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Bidding against the odds? The impact evaluation of grants for young micro and small firms during the recession

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Abstract

Impact evaluations of entrepreneurship policies targeting young firms have been somewhat neglected thus far in the literature. While most research studies focus on the impact of research and development (R&D) grants, a larger percentage of young firms would benefit from grants that assist them in other activities. In this paper we examine the impact of small business development grants on survival and performance of young firms. We study this topic in the context of a long recession in Croatia (2009 to 2014), which makes it possible to better observe the effect of the public instrument intervention. As the grants were too small to produce any direct effects, the positive effects were achieved indirectly, through enabling young firms to get bank loans, either by means of certification effect or because of behavioural additionality which raised their ability to apply for loans. The results show positive impact on firm survival after the recession.

JEL-Classification: H25

Keywords: grants, recession, young firms, survival, firm performance, bank loans

1. Introduction

Young firms are considered crucial for job creation, innovation, and growth, despite high relative exit rates (Huber et al., 2017; Calvino et al., 2015). On the other hand, young firms have greater difficulties in securing external financing (Marti & Quas, 2018) due to high information asymmetries and low value of collateral (Binks et al., 1992). These market imperfections are often corrected by government interventions in form of subsidies and/or grants.

Even though most studies focus on the impact of research and development (R&D) grants (for example, Dimos & Pugh, 2016), it is important to emphasize that not all firms are eligible for R&D grants as they may perform R&D sporadically or not at all. Consequently, a large percentage of young firms would benefit from grants that assist them in other activities. Just a few papers evaluate the impact of matching grants for business development on firm performance (e.g., López-Acevedo & Tan, 2011; Wren & Storey, 2002; McKenzie, Assaf & Cusolito, 2017), but these studies are not specific to young firms. To the authors' best knowledge, McKenzie (2017) is the only paper which addresses the above problem by analysing a business plan competition for start-ups in Nigeria.

Young firms are most vulnerable during the first few years on the market (Cowling, 2004; Coad, 2018), especially in a hostile environment during a recession. As demand decreases, firms update their expectations on future profits, resulting in a lower level of investment and decreased rates of new product introduction (Axarloglou, 2003; Gilchrist & Sim, 2007), all of which increase the need for external funding. Although this raises importance of public instruments, a lack of research on impact of such grants on young firms in recession is preventing governments from designing optimal policies .

This paper addresses the research gap by examining whether such grants increase survival and performance of young firms, and by which mechanism. The setting is the Republic of Croatia, which, due to its uniquely long recession period (2009–2014), is a perfect laboratory environment for studying recession-related topics. Contrary to other countries, the firms in our data set continued to operate in the hostile economic climate for several years after the grant receipt, thus enabling us to isolate the effect of matching grants from the effect of economic recovery.

This study also seeks to understand the mechanism by which these impacts are produced. We postulate that business developments grants may act in both direct and indirect way. For example, in McKenzie (2017) administered grants were substantial enough to have a direct

impact by enabling capital purchase and immediate hiring. But grants can also have an indirect impact, where they achieve results by enabling other related activities that eventually improve performance and survival. To prove that such effects can be significant, we need to decouple them from direct effects, which is possible only if the grants in question are too small to produce any direct impact. As that was true for the observed Croatian grants, we can conclude that any positive effects were achieved indirectly. The indirect effect was most likely achieved by increasing the probability of the young firm getting a bank loan, which in turn produced the positive effect through investment in capital and people. This could be accomplished by two parallel and non-exclusive paths. The first path is through certification effect, where risk-averse banks look upon recipients of government grants as "certified" by the government in terms of their financial health and overall risk. The second path is through behavioral additionality, i.e. through improving people's skills and raising their level of knowledge, including the knowledge of how to acquire external financing.

The indirect effect hypothesis has interesting consequences for public policy. Namely, for a country in recession with tight budget, the question is whether to invest relatively small sums of money in a large number of young firms, as opposed to supporting a very small number of companies with heftier sums. In the absence of a careful comparative analysis, our study shows that although small sums of money are insufficient to produce any direct positive effects, that money need not be wasted as the grants that aim at the business skills development impact are likely to produce positive effects in an indirect way.

To summarize, our contribution to the literature on young firms is the following:

1. We address impact of business development grants instead of R&D grants, which is relevant for a larger percentage of young firms.
2. We examine the impact of business development grants in recession, an under-researched area.
3. We postulate that the impact of business development grants can be achieved indirectly, by enabling firms to get external financing that allows them to grow and survive.

2. Literature review

Young firms are responsible for a lion's share of job creation (Huber et al, 2017), despite their vulnerability. Coad (2018) concludes that 50% of new entrants exit after 3-4 years, while Cowling (2006) shows the peak failure time to be somewhere between 18 months and two years. One of the main reasons for firm exit is limited access to external finance, (Evans & Jovanovic, 1989) , especially during an economic downturn (Gilchrist & Sim, 2007; Stucki, 2014). The financial constraints of young firms are the main rationale for government intervention with the goal of increasing the expected firm life and performance (Crepon & Duguet, 2003).

Most literature focused on R&D grants. Notable impact analyses of grants for young firms have been conducted in the United States (Lerner, 1999), Germany (Almus & Prantl, 2002; Czarnitzki & Delanote, 2015; Pfeiffer & Reize, 2000), Belgium (Decramer & Vanormelingen, 2016), Italy (Colombo, Giannangeli & Grilli, 2013; Del Monte & Scalera, 2001; Pellegrini & Muccigrosso, 2017), France (Crepon & Duguet, 2003; Désiage, Duhautois & Redor, 2010), Spain (Busom, 2000; González & Pazó, 2008; Huergo & Trenado, 2010; Segarra-Biasco & Teruel, 2016), Finland (Koski & Pajarinen, 2013) and Argentina (Butler, Galassi & Ruffo, 2016). Most papers (e.g. Butler et al., 2016; Crepon & Duguet, 2003; Pfeiffer & Reize, 2000) evaluate the impact on firm outcomes, such as survival and firm performance, while others evaluate the probability of receiving a grant (e.g. Busom, 2000; González & Pazó, 2008). Most of these studies find positive effects on survival and/or performance. Finally, the impact of grants on securing external finance has been less researched (e.g. Meuleman & De Maeseneire, 2012; Marti & Quas, 2018; Lerner, 1999).

Although periods of economic downturn are recognized as especially dangerous for young firms, the empirical evidence on the impact of grants during recessions is scarce (Burger & Rojec, 2018; Aristei et al., 2017; Hud & Hussinger, 2015). Aristei et al. (2017) as well as Hud and Hussinger (2015) evaluate the impact of R&D grants on R&D spending during the last recession and find a positive impact. Burger and Rojec (2018) in Slovenia find anti-crisis measures to have a positive impact only on the number of employees, but not on other firm performance metrics.

Just a few papers evaluate the impact of matching grants for business development as opposed to R&D grants (e.g., López-Acevedo & Tan, 2011; Wren & Storey, 2002; McKenzie, Assaf & Cusolito, 2017), but these studies are not specific to young firms. The closest paper to our study is McKenzie (2017), which examines a business plan competition for start-ups in Nigeria.

Information asymmetry is one of the culprits for young firms' problems with external finance securing. In the last two decades, the literature yielded the "certification hypothesis" (e.g. Marti & Quas, 2018), which states that receiving a public grant acts as a governmental quality stamp indicating the firm's quality. Several papers have empirically supported the certification hypothesis (Lerner, 1999; Meuleman, & De Maeseneire, 2012; Marti, & Quas, 2018).

While the certification hypothesis demonstrates one mechanism of how grants can affect obtaining bank loans, it is not the only one. Clarysse, Wright and Mustar (2009) evaluate the behavioral additionality of grants, whereby the firms' learning activities change as a result of a policy instrument. They find a positive effect of R&D grants on learning activities in firms. More recently, Chapman and Hewitt-Dundas (2018) find the impact of innovation subsidies on a higher level of managers' openness to external knowledge as well as risk tolerance. Behavioral additionality is relevant for the scope of this paper, because obtaining a matching grant for business development services directly impacts the behavior of the recipient firm.

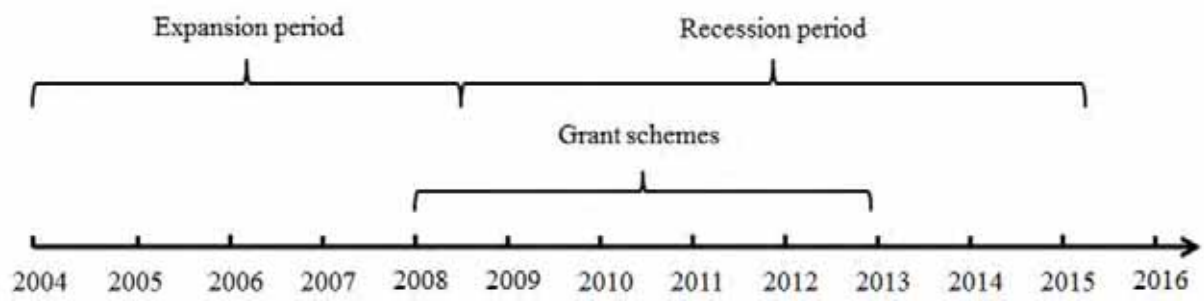
3. Data and methodology

3.1 Data and institutional setting

Data for this research come from three large datasets: (1) financial data on the population of Croatian enterprises from the 2007–2016 period, obtained from the Croatian Financial Agency (FINA); (2) data on grants given to firms in the 2008–2013 period, obtained from the Ministry of Entrepreneurship and Crafts of the Republic of Croatia (hereafter: Ministry); and (3) court register of incorporated companies. The FINA dataset includes all the items from various financial statements each firm has to report at the end of the, and it also includes firms' characteristics such as ownership structure, county, size, etc. On the other hand, the Ministry dataset includes only the name of the firm (recipient of the grant), the amount of money it was given under a certain grant scheme, and the year when this happened. Finally, the court register of incorporated companies contains data on the people associated with each company, together with their characteristics such as age, gender and their function within the company.

As already mentioned, our analysis is set in the period of economic downturn in Croatia. As Figure 1 illustrates[1], Croatian economy experienced a period of expansion that ended with the onset of recession in late 2008. Unlike some other Central European economies, it took Croatia almost seven years to bounce back to positive growth. Grant schemes that are the focus of this research were introduced in 2008 and were running for five years.

Figure 1: Time setting of the research



[1] Unless stated otherwise, all Figures and Tables in this paper are produced by authors themselves.

The Ministry supported young firms during the recession with the following grant schemes: (1) Youth in entrepreneurship; (2) Entrepreneur beginner; (3) Entrepreneurship of youth, beginners and people with disabilities; (4) Entrepreneurship of target groups; and (5) Youth and beginners in entrepreneurship. These five programs are briefly summarized (activities co-funded by the grant, maximum value of a grant and conditions for obtaining a grant) in Table A1 in the Appendix (all monetary values are expressed in Croatian kuna, HRK[2]). Distribution of these grants by year and different grant schemes is presented in Table A2 in the Appendix.

3.2 Methodology

The methodology for the analysis of causal effect is based on Rosenbaum and Rubin's (1983) work, which requires treatment and control groups. The challenge here is to find a control group, as firms receiving the grant might have systematic differences from firms that did not receive the grant (Heckman, Ichimura & Todd, 1998). We define treatment D as a binary variable which takes the value of 1 for treated observations and 0 for non-treated (controlled,) observations. Consequently, y_0 and y_1 are outcomes in the controlled and treatment group, respectively.

We proceed by utilizing Rubin's (1977) assumption of conditional independence (CIA), which states that potential outcomes are independent of treatment assignment, given a set of observable covariates X which are not affected by the treatment, $y_0, y_1 \perp D| X$. In the latter form, the CIA allows for the usage of methods that match a treated unit with one or several control units that are as similar as possible in their pre-treatment characteristics, the latter group being used to estimate the counterfactual scenario. Matching is done using propensity score, defined as the conditional (predicted) probability of receiving treatment given pre-treatment characteristics X (Rosenbaum & Rubin, 1983), $p(X) = P(D = 1|X) = E(D|X)$, estimated using the probit model. The key assumption is that after conditioning on covariates, the expected outcome in the absence of treatment does not depend on treatment status. Propensity scores are restricted to the area of common support, which means that we consider only those

[2] 1 EUR = 7.529 HRK (2016 average).

observations that belong to the intersection of the intervals of propensity scores for treated and control observations. A further advantage of matching methods is that they require no assumptions on the functional form of error terms. However, matching only controls for the selection of observables; therefore, it is important to control for variables which impact both receiving the treatment and the potential outcome.

3.3 Matching algorithm

We use a combination of nearest neighbor and exact matching to obtain the control group. From the dataset of potential control firms, one control firm per one treated firm is drawn without replacement. For an outcome variable y, the average treatment effect on the treated unit (ATT) can be estimated using the formula $ATT = \frac{1}{N^T}\sum_{i\in T}\left(Y_i^T - Y_i^C\right)$. For the treated unit i, y_i^T stands for the outcome value of variable y, while y_i^C denotes the outcome value of itsnearest neighbor. Prior to the matching process, we check whether the pre-treatment covariates are balanced between treatment and control firms (Rosenbaum & Rubin, 1983). If they are not significantly different from each other, then the balancing property holds, meaning that exposure to treatment can be considered as random.

3.4 List of variables used in analysis

We define a binary variable *subs_d* which measures whether a firm obtained any grant funding (Table A3).

Table A4 lists a rich set of covariates used in calculating the propensity score. To avoid the problem of simultaneity, all covariates enter the calculations with a lag of one period. The covariates in our matching procedure were identified during the analysis of public call schemes and literature review[3]. Three covariates were used as exact matching variables: firm's *age*, operating *surplus* in the year prior to the grant call and the *year* to capture the variation within each year.

[3] Detailed elaboration on why each covariate is used has been removed to save space. The elaboration is available upon request.

Table A5 lists all outputs in the analysis. Variable *survives in 2016* is a dummy variable indicating that firm is alive in 2016. The year 2016 was chosen as this marks the end of our available dataset, two years after the recession was officially over. Variables *rturn* and *l* need no further explanation. Labor productivity (*lp*) is the ratio of real value added and number of employees for each firm. Finally, variables *short- and long-term bank loans* represent the value of these loans given to firms.

4. Results

4.1 Descriptive statistics

After defining treatment, covariates and output, we present some descriptive statistics (Table 1). As can be seen, statistically significant differences only appear before the matching process, indicating that we found suitable matches for all treated units. Concentrating now on the pre-matching results, we can see that treated firms are on average younger, have fewer employees and have lower sales and export revenues, while the ratio of firms operating with profit is about the same. Treated firms are also dominated by control firms in terms of all other performance variables, with the most noticeable difference in real short-term liabilities towards the employees and the smallest difference in real average wage. Another important difference can be found in terms of previous grant or subsidy experience, where almost half of all treated firms (47 percent) received some form of government support prior to the grants observed in this study, compared to only 6 percent of control sample firms. When it comes to regional distribution, 40 percent of all firms in the treated group are situated in Zagreb region, about a quarter (23 percent) in central Croatia, while the other Croatian regions each have roughly the same percentage of firms. In the control subsample, less firms are located in eastern and central Croatia, while more firms come from southern Croatia. 95 percent of firms in the control group and all the treated firms are in domestic ownership. In terms of technological and knowledge intensity sectors, most of the firms in both treatment and control samples come from sectors providing knowledge intensive other services and less knowledge intensive services.

Quality of matching was evaluated using t-tests, pseudo R^2, and reduction in standardized bias, as recommended in Caliendo and Kopeinig (2008). T-tests after matching demonstrate no significant difference between the treated and control observations. In addition, for all the variables where the initial difference between treated and untreated units is significant, matching achieves large reductions in the percentage of standardized bias. As for pseudo R^2, probit estimation on the set of treated and control units used in matching yields the pseudo R^2 of 3 percent (compared to 20 percent shown in Table 5), which indicates that matching eliminated systematic differences in the distribution of covariates between both groups. In addition, the highly insignificant LR chi^2-test (prob > chi^2 = 0.99 compared to prob > chi^2 = 0.00 for unmatched observations) confirms that covariates are not significant in explaining the receipt of a subsidy after matching.

Table 1: Balance of covariates used in analysis (common support applies)

	Before matching				After matching				
Variable	**Treated means (n = 222)**	**Control means (n = 32,322)**	**Difference (2-tailed t-tests)**	**St. bias (%)**	**Treated means (n = 222)**	**Control means (n = 222)**	**Difference (2-tailed t-tests)**	**St. bias (%)**	**% of reduction in standardized bias**
Public grant call variables									
l_surplus	0.7838	0.7389	0.0449	10.54	0.7838	0.7838	0.0000	0	100
l_age	0.5405	2.0186	–1.4781***	–128.22	0.5405	0.5405	0.0000	0	100
l_lnl	1.2117	1.4690	–0.2572***	–37.94	1.2117	1.1527	0.0590	9.88	73.96
l_lnrx	1.5608	1.8174	–0.2567	–6.06	1.5608	2.1100	–0.5493	–12.78	–110.86[a]
l_lnrturn	12.2977	13.3458	–1.0481***	–60.88	12.2977	12.1765	0.1212	6.91	88.66
Other performance variables									
l_lnrcash	9.5564	9.7461	–0.1897	–7.46	9.5564	9.4132	0.1432	5.74	23.06
l_lnrlt_liab	2.5516	4.1227	–1.5711***	–28.67	2.5516	2.5570	–0.0054	–0.11	99.62
l_lnrst_liab_l	8.5145	9.1505	–0.6361***	–25.61	8.5145	8.5821	–0.0676	–2.72	89.38
l_lnrst_liab_state	9.1562	9.6473	–0.4912***	–23.75	9.1562	9.1968	–0.0407	–2.06	91.34
l_lnrst_liab_bank	1.7915	2.2847	–0.4932	–11.33	1.7915	1.8972	–0.1057	–2.55	77.49
l_lnrlt_liab_bank	1.8616	3.1102	–1.2486***	–25.22	1.8616	1.7424	0.1192	2.74	89.13
l_lnav_rw	9.7286	10.3727	–0.6441***	–63.99	9.7286	9.6163	0.1123	7.95	87.58
l_lnasset	8.8749	10.0358	–1.1609***	–26.45	8.8749	9.0509	–0.1760	–3.98	84.95
Previous subsidy/grant experience									
l_sub_d	0.1982	0.0665	0.1317***	39.55	0.1982	0.1667	0.0315	8.15	79.38
Entrepreneur characteristics									
mage	36.6122	41.6183	–5.0061***	–50.25	36.6122	36.8138	–0.2017	–2.05	95.93
l_mage*l_lnl team1	45.4105	62.0519	–16.6414***	–49.18	45.4105	42.7401	2.6704	9.50	80.68
team2	0.9775	0.8570	0.1205***	45.67	0.9775	0.9910	–0.0135	–7.97	82.56
team3	0.0090	0.0689	–0.0599***	–31.32	0.0090	0.0045	0.0045	5.49	82.48
gcomb1	0.0135	0.0741	–0.0606***	–29.92	0.0135	0.0045	0.0090	9.52	68.17
gcomb2	0.6532	0.6925	–0.0393	–8.38	0.6532	0.6937	–0.0405	–8.63	–3.06[a]
gcomb3	0.3423	0.2760	0.0663*	14.37	0.3423	0.3018	0.0405	8.66	39.69
	0.0045	0.0315	–0.0270*	–20.40	0.0045	0.0045	0.0000	0.00	100.00

Table 1 (continued)

Variable	Before matching				After matching				
	Treated means (n = 222)	Control means (n = 32,322)	Difference (2-tailed t-tests)	St. bias (%)	Treated means (n = 222)	Control means (n = 222)	Difference (2-tailed t-tests)	St. bias (%)	% of reduction in standardized bias
Firm characteristics									
dom	0.9955	0.9687	0.0268	20.31	0.9955	0.9910	0.0045	5.49	72.98
tech1	0.0090	0.0180	–0.0090	–7.79	0.0090	0.0090	0.0000	0.00	100.00
tech2	0.0135	0.0048	0.0087	9.19	0.0135	0.0000	0.0135	16.51	–79.74[a]
tech3	0.0135	0.0144	–0.0008	–0.72	0.0135	0.0270	–0.0135	–9.58	–1234.9[a]
tech4	0.0541	0.0440	0.0100	4.64	0.0541	0.0450	0.0090	4.14	10.70
tech5	0.0901	0.0549	0.0352*	13.58	0.0901	0.1081	–0.0180	–6.02	55.66
tech6	0.0000	0.0093	–0.0093	–13.67	0.0000	0.0000	0.0000	–	–[b]
tech7	0.1036	0.1328	–0.0292	–9.05	0.1036	0.1081	–0.0045	–1.46	83.86
tech8	0.1261	0.0445	0.0816***	29.49	0.1261	0.1532	–0.0270	–7.79	73.60
tech9	0.3423	0.2252	0.1171***	26.16	0.3423	0.2883	0.0541	11.63	55.56
tech10	0.2477	0.4521	–0.2044***	–43.83	0.2477	0.2613	–0.0135	–3.10	92.94
region1	0.4054	0.3809	0.0245	5.02	0.4054	0.3964	0.0090	1.83	63.43
region2	0.1216	0.1539	–0.0323	–9.37	0.1216	0.1081	0.0135	4.23	54.87
region3	0.1351	0.0829	0.0523**	16.80	0.1351	0.1306	0.0045	1.32	92.12
region4	0.2027	0.1427	0.0600*	15.90	0.2027	0.2297	–0.0270	–6.55	58.77
region5	0.1351	0.2396	–0.1045***	–26.99	0.1351	0.1351	0.0000	0.00	100.00
Year dummies									
year08	0.2477	0.1611	0.0867***	21.58	0.2477	0.2477	0.0000	0.00	100.00
year09	0.0721	0.1627	–0.0906***	–28.41	0.0721	0.0721	0.0000	0.00	100.00
year10	0.2748	0.1625	0.1123***	27.38	0.2748	0.2748	0.0000	0.00	100.00
year11	0.3694	0.1643	0.2050***	47.58	0.3694	0.3694	0.0000	0.00	100.00
year12	0.0135	0.1769	–0.1634***	–57.94	0.0135	0.0135	0.0000	0.00	100.00
year13	0.0225	0.1725	–0.1500***	–52.24	0.0225	0.0225	0.0000	0.00	100.00

Notes: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$. Notation [a] denotes the cases where the standardized bias increases; however, in all these cases the initial difference in means between treated and non-treated units is insignificant. Percentage reduction in standardized bias is computed as $\left(1 - \frac{|\text{st.bias after matching}|}{|\text{st.bias before matching}|}\right) \times 100$. Notation [b] denotes a case that cannot be computed because it involves division by zero.

4.2 Estimating propensity scores

We start off by estimating propensity scores using a probit model:

$$subs_{i,t} = \alpha + \beta' PGC_{i,t-1} + \gamma' PER_{i,t-1} + \delta' X_i + \eta' EC_{it-1} + e_{i,t} \quad (1)$$

where $subs$ represents a dummy variable indicating whether or not the firm received a grant, PGC is a matrix of public call variables, PER is a matrix of performance variables (including previous subsidy experience), EC is a matrix of all entrepreneur characteristics used, X is a matrix of other firm time-invariant characteristics (region, sector and year), and e is the i.i.d. error term. Estimation results are presented in Table 2.

Table 2: Results of the probit model

Variable	Version 1		Version 2	
	Estimate	S. e.	Estimate	S. e.
(Intercept)[4]	228.4535***	34.8424	159.0049***	38.7395
l_surplus	0.2734***	0.0757	0.2953***	0.0770
l_age	–0.3611***	0.0313	–0.3610***	0.0327
l_lnl	–0.0017	0.0561	–0.2020	0.1692
l_lnrx	0.0047	0.0069	0.0056	0.0070
l_lnrturn	–0.0915**	0.0281	–0.0926**	0.0289
l_lnrcash	–0.0075	0.0122	–0.0044	0.0126
l_lnrlt_liab	0.0034	0.0096	0.0050	0.0097
l_lnrst_liab_l	–0.0022	0.0123	0.0005	0.0125
l_lnrst_liab_state	0.0104	0.0163	0.0096	0.0166
l_sh_bank	–0.0027	0.0072	0.0001	0.0073
l_lo_bank	–0.0020	0.0109	–0.0034	0.0110
l_lnav_rw	–0.0336	0.0262	–0.0303	0.0269
l_sub_d	0.4724***	0.0782	0.4868***	0.0798
l_lnasset	0.0115	0.0073	0.0106	0.0074
dom	0.5256	0.3586	0.5324	0.3658
mage			–0.0209***	0.0061
mage_labor			0.0054	0.0039
team1 (ref: team 3)			0.4385	0.2452
team2 (ref: team 3)			–0.3564	0.3377
gcomb1 (ref: gcomb3)			–0.0111	0.4334
gcomb2 (ref: gcomb3)			0.0350	0.4355
Observations	32.544		32.544	
Year FE	YES		YES	
Region FE	YES		YES	
Sector FE	YES		YES	
McFadden pseudo R^2	0.1852		0.2020	

Note: * p < 0.05; ** p < 0.01; *** p < 0.001.

[4] Notice that the intercept in both models is rather large, in order to balance the variable year which is larger than 2008.

Adding entrepreneur characteristics produces almost no changes on the coefficients associated with the joint set of variables in the models. In both versions of the model significant factors are firm age, entrepreneurs' age, turnover, surplus, and history of previous experience with government funding. More precisely, younger firms are more likely to apply, as are firms with lower turnover. On the other hand, the grant-awarding agencies look for proof that the grant will be well used, hence favouring the firms with positive surplus as an indication of financial "health". In addition, if a firm has received some kind of governmental funds in the past, agencies may interpret this as a signal that this firm is lower-risk, as it knows how to utilize grants successfully. With regards to entrepreneur characteristics, the only new significant factor is mean age – younger entrepreneurs more likely to be awarded the grant. This may be because of the conditions of the schemes (Table A1), which favour youth.

4.3 Estimation of treatment effects

The ATT estimations are presented in Table 3, encompassing survival outcomes, bank loans and firm performance. Results indicate that the grant impact on survival in 2016 is positive and significant. Since we performed exact matching on the year of firm founding and the year of grant receipt, we could delve deeper and compare the survival status one to five years after the grant was awarded to check whether the "cash and carry" effect occurs. We find that all those effects are insignificant, although the absolute value of the effect increases. We examined the effect of grants on firm performance, and found no significant effects. By examining the effect on bank loans, we observe that treated firms obtained significantly more long-term loans, with no effect on short-term loans.

Although the grants were very small, they were still able to affect survival and access to external finance. Explanation lies in the fact that grants were targeted at business development: skills and knowledge, they brought introduced changes in behaviour that comprise what Clarisse et al. (2009) call *behavioural additionallity*. The entrepreneurs, emboldened by the successful grant application and their newly acquired knowledge, may have decided to apply for bank loans.

Table 3: Estimation results of ATT

	Treated means (n = 222)	Control means (n = 222)	ATT (one-tailed)	ATT (two-tailed)
Survival				
Survives in 2016 dummy	0.9279	0.8604	0.0676** (0.0277)	0.0676* (0.0277)
Survives in t + 1 dummy	1.0000	1.0000	0.0000 (0.0000)	0.0000 (0.0000)
Survives in t + 2 dummy	1.0000	0.9910	0.0090 (0.0063)	0.0090 (0.0063)
Survives in t + 3 dummy	0.9955	0.9820	0.0135 (0.0100)	0.0135 (0.0100)
Survives in t + 4 dummy	0.9595	0.9324	0.0270 (0.0168)	0.0270 (0.0168)
Survives in t + 5 dummy	0.9189	0.8919	0.0270 (0.0220)	0.0270 (0.0220)
Bank loans				
Log (1 + long-term bank loans at t + 1)	4.0834	2.7488	1.3346** (0.5219)	1.3346** (0.5219)
Log (1 + sum of long-term bank loans at t + 1, t + 2 and t + 3)	5.8937	3.7609	2.1327*** (0.5493)	2.1327*** (0.5493)
Log (1 + short-term bank loans at t + 1)	2.1412	1.8785	0.2627 (0.4042)	0.2627 (0.4042)
Log (1 + sum of short-term bank loans at t + 1, t + 2 and t + 3)	3.5657	3.1291	0.4366 (0.4664)	0.4366 (0.4664)
Firm performance				
Real turnover growth from t to t + 1 (in %)	16.5081	12.0847	4.4235 (5.2920)	4.4235 (5.2920)
Real turnover growth from t to t + 3 (in %)	62.3571	60.4192	1.9379 (14.2497)	1.9379 (14.2497)
Real turnover growth from t to t + 5 (in %)	105.9309	135.2771	–29.3462 (28.7149)	–29.3462 (28.7149)
Number of employees growth from t to t + 1 (in %)	20.6397	16.5886	4.0511 (5.5811)	4.0511 (5.5811)
Number of employees growth from t to t + 3 (in %)	48.2460	39.6938	8.5522 (9.6623)	8.5522 (9.6623)
Number of employees growth from t to t + 5 (in %)	72.2112	55.6292	16.5820 (13.6868)	16.5820 (13.6868)
Labor productivity growth from t to t + 1 (in %)	8.8050	13.1563	–4.3513 (7.2949)	–4.3513 (7.2949)
Labor productivity growth from t to t + 3 (in %)	23.3253	21.5326	1.7926 (9.4471)	1.7926 (9.4471)
Labor productivity growth from t to t + 5 (in %)	31.1653	53.8401	–22.6748 (12.4221)	–22.6748 (12.4221)

Notes: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$. Standard errors used to calculate significance levels of average treatment effect on the treated were based on Abadie and Imbens (2008) formulation.

The fact that a firm was given a government grant can be taken as a signal that a reputable party found it's financial health satisfactory. That makes the young firm appear less risky form the bank's point of view, hence increasing the likelihood of getting a loan. Although allocated

grants were too small to have any direct effect, through behavioral additionality and certification they attracted bank loans that were substantial enough to enable the recipient to survive the recession. These long-term bank loans, which injected larger amounts of cash, allowed the firm to conduct business activities that would not necessarily be performed otherwise. Hence, the impact on survival would become significant only after all those activities came to fruition, which means after a longer period of time.

Table 4: Estimation results of ATT for two age cohorts

	One year old firms			Two to five years old firms		
	Treated means (n = 147)	**Control means (n = 147)**	**ATT**	**Treated means (n = 75)**	**Control means (n = 75)**	**ATT**
Survives in 2016 dummy	0,9252	0,8776	0,0476* (0,0349)	0,933	0,827	0,1067** (0,0527)
Log (1 + short-term bank loans at t + 1)	2,1490	1,4682	0.6808* (0,4747)	2,1259	2,6826	–0,5567 (0,7712)
Log (1 + sum of short-term bank loans at t + 1, t + 2 and t + 3)	3,4851	2,4808	1,0042** (0,5870)	3,7280	4,4713	–0,7433 (0,9505)
Log (1 + long-term bank loans at t + 1)	4,1428	2,5999	1,5428*** (0,6286)	3,9670	3,0405	0,9265 (0,9015)
Log (1 + sum of long-term bank loans at t + 1, t + 2 and t + 3)	5,7833	3,6985	2,0849*** (0,7156)	6,1158	3,8903	2,2255** (1,0397)
Real turnover growth from t to t + 1 (in %)	23,7834	17,7296	6,0540 (7,0550)	2,2486	1,0205	1,228 (8,745)
Real turnover growth from t to t + 3 (in %)	62,760	70,698	–7,937 (17,668)	61,546	39,139	22,407 (26,767)
Real turnover growth from t to t + 5 (in %)	127,996	169,585	–41,589 (45,586)	62,460	67,198	–4,738 (31,357)
Number of employees growth from t to t + 1 (in %)	28,085	17,698	10,387* (7,335)	6,047	14,415	–8,368 (7,279)
Number of employees growth from t to t + 3 (in %)	55,068	40,339	14,729 (13,025)	34,509	38,358	–3,850 (16,395)
Number of employees growth from t to t + 5 (in %)	87,587	48,710	38,877** (18,559)	41,918	69,359	–27,440 (25,842)
Labor productivity growth from t to t + 1 (in %)	10,226	17,469	–7,243 (9,463)	6,021	4,704	1,317 (11,833)
Labor productivity growth from t to t + 3 (in %)	25,492	29,626	–4,134 (12,655)	18,962	4,776	14,186 (11,874)
Labor productivity growth from t to t + 5 (in %)	35,840	74,147	–38,306 (19,737)	21,955	13,545	8,410 (17,803)

Note: * p < 0.1; ** p<0.05; *** p<0.01; Standard errors used to calculate significance levels of average treatment effect on the treated were based on Abadie and Imbens (2008) formulation.

Separate analysis of one-year old firms and two to five year olds are presented in the Table 4. Grants exhibit larger effect on one-year old firms. In particular, a positive impact on both short-term and long-term bank loans is reported. The impact of grants via the mechanism of bank loans on employment growth is observed one year after the grant, but in particular five years after grant. On the other hand, in the subset of firms two to five years old no empirical support was found for a positive effect on firm performance variables, apart for a positive effect on survival after recession.

4.4 Robustness checks

To check the validity of our results, we conduct a placebo test and Rosenbaum bounds. For the former, we discard the treated group, make the control group a placebo treated group and find another control group for them. Since this is an artificially manufactured treatment, we expect no statistically significant results between this placebo treatment and its controls. Results shown in Table A8 support the balancing property, while the placebo test presented in Table 5 supports our main findings.

Table 5: Estimation results of placebo ATT

	Placebo treated means (n = 222)	**Placebo control Means (n = 222)**	**ATT (one-tailed)**	**ATT (two-tailed)**
Survival				
Survives in 2016 dummy	0.8604	0.8739	–0.0135 (0.0322)	–0.0135 (0.0322)
Bank loans				
Log (1 + long-term bank loans at t + 1)	2.7488	2.9261	–0.1773 (0.4818)	–0.1773 (0.4818)
Log (1 + sum of long-term bank loans at t + 1, t + 2 and t + 3)	3.7609	4.0895	–0.3286 (0.5282)	–0.3286 (0.5282)
Log (1 + short-term bank loans at t + 1)	1.8785	1.3187	0.5598 (0.3734)	0.5598 (0.3734)
Log (1 + sum of short-term bank loans at t + 1, t + 2 and t + 3)	3.1291	2.8147	0.3144 (0.4892)	0.3144 (0.4892)

Table 5 (continued)

	Placebo treated means (n = 222)	Placebo control Means (n = 222)	ATT (one-tailed)	ATT (two-tailed)
Firm performance				
Real turnover growth from t to t + 1 (in %)	12.0847	21.7753	–9.6906 (6.7621)	–9.6906 (6.7621)
Real turnover growth from t to t + 3 (in %)	60.4192	49.1048	11.3144 (15.0972)	11.3144 (15.0972)
Real turnover growth from t to t + 5 (in %)	135.2771	96.4329	38.8442 (30.3833)	38.8442 (30.3833)
Number of employees growth from t to t + 1 (in %)	16.5886	16.2746	0.3140 (5.5298)	0.3140 (5.5298)
Number of employees growth from t to t + 3 (in %)	39.6938	35.0107	4.6831 (8.9815)	4.6831 (8.9815)
Number of employees growth from t to t + 5 (in %)	55.6292	55.4564	0.1728 (14.5088)	0.1728 (14.5088)
Labor productivity growth from t to t + 1 (in %)	13.1563	15.7646	–2.6084 (9.1110)	–2.6084 (9.1110)
Labor productivity growth from t to t + 3 (in %)	21.5326	23.2762	–1.7435 (12.2059)	–1.7435 (12.2059)
Labor productivity growth from t to t + 5 (in %)	53.8401	79.2772	–25.4371 (24.6119)	–25.4371 (24.6119)

Notes: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$. Standard errors used to calculate significance levels of average treatment effect on the treated were based on Abadie and Imbens (2008) formulation.

We further check for the possibility of hidden bias with Rosenbaum's (2002) bounding approach. This approach is increasingly used for sensitivity analyses in the literature on the impact of grants using matching methods (e.g. Michalek, Ciaian & Kancs, 2015). The Rosenbaum bounds test estimates how much hidden bias would render the significance of results. Therefore, this robustness is applied to the statistically significant results—survival and long-term bank loans.

As shown in Table 6, the impact on firm survival after the recession is rather robust for up to 20–25 percent hidden bias. Furthermore, long-term bank loans in the next three years are rather robust, not changing significance for up to 20–25 percent hidden bias. Finally, long-term bank loans in the next year are sensitive, not changing significance for up to 5–10 percent hidden bias, in line with other findings (Michalek, Ciaian & Kancs, 2015).

Table 6: Rosenbaum bounds test results (N = 222 matched pairs)

	Survives in 2016 dummy		Long-term bank loans in next three years		Long-term bank loans in next year	
Gamma	**Lower bound significance level**	**Upper bound significance level**	**Lower bound significance level**	**Upper bound significance level**	**Lower bound significance level**	**Upper bound significance level**
1.00	0.0111	0.0111	0.0024	0.0024	0.0316	0.0316
1.05	0.0072	0.0167	0.0011	0.0051	0.0192	0.0499
1.10	0.0046	0.0240	0.0005	0.0096	0.0114	0.0743
1.15	0.0030	0.0333	0.0002	0.0168	0.0067	0.1052
1.20	0.0019	0.0447	0.0001	0.0277	0.0039	0.1424
1.25	0.0012	0.0584	0.0000	0.0430	0.0022	0.1856
1.30	0.0008	0.0743	0.0000	0.0634	0.0013	0.2338

Note: Gamma is odds of differential assignment to treatment due to unobserved factors.

Estimates in Table 6 were performed using R package *rbounds*. Significance levels were computed using the *psens* function, which calculates Rosenbaum bounds for continuous or ordinal outcomes based on the Wilcoxon signed-rank test.

5. Conclusion

In this paper we study the effect of business development grants on young firms in recession. The setting is the Republic of Croatia – a perfect laboratory environment for studying recession-related topics due to its uniquely long recession period (2009–2014). In particular, we explore the impact of grants on obtaining bank loans, on firm survival and on firm performance. We estimate these impacts using matching techniques, and confirm the robustness of our results using placebo tests and Rosenbaum bounds.

Our contribution to the literature is in exploring a unique combination of the following three factors: (1) business development grants (instead of R&D subsidies), (2) concentrating on young firms, and (3) performing analysis in recession setting.

Our major finding is that, although the grants were very small, they were still able to affect survival up to 2016 (after the recession was over), and access to external finance. This positive effect on survival is similar to the findings of Pellegrini and Muccigrosso (2017), Crepon and Duguet (2003) and Almus and Prantl (2002), although their positive effect is found in a different setting than ours. Unlike Pfeiffer and Reize (2000), we do not find any evidence of the negative "cash and carry" effect of grants on firm survival. In regards to external finance, the recipient firms exhibited a larger amount of long-term loans almost immediately after the grant was awarded, as well as three years later. This is in line with other studies, such as Marti and Quas (2018) and Meuleman and De Maeseneire (2012) who also find positive effects of governmental intervention on obtaining external finance, albeit for larger grants or loans and unrelated to recession.

We explain our results through two channels: behavioral additionality and certification effect, which are both consequences of the grant scheme nature. Regarding the former, as the grant could be used only for the purpose of business development, firms were forced to absorb certain business knowledge and consequently change their behavior, which may have encouraged the entrepreneurs to seek bank loans. As for the latter, risk-averse banks might have looked upon recipients of grants as "certified" by the government in terms of their financial health and overall risk, which made them more likely to obtain a loan (especially a long-term one). Although the grants were too small to have any striking direct effect, behavioral additionality and certification paved the way for acquiring bank loans, which were in turn substantial enough to enable the recipients to survive the recession.

Interestingly, we find no significant effect on young firm performance. In the subset analysis, we find positive impact of government intervention on employment growth of one year old firms. Other studies that found positive impacts were conducted on R&D subsidies and outside of a recession. Therefore, the only study that is relevant to our setting is Burger and Rojec (2018), which finds no effect of specific anti-crisis subsidies on revenues. The absence of significant effect in our study can be explained by the difficulty that survival presents for a young firm in recession: namely, just surviving and maintaining the same level of performance takes so much effort that none of the firm's capacity is left for performance improvement. On the other hand, a positive impact on one year old firms can be explained with decreasing informational asymmetry whereby those very young firms obtain bank loans, using them to increase employment. Unfortunately, this process did not increase labor productivity nor turnover.

Our findings raise questions related to the discussion of the extent to which a government should be intervening during a recession, and which firms should receive support (Shane, 2009; Lerner, 2009). This is especially important for emerging economies, which are usually hit hard in recessions and have limited resources for policy intervention. Although one could easily make a case that the preferred approach would be to choose winners carefully and to support them with larger grants as opposed to widely distributing minuscule grants, we find that the latter strategy need not be just a waste of public money. We found that even small sums of money widely distributed can have a significant effect if they are targeted at knowledge absorption and skill creation. These findings provide valuable lessons to be learned and are generalizable at least to the Southeast European countries, which have been found to have shared history, similar institutional settings and existing grant schemes (OECD et al., 2016).

This paper is not without limitations. A standard challenge of matching estimations is the availability of more covariates to account for unobservables. Along this line, future research is encouraged to control for characteristics of entrepreneurs, including their levels of human capital and wealth. Despite data limitations, we managed to control for entrepreneur-level characteristics such as age, gender and size of the founding team. The entrepreneur-level data were supplemented with a rather rich firm-level dataset which proxied for human capital (e.g. average wage) and wealth (e.g. short- and long-term debts, turnover). Finally, a standard limitation is that we do not undertake the general equilibrium analysis, but only analyze the average treatment effect on the treated firms. There might be other positive spillovers to other firms, such as consultants, suppliers of equipment, etc. which we do not estimate.

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Appendix

Table A1: Basic information on the grant schemes

Name	Description	Maximum grant per firm	Eligibility criteria
Entrepreneurship of target groups	Activities supported were: procurement of IT equipment and business software, obtaining the required documentation (costs of public notary, probation forms, court experts, project-technological documentation, environmental impact study, business plan, various permits), part of the registration fee (not including founding capital), supplementary entrepreneurial education and IT education (except for study costs).	The max. possible grant per firm was set at 70,000 HRK.	Micro firms (no more than 9 employees), not older than 3 years, registered in Croatia, no unpaid obligations towards state or towards employees, did not record a loss in previous year.
Entrepreneurship of youth, beginners and people with disabilities	Activities supported were: procurement of IT equipment and business software, obtaining the required documentation (costs of public notary, probation forms, court experts, project-technological documentation, environmental impact study, business plan, various permits), part of the registration fee (not including founding capital), supplementary entrepreneurial education and IT education (except for study costs). The call was active 2008–2011.	In 2008 max. possible grant per firm was set at 80,000 HRK (20,000 minimum), whereby up to 75% (VAT excluded) of the project was subsidized. The minimum grant amount per firm was set at 5,000 HRK in 2011.	Firms on the market at least one month prior to the call, did not record a loss in previous year, registered in Croatia, at least one full-time employee, no unpaid obligations towards state or towards employees.
Entrepreneur beginner/New entrepreneur	The grant was aimed at subsidizing development projects; advertising; education/vocational training; supply of equipment, tools and inventory (excluding consumables, merchandise and vehicles); office renovation/workshops; business plan development and consultancy services; entrepreneurial education (except for study costs); website design and publishing costs; costs of firm establishment (not including founding capital). The call was active 2012–2013.	In 2012 max. possible grant per firm was set at 100,000 HRK (20,000 minimum). The grant was given based on the proposed project, whereby 100% (VAT excluded) of the project was subsidized.	Micro and small firms, owners not older than 30, on the market at least one month prior to the call.

Table A1 (contunued)

Name	Description	Maximum grant per firm	Eligibility criteria
Youth in entrepreneurship	The grant was aimed at motivating youth to enter entrepreneurship in order to create new entrepreneurship generations and improving the existing businesses of young entrepreneurs for future growth and development. It included investments in youth entrepreneur projects with the goal of technological advancement of business operations; marketing; education/vocational training; office renovation/workshops; business plan development and consultancy services; entrepreneurial education (except for study costs); website design and publishing costs; costs of firm establishment (not including founding capital). The call was active 2012–2013.	In 2012 max. possible grant per firm was set at 100,000 HRK (20,000 minimum). The grant was given based on the proposed project, whereby 100% (VAT excluded) of the project was subsidized.	Micro and small firms, owners not older than 30, on the market at least one month prior to the call.
Youth and beginners in entrepreneurship	The grant included investments in business development; developing manufacturing; development of new products/services; penetrating foreign markets; management and protection of intellectual and industrial property; introduction of quality management systems, norms and quality marks; marketing activities; vocational education and training; adaptation, conversion and expansion of business/ manufacturing space. The call was active in 2013.	Max. possible grant per firm was set at 250,000 HRK (20,000 minimum). The grant was given based on the proposed project, whereby 75% (VAT excluded) of the project was subsidized.	Micro firms (no more than 9 employees), not older than 3 years, registered in Croatia, no unpaid obligations towards state or towards employees, independent in doing their business, did not record a loss in previous year.

Sources: Government of the Republic of Croatia (2008, 2009, 2010, 2011) *Operativni plan poticaja malog i srednjeg poduzetništva* & Vlada Republike Hrvatske (2012, 2013) *Poduzetnički impuls – Plan poticanja poduzetništva i obrtništva.*

Table A2: Distribution of government grants

Year	Grant scheme name	Firms	Total amount (HRK)	Mean (s. d.) (HRK)
2008	Entrepreneurship of target groups	275	2,136,000	7,767 (6,178)
2009	Entrepreneurship of youth, beginners and people with disabilities	83	2,030,000	24,458 (9,306)
2010	Entrepreneurship of youth, beginners and people with disabilities	288	3,039,000	10,552 (7,448)
2011	Entrepreneurship of youth, beginners and people with disabilities	346	2,478,000	7,162 (4,420)
2012	Entrepreneur beginner	21	1,898,000	90,381 (22,409)
	Youth in entrepreneurship	19	1,648,386	86,757 (22,728)
2013	Youth and beginners in entrepreneurship	20	3,173,679	158,684 (80,462)
	TOTAL	**1,052**	**16,403,065**	

Table A3: Treatment variable

Variable name	Description
subs_d	1 if the firm received any grant scheme funding, 0 otherwise

Table A4: Covariates used in analysis

Variable name	Description
Public grant call variables[*]	
l_age	Age of a firm at t – 1
l_lnl	Log (1 + number of employees) at t – 1
l_lnrx	Log (1 + real value sales revenue from exports) at t – 1
l_lnrturn	Log (1 + real value of turnover (sales revenue)) at t – 1
l_surplus	Dummy for operating surplus at t – 1
Other performance variables[*]	
l_lnrcash	Log (1 + real value of cash and cash equivalents) at t – 1
l_lnrlt_liab	Log (1 + real value of long-term liabilities) at t – 1
l_lnrst_liab_l	Log (1 + real value of short-term liabilities towards employees) at t – 1
l_lnrst_liab_state	Log (1 + real value of short-term liabilities towards state) at t – 1
l_ lnrlt_liab_bank	Log (1 + real value of long-term liabilities towards banks) at t – 1
l_lnrst_liab_bank	Log (1 + real value of short-term liabilities towards banks) at t – 1
l_lnav_rw	Log (1 + average real value of personnel costs) at t – 1
l_lnasset	Log (1 + fixed assets)
l_mage[*]l_lnl	Interaction term of the average age of the entrepreneur(s) and the log of number of employees
Previous subsidy/grant experience[*]	
l_sub_d	Dummy for positive nominal value of income from grants, government grants and subsidies
Other firm characteristics	
year	Year
region	Region of the firm[5]: 1 – Zagreb, 2 – Western Croatia, 3 – Eastern Croatia, 4 –Central Croatia, 5 – Southern Croatia
dom	More than 50% domestic ownership share
techintens	Sectors of economy based on technological intensity[6]: 1 – Agriculture and mining, 2 – High-tech manufacturing, 3 – Mid high-tech manufacturing, 4 – Mid low-tech manufacturing, 5 – Low-tech manufacturing, 6 – Energy, 7 – Construction, 8 – Knowledge intensive high-tech services, 9 – Knowledge intensive other services, 10 – Less knowledge intensive services
Entrepreneur characteristics	
m_age	Mean age of the people listed in the court register for each firm
team	Number of people listed for each firm in the court register: 1 – one, 2 – two, 3 – three or more
g_comb	Gender combinations connected to each firm in the court register: 1 – only men, 2 – only women, 3 – men and women

Note: [*] Prefix "l_" in these groups of variables indicates a one-year lag.

[5] Regions are defined as in Table A6 in the Appendix.

[6] Technology sectors are defined as in Table A7 in the Appendix.

Table A5: Output variables used in analysis

Variable name	Description
Survives in 2016	Dummy if the firm survives in year 2016
lnrst_liab_bank t + 1	Log (1 + short-term bank loans at t + 1)
lnrst_liab_bank t + 3	Log (1 + sum of short-term bank loans at t + 1, t + 2 and t + 3)
lnrlt_liab_bank t + 1	Log (1 + long-term bank loans at t + 1)
lnrlt_liab_bank t + 3	Log (1 + sum of long-term bank loans at t + 1, t + 2 and t + 3)
rturn t + 1	Real turnover growth from t to t + 1 (in %)
rturn t + 3	Real turnover growth from t to t + 3 (in %)
rturn t + 5	Real turnover growth from t to t + 5 (in %)
l t + 1	Number of employees growth from t to t + 1 (in %)
l t + 3	Number of employees growth from t to t + 3 (in %)
l t + 5	Number of employees growth from t to t + 5 (in %)
lp t + 1	Labor productivity growth from t to t + 1 (in %)
lp t + 3	Labor productivity growth from t to t + 3 (in %)
lp t + 5	Labor productivity growth from t to t + 5 (in %)

Table A6: Definition of five Croatian regions

Region	County
Zagreb	Zagreb
	City of Zagreb
Western Croatia	Primorje-Gorski Kotar
	Lika-Senj
	Istria
Eastern Croatia	Virovitica-Podravina
	Požega-Slavonia
	Brod-Posavina
	Osijek-Baranja
	Vukovar-Srijem
Central Croatia	Krapina-Zagorje
	Sisak-Moslavina
	Karlovac
	Varaždin
	Koprivnica-Križevci
	Bjelovar-Bilogora
	Međimurje
Southern Croatia	Zadar
	Šibenik-Knin
	Split-Dalmatia
	Dubrovnik-Neretva

Table A7: Definition of technological intensity sectors

Technological intensity sector	NACE Rev. 2 2-digit codes
Agriculture and mining	1, 2, 3, 4, 5, 6, 7, 8, 9
High-tech manufacturing	21, 26
Mid high-tech manufacturing	20, 27, 28, 29, 30
Mid low-tech manufacturing	19, 22, 23, 24, 25, 33
Low-tech manufacturing	10, 11, 12, 13, 14, 15, 16, 17, 18, 31, 32
Energy	35, 36, 37, 38, 39
Construction	41, 42, 43
Knowledge intensive high-tech services	59, 60, 61, 62, 63, 72
Knowledge intensive other services	50, 51, 69, 70, 71, 73, 74, 78, 80, 64, 65, 66, 58, 75, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93
Less knowledge intensive services	45, 46, 47, 49, 52, 53, 55, 56, 68, 77, 79, 81, 82, 94, 95, 96, 97, 98, 99

Table A8: Balance of covariates used in placebo treatment analysis

	Placebo treated means (n = 222)	Placebo control means (n = 222)	Difference
l_surplus	0.7838	0.7838	0.0000
l_age	0.5405	0.5405	0.0000
l_lnl	1.1527	1.1256	0.0272
l_lnrx	2.1100	1.9514	0.1586
l_lnrturn	12.1765	12.0661	0.1104
l_lnrcash	9.4132	9.1647	0.2485
l_lnrlt_liab	2.5570	2.4080	0.1490
l_lnrst_liab_l	8.5821	8.6539	–0.0718
l_lnrst_liab_state	9.1968	9.0453	0.1515
l_sh_bank	1.8972	2.0446	–0.1474
l_lo_bank	1.7424	1.4881	0.2543
l_lnav_rw	9.6163	9.7392	–0.1230
l_sub_d	0.1667	0.1667	0.0000
l_lnasset	9.0509	9.1376	–0.0868
dom	0.9910	0.9865	0.0045
mage	36.8138	36.2095	0.6044
l_mage*l_lnl	42.7401	40.7259	2.0142
team1	0.9910	0.9910	0.0000
team2	0.0045	0.0090	–0.0045
team3	0.0045	0.0000	0.0045
gcomb1	0.6937	0.6532	0.0405
gcomb2	0.3018	0.3423	–0.0405
gcomb3	0.0045	0.0045	0.0000
tech1	0.0090	0.0180	–0.0090
tech2	0.0000	0.0000	0.0000
tech3	0.0270	0.0090	0.0180
tech4	0.0450	0.0495	–0.0045
tech5	0.1081	0.1081	0.0000
tech6	0.0000	0.0000	0.0000
tech7	0.1081	0.1351	–0.0270
tech8	0.1532	0.1486	0.0045
tech9	0.2883	0.2838	0.0045
tech10	0.2613	0.2477	0.0135
region1	0.3964	0.4144	–0.0180
region2	0.1081	0.1261	–0.0180
region3	0.1306	0.1036	0.0270
region4	0.2297	0.2252	0.0045
region5	0.1351	0.1306	0.0045
year08	0.2477	0.2477	0.0000
year09	0.0721	0.0721	0.0000
year10	0.2748	0.2748	0.0000
year11	0.3694	0.3694	0.0000
year12	0.0135	0.0135	0.0000
year13	0.0225	0.0225	0.0000

Note: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.