Industrial policy and financial constraint of young innovative companies: evidence from the Italian Startup Act

Emanuele Giraudo[a], Giancarlo Giudici[a], Luca Grilli[a]*

[a] Politecnico di Milano, Department of Management, Economics and Industrial Engineering, Via R. Lambruschini 4/b, 20156, Milan, Italy

* Corresponding author. Phone: +39 02 2399 3955; fax: +39 02 2399 2710.

Abstract

While there is general consensus that young innovative companies (YICs) need special attention by public policy which should aim at alleviating the financial constraints these firms commonly suffer, much less agreement has been reached on the most effective policy instruments reputed to accomplish the task. In this respect, if the scientific debate has very much revolved around the dilemma about the crowding-in or crowding-out effect of public R&D subsidies to firms, there is a dearth of scientific studies which analyse the effectiveness and potential interrelations of different policy instruments which at the same time and in the same institutional context are offered to YICs. By taking advantage of the Italian Startup Act issued in 2012, we analyse, for the first time, the possible existence of interrelationships between firm access to a Government-guaranteed (GG) Bank Loan program and fiscal incentive for venture capital (VC) investment. Results suggest two important facts. First, the access to a GG Bank Loan reduce significantly the likelihood to be baked after by a VC and vice versa, highlighting a crowd-out effect between the two type of investors (and the policy mechanisms). Second, the two mechanisms appear to be functional to different typologies of YICs speaking in favor of a "institutional division of labor" between the two measure. These results speak in favour of a *Task segmentation effect* and a limited capability of the law to reduce the financial limitation of YICs.

Keywords: Young Innovative Companies; Venture Capital; Government-guaranteed Bank Loan; Entrepreneurship Policy; Policy Measures Coordination

JEL Codes: 038; G24

1. Introduction

Entrepreneurial activity in technological advanced sectors is deemed to be a major source of innovation, qualified employment and economic growth (Schumpeter, 1911). Recently, the scientific literature has increasingly focused its attention on the so-called Young Innovative Companies (YICs). Mas-Tur and Moya (2015, p. 1432) identify YICs as small and young firms "with great potential to develop innovations for commercial applications and create value for society" (see also Schneider and Veugelers, 2010; Czarnitzki and Delanote, 2013). These firms are characterized by a specific attitude to grasp technical innovation, they often stimulate the development of new technological paradigms, play a disciplining role towards established leaders, open up new market segments and favour the flow of knowledge and competencies inter- and intra- several industries (Timmons and Spinelli, 2003; Aghion and Howitt, 2005). Accordingly, this typology of company has attracted the interest not only of academics but also of many other actors in modern economies, first among everyone, policy makers.

For long time, governments have designed and implemented several types of interventions in order to alleviate those financing constraints that may hamper the birth and the growth of high-potential YICs and related typology of firms. Policy makers need to step in, as long as these firms are likely to invest less than social optimum. Two main reasons are universally acknowledged to explain the gap between private firms' investment and its social optimum level. First, the presence of important knowledge spillovers in innovative activities (Nelson, 1959; Arrow, 1962; Teece, 1986), which may hamper YICs that suffer from inefficient mechanisms of protection of their R&D investment. Secondly, the existence of relevant capital market imperfections which are specifically severe for young and risky start-ups (Hall, 2002; Revest and Sapio, 2012). Following this latter line of reasoning, YICs' chances of obtaining external financing would be made impervious and, as a matter of fact, restricted by the presence

of information asymmetries between the company and potential financiers (Peneder, 2008), which give often rise to adverse selection and moral hazard problems among the two parties (Carpenter and Petersen, 2002). Things get also worse, making more stringent the financial constraints suffered from YICs, because this typology of firms usually lacks stable cash flows, a solid track record and, mostly important, collateral since YICs usually rely to a great extent on intangibles (Hall, 2002).

Therefore, if there is general consensus among both academics and policymakers on the need of direct policies capable to effectively address the financing needs of YICs, much less agreement is discernible on the subsequent question of *which* policy should be put in place (e.g. see Schneider and Veugelers, 2010). In other words, the fundamental question of how, and if, governments are really able to sustain innovative entrepreneurial activity is far from being resolved.

In particular, several attempts have been implemented by different public institutions in order to ease firms' access to financial resources. Specifically, government interventions have tried to reduce YICs' financial constraints through instruments like direct subsidies for R&D and internationalization activities, intellectual property right protection, taxation and fiscal incentives for investors, stimulation of capital markets through equity and venture capital (VC) programmes, microfinance and loan guarantee schemes (Minniti, 2008). Admittedly, different governments, at different latitudes, have often opted for different instruments on the basis that policy strategies should be tailored to specific institutional and regional contexts to be truly effective (Wagner and Sternberg, 2004). But, despite a broad literature investigating to role of entrepreneurship policy (Storey, 2003), several issues about the validity and efficacy of these specific interventions are yet to be fully explored (Minniti, 2008). One of the main problems of this stream of literature on entrepreneurial policy evaluation (see for example the case of public R&D subsidies documented by the scientific review of Zuniga-Vicente et al., 2014) is

that the effectiveness of policy instruments is often analysed in ‘isolation’. In other terms, the circumstance that firms are embedded in diverse institutional contexts and are potentially the target of different policy-driven schemes has been largely overlooked in the empirical analyses on the efficacy of policy measures (Grilli et al., 2016).

In this respect, we argue about the necessity to better understand which typology of firms get access to which type of measures for then gauging the eventual synergistic effects potentially stemming from the co-existence of different public policy measures available to YICs. Equally important, there is the need to perform this analysis in a controlled institutional setting. In particular, the lack of the existing literature is about the absence of studies that compare policy intervention for Venture Capitalists and Bank Loans.

Studies in financial economics highlighted the partial different investment criteria of bankers and venture capitalists (Mason and Stark, 2004). The former stress more the financials, like presence of collateral and stable generated cash flow (Avery et al., 1998; Storey, 1994) while the latter, as equity investor, give more emphasis on managerial experience and business idea (Fried and Hisrich, 1994; Shepherd and Zacharakis, 1999).

In this respect, the recent Law no. 221 introduced in Italy in 2012 (the “*Italian Startup Act*”, i.e. also known in Italy as “Decreto Crescita 2.0”) and specifically devoted to the support of YICs, offers a valuable opportunity. In fact, the scheme includes *at the same time* two of the most important and widely adopted measures for the support of the YICs’ demand for capital: (i) an equity program that envisages fiscal incentives for venture capitalists and outside investors who invest in these firms and (ii) privileged access for YICs to a Government-guaranteed (GG) Bank Loan program. Venture capital (VC) is often considered for its inherent characteristics as the preferred financing source for YICs (Gompers and Lerner, 2001). VC investors are deemed to better overcoming information asymmetries than other capital market operators (Sahlman, 1990) and they do not only provide financial resources but also 'add value'

to YICs along a series of important dimensions on which YICs often lack managerial skills and competencies (Hellmann and Puri, 2002). But, even when considering the most developed equity-based financial system like the United States (US), the VC industry ends up financing only a very small fraction of start-ups (Mulcahy, 2013). As a matter of fact, particularly in bank-based systems like Italy or continental Europe, YICs have to rely on bank debt as the primary source of external financing (Colombo and Grilli, 2007).

Thanks to the Startup Act here considered, all Italian YICs were potentially subject with the same degree of exposure towards the two potential *treatments* (i) and (ii) above mentioned.

We are therefore in the condition to properly investigate the mutual interdependencies arising between the two different sources of financing (and the underlying policy mechanisms). Specifically, we aim at addressing the following questions: do these measures (and the two types of investors here considered) target YICs with similar characteristics or, conversely, do they serve different typologies of YICs? Can these measures be considered complementary, i.e. access to one type of measure eases access to the other type of measure, or conversely substitute, i.e. access to one type of measure depresses access to the other type? Is there any signaling effect (i.e., "certification effect", see Lerner, 2002) exerted by the GG Bank Loans program towards VC investors?

In order to investigate these issues, we consider a sample of 2,523 Italian YICs and resort to the estimation of a dynamic bivariate survival model (Mosconi and Seri, 2006; Colombo et al., 2007) to highlight simultaneously the determinants of YICs' access to both these modes of financing and the possible existence of substitutability and/or complementarity effects between Government Guaranteed Bank Loans and VC investments (i.e. whether access to one financing mode decreases or increases the probability for an YIC to access the other mechanism).

The results of our analysis offer and unprecedented insights as to the financial needs of YICs and deliver important implications in this respect for entrepreneurs, investors and

policymakers. In a nutshell, our findings highlight the crowd-out effect of the GG Bank Loans measure towards the likelihood to obtain a VC investment after. In addition, at the same time the empirical evidences show how the two measures serve different types of YICs.

The rest of the paper is organized as follows. Section 2 highlights the background literature. Section 3 describes the Italian Startup Act. Section 4 illustrates the methodology and describes the data. Section 5 reports on the empirical analysis, including details on additional evidence and robustness tests produced. Section 6 concludes with final remarks.

2. Literature review and research hypotheses

2.1 Young Innovative Companies, financial constraints and investors

YICs are reputed to experience troubles in accessing financial resources, compared to established companies and other young ventures characterized by lower innovativeness: this particularly applies to (European) bank-based economies and it is clearly shown by cross-national surveys (see the European Investment Fund report by Kraemer-Eis et al., 2014) and by the academic literature (see the survey of the literature of Revest and Sapio, 2012). The success of innovative ventures heavily relies on investments in R&D activity, marketing expenses to promote new products and commercialise innovation, resources to hire qualified personnel (Beck and Demirguc-Kunt, 2006). Yet, YICs are generally riskier and failure rates are high (Coad and Rao, 2008); they rely on intangible assets, that hardly can be used as collateral for lending (O'Sullivan, 2005). Moreover, they need money for the long run: any interest payment in the start-up phase diverts resources from value creation and increases the cash burn rate (Giudici and Paleari, 2000; Mazzucato, 2013). Therefore the access to debt financing through bank loans, which is one of the most common sources of finance for established companies, is a challenge for YICs (Freel, 2007) unless relevant guarantees are provided by the founders, this harming their entrepreneurial boost. The advent of the global

financial crisis contributed to further reduce the supply of capital for YICs (North et al., 2013; Lee et al., 2015) especially from banks, and to increase the cost of outside capital.

Equity capital provided by outside professional investors like venture capitalists (VCs) is typically pointed out as the solution to the credit rationing problem (Mina et al., 2013) and to adverse selection and moral hazard problems (Carpenter and Petersen, 2002). VC investors have superior screening capabilities and are typically selective (Sahlman, 1990), require a number of contractual clauses in order to protect their investment (e.g. veto power, super-majority voting, drag-along and tag-along clauses, governance agreements, board representation) and work alongside the founders to increase the value of the venture, by providing managerial competences, networking and marketing advice (Hellmann and Puri, 2002; Gompers and Lerner, 2004; Ueda, 2004). Bertoni et al. (2011) show that VC investments positively influence firm growth: the treatment effect of VC investments is of large economic magnitude, especially on growth of employment. More generally, most of the available empirical evidence lends large empirical support to the claim of a positive impact of VC on firm performance, basically irrespective of the latitude and the timing on which analyses are carried on (e.g. Manigart and Van Hyfte, 1999; Kortum and Lerner, 2000; Engel and Keilbach, 2007; Puri and Zarutskie, 2012; Cumming et al., 2016).

2.2 Bank's Lending and Venture Capital Fund Investment screening process

Bankers and venture capitalists face the problem of information asymmetry when assessing lending applications and evaluation of investment opportunities. These problems are particularly severe when the request comes from new businesses (Binks and Ennew, 1996; Storey, 1994) but, due to the different type of investment, the risks for bank and VC are not the same. The former suffers two types of risks (Parker, 2002): *Adverse selection* – lending a failure business (type one error), or not lending a successful business (type two) – and *Moral Hazard* risk, given that the bank is unable to monitor entrepreneurs activity after the bank loans

concession (Binks and Ennew, 1996). In this perspective, two considerations are key for bank to lending decision: the presence of collateral and the ability for the company to generate cash flows to pay back the principal and the interests cash flow (Wynant and Hatch, 1991). Unlike banks, VCs subscribe equity capital and have a residual claim compared to debt holders; they are are fully exposed in the business failure and the possibility that their investment will be illiquid if the new venture does not growth significantly is high. What stands out from the existing literature is the fact that, even if the financial issues are an important driver, VCs put more emphasis on the capability of the management team (Muzyka et al., 1996), product characteristics, market characteristics and potential returns (Manigart et al., 1997).

2.3 Policies for the financial needs of Young Innovative Companies

Despite the "near universal recognition of the presence of market failures in the provision of finance" for YICs and high-tech start-ups (Storey and Tether, 1998, p. 1049; see also Hall, 2005), and the alleged consensus on the need for a policy intervention in the field (Schneider and Veugelers, 2010), the debate on the most effective measures to put in place is still quite lively (Colombo et al., 2013). Policy measures generally vary along several dimensions, but crucial factors are usually deemed the channel through which support to companies should be provided (e.g., tax credits, grants, or low interest loans), whether subsidies should be *erga-omnes* for YICs or rather selective, the type of expenditures admissible for public financing, where R&D usually figures prominently. Admittedly, the scientific literature has been of little help in imparting to policymakers clear guidelines on identifying the best mechanisms tailored to each specific institutional context (Wagner and Sternberg, 2004). In fact, much of the scientific debate has revolved around the question of whether public subsidies (especially R&D grants) crowd-out or crowd-in private monies (Czarnitzki and Fier, 2002; Zuniga-Vicente et al., 2014). One other more recent lively area of debate, given the positive role attributed to the VC investor depicted above, is whether the public actor should adopt a 'hands-on' approach

and constitute large governmental venture capital funds or, more generally, whether its (direct or indirect) intervention is really able to trigger the development of a florid venture capital industry (Manigart and Beuselinck, 2001; Leleux and Surlemont, 2003; Cumming and MacIntosh, 2006; Da Rin et al., 2006; Cumming, 2007; Brander et al., 2012; Grilli and Murtinu, 2014; Cumming et al. 2016). While the political discussion is very much open about these issues, from a scientific point of view, it is argued that one of the major deficiency in the literature is traceable in the rather Manichean perspective adopted by most studies (see Colombo et al. 2011; Grilli et al., 2016). In fact the typical study in the field analyzes the effects of a specific policy measure *in isolation* with respect to (i.e. without taking into account) other possible alternative policy measures firms may have access to. In doing so, it is impossible to understand whether different firms select themselves to different instruments and/or self-select themselves out from others, by relegating the analysis to provide, in the best scenario, only a partial picture and, in the worst case, a biased representation. Secondly, eventual mutual interrelationships arising between different policy measures targeted to YICs have largely remained unexplored. Specifically, although the theme of industrial policy coordination has been investigated from both a theoretical (Cooper and John, 1988; Durlauf, 1993) and an empirical point of view (Rodrik, 1996), the possible arise of policy coordination failures and/or synergies in the specific domain here considered has never been investigated before.

Grounding on this research gap, the specific policy reform here considered enables us to explore, within the same institutional reform, two important research questions:

R1. Do Government Guarantee Bank Loans and fiscal incentives for VC investments flow towards YICs with the same characteristics or, conversely, the two type of investors target rather different YICs?

R2. Does access to one type of subsidized financing measure facilitates or, conversely, depresses access to the other?

By combining the answers to these two research questions, it is possible to ascertain four different scenarios as to the effect of the entrepreneurship policy on the financing of YICs. These scenarios are synthesized in Figure 1. A first scenario is labeled *Shadow effect*. In this case, GG Bank Loans and subsidized VC investments target very similar YICs, and once accessed one type of financing the probability for an YIC to access the other is significantly reduced. A second scenario is represented by the *Task segmentation effect*. The two policy measures help different types of YICs, but again access to one type of measure decreases the probability for an YIC to access the other one. Then, the scenario where GG Bank Loans and subsidized VC investments flow towards the same type of YICs, and then, once accessed one type of measure, an YIC shows greater probability to access the other financing source, is a typical *Matthew effect* (Merton, 1968; 1988). Finally, if, in first instance, banks or Venture Capital target different typologies of YICs, but then, if access to one type of external funds enhances possibilities for an YIC to get the other, is labeled as *Halo effect* (Dollinger et al., 1997; Rosenzweig, 2014).

Our empirical analysis will enable us to ascertain which of these different policy scenarios is more likely to refer to YICs, in a specific context where all the YICs are subjected to the same measures at the same time.

3. The Italian Startup Act

In order to boost the birth of new innovative ventures, in 2012 the Italian Government issued a law (Law no. 221/2012, modified by further amendments, the so-called "*Italian Startup Act*") introducing the possibility for young companies to qualify as a YIC (namely "innovative startup"). This status is reserved to limited liability companies (either Italian companies or branches of EU companies registered in Italy), younger than 5 years, operating in technology-related businesses. YICs have also to comply with one of the following three requirements: (i) ownership or licensee of a patent or a registered software or a generic intellectual right, (ii) at

least one third of employees must hold a Ph.D. or a research tenure (or at least two third must hold a M.Sc. degree), (iii) investments in R&D should account for at least 15% of the revenues (or operating costs if they exceed the revenues). Until a company qualifies as an YIC, it cannot distribute dividends and cannot be listed on a stock exchange. The annual revenues must be lower than € 5 million and the company must not be originated from a spin-off or a merger of pre-existing operations.

To YICs (as identified by the law) are granted specific incentives, exemptions and access to privileged (and discounted) services. The retroactive nature of the policy allows access to these support measures not only to new ventures, but also to already existing YICs that fulfilled the law requirements. Measures span over different areas. For example, Italian YICs can be incorporated on the Internet through digital identification almost for free and they are exempted from any relevant entry fee otherwise due to the Chambers of Commerce. Or again, employees and consultants can be remunerated with stock options and "work for equity" tools enjoying particular reliefs. Moreover, Italian YICs may benefit from fail-fast mechanisms in case of liquidation, so to allow fresh new starts to entrepreneurs. A brief synopsis of the law (and a comparison with legislation in other EU Member States) is provided by the European Digital Forum (2016). A complete description of the eligibility criteria and all support measures are available on the governmental website of the Italian Ministry of Economic Development (http://www.mise.gov.it).

As far as the financing side is concerned, which is the focus of our analysis, two are the policy initiatives of interest. The first initiative is a tax incentive scheme to encourage private equity investors for YICs investments. YICs may benefit from robust tax relief on equity investments made by legal entities: a minimum 20% fiscal deduction up to a maximum investment of € 1.8 million. This provision aims at supporting venture capital investors and benefit those YICs which receive VC financing. The second intervention is a loan Government-

Guarantee scheme, designed with the aim to overcome market imperfections in the provision of bank loans for YICs. Italian YICs have priority and simplified access to a Government-Guaranteed (GG) Bank Loan Fund, which offers a partial public guarantee on bank loans. Specifically, the guarantee covers up to 80% of the credit issued by a commercial bank to the YIC, with an upper limit of € 2.5 million. YIC must submit the investment plan to the bank, which conducts internally a proper creditworthiness assessment. After that the institute takes the decision on if Whether to approve the loan request, and eventually the guaranteed amount, while the "Medio Credito Centrale", the entity that manages GG fund, makes a simply formal check, without any additional due diligence.

4. Data and Methodology

4.1 Data

The sample analysed in this paper is composed by 2,523 Italian Innovative start-ups. Sample firms were collected starting from the whole population of Italian YICs at December 8th 2014, amounted to 3,006 firms. Based on this, we built a new hand-collected longitudinal database gathering complete company available information at November 2015. Thus, only YICs born at late 2014 that had not deposited financial statements were omitted from the sample. In November 2016 a new data collection were conducted, adding 2015's financial statement for all the companies that were included in the first round. The observation period starts from 2009 although the year of foundation of the YIC was antecedent (by the legal definition of Italian YIC the foundation year cannot be antecedent to 2007). The sources through which data have been collected were mainly three. First, comprehensive accounting and demographic firm information were collected through AIDA, i.e. the Italian fine-grained version of the Amadeus-Bureau Van Dijk database. Second, we used the commercial database provided by the Union of Italian Chambers of Commerce, i.e. Telemaco, which registers all business activities started in Italy and provides (upon payment request) information about shareholders composition and

firm financial structure and their evolution over time. The one-by-one visual inspection of each firm's official documentation on capital and debt structure throughout its life was instrumental in discerning the VC-backed YICs from the non-VC-backed ones, and to record the eventual year of the first VC investment. Further confirmatory analysis through secondary sources (e.g. specialized press, corporate websites) was applied in order to identify the VC-backed YICs. Third, data on access by firms to the GG Bank Loans program with the indication of the year of loan disbursement was provided by the Italian Ministry of Economic Development.[1] Firm fiscal codes were used in order to anchor all these data across the three different sources.

Then, other information sources were used to complete the set of covariates. We added information on the geographical location of YICs. Specifically, we used several other secondary sources (e.g. Istituto G. Tagliacarne, InfoCamere, Istat) in order to create socio-economic indicators of the regions (at NUTS 2 level) where YICs are located. Finally, we also included in our analysis variables capturing the contingent phase of the macroeconomic business cycle over years (source: Eurostat).

4.1.1 Descriptive statistics

As far as the main interest of this study is concerned, the two policy measures seem not to impact equally on the YICs external financing likelihood (see Table 1). The number of YICs assisted by at least one GG Bank Loan is relatively small (418 companies representing roughly 16.6% of the sample), even so it is much bigger than the number of innovative start-ups backed by VC investments (276 companies equal to almost 11%). These data confirm the difficulties to the external financial resources for YICs and the limited dimension of the VC industry in Continental Europe (Giudici and Roosenboom, 2003). Note also that the number of the firms that accessed both type of financing forms was fairly low, i.e. 48 (2.7%). This is a first and

[1] Data in this respect were strictly confidential and made available to one of the author only for scientific purposes and only thanks to his/her participation to a Ministerial technical committee constituted for the monitoring and evaluation of national policies for the eco-system of Italian innovative start-ups and SMEs.

partial indication that accessing both forms of financing is rather unusual for YICs, pointing to the conceivable existence of substitution effect between the two policy measures.

[Insert Table 1]

The last part of Table 1 reports statistics about "second transitions", i.e. the number of firms that being backed by one type of financier have gained access to the other type and the number of firms that in the same year got access to both VC and GG Bank Loan. Out of these 48 YICs, three-fifths (29 firms) obtained the GG Bank Loan some years after they were invested by a VC, while just seven firms obtained a GG Bank Loan and afterwards they were backed by a VC. Standing the absence of any specific statistical investigations, the small number of beholden YICs backed from a VC represents a preliminary evidence that the crowding-out effect seems to be stronger from the GG Bank Loans towards the VCs, rather than the other way round.

As to other descriptive statistics, the total accounting value of the company assets, as at the end of 2015, was lower than € 100,000 in 37% of the YICs. By the same period, 14% of the firms had not obtained any revenue yet; while only 29% (741 companies) had overcome the threshold of € 100,000 in terms of total revenues, with several YICs still in the early stages of their life (sampled YICs are 3.5 years old on average). Even though the Law no. 221/2012 included specific measures aimed at easing the hiring of workforce, at the end of 2015, 55% of the YICs still relied entirely on the self-employment of entrepreneurs, and 45% declared salaried employees. As a matter of fact, only 18% of the start-ups employed more than three individuals.

4.2 The econometric model

We model an YIC's likelihood to access VC and/or GG Bank Loans through a Bivariate discrete-time binary process $Y_t=[Y^A_t, Y^B_t]$ (see Mosconi and Seri, 2006). The description of the method is based on Colombo et al. (2007) and adapted to our context. In particular $y^A_{i,t} = 1$ if firm *i* got access to VC by the year *t*, $y^B_{i,t} = 1$ if the firm accessed a GG Bank Loan by the year *t*, with $t = [t_i^E \ldots T]$. t_i^E is the foundation year of the firm *i*, *T* is the last year of the observation period, i.e. 2015. For all YICs, at time *t*, only four different states of nature are observable: 0 = [0,0]; 1 = [1,0]; 2 = [0,1]; 3 = [1,1]. The state 0 indicates YICs that did not obtain neither VC funds nor GG Bank Loans. State 1 identifies VC-backed firms that did not access GG Bank Loans, state 2 YICs that obtained a GG Bank Loan but which are not VC-backed, while state 3 indicates access to both VC and GG Bank Loans.

The discrete-time binary model used in this study contemplates five different possible transition probabilities. From state 0 to state 1 or to state 2 the transitions are defined as *first transitions*, instead transitions between states 1 or 2 to 3 and between 0 to 3 are defined *second transitions*. The model is defined as an *absorbing states model* (Mosconi and Seri, 2006) and it assumes that transitions between states are irreversible. Formally, this means that a company which has reached the states $y^J_{i,t-1} = 1$ at time *t-1* will not go back to $y^J_{i,t} = 0$ at time *t*, *j=A,B.* Accordingly, this also means that the probability of an YIC of being VC-backed at time *t* if it was already VC-backed at time *t-1* is equal to 1. $\mathrm{P}\left\{Y^A_{i,t} = 1 \middle| Y_{i,t-1} = (1,0)\right\} = 1)$. Similarly, $\mathrm{P}\left\{Y^B_{i,t} = 1 \middle| Y_{i,t-1} = (0,1)\right\} = 1$.

The model adopts a latent regression approach and poses the assumptions that all companies *i* access GG Bank Loan or VC (variable *j*), if a latent continuous random variable $y^{*j}_{i,t}$ exceeds a threshold level, that without loss of generality is set equal to zero. Given that the variable $y^{*j}_{i,t}$ depends on the firm *i* states of nature at time *t-1*, the dynamics are modeled as a typical first-order *Markov chain* process. The stationary assumption of transition probabilities implied by a

strict first-order Markov process is then relaxed by modeling YIC's access to the two different forms of financing, as a function not only of past realizations of the endogenous variables, i.e. state of nature at time *t-1*, but also as a function of a set of time-varying and unvarying covariates $x_{i,t}$. Following recommendations by Mosconi and Seri (2006), in our analysis all time-dependent YIC-specific explanatory variables which may be correlated to firm access to VC or GG Bank Loan at time *t*, have been lagged at *t-1*, in order to alleviate possible reverse causality problems. Finally, in order to exploit all the available relevant information concerning first transition probabilities in the event that YICs obtain VC and/or GG Bank Loan during their foundation year, we construct a variable indicating whether a firm is less than one year old. In other words, the variable *Dseed* is defined as follows:

$$Dseed = \begin{cases} 1 & t = t_i^E \\ 0 & t > t_i^E \end{cases}. \qquad (1)$$

Lagged time-varying firm-specific explanatory variables (e.g. firm size in terms of employees or firm leverage) are by construction not defined before firm's foundation. The same applies to the lagged endogenous variables of the model, as before foundation firms do not belong to any state of nature. Therefore, these variables are included in a vector $k_{i,t-1}^j$ that cannot influence firms' probability of accessing external funds at $t = t_i^E$. Accordingly, in the specification of the model these independent variables are multiplied by (1-*Dseed*). While, we define another set of explanatory variables included in vector $z_{i,t}^j$, as formed by those time-varying determinants (e.g. firm age, number of managers) which are unlikely to be endogenous and by the time-unvarying covariates (e.g. location specific and macroeconomic variables) which can meaningfully be defined at the foundation time and may exert an impact on firms' access to both forms of financing even in the foundation year.

Hence for an YIC that was not financed by a VC investor and did not access any GG Bank Loan (i.e. it starts from state 0), the latent regression system is:

$$y_{i,t}^{*A} = \alpha_A^T \left[z_{i,t}^A, (1 - Dseed_i) k_{i,t-1}^A \right] + \varepsilon_{i,t}^A$$

$$y_{i,t}^{*B} = \alpha_B^T \left[z_{i,t}^B, (1 - Dseed_i) k_{i,t-1}^B \right] + \varepsilon_{i,t}^B . \qquad (2)$$

For this type of regression model it is usually assumed a standardized bivariate normal distribution for error terms ($\varepsilon_{i,t}^A, \varepsilon_{i,t}^B$):

$$\begin{pmatrix} \varepsilon_{i,t}^A \\ \varepsilon_{i,t}^B \end{pmatrix} \sim iidN\left(\begin{bmatrix} 0 \\ 0 \end{bmatrix}, \begin{bmatrix} 1 & \rho \\ \rho & 1 \end{bmatrix} \right),$$

with

$$\rho = \frac{2e^{\gamma_0}}{1 + e^{\gamma_0}} - 1. \qquad (3)$$

It follows that the probability of moving to state *j*, *j*=1,2,3 at time *t*, provided that firm *i* is in state 0 at time *t-1*, can be modelled through a bivariate probit model. This means that:

$$P\left\{ y_{i,t} \middle| Y_{i,t-1} = (0,0), x_{i,t} \right\} = \Phi_2 \left(\begin{bmatrix} \alpha_A^T x_{i,t}^A \\ \\ \alpha_B^T x_{i,t}^B \end{bmatrix}; 0, \begin{bmatrix} 1 & \rho \\ \\ \rho & 1 \end{bmatrix} \right), \qquad (4)$$

where $x_{i.t}^A$ and $x_{i.t}^B$ are the whole set of independent variables (i.e. those included in $z_{i.t}^j$ and $k_{i.t-1}^j$, with these latter being multiplied by *1-Dseed*).

For an YIC which has obtained VC funds at time *t-1* (i.e. it is in state 1), the only possible transition at time *t* is the one that brings the firm to get also access to the GG Bank Loan Program (i.e. from state 1 to state 3). Hence, the latent regression underlying Y_t^B and can be written as follows:

$$y_{i,t}^{*B} = \alpha_B^T \left[z_{i,t}^B, (1 - Dseed_i) k_{i,t-1}^B \right] + \beta_B (1 - Dseed_i) y_{i,t-1}^A + \varepsilon_{i,t}^B \ , \qquad (5)$$

giving rise to the univariate probit model:

$$\mathrm{P}\left\{ y^B{}_{i,t} \middle| Y_{i,t-1} = (1,0), x_{i,t}^B \right\} = \Phi_1 \left(\alpha_B^T x_{i,t}^B + \beta_B ; 0,1 \right). \qquad (6)$$

Similarly, for transiting from state 2 to state 3, as defined by the latent regression model, we will have:

$$y_{i,t}^{*A} = \alpha_A^T \left[z_{i,t}^A, (1 - Dseed_i) k_{i,t-1}^A \right] + \beta_A (1 - Dseed_i) y_{i,t-1}^B + \varepsilon_{i,t}^A \ , \tag{7}$$

which leads the univariate probit model formulated as follows:

$$\mathrm{P}\left\{ y^A{}_{i,t} \middle| Y_{i,t-1} = (0,1), x_{i,t}^A \right\} = \Phi_1 \left(\alpha_A^T x_{i,t}^A + \beta_A ; 0,1 \right). \tag{8}$$

As customarily, parameter β_A (β_B) captures the increase in the probability of getting VC (GG Bank Loan) once a firm has obtained a GG Bank Loan (VC). Hence, the analysis of the coefficients β_A and β_B provides an immediate test about the causality relationships between YICs' access to VC financing once accessed GG Bank Loans and vice versa. Then, the hypothesis that simultaneous access to VC financing and to GG Bank Loan is more likely to occur than the recourse to each source of financing in isolation can be verified through a Wald test for the parameter γ, which drives the correlation coefficient ρ (see Mosconi and Seri 2006, p. 403).

4.2.1 Variables

The investigation about the probability for the Italian YICs to access VC and GG Bank Loans is carried out using a large set of covariates underpinned by the scientific literature discussed in Section 2. Variables can be grouped into four different categories: firm-specific, location-specific, sector-specific and macro-economic specific variables (see Table 2).

[insert Table 2]

Firm-specific variables are related to the company characteristics, taking into account age, size, financial structure and assets' profitability. According to Mina et al. (2013) and Beck and Demigurc-Kunt (2006), company age and size are important determinants of firms' access to external finance, since younger and smaller ventures are considered riskier than more mature and larger counterparts. In particular, start-up age is captured by both the variable *Dseed*, a dummy that identifies firms in their foundation year, and by the variable Age_t which measures

firm age at time *t*.[2] To describe the size of the YIC, we make use of the number of employees at time *t-1* ($Employees_{t-1}$). On average, we expect that, relatively smaller and younger YICs should be more likely to access GG Bank Loans rather than VC, as this latter typology of investor usually targets sizeable investments (Gompers and Lerner, 2004), even if seed financing is not an uncommon trait of the industry (Barry, 1994). As a further variable for size we also use the natural logarithm of the total assets owned by the company ($LnTotAsset_{t-1}$)[3] (Bougheas et al., 2005). In this respect, we expect a positive impact of the value of company assets and the probability to access the two instruments, especially GG Bank Loans: banks in fact should be particularly sensitive to the assets which may serve as collateral in case of firm default (Ueda, 2004; Beck and Demirguc-Kunt, 2006).[4]

Then, following Hellmann and Puri (2002), and their argument about the importance of professionalization of start-ups as a driver criterion for venture capitalists, we introduce the variable $N\_Manager_t$ counting shareholders and managers who have an "active" role in the governance of the start-up, at time *t*.[5] Accordingly, we expect at least a positive impact of this variable on YICs' access to VC (Mason and Stark, 2004).

The natural logarithm of the absolute value of Leverage ($Leverage_{t-1}$), defined as the ratio of financial debts on equity at time *t-1*, captures YIC's financial structure. Baum and Silverman

[2] Note that the maximum value for the variable *Age* exceeds 5 years and it is equal to 7. In fact, the retroactive nature of the law allows for companies incorporated before 2012 to have the status of "innovative start-ups" for a reduced time span (less than 5 years). So the period of investigation even beyond the time window envisaged by the Law no. 221/2012, in order to better understand the presence of possible interrelationships between the two financing modes, and in particular, to verify whether YICS subsidized by a GG Bank Loan could access venture capital investment even beyond the subsidization period.

[3] The correlation between $Employees_{t-1}$ and $LnTotAsset_{t-1}$ is equal to 0.3335, the coefficient and the standard deviation of the two variables differ in terms of dimension and sign, as well as the sample size is quite big. We can assert that multicollinearity problems should not affect our results. The correlation matrix of explanatory variables is available from the authors upon request.

[4] We must remember that the Government guarantees only a portion of the bank loan. Therefore the lender faces the credit risk on the residual part.

[5] This firm-specific variable was introduced into model specification at time *t*. However, note that introducing into model specification this variable at time *t-1* leaves our findings totally unaltered (results available upon request from the authors).

(2004) argue that VCs invest in more leveraged firms while Mina et al. (2013) find that less leveraged firms are preferred. The company profitability is a further variable examined by investors (Mina et al. 2013); yet both equity investors and banks will consider prospect profitability, more than current profitability. Therefore, on *a priori* ground, we do not expect any strong association in this case. Like proxy of the start-up profitability, we use the natural logarithm of ROA (return on assets), that is the ratio between the operating margin and the total assets of the YIC at time *t-1*. Given the skewed distributions of both firm leverage and ROA, both related variables are introduced into model specification in natural logarithm terms. Firm specific variables are the main drivers in the first transition analysis, giving the possibility to observe the presence of any segmentation related to the investment decision of VC and bankers (Mason and Stark, 2004).

Turning to the location-specific group, four explanatory variables were gathered. The goal of geographical variables is to highlight the effect of the regional (at NUTS 2 level) economic and entrepreneurial ecosystem in which firms are embedded on the YICs' probability to take advantage of the two different policy measures here investigated. A number of studies highlighted the importance of the heterogeneity of the local environment (e.g. wealth distribution, infrastructure availability, industrial clusters), in determining access to finance by entrepreneurial ventures (Fritsch and Noseleit, 2013; Giudici et al., 2016). *DSouth* is a dummy variable which assumes value 1 for companies located in the south of Italy, where this area turns out to be historically the least economically developed of the country. In this respect, it is interesting to investigate if the two investigated policy measures help YICs located in this specific disadvantaged area to lessen their financial constraints more than YICs located elsewhere. In the same vein, we introduce into the model three other variables which aim at capturing the infrastructural context and entrepreneurial ecosystem on which YICs are called to operate and that may ease their access to the two forms of financing. *Industrial Intensity* is

the ratio in the year 2012 between the number of active firms in the focal region over the number of hundreds of residents; *Value Added* computes in percentage terms which was the regional contribution to the national value added in the year 2011, while *Infrastructure* is a composed index referring to the year 2011 and capturing the regional infrastructural and economic endowment in terms of transportation and logistics facilities, telecommunication networks development and capillarity of banking services.

Finally, we include a set of industry and business cycle control variables. In detail, we control for the industry in which firms operate (R&D, software, manufacturing or general services), for the yearly national deficit on the overall GDP ($Deficit/GDP_t$) and for the yearly national growth of GDP ($GDPGrowth_t$). Among others, Da Rin et al. (2006) underlined the importance of controlling for macro-economic factors in explaining firms' access to finance.

Table 3 illustrates the descriptive statistics for the explanatory variables. The logarithm of the total assets ranges from 0 to 16.380, this indicating that the sample comprises both YICs just established and companies with some activities in place. The logarithm of the leverage ratio is also varying; we have companies with virtually no debt and companies that borrowed more consistently. Not surprisingly, also the value of the return on assets ratio is dispersed, since both the operating margin and the total value of assets for many companies are very low, this leading to very low or very high values of their performance ratios.

[insert Table 3]

5. Empirical analysis

5.*1 Main results*

Results of the econometric analysis are exposed in Table 4.[6] Starting from the analysis of the first transitions, the model highlights in the first column the estimates related to the firms'

[6] We have estimated the econometric models using OX Professional (Doornik, 1999).

likelihood to access VC investments (Y_A) and in the second column estimates related to YIC's access to GG Bank Loans (Y_B).

[insert Table 4]

5.1.1 First transitions: segmentation vs similarity

Overall, the results point to the presence of relevant differences among YICs in terms of access to the two different financial resources (and policy interventions).

Focusing upon the coefficients, beside the accumulation point at the founding year which is similar for both typologies of subsidized financing forms (see the coefficients of the variable *Dseed*), the estimated coefficient of *Age* is negative and statistically significant (at 1%) on the probability to access GG Bank Loans, while it turns out to be statistically negligible for what concerns the YIC's probability to access VC funds. The result highlights that GG Bank Loans show a relatively higher propensity than VC investments to flow towards very early staged companies. Similarly, $Employees_{t-1}$ has a negative and significant impact on the GG equation (at 5% level), while it turns positive but not statistical significant for the VC equation. In other words, small-sized YICs, in terms of employees, find easier access to GG Bank Loans while, on the contrary, are relatively overlooked by VC investors (notwithstanding the fiscal incentives at work). The results point to a sort of "institutional division of labour" between the two policy measures under investigation.

But differences among the two estimated equations invest also other determinants. $LnTotasset_{t-1}$ has a positive impact on both VC investments and GG Bank Loans, but the coefficient is greater for the latter than for the former, their difference being statistically significant at the 1% level. In this case, while both financing types do not appear to flow towards largely undercapitalized YICs, the result also suggests the relevance at the banks' eyes of the collateral value embodied in total assets for securing the loan (notwithstanding the presence of the governmental guarantee).

The variable $Managers_t$ has a positive and statistical significant impacts on VC financing (at 1%) and on GG Bank Loans (at 10%), even if the coefficient for the latter is barely over the zero. These results confirm the attention of equity investors to the managerial professionalization of the firm. However, managerial capabilities are partially relevant in terms of banks' evaluation.

The variables $LnLeverage_{t-1}$ and $LnROA_{t-1}$ have a negligible impact on both regressions, indicating the absence of any statistical connection between the likelihood to receive VC funds or a GG Bank Loans and the existing YIC financial structure.

In order to confirm the presence of segmentation between YICs, a specific *z-test* is run between the coefficients of the two equations, with the aim to test the difference (Brame et al., 1998; Paternoster et al., 1998). The null hypothesis (i.e. the coefficient related to the variable X_i for the VC equation is equal to the coefficient for the GG equation) is rejected, at 99%, for all the firm specific variables. These results adhere to the segmentation hypothesis, and they are available upon request from the authors.

Regarding Location-specific variables, *DSouth* positively and significantly impacts VC financing at 5% level of statistical significance, while for GG Bank Loan equation, the coefficient turns out to be close to zero and statistically insignificant. This result highlights the effectiveness of the equity fiscal reduction implemented by the law for that companies located in the most disadvantaged area of the country (i.e. south of Italy). Unfortunately it is not possible to observe the same effect for what concern the GG Bank Loans.

. On the opposite side, the variables *Industrial Intensity* and *Value Added* exhibit a positive and significant (respectively at 5% and 1% level) impact on the YIC's probability to obtain a GG Bank Loan, while only *Value Added* has a positive and statistical significant effect for what concerns the probability to obtain a VC investment.

Looking at the industry dummies, the higher probability to receive a VC investment is for software YICs, while firms active in manufacturing shows a greater propensity than YICs active in other sectors to access GG Bank Loans.

Finally, and interestingly enough since it points to a notable difference, while access by YICs to GG Bank Loans turns out to be pro-cyclical, the reverse applies to VC. In fact both variables $Deficit/GDP_t$ and $GDPGrowtht_t$ show a positive and significant impact (at 1% level) on the GG Bank Loans equation, while a negative impact of the two (not statistical significant for the former and statistically significant at 1% level for the latter) emerges in the VC regression.

5.1.2 Substitutability vs Complementarity

Results related to second transitions are displayed in the lower part of Table 4. First, the coefficient β_B is negative and statistically significant (at the 5% level). This result points to the presence of a substitution effect (once received a GG Bank Loan a YIC is less likely to be backed by a VC). At the same time, the coefficient β_A is not statistically negligible. The statistical weakness of β_A may derive from the small number of companies that obtained a guarantee Bank Loan after being backed at a previous stage by a VC (only 7), giving an additional evidence in favour of the substitutability of the two mechanisms. This result suggests the absence of any relevant complementary and signalling effect of VC investment towards access to GG Bank Loans (and the underlying policy measure). Finally, simultaneous obtainment of both forms of financing is equally likely than obtaining each source of financing in isolation as testified by the large statistical insignificance of the parameter γ.

To sum up, what stands out from the empirical analysis is that the two policy measures sustain rather different typologies of YICs, with different characteristics. Accordingly, once an YIC receives support from one measure this further decrease its likelihood to obtain the other form of subsidized financing interested by the law. Overall, the picture that emerges is one of

inefficient implementation of policy intervention towards YICs. The aim of the intervention to improve the access to external financial resources seems to generate

substitution effects. We now investigate whether this effect is robust to different model specifications.

5.2 Robustness checks

5.2.1 Human capital variables

Starting from the original sample of 2,523 YICs and focusing on the sectors that turned out to be the most attractive for (subsidized) VCs and GG Bank Loans (i.e., the software and manufacturing industries),[7] we also verified whether our findings were robust to an augmented model specification which also included independent variables capturing the human capital of the YICs' entrepreneurial teams. In fact, there is a conspicuous body of literature which highlights how entrepreneurs' human capital is usually an important driver of VCs' target choice (e.g. Muzyka et al., 1996; Zacharakis and Meyer, 2000; Baum and Silverman, 2004). We aim at verifying if the inclusion of these characteristics may change the findings already exposed and, eventually, in which direction they do so. To this extent, we were able to collect manually information on the educational background and work experience of 2256 entrepreneurs of 1072 YICs.[8] Data were retrieved by combining the use of the Telemaco database jointly with the professional social network LinkedIn through a Premium access.[9] The human capital data are related to the education and work experience of entrepreneurs. More specifically, the former includes information about the education degrees (bachelor, master and PhD) and the study fields (technical/scientific or economic). The latter includes information

[7] The two sectors also represents the industries with the largest number of Italian YICs.

[8] $\chi 2$ tests show that there are no statistically significant differences between the distributions of this sample of 1072 YICs and the corresponding distributions of the population of the large sample from which it was drawn. In particular, the small one is very similar to the large one under all the financials indicators/company characteristics and presence of external investors. Results are available upon request from the authors.

[9] The use of information in scientific studies gathered from professional social networks like LinkedIn is increasingly used as in general (Gloor et al., 2011; Weber and Jung, 2015) as with specific reference to the entrepreneurship literature (De Cleyn et al., 2015; Giudici et al., 2016).

about the general pre-entry work experience of the entrepreneur, the pre-entry work experience that each entrepreneur gained in the sector of operations of the start-up and the pre-entry managerial work experience. More specifically, *Economic Education* is the average of years of economic and/or managerial education at graduate and post-graduate level of YICs' founders. *Technical Education* is the corresponding variable in terms of scientific and/or technical subjects. *Managerial Experience* measures the average years of managerial pre-entry work experience of the entrepreneurs. *Sector Work Experience* and *General Work Experience* measure the average years of work experience of founders in the same sector and in other sectors of the start-up before foundation, respectively. Definition of these variables and their descriptive statistics are provided in the dedicated Appendix (see Table A1 and Table A2).

We run the main econometric model on this sample with an augmented specification including these variables and the results are exposed in Table 5 Notably, entrepreneurs' human capital is found to scarcely affect YIC's access to (subsidized) VC, where only *Economic Education* is found to positively and significantly (at the 5% level) impact on the YIC's probability to obtain an equity investment. Other results related to the first transitions are rather similar to those exposed in Table 4, with a generalized loss of statistical significance due to the reduced sample size. The most interesting difference is related to the variable *Dseed* which becomes not statistical significant on the likelihood to be backed by a VC. For what concern the GG equation, the variables *Technical Education Sector, Work Experience* and *General Work Experience* have a slightly negative and statistically significant (at the 10% level) impact. As described by the existing literature, our results confirm the secondary importance of the entrepreneurial team to the bankers, highlighting that the banks funding decisions are dominated by financial considerations. This is a further evidence in favour of segmentation of YICs for what concerns the two type of investors (and the two policy mechanisms). As to the second transitions, it is quite interest to observe that the coefficient β_B is still negative and

statistically significant (at 5% level) as in Table 4. In other words, it is reinforced the result (which to some extent remains statistically weak) that once received a GG Bank Loan, an YIC becomes even less likely than before to access the other form of subsidized financing, i.e. VC.

[insert Table 5]

5.2.2 Alternative specifications

In order to better investigate the effects of the specific geographical location on YICs' probability to access the two financing mechanisms, we also enlarged our model specification by adding two specific geographical-related covariates, *Incubators* and *VC Investment*$_{t-1}$. The former is the number of incubators and permanent accelerator programs (source: Italian Chambers of Commerce) existing at regional level (NUTS2), where we distinguish the number of those active before and after 2012; the latter is the lagged total amount of VC investments per region per year (source: AIFI, the Italian Association of Private Equity and Venture Capital Investors). Business incubators constitute a specific institution designed to support new ventures by providing to the tenant companies several facilities, from workspace to management and knowledge support (Colombo and Delmastro, 2002; Peters et al., 2004; Aerts at al., 2007). Then, VCs are "local" investors, in the sense that most investees are often located nearby VCs' headquarters (Gompers and Lerner, 2004; VICO, 2011; Lutz et al., 2013). Therefore, both variables capture two salient characteristics of the entrepreneurial ecosystem in which YICs operate that may interfere with the investigated dynamics. The results are reported in Table 6. The coefficient of *Incubators* is found to be positive and statistically significant on the YICs access to subsidized VC investments. The result highlights that incubators may offer consultancy services, ease the information flow and direct connection for YICs toward investors. Surprisingly the coefficient of *VC Investment*$_{t-1}$ is barely negative (at 5%) in the VC equation. This implies that previous VC investments do not exert any role on the probability for a YIC to obtain external funds. The coefficients of *Incubators* and *VC*

Investment$_{t-1}$ are found to be statistically insignificant in the GG equation. This implies, as expected, that the likelihood to obtain a Government Guarantee Bank Loan is not affected by the presence of a strong VC environment.

Looking at the second transitions, the results confirms the evidences highlighted in Table 4, confirming the *Task segmentation effect*.

[insert Table 6]

Additionally, we addressed the possible concern that the information loss associated with the use of lagged independent variables, despite their operationalization through equation (1), could undermine the explanatory power of such covariates. To this purpose we run again the model by using all time-varying covariates at time *t*. Results are exposed in Table 7.

[insert Table 7]

The most sensitive change respect to the results shown in Table 4 involves the *Employees*$_t$ variable. Using the total amount of employees per company in the same year of analysis, the coefficient become statistical insignificant in the GG equation.

5.2.3 Bivariate probit model

Finally, we also used alternative methodologies, specifically a bivariate probit regression and a seemingly unrelated bivariate probit model, in order to further assess the strength of our findings. This methodology is consolidated in the existing literature (Mina et al., 2013) for this type of analysis easing confrontation with other results. As shown in Table 8, the results on the same sample are fully comparable with those highlighted in section 5.1 and confirm the hypothesis of the *Task segmentation effect*. Different target companies for the two type of investors and a crowd-out effect between the two policy mechanisms (and the two types of external financial resources investigated). Furthermore, the results highlight that the correlation coefficient between the error terms of the two equation is not statistically significant (looking at the bivariate probit regression, ρ is equal to 0.064, chi-square(1) = 0.848, p-value = 0.357).

[insert Table 8]

6. Conclusions

Both academic scholars and policy makers agree on the importance for an economic system to nurture the creation and sustainment of young innovative companies (YICs) and start-ups. YICs are deemed to be capable to challenge existing technological paradigms and to ensure a high degree of dynamic efficiency in modern economies. Accordingly, they are increasingly becoming a specific object of study for academics (see Schneider and Veugelers, 2010; Czarnitzki and Delanote, 2013) and an explicit target for industrial policies by policy makers, especially in the European context (see for EC-DG ENTR, 2009, for an overview). This typology of firm is in fact reputed to suffer from important capital market imperfections (see Carpenter and Petersen, 2002) which may prevent YICs from exerting their beneficial effects into markets. Thus, while general consensus exists on the need for public intervention devoted to alleviate YICs' financial constraints, much less agreement is traceable on the most effective policy mechanisms that are capable to accomplish the task. Provided that venture capital (VC) investors are considered the preferred financing mode for this typology of firms (Gompers and Lerner, 2001), the way to foster this typology of investments and the possible interdependencies with other existing policy measures aiming at easing YIC's access to external financing sources both remain rather underexplored matters.

This study exploits the Italian Startup Act (Law no. 221/2012) to shed light on this key issue. In this case in fact, YICs are equally exposed *at the same time* and *in the same institutional context* to two specific policy measures which aim at alleviating their financial constraints. The first measure encompasses an equity program that envisages fiscal incentives for venture capitalists who invest in these firms, while the second gives privileged access for YICs to a Government-Guaranteed (GG) Bank Loan program. Therefore, through the collection of a hand-collected dataset on 2,526 Italian YICs and the means of a dynamic bivariate survival

model (Mosconi and Seri, 2006), we firstly investigate whether firms accessing one instrument differ along a series of characteristics from firms accessing the other. Secondly, we dig into the mutual interrelationships existing between the two policy measures. Our first important result is that the two mechanisms appear to be functional to different typologies of YICs. Specifically, YICs obtaining GG Bank Loans appear relatively younger and smaller than those YICs invested by (subsidized) VCs. They also appear relatively highly capitalized compared to VC-backed ones. In other words, a sort of "institutional division of labor" seems to be in place between the two measures, with each instrument financing a given typology of YIC. As expected, in their investment conducts VCs appear to diverge substantially from bankers, and the policy intervention do not change radically the selection process. Secondly, once received support from one measure, clearly substitutability effect emerge towards the other instrument. There is a statistically significant evidence that once received a GG Bank Loan, an YIC becomes even less likely than before to access VC. Conversely, the small number of equity investments of GG Bank Loans' companies confirm indirectly the substitutability effect also in this second transition. Our findings back up the presumption that *Task Segmentation effect* is the result of this type of policy intervention. These findings have interesting implications in the realm of the government's role in the entrepreneurial finance market, and on the preferable ways of public activity in the domain of the financial needs of young innovative companies. First of all, they must to take into consideration the hypothesis of the existence of possible coordination failures (Rodrik, 1996) between different policy measures, at least in this domain. As far as equity and debt financing to YICs are concerned, the public subsidization of these forms does appear to not reduce the cannibalization risk but rather quite the opposite. Furthermore, our findings speak in favor of a substantial "market segmentation" between the two measures and on the presence of significant "substitutability" effects across the two mechanisms. Overall, our analysis highlight the presence of crowd-out effect between the two

instruments, so this finding represents a warning for those who believe that policy may help in reducing the overall screening costs for external financiers of different typology. In other words, the empirical evidence here produced badly complies with the possibility that from decision to finance a given YIC by a (subsidized) VC may stem an informational advantage which translates into a saving in screening costs for a (subsidized) bank, and vice versa.

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Tables & Figures

Figure 1 Taxonomy of the different scenarios about policy effect

Interrelationships between policy intervention **Type of YICs**	*Substitutability*	*Complementarity*
Same	**Shadow effect**	**Matthew effect**
Diverse	**Task segmentation effect**	**Halo effect**

Table 1 VC-backed YICs and YICs accessing the Government Guarantee (GG) Bank Loans program

	Financed YICs	
Financing source	N°	%
YICs invested by VC	276	10.9
YICs financed by GG Bank Loan	418	16.6
YICs financed by VC and GG Bank Loan	48	2.7
Second transitions	N°	%
Transition: *from VC → VC + GG Bank Loan*	29	60.4
Transition: *from GG Bank Loan → GG Bank Loan + VC*	7	14.6
Transition: *from* nothing → *GG Bank Loan + VC*	12	25.0

Legend. Percentages on the Financing sources (upper part) are computed with reference to the whole sample (2,523 firms). Percentages on second transitions refer to the 64 YICs that received both types of financing.

Table 2 Definition of explanatory variables

Variable	Description
Firm-specific	
Dseed	One if *t* is the firm's foundation year, zero otherwise
Age_t	Age of the firm at *t* (source: *AIDA*)
$Employees_{t-1}$	Number of employees at *t-1* (source: *AIDA*)
$LnTotasset_{t-1}$	Natural logarithm of absolute value of company's total assets at *t-1* (source: *AIDA*)
$N\_Manager_t$	Number of managers at *t* (source: *AIDA*)
$LnLeverage_{t-1}$	Natural logarithm of absolute value of Debt compared to the Equity at *t-1* (source: *AIDA*)
$LnROA_{t-1}$	Natural logarithm of absolute value of gross operating margin compared to the Total Assets at *t-1* (source: *AIDA*)
Location-specific	
DSouth	One for firms located in the South of Italy, zero otherwise
Industrial Intensity	Regional Industrial intensity where the start-up headquarter is located (Number of firms/100 residents, reference year: 2012, sources: *ISTAT, Istituto G. Tagliacarne, InfoCamere*)
Value Added	Regional incidence on the Italian value added, in percentage terms (reference year 2011, sources: *ISTAT, Istituto G. Tagliacarne, InfoCamere*)
Infrastructure	Regional infrastructure and economic indicator where the start-up headquarter is located (reference year: 2011, sources: *ISTAT, Istituto G. Tagliacarne, InfoCamere)*
Macroeconomic-specific	
$Deficit/GDP_t$	Italian budget deficit compared to the national GDP at current market prices at *t* (source: *EUROSTAT*)
$GDPGrowth_t$	Italian real GDP growth rate at *t* (source: *EUROSTAT*)
Sector-specific	
R&D sector	One for companies classified in R&D sector (source: *AIDA*)
Software sector	One for companies classified in Software sector (source: *AIDA*)
Manufacturing sector	One for companies classified in Manufacturing sector (source: *AIDA*)
General Services sector	One for companies classified in General Services sector (source: *AIDA*)

Table 3 Descriptive statistics for the explanatory variables in the econometric model

Variable	Mean	Stand. Dev.	Max	Min
Age_t	2.752	1.454	9.000	1.000
$Employees_{t-1}$	0.736	2.409	50.000	0.000
$LnTotasset_{t-1}$	7.703	5.357	16.380	0.000
$N\_Manager_t$	2.538	1.854	13.000	0.000
$LnLeverage_{t-1}$	0.145	1.562	10.651	-9.191
$LnROA_{t-1}$	-1.625	1.742	7.172	-11.687
DSouth	0.186	0.389	1.000	0.000
Industrial Intensity	8.809	1.291	10.200	0.000
Value Added	9.286	6.965	21.290	0.000
Infrastructure	105.379	31.358	220.230	0.000
$Deficit/GDP_t$	-2.916	0.310	-2.600	-4.200
$GDPGrowth_t$	-0.316	1.336	1.700	-2.800
R&D sector	0.175	0.380	1.000	0.000
Software sector	0.392	0.488	1.000	0.000
Manufacturing sector	0.207	0.405	1.000	0.000
General Services sect.	0.223	0.416	1.000	0.000

Legend. Sample: 2,523 firms. N° of observations: 8,093.

Table 4 Determinants of YICs' access to Venture Capital and Government Guaranteed (GG) Bank Loans: dynamic bivariate survival model

		Model	
	First Transitions	Venture Capital (Y^A)	GG Bank Loan (Y^B)
α_{const}	*Constant*	-4.357 (0.5498)***	-3.077 (0.1937)***
α_1	*DSeed*	1.234 (0.3647)***	2.775 (0.2635)***
α_2	Age_t	-0.025 (0.0341)	-0.134 (0.0244)***
α_3	$Employees_{t-1}$	0.016 (0.0120)	-0.026 (0.0119)**
α_4	$LnTotasset_{t-1}$	0.094 (0.0338)***	0.255 (0.0237)***
α_5	$N\_Manager_t$	0.179 (0.0152)***	0.025 (0.0141)*
α_6	$LnLeverage_{t-1}$	-0.035 (0.0236)	0.015 (0.0162)
α_7	$LnROA_{t-1}$	0.028 (0.0281)	0.003 (0.0195)
α_8	*DSouth*	0.217 (0.0963)**	-0.050 (0.0790)
α_9	*Industrial Intensity*	-0.003 (0.0311)	0.046 (0.0223)**
α_{10}	*Value Added*	0.013 (0.0048)***	0.010 (0.0039)***
α_{11}	*Infrastructure*	0.001 (0.0011)	0.000 (0.0009)
α_{12}	*Deficit/GDPt*	-0.163 (0.1084)	0.586 (0.0855)***
α_{13}	$GDPGrowth_t$	-0.077 (0.0245)***	0.250 (0.0243)***
α_{14}	*R&D sector*	-0.174 (0.1160)	0.084 (0.0859)
α_{15}	*Software sector*	0.331 (0.0834)***	0.108 (0.0713)
α_{16}	*Manufacturing sector*	0.005 (0.1023)	0.410 (0.0760)***
	Second Transitions		
β_A	$\rightarrow$ *GG Bank Loan*	0.242 (0.2002)	-
β_B	$\rightarrow$ *Venture Capital*	-	-0.245 (0.1159)**
	Simultaneity		
γ	*Public Funds* $\leftrightarrow$ *VC*	0.126 (0.1394)	

Legend : * p < .10; ** p < .05; *** p < .01. All two-tailed tests. Robust standard errors in parentheses. Number of firms is 2,523 and n° of observations is 8,093.

Table 5 Determinants of YICs' access to Venture Capital and Government Guaranteed (GG) Bank Loans – Human Capital augmented dynamic bivariate survival model

		Model	
	First Transitions	VC (Y^A)	GG Bank Loan (Y^B)
α_{const}	*Constant*	-3.924 (0.6428)***	-2.937 (0.2567)***
α_1	*DSeed*	1.359 (0.5036)***	3.064 (0.3742)***
α_2	Age_t	-0.037 (0.0485)	-0.076 (0.0335)**
α_3	$Employees_{t-1}$	0.007 (0.0141)	-0.028 (0.0149)*
α_4	$LnTotasset_{t-1}$	0.104 (0.0455)**	0.263 (0.0328)***
α_5	$N\_Manager_t$	0.168 (0.0219)***	0.041 (0.0197)**
α_6	$LnLeverage_{t-1}$	-0.042 (0.0328)	0.026 (0.0236)
α_7	$LnROA_{t-1}$	0.033 (0.0394)	-0.002 (0.0277)
α_8	*DSouth*	0.189 (0.1307)	-0.198 (0.1195)*
α_9	*Industrial Intensity*	-0.032 (0.0387)	0.038 (0.0303)
α_{10}	*Value Added*	-0.002 (0.0070)	0.009 (0.0056)*
α_{11}	*Infrastructure*	0.001 (0.0015)	0.000 (0.0012)
α_{12}	$Deficit/GDP_t$	-0.143 (0.1431)	0.611 (0.1163)***
α_{13}	$GDPGrowth_t$	-0.109 (0.0342)***	0.227 (0.0329)***
α_{14}	*Software sector*	0.626 (0.1107)***	-0.021 (0.1155)
α_{15}	*Technical Education*	-0.006 (0.0038)	-0.007 (0.0037)*
α_{16}	*Economic Education*	0.014 (0.0062)**	0.009 (0.0061)
α_{17}	*Managerial Experience*	0.024 (0.0161)	0.023 (0.0154)
α_{18}	*Sector Work Experience*	-0.010 (0.0116)	-0.021 (0.0110)*
α_{19}	*General Work Experience*	-0.004 (0.0143)	-0.030 (0.0149)*
	Second Transitions		
β_A	$\rightarrow$ *GG Bank Loan*	0.333 (0.2583)	-
β_B	$\rightarrow$ *Venture Capital*	-	-0.301 (0.1461)**
	Simultaneity		
γ	*Public Funds* $\leftrightarrow$ *VC*	0.011 (0.1940)	

Legend : * p < .10; ** p < .05; *** p < .01. All two-tailed tests. Robust standard errors in parentheses. Number of firms is 1,072 and n° of observations is 3,665.

Table 6 Determinants of YICs' access to Venture Capital and Government Guaranteed (GG) Bank Loans: dynamic bivariate survival model – Estimation with two additional variables, number of Incubators and total amount of VC investment per region (NUTS2 level).

		Model	
	First Transitions	Venture Capital (Y^A)	GG Bank Loan (Y^B)
α_{const}	*Constant*	-4.491 (0.5757)***	-3.085 (0.1958)***
α_1	*DSeed*	1.163 (0.3709)***	2.731 (0.2667)***
α_2	Age_t	-0.028 (0.0343)	-0.136 (0.0245)***
α_3	$Employees_{t-1}$	0.013 (0.0124)	-0.027 (0.0119)**
α_4	$LnTotasset_{t-1}$	0.102 (0.0344)***	0.255 (0.0237)***
α_5	$N\_Manager_t$	0.178 (0.0152)***	0.026 (0.0141)*
α_6	$LnLeverage_{t-1}$	-0.035 (0.0238)	0.015 (0.0163)
α_7	$LnROA_{t-1}$	0.033 (0.0282)	0.004 (0.0196)
α_8	*DSouth*	0.234 (0.0990)**	-0.041 (0.0797)
α_9	*Industrial Intensity*	-0.015 (0.0325)	0.042 (0.0227)*
α_{10}	*Value Added*	0.022 (0.0062)***	0.014 (0.0058)**
α_{11}	*Infrastructure*	0.002 (0.0012)	0.000 (0.0009)
α_{12}	$Deficit/GDP_t$	-0.185 (0.1104)*	0.583 (0.0859)***
α_{13}	$GDPGrowth_t$	-0.076 (0.0248)***	0.252 (0.0245)***
α_{14}	*R&D sector*	-0.171 (0.1165)	0.081 (0.0860)
α_{15}	*Software sector*	0.332 (0.0841)***	0.105 (0.0714)
α_{16}	*Manufacturing sector*	0.021 (0.1028)	0.412 (0.0760)***
α_{17}	*Incubators*	0.036 (0.0124)***	0.015 (0.0114)
α_{18}	$VC\ Investment_{t-1}$	-0.004 (0.0016)**	-0.001 (0.0013)
	Second Transitions		
β_A	$\rightarrow$ *GG Bank Loan*	0.273 (0.2004)	-
β_B	$\rightarrow$ *Venture Capital*	-	-0.245 (0.1161)**
	Simultaneity		
γ	*Public Funds* $\leftrightarrow$ *VC*	0.135 (0.1397)	

Legend : * p < .10; ** p < .05; *** p < .01. All two-tailed tests. Robust standard errors in parentheses. Number of firms is 2,523 and n° of observations is 8,093.

Table 7 Determinants of YICs' access to Venture Capital and Government Guaranteed (GG) Bank Loans: dynamic bivariate survival model – Estimation with no lagged independent variables in the first transitions

		Model	
	First Transitions	VC (Y^A)	GG Bank Loan (Y^B)
α_{const}	*Constant*	-7.152 (0.6385)***	-3.175 (0.2173)***
α_1	*Dseed*	0.461 (0.1025)***	0.284 (0.0861)***
α_2	Age_t	-0.054 (0.0364)	-0.119 (0.0251)***
α_3	$Employees_t$	-0.009 (0.0096)	-0.010 (0.0076)
α_4	$LnTotasset_t$	0.379 (0.0314)***	0.296 (0.0233)***
α_5	$N\_Manager_t$	0.107 (0.0173)***	0.012 (0.0155)
α_6	$LnLeverage_t$	-0.186 (0.0193)***	0.112 (0.0155)***
α_7	$LnROA_t$	0.186 (0.0257)***	-0.001 (0.0184)
α_8	*DSouth*	0.228 (0.1104)**	-0.135 (0.0913)
α_9	*Industrial Intensity*	0.009 (0.0360)	0.030 (0.0231)
α_{10}	*Value Added*	0.008 (0.0054)	0.008 (0.0041)*
α_{11}	*Infrastructure*	0.001 (0.0013)	-0.001 (0.0010)
α_{12}	$Deficit/GDP_t$	-0.118 (0.1231)	0.736 (0.0928)***
α_{13}	$GDPGrowth_t$	-0.076 (0.0277)***	0.257 (0.0256)***
α_{14}	*R&D sector*	-0.227 (0.1319)*	0.127 (0.0929)
α_{15}	*Software sector*	0.357 (0.0946)***	0.120 (0.0779)
α_{16}	*Manufacturing sector*	-0.017 (0.1144)	0.325 (0.0831)***
	Second Transitions		
β_A	$\rightarrow$ *GG Bank Loan*	0.318 (0.2206)	-
β_B	$\rightarrow$ *Venture Capital*	-	-0.228 (0.1224)**
	Simultaneity		
γ	*Public Funds* $\leftrightarrow$ *VC*	0.198 (0.1585)	

Legend : * p < .10; ** p < .05; *** p < .01. All two-tailed tests. Robust standard errors in parentheses. Number of firms is 2,523 and n° of observations is 8,093.

Table 8 Determinants of YICs' access to Venture Capital and Government Guaranteed (GG) Bank Loans: bivariate probit model

		Model	
	First Transitions	VC (Y^A)	GG Bank Loan (Y^B)
α_{const}	*Constant*	-4.310 (0.5821)***	-1.669 (0.4441)***
α_1	*Dseed*	1.217 (0.3708)***	2.364 (0.2833)***
α_2	Age_t	-0.025 (0.0341)	-0.138 (0.0245)***
α_3	$Employees_{t-1}$	0.016 (0.0121)	-0.018 (0.0117)*
α_4	$LnTotasset_{t-1}$	0.092 (0.0344)***	0.213 (0.0260)***
α_5	$N\_Manager_t$	0.179 (0.0152)***	0.030 (0.0141)**
α_6	$LnLeverage_{t-1}$	-0.034 (0.0237)	0.020 (0.0162)
α_7	$LnROA_{t-1}$	0.027 (0.0281)	-0.001 (0.0194)
α_8	*DSouth*	0.215 (0.0966)**	-0.114 (0.0794)
α_9	*Industrial Intensity*	-0.004 (0.3136)	0.013 (0.0216)
α_{10}	*Value Added*	0.013 (0.0048)***	0.008 (0.0038)**
α_{11}	*Infrastructure*	0.001 (0.0011)	-0.001 (0.0009)
α_{12}	$Deficit/GDP_t$	-0.157 (0.1103)	0.784 (0.1086)***
α_{13}	$GDPGrowth_t$	-0.077 (0.0245)***	0.236 (0.0251)***
α_{14}	*R&D sector*	-0.174 (0.1159)	-0.068 (0.0854)
α_{15}	*Software sector*	0.330 (0.0835)***	0.075 (0.0713)
α_{16}	*Manufacturing sector*	0.005 (0.1022)	0.402 (0.0754)***
	Second Transitions		
β_A	$\rightarrow$ *GG Bank Loan*	0.243 (0.2003)	-
β_B	$\rightarrow$ *Venture Capital*	-	-0.193 (0.1171)**

Legend : * p < .10; ** p < .05; *** p < .01. All two-tailed tests. Robust standard errors in parentheses. Number of firms is 2,523 and n° of observations is 8,093.

Appendix

Table A1 Definition of entrepreneurs' human capital variables

Variable	Description
Human Capital-specific	
Technical Education	Average years of scientific and/or technical education of founders at graduate and post-graduate level (source: *Telemaco and LinkedIn Premium*)
Economic Education	Average years of economic and/or managerial education of founders at graduate and post-graduate level (source: *Telemaco and LinkedIn Premium*)
Managerial Experience	Average years of managerial work experience of founders (source: *Telemaco and LinkedIn Premium*)
Sector Work Experience	Average years of work experience of founders in the same sector of the company before foundation (source: *Telemaco and LinkedIn Premium*)
General Work Experience	Average years of work experience of founders in other sectors before firm's foundation (source: *Telemaco and LinkedIn Premium*)

Table A2 Descriptive statistics for entrepreneurs' human capital variables

Variable	Mean	Stand. Dev.	Max	Min
Technical Education	6.142	10.952	74.000	0.000
Economic Education	1.712	5.060	75.000	0.000
Managerial Experience	1.688	3.476	28.000	0.000
Sector Work Experience	3.102	5.037	38.000	0.000
General Work Experience	1.236	3.237	40.000	0.000