treated districts. This implies that even in the presence of GRW-funding, treated and non-treated districts are characterised by rising economic disparities. However, as stated above, policies like the GRW are usually targeted at regions that would be experiencing even graver difficulties without the programme. Hence, our RD design should enable clarification of whether the GRW funds contribute to a reduction in regional inequality by comparing the outcomes of districts near the threshold.

A first description of the development of the outcomes under analysis is presented in Fig. 5. The figures outline the growth rates of employment, wages, the gross value added (GVA) and the GVA per employee over the treatment period. They show the averages of the district's period growth rates in equally sized bins of 0.05.[15] Dots represent districts where assignment and treatment status are equal; crosses mark districts where treatment and assignment status differ. The fitted lines represent the trend functions of the growth rates of the eligible treated districts (on the left) and the non-eligible, non-treated districts (on the right).

These graphs indicate that gaps might occur at the cut-off value for output (GVA) and productivity growth (GVA per employee). The graphs for employment growth and wage sum do not reveal a jump at the cut-off value. In section 5, we examine whether the presumed gaps are indicative of significant treatment effects. However, before we enter this debate, we take a deeper look at potential and prevalent differences across those districts in the vicinity of the cut-off value in regard to other characteristics.

4.2. Control variables

The RDD might produce biased estimates if regional characteristics exert an influence on the assignment status of a district. To address this issue, we consider three different types of control variables. First, we analyse the elements of the composite score. A second set of controls is associated with additional regional control variables, which might

[13] Constraining the functions to be the same on both sides of the cut-off value would mean using data from the left-hand side to estimate the parameters for the right-hand side, and vice versa. Clearly, doing so would be 'inconsistent with the spirit of the RD design' (Lee and Lemieux, 2010, p. 318). However, Angrist and Pischke (2009) state that estimating the restricted function and the more flexible one yield very similar results. For both functions, we use $(x_i - x_c)$ instead of the eligibility score value itself to capture the treatment effect at the cut-off point (Angrist and Pischke, 2009).

[14] The picture serves as illustration of the treatment dose. For the sake of clarity we again summarize similar values in bins.

[15] The figure just illustrates the relation between the score and the mentioned outcomes that we will estimate in the following. For the sake of clarity of the illustrations, we summarize similar values in bins.

Table 2
Descriptive statistics of the outcomes.

	Nontreated districts			Treated districts		
	Mean	Min	Max	Mean	Min	Max
	Level values 2000					
Employment[a]	109.06	20.50	1048.90	76.25	20.03	332.17
Wage sum[b]	2603.89	447.09	28367.16	1648.03	332.25	7897.87
GVA[b]	5673.67	959.33	70132.19	3350.87	742.17	17631.77
Productivity[c]	47.72	36.58	97.77	42.68	33.67	56.62
	Period growth rate, 2000–2006					
Employment	0.008	−0.097	0.122	−0.021	−0.133	0.097
Wage sum	0.060	−0.069	0.265	0.008	−0.222	0.142
GVA	0.144	−0.067	0.521	0.107	−0.092	0.359
Productivity	0.135	−0.057	0.440	0.132	−0.028	0.375
Observations	229			96		

Notes:
[a] Number of employed persons, in thousands.
[b] Million €.
[c] GVA per employee, in Thousand €.
Sources: Statistical offices of the Federation and the various federal states; BBSR and BA.

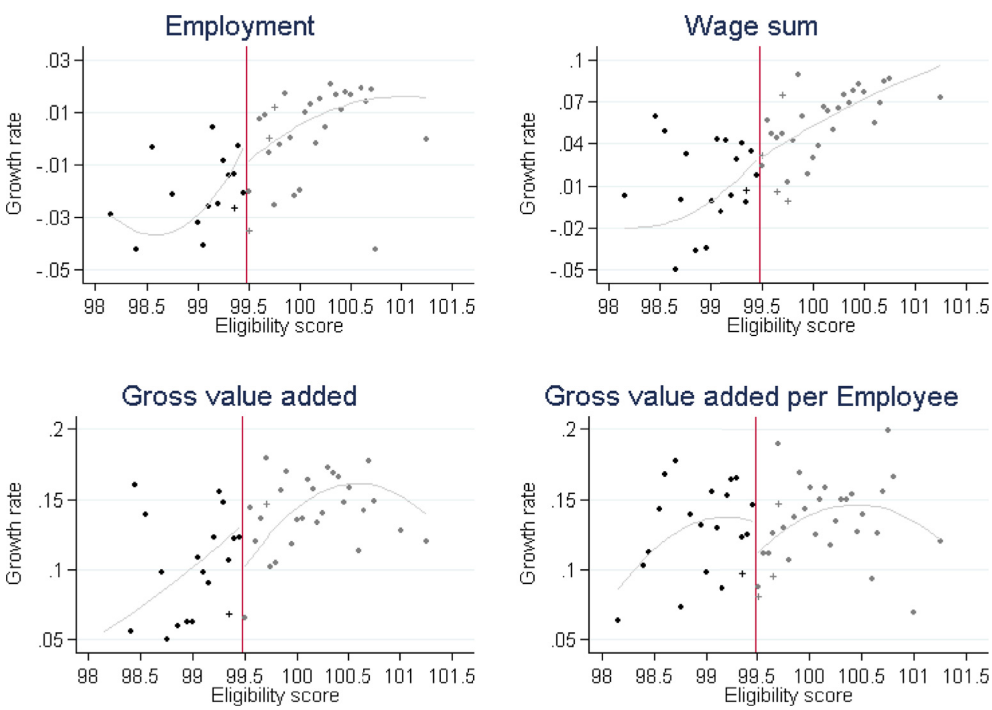

Fig. 5. *Growth rates of districts near the cut-off*. Note: The figure shows averages of the period growth rates of districts in equally sized bins of 0.05; dots: districts where assignment = treatment; crosses: assignment ≠ treatment. The fitted lines represent 3rd-order polynomials of the dotted districs (where assignment = treatment).
Sources: Statistical offices of the Federation and the various federal states; scores: Koller et al. (2000); treatment status: BAFA (2015). Own calculations and illustration.

affect regional development. Thirdly – to ensure that we have isolated the programme effect of the GRW – we must rule out the simultaneous presence of competing programmes that are often available to actors in the same area. We check whether these control variables describe a ‘smooth’ trend at the cut-off. Any jumps at the cut-off value would cast doubt on the credibility of our identification strategy (Becker et al., 2010). We observe the first and second type control variables at the beginning of the programming period (2000–2006). The data on further policy schemes comprise funding information for the entire 2000–2006 programming period.[16] To assess potential discontinuities in the controls, we use the above described estimation model (see equations (1) and (2)) to regress the controls on the eligibility score and examine whether discontinuities, or jumps at the cut-off value, are significantly different from zero.

The following figures provide a graphical representation of the regression results, including confidence intervals for the 95 percent significance level applicable to the three types of controls. Fig. 6 presents the results for the elements of the composite weakness score.[17] As stated above, the indicators include the unemployment rate, gross wages per employee in the manufacturing sector, the quality of infrastructure in terms of time required to reach the next motorway and an employment projection for the years 1997–2004. Data on these variables at the district level are available through the database ‘Indicators, Maps and Graphics on Spatial and Urban Monitoring’ (INKAR).

A second set of controls contains regional controls that might affect the regional development (Fig. 7). These control variables include the district’s employment rate that refers to the proportion of the population in employment, migration as a proxy for regional attractiveness, the share of highly qualified employees as a proxy for human capital

[16] Table A.3 of the Appendix contains the descriptive statistics for all control variables.

[17] Although the composite score is determined at the level of labour market regions, we use district-level data of the elements for the credibility check (with the exception of employment projection which is available only at the level of labour market regions).

Fig. 6. *Elements of the eligibility score.* Notes: Dots represent district-specific values of the controls at the beginning of the treatment period. The black lines are the estimated trends using the presented model; the green lines mark the 95 percent confidence interval. (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.) Sources: scores: Koller et al. (2000); treatment status: BAFA (2015); score elements: INKAR dataset. Own calculations.

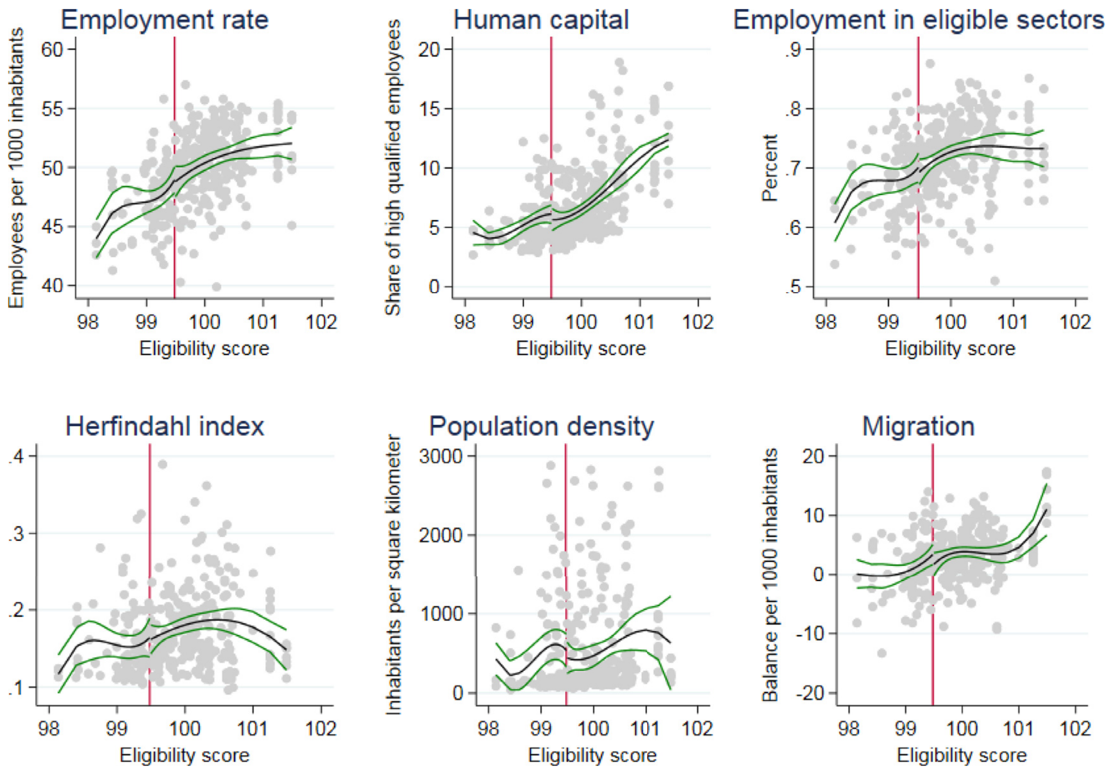

Fig. 7. *Regional Controls.* Notes: Dots represent district-specific values of the controls at the beginning of the treatment period. The black lines are the estimated trends using the presented model; the green lines mark the 95 percent confidence interval. (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.) Sources: scores: Koller et al. (2000); treatment status: BAFA (2015); regional controls: INKAR dataset, German Federal Employment Office. Own calculations.

and a set of variables addressing sectoral structures as well as variables relating to agglomeration economies. Thereby, we take into account that some industries are excluded from receiving investment subsidies according to EU legislation. This mainly applies to the industries in the primary sector, but also to selected industries in the manufacturing (e.g. chemical fibres, shipbuilding, etc.) and service sectors. Hence, we check for the share of employment in the eligible sectors in a district. Potential differences in agglomeration economies are considered by the population density and the degree of regional specialisation, measured using the Herfindahl Index. This indicator is calculated at the level of divi-

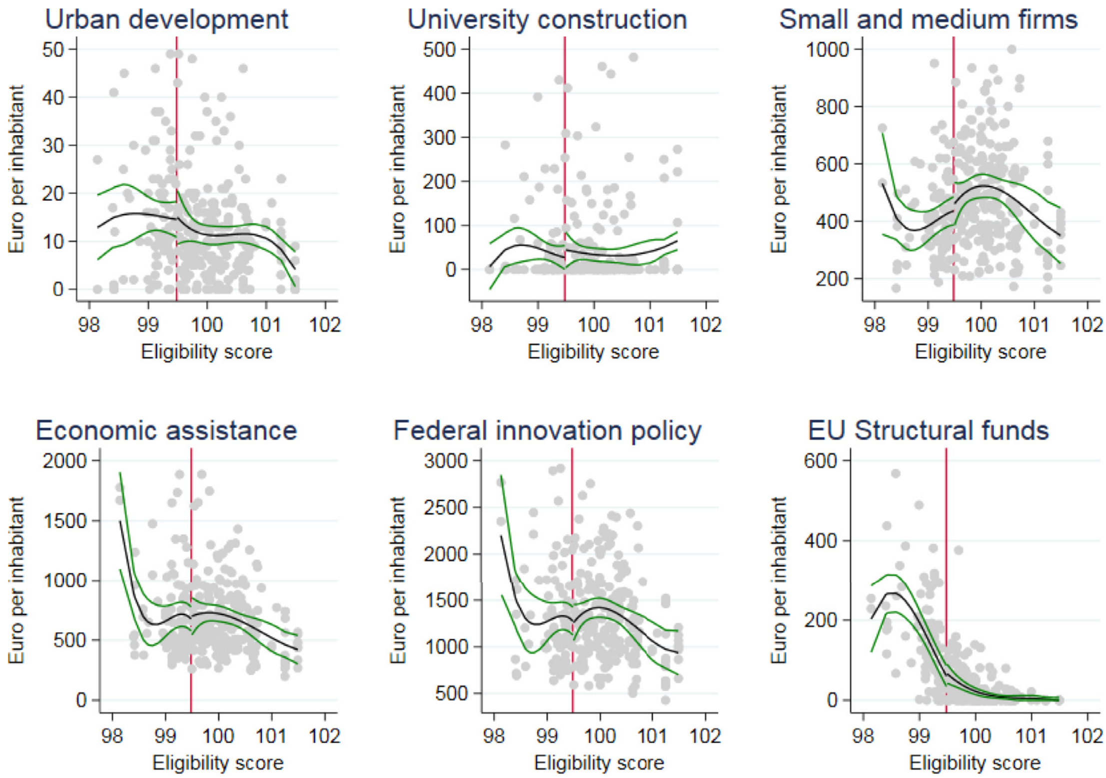

Fig. 8. *Potential alternative funding.* Notes: Dots represent district-specific values of the controls at the beginning of the treatment period. The black lines are the estimated trends using the presented model; the green lines mark the 95 percent confidence interval. (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)
Sources: scores: Koller et al. (2000); treatment status: BAFA (2015); funding information: INKAR dataset, BMBF, European Commission. Own calculations.

sions within the manufacturing sector.[18] Data for the regional controls are taken from statistics of the German Federal Employment Agency (BA) and the German Federal Office for Economic Affairs and Export Control (BAFA).

In a third step – to ensure that we have isolated the programme effect of the GRW – we must rule out the simultaneous presence of competing programmes that are often available to actors in the same area (see e.g. Bondonio and Greenbaum, 2014). This issue represents a specific case of the hidden treatment problem (e.g. Bondonio and Greenbaum, 2014; Guerzoni and Raiteri, 2015). As in many other countries, numerous support programmes are available for firms and municipalities in Germany. However, the GRW programme is the only nationwide funding scheme that follows the above described spatial allocation rule. Other place-based policies mainly relate to Eastern German districts. To ensure, nevertheless, that the main government subsidy programmes do not dilute our results, we control for the spatial pattern of different important regional policies (in German 'Raumwirksame Mittel') issued by the Federal Government and the Laender. Fig. 8 presents estimations for support of urban development, subsides granted under the joint task of university construction and loans for small and medium sized firms.

Furthermore, the sum of period funding from the European Recovery Programme (ERP) and additional programmes of the German state-owned development bank Kreditanstalt für Wiederaufbau (KfW) (i.e. ERP Equity Assistance Programme, ERP Start-up programme, ERP Regional Programme, ERP Innovation Programmme and ERP Environmental Programmes, as well as KfW Entrepreneur Loan and KfW Environmental programme) which is referred to as economic assistance, is taken into account. Furthermore we consider grants provided by the Federal Government's innovation policy schemes and the EU structural funds. The data for the different regional policy schemes are taken from the INKAR database, while information on federal innovation schemes stem from the German Federal Ministry of Education and Research (BMBF). The data on EU structural funds are provided by the European Commission. In none of these controls do we find jumps at the cut-off value of our regression discontinuity design.

5. Results

In a next step, we present the LATE estimates of the model for the period growth rates (i.e. 2000–2006) of the four outcome variables: employment, wage sum, output in terms of gross value added (GVA) and productivity in terms of gross value added per employee. The results presented are based on 3rd-order polynomials (Table 3).[19]

For the programming period 2000–2006, our estimates show a positive treatment effect on output and productivity. Hence, the results indicate that the GRW is effective in stimulating regional growth in terms

[18] Specialisation is measured for industries in the manufacturing sector, because the lion's share of GRW grants are allocated to this sector. This does not imply that this instrument is targeted solely at the manufacturing sector; instead, the eligibility criterion is 'supra-regional sales': the applying firm must sell its goods or services beyond a 50-km radius of the production location. This characteristic is also fulfilled by many service sector industries. Nevertheless, the number and amount of investment projects in the manufacturing sector are far larger than those of the service sector The Herfindahl-Index is calculated at the two-digit level, including the share of each division number in the range from 15 to 37 of the Classification of Economic Activities, Edition 2003 [WZ 2003] within total manufacturing employment.

[19] The results for alternative model specifications are reported in Table 5.

Table 3
Estimation results.

Growth of …	Employment	Wage sum	GVA	GVA/employee
Treatment	−0.00444	−0.0183	0.0514**	0.0561***
	(0.0151)	(0.0179)	(0.0248)	(0.0176)
Constant	−0.00667	0.0387***	0.0839***	0.0912***
	(0.0120)	(0.0136)	(0.0170)	(0.0117)
Observations	325	323	324	324
adjusted R^2	0.146	0.225	0.0756	0.0139

Robust standard errors in parentheses; significance level: ***p < 0.01, **p < 0.05, *p < 0.1. Model specification: 3rd-order polynomial of the eligibility score; no constraints (coefficients omitted); varying numbers of observations due to missings in administrative data.
Sources: Statistical offices of the Federation and the various federal states; scores: Koller et al. (2000); treatment status: BAFA (2015); own calculation.

of GVA and labour productivity. For the growth of gross value added, we find an average increase of 5.1 percent for the complete programming period (0.8 percent per year). The growth of labour productivity is about 5.6 percent (0.9 percent per year) for the districts close to the cut-off value. However, we do not find positive effects of the GRW funding on district employment growth or wage sum growth. Regarding the size of the effects, we have to take into account that the effects are estimated for the districts near the cut-off, i.e. the somewhat less-treated districts (see Fig. 4).

These results are in contrast to the findings for similar investment grants in the empirical literature. De Castris and Pellegrini (2012) for the Law 488/1992 in Italy and Criscuolo et al. (2019) for the Regional Selective Assistance in UK report positive effects of investment grants on regional employment growth but no effects on productivity. Hence, our analysis reveals that place-based policies may work differently in different contexts as emphasised by Neumark and Simpson (2015). How can we interpret our results with respect to theoretical considerations? As stated above, investment grants reduce the marginal costs of capital, lead to increased investment and induce an output effect where an outward production isoquant is reached (Klodt, 2000). However, capital grants can have negative effects on labour input. Since we do not find a positive employment effect of the programme, we conclude that the scale effect does not exceed the substitution effect. One further explanation for the null effects on employment growth can be linked to intra-regional displacement effects. Here, employment growth in the treated firms comes at the expense of comparable non-treated firms in the same district. Indeed, the micro-level study by Bade and Alm (2010) on the effects of the GRW programme finds that annual employment growth rate for treated establishments exceeds those of corresponding non-treated establishments in the same regional labour market, with the non-treated ones actually being characterised by employment losses. Our analysis also reveals no effect of the GRW funding on wage growth. This is surprising, as overall regional labour productivity is increasing. An explanation for this development might be the wage-setting power of firms. Manning (2003) argues that market power of firms is linked to search frictions and heterogeneous worker preferences (see also Bhaskar et al., 2002). These characteristics lead to a labour supply curve that is not perfectly elastic. Indeed, empirical literature for Germany finds wage elasticity estimates that are lower than in a perfectly competitive labour market (e.g., Hirsch et al., 2010; Bachmann and Frings, 2017). Hence, monopsonistic market power of firms in structural weak regions may prevent gains from productivity growth trickling down to wages.

6. Reliability and robustness of the results

The validity of the presented estimation results depends crucially on whether the chosen model provides an adequate description of the connection between the outcome and the forcing variable at the cut-off value (Angrist and Pischke, 2009). Potential deviations from the 'correct' estimation approach can be divided into three categories. First, unobserved regional variables and the influence of neighbouring regions may bias or affect the estimated effects. Second, the selected model specification may not reflect the true relationship, and third, the estimated effects may depend on the underlying sample definition. We present different checks for each of the mentioned categories. Overall, the results of the reliability and robustness checks provide strong evidence for the validity of the identification strategy, as we will show in the following.

While the identification of intra-regional displacement effects is beyond the scope of this paper, we can address potential effects induced by interactions between a district and its neighbours. Regarding neighbours, we distinguish between non-treated districts and those districts that were also treated within the GRW framework. The influence of mutual interactions may differ between both categories. Whereas interactions with non-treated districts may lead to an underestimation of the effect of GRW subsidies in a supported district, the influence of other treated districts is not clear. To test for inter-regional spillovers, we introduce two dummy variables for each district in the regression model presented in section 3.3. Namely, we include one dummy for the existence of a treated neighbour, and one for the existence of a non-treated neighbour into the model specification presented in Table 3. The coefficients are reported in part I of Table 4. They reveal no hint for an influence of inter-regional spillovers, neither for treated nor for non-treated districts on the treatment effect on the growth of employment, wage sum, output and productivity. Moreover, the approach might produce biased estimates, if regional characteristics affect the influence of the treatment on the growth of the analysed outcomes.

The same is true for the existence of potential funding alternatives for the actors. In addition to the tests for significant jumps of the regional controls and funding alternatives (section 4.2), we check if the control variables influence the treatment effect on the analysed outcomes. Parts II to IV of Table 4 give the results of this sensitivity check. The included elements of the eligibility score and additional regional controls (unemployment rate, gross wage per employee, quality of infrastructure, employment projection, employment rate, human capital, share of employment in eligible sectors, Herfindahl Index for specialisation, population density and migration) do not affect the treatment effect on the analysed outcomes, as the coefficients in part II of Table 4 show. Part III contains the estimation results including potential alternative funding: funding for urban development, university construction, assistance for small and medium-sized firms, economic assistance, Federal innovation policy and EU Structural funds. Here as well, we find the coefficients to be very similar to the results presented in Table 3. In part IV of the table, we present the estimation results including all the mentioned control variables. Again, the estimated treatment coefficients are very similar to the ones presented in section 5.[20] Overall, the presented sensitivity checks prove that the results in Table 3 are not sensitive to the inclusion of regional controls and potential alternative funding.

Next, we check the robustness of the presented results with respect to the model specification. The starting point is the model specification with a 3rd-order polynomial of the eligibility score and no constraints for the period 2000–2006. Table 5 presents robustness checks regarding the model choice. We include local linear and local quadratic regressions, as discussed by Lee and Lemieux (2010) and Calonico et al. (2014, 2015, 2017).

Additionally, we estimate the treatment effects using fourth- and fifth-order polynomials of the eligibility score. The estimated effects remain stable: also with alternative model specifications we observe no significant treatment effects on employment and wage growth, and sig-

[20] Table A.4 presents the full model including all control variables.

Table 4
Sensitivity check: Spillovers and Controls.

	Employment	Wage sum	GVA	GVA/employee
Presented results	−0.00444	−0.0183	0.0514**	0.0561***
	(0.0130)	(0.0169)	(0.0222)	(0.0174)
Observations	325	323	324	324
(I) Estimations including potential inter-regional displacement effects				
Treatment	−0.00494	−0.0159	0.0513**	0.0567***
	(0.0148)	(0.0179)	(0.0243)	(0.0177)
Treated neighbour	−0.00334	−0.00760	−0.00505	−0.000923
	(0.00550)	(0.00829)	(0.0122)	(0.0110)
Nontreated neighbour	0.00566	−0.0149	0.00368	−0.00375
	(0.00881)	(0.0124)	(0.0137)	(0.0143)
Observations	325	323	324	324
(II) Estimations including score elements and regional controls				
Treatment	−0.00533	−0.0103	0.0502**	0.0555***
	(0.0140)	(0.0194)	(0.0251)	(0.0184)
Observations	322	322	322	322
(III) Estimations including potential alternative funding				
Treatment	−0.00543	−0.0215	0.0496**	0.0554***
	(0.0148)	(0.0184)	(0.0253)	(0.0183)
Observations	324	322	323	323
(IV) Estimations including regional controls and alternative funding				
Treatment	−0.00898	−0.0160	0.0479*	0.0573***
	(0.0134)	(0.0193)	(0.0250)	(0.0193)
Observations	322	322	322	322

Robust standard errors in parentheses; significance level: ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$. Model specification: 3rd-order polynomial of the eligibility score; no constraints (coefficients omitted); varying numbers of observations within the parts of the table due to missings in administrative data.
Sources: Statistical offices of the Federation and the various federal states; scores: Koller et al. (2000); treatment status: BAFA (2015); matrix of neighbouring districts: BBSR. Own calculations.

Table 5
Robustness check: Model specification.

	Employment	Wage sum	GVA	GVA/employee
Presented results	−0.00444	−0.0183	0.0514**	0.0561***
Standard errors	(0.0130)	(0.0169)	(0.0222)	(0.0174)
Observations	325	323	324	324
Local linear regression	−0.0210	−0.0244	0.0381*	0.0598***
	(0.0144)	(0.0210)	(0.0220)	(0.0170)
Observations	133	133	125	118
Local quadratic regression	−0.0073	−0.0077	0.0758***	0.0803***
	(0.0170)	(0.0249)	(0.0277)	(0.0203)
Observations	127	143	122	143
4th-order polynomial	−0.0156	−0.0247	0.0495*	0.0669***
	(0.0166)	(0.0193)	(0.0263)	(0.0184)
Observations	325	323	324	324
5th-order polynomial	−0.0108	−0.00813	0.0496*	0.0625***
	(0.0163)	(0.0200)	(0.0256)	(0.0199)
Observations	325	323	324	324

Robust standard errors in parentheses; significance level: ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.
Sources: Statistical offices of the Federation and the various federal states; scores: Koller et al. (2000); treatment status: BAFA (2015); own calculation.

nificantly positive effects on output and productivity. The results presented in Table 3 are robust in regard to the selection of alternative model specifications.

The next table presents robustness checks against variations of the sample that are the basis for the estimations. Starting from the sample of all 325 West German districts, we limit the estimation sample in different ways. The first step is to restrict the value range of the eligibility score around the cut-off value for the presented estimation model. In a relatively broad bandwidth, we include all districts within the double standard deviation around the cut-off value (including score values between 98.11 and 100.85), while a narrow bandwidth defines the data range according to one standard deviation around the cut-off value (including score values between 98.79 and 100.17). Part I of Table 6 shows a reduction of the estimation sample to 300 districts and 201 districts, respectively. Nevertheless the estimated coefficients remain stable. In a second step, we exclude the most and least treated districts, respectively to test whether the size of the estimated coefficients could be driven by those districts ‘at the edges of the distribution’. For the estimations presented in part II of Table 6, we remove from the sample the most treated districts in terms of the amount of subsidy per inhabitant and year. Neither the limit of maximum € 300 per capita per annum nor the limit of € 250 p.c.p.a. changes the estima-

Table 6
Robustness check: Sample variation.

	Employment	Wage sum	GVA	GVA/employee
Presented results	−0.00444	−0.0183	0.0514**	0.0561***
	(0.0130)	(0.0169)	(0.0222)	(0.0174)
Observations	325	323	324	324
(I) Variation of the bandwidth around the cut-off				
broad (twice standard deviation)				
Treatment	−0.0115	−0.0207	0.0538**	0.0669***
	(0.0159)	(0.0187)	(0.0249)	(0.0173)
Observations	301	299	300	300
narrow (standard deviation)				
Treatment	−0.00654	−0.0134	0.0532**	0.0605***
	(0.0149)	(0.0179)	(0.0240)	(0.0181)
Observations	201	201	201	201
(II) Exclusion of the most treated districts				
maximum treatment = € 300 per capita *per annum*				
Treatment	−0.00467	−0.0178	0.0517**	0.0567***
	(0.0151)	(0.0179)	(0.0250)	(0.0178)
Observations	320	318	319	319
maximum treatment = € 250 per capita *per annum*				
Treatment	−0.00546	−0.0176	0.0519**	0.0578***
	(0.0151)	(0.0180)	(0.0253)	(0.0180)
Observations	314	312	313	313
(III) Exclusion of the least treated districts				
minimum treatment = € 10 per capita *per annum*				
Treatment	−0.00287	−0.0174	0.0578**	0.0609***
	(0.0192)	(0.0236)	(0.0286)	(0.0209)
Observations	316	314	315	315
minimum treatment = € 30 per capita *per annum*				
Treatment	−0.00556	−0.0160	0.0639**	0.0701***
	(0.0198)	(0.0249)	(0.0305)	(0.0220)
Observations	308	306	307	307
(IV) Exclusion of the fuzzy districts (always takers and never takers)				
Treatment	−0.00547	−0.0180	0.0459*	0.0521***
	(0.0162)	(0.0198)	(0.0243)	(0.0181)
Observations	318	316	317	317
(V) Estimation at the level of labour market regions[a]				
Treatment	0.00230	0.00410	0.0359**	0.0329**
	(0.0106)	(0.0144)	(0.0172)	(0.0138)
Observations	204	204	204	204

Robust standard errors in parentheses; significance level: ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.
[a] Note: mean growth rates of the districts in labour market regions.
Sources: Statistical offices of the Federation and the various federal states; scores: Koller et al. (2000); treatment status: BAFA (2015); own calculation.

tion results. The same applies to the removal of the least treated districts (part III of Table 6). The condition of a minimum investment subsidy of € 10 p.c.p.a. and € 30 p.c.p.a., respectively reduces the sample by 9 and 17 districts, but the size of the coefficients does not change so much. Furthermore, Fig. 4 reveals that the amount of subsidy per capita in the alwaystaker districts, i.e. those districts that receive treatment although they are not formally eligible, is rather small. This could cast some doubts whether we should consider these regions as treated regions. Therefore, we apply a third step to exclude the fuzzy districts (5 always taker and 2 never taker districts) from the analysis. This changes the estimation design into a sharp RDD; the model specification of the applied OLS regression (see equation (1)) is also a 3rd-order polynomial of the eligibility score without constraints. The estimated coefficients of the OLS model presented in part IV of Table 6 are very similar to the results of the IV model. They prove that including the always taker districts in the regression does not harm the reliability of the estimation and the results presented in Table 3. We apply the above mentioned OLS regression model also for the last step of the robustness check regarding sample variations. Part V of Table 6 presents the estimation results at the level of the 204 West German labour market regions instead of districts. Here, we estimate the treatment effects on the mean growth rates of all districts in one labour market region. The coefficients are slightly smaller than the district-level results, but again very similar. All in all, the robustness checks presented in Table 6 show very similar results for all the checked subsamples and confirm the reliability of the results presented in Table 3.

7. Summary and conclusion

This study explores the causal effects of the most important place-based policy scheme in Germany. The GRW provides discretionary investment grants to firms and municipalities in economically lagging regions to trigger their development and to reduce spatial inequalities. To identify whether the GRW achieves its stated goals, we exploit exogenous discontinuities in the treatment probability of the districts.

The analysis focuses on period growth rates of West German districts between 2000 and 2006. We find a positive effect of GRW-funding on the district-level growth of GVA and productivity, by about 5 percentage points, for the entire 2000–2006 programming period. However, we do not find any effect of the programme on growth in the districts' employment and wages. This evidence for productivity effects of GRW funding is in contrast to the results of recent evaluations of similar public investment schemes in Italy and the UK, where positive effects on regional employment growth and no effects on productivity were reported. Hence, our results add novel insights to the discussion of general effects of public investment grants, which may work differently in different jurisdictions. What becomes clear is that investment grants face a trade-off between fostering productivity and employment growth. In our context, the GRW was effective in the reduction of regional inequalities with respect to productivity, which is important for long-term economic development of the districts. On the other hand, the important target of the programme, namely the creation of jobs in economically weak regions, was not achieved. This result might be an outcome of unintended side effects where the positive development of treated firms comes at the expense of the non-treated businesses. One way to address this issue would lie in the analysis of regional worker flows in a linked employer-employee dataset. However, this would be subject for future research, as we did not have access to relevant data. In addition to that, the monopsonistic market power of firms may prevent gains from productivity growth trickling down to wages. In this situation, the provision of funds would contribute to increasing firms' profits, which is clearly not the programme's intended goal. This issue can be addressed by policy, for example by implementing rules in the funding scheme that improve worker bargaining power or by developing funding rules that monitor the development of the labour share with respect to firm profits.

Acknowledgments

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A. Appendix

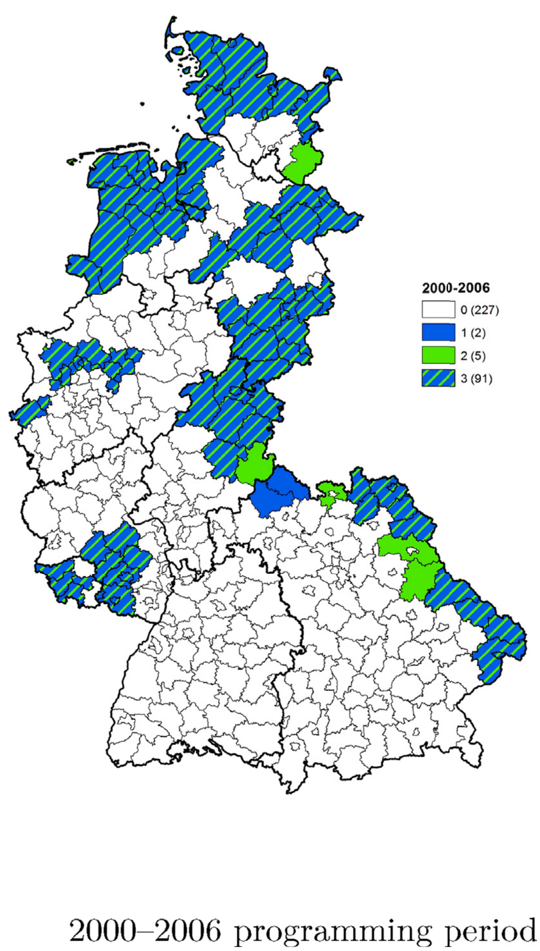

Fig. A.1 *Spatial allocation of the different types of districts*. Notes: The figures in parentheses give the number of the respective districts. Type 0: assignment status = treatment status = 0; Type 1: assignment status = 1, treatment status = 0; Type 2: assignment status = 0, treatment status = 1; Type 3: assignment status = treatment status = 1.
Sources: scores: Koller et al. (2000); eligibility status: coordination frameworks (see Table A.1); treatment status: BAFA (2015). Own illustration.

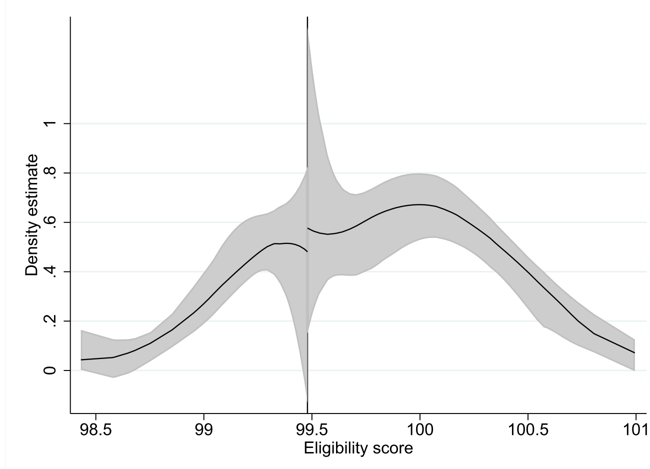

Fig. A.2 *Density test of the eligibility score*. Note: robust test statistic of the continuity density test: 0.0141, p-value: 0.9888.
Sources: scores: Koller et al. (2000); illustration: Cattaneo et al. (2018).

Table A.1
Legal framework for GRW in Germany for the analysed programme.

Kind of the programme	Non-repayable grants for investment projects (co-funding)
Set-up of the programme	1970
programme period	2000–2006
Targets	Reduction of regional disparities Increase of regional income and employment in assisted regions Catching-up of assisted regions to the general economic development
Regional scope of the programme	Eligible labor market regions in the Federal Republic of Germany → Eligibility depends on the degree of the structural weakness of a region; Structural weakness indicator consists of: ∘ unemployment rate (40%), ∘ income per employee (40%), ∘ quality of infrastructure (10%), ∘ employment projection (10%) Limitation of the number of assisted regions according to the population share (40.7% of German population)
Legislation	Treaty of the European Union (Articles 87 and 88) German Basic Law (Articles 72(2) No. 2, 91a, 106(3) No. 2) Joint Task Law (GRW-Gesetz) Coordination framework ∘ No.29, BT-Drucksache (reference number) 14/3250 ∘ No.30, BT-Drucksache (reference number) 14/5600 ∘ No.31, BT-Drucksache (reference number) 14/8463 ∘ No.32, BT-Drucksache (reference number) 15/861 ∘ No.33, BT-Drucksache (reference number) 15/2961 ∘ No.34, BT-Drucksache (reference number) 15/5141 ∘ No.35, BT-Drucksache (reference number) 16/1790 Legislation of the Federal States
Application process	Assessment of a detailed description of the investment project; proposals that do not meet the criteria of excellence will be rejected
Granting authority	Government of the federal state where the investment project is planned

Table A.2
Description of GRW funding rules for the analysed programme period.

Recipients	Establishments in eligible areas			Municipalities in eligible areas
Amount of funds	1532.3 Mio. € (69.8%)			662.9 Mio. € (30.2%)
Subject of funding	Investments in fixed assets ∘ start a new establishment ∘ capacity expansion of existing establishments ∘ change the production programme or overhaul the entire process of production ∘ purchase an inoperative establishment *Sectoral scope of the programme* ∘ industries with supra-regional sales ∘ exclusion of industries according to EU state aid legislation and further economic intentions			Investments in local commerce-related infrastructure ∘ building of business parks ∘ revitalizing of business parks ∘ building and expansion of transport infrastructure ∘ building and expansion of associated utilities infrastructure (water, electricity, telecommunication etc.) ∘ building and expansion of sewage plants ∘ building and expansion of touristic infrastructure ∘ building and expansion of workforce training centers ∘ building and expansion of technology parks
Aid ceilings (in % of eligible costs)	A-areas	small	50	80–90
		medium-sized	50	
		large	35	
	B-areas	small	43	
		medium-sized	43	
		large	28	
	C-areas	small	28	
		medium-sized	28	
		large	18	
	D- and E-areas	small	15	
		medium-sized	7,5	
		large	max. 100 000 €	

Table A.3
Descriptive statistics of control variables.

	Treated districts			Nontreated districts		
	Mean	Min	Max	Mean	Min	Max
Score elements (level values 2000)						
Unemployment rate[a]	9.97	5.40	16.30	6.32	2.60	11.50
Gross wage per employee[b]	29.10	21.59	36.83	31.64	24.45	49.34
Quality of infrastructure[c]	14.65	1.32	66.68	12.55	0.40	43.09
Employment projection[d]	99.32	96.09	103.09	100.37	98.03	104.96
Regional controls (level values 2000)						
Employment rate[a]	47.48	41.30	57.00	50.62	39.90	56.00
Human capital[e]	5.44	2.70	12.50	7.70	3.10	23.40
Employment in eiligible sectors[f]	0.68	0.51	0.88	0.73	0.51	0.89
Herfindahl index	0.16	0.10	0.39	0.18	0.10	0.44
Population density[g]	542.12	42.72	3394.85	572.02	59.32	3898.04
Migration[h]	1.44	−13.30	14.00	3.90	−9.30	17.40
Potential alternative funding for … (per capita; *2000–2006)*						
Urban development	16.80	0.00	100.00	13.62	0.00	106.00
University construction	40.18	0.00	430.00	75.75	0.00	1544.00
Small and medium firms	424.28	167.00	1048.00	504.82	163.00	1920.00
Economic assistance	757.46	297.00	3076.00	680.88	199.00	2145.00
Federal innovation policy	1396.41	428.00	4344.00	1381.65	639.00	4128.00
EU Structural funds	23.85	0.00	622.78	62.07	0.00	886.79
Observations	96			229		

Notes:
[a] Percent.
[b] Thousand €.
[c] Travel time to next motorway, in minutes.
[d] Employment projection for the years 1997–2004.
[e] Share of employees with university degree per 1000 employees.
[f] Share of employment in sectors eligible for GRW subsidies.
[g] Inhabitants per square km.
[h] Net migration per 1000 inhabitants.

Table A.4
Estimation results including control variables (2000–2006).

	Employment	Wage sum	GVA	GVA/employee
Treatment	−0.00898	−0.0160	0.0479*	0.0573***
	(0.0134)	(0.0193)	(0.0250)	(0.0193)
Unemployment rate	0.00165	−0.00387*	−0.000829	−0.00264
	(0.00161)	(0.00226)	(0.00342)	(0.00292)
Gross wage per employee	−0.000411	0.00232	0.00117	0.00145
	(0.00120)	(0.00168)	(0.00259)	(0.00248)
Quality of infrastructure	−0.00102***	−0.00104**	−0.000492	0.000695*
	(0.000249)	(0.000416)	(0.000509)	(0.000392)
Employment projection	0.00779***	0.0105***	0.0100*	0.000933
	(0.00266)	(0.00400)	(0.00571)	(0.00446)
Employment rate	−0.00175*	−0.00366***	−0.00364*	−0.00155
	(0.000916)	(0.00141)	(0.00201)	(0.00174)
Human capital	0.00231	0.00180	0.000639	−0.00175
	(0.00143)	(0.00202)	(0.00255)	(0.00220)
Employment in eiligible sectors	−0.00111	0.126	0.166	0.171
	(0.0648)	(0.0901)	(0.135)	(0.106)
Herfindahl Index	−0.0368	0.0763	0.0353	0.0689
	(0.0841)	(0.129)	(0.262)	(0.213)
Population density	−1.32e-05***	−1.42e-05***	−5.81e-06	8.79e-06
	(3.76e-06)	(5.48e-06)	(9.87e-06)	(9.17e-06)
Migration	0.00138**	0.00140	0.00249	0.000854
	(0.000633)	(0.000949)	(0.00169)	(0.00144)
Urban development	−0.000102	0.000195	0.000295	0.000404
	(0.000167)	(0.000248)	(0.000332)	(0.000310)
University construction	−3.93e-05	−7.71e-05**	−5.82e-05	−1.47e-05
	(2.56e-05)	(3.32e-05)	(5.64e-05)	(4.29e-05)
Small and medium firms	4.98e-06	−5.23e-05	5.19e-06	2.67e-06
	(2.58e-05)	(3.99e-05)	(7.19e-05)	(5.78e-05)
Economic assistance ws_Hilfen	−1.62e-05	−6.95e-05**	−3.10e-05	−1.56e-05
	(2.32e-05)	(3.51e-05)	(5.68e-05)	(4.39e-05)
Federal innovation policy	2.17e-05	6.96e-05**	1.89e-05	−4.68e-06
	(1.88e-05)	(2.73e-05)	(4.91e-05)	(3.89e-05)
EU Structural funds	7.82e-06	5.23e-05	3.02e-05	2.26e-05
	(2.60e-05)	(3.77e-05)	(6.10e-05)	(4.72e-05)
Constant	−0.704**	−0.985**	−0.898	−0.0767
	(0.287)	(0.434)	(0.608)	(0.465)
Observations	322	322	322	322
adjusted R^2	0.337	0.332	0.0928	0.0454

Notes: Robust standard errors in parentheses; significance level: $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$ Model specification: 3rd-order polynomial of the eligibility score; no constraints (coefficients omitted).

Appendix B. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.regsciurbeco.2019.103483.

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