Srhoj, Stjepan; Škrinjarić, Bruno; Radas, Sonja

Book

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

Stjepan Srhoj, Bruno Škrinjarić and Sonja Radas

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

Svibanj . May 2018

Radni materijali EIZ-a . EIZ Working Papers

HR EXCELLENCE IN RESEARCH

ekonomski institut, zagreb

Br . No EIZ-WP-1802

Radni materijali EIZ-a
EIZ Working Papers
EIZ-WP-1802

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

Stjepan Srhoj
Department for Economics and Business Economics
University of Dubrovnik
Lapadska obala 7, 20 000 Dubrovnik, Croatia
E. ssrhoj@unidu.hr

Bruno Škrinjarić
Corresponding author
The Institute of Economics, Zagreb
Trg J. F. Kennedyja 7, 10 000 Zagreb, Croatia
T. +385 1 2362 259
F. +385 1 2335 165
E. bskrinjaric@eizg.hr

Sonja Radas
The Institute of Economics, Zagreb
Trg J. F. Kennedyja 7, 10 000 Zagreb, Croatia
T. +385 1 2362 283
F. +385 1 2335 165
E. sradas@eizg.hr

www.eizg.hr

Zagreb, May 2018

IZDAVAČ / PUBLISHER:
Ekonomski institut, Zagreb / The Institute of Economics, Zagreb
Trg J. F. Kennedyja 7
10 000 Zagreb
Hrvatska / Croatia
T. +385 1 2362 200
F. +385 1 2335 165
E. eizagreb@eizg.hr
www.eizg.hr

ZA IZDAVAČA / FOR THE PUBLISHER:
Maruška Vizek, ravnateljica / director

GLAVNI UREDNIK / EDITOR:
Ivan-Damir Anić

e-ISSN 1847-7844

Sadržaj

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

Abstract:
Impact evaluations of entrepreneurship policies targeting young firms have been somewhat neglected thus far in the literature. This paper seeks to contribute to this topic in the context of a long recession period, such as the one experienced in Croatia from 2009 to 2014. These policies awarded small grant amounts for activities such as business plan development, consultancy, marketing and office renovation. Awarding small grant amounts to many firms might be tempting for politicians, but is this political populism or smart policy? This paper estimates the impact of matching grants for business development on three types of outcomes: bank loans, firm survival and firm performance. The full firm-level census dataset was supplemented with entrepreneur-level court register and firm-level data on grant recipients. Policy evaluation was performed using matching techniques with a combination of nearest neighbor and exact matching, and robustness of results was tested using a placebo test and Rosenbaum bounds. The results show that grants had a positive impact on firm survival after the recession, and on obtaining long-term bank loans during the recession. However, no empirical support was found for the grants' impact on growth in turnover, employment and labor productivity.

Keywords: grants, recession, young firms, survival, firm performance, bank loans
JEL classification: H25

Poticanje mladih poduzeća u neizvjesnim uvjetima? Evaluacija utjecaja bespovratnih sredstava za mlada mikro i mala poduzeća tijekom recesije

Sažetak:
Analize utjecaja politika usmjerenih na mlada poduzeća poprilično su zanemarivana u literaturi. Ovaj članak nastoji pridonijeti razvoju ove teme u kontekstu dugog recesijskog razdoblja, poput onog u Republici Hrvatskoj između 2009. i 2014. godine. Analizirane politike za razvoj poduzetništva su dodjeljivale male potpore za aktivnosti poput razvoja poslovnog plana, savjetovanja, marketinga i uređenja unutarnjeg radnog prostora. Dodjeljivanje malih potpora velikom broju poduzeća zvuči politički primamljivo, no radi li se o političkom populizmu ili promišljenoj ekonomskoj politici? U članku se procjenjuje utjecaj potpora za razvoj poslovanja na tri vrste ishoda: bankovne kredite, preživljavanje na tržištu i uspješnost poduzeća. Mikropodaci na razini poduzeća nadopunjeni su podacima sudskog registra na razini poduzetnika te podacima o primateljima bespovratnih sredstava. Analiza utjecaja politike provedena je primjenom tehnika uparivanja, a robusnost rezultata je testirana primjenom placebo testa i Rosenbaum granica. Rezultati pokazuju pozitivan utjecaj potpora na preživljavanje poduzeća nakon recesije, kao i pozitivan utjecaj na dobivanje dugoročnih bankovnih kredita tijekom recesije. Međutim, nije pronađen empirijski oslonac za utjecaj potpora na rast prihoda od prodaje, zaposlenosti i produktivnosti rada.

Ključne riječi: potpore, recesija, mlade tvrtke, preživljavanje na tržištu, performanse poduzeća, bankovni krediti
JEL klasifikacija: H25

1 Introduction[1]

Entrepreneurship policies targeting new firm creation and support for young firms started in the USA during the 1950s and in Europe during the 1980s, and today they have become very popular in countries worldwide (Landström, 2005). While popular, the central question is whether this public money can be considered well spent? Scott Shane (2009: p. 141) criticized government support for new firms by stressing that "policy makers should stop subsidizing the formation of the typical start-up and focus on the subset of businesses with growth potential." Apart from Shane's (2009) critique of who gets the grants, Lerner (2009) questions whether governments intervene too much during a recession. In line with the above, at the policy level, leading economic institutions worldwide have raised the need to increase impact evaluations of public grants for private firms (López-Acevedo & Tan, 2011; OECD et al., 2016; OECD et al., 2012). In this paper we seek to contribute to the further understanding of this issue by evaluating the impact of an entrepreneurship policy aimed at supporting business development activities of young firms during a recession. The supported business activities consisted of business plan development, consulting services (including help with loan applications), entrepreneurial training and office renovation. 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.

There is an extensive literature which shows that young firms are "more innovative, more dynamic and, in general, more flexible in learning and in adapting to new technological challenges" (Segarra-Biasco & Teruel, 2016, p. 727). However, compared to mature firms, 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). Marti and Quas (2018) show that participative loans in Spain played a certification role and as such managed to tackle the funding gap for small and medium-sized enterprises (SMEs), because banks view such loans as proof of government's confidence in the firms' quality. Interestingly, they found no such significant effect for young firms (less than five years old). The need for external finance is particularly exacerbated during periods of recession. Namely, as demand decreases during an economic downturn, 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 increases the need for external funding. While credit market imperfection is particularly constraining during recession periods (Gilchrist & Sim, 2007), not much is known about the effect of matching grants on obtaining loans in such a context.

[1] A draft version of this paper was presented during the training workshop "Evaluations of Innovation Policies" held November 21–22, 2017 in Zagreb, within the project "Strengthening scientific and research capacity of the Institute of Economics, Zagreb as a cornerstone for Croatian socioeconomic growth through the implementation of Smart Specialization Strategy" (H2020-TWINN-2015-692191-SmartEIZ). This research is also supported by TVOJ GRANT@EIZ, financed by the Institute of Economics, Zagreb. The views expressed in this paper belong solely to the authors and do not represent the views of either of the two projects.

Furthermore, Pellegrini and Muccigrosso (2017) note very few impact studies evaluating the effect of public funds for young firms on firm survival—a gap also addressed in this research. In addition, while many papers evaluate the impact of research and development (R&D) grants (for example, Dimos & Pugh, 2016; Howell, 2017), few papers evaluate the impact of matching grants for business development on firm performance (for example, López-Acevedo & Tan, 2011; Wren & Storey, 2002; McKenzie, Assaf & Cusolito, 2017). We complement the literature with an evaluation of an entrepreneurship policy targeting young firms, up to five years old. Finally, the recession period has recently attracted researchers to evaluate the impact of R&D grants on R&D expenditures in such a context (Aristei, Sterlacchini & Venturini, 2017); however, apart from Burger and Rojec (2018), no research on the impact of business development grants on firm performance has been found in the literature.

In sum, we seek to contribute to the literature by addressing the effect of business development grants on young firms in recession. In particular, we focus on evaluating the impact of business development grants on obtaining bank loans, firm survival and firm performance during a uniquely long recession period in Croatia (2009–2014). The research question is the following: Have matching grants for business development services in young firms helped those firms to obtain more bank loans, survive longer and achieve better performance than they would have if they were left entirely to the market?

2 Literature review

Schumpeter (1934) introduced the concept of creative destruction whereby more productive firms take the place of less productive firms, with innovation being the main mechanism behind such a process. In line with creative destruction, every year researchers observe new firms being created and some firms exiting the market. It is important to understand the factors behind this dynamic process, because young firms are responsible for a lion's share of job creation (Haltiwanger, Jarmin & Miranda, 2013). Evolutionary framework uses the concept of firm heterogeneity to explain entry and exit (Nelson & Winter, 1982), while learning models view entry and exit as the result of informational asymmetry (Ericson & Pakes, 1995; Jovanovic, 1982). Namely, firms are heterogeneous in their efficiency but they do not know how efficient they truly are: this is revealed to them only after they enter the market and thus either continue their business or exit the market. Evans and Jovanovic (1989) highlight the fact that the amount of money entrepreneurs can borrow is limited, which in turn prevents some young firms from carrying out their investment projects, thus hampering firm growth and survival. Credit constraints will probably always be an issue for young firms because of the uncertain returns, which is only further amplified during an economic downturn (Gilchrist & Sim, 2007). In particular, Musso and Schiavo (2008) find that financial constraints increase the probability of firms

exiting the market, while Stucki (2014) finds young firms to be particularly vulnerable to these constraints. 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).

While empirical evidence on the impact of grants during recessions is scarce (Burger & Rojec, 2018; Aristei et al., 2017; Hud & Hussinger, 2015), we review the overall impact assessments literature on grants and young firms. 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, which stemmed from stable R&D spending of the treated group and a decline in the control group's R&D spending. 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 measures. Notable impact analyses of grants for young firms have been conducted in the United States (Lerner, 1999), Germany (Almus & Prantl, 2002; Cantner & Kösters, 2012; 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; Rojas & Huergo, 2016; 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; Cantner & Kösters, 2012; González & Pazó, 2008). Finally, the impact of grants on securing external finance has been less researched (e.g. Meuleman & De Maeseneire, 2012; Marti & Quas, 2018; Lerner, 1999). In the following sections we review the literature that deals with grant impact on bank loans, firm survival and performance.

2.1 The impact on obtaining bank loans

The role of banks is to differentiate between good and bad borrowers and subsequently channel the funds from savers to good borrowers (Bernanke, 1983). In trying to channel the funds in such a way, banks face "cost of credit intermediation for activities such as screening, monitoring and accounting, as well as losses from giving the funds to bad borrowers" (Bernanke, 1983; p. 263). Obviously, the cost of credit intermediation will be higher the higher the informational asymmetry is between the bank and the firms. Given that young firms do not have much track record, banks could be reluctant to provide them with loans because of moral hazard problems. The uncertainty at the banks' side is whether these young firms will act too risky with the bank's money (Marti & Quas, 2018). The resulting young firms' debt gap arises due to: (1) difficulties evaluating innovation, as it is

an intangible asset which gives uncertain returns on investment (Hall & Lerner, 2009; Kerr & Nanda, 2015); (2) limited screening of skills young firms possess (Ueda, 2004); and (3) low values of collateral and reputational capital (Binks et al., 1992).

Over the course of the last two decades, the literature has 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, which is relevant when information is lacking. Several papers have empirically supported the certification hypothesis—Lerner (1999) finds a positive impact of Small Business Innovation Research (SBIR) on receiving external finance from venture capitalists, Meuleman and De Maeseneire (2012) find R&D grants to increase the likelihood of Belgian firms obtaining long-term financing, while Marti and Quas (2018) find a positive impact of receiving government participative loans on further obtaining external finance.

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. Namely, obtaining a matching grant for business development services directly impacts the behavior of the recipient firm. A matching grant implies the entrepreneur complements the public with private funds to be used as vouchers for activities such as consultancy and business plan development, redesigning internal workspace (e.g. buying a computer, developing a website) or marketing activities. Upon signing the white bill, the entrepreneur has obliged himself/herself to conduct these activities during the economic downturn. Based on these findings, we hypothesize:

H1: The matching grants given to young firms for financing business development activities have a positive impact on acquiring bank loans.

2.2 The impact on firm survival

Pfeiffer and Reize (2000) study German start-ups whose founders were previously unemployed, and evaluate the impact of public subsidies on firm survival one year after treatment. They find a difference between eastern and western Germany: whereas no effect is found in western Germany, lower probability of survival is found in eastern Germany. They explain this phenomenon as the "cash and carry" effect, where firms collect subsidies and then close their businesses. Almus and Prantl (2002) focus on start-ups in eastern

Germany to evaluate the impact of public subsidies on five-year firm survival as well as on employment growth. These authors find that receiving grants is linked to higher survival and employment growth, concluding that a longer time span (five years vs. one year in Pfeiffer and Reize, 2000) overcomes the "cash and carry" effect. Cantner and Kösters (2012) evaluate the probability of a start-up receiving an R&D subsidy in one German region, where they find bureaucrats to follow the "picking the winners" strategy. The authors find projects with high degree of novelty, academic spin-offs, team start-ups and/or founders with a substantial amount of capital to increase the probability of receiving an R&D grant.

Crepon and Duguet (2003) consider whether a lump-sum grant for starting a business impacts firm survival (three years after the grant). They find that these lump sums produce a higher survival rate and that this positive effect is found regardless of how long the entrepreneurs were previously unemployed. Desiage, Duhautois and Redor (2010) take all French firms created in 1998 to estimate operating subsidies' (tax cuts and social contribution) impact on firm survival and turnover growth, which are both showed to be positive. Lerner (1999) evaluates the SBIC program in the United States and finds a positive impact on firm growth. Pellegrini and Muccigrosso (2017) show that Italian regional policy (Law 488/1992) in the form of a capital subsidy had a positive effect on the survival of start-ups during the 1996–2009 period. Del Monte and Scalera (2001) examine the effect of Law 44 in Italy during the 1988–1997 period and find a negative relationship between the amount of capital invested and firms' life duration, while the capital/labor ratio and the amount of subsidy are positively related. Based on the previous findings, we hypothesize:

H2: The matching grants given to young firms for financing business development activities have a positive impact on young firm survival.

2.3 The impact on firm performance

Probably the most interesting question is whether these grants lead to output additionality, that is, additional turnover, employment and labor productivity. Butler, Galassi and Ruffo (2016) estimate the impact of a grant scheme for innovative start-ups in Argentina. The authors find the grant scheme to increase firm creation, survival and employment, with no significant effects on income and sales. Czarnitzki and Delanote (2015) evaluate the effect of subsidies on young SMEs in high-tech sectors. They compare the impact on R&D input and output for independent high-tech young firms (NTBFs), independent low-tech young firms (LTBFs) and their non-independent counterparts, and show that treatment effect is highest for independent high-tech firms. Decramer and Vanormelingen (2016) analyze the effects of an SME subsidy program in Flanders which favored young firms, and show that

positive output effects exist only if firms are small. Although subsidies can increase a firm's R&D expenditure, they can have a negative effect on employment, especially in situations when firms can substitute capital for labor (Criscuolo et al., 2012). Colombo et al. (2013) study new technology-based firms (NTBFs) and show that "selective support schemes had a larger impact on employment growth than automatic ones, but only if they were awarded in the very early period of the recipient firms' lives". Koski and Pajarinen (2013) show that the effect on employment growth differs more between high-growth start-ups and other firms than between start-ups and incumbents. However, for young high-growth companies, subsidies do not provide a significant additional boost. Burger and Rojec (2018) analyze substantial anti-crisis funds given to firms in Slovenia during the last recession and show these measures not to have a significant effect on turnover and only a modest effect on employment. Finally, McKenzie, Assaf and Cusolito (2017) evaluate matching grants for consulting services targeted at small firms in Yemen and find a positive impact on sales growth.

An interesting question is whether young firms are more likely to apply for public subsidies. The impact of firms' age on the probability of applying is unclear—some authors (Busom, 2000; González & Pazó, 2008) find a positive impact, while others (Huergo & Trenado, 2010) find it to be negative. Segarra-Biasco and Teruel (2016), who show that younger firms tend to have a larger propensity to receive an R&D subsidy, advocate designing R&D public policies that explicitly favor applications by young firms to help overcome their obstacles to innovation. Based on all the previous findings, our final three hypotheses are as follows:

H3: The matching grants given to young firms for business development activities have a positive impact on young firms' turnover.
H4: The matching grants given to young firms for business development activities have a positive impact on young firms' employment.
H5: The matching grants given to young firms for business development activities have a positive impact on young firms' labor productivity.

3 Data and methods

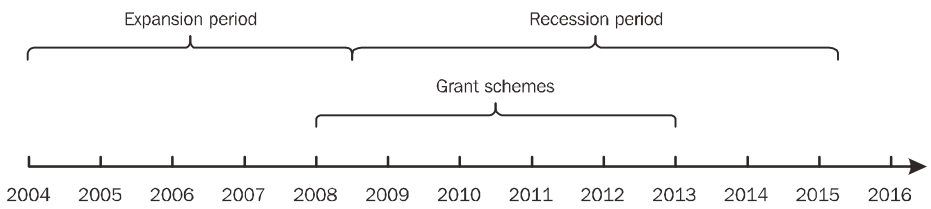
3.1 Data and institutional setting

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 year such as its balance sheet, profit and loss account, cash flow statement, 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[2], Croatian economy experienced a period of expansion which ended in late 2008 with the arrival of the financial crisis. Unlike some other Central European economies, it took Croatia almost seven years to bounce back to positive growth paths. Grant schemes that are the focus of this research were introduced at the onset of this downturn and were running for five years.

Figure 1 **Time setting of the research**



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 in Table A1 in the Appendix (all monetary values in this research are expressed in Croatian kuna, HRK[3]).

The conditions for obtaining a grant typically involved the following requirements: (1) to be registered in Croatia, (2) to have a surplus recorded in the previous year of business, (3) to have at least one full-time employee, and (4) to have no unpaid debts towards the state or employees. Activities which were co-funded by the grant typically involved: development of business plan and consulting services; entrepreneurial training, apart from the cost of studies; purchase of equipment, tools and inventory (excluding consumables, merchandise and vehicles); redesigning office space; marketing activities, including website design and

[2] Unless stated otherwise, all figures and tables in this paper are produced by the authors themselves.

[3] 1 EUR = 7.529 HRK (2016 average).

publishing costs. The selection process went as follows. Firstly, the public call was published online with the conditions for application. Firms then had to fill in the necessary forms, provide financial statements and develop a project which they wanted to be subsidized. Thirdly, the Ministry's expert team was established to evaluate the grant applicants. Finally, after the evaluation of all applicants that fulfilled the administrative criteria, the best among them were awarded the matching grants (for details on percentage by which projects were subsidized see Table A1). Once the Ministry chose the winning firms, it offered them a white bill by which the firms obliged themselves to undertake the planned activities. Distribution of these grants by year and different grant schemes is presented in Table A2 in the Appendix.

3.2 Data cleaning

After the initial merge of the FINA and Ministry dataset, we ended up with over 180,000 firms, out of which 909 obtained at least one of the analyzed grants. This initial dataset was then put through a rigorous data cleaning process to remove any potential source of endogeneity and bias in our results. We initially removed all firms that reported either having zero employees or zero real turnover, as these firms cannot be considered "healthy" firms. After this we dropped all firms operating more than five years on the market, as these are not young firms by the definition of our research. Next, we also excluded firms that got a grant in the same year they became incorporated—for these firms we do not have any previous financial record or the characteristics of the entrepreneurs. Firms which received more than one of the analyzed grant schemes were also excluded from our analysis, as we would not be able to differentiate the impacts of the schemes. Therefore, our sample consists of firms that received only one analyzed grant in the whole analyzed period[4].

Finally, we exclude all medium and large firms as those were not targeted by any of these grant schemes. At the end of the data cleaning process, we were left with 12,429 firms, out of which 222 received grants. In terms of observations, this translates to 32,322 observations, out of which 222 received grants.

3.3 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 causal effect is defined as the difference between the potential outcome with the grant (written as Y_1) and the

[4] The Ministry dataset enables us to analyze grants given from 2008 onwards; thus, we are not aware of grant recipients prior to 2008. One imperfect proxy we use is the accounting variable "Income from subsidies, dotations and grants" (as defined by the Croatian Financial Agency), which bundles these three support activities into only one category.

potential outcome without the grant (written as Y_0), that is $Y_1 - Y_0$. The evaluation challenge here is the data unavailability, as it is not possible to observe the potential outcome without the grant (Y_0). In order to estimate Y_0, it is necessary to find a control group, which is central in impact evaluation studies, as firms receiving the grant might have systematic differences from firms that did not receive the grant (Heckman, Ichimura & Todd, 1998; Klett, Møen & Griliches, 2000). There are a couple of approaches used to deal with this problem. Each time we define treatment D as a binary variable which takes the value of 1 for treated observations and 0 for non-treated (controlled, counterfactual) observations. Consequently, y_0 and y_1 are outcomes in the controlled and treatment group, respectively.

A few options were available when choosing the appropriate methodology. Of course, the best scenario would be if firms were assigned treatment based on randomized trials, but as we have described before, this was not how the grant selection process went in our case. To use the difference-in-difference (DiD) design, we would need to show that both treated and control firms behaved similarly, i.e., that they had similar trends in some key variables prior to receiving a treatment. However, since we are dealing with young firms, most of which are only one year old, we do not possess the necessary time frame to opt for this method. The next option we looked at was the regression discontinuity design (RDD). However, to utilize this method we would need to have data on firms within a certain bandwidth of the cut-off score when deciding to award the grant or not. Since we do not have these data, we had to move on to the next option. What we were left with was the fixed effect panel data model and different matching techniques. A relatively small number of treated firms compared to controls prompted us to use matching techniques as our primary methodology.

We opted to use matching techniques using Rubin's (1977) assumption of conditional independence (CIA). For random experiments, the CIA states that outcomes are independent of treatment, $y_0, y_1 \perp D$. In observational studies such as ours, the CIA states that potential outcomes are independent of treatment assignment, given a set of observable covariates X which are not affected by the treatment, $y_0, y_1 \perp D \mid X$. In the latter form, the CIA allows for the usage of methods that match a treated unit with one or several control units which are as similar as possible in their pre-treatment characteristics, the latter group being used to estimate the counterfactual scenario. The most direct way of performing this matching is to find a match (or several matches) between the treated unit and (several) control unit(s) on each covariate X. However, as the dimensionality of the dataset increases, this becomes both impractical and time-consuming. To resolve this issue, Stuart and Rubin (2007) propose the usage of several methods to summarize the variance of all covariates X in a single scalar, the most popular being the propensity score.

Propensity score, $p(X)$, is defined as the conditional (predicted) probability of receiving treatment given pre-treatment characteristics X (Rosenbaum & Rubin, 1983) and

$p(X)=P(D=1 \mid X)=E(D \mid X)$, estimated using the probit/logit model. The key assumption is that after conditioning on covariates, the expected outcome in the absence of treatment does not depend on treatment status. For the firm *i*, the propensity score can be estimated using any standard probability model in the following way: $p(X_i) = P(D_i=1 \mid X_i)=F\{h(X_i)\}$, where $F(.)$ is the normal or the logistic cumulative distribution and $h(X_i)$ is a function of covariates which can contain linear and higher order terms. Propensity scores are restricted to the area of common support, which means that we consider only those 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. On the other hand, matching only controls for the selection of observables; therefore, it is important to control for variables which explain both receiving the treatment and the potential outcome.

3.4 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, in such a way that the control firm is the one with the nearest distance from the treated observation, conditional on identical exact matching covariates. As we have a large pool of potential control firms, matching is done without replacement, meaning that once a control observation is used as a match, it is deleted from the set of controls and can thus not be reused. As one of the covariates is the propensity score determined above, we restrict our analysis to observations that belong to the common support. For an outcome variable *Y*, the average treatment effect on the treated unit (or ATT) can be estimated using the formula $ATT = \frac{1}{N^T}\sum_{i \in T}\left(Y_i^T - Y_i^C\right)$, where the sum goes over all the treated units N^T. For the treated unit *i*, Y_i^T stands for the value of the outcome variable *Y*, while Y_i^C denotes the value of the outcome variable for the nearest neighbor of the treated unit *i*. Prior to the matching process, we check whether the pre-treatment covariates are balanced between treatment and control firms (Rosenbaum & Rubin, 1983). For each covariate *X*, the mean is computed for treated and control firms after matching, and these means are compared. If they are not significantly different from each other, then the balancing property holds, meaning that exposure to treatment can be considered as random.

3.5 List of variables used in analysis

In order to measure the effect of participation in the analyzed grant schemes, we define a binary variable *subs_d* which measures whether a firm obtained any grant funding (Table 1). Table 2 lists a rich set of variables 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 as important during the analysis of public call schemes and literature review. First, our main exact matching variable which we control for is firm's age because the grant schemes under evaluation targeted young firms. Next, we use number of employees and sales revenue as proxies of firm size, as smaller and younger firms were shown to face higher financing constraints when compared to larger firms (Czarnitzki, 2006). Third, we include revenues from exporting following the literature on learning-by-exporting (Costa, Pappalardo & Vicarelli, 2017), because exporters were found to be self-selected into exporting due to higher productivity, which can affect both receiving the grant and the potential outcomes. Fourth, the public call implied firms had to have an operating surplus in the year prior to the grant call, which is why we add an exact matching dummy if total revenues are larger than total costs. We also include five variables for financial constraints of firms: the real values of short-term liabilities towards employees, short-term liabilities towards the state, short-term and long-term liabilities towards banks and long-term liabilities, as firms with higher financial constraints were found to be more likely to exit the market (Musso & Schiavo, 2008), while younger firms were found to be particularly vulnerable to financial constraints (Stucki, 2014). Fifth, we include a proxy for human capital with average real value of personnel costs, and we also include real value of cash and cash equivalents, as firms with growth opportunities were found to have higher levels of cash holdings (García-Teruel & Martínez-Solano, 2008). Sixth, we include a proxy for experience with governmental programs (Afcha & García-Quevedo, 2016) by including a dummy if the nominal value of income from grants, government grants and subsidies is non-zero in the year prior to the scheme[5]. To control for number of years spent in the recession, we include variable year in the exact matching. Furthermore, we include the categorical variable of region to capture regional effect, as firms closer to the capital might be closer to the necessary information (Afcha & García-Quevedo, 2016). We also control for the firm's ownership, as foreign firms are found to be more productive (Costa, Pappalardo & Vicarelli, 2017). In addition, we add a categorical variable which captures sets of sectors by technological intensity, encompassing manufacturing as well as service sectors (Galindo-rueda & Verger, 2016). To further decrease the number of unobservable characteristics driving the selection procedure, we also add three entrepreneur-level variables from the court register. Mean age of entrepreneurs is included, as younger entrepreneurs are more likely to receive a grant. Dummies for number of founders are included because firms with more founders have a larger social network and are more resource-seeking (Forbes et al., 2006). We include dummies if the founding team is female only, male only or a mix of both, as females were found to have less likelihood of obtaining finance from banks (Eddleston et al., 2016). We include an interaction between the entrepreneurs' average age and the number of

[5] It should be noted that this variable consists of three income flows: dotations, grants and subsidies. All these flows represent different schemes than the ones analyzed in this paper.

employees to capture small firms that are founded by young individuals, as they may be especially vulnerable in terms of resources.

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

Table 2 **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[6]: 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[7]: 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.*

[6] Regions are defined as in Table A3 in the Appendix.

[7] Technology sectors are defined as in Table A4 in the Appendix.

Table 3 lists all variables used as outputs in the analysis. Variable *survives in* 2016 is a dummy variable taking the value of 1 if the firm is alive in 2016 and 0 otherwise. Variables *rturn* and *l* need no further explanation. Labor productivity (*lp*) is calculated as a ratio of real value added and number of employees for each firm.

Table 3 **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 %)

The next section gives the results of the probit model, the balance and the estimation of the ATT, followed by the robustness checks and conclusion.

4 Results

4.1 Descriptive statistics

After defining treatment, covariates and output variables, we present some descriptive statistics on the firms in our sample. Table 4 reports the mean comparison (using 2-tailed t-tests) between treated and control observations before and after matching. 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 being in real short-term liabilities towards the employees and the smallest difference being in real average wage. Another noticeable difference can be found in terms of previous grant or subsidy experience, where almost half of all treated firms (47 percent) had received some form of government support prior to the grants observed in this study, compared to only 6 percent of firms in the control sample.

Table 4 **Balance of covariates used in analysis (common support applies)**

	Before matching				After matching				
Variable	**Treated means (n = 222)**	**Control means (n = 32,322)**	**Difference**	**St. bias in %**	**Treated means (n = 222)**	**Control means (n = 222)**	**Difference**	**St. bias in %**	**% 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
Previous subsidy/grant experience									
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
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.*

When it comes to regional distribution, 40 percent of all firms in the treated group are situated in the 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 of firms, less firms are located in eastern and central Croatia, while more firms come from southern Croatia. A total of 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 the 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). Table 4 shows that 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 (Table 4). 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.

4.2 Estimating the propensity to get treated

The first step in our matching algorithm is to estimate propensity scores using a probit model, as presented in equation (1):

$$y_{i,t} = \alpha + \beta' X_{i,t-1} + \gamma' REGION_i + \delta' SECTOR_i + \psi' YEAR_t + e_{i,t} \quad (1)$$

where y represents a dummy variable indicating whether or not the firm received a grant, X is a matrix of other covariates about each firm (public grant call variables, other performance variables and previous subsidy experience), *REGION*, *SECTOR* and *YEAR* are region, sector and year fixed effects, and e is the error term. It is important to notice that all the variables in matrix X enter the equation (1) with a time lag of one period. The results of this model are presented in Table 5.

Table 5 **Results of the probit model**				
Variable	**Model 1**		**Model 2**	
	Estimate	**S.e.**	**Estimate**	**S.e.**
(Intercept)[8]	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: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.*

Adding entrepreneur characteristics produces almost no changes on the coefficients associated with the joint set of variables in the models. In both models 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 that earn less (have lower turnover). On the other hand, the grant-awarding agencies will look for proof that the grant will be well used: they try to minimize risk and thus maximize success. For that reason, they favor the firms that have 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. In regards to entrepreneur characteristics, the only new significant factor is mean age of the employees. This means that the younger the entrepreneurs are, the more likely they are to be awarded the grant. This may be because of the conditions of the schemes (Table A1), which favor youth.

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

4.3 Estimation of treatment effects

The average treatment effect on the treated is presented in Table 6, encompassing survival outcomes, bank loans and firm performance.

Table 6 shows that the grant impact on survival in 2016 is positive and significant. The year 2016 was chosen as this marks the end of our available dataset, two years after the recession was officially over. 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 also examined the effect of grants on firm performance, but did not find any 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. How can we explain these findings? Since the grants were targeted at business development, they brought skills and knowledge, which introduced changes in behavior that comprise what Clarisse et al. (2009) call behavioral additionality. The entrepreneurs, emboldened by the successful grant application and their newly acquired knowledge, may have decided to apply for bank loans.

But banks, on the other hand, consider young firms as risky clients because their ability to stay around long enough to repay the loan is questionable. The fact that a firm was given a government grant can be taken as a signal that a reputable party checked it for financial health and found it satisfactory. That, in line with the certification effect by Marti and Quas (2018), makes the young firm appear less of a risk to the bank, and hence increases the likelihood of getting a loan. Although allocated grants were too small to have any striking direct effect, through behavioral additionality and certification they attracted bank loans, which were in turn 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 it is logical that the impact on survival would become significant only after all those activities came to fruition, which means after a longer period of time.

Table 6 **Estimation results of ATT**						
	One-tailed			**Two-tailed**		
	Treated means (n = 222)	**Control means (n = 222)**	**ATT**	**Treated means (n = 222)**	**Control means (n = 222)**	**ATT**
Survival						
Survives in 2016 dummy	0.9279	0.8604	0.0676** (0.0277)	0.9279	0.8604	0.0676* (0.0277)
Survives in t + 1 dummy	1.0000	1.0000	0.0000 (0.0000)	1.0000	1.0000	0.0000 (0.0000)
Survives in t + 2 dummy	1.0000	0.9910	0.0090 (0.0063)	1.0000	0.9910	0.0090 (0.0063)
Survives in t + 3 dummy	0.9955	0.9820	0.0135 (0.0100)	0.9955	0.9820	0.0135 (0.0100)
Survives in t + 4 dummy	0.9595	0.9324	0.0270 (0.0168)	0.9595	0.9324	0.0270 (0.0168)
Survives in t + 5 dummy	0.9189	0.8919	0.0270 (0.0220)	0.9189	0.8919	0.0270 (0.0220)
Bank loans						
Log (1 + long-term bank loans at t + 1)	4.0834	2.7488	1.3346** (0.5219)	4.0834	2.7488	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)	5.8937	3.7609	2.1327*** (0.5493)
Log (1 + short-term bank loans at t + 1)	2.1412	1.8785	0.2627 (0.4042)	2.1412	1.8785	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)	3.5657	3.1291	0.4366 (0.4664)
Firm performance						
Real turnover growth from t to t + 1 (in %)	16.5081	12.0847	4.4235 (5.2920)	16.5081	12.0847	4.4235 (5.2920)
Real turnover growth from t to t + 3 (in %)	62.3571	60.4192	1.9379 (14.2497)	62.3571	60.4192	1.9379 (14.2497)
Real turnover growth from t to t + 5 (in %)	105.9309	135.2771	-29.3462 (28.7149)	105.9309	135.2771	-29.3462 (28.7149)
Number of employees growth from t to t + 1 (in %)	20.6397	16.5886	4.0511 (5.5811)	20.6397	16.5886	4.0511 (5.5811)
Number of employees growth from t to t + 3 (in %)	48.2460	39.6938	8.5522 (9.6623)	48.2460	39.6938	8.5522 (9.6623)
Number of employees growth from t to t + 5 (in %)	72.2112	55.6292	16.5820 (13.6868)	72.2112	55.6292	16.5820 (13.6868)
Labor productivity growth from t to t + 1 (in %)	8.8050	13.1563	-4.3513 (7.2949)	8.8050	13.1563	-4.3513 (7.2949)
Labor productivity growth from t to t + 3 (in %)	23.3253	21.5326	1.7926 (9.4471)	23.3253	21.5326	1.7926 (9.4471)
Labor productivity growth from t to t + 5 (in %)	31.1653	53.8401	-22.6748 (12.4221)	31.1653	53.8401	-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.*

4.4 Robustness checks

To check the validity of results, we conduct a placebo test and Rosenbaum bounds. For the placebo test, we discard the treated group, make the control group a placebo treated group and regard these firms as treated firms in order to find another control group for them. Since this is an artificially manufactured treatment, we expect to find no statistically significant results between this placebo treatment and its controls. Results shown in Table

A5 support the balancing property, while the placebo test presented in Table 8 supports our main findings.

We further check for the possibility of hidden bias with Rosenbaum's (2002) bounding approach. The approach is being increasingly used for sensitivity analyses in the literature on the impact of grants using matching methods (e.g. Michalek, Ciaian & Kancs, 2015). Previous authors find the impact of an EU agricultural policy on firm-level investments to be sensitive to 5–10 percent hidden bias. In other words, the Rosenbaum bounds test estimates how much hidden bias (see Rosenbaum, 2002) would render the significance of the results. Therefore, this robustness is applied to the statistically significant results—survival and long-term bank loans.

Table 7 **Estimation results of placebo ATT**

	One-tailed			Two-tailed		
	Placebo treated means (n = 222)	**Placebo control means (n = 222)**	**ATT**	**Placebo treated means (n = 222)**	**Placebo control means (n = 222)**	**ATT**
Survival						
Survives in 2016 dummy	0.8604	0.8739	-0.0135 (0.0322)	0.8604	0.8739	-0.0135 (0.0322)
Bank loans						
Log (1 + long-term bank loans at t + 1)	2.7488	2.9261	-0.1773 (0.4818)	2.7488	2.9261	-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)	3.7609	4.0895	-0.3286 (0.5282)
Log (1 + short-term bank loans at t + 1)	1.8785	1.3187	0.5598 (0.3734)	1.8785	1.3187	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)	3.1291	2.8147	0.3144 (0.4892)
Firm performance						
Real turnover growth from t to t + 1 (in %)	12.0847	21.7753	-9.6906 (6.7621)	12.0847	21.7753	-9.6906 (6.7621)
Real turnover growth from t to t + 3 (in %)	60.4192	49.1048	11.3144 (15.0972)	60.4192	49.1048	11.3144 (15.0972)
Real turnover growth from t to t + 5 (in %)	135.2771	96.4329	38.8442 (30.3833)	135.2771	96.4329	38.8442 (30.3833)
Number of employees growth from t to t + 1 (in %)	16.5886	16.2746	0.3140 (5.5298)	16.5886	16.2746	0.3140 (5.5298)
Number of employees growth from t to t + 3 (in %)	39.6938	35.0107	4.6831 (8.9815)	39.6938	35.0107	4.6831 (8.9815)
Number of employees growth from t to t + 5 (in %)	55.6292	55.4564	0.1728 (14.5088)	55.6292	55.4564	0.1728 (14.5088)
Labor productivity growth from t to t + 1 (in %)	13.1563	15.7646	-2.6084 (9.1110)	13.1563	15.7646	-2.6084 (9.1110)
Labor productivity growth from t to t + 3 (in %)	21.5326	23.2762	-1.7435 (12.2059)	21.5326	23.2762	-1.7435 (12.2059)
Labor productivity growth from t to t + 5 (in %)	53.8401	79.2772	-25.4371 (24.6119)	53.8401	79.2772	-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.*

As shown in Table 8, 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 8 **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 8 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 of the study is the Republic of Croatia, which is 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 by using nearest neighbor and exact matching, where grant recipients are compared with the group of identical control firms. To ensure against possible bias, we conduct robustness checks 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) young firms, and (3) recession. While R&D subsidies have been researched extensively, business development grants have not received much attention. We focus on them because they are less specialized than R&D grants and as such are available to a much larger population of firms. Subsidies targeting young firms have been addressed in the literature, but the studies

were not conducted in recession and they were mostly R&D-related. In addition, studies regarding recession itself are still scarce as they have started appearing only recently.

While the topic of business development grants for young firms in recession has not been explored before, we find it to be a very relevant one, since young firms have a very important role in job creation and are a vulnerable part of an economy.

Our major finding is that, although the grants were very small, they were still able to affect survival (in 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 factors: behavioral additionality and certification effect, which are both consequences of the nature of the grant scheme. Namely, as the grant could be used only for the purpose of business development, the firms were forced to absorb certain business knowledge and consequently change their behavior (behavioral additionality effect). This new knowledge may have encouraged the entrepreneurs to seek bank loans. On the other hand, risk-averse banks very likely looked upon recipients of government grants as "certified" by the government in terms of their financial health and overall risk (certification effect). This made it more likely for grant recipients to obtain a loan (especially a long-term one). Although the grants were too small to have any striking direct effect, through behavioral additionality and certification they paved the way for the arrival of 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. Other studies that found positive impacts were conducted on R&D subsidies (instead of business development grants) 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 any 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.

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. Surprisingly, 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., 2012; OECD et al., 2016).

This paper is not without limitation. 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.

6 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.
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 **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 A4 **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 A5 **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: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.*

References

Abadie, A., & Imbens, G. W. (2008). On the failure of the bootstrap for matching estimators. *Econometrica, 76*(6), 1537-1557.

Acevedo, G. L., & Tan, H. W. (Eds.). (2011). *Impact evaluation of small and medium enterprise programs in Latin America and the Caribbean*. Washington. D.C.: World Bank Publications.

Afcha, S., & García-Quevedo, J. (2016). The impact of R&D subsidies on R&D employment composition. *Industrial and Corporate Change*, *25*(6), 955-975.

Almus, M., & Prantl, S. (2002). The impact of public start-up promotion on survival and growth of new firms. *Jahrbucher Fur Nationalokonomie Und Statistik*, *222*(2), 161-185.

Aristei, D., Sterlacchini, A., & Venturini, F. (2017). Effectiveness of R&D subsidies during the crisis: firm-level evidence across EU countries. *Economics of Innovation and new Technology*, *26*(6), 554-573.

Axarloglou, K. (2003). The cyclicality of new product introductions. *The Journal of Business*, *76*(1), 29-48. doi: 10.1086/344112

Bernanke, B. S. (1983). Irreversibility, uncertainty, and cyclical investment. *The Quarterly Journal of Economics*, *98*(1), 85-106.

Binks, M. R., Ennew, C. T., & Reed, G. V. (1992). Information asymmetries and the provision of finance to small firms. *International small business journal*, *11*(1), 35-46.

Burger, A., & Rojec, M. (2018). Impotence of Crisis-Motivated Subsidization of Firms: The Case of Slovenia. *Eastern European Economics*, 1-27.

Busom, I. (2000). An empirical evaluation of the effects of R&D subsidies. *Economics of innovation and new technology*, *9*(2), 111-148.

Butler, I., Galassi, G., & Ruffo, H. (2016). Public funding for startups in Argentina: an impact evaluation. *Small Business Economics*, *46*(2), 295-309.

Caliendo, M, & S. Kopeinig (2008) Some Practical Guidance for the Implementation of Propensity Score Matching, *Journal of Economic Surveys*, 22(1), 31-72.

Cantner, U., & Kösters, S. (2012). Picking the winner? Empirical evidence on the targeting of R&D subsidies to start-ups. *Small Business Economics*, *39*(4), 921-936.

Chapman, G., & Hewitt-Dundas, N. (2018). The effect of public support on senior manager attitudes to innovation. *Technovation*, *69*, 28-39.

Ciaian, P., Kancs, D. A., & Michalek, J. (2015). Investment crowding-out: firm-level evidence from Germany. *LICOS Discussion Paper 370/2015*

Clarysse, B., Wright, M., & Mustar, P. (2009). Behavioural additionality of R&D subsidies: A learning perspective. *Research Policy*, *38*(10), 1517-1533.

Colombo, M. G., Giannangeli, S., & Grilli, L. (2012). Public subsidies and the employment growth of high-tech start-ups: assessing the impact of selective and automatic support schemes. *Industrial and Corporate Change*, *22*(5), 1273-1314.

Costa, S., Pappalardo, C., & Vicarelli, C. (2017). Internationalization choices and Italian firm performance during the crisis. *Small Business Economics*, *48*(3), 753-769.

Crépon, B., & Duguet, E. (2003). Bank loans, start-up subsidies and the survival of the new firms: an econometric analysis at the entrepreneur level. *SSRN Electronic Journal*. doi: 10.2139/ssrn.421921

Criscuolo, C., Martin, R., Overman, H., & Van Reenen, J. (2012). The causal effects of an industrial policy (No. w17842). *National Bureau of Economic Research.*

Czarnitzki, D., & Delanote, J. (2015). R&D policies for young SMEs: input and output effects. *Small Business Economics*, *45*(3), 465-485.

Decramer, S., & Vanormelingen, S. (2016). The effectiveness of investment subsidies: evidence from a regression discontinuity design. *Small Business Economics*, *47*(4), 1007-1032.

Désiage, L. J., Duhautois, R., & Redor, D. (2010). Do public subsidies have an impact on new firm survival? An empirical study with French data. *SSRN Electronic Journal*. doi: 10.2139/ssrn.1640560

Dimos, C., & Pugh, G. (2016). The effectiveness of R&D subsidies: A meta-regression analysis of the evaluation literature. *Research Policy*, *45*(4), 797-815.

Eddleston, K. A., Ladge, J. J., Mitteness, C., & Balachandra, L. (2016). Do you see what I see? Signaling effects of gender and firm characteristics on financing entrepreneurial ventures. *Entrepreneurship Theory and Practice*, *40*(3), 489-514.

Ericson, R., & Pakes, A. (1995). Markov-perfect industry dynamics: A framework for empirical work. *The Review of Economic Studies*, *62*(1), 53-82.

Evans, D. S., & Jovanovic, B. (1989). An estimated model of entrepreneurial choice under liquidity constraints. *Journal of political economy*, *97*(4), 808-827.

Forbes, D. P., Borchert, P. S., Zellmer-Bruhn, M. E., & Sapienza, H. J. (2006). Entrepreneurial team formation: An exploration of new member addition. *Entrepreneurship Theory and Practice*, *30*(2), 225-248.

Galindo-Rueda, F., & Verger, F. (2016). OECD taxonomy of economic activities based on R&D intensity. *OECD Science, Technology and Industry Working Papers, 2016/04*. OECD Publishing, Paris.

García-Teruel, P. J., & Martínez-Solano, P. (2008). On the determinants of SME cash holdings: Evidence from Spain. *Journal of Business Finance & Accounting*, *35*(1-2), 127-149.

Gilchrist, S., & Sim, J. W. (2007). Investment during the Korean financial crisis: a structural econometric analysis. *NBER Working Paper No. w13315*. doi: 10.3386/w13315

González, X., & Pazó, C. (2008). Do public subsidies stimulate private R&D spending?. *Research Policy*, *37*(3), 371-389.

Hall, B. H., & Lerner, J. (2009). The Financing of R & D and Innovation. *In Handbook of the Economics of Innovation* (pp. 609–639). https://doi.org/10.1016/S0169-7218(10)01014-2

Haltiwanger, J., Jarmin, R. S., & Miranda, J. (2013). Who creates jobs? Small versus large versus young. *Review of Economics and Statistics*, *95*(2), 347-361.

Heckman, J. J., Ichimura, H., & Todd, P. (1998). Matching as an econometric evaluation estimator. *The review of economic studies*, *65*(2), 261-294.

Howell, S. T. (2017). Financing innovation: evidence from R&D grants. *American Economic Review*, *107*(4), 1136-64.

Hud, M., & Hussinger, K. (2015). The impact of R&D subsidies during the crisis. *Research policy*, *44*(10), 1844-1855.

Huergo, E., & Trenado, M. (2010). The application for and the awarding of low-interest credits to finance R&D projects. *Review of Industrial Organization*, *37*(3), 237-259.

Jovanovic, B. (1982). Selection and the Evolution of Industry. *Econometrica: Journal of the Econometric Society*, *50*(3), 649-670.

Kerr, W. R., & Nanda, R. (2015). Financing innovation. *Annual Review of Financial Economics*, *7*, 445-462.

Klette, T. J., Møen, J., & Griliches, Z. (2000). Do subsidies to commercial R&D reduce market failures? Microeconometric evaluation studies1. *Research Policy*, *29*(4-5), 471-495.

Koski, H., & Pajarinen, M. (2013). The role of business subsidies in job creation of start-ups, gazelles and incumbents. *Small Business Economics*, *41*(1), 195-214.

Kovac, D., Vukovic, V., Kleut, N., & Podobnik, B. (2016). To invest or not to invest, that is the question: Analysis of firm behavior under anticipated shocks. *PloS one*, *11*(8), e0158782. doi:10.1371/journal.pone.015878

Landstrom, H. (2005). *Pioneers in entrepreneurship and small business research.* 8. Springer Science & Business Media. doi: 10.1007/b102095

Lerner, J. (1999). The government as venture capitalist: the long-run impact of the SBIR program. *The Journal of Private Equity*, *72*(3), 55-78. doi: 10.1086/209616

Mahalanobis, P. C. (1936). On the generalized distance in statistics. *Proceedings of the National Institute of Sciences in India, 2*(1), 49-55.

Martí, J., & Quas, A. (2018). A beacon in the night: government certification of SMEs towards banks. *Small Business Economics*, *50*(2), 397-413.

McKenzie, D., Assaf, N., & Cusolito, A. P. (2017). The additionality impact of a matching grant programme for small firms: experimental evidence from Yemen. *Journal of Development Effectiveness*, *9*(1), 1-14.

Meuleman, M., & De Maeseneire, W. (2012). Do R&D subsidies affect SMEs' access to external financing?. *Research Policy*, *41*(3), 580-591.

Monte, A. D., & Scalera, D. (2001). The life duration of small firms born within a start-up programme: Evidence from Italy. *Regional Studies*, *35*(1), 11-21.

Musso, P., & Schiavo, S. (2008). The impact of financial constraints on firm survival and growth. *Journal of Evolutionary Economics*, *18*(2), 135-149.

Nelson, R. R., & Sidney, G. (1982). *An evolutionary theory of economic change*, Belknap Press: Cambridge. MA.

OECD, ETF, EU, EBRD, & SEECEL. (2016). SME Policy Index: Western Balkans and Turkey 2016. Assessing the Implementation of the Small Business Act for Europe. Paris. doi: 10.1787/9789264254473-en

OECD, EU, EBRD, & ETF. (2012). SME Policy Index: Western Balkans and Turkey 2012 - Progress in the Implementation of the Small Business Act for Europe. Paris.

Pellegrini, G., & Muccigrosso, T. (2017). Do subsidized new firms survive longer? Evidence from a counterfactual approach. *Regional Studies*, *51*(10), 1483-1493. doi: 10.1080/00343404.2016.1190814

Pfeiffer, F., & Reize, F. (2000). Business start-ups by the unemployed—an econometric analysis based on firm data. *Labour Economics*, *7*(5), 629-663.

Radas, S., Anić, I. D., Tafro, A., & Wagner, V. (2015). The effects of public support schemes on small and medium enterprises. *Technovation*, *38*, 15-30.

Rojas, F., & Huergo, E. (2016). Characteristics of entrepreneurs and public support for NTBFs. *Small Business Economics*, *47*(2), 363-382.

Rosenbaum, P. R., & Rubin, D. B. (1983). The central role of the propensity score in observational studies for causal effects. *Biometrika*, *70*(1), 41-55.

Rubin, D. B. (1977). Assignment to treatment group on the basis of a covariate. *Journal of educational Statistics*, *2*(1), 1-26.

Schumpeter, J. A. (1934). *The schumpttr: Theory economic development*. Harvard University Press.

Segarra-Blasco, A., & Teruel, M. (2016). Application and success of R&D subsidies: what is the role of firm age?. *Industry and Innovation, 23*(8), 713-733.

Stucki, T. (2013). Success of start-up firms: the role of financial constraints. *Industrial and Corporate Change*, *23*(1), 25-64.

Shane, S. (2009). Why encouraging more people to become entrepreneurs is bad public policy. *Small business economics*, *33*(2), 141-149.

Stuart, E. A., & Rubin, D. B. (2008). Best practices in quasi-experimental designs: Matching Methods for Causal Inference. In J. Osborne (Eds.), *Best Practices in Quantitative Social Science* (pp. 155-176). Thousand Oaks. CA: Sage Publications.

Wooldridge, J. M. (2009). On estimating firm-level production functions using proxy variables to control for unobservables. *Economics Letters*, *104*(3), 112-114.

Wren, C., & Storey, D. J. (2002). Evaluating the effect of soft business support upon small firm performance. *Oxford Economic Papers*, *54*(2), 334-365.

Zúñiga-Vicente, J. Á., Alonso-Borrego, C., Forcadell, F. J., & Galán, J. I. (2014). Assessing the effect of public subsidies on firm R&D investment: a survey. *Journal of Economic Surveys*, *28*(1), 36-67.

Popis objavljenih Radnih materijala EIZ-a / Previous issues in this series

2018

EIZ-WP-1801 Dubravka Jurlina Alibegović: *Porezna autonomija gradova u Hrvatskoj u razdoblju 2002.–2016.*

2017

EIZ-WP-1706 Katarina Bačić, Ivana Rašić Bakarić and Sunčana Slijepčević: *Sources of productivity differentials in manufacturing in post-transition urban South-East Europe*

EIZ-WP-1705 Martin Larsson: *EU Emissions Trading: Policy-Induced Innovation, or Business as Usual? Findings from Company Case Studies in the Republic of Croatia*

EIZ-WP-1704 Marina Tkalec and Ivan Žilić: *Does Proximity to Conflict Affect Tourism: Evidence from NATO Bombing*

EIZ-WP-1703 Nebojša Stojčić and Zoran Aralica: *Choosing Right from Wrong: Industrial Policy and (De)industrialization in Central and Eastern Europe*

EIZ-WP-1702 Bruno Škrinjarić, Jelena Budak and Mateo Žokalj: *The Effect of Personality Traits on Online Privacy Concern*

EIZ-WP-1701 Alexander Ahammer and Ivan Zilic: *Do Financial Incentives Alter Physician Prescription Behavior? Evidence from Random Patient-GP Allocations*

2016

EIZ-WP-1609 Edo Rajh, Jelena Budak, Jovo Ateljević, Ljupčo Davčev, Tamara Jovanov and Kosovka Ognjenović: *Entrepreneurial Intentions in Selected Southeast European Countries*

EIZ-WP-1608 Ivan Žilić: *General versus Vocational Education: Lessons from a Quasi-Experiment in Croatia*

EIZ-WP-1607 Valerija Botrić: *Public vs. private sector wage skill premia in recession: Croatian experience*

EIZ-WP-1606 Edo Rajh, Jelena Budak and Mateo Žokalj: *Personal Values of Internet Users: A Cluster Analytic Approach*

EIZ-WP-1605 Simon Stickelmann: *The Influence of the European Union Consumer Protection Policy on Croatian Consumers*

EIZ-WP-1604 Bojan Basrak, Petra Posedel, Marina Tkalec and Maruška Vizek: *Searching high and low: Extremal dependence of international sovereign bond markets*

EIZ-WP-1603 Valerija Botrić and Iva Tomić: *Self-employment of the young and the old: exploring effects of the crisis in Croatia*

EIZ-WP-1602 Vedran Recher: *Tougher Than the Rest? Relationship between Unemployment and Crime in Croatia*

EIZ-WP-1601 Iva Tomić: *What drives youth unemployment in Europe?*

2015

EIZ-WP-1505 Petra Palić, Petra Posedel Šimović and Maruška Vizek: *The Determinants of Country's Risk Premium Volatility: Evidence from Panel VAR Model*

EIZ-WP-1504 Sunčana Slijepčević, Jelena Budak and Edo Rajh: *Challenging Competition at Public Procurement Markets: Are SMEs Too Big to Fail? The Case of BiH and Croatia*

EIZ-WP-1503 Ivan Žilić: *Effect of forced displacement on health*

EIZ-WP-1502 Vedran Recher, Jelena Budak and Edo Rajh: *Eye in the Sky: Contextualizing Development with Online Privacy Concern in Western Balkan Countries*

EIZ-WP-1501 Petra Posedel Šimović, Marina Tkalec and Maruška Vizek: *Time-varying integration in European post-transition sovereign bond market*

2014

EIZ-WP-1403 Jelena Nikolic, Ivica Rubil and Iva Tomić: *Changes in Public and Private Sector Pay Structures in Two Emerging Market Economies during the Crisis*

EIZ-WP-1402 Jelena Budak, Edo Rajh and Ivan-Damir Anić: *Privacy Concern in Western Balkan Countries: Developing a Typology of Citizens*

EIZ-WP-1401 Jelena Budak and Edo Rajh: *The Public Procurement System: A Business Sector Perspective*

2013

EIZ-WP-1302 Valerija Botrić: *Identifying Key Sectors in Croatian Economy Based on Input-Output Tables*

EIZ-WP-1301 Ivica Rubil: *Accounting for Regional Poverty Differences in Croatia: Exploring the Role of Disparities in Average Income and Inequality*

2012

EIZ-WP-1205 Hrvoje Mirošević: *Analiza razvojnih dokumenata Republike Hrvatske*

EIZ-WP-1204 Iva Tomić: *The Efficiency of the Matching Process: Exploring the Impact of Regional Employment Offices in Croatia*

EIZ-WP-1203 Jelena Budak, Ivan-Damir Anić and Edo Rajh: *Public Attitudes towards Surveillance and Privacy in Western Balkans: The Case of Serbia*

EIZ-WP-1202 Valerija Botrić: *Intra-industry Trade between the European Union and Western Balkans: A Close-up*

EIZ-WP-1201 Jelena Budak and Edo Rajh: *Corruption Survey in Croatia: Survey Confidentiality and Trust in Institutions*

2011

EIZ-WP-1104 Jelena Budak and Edo Rajh: *Corruption as an Obstacle for Doing Business in the Western Balkans: A Business Sector Perspective*

EIZ-WP-1103 Alfio Cerami and Paul Stubbs: *Post-communist Welfare Capitalisms: Bringing Institutions and Political Agency Back In*

EIZ-WP-1102 Marina Tkalec: *The Dynamics of Deposit Euroization in European Post-transition Countries: Evidence from Threshold VAR*

EIZ-WP-1101 Jelena Budak, Ivan-Damir Anić and Edo Rajh: *Public Attitudes Towards Surveillance and Privacy in Croatia*

2010

EIZ-WP-1003 Marin Božić: *Pricing Options on Commodity Futures: The Role of Weather and Storage*

EIZ-WP-1002 Dubravka Jurlina Alibegović and Sunčana Slijepčević: *Performance Measurement at the Sub-national Government Level in Croatia*

EIZ-WP-1001 Petra Posedel and Maruška Vizek: *The Nonlinear House Price Adjustment Process in Developed and Transition Countries*

2009

EIZ-WP-0902 Marin Božić and Brian W. Gould: *Has Price Responsiveness of U.S. Milk Supply Decreased?*

EIZ-WP-0901 Sandra Švaljek, Maruška Vizek and Andrea Mervar: *Ciklički prilagođeni proračunski saldo: primjer Hrvatske*

2008

EIZ-WP-0802 Janez Prašnikar, Tanja Rajkovič and Maja Vehovec: *Competencies Driving Innovative Performance of Slovenian and Croatian Manufacturing Firms*

EIZ-WP-0801 Tanja Broz: *The Introduction of the Euro in Central and Eastern European Countries – Is It Economically Justifiable?*

2007

EIZ-WP-0705 Arjan Lejour, Andrea Mervar and Gerard Verweij: *The Economic Effects of Croatia's Accession to the EU*

EIZ-WP-0704 Danijel Nestić: *Differing Characteristics or Differing Rewards: What is Behind the Gender Wage Gap in Croatia?*

EIZ-WP-0703 Maruška Vizek and Tanja Broz: *Modelling Inflation in Croatia*

EIZ-WP-0702 Sonja Radas and Mario Teisl: *An Open Mind Wants More: Opinion Strength and the Desire for Genetically Modified Food Labeling Policy*

EIZ-WP-0701 Andrea Mervar and James E. Payne: *An Analysis of Foreign Tourism Demand for Croatian Destinations: Long-Run Elasticity Estimates*

e-ISSN 1847-7844