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Working Paper

Size matters? Impact evaluation of business development grants on SME performance

Working Papers in Economics and Statistics, No. 2019-14

Provided in Cooperation with:

Institute of Public Finance, University of Innsbruck

Suggested Citation: Srhoj, Stjepan; Lapinski, Michael; Walde, Janette F. (2019) : Size matters? Impact evaluation of business development grants on SME performance, Working Papers in Economics and Statistics, No. 2019-14, University of Innsbruck, Research Platform Empirical and Experimental Economics (eecon), Innsbruck

This Version is available at:

<https://hdl.handle.net/10419/207080>

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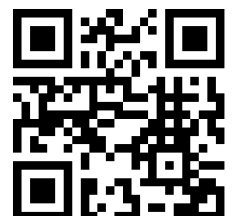


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Working Papers in Economics and Statistics

2019-14



University of Innsbruck
Working Papers in Economics and Statistics

The series is jointly edited and published by

- Department of Banking and Finance
- Department of Economics
- Department of Public Finance
- Department of Statistics

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Size matters? Impact evaluation of business development grants on SME performance

Abstract

Many international organisations emphasize the need of public grant schemes evaluations. An evaluation provides the opportunity to assess the socio-economic impact achieved by the grant and allows for a refinement of such policy instruments in order to make public funding more effective in achieving the objectives. In this paper, we investigate the effects of a business development grant scheme. More specifically we question whether firms' performance measures increased after participating in this grant scheme. Methodically, we match grant receiving firms with grant non-receivers and estimate the average treatment effect on the treated using a two way fixed effects regression. Our results point towards a positive effect of the grant scheme, which is particularly evident for firms of smaller size. Our estimated dose-response functions show that the share of grant amount in firm profits needs to be high enough for the grants to be effective. According to back-of-the envelope analysis, benefits outweigh the direct scheme costs.

Keywords: business development grants; policy evaluation; two-way fixed effects regression; matching; heterogeneous treatment effects; dose-response-function

JEL: C21; G01; H23; H50; O38

1. Introduction

The recent decade has seen an increase in availability of micro firm data which in turn has enabled researchers to provide detailed insights into effectiveness of industrial policy measures. From work of Klette, Moen and Griliches (2000) to recent work of Freel, Liu and Rammer (2019) impact evaluations of research and development (R&D) grants have mostly found positive effects on R&D expenditures, innovation and firm performance. As opposed to R&D grants, this paper focuses on business development grants for small and medium sized enterprises (SMEs). Compared to R&D grants business development grants provide smaller grant amounts and can benefit therefore a larger number of smaller beneficiaries, support acquisition of machinery, tools and equipment as well as firm's learning activities, and are targeted towards loosening capital constraints of smaller firms. These characteristics make business development grants an attractive tool for policy makers in (developing) countries (OECD, ETF, EU, EBRD, & SEECEL, 2016) where own R&D activities are scarce and technology upgrading dominates (Radosevic & Yoruk, 2018).

Literature on evaluating business development grants is sparse but of course evaluating business development grants share some of the problems of R&D grants evaluation. The central question in the impact assessment of a grant scheme is whether the firms would have done the subsidized activities regardless of the grant (Klette et al., 2000). Undesired substitution of public for private funds is more likely, when agencies award small grants to firms, as it is not yet clear what level of grant amount induce additionality. The advantage of providing grants to more companies carries the risk of substitution rather than additionality, which is particularly evident in the case of grants for business development. Recent studies analysing the impact of business development grants show mixed findings (e.g., McKenzie, 2017; Srhoj, Škrinjarić, & Radas, 2019). McKenzie (2017) finds positive effects of winning the business plan competition on capital stock, employment, sales, and profits. Srhoj et al. (2019) show positive effects of business development grants on firms' sales and employment, survival probability and access to bank loans, but only for one year old firms and no effects are found for two up to five year old firms. Both studies demonstrate the suitability of business developments grants but for young firms. The question remains whether these grants are just suitable for young firms to achieve positive effects on firm performance or whether in the context of grant success “young“ is more likely just a proxy for small firm size and its

corresponding characteristics. The optimal firm size in combination with grant size has not yet been investigated and is the focus of this paper.

Our theoretical economic framework describes the behaviour of capital constraint firms that can improve their production output if the constraint in capital (or labour) is relaxed. The easing of capital restrictions is therefore one reason why firm performance measures are expected to increase given the support via grants. On the other hand receiving a grant also certifies a firm's quality to banks and makes it easier to obtain a credit. This is the so called certification effect, which has been already investigated by Martí and Quas (2018) and Srhoj et al. (2019).

We expect the impact of a grant to be particularly relevant for smaller firms, which have been found to have stronger difficulties with credit constraints compared to larger firms (Rostamkalaei & Freel, 2016), and which have been found to have stronger learning benefits from importing inputs, machinery and equipment (Castellani & Fassio, 2019). In addition, we question the policy design and expect additionality to occur if the grant size is substantial enough (Hottenrott, Lopes-Bento, & Veugelers, 2017).

Hence, we investigate the following four research questions: *i)* Do business development grants have a positive impact on firms' performance, with a focus on firms that have been in the market for at least five years?, *ii)* Are business development grants more effective for smaller firms?, *iii)* Is there an appropriate measure to capture the turning point between substitution and additionality?, and *iv)* What is the macroeconomic effect of such policy measure?. For this purpose we evaluate the SME policy with which the *Ministry of Entrepreneurship and Crafts of the Republic of Croatia* awarded business development grants to SMEs. The sample of firms receiving the grant comprises 610 SMEs of which the important financial data is available in the period from 2004 up to 2016. This long period gives us the opportunity to observe the firms during a four year pre-treatment as well as a four year post-treatment period because the grants were received between 2008 and 2012. The corresponding financial data for the universe of firms is available. We use matching in order to achieve parallel time trends in many firms' performance measures in the pre-treatment period and estimate with a two-way fixed effects regression with and without control variables the average treatment effect on the treated (ATT). As firm performance measure we analyse firm-level capital inputs, labour inputs, outputs and productivity.

Results show considerable positive effects of business development grants on additional capital investments, evidence for the certification effect as additional bank loans are acquired, and additionality in value added. Following Munch and Schaur (2018) even stronger positive effects are found for firms below 20 employees. Within the sample of smaller firms we show that the ratio of grant amount over profits can be used to figure out the turning point between substitution and additionality. Our cost benefit analysis provides empirical support in favour of the business development grants. Public money of about €2.4 million increases the difference in capital stock of the grant and non grant receivers for almost twice the grant amount, releases bank loans in addition of about 1.5 times the grant amount, saves 163 jobs, and creates in the economic system value added per employee just above the grant scheme direct costs.

The rest of the paper is structured as follows: in the second section the theoretical background followed by a review of existing empirical evidences is given. Section 3 provides the institutional setting, and the fourth section gives details on data and methods. The fifth section gives results and the final section discussion and conclusions.

2. Theoretical and Empirical Background

The neoclassical assessment of the effectiveness of state support lies in the creation of input, output and behavioural *additionality* (Hall & Maffioli, 2008). The additionality in relation to grants signifies a higher increase in firm-level outcomes for a firm receiving the grant, as opposed to the situation where the same firm did not receive the grant (Czarnitzki & Delanote, 2015). Previous studies have focused mostly on R&D grants as a uniform type of grants, however, recently (Clausen, 2009; Hottenrott et al., 2017) researchers started to disentangle R&D grants into research grants and development grants, as these two types are related but apply to different types of activities (Czarnitzki, Hottenrott, & Thorwarth, 2011; OECD, 2002). As opposed to research activities, the development activities (1) are closer to the market (OECD, 2002), (2) have lower level of informational asymmetry between the firm and external financiers (Arrow, 1962), (3) lower uncertainty of project outcomes (Czarnitzki et al., 2011), (4) are publicly supported with lower grant amounts (Hottenrott et al., 2017), (5) and need a shorter time span for a measurable impact (Clausen, 2009).

Theoretically, we are considering a partial equilibrium model (McKenzie, 2017) with firm's production function $f(A, K, L)$, where K denotes capital, L labor and A total factor productivity. Assuming that capital may be restricted by the value \bar{K} , the following Lagrange function l is maximized varying K and L (and the Lagrange multiplier δ), i.e

$$l(K, L, \delta) = p \cdot f(K, L, A) - r \cdot K - w \cdot L - \delta \cdot (K - \bar{K}), \quad (1)$$

where p is the outcome price, r the interest rate, and w the wage. Besides the first order conditions of the Lagrange function the additional Kuhn-Tucker condition indicates that the optimal Lagrange multiplier fulfills $\delta^* \geq 0$ with $\delta^* = 0$ if $K < \bar{K}$. With $\delta^* = \frac{\partial f^*}{\partial \bar{K}} \left(\sim \frac{\Delta f^*}{\Delta \bar{K}} \right)$, for firms that are not capital constraint an increase in output performance will not be observed. These firms are already in their optimum and thus the grant amount will just be used to substitute firms' own capital (substitution effect, substitution of public for private funds, (Michalek, Ciaian, & Kancs, 2015)). On the other hand with capital restriction ($\delta^* \geq 0$) the grant money implies $\Delta \bar{K} > 0$ and therewith in general an increase in the optimal value of the output, i.e. $\Delta f^* > 0$ (additionality effect), is the consequence. The grant scheme can lower capital constraints of the firm directly via the grant amount and indirectly via certifying the firm to bank lending (Martí & Quas, 2018).

Such an increase in the optimal value of the objective function depends on the size of the Lagrange multiplier in the optimum and the size of the grant amount or $\Delta \bar{K}$ respectively. According to the grant scheme design the size of the grant is associated with the firm size but in general rather small. We therefore expect different increases in the objective function depending on the size of the firm. Regarding econometric analysis, this leads to heterogeneous average treatment effects according to firm size. Furthermore, within a relatively similar firm size group (in our case less than 20 employees) we estimate the dose-response function of the grant in order to investigate the existence of an optimal grant amount. There is a discussion on how to achieve additionality and not substitution in the literature by calibrating the grant amount in an optimal way (e.g. Marino, Lhuillery, Parrotta & Sala, 2016). To estimate the dose-response function we use a relative measure for the grant dose, the grant amount relative to the firm's previous year's profits, in order to take into account firm size, its internal finances and grant size in estimating additionality of different dosages.

An additional type of effect of a capital increase might be observed. If the firm is heavily credit-constrained and has previously substituted capital for labor this firm will reduce

workers once capital can replace them again. If capital and labor are complements, more capital will enable the firm to hire more workers.

Therefore, the greater the capacity of the agency to award grants to entrepreneurs with capital constraints, the greater the impact of the development grant scheme. If this ability is low, no effect is expected.

Empirical evidences

Researchers have mostly analyzed the effects of R&D grants on R&D expenditures (David, Hall, & Toole, 2000; Edler, Cunningham, & Gök, 2016). Hottenrott et al. (2017) analyze the impact of both research grants and development grants on R&D expenditures, but find no evidence for an impact of development grants. This can be explained by the fact that close-to-market activities should rather influence firm's output directly through an increase in capital and/or labour (McKenzie, 2017). Therefore, our variables to be examined are firm performance indicators such as value added and sales.

Regarding output additionality most researchers investigate whether grants induce additional profits, turnover, and/or employment (Howell, 2017; Srhoj et al., 2019), while input additionality has been analyzed on additionality in capital stock/investments and R&D expenditures (Howell, 2017; Michalek et al., 2015). Although employment is generally an input of the production function, literature often considers it as output because some grant schemes have an explicit goal to increase firm employment. Previous studies find a positive grant impact on employment (Butler, Galassi, & Ruffo, 2016; Colombo, Giannangeli, & Grilli, 2013; Criscuolo, Martin, Overman, & Van Reenen, 2016; Girma, Görg, Strobl, & Walsh, 2008; McKenzie, 2017). The impact on turnover shows mixed findings, some authors find no impact (e.g. Butler et al., 2016), while others find a positive impact (Howell, 2017; McKenzie, 2017). Impacts on profits also have mixed support. Michalek et al. (2015) find negative grants impact, while McKenzie (2017) finds a positive impact of grant awards. Many researchers do not evaluate output additionality together with input additionality (i.e., both capital and labor) but focus on one of these (Colombo et al., 2013; Girma et al., 2008). The papers in which the mechanisms of output additionality are studied show mixed findings. Howell (2017) finds output additionality to be achieved via an increase in capital stock, McKenzie (2017) shows output additionality via both an increase in capital stock and

employment. However, Michalek et al. (2015) show firms' capital investments to be crowded-out up to 100%.

There is even less clarity about the impact of grants in Central and South East Europe. Some papers find a positive impact on employment (Bah, Brada, & Yigit, 2011; Burger & Rojec, 2018), and others no impact (Brown, Earle, & Lup, 2005; Srhoj et al., 2019). Evidences for no impact on turnover can be found in the literature (Brown et al., 2005; Burger & Rojec, 2018; Srhoj et al., 2019), as well as evidences for positive effects (Radas, Anić, Tafro, & Wagner, 2015). Srhoj et al. (2019) show empirical evidence for grants acting as a governmental stamp that signals quality of firms to banks – the so called certification effect which implies positive effect on obtaining bank loans. Finally, evidence is found for positive grant effects on labor productivity, but negative on total factor productivity (TFP) (Dvouletý & Blažková, 2019). More details to the cited papers can be found in Table A1 in the Appendix.

Only few articles in the literature consider heterogeneous treatment effects with regard to firms of different sizes. Although theoretical literature already acknowledges firm size heterogeneity, for example the difficulties of smaller firms in acquiring loans (Hall & Lerner, 2009), in facing credit rationing (e.g., Stiglitz & Weiss, 1981; Vos, Yeh, Carter, & Tagg, 2007) or informational barriers to enter foreign markets (Munch & Schaur, 2018). Impact assessment studies (in Eastern and South-Eastern Europe) have largely neglected these issues. In accessing bank financing, compared to large and established firms small firms are disadvantaged by their information opacity, the relative scarcity of collateralisable assets, and disproportionately high monitoring costs (Beck & Demirguc-Kunt, 2006). The increase in capital may enhance the opportunities for small enterprises in particular to import intermediate inputs and capital goods. As Rostamkalaei and Freel (2016) show, especially for smaller firms, such an import can be a particularly efficient way to strengthen the ability of firms to improve or innovate their own products for export markets and ultimately increase their export competitiveness. Concerning grants Criscuolo et al. (2016) find a positive impact on the investments of micro-firms, but not for large firms. Similarly Bronzini and Piselli (2016) demonstrate that R&D subsidies have a much greater positive effect on the innovation of smaller firms than of larger firms. Le and Jaffe (2017), on the other hand, consider the impact of R&D grants on innovation outcomes to be important for larger firms, but not for smaller firms. Because the findings are that mixed, further studies on the impact of grants with respect to different firm sizes are needed.

Dose response functions (DRFs) can be used to investigate whether different amounts of funding have different effects on firm performance (Biagi, Bondonio, & Martini, 2015; Bondonio & Greenbaum, 2014; Burger & Rojec, 2018). In this way, both the minimum grant amount necessary for a positive effect and the amount giving the highest effect can be determined. Here, too, the literature shows mixed results. Bondonio and Greenbaum (2014) find almost linearly increasing employment effects depending on the amount of capital grants per firm. Biagi et al. (2015) find linear, increasing effects on capital investment for micro and small firms, while in the sample of medium-sized firms they find larger grant amount to be ineffective. A minimum threshold is also found by Burger and Rojec (2018) who do not find any effects from grants below €3,800. Hottenrott et al. (2017) and Marino, Lhuillery, Parrotta & Sala (2016) who evaluate the effects of R&D grants on R&D expenditures find similar shapes of DRFs as those for medium-firms investigated by Biagi et al. (2015).

3. Institutional Setting

During the period 2008-2015, the *Ministry of Entrepreneurship and Crafts of the Republic of Croatia*¹ was in charge of the vast majority of grant schemes in the Republic of Croatia. The policy basis for these grant schemes can be found in the policy documents entitled *Operational Plan of Incentives for Small and Medium Entrepreneurship* (OPPMSP, 2008; 2009; 2010; 2011) and *Entrepreneurial impulse: Plan of Incentives for Entrepreneurship and Craftsmanship* (MINPO, 2012; 2013; 2014; 2015). The grant schemes under the umbrella of this ministry encompassed development grants, start-up grants, grants for women entrepreneurs, grants for people with disabilities and grants for learning of craftsman. In addition, *Ministry of Economy and Industry of the Republic of Croatia* and Business Innovation Centre (BICRO) and Croatian Agency for SMEs (HAMAG) provided R&D grants and grants for targeted support of industries, such as shipbuilding or textile industries.

The focus of this paper is on development grants which support *close-to-market* activities, including investment in development and procurement of new technologies – acquisition of machinery, tools and equipment and technological development (Hottenrott et al., 2017). These grants were designed as matching grants, implying that firms had to match the public funds with their own private funds. The selection procedure always followed the following

¹ Please note the name of the Ministry changed. In the period, it was firstly *Ministry of Economy, Labour and Entrepreneurship*, then *Ministry of Entrepreneurship and Crafts*, and is currently (2018) part of the *Ministry of Economy, Entrepreneurship and Crafts*.

steps. Firstly, at the beginning of each year a public grant call was published online, setting out the conditions under which applications could be submitted. Secondly, firms had to develop a project proposal, gather supplementary documents and apply for the grants. Thirdly, two expert groups, one from the ministry and one independent, comprised of academics, business consultants and chamber officials evaluated the proposed idea on various dimensions, primarily project feasibility, project's impact, and firm's capacity to conduct the proposed project, given these dimensions, all grant applications were ranked. The results of the selection procedure and the names of the individual applicants were not provided by the respective ministry. Only the names of the firms that received the grants were available.² The two expert groups could have conflicting views on the project proposals and, if so, a third expert group was consulted for a final decision. Fourthly, if the project application was rated high enough, the ministry's finance team offered the firm a grant amount after analysing the potentially excessive costs in the project application. The firm could then choose whether to sign the contract and the white bill by which it undertook to carry out the planned activities (more details of subsidized activities can be found in the Appendix Table A2).

4. Data and Methods

4.1 Data

Two datasets are used in the analysis. The first dataset is provided by the *Ministry of Entrepreneurship and Crafts of the Republic of Croatia*, which gives information on organizations that benefited from the grants in the period 2008-2016, encompassing organization name, grant scheme name, grant amount and grant year. The second dataset is the *Annual Financial Statements Registry of the Republic of Croatia* database with profit and loss statements, balance sheets and firm demographic information of all the limited liability and joint-stock firms in the Republic of Croatia for fourteen years (2003–2016) encompassing 380 financial variables.

As the grant programmes under evaluation were active in the period 2008-2012, the 2003-2016 period gives enough pre-treatment and post-treatment period for matching and subsequent impact evaluation. In order to obtain reliable results, the dataset is cleaned up as follows. In line with impact evaluation literature (e.g., Czarnitzki & Delanote, 2015) we focus

² An official letter stating this data unavailability is available upon request. The application success rates ranged from 47% to 50% (OPPMSP, 2008; 2009; 2010; 2011; MINPO, 2012; 2013; 2014).

on firms which received just a single grant in a specific year in order to avoid endogeneity of subsequent treatments. We discard firms that received their grants after 2012 in order to prevent shorter post-treatment periods. Following Hottenrott et al. (2017), firms receiving R&D grants from BICRO and HAMAG are discarded to focus on the effect of development grants and thus avoid potential cross-scheme effects. For the same reasons firms receiving grants from targeted industry schemes from the *Ministry of Economy and Industry of the Republic of Croatia*³ are discarded too. We discard firms benefiting from entrepreneurship policies which are particularly small and firms only benefiting from obtaining bank loans. In addition, craft firms that are not obliged to report by the corporate tax law are discarded due to their missing covariates (as in Peric & Vitezic, 2016; Srhoj et al., 2019). Finally, firms with yearly wage or turnover less €700 (about 5,000 kunas), firms with no employees and firms with operating loss are discarded as they are no candidates for a grant. The remaining number of single treated firms is 610 firms, and the number of potential control firms in the 2008-2012 period ranges from 14,434 up to 16,386 firms per year. The mean grant amount is €9,068 with standard deviation of €5,570. Further descriptive statistics of the treated and in principle available control firms is given in Table A3 in the Appendix.

4.2 Methods

The investigation strategy consists of four steps. First, we use matching to find a control firm for each treated firm that is as similar as possible in the firm characteristics. After matching the treatment variable is closer to being independent of the background covariates. This has numerous advantages like less dependence of the estimates on modelling choices and specifications or less potential for bias due to confounding control variables (Ho et al., 2007). Two way fixed effects regression (time and firm fixed effects) with and without control variables are employed in order to estimate the average treatment effect on the treated (the grant receivers). Further, heterogeneity with respect to firm size is investigated by dividing the sample into firms with 1 up to 20 employees and into the group of firms with more than 20 employees according to the approach of Munch and Schaur (2018). For each group of firms matching, checking balance properties and ATT estimation are then carried out again. Finally, dose-response-functions are computed to investigate the impact of various grant sizes within the group of smaller firms.

³ This grant scheme targeted industries like shipbuilding or textile and therefore many similar firms benefited from this scheme, which makes obtaining a good counterfactual particularly difficult.

Matching

Although propensity score matching procedures are commonly used we follow in a first step King and Nielsen (2016) who argue in favour for distance measures and use Mahalanobis distance as distance metric. For matching we use all outcome variables in the pre-treatment period in order to obtain parallel trends over time of the firms before treatment. The variables out of the financial reports are also matched between treated and control firms in the four years before the year the grant is received (thus exclusively in each year of the pre-treatment period) (Chabé-Ferret, 2017). The additional variables in the matching approach are described below and we employ perfect matching on NACE 2-digit sectors.

The matching approach is based on the conditional independence assumption, stating that given the set of covariates the selection into treatment is as if random. It is crucial to include all the important observable covariates that affect outcome variables and the assignment to treatment. For this reason, the richness of our dataset is essential for identification. In the matching procedure, we employ a dummy indicating whether a firm has more than 50% foreign ownership. This variable is included because the scheme could favor domestic firms. An additional dummy variable indicates if the firm's headquarters are in the county where the national political party is the same as the county's political party. This dummy is inserted to pick-up potential political biases in the evaluation process, given that politicians at the local level could be tempted to lobby for owners of firms who support them in the elections or are connected to them in other ways. To capture the trade status of firms dummy variables are included indicating whether firms are only exporting, only importing, two-ways traders (both export and import) or domestic producers (do not import nor export). Firms' age and firms' age squared are included, as well as a dummy for the capital region. Finally, dummies for NACE two-digit industry sectors are included (cf. Table A3).

As we follow Chabé-Ferret (2017) and condition on pre-treatment outcomes for four pre-treatment periods, the following outcome variables are transformed and used in the matching procedure. The number of employees and log sales are included based on the re-examination of Gibrats' law showing that previous sales and employment are correlated with the present values (Peric & Vitezic, 2016). The average wage is included as a proxy for human capital. In line with the theoretical model, we include log non-current, log current debts, log bank loans as well as the debt ratio. Log tangible assets are included to control for firms pre-treatment capital level and log raw materials to capture intermediate inputs. TFP is calculated with Levinsohn-Petrin method (Levinsohn & Petrin, 2003) using Akerberg-Caves-Frazer

correction for each NACE 2-digit separately (details in Table A3) and is included to capture the unobserved effectiveness of transforming capital, labour, and intermediate inputs into outputs. The log-transformed sum of four-year investments and the logarithmized sum of four-year R&D expenditures are included. These variables are important because the ministry could favor those firms investing prior to the grant application. Log intangible assets are included as agencies could favor firms with higher knowledge stock. Finally, export intensity, import intensity in period $t-1$ are included as well as change in these intensities from $t-2$ to $t-1$ (Munch & Schaur, 2018). The complete list of variables is provided in Table A3.

After a successful matching, the observed empirical density of the covariables is the same for treated and control firms. All outcome variables of both groups must have parallel time trends in the pre-treatment period (Angrist & Pischke, 2010). These prerequisites are checked before moving on to the estimation of the models.

Average treatment effect on the treated (ATT)

With the matched firms the two-way fixed effects models are estimated with and without control variables (X_{it}):

$$Y_{it} = \alpha_i + D_t + \delta_{ATT}TREAT_{it} + \theta X_{it} + \varepsilon_{it}, \quad (2)$$

where α_i are the firm ($i = 1, \dots, 610$) and D_t the time fixed effects ($t = 2004, \dots, 2016$); $TREAT_{it}$ is a dummy being 1 for the treated firms in their post-treatment period and 0 otherwise, thus the parameter of interest is δ_{ATT} , the average treatment effect on the treated; X_{it} are the control variables with their corresponding regression parameters (θ) where we include time varying firm characteristics like age, firm size, and trade status, and ε_{it} is the remainder noise. Match-level clustered standard errors are employed (Abadie & Spiess, 2019).

Following Munch and Schaur (2018) we split our sample according to the number of employees into firms with 1 up to 20 employees and firms with more than 20 employees and compute the two-way fixed effects regressions for each subsample. In this way heterogeneous treatment effects may be identified.

Dose-response-function (DRF)

In order to investigate the grant scheme design, i.e. the effectiveness of various grant sizes, we estimate DRFs. Relying on the *growth of the fitter principle* (Nelson & Winter, 1982) we compute the grant dose as grant amount over profits in period $t-1$. This ratio is employed because internal finances are found to be important for spurring firm growth (Coad, Cowling, & Siepel, 2017; Coad & Srhoj, 2019). A too small grant amount, more specifically a too low share of grant amount over profits, is hardly perceived or considered as an important factor in loosening capital constraints. On the other hand, a high share of grant amount over profits points to a higher chance of the grant being important in loosening capital constraints.

For smaller firms we estimate separately the ATT with respect to defined bins. The bin sizes are set as the 33rd- and 66th-percentile of the amount of grant over profits, in this way we obtain three bins with more or less the same number of firms.

Placebo test and robustness check

For the placebo test we discard the treated firms, make the control firms of our main specification to the placebo treated group and conduct the entire procedure again (matching, checking assumptions, estimating ATT).

As propensity score matching is commonly used we employ this kind of matching as a robustness check. With the propensity score of the estimated probit model we conduct the matching procedure. For the probit model we employ a rich set of independent variables, thus neglecting for example multicollinearity between these variables, as the focus of this exercise lies on the estimation of the propensity score and not on the appropriate estimation of the estimates' standard errors. Again exact matching with respect to NACE 2-digit sectors is used and all matching variables are only in the pre-treatment period used.

Additionally, we employ one, two and three nearest neighbours matching, caliper matching, and inverse probability weighted regression adjustment (IPWRA). With the former approaches we check for efficiency gains. After each matching procedure the covariates' balance is checked (for example via empirical quantile-quantile plots), the distribution overlap of the propensity score of treated and control firms is evaluated, the reduction in standardized bias is checked as well as the parallel trend assumptions. After each type of matching we compute the two-way fixed effects models again. For the doubly robust IPWRA we calculate weights based on our probit model from the one nearest neighbour specification (van der Wal & Geskus, 2011) and then compute the two-way fixed effects weighted regression.

All analyses are done in R (R Core Team, 2014) with the packages *MatchIt* (Ho, Imai, King, & Stuart, 2011), *ipw* (van der Wal & Geskus, 2011), and *multiwayvcov* (Graham, Arai, & Hagstromer, 2016).

5 Results

5.1 Matching

The number of treated firms is 610. After Mahalanobis distance matching we obtain 541 pairs of treated and control firms. Descriptive statistics about the 69 firms for which no match is found reveals that these firms are mainly larger firms. The mean of employees of the not included treated firms is 70 whereas the mean of the matched treated firms is only 23. The excluded firms by Mahalanobis distance matching have also a higher mean export intensity (on average 23% versus 11%).

Comparing the treated with the matched control firms, we can conclude that the covariates' distributions are sufficiently close for the treated and control firms (details are provided in Table A3) and the pre-treatment parallel trend assumption is fulfilled appropriately (cf. Figure 1).

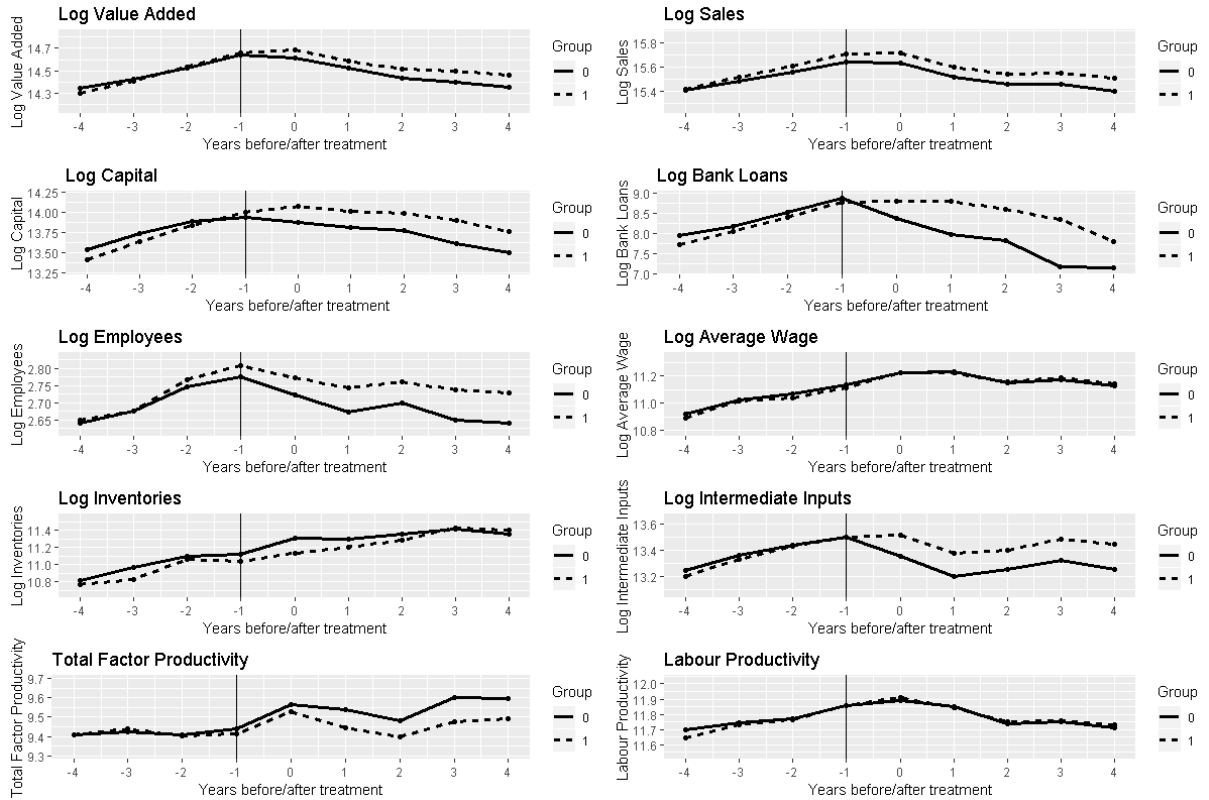


Figure 1. The trends in outcome variables after matching with Mahalanobis distance measure. The zero on the x-axis indicates the year when firms received the grant, negative values indicate pre-treatment period. The dashed line represents the treated group (1), while the solid line represents the control group (0). Parallel trend assumption holds also for the levels of the outcome variables, results are available upon request.

The decrease in the outcome performance measures may also be contributed to the specific context of the long recession period (2009-2014) in Croatia.

5.2 Average treatment effect on the treated (ATT)

The results of our two parametric models are shown in Table 4. The results remain robust over both model specifications indicating the achievement of a rather appropriate separation of the treatment variable from the covariates. The second (fourth) column shows the estimated coefficients of the two-way fixed effects regression without (with) control variables, two-sided p values are computed with robust standard errors.

Table 4. The impact of grants (ATT) on SME performance

Outcome	ATT	p value	ATT	p value
Log value added (truncated)	0.087* (0.036)	0.015	0.079* (0.033)	0.017
Log sales	0.058 (0.033)	0.082	0.052 (0.031)	0.096
Log capital	0.123** (0.046)	0.008	0.096* (0.042)	0.022
Log bank loans	0.701* (0.282)	0.013	0.696* (0.282)	0.013
Log employees	0.047 (0.026)	0.068	0.038 (0.021)	0.073
Log average wage	0.067 (0.038)	0.079	0.065 (0.038)	0.087
Log inventories	0.237 (0.140)	0.091	0.231 (0.139)	0.098
Log intermediate inputs	0.215** (0.076)	0.004	0.206** (0.073)	0.005
TFP	-0.044 (0.043)	0.307	-0.034 (0.042)	0.417
Log labor productivity (value added)	0.040 (0.029)	0.168	0.041 (0.030)	0.171
Controls	No		Yes	
Number of observations	9,738			

Note: * p<0.05; ** p<0.01; robust standard errors are given in brackets. Both models are two-way fixed effects regressions.

We find evidence that for grant receivers firms' value added improved by about 7.9% on average compared to non-receivers *ceteris paribus* (c.p.). Grants increased on average capital stock (9.6%), intermediate inputs (20.6%) and bank loans (69.6%). No empirical support is found for a positive effect on TFP, value added per employee, sales, average wage, and inventories.

4.3 Heterogeneous treatment effect according to firm size

We split the sample into firms with 1 up to 20 employees (354 treated firms in this subsample) and firms above 20 employees (187 treated firms in the subsample). The firms of smaller size have on average 8.6 employees (1st quartile = 4, median = 8, 3rd quartile = 12.75) and the larger firms 52.6 employees (1st quartile = 28, median = 40, 3rd quartile = 58.5).

Table 5 presents our findings. We observe that the grants provided are most effective for firms below 20 employees. For the smaller firms, receiving a grant has on average a positive effect on capital stock (14.7%), bank loans (67.6%), intermediate inputs (18.6%), employees (5.6%), average wage (7.1%), value added (10.9%), sales (5.9%), and log value added per employee (5.3%). These results indicate that the grant scheme increases firm performance of smaller firms significantly.

Table 5. The impact of grants (ATT) with respect to firm size

Outcome	1-20 employees (n=6,048)		20 and more employees (n=4,356)	
	ATT	p value	ATT	p value
Log value added (truncated)	0.109*** (0.021)	0.000	0.014 (0.043)	0.745
Log sales	0.059*** (0.017)	0.000	0.012 (0.046)	0.794
Log capital	0.147* (0.059)	0.013	0.080 (0.095)	0.403
Log bank loans	0.676*** (0.191)	0.000	0.899* (0.390)	0.021
Log employees	0.056** (0.018)	0.003	-0.009 (0.044)	0.833
Log average wage	0.071** (0.025)	0.005	0.043 (0.046)	0.360
Log inventories	0.111 (0.101)	0.275	0.106 (0.184)	0.565
Log intermediate inputs	0.186*** (0.048)	0.000	-0.050 (0.110)	0.651
TFP	-0.075 (0.043)	0.081	0.017 (0.088)	0.844
Log value added per employee	0.053* (0.023)	0.023	0.023 (0.052)	0.656

Note: * p<0.05; ** p<0.01. ***. p<0.001; robust standard errors are given in brackets. Models are two-way fixed effects regressions with controls.

Table 5 also shows a positive effect of grants on larger firms' bank loans, but no statistically significant effect on value added, sales, employment, capital, intermediate inputs or productivity measures. Regarding firm size the impact is heterogeneous.

4.4 Dose-response-function (DRF)

To estimate the DRFs we focus on firms up to 20 employees as these show a significant impact of the grant. Table 6 shows the estimates of the DRFs for the outputs, labor and capital inputs. We find evidence that a lower dose (grant amount/profit_{t-1} below 9%) yields no statistically significant positive effect on any of the firm performance measures. A medium dose (grant amount/profit_{t-1} between 9% and 43%) shows positive effects on outputs, capital and labour inputs, with no statistically significant positive effect on productivity measures. The highest dose (grant amount/profit_{t-1} above 43%) shows on average highest positive effects on capital stock (37.8%) and bank loans (178.1%) with positive effects on outputs and labour similar to medium dose.

Table 6. Dose response functions for firms with 1 up to 20 employees

Outcome	Dose 1 grant amount/ profit _{t-1} ·100 < 9%		Dose 2 9% - 43% range of grant amount/profit _{t-1} ·100		Dose 3 grant amount/ profit _{t-1} ·100 > 43%	
	ATT	p value	ATT	p value	ATT	p value
Log value added (truncated)	0.049 (0.034)	0.148	0.123 (0.036)	0.001	0.111 (0.035)	0.002
Log sales	0.033 (0.027)	0.224	0.084 (0.033)	0.011	0.094 (0.029)	0.001
Log capital	-0.049 (0.085)	0.562	0.239 (0.086)	0.005	0.378 (0.125)	0.002
Log bank loans	0.092 (0.358)	0.798	0.892 (0.315)	0.005	1.718 (0.314)	0.000
Log employees	0.006 (0.005)	0.251	0.062 (0.024)	0.009	0.054 (0.022)	0.014
Log average wage	0.061 (0.036)	0.092	0.008 (0.032)	0.812	0.049 (0.053)	0.355
Log inventories	-0.045 (0.182)	0.803	0.360 (0.180)	0.046	0.179 (0.167)	0.285
Log intermediate inputs	0.051 (0.062)	0.410	0.252 (0.083)	0.002	0.234 (0.079)	0.003
TFP	-0.047 (0.057)	0.413	0.008 (0.058)	0.893	-0.065 (0.061)	0.283
Log value added per employee	0.043 (0.040)	0.278	0.061 (0.027)	0.026	0.057 (0.024)	0.017
Number of observations	2,106		2,106		2,232	

Note: Robust standard errors are given in brackets. Models are two-way fixed effects regressions with controls. Effects significant at the 5% level are highlighted in grey.

4.5 Placebo test

Parallel trends in outcome variables of the placebo treated firms and the placebo control firms are shown in the Figure 2.

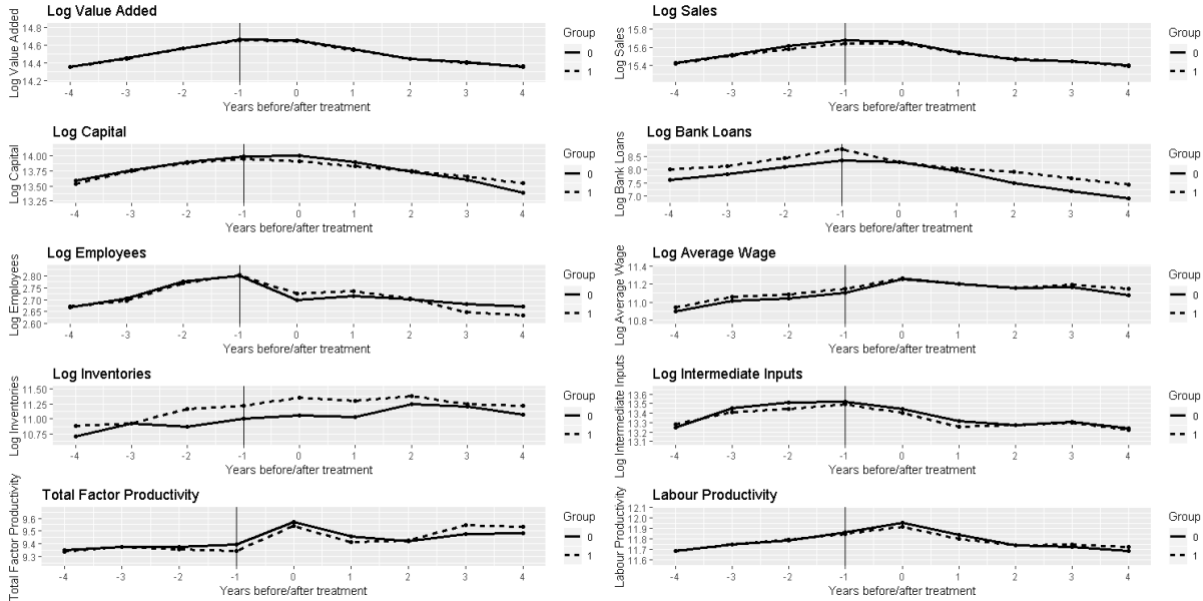


Figure 2. Trends in outcome variables of placebo treated firms and their control firms
 The zero on the x-axis indicates the year when firm received a grant, negative values indicate pre-treatment period. The dashed line represents treated group (1), while the solid line represents the control group (0). Parallel trends assumption holds also for levels, results are available upon request.

Table 7 provides the estimates of the two-way fixed effects approach with the placebo treated firms. For all outcome variables no statistically significant effects are found. This supports our assumption of having controled for all important covariates, because if our model does not pick up some systematic unobservable, the placebo test will show positive effects.

Table 7. Estimation of ATT with matched placebo treated firms and control firms

Outcome	ATT	p value	ATT	p value
Log value added (truncated)	-0.021 (0.017)	0.230	-0.022 (0.017)	0.201
Log sales	0.008 (0.014)	0.570	0.007 (0.013)	0.614
Log capital	0.058 (0.046)	0.201	0.054 (0.045)	0.230
Log bank loans	0.206 (0.158)	0.193	0.198 (0.157)	0.210
Log employees	-0.010 (0.017)	0.543	-0.012 (0.016)	0.456
Log average wage	0.007 (0.023)	0.755	0.007 (0.023)	0.757
Log inventories	-0.116 (0.079)	0.140	-0.117 (0.079)	0.136
Log intermediate inputs	0.015 (0.041)	0.718	0.011 (0.041)	0.783
TFP	0.033 (0.033)	0.311	0.036 (0.033)	0.275
Log value added per employee	-0.010 (0.020)	0.606	-0.009 (0.020)	0.640
Controls	No		Yes	
Number of observations	6,048			

Note: * p<0.05; ** p<0.01; *** p<0.001; robust standard errors are given in brackets. Models are two-way fixed effects with controls.

4.6 Robustness check

As propensity score matching is commonly used we employ it as a robustness check. The estimated probit model to explain the selection into treatment can be found in Table A4. The high Pseudo R² (0.268) give confidence that our employed variables capture the selection process adequately. Also a large reduction in the standardized bias (defined as the difference in mean covariate value divided by the standard deviation of treated group, also known as covariate effect size) points towards this interpretation. Last but not least, we obtain an appropriate distribution overlap of propensity scores of treated and control firms (Figure A1). Summing up, our findings give evidence that the matched control and treated firms are very similar in observed characteristics.

With the propensity score we conduct the matching procedure. Again exact matching with respect to NACE 2-digit sectors is conducted. For sensitivity analysis we employ one (Table 8, NN1), two (NN2) and three nearest (NN3) neighbours, use caliper matching⁴ (Table 8, caliper) and additionally inverse probability weighted regression adjustment (IPWRA). After

⁴ Caliper is set to default value 0.25.

each matching procedure the covariates balance is checked, the distribution overlap of the propensity score of treated and control firms is evaluated, the reduction in standardized bias are checked as well as the parallel trend assumptions. All prerequisites for claiming a successful matching procedure are fulfilled.⁵ After each type of matching we compute two-way fixed effects model again. For the doubly robust IPWRA we calculate weights based on our probit model from the one nearest neighbour specification (van der Wal & Geskus, 2011) and then compute two-way fixed effects weighted regression. Our final findings for the ATT are very similar in both significance and magnitude to our main specification (cf. Table 8).

Table 8. Alternative matching estimators and IPWRA (for firms with 1-20 employees).

Outcome	NN1 (n=6,534)		NN2 (n=9,801)		NN3 (n=13,059)		Caliper (n=6,102)		IPWRA (n=6,534)	
	ATT	p value	ATT	p value	ATT	p value	ATT	p value	ATT	p value
Log value added (truncated)	0.062** (0.022)	0.005	0.076*** (0.021)	0.000	0.075*** (0.020)	0.000	0.085*** (0.023)	0.000	0.087*** (0.021)	0.000
Log sales	0.046* (0.019)	0.013	0.058** (0.017)	0.001	0.061*** (0.016)	0.000	0.059** (0.019)	0.002	0.050** (0.017)	0.003
Log capital	0.140* (0.063)	0.028	0.141* (0.057)	0.013	0.174** (0.055)	0.002	0.213** (0.065)	0.001	0.235*** (0.060)	0.000
Log bank loans	0.774*** (0.192)	0.000	0.538** (0.168)	0.001	0.477** (0.160)	0.003	0.834*** (0.193)	0.000	0.460** (0.189)	0.015
Log employees	0.062** (0.019)	0.001	0.063*** (0.017)	0.000	0.078*** (0.016)	0.000	0.060** (0.019)	0.002	0.046* (0.019)	0.013
Log average wage	0.015 (0.027)	0.579	0.016 (0.024)	0.512	0.015 (0.023)	0.530	0.022 (0.025)	0.389	0.062* (0.024)	0.012
Log inventories	0.276** (0.105)	0.009	0.181 (0.093)	0.052	0.168 (0.090)	0.063	0.024 (0.115)	0.833	0.147 (0.101)	0.145
Log intermediate inputs	0.119* (0.052)	0.023	0.150** (0.046)	0.001	0.178*** (0.044)	0.000	0.185*** (0.051)	0.000	0.151** (0.046)	0.001
TFP	-0.067 (0.052)	0.199	-0.072 (0.047)	0.123	-0.097* (0.045)	0.030	-0.056 (0.037)	0.132	-0.032 (0.035)	0.361
Log value added per employee	0.047* (0.023)	0.041	0.051* (0.022)	0.019	0.049* (0.019)	0.012	0.062* (0.028)	0.029	0.040 (0.023)	0.080

Note: * p<0.05; ** p<0.01. ***. p<0.001; robust standard errors are given in brackets. Models are two-way fixed effects regressions with controls.

4.7 Macroeconomic impact of the grant scheme

To estimate the macroeconomic impact of the development grants awarded we follow a *back-of-the-envelope* estimation (Czarnitzki & Lopes-Bento, 2013; Munch & Schaur, 2018). We are particularly interested in estimating how many jobs have been maintained in the economy due to the grant scheme, how much value added has been created in the economy due to the grant scheme, how much more capital investments have been undertaken and how much

⁵ All of these results are available from authors upon request.

higher has been the access to external finances. In doing so, we focus on the effects for firms up to 20 employees (from Table 7).

Table 9. Quantification of treatment effects for firms with 1 up to 20 employees

Outcome variable	Time <i>t-1</i>	Post-treatment period
Average value added (€)	169,099	
Total value added (million €)	61.382	
Estimated effect		0.109
Quantification (million €)		6.691
Average number of employees	8.001	
Total number of employees	2,904	
Estimated effect		0.056
Quantification (number of jobs)		163
Average value added per employee (€)	17,910	
Total number of employees	2,904	
Estimated effect		0.053
Quantification (million €)		2.757
Average value of capital (€)	82,904	
Total value of capital (million €)	30.094	
Estimated effect		0.147
Quantification (million €)		4.423
Average bank loans (€)	13,276	
Total bank loans (million €)	4.819	
Estimated effect		0.676
Quantification (million €)		3.258

Table 9 shows the grant scheme saved about 0.45 jobs in firms up to 20 employees, which sums up to a total of 163 jobs saved in the economy. Results also show €6.7 million value added has been created, however, as this value added could have also been created by means of hiring new employees who might have come from other productive jobs, we focus on value added per employee (Munch & Schaur, 2018). This way we estimate €2.8 million new value added per employee created in the economy. In addition, we estimate €4.4 million investments in capital and €3.3 million more external finances than would have been without the grant scheme.

The total direct costs of the grant scheme are €2,367,595, this gives per saved job costs of about €14,525. Since we know which firms were awarded grants and in which year, we used this information to calculate the average costs of an employee in the treated firm (one year prior to the treatment). These costs amount on average to €14,250 per year. As firm increases only 0.45 employees, we need to multiply €14,250 with 0.45 employees to get small firms

cost per saved employee, which equals €6,413. This leads to the conclusion that the grant scheme does not pay off. However, this is not the only effect and thus not the full picture.

We find almost two times higher capital stock (€4.4 million) than the public funds invested, which points to high capital additionality induced by the grant scheme. The additional access to external finances is about 138% the amount received, which is in line with the public grant call subsidy rate of 50% of the project value VAT excluded. Thirdly, the value added created in the economy is about 116% of the direct scheme cost, which is considerably lower than the 300% increase in value added found by Munch and Schaur (2018) in Denmark for export promotion activities.

Of course we have to admit that other costs of the ministry needed to implement the grant schemes are not included in these estimations (e.g. ministry officials employed to run the schemes, marketing and other costs).

5 Conclusions

This paper presents new microeconomic evidence on the impact of business development grant schemes on output and input additionality. Previous research attempts focus mainly on the impact of R&D grants, while there is scarce empirical evidence on the effect of business development grants despite the policy-interesting features of this type of grant. Business development grants are smaller grants in terms of their financing volume and therefore carry the risk of substituting private money with public money rather than generating additionality. Therefore, several international institutions question the effectiveness of such grants, i.e. the reasonable use of public money especially in developing countries (OECD et al., 2016). To what extent this is justified is the objective of our work. We use public grant schemes between 2008 and 2012 of the *Ministry of Entrepreneurship and Crafts of the Republic of Croatia* for the identification how such grants effect firm's performance.

Our results show on average strong positive effects of business development grants on capital stock, bank loans, intermediate inputs, and value added, but no empirical evidence for a positive effect on productivity measures, sales, employment, average wage and inventories. However, the significant findings rely on the positive effects of firms of smaller size and a further investigation allows us to identify this heterogeneity of the treatment effects. Similar to Munch and Schaur (2018), we find the grants to be most effective in the sample of firms up to 20 employees. More favorable effects of business development grants on smaller firms

capital (14.7%), bank loans (67.6%), employment (5.6%), value added (10.9%), sales (5.9%), and labor productivity (5.3%) are theoretically justified as the specific grant amount is designed more appropriately for loosening the capital constraints of smaller firms in comparison to larger firms. Considerations about the mechanism of the effects suggest that the main effect of the grant scheme has been to enable firms to get more capital. With the strong certification effect grant receiver firms obtain on average also an even higher bank loan than just the amount considered in the grant approval. Overall, providing €2.4 million public money to smaller firms increases capital stock for almost twice of the grant amount, releases bank loans of 1.5 times this amount, saves 163 jobs (compared to 2,904 total number of employees), and creates value added above the size of the grant amount in the economic system.

In order to delve deeper into the question what level of grant amount may be too small or where the turning point from substitution to additionality lies, we calculated DRFs. As opposed to few existing papers evaluating DRFs with absolute grant size (Biagi et al., 2015; Bondonio & Greenbaum, 2014), we use a relative measure to shed light on substitution of private funds with public funds. Grants with a share of grant amount over profits below 9% are not effective in stimulating additionality in capital and labor and therefore not effective in fostering higher outputs of smaller firms. The medium (9% - 43%) and larger grants (43% and above) are effective, with strong positive effects on capital and labor inputs as well as outputs. However, this finding is of explorative nature as our sample size is rather small and the cuts are chosen in order to split the sample evenly. How appropriate the cut points are has to be left for future research.

To sum up, we show business development grants do not have significant effects on small firms when dose (grant amount over last years profits) is small. In order to be able to make more reliable statements about the minimum dose level necessary for the effectiveness of a grant, more research is needed. However, the results suggest that grants can induce a positive impact with a careful scheme design as size matters. The precise design of the grant scheme is crucial for policy makers in order to achieve additionality.

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Appendix

Table A1 Summary of the recent literature on the grants' impact on firm performance

Author(s)	Grant name	Grant size ⁶	Country	Outcome	Effect size
Criscuolo et al. (2019)	Investment subsidies; Regional Selective Assistance (RSA)	£46k	United Kingdom	Employment; TFP	+4.2% employment; No effect on TFP
Dvoutely and Blažková (2019)	European Regional and Development Fund (ERDF)	N/A	Czech Republic	Production efficiency, labor productivity, TFP	+ 18-31.5% labor productivity; - 2.3-4.3% TFP
Štrhoj, Škrinjarić, and Radas (2019)	Entrepreneurship policy for youth and new firms	€2k	Croatia	Employment; turnover; labor productivity; bank loans	No effect on employment, turnover and labor productivity. Positive effect on bank loans and survival.
Burger and Rojec (2018)	State aid for mitigating the crisis; employment; R&D; training	€52k ⁷	Slovenia	Turnover; employment	+ 1.1 to 2.7 employees; No effect on turnover
McKenzie (2017)	Business plan competition	\$50k	Nigeria	Profits, turnover, employment, capital stock, inventories, external financing	+80% employment (4.4 employees); +17 to 60 % increase in profits; +270% increase in capital stock
Howell (2017)	R&D grants; Small Business Innovation Research (SBIR)	\$150k (Phase 1); \$500k (Phase 2)	United States of America	Turnover	+2.3 million \$ (Phase 1)
Butler et al. (2016)	Innovation grant; The Buenos Aires Empreende Program	\$16k and up to 12 months mentorship	Argentina	Employment, sales	+2.4 employees; No effect on sales
Afcha and García-Quevedo (2016)	R&D grants; Spanish Plans for Scientific Research, Development,	Not reported	Spain	R&D Employment	+1.40 R&D employees

⁶ Average (if reported)

⁷ Authors do not report grant sizes by grant category, nor the grant sizes of firms that were analysed. The amount reported is the average amount given by dividing the total amount of subsidies by the total number of recipients in 2009.

	and Technological Innovation					
Radas et al. (2015)	R&D grants	Not reported	Croatia	Percentage of sales from innovation	Positive	
Biagi, Bondonio and Martini (2015)	Italian Law 488	4 thresholds reported: (1) 125k; (2) 125k-250k; (3) 250k-500k; (4) above 500k (all in €)	Italy	Employment	Micro ((1) +0.93; (2) +1.24; (3) + 2.16; (4) + 3.82); Small ((1) +1.22; (2) + 1.77; (3) + 2.39; (4) +2.68); Medium ((1&2) no effect; (3) +3.58; (4) + 2.68); Large ((4) – 16.02)	
Crespi et al. (2015)	R&D (matching grants and contingent credit lines); Colombian Innovation Agency (COLCIENCIAS)	Not reported	Colombia	Employment; Number of products; Capital investments (CI); Labor productivity (LP); TFP	No effect on Employment and CI; +0.14 new products; +10% LP	
Michalek et al. (2015)	Investment support; European Union Rural Development Programme (RDP)	Not reported	Germany	Profits; Investment	-3% profits; No effect on investment	
Bondonio and Greenbaum (2014)	Regional and European grants for regional imbalances; European Regional Development Fund (ERDF)	€44k	Italy	Employment	+1.87 employees (up to 6.86 employees)	
Colombo et al. (2013)	R&D grants; Research on Entrepreneurship in Advanced Technologies (RITA)	Not reported	Italy	Employment	+53% employment	
Bernini and Pellegrini (2011)	Capital subsidies; Law 488 for reducing territorial disparities	Not reported	Italy	Employment, TFP	-8% TFP, +16% Employment	
Bah, Brada, and Yigit (2011)	USAID programmes for Macedonian SMEs	Not reported	Macedonia	Employment	1 year after (16-20%) and 3 years after (26-30%)	
Hall and Maffioli	R&D grants; Technology	Not reported	Argentina,	TFP; LP; Growth in sales,	No effect on TFP and LP;	

(2008)	Development Funds (TDF)		Brazil, Chile and Panama	exports, employment	Mixed results for employment, sales, and exports
Girma et al. (2008)	R&D grants; Industrial Development Authority (IDA Ireland)	Not reported	Ireland	Employment	Positive
Brown, Earle, and Lup (2005)	Grants and technical assistance from USAID in Romania	Not reported	Romania	Growth in employment and turnover	No effect on employment and turnover

Note: these papers are selected as relevant for the discussion of the findings in this paper. However, this is not the full list of papers that evaluate the impact of different grants on firm performance. The letter 'x' denotes 1000.

Table A2. Description of the development grant scheme

Grant name	Description	Minimum and maximum amount	Grant availability	Prerequisites
Strengthening competitiveness of small economy	Aims to subsidize investment in development and procurement of new technologies: machines, plants and equipment; transfer of specialized industrial knowledge; consulting services in the process of developing new or improved products; vocational training of employees for application of new technologies in technology processes; commercialisation of innovations developed within the academic community, and investment in energy efficient and green manufacturing; market research; brand creation; design; accreditation of laboratory methods; costs of acquiring the rights of the marks 'Croatian Quality', 'Made in Croatia' and 'Croatian Island Product'.	5,000-400,000 kuna	2008-2012	Financial surplus; headquarters in Croatia; at least 1 full time employee; no bankrupt firms; firms in the liquidation process and those who have outstanding obligations towards the country and/or employees cannot attend the public call

Source: OPPMSP (2008, 2009, 2010, 2011, 2012)

Table A3. Balance before and after matching

Outcome/Variables	Before matching							After matching							Percent Balance Improvement				
	Means Treated	Means Control	Std. Mean Diff.	eCDF Med	eCDF Mean	eCDF Max	Means Treated	Means Control	Std. Mean Diff.	eCDF Med	eCDF Mean	eCDF Max	Std. Mean Diff.	eCDF Med	eCDF Mean	eCDF Max			
Log sales (t-1)	15.716	14.301	1.027	0.278	0.242	0.374	15.705	15.644	0.045	0.015	0.015	0.040	95.637	94.663	93.759	89.439			
Log sales (t-2)	15.620	14.292	0.955	0.258	0.227	0.346	15.610	15.561	0.035	0.012	0.013	0.043	96.331	95.531	94.118	87.602			
Log sales (t-3)	15.529	14.277	0.887	0.251	0.214	0.321	15.520	15.489	0.022	0.012	0.012	0.040	97.495	95.404	94.256	87.675			
Log sales (t-4)	15.426	14.229	0.836	0.237	0.204	0.310	15.417	15.408	0.006	0.010	0.010	0.026	99.266	95.829	95.206	91.498			
Log truncated value added (t-1)	14.671	13.272	1.134	0.294	0.266	0.422	14.661	14.637	0.020	0.017	0.018	0.051	98.245	94.390	93.116	87.886			
Log truncated value added (t-2)	14.543	13.240	1.014	0.281	0.246	0.386	14.534	14.520	0.011	0.010	0.012	0.043	98.932	96.482	95.313	88.895			
Log truncated value added (t-3)	14.418	13.206	0.928	0.261	0.230	0.356	14.409	14.424	-0.012	0.008	0.009	0.030	98.747	96.847	96.044	91.672			
Log truncated value added (t-4)	14.305	13.136	0.879	0.248	0.219	0.338	14.297	14.340	-0.033	0.010	0.011	0.033	96.305	96.019	95.158	90.254			
Log capital (t-1)	14.007	11.603	1.127	0.297	0.264	0.383	13.993	13.937	0.026	0.021	0.022	0.049	97.671	92.791	91.602	87.096			
Log capital (t-2)	13.852	11.662	1.051	0.275	0.245	0.349	13.840	13.882	-0.020	0.012	0.011	0.031	98.075	95.806	95.497	91.031			
Log capital (t-3)	13.650	11.659	0.904	0.249	0.228	0.341	13.639	13.735	-0.044	0.013	0.013	0.040	95.159	94.708	94.333	88.400			
Log capital (t-4)	13.417	11.538	0.767	0.233	0.218	0.324	13.405	13.542	-0.056	0.015	0.018	0.056	92.726	93.625	91.863	82.722			
Log bank loans (t-1)	8.793	4.742	0.603	0.284	0.244	0.324	8.759	8.853	-0.014	0.012	0.013	0.033	97.669	95.935	94.735	89.830			
Log bank loans (t-2)	8.420	4.849	0.533	0.243	0.210	0.270	8.382	8.528	-0.022	0.007	0.009	0.033	95.920	97.284	95.611	87.773			
Log bank loans (t-3)	8.065	4.835	0.478	0.226	0.194	0.250	8.051	8.167	-0.017	0.010	0.011	0.035	96.424	95.628	94.589	86.158			
Log bank loans (t-4)	7.724	4.672	0.454	0.207	0.176	0.236	7.713	7.951	-0.035	0.018	0.021	0.049	92.205	91.246	88.307	79.095			
Log employees (t-1)	2.817	1.767	0.965	0.028	0.075	0.411	2.807	2.777	0.028	0.010	0.011	0.030	97.150	64.492	85.441	92.790			
Log employees (t-2)	2.777	1.776	0.931	0.025	0.065	0.403	2.767	2.747	0.019	0.007	0.009	0.031	97.935	74.043	86.875	92.229			
Log employees (t-3)	2.685	1.767	0.819	0.014	0.058	0.366	2.675	2.677	-0.002	0.007	0.009	0.028	99.816	51.499	84.911	92.343			
Log employees (t-4)	2.658	1.753	0.824	0.017	0.057	0.364	2.649	2.640	0.008	0.008	0.009	0.020	98.990	52.282	84.501	94.565			
Log average wage (t-1)	11.115	10.596	0.705	0.161	0.140	0.224	11.113	11.137	-0.032	0.023	0.022	0.046	95.462	85.692	84.542	79.387			
Log average wage (t-2)	11.042	10.569	0.665	0.154	0.122	0.199	11.040	11.069	-0.042	0.026	0.024	0.049	93.740	82.854	80.134	75.154			
Log average wage (t-3)	11.017	10.537	0.656	0.147	0.119	0.188	11.015	11.023	-0.010	0.030	0.026	0.056	98.480	79.773	78.007	70.255			
Log average wage (t-4)	10.895	10.468	0.619	0.124	0.105	0.176	10.893	10.923	-0.043	0.025	0.026	0.058	93.131	80.073	75.687	67.243			

Outcome/Variables	Before matching						After matching						Percent Balance Improvement					
	Means Treated	Means Control	Std. Mean Diff.	eCDF Med	eCDF Mean	eCDF Max	Means Treated	Means Control	Std. Mean Diff.	eCDF Med	eCDF Mean	eCDF Max	Std. Mean Diff.	eCDF Med	eCDF Mean	eCDF Max		
Log intermediate inputs (t-1)	13.516	11.239	1.007	0.335	0.289	0.411	13.502	13.498	0.002	0.013	0.016	0.051	99.849	96.067	94.472	87.579		
Log intermediate inputs (t-2)	13.443	11.260	1.027	0.323	0.277	0.397	13.430	13.436	-0.003	0.008	0.010	0.038	99.710	97.451	96.518	90.444		
Log intermediate inputs (t-3)	13.344	11.274	0.909	0.306	0.269	0.388	13.331	13.364	-0.014	0.013	0.013	0.030	98.450	95.690	95.299	92.365		
Log intermediate inputs (t-4)	13.215	11.263	0.855	0.296	0.258	0.367	13.203	13.248	-0.020	0.007	0.009	0.036	97.685	97.771	96.689	90.127		
TFP (t-1)	9.410	9.701	-0.171	0.063	0.053	0.099	9.414	9.438	-0.014	0.015	0.017	0.054	91.828	76.475	67.546	44.964		
TFP (t-2)	9.400	9.644	-0.152	0.051	0.045	0.079	9.404	9.410	-0.004	0.013	0.015	0.038	97.674	73.949	67.567	52.144		
TFP (t-3)	9.437	9.617	-0.108	0.041	0.034	0.062	9.442	9.424	0.011	0.018	0.019	0.048	89.956	56.172	43.457	22.774		
TFP (t-4)	9.403	9.569	-0.105	0.029	0.026	0.046	9.407	9.408	-0.001	0.015	0.016	0.048	99.013	49.602	40.338	-3.290		
Log current debt (t-1)	14.395	12.922	0.956	0.262	0.228	0.330	14.384	14.207	0.115	0.036	0.033	0.069	87.985	86.141	85.439	78.998		
Log current debt (t-2)	14.297	12.914	0.917	0.258	0.216	0.313	14.288	14.160	0.085	0.026	0.025	0.053	90.696	89.796	88.580	83.165		
Log current debt (t-3)	14.170	12.886	0.852	0.233	0.206	0.319	14.161	14.085	0.051	0.018	0.018	0.043	94.044	92.233	91.241	86.553		
Log current debt (t-4)	14.066	12.832	0.801	0.221	0.197	0.300	14.056	14.008	0.031	0.012	0.012	0.040	96.093	94.791	93.716	86.805		
Log non-current debt (t-1)	9.970	5.871	0.641	0.283	0.255	0.338	9.938	10.043	-0.017	0.017	0.016	0.048	97.424	94.183	93.618	85.869		
Log non-current debt (t-2)	9.495	5.917	0.550	0.250	0.222	0.285	9.461	9.658	-0.030	0.007	0.011	0.041	94.486	97.360	94.957	85.553		
Log non-current debt (t-3)	9.241	5.848	0.520	0.239	0.206	0.266	9.209	9.148	0.009	0.007	0.007	0.021	98.198	97.241	96.629	91.941		
Log non-current debt (t-4)	8.868	5.637	0.492	0.218	0.191	0.261	8.835	8.730	0.016	0.012	0.013	0.036	96.746	94.719	93.325	86.113		
Log profits (truncated) (t-1)	12.019	10.424	0.532	0.212	0.192	0.291	12.000	11.696	0.101	0.042	0.040	0.092	80.965	80.272	79.315	68.355		
R&D expenditures last four years	0.693	0.206	0.113	0.013	0.013	0.020	0.697	0.417	0.065	0.008	0.008	0.015	42.734	38.044	36.642	27.446		
Investments last four years	26.438	16.159	0.645	0.272	0.248	0.311	26.351	26.533	-0.011	0.013	0.015	0.036	98.230	95.146	93.959	88.329		
Export intensity (t-1)	0.130	0.063	0.262	0.064	0.108	0.332	0.130	0.112	0.067	0.023	0.025	0.064	74.342	64.148	77.308	80.669		
Delta export intensity (t-1)	0.006	-0.002	0.058	0.061	0.071	0.219	0.006	0.004	0.013	0.020	0.022	0.063	78.349	67.514	68.525	71.381		
Import intensity (t-1)	0.127	0.077	0.254	0.052	0.089	0.289	0.126	0.128	-0.009	0.015	0.016	0.041	96.455	71.214	82.229	85.757		
Delta import intensity (t-1)	0.003	-0.004	0.053	0.050	0.061	0.182	0.003	-0.001	0.028	0.023	0.025	0.063	47.454	53.758	59.694	65.565		
Log finished products at stock (t-1)	3.203	0.701	0.458	0.128	0.116	0.204	3.195	3.052	0.026	0.008	0.008	0.020	94.319	93.575	93.070	90.329		
Log intangible capital (t-1)	4.126	2.495	0.310	0.111	0.099	0.152	4.085	3.678	0.077	0.017	0.018	0.056	75.102	85.119	81.457	63.244		

Outcome/Variables	Before matching						After matching						Percent Balance Improvement					
	Means Treated	Means Control	Std. Mean Diff.	eCDF Med	eCDF Mean	eCDF Max	Means Treated	Means Control	Std. Mean Diff.	eCDF Med	eCDF Mean	eCDF Max	Std. Mean Diff.	eCDF Med	eCDF Mean	eCDF Max		
Debt ratio (-1)	0.578	0.641	-0.264	0.037	0.040	0.089	0.577	0.558	0.080	0.021	0.022	0.048	69.694	41.735	46.227	46.387		
Two way trader dummy	0.212	0.067	0.354	0.072	0.072	0.145	0.211	0.214	-0.008	0.002	0.002	0.003	97.722	97.722	97.722	97.722		
Exporter only dummy	0.110	0.066	0.141	0.022	0.022	0.044	0.110	0.102	0.026	0.004	0.004	0.008	81.384	81.384	81.384	81.384		
Importer only dummy	0.166	0.132	0.090	0.017	0.017	0.034	0.166	0.158	0.022	0.004	0.004	0.008	75.435	75.435	75.435	75.435		
Domestic trader only dummy	0.284	0.651	-0.815	0.184	0.184	0.368	0.285	0.292	-0.015	0.003	0.003	0.007	98.208	98.208	98.208	98.208		
Firm up to 20 employees dummy	0.595	0.893	-0.607	0.149	0.149	0.298	0.598	0.616	-0.037	0.009	0.009	0.018	93.924	93.924	93.924	93.924		
Firm above 20 employees dummy	0.405	0.107	0.607	0.149	0.149	0.298	0.402	0.384	0.037	0.009	0.018	93.924	93.924	93.924	93.924	93.924		
Age	13.695	20.806	-1.553	0.003	0.013	0.112	13.692	17.297	-0.787	0.008	0.019	0.058	49.307	-141.429	-49.297	48.446		
Age squared	208.482	13945.5	-87.94	0.003	0.013	0.112	208.49	6865.59	-42.62	0.008	0.019	0.058	51.539	-141.429	-49.297	48.446		
Capital region	0.408	0.408	0.001	0.000	0.000	0.000	0.407	0.384	0.047	0.012	0.012	0.023	-65.151	-65.151	-65.151	-65.151		
Foreign ownership	0.038	0.032	0.028	0.003	0.003	0.005	0.038	0.030	0.043	0.004	0.004	0.008	-54.143	-54.143	-54.143	-54.143		
Positive debt towards state (-1)	0.003	0.007	-0.061	0.002	0.002	0.004	0.003	0.002	0.029	0.001	0.001	0.002	52.489	52.489	52.489	52.489		
Positive debt towards employees (-1)	0.959	0.915	0.220	0.022	0.022	0.044	0.9588	0.9506	0.0415	0.0041	0.0041	0.008	81.125	81.125	81.125	81.125		
Other mining and quarrying	0.002	0.002	-0.005	0.000	0.000	0.000	0.002	0.002	0.000	0.000	0.000	0.000	100.000	100.000	100.000	100.000		
Manufacture of food products	0.046	0.013	0.157	0.016	0.016	0.033	0.046	0.046	0.000	0.000	0.000	0.000	100.000	100.000	100.000	100.000		
Manufacture of beverages	0.005	0.002	0.042	0.002	0.002	0.003	0.005	0.005	0.000	0.000	0.000	0.000	100.000	100.000	100.000	100.000		
Manufacture of textiles	0.008	0.003	0.061	0.003	0.003	0.006	0.008	0.008	0.000	0.000	0.000	0.000	100.000	100.000	100.000	100.000		
Manufacture of wearing apparel	0.025	0.005	0.129	0.010	0.010	0.020	0.025	0.025	0.000	0.000	0.000	0.000	100.000	100.000	100.000	100.000		
Manufacture of leather and related products	0.003	0.001	0.035	0.001	0.001	0.002	0.003	0.003	0.000	0.000	0.000	0.000	100.000	100.000	100.000	100.000		
Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	0.049	0.008	0.190	0.021	0.021	0.041	0.048	0.048	0.000	0.000	0.000	0.000	100.000	100.000	100.000	100.000		
Manufacture of paper and paper products	0.018	0.003	0.114	0.008	0.008	0.015	0.018	0.018	0.000	0.000	0.000	0.000	100.000	100.000	100.000	100.000		
Printing and reproduction of recorded media	0.044	0.013	0.151	0.016	0.016	0.031	0.045	0.045	0.000	0.000	0.000	0.000	100.000	100.000	100.000	100.000		

Outcome/Variables	Before matching						After matching						Percent Balance Improvement					
	Means Treated	Means Control	Std. Mean Diff.	eCDF Med	eCDF Mean	eCDF Max	Means Treated	Means Control	Std. Mean Diff.	eCDF Med	eCDF Mean	eCDF Max	Std. Mean Diff.	eCDF Med	eCDF Mean	eCDF Max		
Manufacture of chemicals and chemical products	0.018	0.004	0.106	0.007	0.007	0.014	0.018	0.018	0.000	0.000	0.000	0.000	100.000	100.000	100.000	100.000		
Manufacture of basic pharmaceutical products and pharmaceutical preparations	0.002	0.000	0.034	0.001	0.001	0.001	0.002	0.002	0.000	0.000	0.000	0.000	100.000	100.000	100.000	100.000		
Manufacture of rubber and plastic products	0.046	0.008	0.183	0.019	0.019	0.038	0.046	0.046	0.000	0.000	0.000	0.000	100.000	100.000	100.000	100.000		
Manufacture of other non-metallic mineral products	0.018	0.007	0.080	0.005	0.005	0.011	0.018	0.018	0.000	0.000	0.000	0.000	100.000	100.000	100.000	100.000		
Manufacture of basic metals	0.005	0.001	0.052	0.002	0.002	0.004	0.005	0.005	0.000	0.000	0.000	0.000	100.000	100.000	100.000	100.000		
Manufacture of fabricated metal products, except machinery and equipment	0.079	0.023	0.206	0.028	0.028	0.055	0.079	0.079	0.000	0.000	0.000	0.000	100.000	100.000	100.000	100.000		
Manufacture of computer, electronic and optical products	0.021	0.009	0.086	0.006	0.006	0.013	0.021	0.021	0.000	0.000	0.000	0.000	100.000	100.000	100.000	100.000		
Manufacture of electrical equipment	0.023	0.005	0.123	0.009	0.009	0.018	0.023	0.023	0.000	0.000	0.000	0.000	100.000	100.000	100.000	100.000		
Manufacture of machinery and equipment n.e.c.	0.056	0.008	0.206	0.024	0.024	0.047	0.056	0.056	0.000	0.000	0.000	0.000	100.000	100.000	100.000	100.000		
Manufacture of motor vehicles, trailers and semi-trailers	0.010	0.001	0.090	0.005	0.005	0.009	0.007	0.007	0.000	0.000	0.000	0.000	100.000	100.000	100.000	100.000		
Manufacture of other transport equipment	0.008	0.002	0.070	0.003	0.003	0.006	0.008	0.008	0.000	0.000	0.000	0.000	100.000	100.000	100.000	100.000		
Manufacture of furniture	0.033	0.005	0.154	0.014	0.014	0.027	0.033	0.033	0.000	0.000	0.000	0.000	100.000	100.000	100.000	100.000		
Other manufacturing	0.005	0.005	-0.002	0.000	0.000	0.000	0.005	0.005	0.000	0.000	0.000	0.000	100.000	100.000	100.000	100.000		
Repair and installation of machinery and equipment	0.007	0.008	-0.016	0.001	0.001	0.001	0.007	0.007	0.000	0.000	0.000	0.000	100.000	100.000	100.000	100.000		
Electricity, gas, steam and air conditioning supply	0.003	0.002	0.030	0.001	0.001	0.002	0.003	0.003	0.000	0.000	0.000	0.000	100.000	100.000	100.000	100.000		
Sewerage	0.002	0.000	0.031	0.001	0.001	0.001	0.002	0.002	0.000	0.000	0.000	0.000	100.000	100.000	100.000	100.000		
Waste collection, treatment and disposal activities, materials recovery	0.013	0.006	0.063	0.004	0.004	0.007	0.013	0.013	0.000	0.000	0.000	0.000	100.000	100.000	100.000	100.000		
Remediation activities and other waste management services	0.002	0.001	0.024	0.001	0.001	0.001	0.002	0.002	0.000	0.000	0.000	0.000	100.000	100.000	100.000	100.000		
Construction of buildings	0.021	0.027	-0.038	0.003	0.003	0.006	0.021	0.021	0.000	0.000	0.000	0.000	100.000	100.000	100.000	100.000		
Civil engineering	0.012	0.011	0.003	0.000	0.000	0.000	0.012	0.012	0.000	0.000	0.000	0.000	100.000	100.000	100.000	100.000		

Outcome/Variables	Before matching							After matching							Percent Balance Improvement				
	Means Treated	Means Control	Std. Mean Diff.	eCDF Med	eCDF Mean	eCDF Max	Means Treated	Means Control	Std. Mean Diff.	eCDF Med	eCDF Mean	eCDF Max	Std. Mean Diff.	eCDF Med	eCDF Mean	eCDF Max			
Specialised construction activities	0.059	0.046	0.056	0.007	0.007	0.013	0.059	0.059	0.000	0.000	0.000	0.000	100.000	100.000	100.000	100.000			
Wholesale and retail trade and repair of motor vehicles and motorcycles	0.002	0.036	-0.846	0.017	0.017	0.034	0.002	0.002	0.000	0.000	0.000	0.000	100.000	100.000	100.000	100.000			
Wholesale trade, except of motor vehicles and motorcycles	0.110	0.226	-0.371	0.058	0.058	0.116	0.110	0.110	0.000	0.000	0.000	0.000	100.000	100.000	100.000	100.000			
Retail trade, except of motor vehicles and motorcycles	0.018	0.100	-0.614	0.041	0.041	0.082	0.018	0.018	0.000	0.000	0.000	0.000	100.000	100.000	100.000	100.000			
Land transport and transport via pipelines	0.005	0.032	-0.382	0.013	0.013	0.027	0.005	0.005	0.000	0.000	0.000	0.000	100.000	100.000	100.000	100.000			
Warehousing and support activities for transportation	0.003	0.013	-0.175	0.005	0.005	0.010	0.003	0.003	0.000	0.000	0.000	0.000	100.000	100.000	100.000	100.000			
Accommodation	0.002	0.011	-0.229	0.005	0.005	0.009	0.002	0.002	0.000	0.000	0.000	0.000	100.000	100.000	100.000	100.000			
Food and beverage service activities	0.005	0.026	-0.297	0.010	0.010	0.021	0.005	0.005	0.000	0.000	0.000	0.000	100.000	100.000	100.000	100.000			
Publishing activities	0.008	0.008	-0.001	0.000	0.000	0.000	0.008	0.008	0.000	0.000	0.000	0.000	100.000	100.000	100.000	100.000			
Programming and broadcasting activities	0.002	0.003	-0.041	0.001	0.001	0.002	0.002	0.002	0.000	0.000	0.000	0.000	100.000	100.000	100.000	100.000			
Computer programming, consultancy and related activities	0.082	0.024	0.212	0.029	0.029	0.058	0.082	0.082	0.000	0.000	0.000	0.000	100.000	100.000	100.000	100.000			
Real estate activities	0.003	0.008	-0.087	0.003	0.003	0.005	0.003	0.003	0.000	0.000	0.000	0.000	100.000	100.000	100.000	100.000			
Legal and accounting activities	0.005	0.086	-1.162	0.041	0.041	0.081	0.005	0.005	0.000	0.000	0.000	0.000	100.000	100.000	100.000	100.000			
Activities of head offices; management consultancy activities	0.003	0.012	-0.159	0.005	0.005	0.009	0.003	0.003	0.000	0.000	0.000	0.000	100.000	100.000	100.000	100.000			
Architectural and engineering activities; technical testing and analysis	0.069	0.081	-0.047	0.006	0.006	0.012	0.069	0.069	0.000	0.000	0.000	0.000	100.000	100.000	100.000	100.000			
Scientific research and development	0.008	0.003	0.058	0.003	0.003	0.005	0.008	0.008	0.000	0.000	0.000	0.000	100.000	100.000	100.000	100.000			
Advertising and market research	0.003	0.012	-0.154	0.004	0.004	0.009	0.003	0.003	0.000	0.000	0.000	0.000	100.000	100.000	100.000	100.000			
Other professional, scientific and technical activities	0.005	0.008	-0.041	0.001	0.001	0.003	0.005	0.005	0.000	0.000	0.000	0.000	100.000	100.000	100.000	100.000			
Veterinary activities	0.008	0.005	0.031	0.001	0.001	0.003	0.008	0.008	0.000	0.000	0.000	0.000	100.000	100.000	100.000	100.000			
Rental and leasing activities	0.002	0.005	-0.087	0.002	0.002	0.004	0.002	0.002	0.000	0.000	0.000	0.000	100.000	100.000	100.000	100.000			

Outcome/Variables	Before matching						After matching						Percent Balance Improvement				
	Means Treated	Means Control	Std. Mean Diff.	eCDF Med	eCDF Mean	eCDF Max	Means Treated	Means Control	Std. Mean Diff.	eCDF Med	eCDF Mean	eCDF Max	Std. Mean Diff.	eCDF Med	eCDF Mean	eCDF Max	
Travel agency, tour operator reservation service and related activities	0.002	0.016	-0.350	0.007	0.007	0.014	0.002	0.002	0.000	0.000	0.000	0.000	100.000	100.000	100.000	100.000	
Services to buildings and landscape activities	0.002	0.006	-0.111	0.002	0.002	0.005	0.002	0.002	0.000	0.000	0.000	0.000	100.000	100.000	100.000	100.000	
Office administrative, office support and other business support activities	0.002	0.001	0.020	0.000	0.000	0.001	0.002	0.002	0.000	0.000	0.000	0.000	100.000	100.000	100.000	100.000	
Education	0.002	0.016	-0.359	0.007	0.007	0.015	0.002	0.002	0.000	0.000	0.000	0.000	100.000	100.000	100.000	100.000	
Repair of computers and personal and household goods	0.005	0.011	-0.079	0.003	0.003	0.006	0.005	0.005	0.000	0.000	0.000	0.000	100.000	100.000	100.000	100.000	
Other personal service activities	0.002	0.011	-0.238	0.005	0.005	0.010	0.002	0.002	0.000	0.000	0.000	0.000	100.000	100.000	100.000	100.000	
Propensity Score	0.071	0.007	0.784	0.453	0.419	0.696	0.069	0.068	0.008	0.005	0.008	0.041	98.993	98.908	98.111	94.079	

Note: TFP is estimated with Levinsohn-Petrin method using Akerberg-Caves-Frazer correction for each NACE 2-digit separately (Akerberg, Caves, & Garth, 2015; Levinsohn & Petrin, 2003). The output is log value added and is deflated by NACE 2-digit AMECO financial database value added deflators. Capital is log tangible assets, deflated by GDP deflator. Labour is the log number of employees, while log intermediate inputs were calculated as a log of sum of material costs and energy costs deflated by the Eurostat NACE 2-digit deflator for intermediate consumption. All other monetary variables are deflated by the NACE 2-digit value added deflators. Value added is calculated as the difference between sales and sum of intermediate inputs and energy. eCDFMed, eCDFMean, eCDFMax - give summary statistics of a quantile-quantile plot. These columns give the median, mean, and maximum distance between the two empirical quantile functions (treated and control groups). Values greater than 0 indicate deviations between the groups in some part of the empirical distributions.

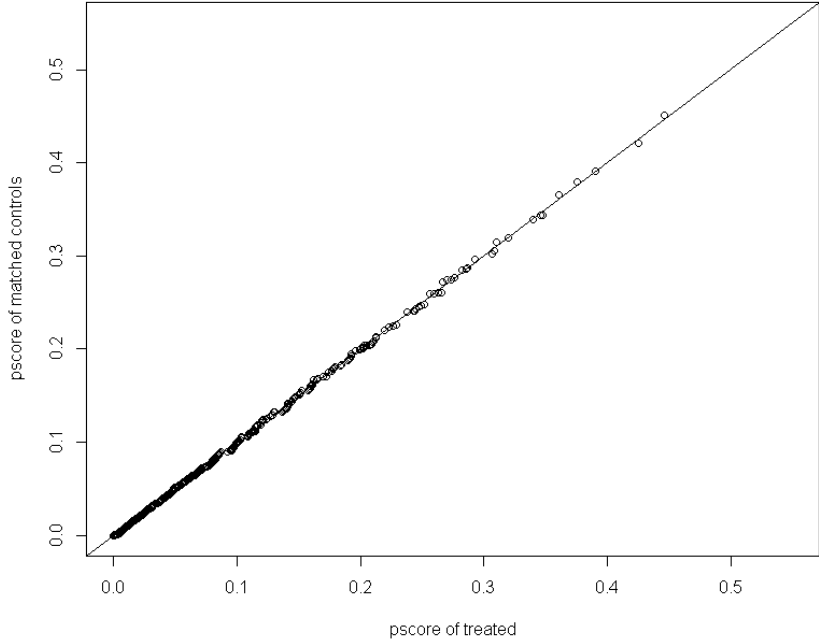
Table A4. Probit model – selection into business development grant

Variable	Coef (s.e.)
Log sales (t-1)	0.086 (0.095)
Log sales (t-2)	-0.248 (0.119)
Log sales (t-3)	0.249 (0.110)
Log sales (t-4)	-0.103 (0.099)
Log truncated value added (t-1)	0.145 (0.062)
Log truncated value added (t-2)	-0.001 (0.064)
Log truncated value added (t-3)	-0.093 (0.057)
Log truncated value added (t-4)	-0.040 (0.053)
Log capital (t-1)	0.033 (0.020)
Log capital (t-2)	0.003 (0.022)
Log capital (t-3)	-0.025 (0.019)
Log capital (t-4)	0.017 (0.014)
Log bank loans (t-1)	0.002 (0.007)
Log bank loans (t-2)	0.005 (0.008)
Log bank loans (t-3)	-0.006 (0.008)
Log bank loans (t-4)	0.007 (0.007)
Log employees (t-1)	0.083 (0.131)
Log employees (t-2)	0.220 (0.155)
Log employees (t-3)	-0.259 (0.135)
Log employees (t-4)	0.164 (0.142)
Log average wage (t-1)	0.086 (0.052)
Log average wage (t-2)	-0.071 (0.058)
Log average wage (t-3)	0.029 (0.058)
Log average wage (t-4)	-0.031 (0.040)
Log intermediate inputs (t-1)	0.019 (0.021)
Log intermediate inputs (t-2)	0.016 (0.025)
Log intermediate inputs (t-3)	-0.001 (0.024)
Log intermediate inputs (t-4)	-0.009 (0.021)
TFP (t-1)	-0.052 (0.059)
TFP (t-2)	0.098 (0.068)
TFP (t-3)	-0.131 (0.063)
TFP (t-4)	0.114 (0.065)
Log current debt (t-1)	0.047 (0.036)
Log current debt (t-2)	-0.006 (0.039)
Log current debt (t-3)	-0.012 (0.037)
Log current debt (t-4)	-0.041 (0.032)
Log non-current debt (t-1)	0.014 (0.007)
Log non-current debt (t-2)	-0.012 (0.009)
Log non-current debt (t-3)	0.002 (0.008)
Log non-current debt (t-4)	-0.003 (0.007)
R&D expenditures last four years	0.006 (0.005)
Investments last four years	0.001 (0.001)
Export intensity (t-1)	0.011 (0.116)
Delta export intensity (t-1)	-0.032 (0.136)
Import intensity (t-1)	-0.051 (0.125)
Delta import intensity (t-1)	0.154 (0.171)
Log finished products at stock (t-1)	0.012 (0.004)
Log intangible capital (t-1)	0.004 (0.004)
Debt ratio (t-1)	0.0003 (0.007)
Age	0.004 (0.005)
Age squared	-2.023e-06 (4.222e-06)
Capital region	0.001 (0.040)
Foreign ownership	-0.351 (0.108)
Positive debt towards state (t-1)	-0.598 (0.283)
Positive debt towards employees (t-1)	-0.002 (0.087)
Observations	77,987

McFadden Pseudo R ²	0.268
Log Likelihood	-2,609.659
Akaike Inf. Crit.	5,463.317

Note: Firm size dummies, NACE 2-digit dummies, year dummies and trade dummies are included. The significance of the coefficients is not our focus, thus we do not care about multicollinearity for example, but the appropriate estimation of the propensity score. The propensity score is used as a measure of similarity between treated and control firm in our robustness check of the findings.

Figure A1. Overlap of propensity scores



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Stjepan Srhoj, Michael Lapinski, Janette Walde

Size matters? Impact evaluation of business development grants on SME performance

Abstract

Many international organisations emphasize the need of public grant schemes evaluations. An evaluation provides the opportunity to assess the socio-economic impact achieved by the grant and allows for a refinement of such policy instruments in order to make public funding more effective in achieving the objectives. In this paper, we investigate the effects of a business development grant scheme. More specifically we question whether firms' performance measures increased after participating in this grant scheme. Methodically, we match grant receiving firms with grant non-receivers and estimate the average treatment effect on the treated using a two way fixed effects regression. Our results point towards a positive effect of the grant scheme, which is particularly evident for firms of smaller size. Our estimated dose-response functions show that the share of grant amount in firm profits needs to be high enough for the grants to be effective. According to back-of-the envelope analysis, benefits outweigh the direct scheme costs.

ISSN 1993-4378 (Print)

ISSN 1993-6885 (Online)