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RESEARCH ARTICLE

Investment grants and firms' productivity: how effective is a grant booster shot?

Fernando Alexandre · Miguel Chaves · Miguel Portela

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Abstract This paper evaluates the impact of awarding a second investment grant to the same firm. We implement a Regression Discontinuity Design strategy using a rich firm-level administrative database, which allows us to link applications to grants and their scores to firms' performance. Our results show that while a single grant has a positive impact on firms' labour productivity, a second investment grant produces an even stronger effect. A more granular analysis suggests that only micro- and small-sized firms benefit from a single grant, whereas the overall effect of an investment grant booster shot is confirmed for the micro- and small-sized firms. No effects were found on total factor productivity for either the single or the second grant.

Plain English Summary The Portuguese economy has lived through protracted productivity stagnation and economic divergence in the 21st century. Grants funded by the European Union have been an important policy tool to promote firm productivity and economic convergence. In our analysis, a notable pattern emerges: multiple grants, accounting for a significant

share of total funds, tend to be concentrated in a small number of firms. This concentration raises concerns regarding both equity and efficiency. This study shows that allocating multiple grants to the same firm may be an effective strategy for enhancing firm performance. Our findings suggest that the benefits of a second grant are stronger than those of a single grant. However, no discernible effects are observed on total factor productivity. While micro and small firms seem to benefit significantly from a grant booster shot, the analysis for other firm sizes warrants further research.

Keywords Industrial policy · Investment grants · Multiple grants · Productivity

JEL Classification D22 · H25 · L25 · L52

1 Introduction

This paper evaluates the impact of investment grants on firm performance. Our analysis focuses on the effectiveness of awarding a second investment grant to the same firm. There is considerable consensus among economists about the benefits of investment grants; however, there is mixed evidence on their effectiveness in improving firms' productivity (e.g., (Bernini et al., 2017; Bronzini & Iachini, 2014; Bronzini & Piselli, 2016; Cerqua & Pellegrini, 2014; Criscuolo et al., 2019; Dvoulety et al., 2021)). Some challenges that the empirical literature on the impact of public

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grants faces partly result from incomplete and non-representative data samples, or identification issues related to, for example, the self-selection of applicants (e.g., (Bronzini & Piselli, 2016; Criscuolo et al., 2022, 2019)). These limitations are even more pertinent when assessing the impact of allocating multiple grants to the same firm (e.g., (Howell, 2017; Murakozy & Telegdy, 2022; Srhoj & Walde, 2020)).

Public grants are an important policy tool and are back to the limelight — see, for example, Cheng et al. (2019), Fang et al. (2018), Lim et al. (2018) on public grants in China, Brown and Earle (2017) on the public support to small firms by the Small Business Administration in the United States, and the European Commission's NextGenerationEU ((European, 2022)). In this context, it is crucial to evaluate the outcome of this new wave of industrial policy, namely the effectiveness of public grants to firms (e.g., (Criscuolo et al., 2022)).

Investment grants aim to address the presence of market failures, namely financial constraints (e.g., (Fang et al., 2018; Hall & Lerner, 2010)), knowledge spillovers and disincentives for socially optimal levels of investment in R&D (e.g., (Arrow, 1972; Bloom et al., 2019)). The mixed evidence on the benefits of grants to firm performance reflects the limitations of industrial policy. The effectiveness of investment grants also depends on eligibility criteria: sectors and firms to be targeted (e.g., (Jugend et al., 2020)); the type of grant, that is, grants or subsidised loans (e.g., (Huergo & Moreno, 2017)); the optimal amount of funds to allocate to each firm (e.g., (Gorg & Strobl, 2007)); the certification effect of grants, namely for ventures (e.g., (Lanahan & Armanios, 2018)); the characteristics of firm owners, namely gender (e.g., (Gicheva & Link, 2013)); or firms' characteristics such as size or their participation in international trade (e.g., (Rotemberg, 2019)). The selection process is also crucial to attaining their economic and social goals. The assessment of applications by independent experts, based on objective criteria, is a necessary condition for a transparent and effective allocation of investment grants. Otherwise, the industrial policy may favour specific firms over others, breaking competition rules and, thus, distorting the level playing field and hindering efficiency (e.g., (Akcigit et al., 2023)). The expansion of selected firms at the cost of their competitors might wreak havoc

impact on aggregate output (e.g., (Rotemberg, 2019)). These risks are magnified when multiple grants are allocated to the same firm, resulting in a high concentration of public grants in a small number of firms (e.g., (Trajtenberg, 2020)), raising concerns about the effectiveness and fairness of the allocation of public grants.

Several papers have found a positive impact of public grants on firms' investment, employment and turnover (e.g., (Cerqua & Pellegrini, 2014; Cingano et al., 2022)), while there is ambiguity regarding the impact on productivity. Srhoj et al. (2021b), Srhoj and Walde (2020) evaluated the impact of specific grants programs on the performance of firms in Croatia. Srhoj and Walde (2020) found that an export-oriented grant program has a positive effect on exports, sales and value-added, but no effect on employment, and a slight effect on total factor productivity (TFP). Cin et al. (2017), Crespi et al. (2020), analysing grants for R&D to firms in Chile and South Korea, respectively, found a positive impact on firms' productivity. Murakozy and Telegdy (2022), in an analysis of ERDF grants for Hungary, found a positive impact of grants on labour productivity but no effect on TFP. Cerqua and Pellegrini (2014), investigating the impact of the main Italian regional policy, found a negligible effect. Criscuolo et al. (2019) found no evidence of a positive impact of investment grants on productivity. Mesquita et al. (2022), Santos (2019) investigate the impact of ERDF grants in the Portuguese economy and found no effect on productivity.

The empirical evidence of the impact of multiple grants allocated to the same firm is scarce and mixed. The concentration of grants in a small number of firms raises concerns that the strategy may not be effective both in improving firm performance and the country's competitiveness. The results of Feldman et al. (2022), for the U.S. Small Business Innovation Research (SBIR) program, emphasise the benefits of awarding several R&D grants to the same firm. These authors show that in every outcome dimension — commercial activity, human capital development, patents, and scientific publications — there was a positive effect, that also benefited the government and society. Murakozy and Telegdy (2022) investigate the impact of multiple ERDF grants for Hungarian firms. Those authors concluded that firms receiving multi-

ple grants grow faster than those receiving only one and that multiple grants may favour the efficiency of the European Union's Structural and Cohesion Funds. Srhoj and Walde (2020) use the full database of publicly co-financed projects over the period 2009–2012 in Croatia. Those authors investigate the impact of two types of export-oriented grants, the grants for technology-oriented and for commercialization activities, using a differences-in-differences matching estimator. In this study, the treated group is composed of firms that received export-oriented grants and have also received other grants from the government. The results of Srhoj and Walde (2020) show a positive impact of the additional grant on export growth, in particular of the export-oriented grants. Howell (2017) uses an extensive database of ranked applications to the US Department of Energy's Small Business Innovation Research to evaluate a two-stage R&D grant program. In this program, only the winners of grants in Phase I could apply to Phase II. The author considers different competitions and centres the ranks around zero to implement a sharp RDD by comparing firms in the neighbourhood of the cut-off. Howell (2017) concluded that the first treatment strongly affected innovation and financial and commercial success. On the other hand, the author found no effects for the grant awarded in Phase II, which may be due to eligibility criteria and adverse selection. Moreover, the author concluded that a single grant is more effective for firms facing financial constraints.

Existing literature also suggests heterogeneity in the effectiveness of investment grants across firm sizes. The results by firm size show that investment grants have a greater impact on small-sized firms (e.g., Criscuolo et al., 2022). Santoleri et al. (2022) investigated the impact of the SME Instrument, a two-phase R&D grant program targeting innovative and small and medium-sized firms, implementing an RDD. The authors conclude that Phase 1, which awards small R&D grants, was not effective, whereas Phase 2, which awards R&D grants up to €2.5 million, had sizeable effects on firm-level outcomes, namely on investment, innovation, employment and revenues. These effects were stronger on smaller and younger firms, and also for firms with higher financial fragility. Srhoj et al. (2021b) showed that business development grants have a positive effect on capital stock, bank loans, intermediate inputs and value-added, but no positive effect on productivity, sales and employment. Srhoj et al.

(2021b) also highlighted that the findings rely on the positive effects of small-sized firms. Criscuolo et al. (2019) investigating the impact of investment grants from the Regional Selective Assistance program in the United Kingdom found a positive effect on employment, but only for small-sized firms. Analysing an R&D grant program implemented in Italy, Bronzini and Iachini (2014) found that the grants increase investment by small-sized firms, whereas there is no impact on larger firms. Bronzini and Piselli (2016) evaluating the impact of R&D grants in Italy also found a positive impact of the program on the number of patent applications, but the effect was greater for smaller firms. Those results suggest that the impact of grants on investment, employment and turnover is more pronounced in small-sized firms.

Our paper contributes to the literature on the evaluation of the impact of investment grants, namely on the effectiveness of awarding a second grant to the same firm. The contributions of our evaluation are fourfold. First, we propose an effective identification strategy to evaluate the impact of awarding multiple investment grants to the same firm, a topical issue scarcely explored in the literature. We use a rich firm-level administrative database that includes the population of Portuguese firms that have applied to the European Regional Development Fund (ERDF) in 2007–2018. In that period, a high concentration of grants in a small group of firms, that have received multiple grants, stands out. Around 30% of the supported firms were awarded multiple grants, representing about 65% of the total ERDF. Among those, a group of 2167 firms received almost 50% of the total funds. Our database comprises 54,765 applications by 24,627 firms, 16,428 funded projects of 10,980 firms, corresponding to 5.9 billion euros. We have information about the application scores for selected and non-selected firms, which a committee of independent experts awards, the applications' and the projects' implementation dates. The combination of that data with detailed balance sheet information on the financial and operational status of firms allows us to assess the impact on productivity of awarding multiple grants to the same firm. This data allows us to implement a Regression Discontinuity Design (RDD) strategy to identify the effects of allocating multiple grants to the same firm, namely on its productivity.

Second, our RDD estimates show that a single investment grant has a positive and statistically significant effect on the performance of micro and small-sized

firms and no effects on medium- and large-sized firms, corroborating the findings in the literature. Third, the estimates concerning the grant booster shot show a positive and statistically significant impact on value-added and labour productivity. The impact of the grant booster shot on those variables is significantly larger than the effect of a single grant. Therefore, our results suggest that allocating multiple grants to the same firm may be an effective strategy to improve firm performance. However, no effects were found on total factor productivity. Fourth, a more granular analysis by firm size shows that the overall effect of the investment grant booster shot is confirmed for micro- and small-sized firms. The analysis for other firm sizes warrants further research.

The remainder of this paper is organised as follows. Section 2 describes the ERDF investment grants program and describes the database. Section 3 presents the empirical strategy. Section 4 presents the descriptive statistics underlying the RDD analysis. Section 5 presents and discusses the results of the RDD analysis. Section 6 provides a robustness check analysis. Section 7 concludes and discusses the policy implications of allocating multiple grants to the same firm.

2 Program description and data

In our empirical analysis, we use data from the ERDF to support Portuguese firms' investment. This data includes two multi-annual financial frameworks: the National Strategic Reference Framework, 2007–2013 (NSRF), and PT2020, 2014–2018. The ERDF aims at strengthening economic and social cohesion in the EU and is one of the five funds settled by the European Structural Investment Funds (ESIF), managed by the European Commission and the EU member states.

ERDF grants to firms aim at increasing firms' productivity and competitiveness, improving economic specialisation, regional development, and the economy's internationalisation. These objectives are of utmost importance in the context of the Portuguese economy, which has lived through a long period of low growth, protracted productivity stagnation and economic divergence in the 21st century (e.g., (Blanchard & Portugal, 2017; Eichenbaum et al., 2017)).

ERDF has been an important instrument in Portuguese policymakers' toolkit to promote competitiveness and productivity. The ERDF program comprises

three instruments to support different types of firms' investment: the Innovation Incentive System, the Qualification Incentive System and the Research and Development Incentive System.¹

The Innovation Incentive System aims at promoting investment in innovation and the firms' internationalisation, accounting for over 65% of total ERDF in the NSRF and in PT2020. This instrument supports investment in tangible and intangible assets, including machinery, equipment and software, and also the construction of facilities. These investments aim at increasing the production of goods and services, to improve production processes or to expand the production capacity of high-technology goods. The Innovation Incentive System also supports the creation of new firms based on a high-skilled labour force and targeting international markets. Santos (2019) provides a detailed description and an impact assessment of this program, and concludes that grants have a positive impact on investment, employment, sales and TFP. The Qualification Incentive System aims at increasing SME productivity and internationalisation through investment in intangible assets, accounting for around 20% of total ERDF. Wagner (2007) surveys the evidence between exporting and productivity and shows that exporting firms have higher productivity and, in many studies, higher productivity growth. Although there may exist self-selection of more productive firms into export markets, public grants programs that aim at stimulating exports also address competitiveness and productivity. For example, Srhoj and Walde (2020) evaluate the impact of two types of exported-oriented programs for Croatia and conclude that the program that resulted in a higher impact on exports was also more effective in fostering labour productivity. The third ERDF instrument is the Research and Development Incentive System which aims at increasing investment in R&D and the development of new products and services, involving entities of the scientific and technological system, accounts for around 15% of total ERDF. This program aims at stimulating technological innovation that will translate into higher productivity. Alexan-

¹ In fact, the designation of those three ERDF instruments is slightly different in NSRF and in PT2020. In NSRF the incentive systems were the following: Innovation; SME Qualification; and Research and Technological Development. In PT2020, the three instruments were the following: Entrepreneurial Innovation and Entrepreneurship; Qualification and Internationalisation of SME; and Research and Technological Development.

dre et al. (2023) conclude that the impact of R&D grants on firm productivity in the Portuguese economy, in the period 2007–2019, seems to be transitory.

It must be stressed that the mechanisms through which those three instruments impact on productivity are very different. Dimos et al. (2022) for R&D grants, Dvoulety et al. (2021) for SME business development grants and Srhoj et al. (2023) for export boosting policies show that the impact of grants on firm performance varies significantly across different grant programs. However, in our econometric analysis, we include the investment grants awarded to firms by those three programs. Although those three instruments subsidise different types of investments, namely, tangible and intangible assets, the ultimate goal of those three instruments is to foster firms' productivity. However, given the specificities of the Research and Development Incentive System, in our robustness check analysis, we will exclude it from our analysis. Dvoulety et al. (2021), in a survey of the impact of public SME grants on firm performance, also excluded grants that support R&D activities. The application to grants for firms' investment projects by ERDF follows calls for tender. The selection criteria are made available in the call that announces the opening of the tender. Applications are evaluated by a group of independent experts of recognised merit and suitability, with a significant share selected among scholars from the main Portuguese universities. Applications' scores vary between 0 and 5. The best-scored projects are awarded a grant until the program's specified budget line. Selected projects receive grants according to the project's specifications, investment implementation and goals contracted.

In our empirical analysis, we use two rich longitudinal firm-level administrative databases for the Portuguese economy. The database from the Portuguese Agency for Development and Cohesion (AdC) includes information for the population of applications to ERDF grants, including the firm identification, the application evaluation score for selected and non-selected firms, the application and contract dates, the amount of the ERDF benefit and total investment, both for NSRF and PT2020 (the data has been used at the (Banco, 2019)). The database from AdC comprises 24,627 firms and 16,428 funded projects corresponding to 10,980 firms. The AdC database allows us to identify the number and timing of grants allocated to each firm in the period 2007–2018.

The second dataset used in our analysis is the Central Balance Sheet (CBS) from the Bank of Portugal (see (Banco, 2020)). The CBS database provides annual economic and financial information on firms operating in Portugal, since 2006. The CBS database contains firm-level administrative data, including balance sheets and other accounting data, such as the turnover, value-added, labour costs, leverage, total assets or the number of employees. This information allows us to compute labour productivity and total factor productivity. These data are available yearly for the population of non-financial private sector firms, from 2006 to 2018 (about 390 thousand firms per year).

Those two datasets can be linked at the firm-level as they use the same (anonymised) firm identifier. By linking the two longitudinal databases, we can apply adequate identification strategies to gauge the impact of multiple grants on firms' performance.²

In the NSRF, ERDF grants to firms' investment reached an amount of 3.3 billion euros, corresponding to a total investment of 8.3 billion euros, allocated to 6487 firms. In PT2020, ERDF grants amounted to 4.2 billion euros contracted until 2018, the period of our analysis, corresponding to a total investment of 9.2 billion euros, allocated to 7243 firms. Figure 1 presents the number and value of grants by year. Since 2012, the number of grants to firms has increased substantially and 2016 was the year with the highest amount of projects contracted (around 4000) and the highest amount of grants awarded (over 1.5 billion euros).

The analysis of the distribution of ERDF grants to firms' investment shows a high concentration in a small number of firms, both in the NSRF (2007–2013) and in PT2020 (2014–2018). Figure 2 presents the decile distribution of ERDF grants to firms' investment in both programs. Figure 2 shows a high concentration of ERDF grants, where 10% of the firms which received the highest grants account for 69% and 66% of total ERDF grants to firms' investment in the NSRF and in PT2020, respectively.

Figure 3 presents an overview of the distribution of the ERDF grants to firms' investment. In the period 2007–2018, 24,627 firms applied to ERDF grants, 10,980 received ERDF grants, and 13,647 were not selected to receive a grant. Thus, 55% of the firms that applied to receive ERDF grants were not supported.

² A full description of the variables used in our empirical analysis is presented in Table 15 in the Appendix.

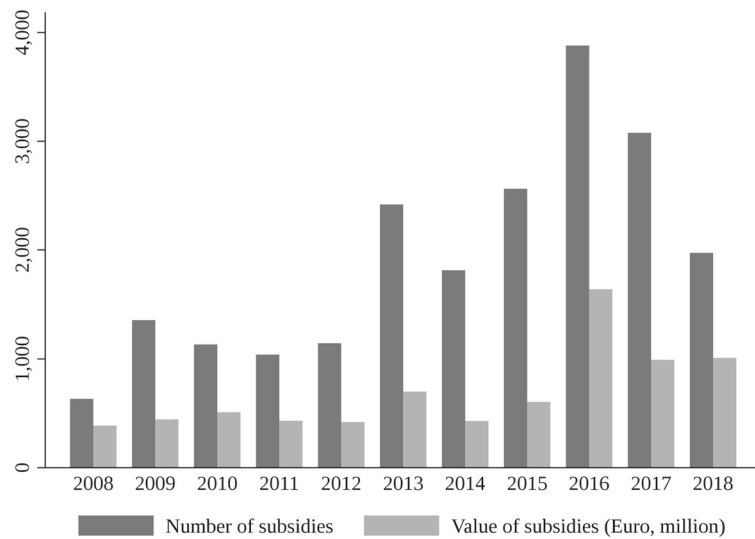


Fig. 1 Number and value of grants by year. *Source:* Own computations using data from the *Portuguese Agency for Development and Cohesion*

From the analysis of the data in Fig. 3, a feature stands out in both ERDF programs: a significant share of firms have received more than one grant; that is, 3226 firms of the awarded firms (29%) received more than one grant. From the group of firms that have received multiple treatments, 2167, were awarded a grant, both in the NSRF and PT2020. That group of firms received

around 1.6 billion euros in the NSRF (47.7% of total ERDF) and 1.9 billion euros in PT2020 (43.8% of total ERDF). On the other hand, 519 and 540 firms received multiple grants in the NSRF and in PT2020, respectively.

The availability of detailed information on the timing of grants and the application scores allows us to

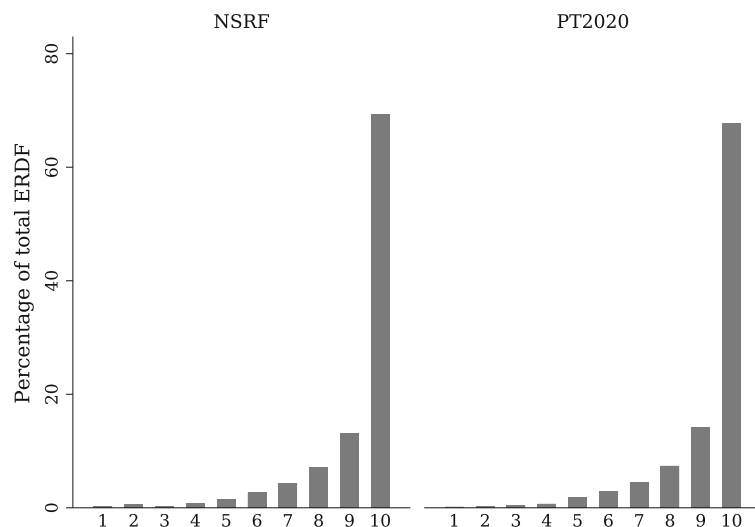
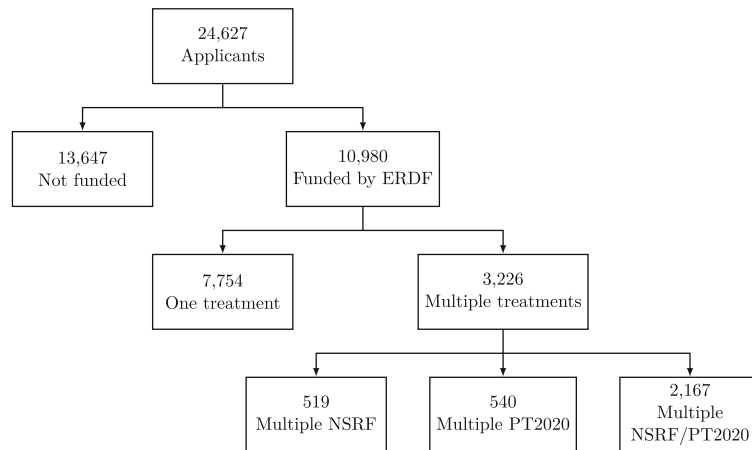


Fig. 2 Decile distribution of ERDF grants for firm investment: NSRF (2007–2013) vs. PT2020 (2014–2018). *Source:* Own computations using data from the *Portuguese Agency for Development and Cohesion*

Fig. 3 Overview of the distribution of the ERDF grants for firm investment, 2007–2018 (NSRF and PT2020). *Source:* Own computations using data from the *Portuguese Agency for Development and Cohesion*



investigate in a more effective way the effectiveness of allocating multiple grants to the same firm, that is, the effectiveness of investment grants booster shots.

Table 1 shows the distribution of firms by the number of grants and the corresponding share of ERDF. The one-off treatment, that is, firms that received only one grant, accounts for 7754 firms (around 70% of the total supported firms), corresponding to 35% of total ERDF grants. On the other hand, around 30% of the awarded firms received multiple grants, which accounted for 65% of the total ERDF grants to firms. For example, 1900 firms received two grants, accounting for 22% of total ERDF.

3 Empirical strategy

In this section, we describe our empirical strategy to evaluate the impact of an investment grant on firms' performance. The empirical literature on the impact of public grants is ambiguous in part due to incomplete and non-representative data samples and identification issues (e.g., (Bronzini & Piselli, 2016; Criscuolo et al., 2022, 2019)). We implement a sharp RDD to identify a causal relationship between grants and firms' performance, namely on firms' productivity. The availability of the scores of both non-selected and funded applications allows us to carry out a robust identification strategy to evaluate the impact of a grant booster shot on firms' investment, employment, value-added and productivity. In our analysis, we consider two measures of productivity. Labour productivity is computed as the ratio of value-added over the number of workers. Total factor productivity is computed following Gandhi et al.

(2020) at the NACE 1-digit sectors (10 sectors). The outcome is the log of real sales and the inputs considered are fixed assets, hours worked, and intermediate inputs. The intermediate inputs are determined by the sum of the cost of goods sold, materials consumed, supplies, and external services, serving as a measure of flexible inputs. All variables are represented in logs and monetary variables are adjusted for inflation and winsorized. Additionally, the estimation includes the ratio of intermediate inputs to sales as a regressor.³

In our econometric specification, the dependent variable is generically defined as Y_i and can take two possible values, $Y_i(1)$, under the treatment, and $Y_i(0)$ in its absence. The running variable which defines the treatment assignment is the application's (standardised) score (S_i) — see Angrist and Rokkanen (2015). The treatment indicator (T_i) is a binary variable that assumes the value 1 if the firm receives the grant (score equal to or above zero, $S_i \geq 0$) and 0 otherwise (score below zero, $S_i < 0$). Equation 1 presents firms' two potential outcomes:

$$Y_i = (1 - T_i) \cdot Y_i(0) + T_i \cdot Y_i(1) = \begin{cases} Y_i(0) & \text{if } S_i < 0 \\ Y_i(1) & \text{if } S_i \geq 0 \end{cases} \quad (1)$$

The average treatment effect is estimated as the difference in the outcomes between the treated and the

³ As a sensitivity analysis, we estimated TFP replacing the hours worked with the number of employees. The results, available upon request, are consistent with our main findings.

Table 1 Firms count and grant shares by number of grants received (2007–2018)

Grants	Firms	Share (%)
0	13,647	0
1	7754	35
2	1900	22
3	732	15
4	292	11
5 or more	302	18

Source: Own computations using data from the *Portuguese Agency for Development and Cohesion*

control group at the cut-off (c) — see Eq. 2.

$$\tau_{RDD} = E[Y_i(1) - Y_i(0)|S_i = c] \quad (2)$$

The key assumption underlying our identification strategy is that firms with scores in the neighbourhood of the cut-off are similar and have the same potential outcome. Thus, the causal effect is identified by comparing both groups in the neighbourhood of the cut-off — see Cattaneo et al. (2020b), Cattaneo and Titiunik (2022), Lee and Lemieux (2010) for a detailed discussion of the RDD strategy.

Figure 4 outlines our two-step RDD empirical strategy. First, we assess the impact of receiving a single grant versus no grant on firms' performance. The sample used in the analysis corresponds to Box A of the diagram, where treated firms are those that received a single grant. Second, we examine the effect on firms' performance of receiving a second grant. For this step, our sample includes firms that have already received one grant and have applied for a second. The sample evaluating the booster shot effect is represented by Box B in the diagram. In this context, the treated group consists of firms that secured the second grant.

The analysis incorporates two distinct control groups. In the first step, the control group consists of firms that applied for a grant but were never selected for funding. In the second step, the control group comprises firms

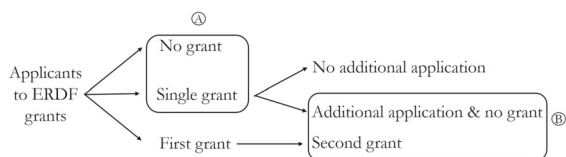
that were awarded a first grant, and applied for a second grant, but were not selected.

In our dataset, firms may submit multiple applications within the same year. However, our econometric strategy only allows us to consider a single application per firm per year. Therefore, we apply the following application selection criteria. First, we prioritise the chosen application with the highest score. Second, in cases where all applications were rejected, we select the one with the highest score.⁴

4 Descriptive statistics for the RDD analysis

In this Section, we present the descriptive statistics of the sample used in the RDD analysis. In the period 2007–2018, we consider 705 calls for the allocation of ERDF grants to support firm investments. We exclude from the analysis the calls without a cut-off, that is, the calls in which all applications were selected for funding or all applications were non-selected.⁵

The sample used in the first step of our empirical strategy, that assesses the impact of receiving a single

**Fig. 4** Control and treatment groups

⁴ As a robustness check, we excluded firms with more than one successful application in a given year from the estimations, and the corresponding results remained consistent.

⁵ Table 16 in the Appendix presents the descriptive statistics for the calls excluded from the analysis. The total number of calls in which all applications were selected for funding is 94, corresponding to 173 selected applications from 154 firms, each firm averaging 66 employees. These calls are characterised by a small number of applications per call, ranging from 1 to 8 per call, with a median of 1 application. The average grant awarded per application was approximately €443 thousand, while the median grant amount was around €144 thousand. On the other hand, there were 110 calls where no applications received funding, encompassing 275 applications from 267 firms — the median number of applications per call is 1.

grant versus no grant, includes 6409 firms from 485 calls, where 2650 firms were not selected and 3759 firms received a single grant. When a firm submits multiple applications for ERDF grants across different years and none of the applications are selected, we consider only the firm's first application.⁶

Application scores range from zero to five. Each call possesses a cut-off that distinguishes between funded applications and those not selected. The calls have disparate numbers of applicants, awards, and cut-offs. To pool these calls, we must standardise the scores. In our methodology, we adopt the approach of Howell (2017), whose centres rank around zero. We accomplish score standardisation by establishing the within-tender score as the difference between the continuous raw score and the cut-off. Consequently, the cut-off is uniformly set to zero for all calls. All calls are then merged into a single dataset, with each firm represented by a single observation.

Figure 5 presents the distribution of the scores after standardising the cut-off of all calls to zero. The scores equal to or above zero correspond to firms that received a single grant, while those below zero correspond to non-selected firms. The standardisation implies that the scores vary between minus five and five. Within the bandwidth typically used in the RDD regression analysis, which will be discussed in the following section, there is significant variation in the score.⁷

The sample used in the second step of our analysis, where we assess the impact of a grant booster shot, includes 220 calls and 821 firms, where 260 firms were not selected to receive a second grant, and 561 firms were awarded a second grant. In order to improve the identification of the impact of the grant booster shot we exclude non-selected applications in years when a firm has received a grant from a previous call. We also exclude firms that received a third treatment within 3 years of receiving the second grant.

⁶ In the context of the regression analysis detailed in Section 5, we replicated the estimations considering the non-selected application with the highest score. We found similar results.

⁷ In Fig. 5, the highest bar includes scores above the cut-off, ranging from $[0;0.1]$, with 49% of those scores being 0. Since the scores are standardised and the cut-off is set to 0 (the threshold for funding), there is a concentration of scores at 0. As a robustness check, we implement a series of "donut" RDD regressions, excluding scores of 0, between -0.02 and 0.02 , and between -0.05 and 0.05 , as detailed in Section 6 of the paper.

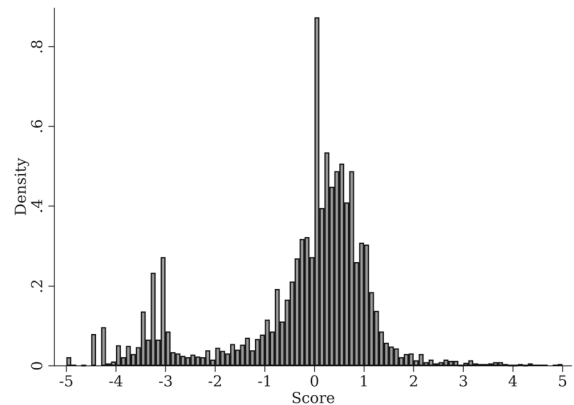


Fig. 5 Standardised score distribution — no grant vs. a single grant. *Source:* Own computations using data from the Portuguese Agency for Development and Cohesion

Figure 6 presents the distribution of the standardised scores for firms that have received a single grant (scores below zero) and firms that have received two grants (scores equal to or above zero). As with the first step of the analysis, there is significant variation in the scores around the cut-off.

Table 2 presents the descriptive statistics for the outcome variables in the year before firms have applied for a grant. Panels A and B correspond to the sample used in the first step, no grant vs. a single grant, while panels C and D provide statistics for the second step sample, a single grant vs. two grants. For the two assessments, we report the statistics for the full sample, panels A and C, as well as for the sub-samples inside the bandwidth around the cut-off used in the regressions analysis, pan-

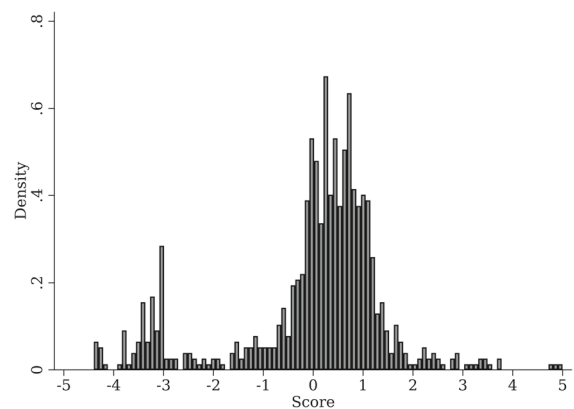


Fig. 6 Standardised score distribution — a single grant vs. two grants. *Source:* Own computations using data from the Portuguese Agency for Development and Cohesion

Table 2 Descriptive statistics for the outcome variables in the year before application (2007–2016)

	Control				Treated				<i>t – test</i>
	Obs.	Mean	Median	s.d.	Obs.	Mean	Median	s.d.	
Panel A: no grant vs. a single grant, full sample									
Investment	2622	174.84	19.12	553.91	3754	195.76	30.10	561.99	-1.47
Employment	2622	24.73	9	50.52	3754	27.67	12	49.13	-2.33**
Value-Added	2622	783.87	209.34	1909.11	3754	862.93	299.51	1786.21	-1.69*
Labour Productivity	2622	27.96	22.16	23.37	3754	29.91	24.27	22.75	-3.32***
TFP	2540	0.04	0.02	0.05	3654	0.04	0.03	0.05	0.71
Panel B: no grant vs. a single grant, inside the bandwidth									
Investment	672	167.47	12.95	545.77	2413	201.11	23.16	600.43	-1.31
Employment	672	22.40	6	51.52	2413	25.83	9	50.56	-1.56
Value-Added	672	744.93	140.55	1989.35	2413	839.64	238.93	1883.94	-1.14
Labour Productivity	672	26.81	21.55	22.67	2413	30.07	23.97	24.09	-3.15***
TFP	648	0.04	0.01	0.05	2337	0.05	0.03	0.05	-1.61
Panel C: a single grant vs. two grants, full sample									
Investment	260	514.98	68.61	1554.36	561	549.32	120.65	1257.03	-0.34
Employment	260	48.76	17	130.11	561	67.20	26	135.74	-1.83*
Value-Added	260	1768.34	465.16	6360.42	561	2714.44	799.49	7262.62	-1.80*
Labour Productivity	260	31.61	25.75	23.99	561	35.50	29.91	23.42	-2.19**
TFP	253	0.05	0.03	0.05	557	0.05	0.03	0.05	-0.24
Panel D: a single grant vs. two grants, inside the bandwidth									
Investment	140	494.85	44.22	1603.02	282	554.07	101.16	1385.63	-0.39
Employment	140	46.53	16	130.09	282	61.09	20	139.05	-1.03
Value-Added	140	1675.20	448.02	5462.45	282	2519.39	616.02	7417.23	-1.20
Labour Productivity	140	33.05	26.69	24.93	282	36.41	30.70	24.76	-1.31
TFP	135	0.05	0.03	0.05	278	0.05	0.03	0.05	-1.22

Notes: Investment, value-added, and labour productivity are expressed in thousands of euros. The *t* – *test* assesses the difference in mean values between the treated and control groups. Significance levels: ***, 1%; **, 5%; *, 10%. “Obs.” stands for the number of observations, and “s.d.” represents the standard-deviation. Source: Own computations using data from the *Portuguese Agency for Development and Cohesion* and *Central Balance Sheet*

els B and D. For the first step analysis the bandwidth corresponds to the set of estimations presented in Section 5.1 and is computed according to Calonico et al. (2014). Due to the small number of observations available for the second step of our RDD empirical strategy, we define the bandwidth as 50% of applications in the neighbourhood of the cut-off.

The *t* – *tests* presented in Table 2 assess the difference in mean values of the firms’ performance measures between the treated and control groups in the year prior to application for a grant. For the full samples, panels A and C, there are statistically significant differences between treated and control firms, regarding employment, value-added and labour productivity. Narrowing the sample to the observations inside the

bandwidth, which are used in the regression analysis, panels B and D, we do not reject the null hypothesis of absence of statistically significant differences between the control and the treated group, except for labour productivity in the case of no grant vs. a single grant.⁸

It should be stressed that firms included in the sample of the analysis of the first treatment invest less, are smaller, have a considerably smaller gross value-added and are less productive than those that receive the grant booster shot.

⁸ Given the small number of observations in some of the samples, we report a statistical power analysis in Section 8.1 of the Appendix. The results provide support to the similarity of treated and control groups before grant application.

Tables 17 and 18 in the Appendix breakdown the information provided in Table 2 by year for the samples inside the bandwidth.⁹ For each year represented in these tables we report the statistics for firms that applied for a grant in the following year. For example, within each table, the section labeled “2010” reports statistics for firms that applied for a grant in 2011. Looking to Table 17, no grant vs. a single grant sample, we observe that in the majority of the cases treated and control firms are identical in the year before the grant application. The noticeable exceptions are the year 2011, where we find discernible differences for employment and value-added, and the year 2012, where treated and control groups are statistically different for the five outcome variables.¹⁰ Regarding a single grant vs. two grants, Table 18, we do not find statistical differences between treated and control firms for most of the cases. In a few cases, we only find statistical differences at the 10% significance level.¹¹

In our empirical analysis, we also evaluate how the impact of a single grant and a grant booster shot hinges on firm-size. We consider three firm-size classes: micro-, small-, and medium/large-sized firms.¹² For

the analysis of the impact of a single grant the distribution of observations among micro-, small-, and medium/large-sized firms is 40.6%, 46.9%, and 12.5%, respectively. For the analysis of the impact of a grant booster shot the distribution is 22.2%, 53.0%, and 24.8%, respectively.

5 Results

This section presents the results of the RDD estimations from our two-step empirical strategy: the impact of a single grant and that of an investment grant booster shot on firm performance. We evaluate the impact 1, 2, and 3 years after the firm has received the grant, represented as leads $t + 1$, $t + 2$, and $t + 3$, respectively. We present these results for the entire sample and by firm size.

5.1 No grant versus a single grant

The RDD plots presented in Fig. 7 illustrate the differences in investment, employment, value-added, and labour productivity near the cut-off, between non-selected firms and those that received a single grant in lead $t + 3$. The sub-panels of Fig. 7 suggest a potential discontinuity between the control and treated groups, especially in terms of investment, value-added, and labour productivity. This anticipates some of the RDD estimation results that we present below.

Table 3 presents the RDD estimates of the impact of a single investment grant on firms' performance.¹³ Each set of lines corresponds to a regression where the dependent variable, defined in logs, is identified in the first column. For the outcomes investment, employment, value-added, labour productivity, and TFP, we

⁹ In the case of Table 17 in the year 2014 there was a negligible number of applications and, therefore, we do not present the descriptive statistics for the year 2013. We also do not report the statistics for 2017, as the last year used in the sample is 2018 and we are not able to evaluate the impact of grants received in that year. For Table 18 the descriptive statistics for 2008, 2009, 2013, 2015, and 2016 are not presented given the small number of observations in those years.

¹⁰ Table 2 shows that, in the case of no grant vs. a single grant within the bandwidth, the treated and control groups are statistically significantly different solely in terms of labour productivity. Table 17 suggests that this difference may be largely attributable to the year 2012, which corresponds to the application year 2013. Consequently, we run a robustness test using a sample excluding this application year. On the one hand, we do not find statistically significant differences between the control and treated groups conducting the $t - test$. On the other hand, we estimated the regressions for no grant vs. a single grant, and we found consistent results.

¹¹ The statistical power analysis is presented in Section 8.1 of the Appendix.

¹² For the classification of firm size, we follow the classification defined in the Official Journal of the European Union, L 124, 20/05/2003 P. 0036–0041, Annex, Article 2: “1. the category of micro, small and medium-sized enterprises (SMEs) is made up of enterprises which employ fewer than 250 persons and which have an annual turnover not exceeding EUR 50 million, and/or an annual balance sheet total not exceeding EUR 43 million. 2. Within the SME category, a small enterprise is defined as an enterprise which employs fewer than 50 persons and whose

annual turnover and/or annual balance sheet total does not exceed EUR 10 million. 3. Within the SME category, a microenterprise is defined as an enterprise which employs fewer than 10 persons and whose annual turnover and/or annual balance sheet total does not exceed EUR 2 million”. For more details see the information at <http://data.europa.eu/eli/reco/2003/361/oj>.

¹³ Overall, for the different regressions, the control and treatment groups inside the bandwidth represent between 11 and 25%, and between 32 and 51%, of the sample, respectively. For example, the sample used to analyse the impact of a single grant on employment over a 1-year lead ($t + 1$) consists of 6358 observations, as shown in Table 3. The control group comprises 2611 firms, while the treated group contains 3747 firms. Within the bandwidth used for the Triangular kernel estimation, the control group includes 669 firms, and the treated group has 2409 firms.

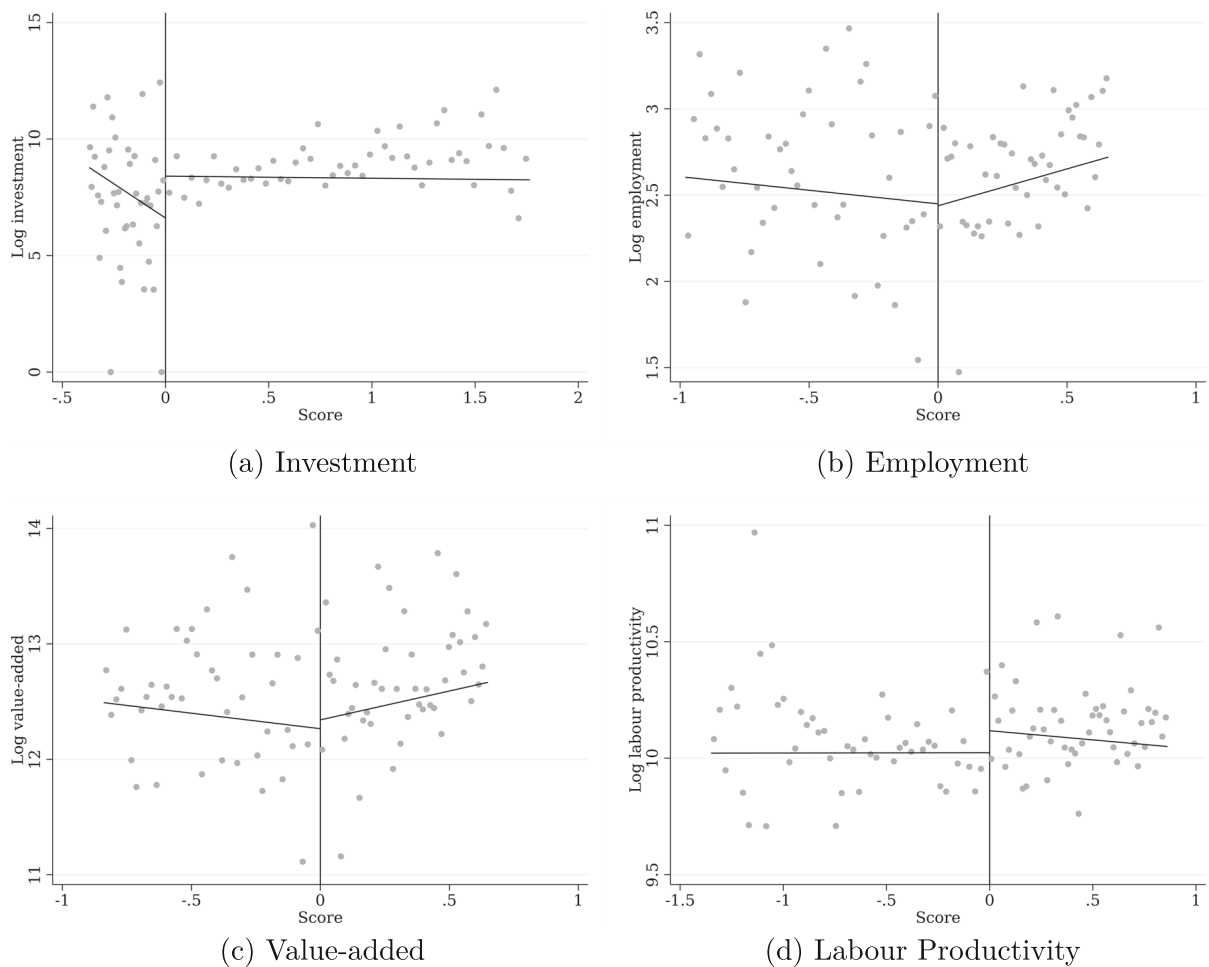


Fig. 7 RDD plots — no grant vs. a single grant. *Note:* Local linear plots based on a triangular kernel for outcomes in lead $t + 3$. *Source:* Own computations using data from the *Portuguese Agency for Development and Cohesion* and *Central Balance Sheet*

evaluate the impact in leads $t + 1$, $t + 2$, and $t + 3$ after the firm has received the grant.¹⁴ For each dependent variable and lead we report two estimates, corresponding to the two definitions of the kernel function underlying each regression. In odd columns, we report the estimates using a triangular kernel function, where observations are assigned a weight that declines symmetrically and linearly with the distance to the cut-off. In contrast, in even columns we use an Epanechnikov kernel to set the weight as a quadratic decaying — see Cattaneo et al. (2020b). In both cases, observations outside the bandwidth have a zero weight. We allow

the bandwidth to differ on each cut-off side.¹⁵ Following Gelman and Imbens (2019), we use local linear RDD estimators.

Our estimations follow a non-parametric approach that includes covariates — see Calonico et al. (2019) for a detailed discussion of the methodology and Greenstone et al. (2022) for an application showing that it provides consistent results. We consider the following control variables: profitability, leverage, sales growth, assets, firm age, size and sector of activity defined by the one letter code.¹⁶ In line with Cattaneo et al.

¹⁴ We drop observations where employment, value-added, labour productivity or TFP are zero.

¹⁵ We replicated the estimations discussed below using a symmetric bandwidth and the results are consistent.

¹⁶ As a robustness check, we have also included as covariates NUTS III regions, a dummy variable indicating whether the firm

Table 3 RDD estimation results — no grant vs. a single grant

Dependent variable (in logs)	$t + 1$		$t + 2$		$t + 3$	
	Triangular	Epanechnikov	Triangular	Epanechnikov	Triangular	Epanechnikov
Investment	1.978*** (0.313)	2.025*** (0.294)	1.512*** (0.283)	1.396*** (0.258)	1.835*** (0.290)	1.793*** (0.314)
<i>N</i>	6389	6389	5511	5511	4614	4614
Employment	0.120* (0.067)	0.128** (0.064)	-0.028 (0.050)	0.006 (0.050)	-0.012 (0.050)	0.072 (0.062)
<i>N</i>	6358	6358	5481	5481	4614	4614
Value-Added	0.201** (0.079)	0.196*** (0.074)	0.085 (0.073)	0.097 (0.074)	0.093 (0.066)	0.198** (0.086)
<i>N</i>	6213	6213	5389	5389	4614	4614
Labour Productivity	0.110** (0.043)	0.119*** (0.038)	0.046 (0.042)	0.088*** (0.033)	0.094*** (0.032)	0.095*** (0.030)
<i>N</i>	6194	6194	5374	5374	4614	4614
TFP	0.036 (0.058)	0.038 (0.059)	0.016 (0.045)	0.010 (0.047)	0.031 (0.046)	0.017 (0.048)
<i>N</i>	6274	6274	5392	5392	4520	4520

Notes: The dependent variable of each regression is defined in the first column. In the columns, we report the RDD estimates for leads, $t + 1$, $t + 2$ and $t + 3$, based on the kernel function identified in the respective column. “N” stands for the number of observations. All regressions include the following control variables: profitability, leverage, sales growth, assets, firm age, size and sector of activity. Robust standard-errors clustered at the application year level are reported in parentheses. Significance levels: ***, 1%; **, 5%; *, 10%. Source: Own computations using data from the *Portuguese Agency for Development and Cohesion* and *Central Balance Sheet*

(2020b), we clustered the standard errors. As the application year is different according to the calls, we cluster at the application year level.

The results presented in Table 3 indicate that, except for TFP, a single grant has a positive impact on firms' investment, employment, value-added and labour productivity.¹⁷ However, the persistence of these effects varies among different outcomes. In terms of investment, and looking to the estimates based on the Epanechnikov kernel, the results show that 3 years after receiving the initial grant, firms' investment more than doubled. Conversely, the effect on employment stands at approximately 14% (computed as $(e^{0.128} - 1) \times 100$), but is statistically significant only in the year immediately following the treatment. The average employment for treated firms is 27.7 (as shown in Panel A

of Table 2 in the Appendix), implying an increase of nearly 4 employees.

One year after obtaining the first grant, firms' value-added experiences an increase of over 20% (± 15 percentage points, computed from the 95% confidence interval). No significant impact on value-added is observed 2 years after treatment. Our estimates reveal a value-added impact in the third year, statistically significant at the 5% level, although this significance disappears when the Triangular kernel is considered.

The positive impact on labour productivity is approximately 10% (± 6 percentage points) 3 years after the firm receives the initial grant. This effect remains significant across all three-time leads. Given an average productivity of 30 thousand euros (Panel A of Table 2), the increase in productivity amounts to nearly 3 thousand euros.¹⁸

is an exporter, and the variables used in the TFP calculation (hours worked, and intermediates). Overall, the results from these estimates corroborate the results presented below.

¹⁷ Following the suggestion of an anonymous referee, we estimated a set of models where we use the variables included in the TFP estimation as outcomes to analyse why TFP does not change. The results suggest that the absence of effects on TFP might be due to inefficiency in the allocation of capital.

¹⁸ As a robustness check, we implemented a placebo cut-off following Cattaneo et al. (2020b). We set an artificial cut-off at 0.5 for the treated group evaluation and -0.5 for the control group. Overall, we found no statistically significant results. Furthermore, we replicated our estimates for different bandwidths around the threshold and the results remained consistent.

The impact of investment grants may change with firm-size. The economic rationale for public grants to firms is based on liquidity constraints, that may affect more micro and small-sized firms — see, for example, Fazzari et al. (1988), Zwick and Mahon (2017). Public grants may foster firms' investment by reducing the cost of capital. Therefore, we expect the impact of grants to be stronger for micro and small-sized firms (e.g., (Criscuolo et al., 2022)). Our results for micro- and small-sized firms corroborate the findings in the empirical literature.

The results for micro-sized firms, Table 4, show that a single grant has an effect on investment, employment, value-added, and labour productivity. In comparison with the aggregated results presented in Table 3, we stress the following: the effect on employment persists in the 3 years following the receipt of the public grant, representing an increase of 15.3% (± 11 percentage points) after 3 years; the effect on value-added approaches 30% after 3 years; the impact on labour pro-

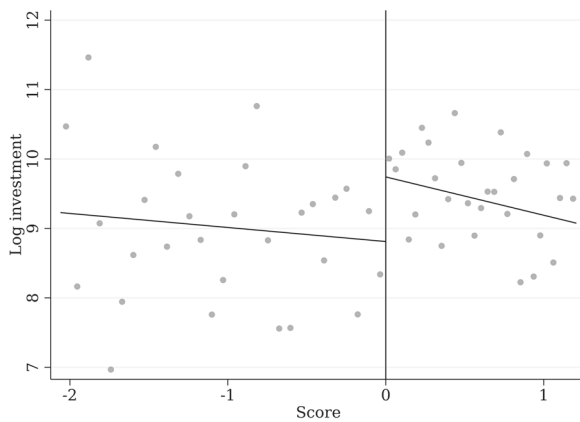
ductivity is around 12%, but becomes non-significant after the first year following the grant receipt.

Concerning small-sized firms, the RDD plots presented in Fig. 8 show discontinuities at the cut-off on investment, value-added, and labour productivity in lead $t + 3$. The results presented in Table 5 show that a single grant yields a favourable labour productivity increase of approximately 19% (statistically significant at the 5% level). This effect is more robust and enduring when contrasted with the effect of the public grant on micro-sized companies. Notably, there is no observable positive impact on employment. The positive influence on gross value-added is sustained only for a year after the company receives the public grant (around 21%, with a margin of ± 17 percentage points). The stronger impact of grants on small-sized firms is in line with the studies of Bronzini and Iachini (2014), Criscuolo et al. (2019), Dechezlepretre et al. (2023), Decramer and Vanormelingen (2016), Howell (2017), Santoleri et al. (2022), Srhoj et al. (2021a).

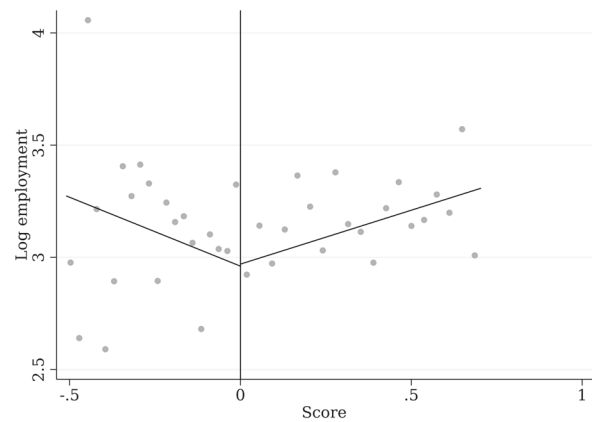
Table 4 RDD estimation results — no grant vs. a single grant, micro-sized firms

Dependent variable (in logs)	t+1		t+2		t+3	
	Triangular	Epanechnikov	Triangular	Epanechnikov	Triangular	Epanechnikov
Investment	1.630*** (0.374)	1.626*** (0.365)	1.947*** (0.509)	1.939*** (0.521)	1.833*** (0.572)	1.844*** (0.605)
<i>N</i>	2603	2603	2224	2224	1929	1929
Employment	0.077* (0.046)	0.094** (0.046)	0.098** (0.046)	0.105** (0.045)	0.137** (0.059)	0.143** (0.057)
<i>N</i>	2574	2574	2198	2198	1929	1929
Value-Added	0.194** (0.091)	0.213** (0.092)	0.064 (0.105)	0.072 (0.102)	0.260** (0.128)	0.259** (0.125)
<i>N</i>	2485	2485	2146	2146	1929	1929
Labour Productivity	0.114* (0.059)	0.113** (0.052)	0.009 (0.076)	0.017 (0.074)	0.075 (0.056)	0.073 (0.059)
<i>N</i>	2468	2468	2131	2131	1929	1929
TFP	0.083 (0.055)	0.079 (0.058)	0.101 (0.079)	0.102 (0.080)	0.090 (0.109)	0.096 (0.110)
<i>N</i>	2500	2500	2117	2117	1845	1845

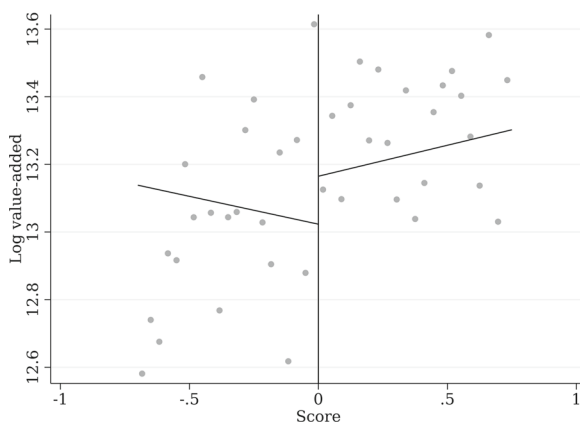
Notes: The dependent variable of each regression is defined in the first column. In the columns, we report the RDD estimates for leads, $t + 1$, $t + 2$, and $t + 3$, based on the kernel function identified in the respective column. “N” stands for the number of observations. All regressions include the following control variables: profitability, leverage, sales growth, assets, firm age and sector of activity. Robust standard-errors clustered at the application year level are reported in parentheses. Significance levels: ***, 1%; **, 5%; *, 10%. Source: Own computations using data from the *Portuguese Agency for Development and Cohesion* and *Central Balance Sheet*



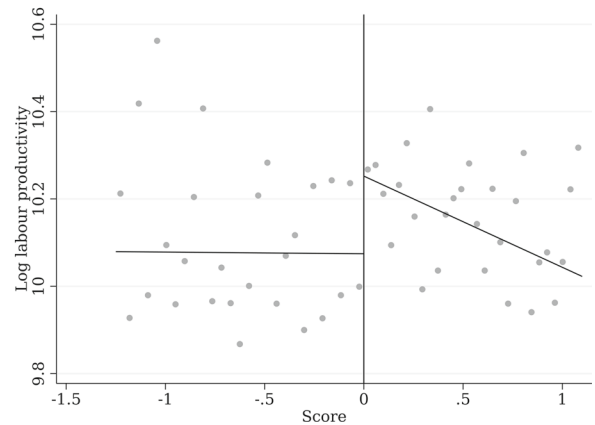
(a) Investment



(b) Employment



(c) Value-added



(d) Labour Productivity

Fig. 8 RDD plots — no grant vs. a single grant, small-sized firms. *Note:* Local linear plots based on a triangular kernel for outcomes in lead $t + 3$. *Source:* Own computations using data

from the *Portuguese Agency for Development and Cohesion and Central Balance Sheet*

Combining micro- and small-sized firms, the results show a positive effect on value-added in the first and third leads (statistically significant at the 1% and 5% levels, respectively) and a positive impact on investment and labour productivity during the 3 years following the awarding of a grant (statistically significant at the 1% level) — see Table 20 in the Appendix.

For medium- and large-sized firms, we did not find any positive impact on firms' performance — Table 6. The noteworthy outcome is the negative impact on value-added in the third lead, which is statistically significant at the 5% level of significance.

5.2 A single grant versus two grants

In this section, we implement the second step of our empirical strategy, which aims at evaluating the impact of an investment grant booster shot. We add as a control variable the amount of grant received in the first treatment and we define the bandwidth as 50% of applications in the neighbourhood of the threshold.¹⁹

¹⁹ We also estimated the impact of a grant booster shot defining the bandwidth according to the optimization techniques discussed in Calonico et al. (2014). The results are consistent with the ones presented in this section — see Tables 21 and 22 in the Appendix.

Table 5 RDD estimation results — no grant vs. a single grant, small-sized firms

Dependent variable (in logs)	t+1		t+2		t+3	
	Triangular	Epanechnikov	Triangular	Epanechnikov	Triangular	Epanechnikov
Investment	1.791*** (0.468)	1.821*** (0.482)	1.008*** (0.348)	1.006*** (0.349)	0.915*** (0.340)	0.901*** (0.344)
<i>N</i>	2987	2987	2595	2595	2115	2115
Employment	0.037 (0.079)	0.077 (0.081)	0.068 (0.096)	0.124 (0.090)	0.009 (0.091)	0.009 (0.089)
<i>N</i>	2985	2985	2594	2594	2115	2115
Value-Added	0.179** (0.083)	0.188** (0.084)	0.125 (0.085)	0.134 (0.086)	0.144 (0.096)	0.136 (0.092)
<i>N</i>	2943	2943	2561	2561	2115	2115
Labour Productivity	0.151*** (0.052)	0.143*** (0.050)	0.137** (0.065)	0.142** (0.063)	0.177** (0.084)	0.171** (0.081)
<i>N</i>	2941	2941	2561	2561	2115	2115
TFP	-0.006 (0.106)	-0.009 (0.109)	-0.039 (0.101)	-0.058 (0.103)	-0.014 (0.104)	-0.018 (0.102)
<i>N</i>	2977	2977	2586	2586	2106	2106

Notes: The dependent variable of each regression is defined in the first column. In the columns, we report the RDD estimates for leads, $t + 1$, $t + 2$, and $t + 3$, based on the kernel function identified in the respective column. “N” stands for the number of observations. All regressions include the following control variables: profitability, leverage, sales growth, assets, firm age and sector of activity. Robust standard-errors clustered at the application year level are reported in parentheses. Significance levels: ***, 1%; **, 5%; *, 10%. *Source:* Own computations using data from the *Portuguese Agency for Development and Cohesion* and *Central Balance Sheet*

Table 6 RDD estimation results — no grant vs. a single grant, medium- and large-sized firms

Dependent variable (in logs)	t+1		t+2		t+3	
	Triangular	Epanechnikov	Triangular	Epanechnikov	Triangular	Epanechnikov
Investment	0.311 (0.538)	0.193 (0.516)	0.081 (0.308)	-0.018 (0.361)	1.276* (0.679)	1.032 (0.653)
<i>N</i>	799	799	692	692	570	570
Employment	-0.019 (0.160)	-0.072 (0.152)	0.026 (0.172)	-0.036 (0.170)	-0.030 (0.232)	-0.092 (0.214)
<i>N</i>	799	799	689	689	570	570
Value-Added	-0.023 (0.137)	-0.042 (0.135)	-0.089 (0.148)	-0.109 (0.149)	-0.352** (0.149)	-0.366** (0.146)
<i>N</i>	785	785	682	682	570	570
Labour Productivity	0.056 (0.062)	0.093 (0.067)	-0.031 (0.092)	0.017 (0.103)	-0.173* (0.102)	-0.122 (0.116)
<i>N</i>	785	785	682	682	570	570
TFP	-0.044 (0.114)	-0.036 (0.114)	-0.098 (0.149)	-0.096 (0.148)	-0.070 (0.166)	-0.084 (0.173)
<i>N</i>	797	797	689	689	569	569

Notes: The dependent variable of each regression is defined in the first column. In the columns, we report the RDD estimates for leads, $t + 1$, $t + 2$, and $t + 3$, based on the kernel function identified in the respective column. “N” stands for the number of observations. All regressions include the following control variables: profitability, leverage, sales growth, assets, firm age and sector of activity. Robust standard-errors clustered at the application year level are reported in parentheses. Significance levels: ***, 1%; **, 5%; *, 10%. *Source:* Own computations using data from the *Portuguese Agency for Development and Cohesion* and *Central Balance Sheet*

Table 7 RDD estimation results — a single grant vs. two grants

Dependent variable (in logs)	$t + 1$		$t + 2$		$t + 3$	
	Triangular	Epanechnikov	Triangular	Epanechnikov	Triangular	Epanechnikov
Investment	0.975** (0.396)	0.913** (0.375)	0.493 (0.536)	0.530 (0.509)	1.159 (0.886)	1.260 (0.900)
<i>N</i>	817	817	756	756	729	729
Employment	0.057 (0.065)	0.065 (0.065)	0.156* (0.091)	0.162* (0.090)	0.133 (0.168)	0.130 (0.157)
<i>N</i>	817	817	756	756	729	729
Value-Added	0.243** (0.102)	0.242** (0.098)	0.214* (0.124)	0.210* (0.117)	0.398** (0.193)	0.406** (0.202)
<i>N</i>	804	804	744	744	729	729
Labour Productivity	0.194** (0.078)	0.187** (0.077)	0.080 (0.077)	0.071 (0.073)	0.216*** (0.083)	0.228*** (0.088)
<i>N</i>	803	803	744	744	729	729
TFP	0.114 (0.241)	0.075 (0.239)	0.120 (0.262)	0.086 (0.259)	0.179 (0.247)	0.182 (0.243)
<i>N</i>	808	808	747	747	716	716

Notes: The dependent variable of each regression is defined in the first column. In the columns, we report the RDD estimates for leads, $t + 1$, $t + 2$, and $t + 3$, based on the kernel function identified in the respective column. “N” stands for the number of observations. All regressions include the following control variables: profitability, leverage, sales growth, assets, firm age, amount of grant in the first grant, size and sector of activity. Robust standard-errors clustered at the application year level are reported in parentheses. Significance levels: ***, 1%; **, 5%; *, 10%. Source: Own computations using data from the *Portuguese Agency for Development and Cohesion* and *Central Balance Sheet*

Table 7 presents the estimates of the impact of a second grant on firms' performance.²⁰ The second grant only has a positive and statistically significant impact on investment in the first year at the 5% significance level. Compared to the effect of a single grant, Table 3, the impact on investment is considerably lower, and temporary. Regarding employment, our analysis suggests no significant effect. On the other hand, the results from Table 7, specifically in the Epanechnikov column, indicate that a grant booster shot positively and significantly impacts both value-added and labour productivity. This effect remains statistically significant for the 3 years after receiving the second grant for value-added and is observed in the first and third years for labour

productivity. However, our estimates do not show any effect of the second grant on TFP. Overall, for value-added and labour productivity, the magnitude of the coefficients is much higher for an investment grant booster shot than for a single grant — see Table 3. The impact of a booster shot on value-added and labour productivity in lead $t + 3$ is more than twice as large as the one of a single grant. Three years after receiving the second grant, the positive impact on value-added is about 50% $((e^{0.406} - 1) \times 100)$ and statistically significant at the 5% level. On labour productivity, the second grant has a positive effect of about 25% at the 1% significance level (± 17 percentage points, considering the 95% confidence interval), which means that considering an average labour productivity of 36 thousand euros, we expect an average increase of about 9 thousand euros.

Similar to our approach for no grant versus a single grant, we evaluate the potential heterogeneity in the impact of a second grant according to firm size. Since the number of observations for micro-sized firms and medium- and large-sized firms is small, we conducted

²⁰ Within the bandwidth used for the following estimations, the control and treatment groups account for 12 to 17% and 34 to 38% of the sample, respectively. For instance, when estimating the impact of a grant booster shot on employment in the first lead using a triangular kernel function, the sample comprises 817 observations, as shown in Table 7. The control group consists of 258 firms, while the treatment group contains 559 firms. When considering firms with scores close to the cut-off, the control group includes 138 firms and the treated group has 280 firms.

Table 8 RDD estimation results — a single grant vs. two grants, micro- and small-sized firms

Dependent variable (in logs)	t+1		t+2		t+3	
	Triangular	Epanechnikov	Triangular	Epanechnikov	Triangular	Epanechnikov
Investment	1.266*** (0.437)	1.202*** (0.410)	0.639 (0.719)	0.724 (0.655)	1.267 (1.041)	1.435 (1.050)
<i>N</i>	614	614	565	565	541	541
Employment	0.054 (0.082)	0.076 (0.078)	0.119 (0.085)	0.141* (0.084)	0.084 (0.204)	0.101 (0.196)
<i>N</i>	614	614	565	565	541	541
Value-Added	0.268** (0.133)	0.279** (0.134)	0.193 (0.121)	0.206* (0.115)	0.337* (0.183)	0.356* (0.184)
<i>N</i>	601	601	554	554	541	541
Labour productivity	0.243** (0.100)	0.229** (0.102)	0.116 (0.101)	0.101 (0.094)	0.225* (0.121)	0.229** (0.114)
<i>N</i>	600	600	554	554	541	541
TFP	0.251 (0.263)	0.212 (0.268)	0.273 (0.315)	0.238 (0.313)	0.352 (0.283)	0.350 (0.282)
<i>N</i>	605	605	556	556	528	528

Notes: The dependent variable of each regression is defined in the first column. In the columns, we report the RDD estimates for leads, $t + 1$, $t + 2$, and $t + 3$, based on the kernel function identified in the respective column. “N” stands for the number of observations. All regressions include the following control variables: profitability, leverage, sales growth, assets, firm age, amount of grant in the first grant and sector of activity. Robust standard-errors clustered at the application year level are reported in parentheses. Significance levels: ***, 1%; **, 5%; *, 10%. Source: Own computations using data from the *Portuguese Agency for Development and Cohesion* and *Central Balance Sheet*

a statistical power analysis by firm size — see Section 8.2 of the Appendix. We conclude that for micro-sized firms and for medium- and large-sized firms, there is insufficient statistical power to detect economically relevant effects. As such, we present the results for micro- and small-sized firms combined, Table 8, and for small-sized firms, Table 9. The size of the firm is defined at the time it applies for a second grant.²¹

We found a statistically significant positive impact of an investment booster shot on investment, value-added, and labour productivity for micro- and small-

sized firms, as shown in Table 8. The positive impact on investment is statistically significant at the 1% level in the first lead, but is transitory. The investment grant booster shot has a positive impact on value-added in the first lead of approximately 32% $((e^{0.279} - 1) \times 100)$, statistically significant at the 5% significance level, while in the third lead, it is only statistically significant at the 10% significance level. We found a positive impact on labour productivity in the first and third leads of about 26% $((e^{0.229} - 1) \times 100)$, significant at the 5% level.

Focusing on small-sized firms, our estimates in Table 9 reinforce the conclusion that a grant booster shot has a positive impact on investment. This effect is statistically significant at the 1% level in the first year and at the 5% level in the second year. There is a sizeable, but transitory, positive effect in the first year on value-added of approximately 65% $((e^{0.504} - 1) \times 100)$ and on labour productivity of about 45% $((e^{0.385} - 1) \times 100)$, both statistically significant at a 1% level. The results for small-sized firms corroborate the conclusion of no impact of a second investment grant on TFP.

²¹ As pointed out by an anonymous referee, if the amount of grants is different between micro-sized, small-sized, and medium-large-sized firms, the heterogeneity of the grant impacts by firm size could catch differences in the grant amounts by firm size. Table 19 in the Appendix shows that in our sample there are substantial differences across firm size as well as between single grant and multiple grants. In the case of a single grant, there is not an obvious solution to account for the amount of the grant, as the value is only available for grant receivers. Under our identification strategy followed in the paper, we cannot address this issue. In the case of the booster shot, we include in the estimations the grant amount received in the first treatment.

Table 9 RDD estimation results — a single grant vs. two grants, small-sized firms

Dependent variable (in logs)	t+1		t+2		t+3	
	Triangular	Epanechnikov	Triangular	Epanechnikov	Triangular	Epanechnikov
Investment	1.593*** (0.604)	1.488*** (0.527)	1.763** (0.830)	1.789** (0.811)	1.765 (1.149)	1.787 (1.116)
<i>N</i>	435	435	405	405	385	385
Employment	0.087 (0.097)	0.085 (0.099)	0.090 (0.142)	0.082 (0.142)	0.108 (0.260)	0.093 (0.249)
<i>N</i>	435	435	405	405	385	385
Value-Added	0.504*** (0.195)	0.504*** (0.193)	0.265 (0.193)	0.246 (0.193)	0.451 (0.308)	0.423 (0.321)
<i>N</i>	431	431	403	403	385	385
Labour Productivity	0.386** (0.150)	0.385*** (0.147)	0.188 (0.134)	0.183 (0.132)	0.299 (0.210)	0.285 (0.215)
<i>N</i>	431	431	403	403	385	385
TFP	0.459 (0.324)	0.391 (0.323)	0.421 (0.390)	0.346 (0.378)	0.383 (0.555)	0.345 (0.550)
<i>N</i>	435	435	404	404	382	382

Notes: The dependent variable of each regression is defined in the first column. In the columns, we report the RDD estimates for leads, $t + 1$, $t + 2$, and $t + 3$, based on the kernel function identified in the respective column. “N” stands for the number of observations. All regressions include the following control variables: profitability, leverage, sales growth, assets, firm age, amount of grant in the first grant and sector of activity. Robust standard-errors clustered at the application year level are reported in parentheses. Significance levels: ***, 1%; **, 5%; *, 10%. Source: Own computations using data from the *Portuguese Agency for Development and Cohesion* and *Central Balance Sheet*

Following Calonico et al. (2014), we analyze the effect of the second grant for small-sized firms using an optimised bandwidth. The results, detailed in Table 22 in the Appendix, are broadly in line with those presented in Table 9. The notable difference is the positive impact of the grant booster shot on labour productivity in the third year, strengthening the conclusion of a beneficial effect on labour productivity. The coefficient's magnitude is considerably greater for small-sized firms when compared to the entire sample (Table 7), and to micro- and small-sized firms (Table 8). Hence, an investment grant booster shot appears to effectively enhance the performance of small-sized firms.

6 Robustness checks

In this section, we present the results of robustness checks for our empirical analysis. First, we consider estimations specific to the manufacturing sector; second, given the specificities of R&D investment projects we exclude them from the sample; and finally, we con-

duct a “donut” analysis to account for the possibility of sorting in the selection process.

First robustness check The manufacturing sector is the most representative in our sample. For example, in the estimations presented in Sections 5.1 and 5.2 the manufacturing sector accounted for, respectively, 34.2% and 47.9% of the sample — see Tables 23 and 24 in the Appendix.

For the manufacturing sector, the results regarding the impact of a single grant can be seen in Table 10. The findings for investment and TFP are consistent with the estimates discussed in Section 5.1. However, there are noticeable changes for employment, value-added and labour productivity. First, regarding employment, firms in the manufacturing sector that received the grant experienced a stronger impact on employment, which amounts to almost 29% in lead three — see Table 10. Second, firms in the manufacturing sector exhibit a higher increase in value-added over three leads — almost 24 percentage points relative to our baseline case. The impact is of 45.5% ($(e^{0.375} - 1) \times 100$). Third, unlike the findings for the whole sample pre-

Table 10 RDD estimation results — no grant vs. a single grant, manufacturing sector

Dependent variable (in logs)	$t + 1$		$t + 2$		$t + 3$	
	Triangular	Epanechnikov	Triangular	Epanechnikov	Triangular	Epanechnikov
Investment	2.320*** (0.470)	2.281*** (0.463)	2.201*** (0.527)	2.098*** (0.525)	2.025*** (0.388)	1.930*** (0.410)
<i>N</i>	2178	2178	1848	1848	1411	1411
Employment	0.124 (0.083)	0.136 (0.083)	0.198* (0.102)	0.203** (0.100)	0.247** (0.116)	0.254** (0.121)
<i>N</i>	2175	2175	1842	1842	1411	1411
Value-Added	0.254*** (0.085)	0.252*** (0.082)	0.206*** (0.076)	0.210*** (0.077)	0.388*** (0.139)	0.375*** (0.131)
<i>N</i>	2129	2129	1822	1822	1411	1411
Labour Productivity	0.061 (0.068)	0.054 (0.065)	-0.021 (0.109)	-0.004 (0.109)	0.122 (0.087)	0.129 (0.087)
<i>N</i>	2127	2127	1821	1821	1411	1411
TFP	0.224* (0.134)	0.232* (0.132)	0.222* (0.126)	0.175 (0.126)	0.124 (0.128)	0.043 (0.121)
<i>N</i>	2168	2168	1833	1833	1405	1405

Notes: The dependent variable of each regression is defined in the first column. In the columns, we report the RDD estimates for leads, $t + 1$, $t + 2$, and $t + 3$, based on the kernel function identified in the respective column. “N” stands for the number of observations. All regressions include the following control variables: profitability, leverage, sales growth, assets, firm age and size. Robust standard-errors clustered at the application/year level are reported in parentheses. Significance levels: ***, 1%; **, 5%; *, 10%. *Source:* Own computations using data from the *Portuguese Agency for Development and Cohesion* and *Central Balance Sheet*

sented in Table 3, the manufacturing sector does not exhibit a significant impact of grants on labour productivity, although the magnitude of the estimate is in line with the one we find for the whole sample.

The estimates for micro-sized firms, Table 25 in the Appendix, confirm the positive impact of a single grant on investment, employment and value-added that we found when we consider the sample with all sectors (Table 4). Nevertheless, for manufacturing micro-sized firms, a single grant has no impact on labour productivity throughout the three leads.

From the results for manufacturing small-sized firms, Table 26 in the Appendix, we highlight three aspects. First, the short-term impact on value-added loses its statistical significance compared with the estimates considering all sectors (Table 5). Second, a positive impact on labour productivity is visible in the first lead. Third, we stress the positive and significant impact of a grant on TFP in leads one and two for small-sized firms in the manufacturing sector.

Combining micro- and small-sized firms in the manufacturing sector (Table 27 in the Appendix), the positive impact of a single grant on investment and value-

added is in line with the estimations including all sectors (Table 20 in the Appendix). However, there are two noticeable differences between the two samples. Firstly, micro- and small-sized firms in the manufacturing sector seem to increase their employment in the third year after receiving an investment grant (statistically significant at the 5% level). Secondly, in the manufacturing sector, we do not find statistically significant results for labour productivity.

Our findings on the impact of an investment grant booster shot within the manufacturing sector are detailed in Tables 11, 12, and 28 in the Appendix. When evaluating manufacturing firms of all sizes, Table 11, the results on value-added corroborate our main estimations (Table 7). Specifically, a second investment grant produces a positive effect in lead one. The impact stands at approximately 35.5%, surpassing the 27.4% observed for the whole sample. Contrary to our main findings for all economic sectors, the impact on labour productivity for the manufacturing sector emerges only in the third lead — see Table 11.

When focusing on micro- and small-sized manufacturing firms, we do not find an effect of an invest-

Table 11 RDD estimation results — a single grant vs. two grants, manufacturing sector

Dependent variable (in logs)	t+1		t+2		t+3	
	Triangular	Epanechnikov	Triangular	Epanechnikov	Triangular	Epanechnikov
Investment	0.344 (0.943)	0.477 (0.985)	-0.053 (0.910)	0.094 (0.930)	-0.267 (1.429)	0.059 (1.472)
<i>N</i>	392	392	363	363	354	354
Employment	0.208 (0.130)	0.210* (0.123)	0.245 (0.199)	0.251 (0.194)	0.178 (0.302)	0.198 (0.299)
<i>N</i>	392	392	363	363	354	354
Value-Added	0.308** (0.139)	0.304** (0.143)	0.153 (0.128)	0.154 (0.123)	0.477* (0.284)	0.556* (0.328)
<i>N</i>	388	388	362	362	354	354
Labour Productivity	0.077 (0.135)	0.063 (0.131)	-0.112 (0.114)	-0.116 (0.107)	0.231* (0.123)	0.264** (0.118)
<i>N</i>	388	388	362	362	354	354
TFP	0.558* (0.323)	0.499 (0.324)	0.513 (0.387)	0.443 (0.376)	0.752 (0.546)	0.664 (0.517)
<i>N</i>	391	391	362	362	353	353

Notes: The dependent variable of each regression is defined in the first column. In the columns, we report the RDD estimates for leads, $t + 1$, $t + 2$, and $t + 3$, based on the kernel function identified in the respective column. “N” stands for the number of observations. All regressions include the following control variables: profitability, leverage, sales growth, assets, firm age, amount of grant in the first grant and size. Robust standard-errors clustered at the application year level are reported in parentheses. Significance levels: ***, 1%; **, 5%; *, 10%. Source: Own computations using data from the *Portuguese Agency for Development and Cohesion* and *Central Balance Sheet*

ment grant booster shot on labour productivity — see Table 28 in the Appendix. The positive impact on value-added in the first lead is consistent with what we find for all economic sectors (Table 8).

For small-sized manufacturing firms, the estimates presented in Table 12 show a positive and significant effect on value-added and labour productivity, which is in line with the results for all sectors (Table 9). However, for the manufacturing sector, we find no positive effects on investment.

Second robustness check In our main estimations, we included the three systems of incentives: the Innovation Incentive System, the Qualification Incentive System, and the Research and Development Incentive System — see Section 2. The goals and the specificities of R&D investment projects are expected to take longer to impact on firms' performance. Therefore, as a robustness check, we exclude the applications to the Research and Development Incentive System and replicate our estimations as defined in our empirical strategy.

The estimates from this new sample, Tables 13 and 14, align with the findings of our baseline esti-

mates (Tables 3 and 7, respectively). In the case of a single grant, we observe a robust impact on investment and a mildly visible effect on employment in the first lead. There is also an immediate positive and significant influence on value-added — see Table 13. Labour productivity shows an effect after 3 years, ranging between 8 and 10%. However, we found no discernible effects on TFP. As observed in the baseline case, an investment grant booster shot, Table 14, yields immediate effects on investment, while showing no significant impacts on employment and TFP. There is an effect on value-added in the first lead. Furthermore, there is an impact of 30% on labour productivity after 3 years.

Aggregating micro- and small-sized firms, the results in Table 29 in the Appendix show a positive and statistically significant impact of a single grant on investment, value-added, and labour productivity, consistent with the results including R&D grants (Table 20 in the Appendix). The impact of a single grant on labour productivity is statistically significant at the 1% level for the three leads. The results for the second grant (Table 30 in the Appendix), combining micro- and

Table 12 RDD estimation results — a single grant vs. two grants, manufacturing sector, small-sized firms

Dependent variable (in logs)	t+1		t+2		t+3	
	Triangular	Epanechnikov	Triangular	Epanechnikov	Triangular	Epanechnikov
Investment	0.955 (0.646)	1.068 (0.661)	0.431 (0.660)	0.533 (0.631)	-0.639 (1.338)	-0.631 (1.282)
<i>N</i>	226	226	209	209	201	201
Employment	0.108 (0.176)	0.102 (0.173)	0.102 (0.267)	0.105 (0.272)	-0.004 (0.487)	0.003 (0.491)
<i>N</i>	226	226	209	209	201	201
Value-Added	0.464** (0.193)	0.439** (0.199)	0.192 (0.177)	0.174 (0.175)	0.225 (0.358)	0.212 (0.371)
<i>N</i>	223	223	208	208	201	201
Labour Productivity	0.352*** (0.123)	0.332*** (0.122)	0.102 (0.139)	0.090 (0.133)	0.228 (0.190)	0.207 (0.189)
<i>N</i>	223	223	208	208	201	201
TFP	0.515 (0.520)	0.423 (0.523)	0.312 (0.668)	0.202 (0.671)	0.479 (1.006)	0.359 (0.996)
<i>N</i>	226	226	208	208	200	200

Notes: The dependent variable of each regression is defined in the first column. In the columns, we report the RDD estimates for leads, $t + 1$, $t + 2$, and $t + 3$, based on the kernel function identified in the respective column. “N” stands for the number of observations. All regressions include the following control variables: profitability, leverage, sales growth, assets, firm age and amount of grant in the first grant. Robust standard-errors clustered at the application year level are reported in parentheses. Significance levels: ***, 1%; **, 5%; *, 10%. *Source:* Own computations using data from the *Portuguese Agency for Development and Cohesion* and *Central Balance Sheet*

Table 13 RDD estimation results — no grant vs. a single grant, excluding R&D grants

Dependent variable (in logs)	t+1		t+2		t+3	
	Triangular	Epanechnikov	Triangular	Epanechnikov	Triangular	Epanechnikov
Investment	1.963*** (0.324)	1.982*** (0.304)	1.502*** (0.282)	1.363*** (0.249)	1.791*** (0.332)	1.743*** (0.351)
<i>N</i>	6119	6119	5259	5259	4390	4390
Employment	0.115 (0.070)	0.106* (0.061)	-0.039 (0.052)	0.003 (0.053)	-0.024 (0.051)	0.071 (0.065)
<i>N</i>	6089	6089	5230	5230	4390	4390
Value-Added	0.159** (0.079)	0.154** (0.073)	0.064 (0.070)	0.068 (0.076)	0.041 (0.064)	0.172** (0.086)
<i>N</i>	5945	5945	5141	5141	4390	4390
Labour Productivity	0.079* (0.042)	0.085** (0.038)	0.027 (0.046)	0.068* (0.035)	0.082** (0.037)	0.079** (0.036)
<i>N</i>	5927	5927	5127	5127	4390	4390
TFP	0.032 (0.059)	0.034 (0.060)	0.014 (0.048)	-0.001 (0.046)	0.025 (0.047)	0.017 (0.050)
<i>N</i>	6006	6006	5144	5144	4297	4297

Notes: The dependent variable of each regression is defined in the first column. In the columns, we report the RDD estimates for leads, $t + 1$, $t + 2$, and $t + 3$, based on the kernel function identified in the respective column. “N” stands for the number of observations. All regressions include the following control variables: profitability, leverage, sales growth, assets, firm age, size and sector of activity. Robust standard-errors clustered at the application year level are reported in parentheses. Significance levels: ***, 1%; **, 5%; *, 10%. *Source:* Own computations using data from the *Portuguese Agency for Development and Cohesion* and *Central Balance Sheet*

Table 14 RDD estimation results — a single grant vs. two grants, excluding R&D grants

Dependent variable (in logs)	t+1		t+2		t+3	
	Triangular	Epanechnikov	Triangular	Epanechnikov	Triangular	Epanechnikov
Investment	0.815* (0.484)	0.825* (0.477)	0.187 (0.601)	0.280 (0.573)	1.048 (0.903)	1.221 (0.900)
<i>N</i>	661	661	600	600	573	573
Employment	0.000 (0.066)	0.014 (0.067)	0.085 (0.090)	0.095 (0.092)	0.040 (0.171)	0.040 (0.165)
<i>N</i>	661	661	600	600	573	573
Value-Added	0.212** (0.099)	0.219** (0.097)	0.151 (0.129)	0.153 (0.126)	0.360* (0.199)	0.370* (0.210)
<i>N</i>	650	650	589	589	573	573
Labour Productivity	0.216** (0.091)	0.211** (0.088)	0.104 (0.073)	0.096 (0.068)	0.256*** (0.081)	0.270*** (0.085)
<i>N</i>	649	649	589	589	573	573
TFP	0.073 (0.274)	0.057 (0.275)	0.060 (0.300)	0.040 (0.300)	0.095 (0.267)	0.095 (0.265)
<i>N</i>	653	653	593	593	562	562

Notes: The dependent variable of each regression is defined in the first column. In the columns, we report the RDD estimates for leads, $t + 1$, $t + 2$, and $t + 3$, based on the kernel function identified in the respective column. “N” stands for the number of observations. All regressions include the following control variables: profitability, leverage, sales growth, assets, firm age, amount of grant in the first grant, size and sector of activity. Robust standard-errors clustered at the application year level are reported in parentheses. Significance levels: ***, 1%; **, 5%; *, 10%. Source: Own computations using data from the *Portuguese Agency for Development and Cohesion* and *Central Balance Sheet*

small-sized firms, also align with previous findings (Table 8). Excluding R&D grants, the second grant has a positive effect on labour productivity in the first and third leads, statistically significant at the 5% and 1% levels, respectively.

For small-sized firms, Table 31 in the Appendix, we find no positive effects of a single grant on employment and TFP. However, there is a positive impact on value-added in lead one, in line with the results including R&D grants (Table 5). The significant effects on labour productivity take place in the first two leads. Analysing the effects of a grant booster shot, the results in Table 32 in the Appendix show a consistent positive effect on labour productivity for small-sized firms over three consecutive years. Our previous results, considering all three incentive systems, showed a positive impact on labour productivity that only lasted for one lead (Table 9). Comparing the magnitude of the effects for small-sized firms with that for micro- and small-sized firms combined (excluding R&D grants), the impact

of a second grant on labour productivity seems to be stronger for small-sized firms — see Tables 30 and 32 in the Appendix.

Third robustness check The slight concentration of scores above the threshold visible in Figs. 5 and 6 could be a sign of sorting in the selection process, which would invalidate our RDD analysis. Therefore, following Barreca et al. (2011), we implement a series of “donut” RDD regressions. Our analysis is carried out in three stages: first, we excluded scores of 0; next, scores between -0.02 and 0.02 were omitted; and finally, scores in the range of -0.05 to 0.05 were dropped.²² See Tables 33 through 38 in the Appendix for a breakdown of the results. Overall, the results of the “donut” analysis corroborate the results presented

²² For example, looking at the impact of the single treatment in the first lead, $t + 1$, in general, the proportion of observations eliminated in each stage represents roughly 4%, 5%, and 7% of the entire sample, respectively — see Tables 33, 34 and 35 in the Appendix.

in Section 5. Considering the zero versus one treatment, for the overall sample, Tables 33, 34, and 35, the results are very robust: highly significant positive effect on investment, an immediate return on employment, which disappears for leads two and three. The positive effect on value-added becomes more evident when we drop those observations exactly in the cut-off, being statistically significant at the 1% level in leads one and three (except in lead three under the triangular kernel, when it is significant at the 5% significance level). The results for productivity reported in Section 5.1 are fully corroborated for those three stages. Considering the grant booster shot, Tables 36, 37 and 38 in the Appendix, the main difference to the results reported in Section 5.2 is the lack of an effect on investment, and a slight decrease in significance for labour productivity, which is statistically significant at the 5% significance level when we drop observations with scores between -0.05 and 0.05 — see Table 38 in the Appendix.

As an additional verification, we have analysed if there is manipulation of firms' application scores. We follow Cattaneo et al. (2020a) and conduct manipulation tests on the density of the running variable, that is, the scores. Our results indicate no significant differences in the number of observations just above and below the cut-off for both the score distributions of no grant versus a single grant and for the score distribution of a single grant versus two grants. In the first case, the test statistic is 0.30 with a corresponding p-value of 0.76, while in the second case, the statistic is 0.38 with a p-value of 0.71.

7 Concluding remarks

ERDF support to firms' investment has been a pivotal instrument in Portuguese policymakers' toolkit to promote competitiveness and productivity. These objectives are of utmost importance, especially considering the Portuguese economy has experienced an extended period of low growth, prolonged productivity stagnation, and economic divergence throughout the 21st century. In the period 2007–2018, a high share of total ERDF has been allocated to a small number of firms that have received multiple grants. Awarding several

grants to the same firm, rather than distributing them to firms that have never benefited from a public grant for an investment plan, raises concerns about the effectiveness of this strategy in enhancing firm performance and the eligibility criteria used. In fact, several authors have noted the risk that firms receiving multiple grants might rely on government funding without bringing any benefits to the country or society. On the other hand, the concentration of funds on a small number of firms may be more effective to foster firms' productivity growth. Therefore, evaluating the impact of these investment grant booster shots on firm performance is of paramount importance, both for equity and efficiency reasons.

Our results show that a single grant has a positive impact on firms' employment, value-added and labour productivity. Concerning the analysis of the impact of awarding a second grant to the same firm, our estimates show that it affects its value-added and labour productivity. The magnitude of these effects from the grant booster shot is significantly greater than that of a single grant. These findings suggest that allocating multiple grants to the same firm might be an effective strategy for enhancing labour productivity. A more granular analysis shows that only micro-sized and small-sized firms benefit from a single investment grant, namely on value-added and labour productivity. Regarding the effects of an investment grant booster shot, while the overall positive effect on labour productivity is confirmed for the micro- and small-sized firms, the analysis for other firm sizes warrants further research. It is also worth noting that we observed no effect on total factor productivity, regardless of whether it was a single or second grant.

In conclusion, while there is scope to improve programs funded by ERDF, our results indicate that an investment grant booster shot can be effective in enhancing firm performance. This research may contribute to improve the program design of grants allocation. The success of those firms' projects is vital for the transformation of Portugal into an innovation-driven economy. Two avenues to consider in further research include the certification effects of grants and the role of the characteristics of founders and managers in the impact of grants on firm performance.

Appendix

8 Statistical power analysis

8.1 Descriptive statistics

The number of observations for some samples underlying the descriptive statistics and t – $tests$ analysis is small. Consequently, we conducted a statistical power analysis (for further discussion, see (Cohen, 2013), for example). In this discussion, we adopt a significance level of 0.05. When data from all years are aggregated in Table 2, the smallest samples are observed in “a single grant vs. two grants, inside the bandwidth”, Panel D, with 413 to 422 observations. In these subsets of samples, the t – $tests$ do not reveal any statistically significant differences between control and treated groups. The power of the t – $tests$ for investment, employment, value-added, labour productivity and TFP are as low as 0.07, 0.18, 0.26, 0.26, and 0.23, respectively. Further power analysis reveals that, in the case of investment, a sample size of 20,098 would be needed to achieve statistically significant differences with a power of 0.8, compared to the actual sample size of 422 observations. For the same power level and a sample size of 422, the effect size is 446.2, in contrast to the current difference in means of 59.2. Taking the average investment of 494.9 for the control group, the average for the treated group would have to increase to 941.0 thousand euros (an increase of 70%). For employment, value-added, labour productivity, and TFP, detecting statistically significant differences between the control and treated groups' means would necessitate increasing the sample size by at least 308% (for labour productivity). Moreover, the effect size implies that the difference in means between control and treated groups would need to increase by at least 113% (the case of value-added). The concern over small sample sizes and low statistical power is particularly relevant for the yearly statistics reported in Tables 17 and 18 in the Appendix, especially in the comparison of “a single grant vs. two grants, inside the bandwidth” as detailed in Table 18. For example, when examining the year 2014 in Table 18, which compares “a single grant vs. two grants, inside the bandwidth”, with a sample of 70 observations we find no statistically significant differences in mean TFP between the control and treated

groups. However, the power of the t – $test$ is 0.19. For investment, employment, value-added, and labour productivity, the respective power values are 0.39, 0.19, 0.21, and 0.05. Nevertheless, similar to the aggregate sample, achieving statistically significant differences between control and treated groups requires substantial increases in sample size and effect size.

8.2 Regression analysis

In the context of the RDD regression analysis, two scenarios with a limited number of observations necessitate a power analysis due to potential concerns about insufficient statistical power to detect economically relevant effects. These scenarios pertain to the analysis of “a single grant vs. two grants” for both micro-sized firms and medium- and large-sized firms. The majority of estimations in these sets of regressions rely on samples with fewer than 200 observations. In our discussion of power in the context of the RDD regressions, we reference the work of Cattaneo and Titiunik (2022), Cattaneo et al. (2019), and its application in Bagues and Campa (2021). The computations are conducted using the Stata command *rdpower*, as detailed in Cattaneo et al. (2019).

When estimating the investment booster shot's effect on micro-sized firms, we observe that most estimates are not statistically significant.²³ All the non-significant estimates, including for labour productivity, are generally underpowered, with estimated statistical power ranging from 0.05 to 0.56. For medium- and large-sized firms, despite the statistical power of insignificant estimates for employment ranging between 0.77 and 0.93, the statistical power of the non-significant estimates for labour productivity at leads $t + 1$ and $t + 2$ are as low as 0.05 and 0.15, respectively. Therefore, the insufficient statistical power of those estimations led us, first, to combine micro- and small-sized firms, and second, to not present the results for medium- and large-sized firms in the analysis of a single grant versus two grants.

9 Variables description and additional computations

²³ The results are available upon request.

Table 15 Variables description and sources

Variable	Description	Source
Gross Capital Formation	Investment (€)	CBS
Employment	Number of workers	CBS
Value-added	Gross value-added (€)	CBS
Labour Productivity	Gross value-added / Employment (€)	CBS
TFP	Total factor productivity	CBS
Profitability	EBITDA / Total assets	CBS
Turnover	Growth rate of sales (%)	CBS
Assets	Total assets (€)	CBS
Leverage	Total liabilities / Total assets	CBS
Score	Application evaluation score	AdC

Notes: TFP is computed by the authors using data from the CBS and following the methodology proposed by Gandhi et al. (2020). CBS: Central Balance Sheet. AdC: Portuguese Agency for Development and Cohesion

Table 16 Descriptive statistics for the calls excluded from the sample

	All applications selected	No application selected
Number of calls	94	110
Number of applications	173	275
Number of firms	154	267
Average employment	66.32	44.44
Median employment	15	9
Average grant amount (€)	442,546	-
Median grant amount (€)	144,145	-

Source: Own computations using data from the *Portuguese Agency for Development and Cohesion* and *Central Balance Sheet*

Table 17 Descriptive statistics for the outcome variables in the year before application — no grant vs. a single grant sample, inside the bandwidth (2007–2012, 2014–2016)

	Control				Treated				<i>t</i> – test
	Obs.	Mean	Median	s.d.	Obs.	Mean	Median	s.d.	
	2007				2007				
Investment	90	418.80	38.59	1014.98	203	304.84	58.09	784.47	1.04
Employment	90	38.16	11	74.49	203	32.31	12	55.42	0.75
Value-Added	90	1483.45	358.88	3098.37	203	1151.78	387.80	2212.45	1.04
Labour Productivity	90	33.38	24.62	26.38	203	35.41	26.63	26.71	-0.60
TFP	90	0.05	0.03	0.05	201	0.05	0.03	0.06	-0.76
	2008				2008				
Investment	57	369.78	67.02	765.41	235	299.60	30.89	815.29	0.59
Employment	57	52.23	21	88.93	235	35.81	11	69.12	1.52
Value-Added	57	1630.08	463.14	2975.31	235	1203.66	291.32	2661.94	1.06
Labour Productivity	57	28.55	22.61	24.67	235	31.06	23.79	26.99	-0.64
TFP	56	0.05	0.02	0.06	233	0.04	0.01	0.05	0.82

Table 17 continued

	Control				Treated				<i>t - test</i>
	Obs.	Mean	Median	s.d.	Obs.	Mean	Median	s.d.	
	2009				2009				
Investment	38	356.86	41.37	867.26	73	606.52	48.24	1218.78	-1.12
Employment	38	35.29	9	60.75	73	61.70	19	99.63	-1.49
Value-Added	38	1323.01	317.85	2691.66	73	1892.43	553.95	3300.93	-0.92
Labour Productivity	38	27.91	22.97	24.33	73	33.52	25.81	27.90	-1.05
TFP	37	0.03	0.01	0.04	73	0.04	0.02	0.05	-1.09
	2010				2010				
Investment	47	204.39	42.24	622.36	159	275.36	28.66	719.48	-0.61
Employment	47	25.45	13	53.47	159	27.10	9	54.75	-0.18
Value-Added	47	998.98	297.35	2374.19	159	1048.87	248.76	2414.54	-0.12
Labour Productivity	47	31.37	24.26	28.72	159	33.09	27.27	26.48	-0.38
TFP	46	0.05	0.03	0.05	157	0.05	0.03	0.06	-0.56
	2011				2011				
Investment	76	102.83	10.51	258.62	515	91.32	8.47	382.37	0.25
Employment	76	27.13	6	63.57	515	14.08	5	34.11	2.71***
Value-Added	76	891.45	154.22	2462.33	515	442.26	117.45	1315.49	2.42**
Labour Productivity	76	26.81	19.95	24.24	515	27.42	21.47	23.44	-0.21
TFP	72	0.05	0.02	0.05	497	0.05	0.01	0.06	0.09
	2012				2012				
Investment	231	30.85	3.13	96.17	316	110.71	7.10	441.91	-2.70***
Employment	231	7.98	4	16.75	316	18.03	5	41.65	-3.47***
Value-Added	231	168.54	72.16	414.05	316	575.84	120.25	1580.17	-3.82***
Labour Productivity	231	19.54	16.93	13.14	316	25.64	20.32	23.78	-3.53***
TFP	221	0.04	0.01	0.05	294	0.05	0.03	0.06	-2.21**
	2014				2014				
Investment	28	132.95	38.30	252.85	356	255.06	50.49	583.96	-1.10
Employment	28	14.11	14	11.61	356	33.19	15	51.58	-1.95*
Value-Added	28	493.19	446.35	413.07	356	1092.73	427.65	1967.31	-1.61
Labour Productivity	28	39.76	30.56	34.74	356	32.26	26.37	22.93	1.59
TFP	27	0.05	0.02	0.06	349	0.04	0.03	0.05	0.68
	2015				2015				
Investment	53	145.40	21.26	303.42	519	169.72	30.76	468.62	-0.37
Employment	53	17.40	10	24.64	519	25.19	13	41.18	-1.35
Value-Added	53	535.33	300.54	814.08	519	731.08	291.03	1272.75	-1.10
Labour Productivity	53	32.85	26.43	24.23	519	29.76	24.75	21.31	0.99
TFP	53	0.03	0.01	0.04	500	0.04	0.03	0.04	-1.83*
	2016				2016				
Investment	51	65.64	14.25	133.68	37	109.21	22.89	204.80	-1.21
Employment	51	16.69	6	27.99	37	19.14	9	30.54	-0.39
Value-Added	51	539.34	183.45	1006.20	37	710.64	286.36	1148.83	-0.74
Labour Productivity	51	27.96	23.87	18.95	37	32.87	27.14	21.06	-1.15
TFP	45	0.04	0.03	0.05	33	0.06	0.04	0.05	-1.34

Notes: Investment, value-added, and labour productivity are expressed in thousands of euros. The *t - test* assesses the difference in mean values between the treated and control groups. Significance levels: ***, 1%; **, 5%; *, 10%. "Obs." stands for the number of observations, and "s.d." represents the standard-deviation. Source: Own computations using data from the *Portuguese Agency for Development and Cohesion* and *Central Balance Sheet*

Table 18 Descriptive statistics for the outcome variables in the year before application — a single grant vs. two grants sample, inside the bandwidth (2010, 2011, 2012, 2014)

	Control				Treated				<i>t</i> – <i>t</i> test
	Obs.	Mean	Median	s.d.	Obs.	Mean	Median	s.d.	
	2010				2010				
Investment	12	1449.04	194.37	2482.26	60	526.54	94.65	1346.42	1.85*
Employment	12	158.17	27	297.80	60	55.05	22	130.86	1.94*
Value-Added	12	4294.50	645.73	6872.34	60	2911.21	766.54	9239.28	0.49
Labour Productivity	12	30.32	26.46	17.79	60	41.76	35.52	29.93	-1.28
TFP	12	0.05	0.05	0.04	60	0.06	0.04	0.06	-0.65
	2011				2011				
Investment	16	713.52	33.60	2340.18	78	479.57	106.36	1214.71	0.59
Employment	16	106.00	14	259.61	78	68.92	15	166.55	0.73
Value-Added	16	4303.86	299.90	14066.45	78	2604.01	495.98	7886.98	0.67
Labour Productivity	16	30.83	19.26	33.65	78	36.05	27.99	21.03	-0.81
TFP	16	0.03	0.01	0.04	76	0.06	0.04	0.05	-1.70*
	2012				2012				
Investment	36	394.01	20.88	1623.69	58	355.07	76.53	1004.75	0.14
Employment	36	16.36	8	17.86	58	57.62	19	136.53	-1.80*
Value-Added	36	988.18	268.15	2548.53	58	2051.21	649.51	5562.98	-1.08
Labour Productivity	36	34.99	25.31	32.39	58	31.50	28.02	21.69	0.63
TFP	34	0.06	0.03	0.06	58	0.05	0.04	0.05	0.66
	2014				2014				
Investment	19	103.39	69.60	97.63	53	344.78	75.89	1012.26	-1.03
Employment	19	26.95	16	31.09	53	48.00	18	132.22	-0.68
Value-Added	19	762.46	538.23	720.11	53	2032.68	430.57	7753.58	-0.71
Labour Productivity	19	34.75	26.04	25.86	53	34.04	27.06	27.64	0.10
TFP	18	0.04	0.02	0.04	52	0.05	0.03	0.05	-0.99

Notes: Investment, value-added, and labour productivity are expressed in thousands of euros. The *t* – *t* test assesses the difference in mean values between the treated and control groups. Significance levels: ***, 1%; **, 5%; *, 10%. “Obs.” stands for the number of observations, and “s.d.” represents the standard-deviation. Source: Own computations using data from the *Portuguese Agency for Development and Cohesion* and *Central Balance Sheet*

Table 19 Average amount of grants

	Average grant amount (€)
Single treatment	249,756
Single treatment: Micro	100,549
Single treatment: Small	259,892
Single treatment: Medium and large	612,805
Second treatment	570,208
Second treatment: Micro	140,625
Second treatment: Small	340,942
Second treatment: Medium and large	1,286,468

Source: Own computations using data from the *Portuguese Agency for Development and Cohesion* and *Central Balance Sheet*

Table 20 RDD estimation results — no grant vs. a single grant, micro- and small-sized firms

Dependent variable (in logs)	t+1		t+2		t+3	
	Triangular	Epanechnikov	Triangular	Epanechnikov	Triangular	Epanechnikov
Investment	1.960*** (0.301)	1.935*** (0.292)	1.517*** (0.269)	1.415*** (0.243)	1.693*** (0.314)	1.688*** (0.321)
<i>N</i>	5590	5590	4819	4819	4044	4044
Employment	0.076 (0.051)	0.070 (0.050)	0.056 (0.050)	0.045 (0.048)	0.079 (0.051)	0.073 (0.048)
<i>N</i>	5559	5559	4792	4792	4044	4044
Value-Added	0.201*** (0.073)	0.196*** (0.072)	0.098 (0.076)	0.093 (0.076)	0.215** (0.096)	0.211** (0.091)
<i>N</i>	5428	5428	4707	4707	4044	4044
Labour Productivity	0.126*** (0.038)	0.125*** (0.038)	0.099*** (0.037)	0.107*** (0.027)	0.111*** (0.035)	0.110*** (0.033)
<i>N</i>	5409	5409	4692	4692	4044	4044
TFP	0.049 (0.066)	0.042 (0.067)	0.026 (0.052)	0.023 (0.053)	0.024 (0.057)	0.015 (0.059)
<i>N</i>	5477	5477	4703	4703	3951	3951

Notes: The dependent variable of each regression is defined in the first column. In the columns, we report the RDD estimates for leads, $t + 1$, $t + 2$ and $t + 3$, based on the kernel function identified in the respective column. “N” stands for the number of observations. All regressions include the following control variables: profitability, leverage, sales growth, assets, firm age and sector of activity. Robust standard-errors clustered at the application year level are reported in parentheses. Significance levels: ***, 1%; **, 5%; *, 10%. *Source:* Own computations using data from the *Portuguese Agency for Development and Cohesion* and *Central Balance Sheet*

Table 21 RDD estimation results — a single grant vs. two grants, optimised bandwidth

Dependent variable (in logs)	t+1		t+2		t+3	
	Triangular	Epanechnikov	Triangular	Epanechnikov	Triangular	Epanechnikov
Investment	0.775 (0.512)	0.823 (0.538)	-0.282 (1.163)	-0.402 (1.366)	0.623 (0.937)	0.477 (0.916)
<i>N</i>	817	817	756	756	729	729
Employment	0.010 (0.070)	-0.006 (0.072)	0.160* (0.094)	0.156* (0.092)	0.181 (0.154)	0.147 (0.189)
<i>N</i>	817	817	756	756	729	729
Value-Added	0.213* (0.120)	0.227* (0.128)	-0.096 (0.143)	-0.140 (0.157)	-0.011 (0.227)	0.163 (0.206)
<i>N</i>	804	804	744	744	729	729
Labour Productivity	0.224** (0.102)	0.195** (0.090)	-0.002 (0.134)	0.006 (0.128)	0.061 (0.195)	0.075 (0.186)
<i>N</i>	803	803	744	744	729	729
TFP	0.213 (0.255)	0.208 (0.244)	0.201 (0.306)	0.185 (0.296)	0.181 (0.306)	0.205 (0.299)
<i>N</i>	808	808	747	747	716	716

Notes: The dependent variable of each regression is defined in the first column. In the columns, we report the RDD estimates for leads, $t + 1$, $t + 2$, and $t + 3$, based on the kernel function identified in the respective column. “N” stands for the number of observations. All regressions include the following control variables: profitability, leverage, sales growth, assets, firm age, amount of grant in the first grant, size and sector of activity. Robust standard-errors clustered at the application year level are reported in parentheses. Significance levels: ***, 1%; **, 5%; *, 10%. *Source:* Own computations using data from the *Portuguese Agency for Development and Cohesion* and *Central Balance Sheet*

Table 22 RDD estimation results — a single grant vs. two grants, optimised bandwidth, small-sized firms

Dependent variable (in logs)	t+1		t+2		t+3	
	Triangular	Epanechnikov	Triangular	Epanechnikov	Triangular	Epanechnikov
Investment	1.921** (0.841)	1.781** (0.774)	1.425 (1.082)	1.505 (1.029)	2.651 (1.985)	3.427 (2.249)
<i>N</i>	435	435	405	405	385	385
Employment	0.084 (0.091)	0.102 (0.096)	-0.134 (0.210)	0.111 (0.138)	0.036 (0.275)	-0.022 (0.320)
<i>N</i>	435	435	405	405	385	385
Value-Added	0.514*** (0.195)	0.517*** (0.199)	-0.027 (0.189)	0.231 (0.216)	0.429 (0.264)	0.382 (0.254)
<i>N</i>	431	431	403	403	385	385
Labour Productivity	0.367** (0.156)	0.364** (0.157)	0.170 (0.122)	0.170 (0.121)	0.391*** (0.100)	0.383*** (0.105)
<i>N</i>	431	431	403	403	385	385
TFP	0.546 (0.361)	0.505 (0.359)	0.501 (0.456)	0.467 (0.445)	0.385 (0.666)	0.407 (0.685)
<i>N</i>	435	435	404	404	382	382

Notes: The dependent variable of each regression is defined in the first column. In the columns, we report the RDD estimates for leads, $t + 1$, $t + 2$, and $t + 3$, based on the kernel function identified in the respective column. “N” stands for the number of observations. All regressions include the following control variables: profitability, leverage, sales growth, assets, firm age, amount of grant in the first grant and sector of activity. Robust standard-errors clustered at the application year level are reported in parentheses. Significance levels: ***, 1%; **, 5%; *, 10%. Source: Own computations using data from the *Portuguese Agency for Development and Cohesion* and *Central Balance Sheet*

Table 23 Distribution of firms by sector of activity in the sample for the analysis of no grant vs. a single grant

Sector	%
Agriculture, forestry and fishing	1.11
Mining and quarrying	1.08
Manufacturing	34.18
Electricity, gas, steam and air-conditioning supply	0.17
Water supply, sewerage, waste management and remediation	0.78
Construction	6.34
Retail	22.41
Transport services	2.48
Accommodation and food services	4.78
Telecommunications services	6.20
Financial and insurance activities	0.03
Real estate activities	0.33
Consulting, scientific and technical services	13.57
Administrative services	3.12
Education	0.91
Human health services	0.88
Arts, entertainment and recreation	1.10
Other service	0.53

Source: Own computations using data from the *Portuguese Agency for Development and Cohesion* and *Central Balance Sheet*

Table 24 Distribution of firms by sector of activity in the sample for the analysis of a single grant vs. two grants

Sector	%
Agriculture, forestry and fishing	1.22
Mining and quarrying	1.34
Manufacturing	47.87
Electricity, gas, steam and air-conditioning supply	0.12
Water supply, sewerage, waste management and remediation	1.10
Construction	2.92
Retail	13.64
Transport services	0.97
Accommodation and food services	2.68
Telecommunications services	10.60
Consulting, scientific and technical services	13.15
Administrative services	2.44
Education	0.49
Human health services	0.24
Arts, entertainment and recreation	0.97
Other service	0.24

Source: Own computations using data from the *Portuguese Agency for Development and Cohesion* and *Central Balance Sheet*

Table 25 RDD estimation results — no grant vs. a single grant, manufacturing sector, micro-sized firms

Dependent variable (in logs)	t+1		t+2		t+3	
	Triangular	Epanechnikov	Triangular	Epanechnikov	Triangular	Epanechnikov
Investment	4.343*** (1.327)	4.267*** (1.324)	3.257*** (1.235)	3.215*** (1.165)	4.230*** (1.417)	4.167*** (1.433)
<i>N</i>	445	445	362	362	288	288
Employment	0.265 (0.187)	0.275 (0.185)	0.428* (0.221)	0.436* (0.225)	0.587** (0.241)	0.575** (0.248)
<i>N</i>	442	442	359	359	288	288
Value-Added	0.378* (0.207)	0.367* (0.190)	0.555** (0.270)	0.549** (0.269)	0.941** (0.390)	0.934** (0.395)
<i>N</i>	424	424	348	348	288	288
Labour Productivity	0.043 (0.108)	0.013 (0.106)	0.138 (0.139)	0.141 (0.153)	0.213 (0.239)	0.157 (0.222)
<i>N</i>	422	422	347	347	288	288
TFP	-0.092 (0.298)	-0.101 (0.298)	0.102 (0.334)	0.086 (0.336)	0.003 (0.337)	0.035 (0.382)
<i>N</i>	439	439	352	352	287	287

Notes: The dependent variable of each regression is defined in the first column. In the columns, we report the RDD estimates for leads, $t + 1$, $t + 2$, and $t + 3$, based on the kernel function identified in the respective column. “N” stands for the number of observations. All regressions include the following control variables: profitability, leverage, sales growth, firm age and assets. Robust standard-errors clustered at the application year level are reported in parentheses. Significance levels: ***, 1%; **, 5%; *, 10%. Source: Own computations using data from the *Portuguese Agency for Development and Cohesion* and *Central Balance Sheet*

Table 26 RDD estimation results — no grant vs. a single grant, manufacturing sector, small-sized firms

Dependent variable (in logs)	t+1		t+2		t+3	
	Triangular	Epanechnikov	Triangular	Epanechnikov	Triangular	Epanechnikov
Investment	1.785** (0.708)	1.763*** (0.684)	1.326** (0.529)	1.273** (0.505)	1.014* (0.606)	0.924 (0.584)
<i>N</i>	1324	1324	1136	1136	841	841
Employment	0.043 (0.102)	0.045 (0.102)	0.053 (0.132)	0.041 (0.127)	0.073 (0.146)	0.048 (0.140)
<i>N</i>	1324	1324	1136	1136	841	841
Value-Added	0.132 (0.094)	0.105 (0.086)	0.063 (0.091)	0.046 (0.092)	0.219 (0.158)	0.057 (0.125)
<i>N</i>	1307	1307	1130	1130	841	841
Labour Productivity	0.111*** (0.039)	0.104*** (0.038)	0.034 (0.117)	0.052 (0.115)	0.208* (0.116)	0.219* (0.113)
<i>N</i>	1307	1307	1130	1130	841	841
TFP	0.292* (0.157)	0.307** (0.146)	0.396** (0.155)	0.418*** (0.140)	0.189 (0.206)	0.183 (0.200)
<i>N</i>	1322	1322	1134	1134	837	837

Notes: The dependent variable of each regression is defined in the first column. In the columns, we report the RDD estimates for leads, $t + 1$, $t + 2$, and $t + 3$, based on the kernel function identified in the respective column. “N” stands for the number of observations. All regressions include the following control variables: profitability, leverage, sales growth, firm age and assets. Robust standard-errors clustered at the application year level are reported in parentheses. Significance levels: ***, 1%; **, 5%; *, 10%. *Source:* Own computations using data from the *Portuguese Agency for Development and Cohesion* and *Central Balance Sheet*

Table 27 RDD estimation results — no grant vs. a single grant, manufacturing sector, micro- and small-sized firms

Dependent variable (in logs)	t+1		t+2		t+3	
	Triangular	Epanechnikov	Triangular	Epanechnikov	Triangular	Epanechnikov
Investment	2.401*** (0.491)	2.348*** (0.472)	2.455*** (0.658)	2.379*** (0.641)	2.118*** (0.529)	1.997*** (0.545)
<i>N</i>	1769	1769	1498	1498	1129	1129
Employment	0.143 (0.107)	0.142 (0.109)	0.230 (0.140)	0.220 (0.136)	0.298** (0.142)	0.292** (0.144)
<i>N</i>	1766	1766	1495	1495	1129	1129
Value-Added	0.213*** (0.078)	0.194** (0.077)	0.267*** (0.091)	0.268*** (0.095)	0.422** (0.164)	0.401** (0.157)
<i>N</i>	1731	1731	1478	1478	1129	1129
Labour Productivity	0.084 (0.057)	0.079 (0.054)	0.041 (0.123)	0.064 (0.119)	0.188* (0.102)	0.196* (0.101)
<i>N</i>	1729	1729	1477	1477	1129	1129
TFP	0.274 (0.175)	0.268 (0.167)	0.281* (0.159)	0.192 (0.161)	0.116 (0.146)	0.056 (0.144)
<i>N</i>	1761	1761	1486	1486	1124	1124

Notes: The dependent variable of each regression is defined in the first column. In the columns, we report the RDD estimates for leads, $t + 1$, $t + 2$, and $t + 3$, based on the kernel function identified in the respective column. “N” stands for the number of observations. All regressions include the following control variables: profitability, leverage, sales growth, firm age and assets. Robust standard-errors clustered at the application year level are reported in parentheses. Significance levels: ***, 1%; **, 5%; *, 10%. *Source:* Own computations using data from the *Portuguese Agency for Development and Cohesion* and *Central Balance Sheet*

Table 28 RDD estimation results — a single grant vs. two grants, manufacturing sector, micro- and small-sized firms

Dependent variable (in logs)	t+1		t+2		t+3	
	Triangular	Epanechnikov	Triangular	Epanechnikov	Triangular	Epanechnikov
Investment	0.460 (0.966)	0.634 (1.025)	0.116 (0.731)	0.332 (0.763)	0.278 (1.828)	0.504 (1.950)
<i>N</i>	254	254	232	232	223	223
Employment	0.249 (0.163)	0.264 (0.167)	0.256 (0.270)	0.278 (0.273)	0.209 (0.473)	0.235 (0.483)
<i>N</i>	254	254	232	232	223	223
Value-Added	0.456*** (0.166)	0.466*** (0.171)	0.253 (0.185)	0.261 (0.183)	0.514 (0.355)	0.546 (0.390)
<i>N</i>	250	250	231	231	223	223
Labour Productivity	0.193 (0.145)	0.185 (0.145)	-0.019 (0.141)	-0.027 (0.136)	0.275 (0.230)	0.278 (0.232)
<i>N</i>	250	250	231	231	223	223
TFP	0.811* (0.417)	0.779* (0.428)	0.851 (0.521)	0.808 (0.517)	1.225 (0.816)	1.159 (0.791)
<i>N</i>	253	253	231	231	222	222

Notes: The dependent variable of each regression is defined in the first column. In the columns, we report the RDD estimates for leads, $t + 1$, $t + 2$, and $t + 3$, based on the kernel function identified in the respective column. “N” stands for the number of observations. All regressions include the following control variables: profitability, leverage, sales growth, assets, firm age and amount of grant in the first grant. Robust standard-errors clustered at the application year level are reported in parentheses. Significance levels: ***, 1%; **, 5%; *, 10%. *Source:* Own computations using data from the *Portuguese Agency for Development and Cohesion* and *Central Balance Sheet*

Table 29 RDD estimation results — no grant vs. a single grant, excluding r&d grants, micro- and small-sized firms

Dependent variable (in logs)	t+1		t+2		t+3	
	Triangular	Epanechnikov	Triangular	Epanechnikov	Triangular	Epanechnikov
Investment	1.940*** (0.321)	1.915*** (0.313)	1.491*** (0.257)	1.411*** (0.225)	1.637*** (0.360)	1.649*** (0.365)
<i>N</i>	5386	5386	4627	4627	3874	3874
Employment	0.064 (0.054)	0.058 (0.052)	0.046 (0.052)	0.035 (0.050)	0.065 (0.053)	0.052 (0.052)
<i>N</i>	5356	5356	4601	4601	3874	3874
Value-Added	0.163** (0.074)	0.156** (0.072)	0.069 (0.082)	0.069 (0.079)	0.197** (0.094)	0.197** (0.093)
<i>N</i>	5226	5226	4519	4519	3874	3874
Labour Productivity	0.106*** (0.038)	0.105*** (0.038)	0.083** (0.040)	0.094*** (0.030)	0.109*** (0.035)	0.108*** (0.033)
<i>N</i>	5208	5208	4505	4505	3874	3874
TFP	0.044 (0.066)	0.035 (0.064)	0.019 (0.054)	-0.001 (0.053)	0.015 (0.055)	0.014 (0.059)
<i>N</i>	5275	5275	4515	4515	3782	3782

Notes: The dependent variable of each regression is defined in the first column. In the columns, we report the RDD estimates for leads, $t + 1$, $t + 2$, and $t + 3$, based on the kernel function identified in the respective column. “N” stands for the number of observations. All regressions include the following control variables: profitability, leverage, sales growth, assets, firm age and sector of activity. Robust standard-errors clustered at the application year level are reported in parentheses. Significance levels: ***, 1%; **, 5%; *, 10%. *Source:* Own computations using data from the *Portuguese Agency for Development and Cohesion* and *Central Balance Sheet*

Table 30 RDD estimation results — a single grant vs. two grants, excluding r&d grants, micro- and small-sized firms

Dependent variable (in logs)	t+1		t+2		t+3	
	Triangular	Epanechnikov	Triangular	Epanechnikov	Triangular	Epanechnikov
Investment	1.105** (0.489)	1.096** (0.482)	0.301 (0.749)	0.400 (0.675)	1.092 (1.064)	1.356 (1.076)
<i>N</i>	499	499	450	450	426	426
Employment	-0.010 (0.075)	0.010 (0.073)	0.007 (0.074)	0.031 (0.076)	-0.036 (0.196)	-0.017 (0.191)
<i>N</i>	499	499	450	450	426	426
Value-Added	0.227* (0.136)	0.245* (0.139)	0.097 (0.128)	0.114 (0.123)	0.282 (0.185)	0.305 (0.192)
<i>N</i>	488	488	440	440	426	426
Labour Productivity	0.276** (0.107)	0.270** (0.109)	0.170* (0.090)	0.157* (0.084)	0.288*** (0.110)	0.295*** (0.107)
<i>N</i>	487	487	440	440	426	426
TFP	0.213 (0.319)	0.193 (0.330)	0.198 (0.367)	0.175 (0.369)	0.271 (0.313)	0.263 (0.313)
<i>N</i>	491	491	443	443	415	415

Notes: The dependent variable of each regression is defined in the first column. In the columns, we report the RDD estimates for leads, $t + 1$, $t + 2$, and $t + 3$, based on the kernel function identified in the respective column. “N” stands for the number of observations. All regressions include the following control variables: profitability, leverage, sales growth, assets, firm age, amount of grant in the first grant and sector of activity. Robust standard-errors clustered at the application year level are reported in parentheses. Significance levels: ***, 1%; **, 5%; *, 10%. Source: Own computations using data from the *Portuguese Agency for Development and Cohesion* and *Central Balance Sheet*

Table 31 RDD estimation results — no grant vs. a single grant, excluding R&D grants, small-sized firms

Dependent variable (in logs)	t+1		t+2		t+3	
	Triangular	Epanechnikov	Triangular	Epanechnikov	Triangular	Epanechnikov
Investment	1.938*** (0.496)	1.892*** (0.473)	1.015*** (0.323)	0.984*** (0.323)	0.965*** (0.351)	0.954*** (0.356)
<i>N</i>	2877	2877	2492	2492	2030	2030
Employment	0.026 (0.075)	0.052 (0.076)	0.049 (0.096)	0.119 (0.091)	-0.001 (0.088)	0.013 (0.090)
<i>N</i>	2875	2875	2491	2491	2030	2030
Value-Added	0.160* (0.083)	0.169** (0.084)	0.104 (0.085)	0.112 (0.087)	0.116 (0.100)	0.114 (0.099)
<i>N</i>	2834	2834	2459	2459	2030	2030
Labour Productivity	0.136** (0.053)	0.131** (0.051)	0.126* (0.067)	0.130** (0.064)	0.158* (0.087)	0.151* (0.084)
<i>N</i>	2832	2832	2459	2459	2030	2030
TFP	-0.029 (0.115)	-0.024 (0.117)	-0.070 (0.106)	-0.090 (0.107)	-0.078 (0.114)	-0.089 (0.114)
<i>N</i>	2867	2867	2483	2483	2021	2021

Notes: The dependent variable of each regression is defined in the first column. In the columns, we report the RDD estimates for leads, $t + 1$, $t + 2$ and $t + 3$, based on the kernel function identified in the respective column. ‘N’ stands for the number of observations. All regressions include the following control variables: profitability, leverage, sales growth, assets, firm age and sector of activity. Robust standard-errors clustered at the application year level are reported in parentheses. Significance levels: ***, 1%; **, 5%; *, 10%. Source: Own computations using data from the *Portuguese Agency for Development and Cohesion* and *Central Balance Sheet*

Table 32 RDD estimation results — a single grant vs. two grants, excluding R&D grants, small-sized firms

Dependent variable (in logs)	t+1		t+2		t+3	
	Triangular	Epanechnikov	Triangular	Epanechnikov	Triangular	Epanechnikov
Investment	1.743*** (0.551)	1.684*** (0.510)	1.575* (0.941)	1.686* (0.909)	2.250* (1.198)	2.213** (1.128)
<i>N</i>	357	357	327	327	307	307
Employment	0.010 (0.087)	0.026 (0.089)	-0.005 (0.131)	0.006 (0.133)	0.011 (0.251)	0.012 (0.249)
<i>N</i>	357	357	327	327	307	307
Value-Added	0.515*** (0.191)	0.514*** (0.192)	0.240 (0.181)	0.223 (0.183)	0.528* (0.297)	0.502 (0.309)
<i>N</i>	354	354	325	325	307	307
Labour Productivity	0.435*** (0.145)	0.417*** (0.143)	0.268** (0.108)	0.245** (0.111)	0.444*** (0.146)	0.418*** (0.153)
<i>N</i>	354	354	325	325	307	307
TFP	0.441 (0.316)	0.372 (0.324)	0.368 (0.393)	0.283 (0.391)	0.337 (0.532)	0.267 (0.531)
<i>N</i>	357	357	326	326	304	304

Notes: The dependent variable of each regression is defined in the first column. In the columns, we report the RDD estimates for leads, $t + 1$, $t + 2$ and $t + 3$, based on the kernel function identified in the respective column. 'N' stands for the number of observations. All regressions include the following control variables: profitability, leverage, sales growth, assets, firm age, amount of grant in the first grant and sector of activity. Robust standard-errors clustered at the application year level are reported in parentheses. Significance levels: ***, 1%; **, 5%; *, 10%. Source: Own computations using data from the *Portuguese Agency for Development and Cohesion* and *Central Balance Sheet*

Table 33 RDD “donut” estimation results — no grant vs. a single grant, exclude applications with a score equal to 0

Dependent variable (in logs)	t+1		t+2		t+3	
	Triangular	Epanechnikov	Triangular	Epanechnikov	Triangular	Epanechnikov
Investment	2.109*** (0.297)	2.117*** (0.271)	1.656*** (0.278)	1.517*** (0.246)	2.022*** (0.290)	1.959*** (0.310)
<i>N</i>	6110	6110	5251	5251	4389	4389
Employment	0.159** (0.066)	0.150** (0.062)	-0.005 (0.059)	0.038 (0.060)	0.006 (0.054)	0.094 (0.068)
<i>N</i>	6081	6081	5223	5223	4389	4389
Value-Added	0.248*** (0.056)	0.240*** (0.050)	0.136* (0.072)	0.137* (0.074)	0.136** (0.064)	0.257*** (0.083)
<i>N</i>	5943	5943	5133	5133	4389	4389
Labour Productivity	0.126*** (0.043)	0.131*** (0.040)	0.051 (0.050)	0.094** (0.042)	0.124*** (0.044)	0.122*** (0.043)
<i>N</i>	5925	5925	5119	5119	4389	4389
TFP	0.013 (0.068)	0.016 (0.065)	0.010 (0.065)	-0.017 (0.061)	0.006 (0.061)	-0.002 (0.063)
<i>N</i>	6007	6007	5144	5144	4306	4306

Notes: The dependent variable of each regression is defined in the first column. In the columns, we report the RDD estimates for leads, $t + 1$, $t + 2$, and $t + 3$, based on the kernel function identified in the respective column. “N” stands for the number of observations. All regressions include the following control variables: profitability, leverage, sales growth, assets, firm age, size and sector of activity. Robust standard-errors clustered at the application year level are reported in parentheses. Significance levels: ***, 1%; **, 5%; *, 10%. Source: Own computations using data from the *Portuguese Agency for Development and Cohesion* and *Central Balance Sheet*

Table 34 RDD “donut” estimation results — no grant vs. a single grant, exclude applications with a score between -0.02 and 0.02

Dependent variable (in logs)	t+1		t+2		t+3	
	Triangular	Epanechnikov	Triangular	Epanechnikov	Triangular	Epanechnikov
Investment	2.266*** (0.273)	2.216*** (0.231)	1.806*** (0.332)	1.524*** (0.284)	1.864*** (0.315)	1.842*** (0.332)
<i>N</i>	6049	6049	5202	5202	4348	4348
Employment	0.161** (0.070)	0.138** (0.062)	-0.026 (0.052)	-0.007 (0.052)	-0.005 (0.048)	0.103* (0.061)
<i>N</i>	6020	6020	5174	5174	4348	4348
Value-Added	0.239*** (0.062)	0.213*** (0.054)	0.096 (0.062)	0.100 (0.074)	0.127** (0.053)	0.138** (0.057)
<i>N</i>	5886	5886	5085	5085	4348	4348
Labour Productivity	0.135*** (0.039)	0.137*** (0.036)	0.074 (0.048)	0.089** (0.045)	0.126*** (0.044)	0.121*** (0.043)
<i>N</i>	5868	5868	5071	5071	4348	4348
TFP	-0.036 (0.060)	-0.033 (0.057)	-0.008 (0.073)	-0.026 (0.068)	-0.002 (0.073)	0.004 (0.074)
<i>N</i>	5947	5947	5098	5098	4268	4268

Notes: The dependent variable of each regression is defined in the first column. In the columns, we report the RDD estimates for leads, $t + 1$, $t + 2$, and $t + 3$, based on the kernel function identified in the respective column. “N” stands for the number of observations. All regressions include the following control variables: profitability, leverage, sales growth, assets, firm age, size and sector of activity. Robust standard-errors clustered at the application year level are reported in parentheses. Significance levels: ***, 1%; **, 5%; *, 10%. Source: Own computations using data from the *Portuguese Agency for Development and Cohesion* and *Central Balance Sheet*

Table 35 RDD “donut” estimation results — no grant vs. a single grant, exclude applications with a score between -0.05 and 0.05

Dependent variable (in logs)	t+1		t+2		t+3	
	Triangular	Epanechnikov	Triangular	Epanechnikov	Triangular	Epanechnikov
Investment	2.221*** (0.279)	2.260*** (0.270)	1.526*** (0.320)	1.421*** (0.303)	1.761*** (0.445)	1.684*** (0.433)
<i>N</i>	5967	5967	5138	5138	4297	4297
Employment	0.166* (0.085)	0.161** (0.078)	-0.109** (0.048)	-0.063 (0.050)	-0.075 (0.048)	0.000 (0.060)
<i>N</i>	5939	5939	5111	5111	4297	4297
Value-Added	0.259*** (0.079)	0.203*** (0.066)	-0.045 (0.041)	-0.033 (0.043)	0.038 (0.055)	0.151** (0.070)
<i>N</i>	5806	5806	5024	5024	4297	4297
Labour Productivity	0.154*** (0.035)	0.147*** (0.032)	0.104** (0.052)	0.110** (0.054)	0.123*** (0.037)	0.122*** (0.039)
<i>N</i>	5788	5788	5010	5010	4297	4297
TFP	-0.005 (0.073)	-0.010 (0.069)	-0.037 (0.073)	-0.050 (0.066)	-0.050 (0.077)	-0.040 (0.080)
<i>N</i>	5867	5867	5036	5036	4218	4218

Notes: The dependent variable of each regression is defined in the first column. In the columns, we report the RDD estimates for leads, $t + 1$, $t + 2$, and $t + 3$, based on the kernel function identified in the respective column. “N” stands for the number of observations. All regressions include the following control variables: profitability, leverage, sales growth, assets, firm age, size and sector of activity. Robust standard-errors clustered at the application year level are reported in parentheses. Significance levels: ***, 1%; **, 5%; *, 10%. Source: Own computations using data from the *Portuguese Agency for Development and Cohesion* and *Central Balance Sheet*

Table 36 RDD “donut” estimation results — a single grant vs. two grants, exclude applications with a score equal to 0

Dependent variable (in logs)	t+1		t+2		t+3	
	Triangular	Epanechnikov	Triangular	Epanechnikov	Triangular	Epanechnikov
Investment	0.674 (0.457)	0.682 (0.425)	0.192 (0.567)	0.289 (0.544)	0.875 (0.963)	1.061 (0.944)
<i>N</i>	790	790	729	729	702	702
Employment	0.118 (0.080)	0.125 (0.078)	0.223* (0.116)	0.230** (0.112)	0.175 (0.176)	0.176 (0.166)
<i>N</i>	790	790	729	729	702	702
Value-Added	0.308*** (0.112)	0.307*** (0.107)	0.295** (0.139)	0.290** (0.129)	0.514*** (0.187)	0.513*** (0.196)
<i>N</i>	778	778	718	718	702	702
Labour Productivity	0.181** (0.083)	0.178** (0.081)	0.093 (0.068)	0.082 (0.065)	0.264*** (0.083)	0.268*** (0.092)
<i>N</i>	778	778	718	718	702	702
TFP	0.156 (0.235)	0.116 (0.235)	0.142 (0.252)	0.105 (0.252)	0.332 (0.217)	0.306 (0.215)
<i>N</i>	784	784	722	722	690	690

Notes: The dependent variable of each regression is defined in the first column. In the columns, we report the RDD estimates for leads, $t + 1$, $t + 2$, and $t + 3$, based on the kernel function identified in the respective column. “N” stands for the number of observations. All regressions include the following control variables: profitability, leverage, sales growth, assets, amount of grant in the first grant, firm age, size and sector of activity. Robust standard-errors clustered at the application year level are reported in parentheses. Significance levels: ***, 1%; **, 5%; *, 10%. Source: Own computations using data from the *Portuguese Agency for Development and Cohesion* and *Central Balance Sheet*

Table 37 RDD “donut” estimation results — a single grant vs. two grants, exclude applications with a score between -0.02 and 0.02

Dependent variable (in logs)	t+1		t+2		t+3	
	Triangular	Epanechnikov	Triangular	Epanechnikov	Triangular	Epanechnikov
Investment	0.576 (0.614)	0.589 (0.560)	-0.115 (0.602)	0.018 (0.569)	0.801 (0.975)	1.007 (0.961)
<i>N</i>	776	776	717	717	690	690
Employment	0.168* (0.088)	0.169** (0.085)	0.321** (0.135)	0.312** (0.127)	0.300 (0.191)	0.279 (0.177)
<i>N</i>	776	776	717	717	690	690
Value-Added	0.365*** (0.126)	0.356*** (0.118)	0.360** (0.153)	0.341** (0.139)	0.606*** (0.196)	0.585*** (0.203)
<i>N</i>	764	764	706	706	690	690
Labour Productivity	0.184* (0.097)	0.177* (0.092)	0.050 (0.074)	0.041 (0.071)	0.212** (0.103)	0.220** (0.108)
<i>N</i>	764	764	706	706	690	690
TFP	-0.112 (0.271)	-0.115 (0.265)	-0.190 (0.263)	-0.178 (0.262)	0.169 (0.240)	0.169 (0.241)
<i>N</i>	770	770	710	710	679	679

Notes: The dependent variable of each regression is defined in the first column. In the columns, we report the RDD estimates for leads, $t + 1$, $t + 2$, and $t + 3$, based on the kernel function identified in the respective column. “N” stands for the number of observations. All regressions include the following control variables: profitability, leverage, sales growth, assets, amount of grant in the first grant, firm age, size and sector of activity. Robust standard-errors clustered at the application year level are reported in parentheses. Significance levels: ***, 1%; **, 5%; *, 10%. Source: Own computations using data from the *Portuguese Agency for Development and Cohesion* and *Central Balance Sheet*

Table 38 RDD “donut” estimation results — a single grant vs. two grants, exclude applications with a score between -0.05 and 0.05

Dependent variable (in logs)	$t + 1$		$t + 2$		$t + 3$	
	Triangular	Epanechnikov	Triangular	Epanechnikov	Triangular	Epanechnikov
Investment	0.286 (0.743)	0.345 (0.659)	-0.123 (0.690)	0.014 (0.640)	0.617 (0.921)	0.855 (0.943)
N	762	762	706	706	680	680
Employment	0.159** (0.062)	0.165*** (0.062)	0.328*** (0.075)	0.319*** (0.077)	0.300* (0.154)	0.280* (0.146)
N	762	762	706	706	680	680
Value-Added	0.379** (0.153)	0.369*** (0.143)	0.374*** (0.122)	0.350*** (0.112)	0.558*** (0.204)	0.546** (0.213)
N	751	751	695	695	680	680
Labour Productivity	0.246* (0.141)	0.229* (0.127)	0.050 (0.080)	0.039 (0.074)	0.206** (0.084)	0.216** (0.095)
N	751	751	695	695	680	680
TFP	-0.114 (0.368)	-0.120 (0.348)	-0.268 (0.354)	-0.243 (0.342)	0.111 (0.304)	0.121 (0.300)
N	756	756	699	699	669	669

Notes: The dependent variable of each regression is defined in the first column. In the columns, we report the RDD estimates for leads, $t + 1$, $t + 2$, and $t + 3$, based on the kernel function identified in the respective column. “N” stands for the number of observations. All regressions include the following control variables: profitability, leverage, sales growth, assets, amount of grant in the first grant, firm age, size and sector of activity. Robust standard-errors clustered at the application year level are reported in parentheses. Significance levels: ***, 1%; **, 5%; *, 10%. Source: Own computations using data from the *Portuguese Agency for Development and Cohesion* and *Central Balance Sheet*

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Data Availability Statement The anonymized data from the Central Balance Sheet and Incentives Systems is made available by the Banco de Portugal Microdata Research Laboratory (BPLIM). Due to the confidentiality level of the data, it can only

be accessed using BPLIM’s server and cannot be shared openly. Researchers can access the data sources by opening a research project at BPLIM. Details on accessing the data can be found on BPLIM’s site: <https://bplim.bportugal.pt>. Requests for data access can be emailed to: bplim@bportugal.pt. The authors will make available the code underlying the data assembly and analysis that replicates the tables and figures presented in the paper.

Declarations

Conflict of interest The authors declare no competing interests.

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