OECD publishing

THE EVALUATION OF THE ITALIAN "START-UP ACT"

OECD SCIENCE, TECHNOLOGY AND INDUSTRY
POLICY PAPERS

September 2018 **No. 54**

OECD
BETTER POLICIES FOR BETTER LIVES

Foreword

This document was authored by Timothy DeStefano and Carlo Menon from the Structural Policy Division (SPD) at the OECD Directorate for Science, Technology and Innovation (STI), Francesco Manaresi and Giovanni Soggia from Bank of Italy, and Pietro Santoleri from University S. Anna of Pisa. Nick Johnstone contributed with several insights and supervised the project. The paper has also benefited from helpful suggestions and feedback from Silvia Appelt, Koen de Backer, Sarah Box, Fernando Galindo-Rueda, and Dirk Pilat (OECD/STI). Stefano Firpo (Italian Ministry for Economic Development – MISE) provided many valuable comments, and Mattia Corbetta and Roberto Volpe (MISE) have been instrumental in the elaboration of this report by providing a number of clarifications on technical details and in assisting with data sources. Marco Cantamessa (Politecnico di Torino, Italy), Claudio Giuliano (Innogest), and Massimiliano Magrini (United Ventures) kindly agreed on discussing with the authors about the Italian venture capital market; many useful insights originated during those conversations. Any errors or omissions are the authors' sole responsibility. A previous version of this document was presented and discussed by the OECD Committee on Industry, Innovation and Entrepreneurship (CIIE). This report was approved and declassified by the CIIE on 26-27 April 2018 and was prepared for publication by the OECD Secretariat.

Note to Delegations: This document is also available on OLIS with the cote: DSTI/CIIE/(2018)3/FINAL

This document, as well as any data and any map included herein are without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries and to the name of any territory, city or area. The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law.

© OECD 2018

You can copy, download or print OECD content for your own use, and you can include excerpts from OECD publications, databases and multimedia products in your own documents, presentations, blogs, websites and teaching materials, provided that suitable acknowledgment of OECD as source and copyright owner is given. All requests for commercial use and translation rights should be submitted to rights@oecd.org.

Table of Contents

Foreword **2**

Executive Summary **5**

1. Introduction **7**

1.1. The Italian "Start-up Act": eligibility criteria and instruments 9

2. Why a start-up policy? **15**

2.1. The role of young and innovative firms 15
2.2. The importance of experimentation: let one hundred flowers bloom 16
2.3. Low productivity growth and weak demand for innovation: the Italian challenges 18
2.4. A strong case for "horizontal" structural reforms 19

3. The evaluation: data and methodology **22**

3.1. The goal: an independent and useful evaluation 22
3.2. The data 23

4. The causal impact of the policy: a counterfactual analysis **26**

4.1. Empirical challenges 26
4.2. Solutions 27
4.3. Results 28
4.4. Instrumental variable strategy 36

5. Is Italy a country for young firms? The Italian start-up ecosystem **39**

5.1. The profile of Italian start-up founders: a cross-country comparison 39
5.2. Finance for innovative start-ups in Italy 42
5.3. Characteristics of the equity investors 54

6. The Italian innovative start-ups: descriptive evidence **59**

6.1. A snapshot of the start-ups registered in the policy 59
6.2. Enrolment into the policy 60
6.3. The appreciation of different policy instruments and its correlation with start-ups' growth 61
6.4. For which start-ups is the policy the most useful? Evidence from companies registering at birth 65

7. Cross-country evidence: venture-capital deals and web searches **67**

7.1. Aggregate cross-country assessment 67
7.2. Entrant probability of receiving VC: registered vs. non-registered firms 69
7.3. Cultural spill-over effects 72

8. Summary of the main findings and policy recommendations **75**

References **80**

Notes **88**

Tables

Table 1. Derived variables definition ... 29
Table 2. Regression results, baseline ... 29
Table 3. Heterogeneous effects: bank credit guarantee scheme ... 31
Table 4. Heterogeneous effects: eligibility criteria ... 32
Table 5. Exit probability ... 34
Table 6. Exit probability and credit applications ... 35
Table 7. Regression results, credit quantity, price and characteristics ... 36
Table 8. Preliminary instrumental variable results ... 38
Table 9. Average number of equity investors and share of ownership by type ... 55
Table 10. Sectors serial investors are targeting vs non-serial investors ... 57
Table 11. Size dimensions of start-ups supported by a serial investor or a non-serial investor ... 58
Table 12. Start-up characteristics, supported by a serial investor or a non-serial investor ... 58
Table 13. Descriptive statistics of start-up participants ... 59
Table 14. How start-ups qualified into the programme ... 60
Table 15. Average take-up of policy instruments ... 62
Table 16. Correlation between policy instruments ... 63
Table 17. Appreciation of individual policy instruments and 2016 outcome ... 64
Table 18. Probability of registering at birth by type of company ... 66
Table 19. The "Start-up Act" and VC activity ... 69
Table 20. Survival analysis estimates of the probability of receiving VC ... 71
Table 21. The cultural effect of the "Start-up Act": evidence from web searches data ... 74

Figures

Figure 1. Young firms contribute disproportionally to job creation in all countries ... 15
Figure 2. Treatment effect over time ... 30
Figure 3. Monthly cumulated number of registered start-ups ... 38
Figure 4. Start-up founders' profile: education ... 40
Figure 5. Start-up founders' profile: previous occupation ... 41
Figure 6. Start-up founders' profile: gender and patent authorship ... 42
Figure 7. Venture capital investments ... 45
Figure 8. Number of venture capital-backed companies ... 46
Figure 9. Total amount of corporate VC funding ... 47
Figure 10. Number of deals with corporate VC investors ... 47
Figure 11 Venture capital activities by start-up and investor country ... 49
Figure 12. Venture capital by investor type for Italy and France, number of deals and values ... 50
Figure 13. Amount of VC investment by type of investor ... 52
Figure 14. Types of equity investors ... 55
Figure 15. Share of partners (left) and employees (right) residing in same municipality as start-up ... 56
Figure 16. Total number of registered start-ups, 2013 to 2017 ... 60
Figure 17. Number of start-ups registering into the policy by month ... 61
Figure 18. Proportion of firms that do not receive VC ... 72

Boxes

Box 1. The policy instruments of the "Start-up Act" ... 10
Box 2. Summary of the main policy recommendations related to the "Start-up Act" ... 77

Executive Summary

This report provides an independent and comprehensive evaluation of the economic and social impact of the Italian policy framework for innovative start-ups, also known as the "Start-up Act", first introduced by the Decree-law 179 in 2012. The policy aims at creating a more favourable environment for small innovative start-ups through a number of complementary instruments, including "fast-track" and zero cost incorporation, simplified insolvency procedures, tax incentives for equity investments, and a public guarantee scheme for bank credit. While the report focuses only on Italy, the "Start-up Act" can be seen as a very useful "laboratory" to inform policies for innovative entrepreneurship across OECD member countries, as it presents a number of specificities that make it an interesting case in the field of entrepreneurship policy.

The evaluation highlights that the impact of the policy on beneficiary firms has been positive overall, but that complementary policy actions in other areas are required in order to further realise the full potential of Italian innovative start-ups. Given that the policy is still relatively young, the outcome of this evaluation consists of a series of early findings and recommendations that may be useful to steer future improvements. This evaluation may also inform policy actions in the area of innovative entrepreneurship more generally and across all OECD countries.

Policy interventions in the area of innovative entrepreneurship are widespread among OECD member countries and are motivated by both the disproportionate contribution of young firms to employment creation, and by the number of market failures that may hamper their growth. However, there is a substantial debate in the economic literature on the conditions under which start-up policies can be successful, motivated by the empirical observation that only a tiny proportion of new firms are relevant for economic growth. The Italian "Start-up Act" attempts to strike the right balance between, on the one hand, fostering experimentation and "letting one hundred flowers bloom", and, on the other hand, concentrating limited public resources only on the sub-sample of firms with growth potential. This is done by pre-selecting eligible start-ups based on some indicators of innovation potential, while at the same time streamlining both entry and exit into the market.

The evaluation combines a number of different methodologies and data sources in order to achieve a comprehensive and "holistic" assessment of the policy impact. First, the specific effects of the policy on beneficiary firms are examined. A counterfactual analysis based on detailed balance-sheet, patent, and bank credit data at the micro level estimates the causal effect of the policy on the beneficiary firms using a wide set of different outcome variables. The results indicate that the "Start-up Act" has a sizeable positive effect on both the inputs and the outputs of the beneficiary firms. In particular, the policy allows firms to increase their revenues, value added, and assets by about 10-15%, relative to similar start-ups that do not benefit from it, or benefit at a later stage. The empirical analysis also shows that enrolled firms are more likely to receive credit from banks. For instance, the probability of acceptance of a first credit application increases by 8 to 16 percentage points (p.p.), corresponding to around one third of the average probability of acceptance for young firms (33%). In addition, the policy appears to be robustly correlated with higher probability of receiving VC funding – although this latter link is not necessarily causal. Furthermore, the positive effects at

the firm-level do not appear to translate into a significantly higher volume of VC investments at the aggregate level, pointing to the issue of the excessively small size of risk finance deals in Italy.

Subsequently, the report broadens its scope and looks at the economic environment for start-ups in Italy. The general message is that an effective start-up policy is not a sufficient condition for innovative small businesses to thrive. A number of "horizontal" structural reforms benefitting the whole economy – e.g. improving the efficiency of civil justice (and of the public sector at large), fighting corruption and tax evasion – are also needed, as they would have a disproportionately positive effect on innovative start-ups. The need for synergic policy action is rooted on some of the specific weaknesses of the start-up ecosystem – like e.g. the exiguity of venture capital (VC) investments and the weakness of the domestic end-market for innovative goods and services.

The report concludes by listing a number of general policy recommendations to streamline the impact of the policy, which are grouped in four different areas. The first area relates to the eligibility criteria; the second area points to striking the right balance between subsidising equity and debt financing; the third area is related to streamlining information and awareness about innovative start-ups and their role in the economy; the fourth area, finally, relates to making innovative start-ups an engine of inclusiveness and social mobility.

1. Introduction

This report provides an assessment on the economic and social implications of the Italian "Start-up Act", which came into effect in October 2012 and continues to this day. The objective of the policy is to induce growth, spur technological progress, and create a more innovative business environment (Italian Ministry of Economic Development 2016). The evaluation combines a rigorous counterfactual analysis with several other empirical assessments in order to reach a balanced and comprehensive assessment of the policy, taking into account also the general entrepreneurship and innovation ecosystem in which the policy is framed. By so doing, the ex-post evaluation of the policy is discussed jointly with ex-ante considerations on the policy design and on the specific context in which the policy is operating.

The policy framework constructed by the Italian "Start-up Act" presents a number of specificities that make it an interesting case in the field of entrepreneurship policy. First, the framework is comprehensive, as it encompasses interventions of very different nature, e.g. aimed at: reducing red tape and entry barriers; simplifying insolvency procedures; providing tailor-made flexible employment and financial regulations; offering tax incentives for equity investments; and guaranteeing bank loans with a public fund. Second, the Italian Ministry for Economic Development (MISE) has been closely monitoring the policy since its initial implementation, with the result that a comprehensive information base and ad-hoc datasets are available for evaluating the policy. Third, the motivations and the objectives of policies supporting entrepreneurship are highly debated in the economic literature. In addition, there is also a lack of consensus on which are the policy levers that should be activated in this domain.

In light of that, The Italian "Start-up Act" can be seen as a useful "laboratory" to inform policies for innovative entrepreneurship across OECD member countries. Indeed, supporting innovative start-ups is a policy priority in most countries. This is motivated by the disproportionate role that young firms have in creating employment, through the contributions of the most successful entrants to economic growth and innovation, and by the existence of a number of market failures that could constrain start-up growth potential. Since the financial crisis, many OECD countries have been struggling with sluggish productivity growth that appears to be driven in part by lower levels of firm dynamism and innovation (Berlingieri et al., 2017; Decker et al., 2016). In terms of innovation, the rate of technological change is occurring faster and the product lifecycle is shortening, meaning that if firms fail to keep up with inventiveness and technology change, they may quickly fall behind (DeStefano et al., 2017; OECD, 2015; McGrath, 2013).

The report starts with a detailed description of the policy framework and of the different instruments put in place. Subsequently, the economic rationale motivating policy interventions in the field of innovative entrepreneurship is discussed, analysing also how policy design of the Italian "Start-up Act" is informed by this debate.

The effect of the policy on enrolled firms is closely examined, through a counterfactual evaluation. The estimates indicate that the policy is causally linked to an increase in several balance sheet variables including revenues, assets, value added, and intangible assets. The estimated magnitude of this effect is sizeable: for instance, firms that benefit

from the policies on average increase their total and their value added by 11%. These positive real effects are accompanied by better access to credit markets, as measured by the probability that credit applications are accepted by banks. For instance, the probability of acceptance of the first credit application increases from 8 to 16 percentage points (p.p.), corresponding to around one third of the average probability of acceptance for young firms (33%). Overall, the empirical evidence points to a positive effect of the policy on a number of firm input and output measures.

The remainder of the report examines the context in which the Italy "Start-up Act" was implemented, focusing in particular on some aspects of the current economic and financial environment that can be detrimental for small innovative start-ups. The modest size of the venture capital (VC) market, for instance, emerges as a symptom of the bottle-necks of the Italian start-up ecosystem. The report subsequently discusses the findings from cross-country analyses on VC micro-data. While VC investments typically involve less than 1% of new firms, the empirical evidence suggests that VC-backed firms represent a large share of successful and innovative companies. The results indicate that the policy is positively correlated with the number of VC deals: start-ups who participated in the policy are more likely to receive VC support and at an earlier time than non-participants. However, there are not significant differences related to investment amount. This may suggest that the policy has directly or indirectly stimulated seed and angel-financing investments (as suggested also by the Venture Capital Monitor 2016 by AIFI, the Italian Association of private equity and venture capital investors), while further action is needed in order to create a more attractive environment for larger and later investment rounds and for corporate VC investments (see Breschi et al., Forthcoming, for a discussion of government VC investments across OECD countries). The "Start-up Act" also appears to have generated more interest in innovative entrepreneurship in the country, as the implementation of the policy is robustly correlated with an uptick in web searches linked to start-ups.

While the empirical evidence finds a number of positive economic, financial, and social implications, the Italian ecosystem appears to require a number of other reforms in order to fully unleash the full potential of the policy and of innovative entrepreneurship more generally. In particular, policy actions may be required both "upstream" at the VC investment phase, where the lack of a critical mass appears evident; and "downstream", in order to foster the domestic demand of innovative goods and services produced by start-ups. The coordination of the different instrument is particularly important in this context, as "upstream" interventions may result in a saturation of the venture capital market if the start-ups' access to the domestic market is not streamlined "downstream".

The report concludes with a number of policy recommendations. These recommendations encompass different areas and build upon the findings from the different analyses discussed in the report. Given the very general scope of this evaluation, it is important to stress that the recommendations should not be interpreted as a list of precise and technical prescriptions, but rather as a broad set of guiding principles for future adjustments and revisions of the current policy setting and that they be considered in conjunction with the other findings contained in the report.

It is important to mention that this report is complementary to a number of other informative studies and analyses of the "Start-up Act", which also implies that some important areas of analysis are not discussed in this report as the information is already available in other referenced publications. For instance, the 2017 Rapport to the Italian

Parliament on the implementation and the impact of the "Start-up Act" (MISE, 2017) contains a comprehensive description of the characteristics of the start-ups registered in the policy, including a detailed analysis of their growth pattern. Grilli, Mrkajic, and Giraudo (2017) compare the socio-demographic characteristics of the founders before and after the implementation of the policy, respectively, to find that the policy incentivised younger individuals with a stronger professional background to start their business. Giraudo, Giudici, and Grilli (2016) analyse the sources of financing of the innovative start-ups registered in the policy, with a particular focus on the differences between equity-backed and debt-backed companies; Finaldi Russo, Magri, and Rampazzi (2016) compares innovative start-ups in the policy with a suitable counterfactual, to find that firms enrolled in the policy and operating in the service sector raise more external funding and invest more. Similarly, this evaluation mentions only tangentially the "sister" policy on innovative SMEs, which, despite presenting many similarities with the policy under scrutiny, has been introduced more recently and targets older firms, and it is beyond the scope of this report.

1.1. The Italian "Start-up Act": eligibility criteria and instruments

The "Start-up Act" defines a set of eligibility criteria to identify start-ups that are expected to be (or become) innovative firms and thus may benefit from policy support: i) the company should be operational for less than five years; ii) be headquartered in Italy; iii) have an annual turnover lower than EUR five million; iv) not be the result of a branch split or merger from a previous company; v) have a mission statement explicitly related to innovation; vi) be a limited company and not publicly listed; and, vii) should not have distributed profits. Furthermore, firms need to fulfil at least one of the following three criteria: at least 15% of R&D expenditure ratio; 1/3 of employees are PhD students or graduates or researchers and/or 2/3 hold a Master's degree; and, being the holder, depository or licensee of a patent, or owner/author of registered software.

By posing stringent limits on company size and age, the policy maker narrows eligibility to firms that are also expected to be in need of support, i.e., are more likely to be confronted with a number of possible market failures. In addition, the targeting of high-potential ventures is intrinsic in the choice of the policy instruments activated within the "Start-up Act" framework. As will be clear in the following (see also Box 1), most of these instruments are attractive for start-ups that are seeking to raise equity assets from external investors, which is a form of financing that is typically reserved to high-growth (and high-risk) businesses. However, the framework also contemplates substantial subsidies for debt financing (through a public guarantee scheme).

The Italian "Start-up Act" is an extensive policy framework with the objective of assisting innovative entrepreneurs across all sectors by providing support until the fifth year of activity since incorporation. This policy stands out relative to most of those implemented in other countries as it includes an entire bundle of policy instruments that are potentially relevant for successful innovation. These include policies which cut red tape and facilitate entry and exit to the market; tax incentives; tailor made labour laws; flexible remuneration schemes; incentives for equity crowd funding; etc.

One of the innovative ways the policy attempts to cut red tape is through the use of digital technologies. The entire incorporation procedure can be undertaken using a standard online model and signed with a digital signature. In addition, if the same firms

require modifications to their deed at a later period, changes can be made via a digital procedure. The usage of this service is provided to the firms free of charge.

Box 1. The policy instruments of the "Start-up Act"

- Dedicated digital and free-of-charge procedure for incorporation: based on a web platform, it reduces red tape and costs (saving of about EUR 2 000 per incorporation) and simplifies subsequent adjustments to the deed of incorporation.
- Exemption from payment of annual fees to Chamber of Commerce and other fees (e.g. stamp duty) otherwise due when depositing an act (e.g. annual balance sheet) at the business registry.
- Flexible corporate management: permits participants to create categories of shares with specific rights, carry out financial operations on their own shares and offer shares to the public.
- Extension of terms for covering losses: in the event of financial losses, participants receive a one-year extension to reduce capital, as otherwise required by Italian company law.
- Exemption from regulations on dummy companies: start-ups are not subject to regulation regarding non-operational companies and businesses registering systematic losses.
- Exemption from the duty to affix the compliance visa for compensation of VAT credit, for credit up to EUR 50 000 (for other companies, the cap amounts to EUR 5 000).
- Tailor-made labour laws: start-ups are allowed to hire employees through fixed term contracts for any duration and can be renewed an indefinite number of times for 36 months. After that, the contract can be renewed once more for a maximum duration of 12 months. Standard regulations on rate of fixed-term employees over open-ended employees do not apply, i.e. start-ups can hire as many fixed-term employees as they want.
- Remuneration through stock options and work for equity schemes: participants (start-ups) can offer additional remuneration to collaborators, employees and even external service providers through stock options and work equity schemes. These participative financial instruments do not concur to determine the taxable labour income, i.e. people who get a stock option do not pay taxes on this type of income.
- A tax credit for hiring highly qualified personnel (35% of the cost incurred), up to EUR 200 000 per company. This measure could

be used for hiring in 2012, 2013, 2014 (then it was not renewed, as it was absorbed by a broader tax credit on R&D).

- Tax incentives to corporate and private investors who invest in start-ups: for individuals a deduction of income amounting to 30% of the amount invested, with maximum limit on the size of the deductible of EUR one million. Legal entities receive fiscal deduction on taxable income equal to 30%, with maximum limit of EUR 1.8 million.
- Possibility to raise and collect capital through equity crowdfunding platforms. Italy was the first country worldwide to introduce ad hoc regulations on equity crowdfunding in 2013 followed by France and Germany in 2014, USA and UK in 2015. Italy as therefore a first-mover in this domain.
- Fast-track simplified and free access for innovative start-ups to SME Guarantee Fund: this State Fund enables access to credit through guarantees on bank loans (in the measure of 80% of the total loan). The amount covered by the public guarantee is up to EUR 2.5 million. Unlike other companies, start-ups can obtain the guarantee without costs. Fast-track refers to the fact that their files are given priority over those concerning other companies. Unlike other companies, the SME Guarantee Fund does not evaluate any balance sheet or business plan submitted by the concerned start-up, i.e. the guarantee is provided *automatically*, based on the "merit of credit" evaluation carried out by the lending bank.
- Service and support for start-ups looking to access foreign markets from the Italian Trade Agency: start-ups receive a 30% discount on standard fees applied to services such as targeted advice on legal, business and/or fiscal activities. Free-of-charge participation of selected start-ups in international events is also provided.
- Italia Start-up Visa programme: fast-track, web-based procedure for obtaining self-employment visas to Italy. It is addressed to non-EU citizens who intend to establish an innovative Start-up in Italy. In addition, non-EU citizens who already reside in Italy, e.g. for study, and intend to prolong their stay in Italy with the purpose of establishing an innovative start-ups, are allowed to convert their residence permit to a self-employment type through a similar fast-track, web-based procedure ("Italia Start-up Hub" programme).
- Fast fail bankruptcy procedure: participants are exempt from normal bankruptcy processes, preliminary closure agreements, and forced liquidation if the start-up becomes over-indebted.
- Conversion to innovative SME status: innovative start-ups can acquire the innovative SME status when they reach the fifth year of life, a five-million turnover threshold, get listed, or distribute

dividends. Innovative SMEs benefit from most of the instruments available to innovative start-ups, with a few exceptions, such as the new digital and free incorporation procedure, the exemption from payment of annual fees to the Chamber of Commerce, the fast fail bankruptcy procedure.

The Italian Ministry of Economic Development also provides the following measures, to which all firms are eligible, to support the innovation ecosystem. Given their innovative nature, start-ups are a natural target for these measures. Some of these measures are part of the recently launched "Industry 4.0" action plan.

- R&D tax credit: introduced in 2015 amount to 25% of the yearly increase compared to the average R&D expenditure reported in the 2012-14 period, it was increased to 50% in 2017, and it covers both *intra-muros* and *extra-muros* expenditures.
- Patent box (introduced in 2015): a special tax benefit allowing a reduction in taxation by 50% for income derived from the direct use or licence of intellectual property assets (e.g. industrial patents, software copyright) originating from research and development activity.
- Smart&Start Italia Programme: launched in February 2015, it is a subsidised financing scheme to innovative start-ups for spending programmes with zero-interest mortgages for 70% of the fund. Spending programmes submitted by start-ups in obtaining a mortgage can range from a minimum of EUR 100 000 to a maximum amount of EUR 1.5 million.
- Smart&Start: a previous subsidised financing scheme (operating between 2013-14), only aimed at newly-established (not necessarily innovative start-ups as defined by the Italian "Start-up Act") based in the South of Italy.
- "Hyper-depreciation" of investments in advanced manufacturing solutions (so-called Industry 4.0 technologies), introduced in 2017. It allows firms to amortise up to 250% of the value of investments (or leasing) in highly innovative material and immaterial capital, thus effectively reducing the tax burden on these expenditures.
- "Super-depreciation" of investment applies to machinery and allows a company to amortise up to 130% of acquisition value (until the 2018 Budget Law the rate was a bit higher, 140%), and thus obtaining in return a sizable fiscal advantage.

Another positive aspect of this policy is the fact that a large variety of data is collected on firm participants. The Italian Chambers of Commerce, on behalf of the Ministry of Economic Development (MISE), maintains a registry on the start-ups, which participated in the programme. In addition, the Ministry conducted a detailed survey

on all participants (with a response rate of more than 40%) which provides specific information on ex-ante firm characteristics such as funding sources and employment composition.1 The respondents were also asked to indicate which policy tools the firms used and what their perception of each of these policies are. Both the Business Registry and the Survey datasets contain unique firm identifiers enabling these two sources of data to be linked to other administrative data sources.

Registering into the special section of the business register is an essential prerequisite to access the policy incentives and benefits. Entry into the programme took off rather slowly in the initial years, but has steadily increased over time (see Section 5). This is likely due to the fact that there was limited publicity about the policy at the start of the programme, and the information spread gradually through accountants, specialised consultants, start-up events, chambers of commerce, and word of mouth. It is therefore possible that a number of eligible firms were not aware of the programme, especially in the initial years of the policy.

Given the number and variety of different policy instruments, it is not straightforward to calculate precisely the total fiscal cost of the policy. However, it is possible to calculate an approximate estimation for the main instruments, most of which is foregone tax revenues (more details are available in Italian Ministry of Economic Development 2017):

- Exemption from duty stamps and other fees otherwise due to the Chamber of Commerce: around EUR 10 million
- Tax breaks for equity investment: EUR 11.6 million in fiscal year 2015, EUR 7.6 million in fiscal year 2014, EUR 3.7 million in fiscal year 2013.
- Public Guarantee Fund: guarantee activated or losses repaid amount to around EUR 6 million (up to 30 June 2017), out of a total guarantees amount of EUR 372 million.
- CIPAQ (2012-14): around EUR 2 million
- Administrative cost (mostly dedicated staff): less than EUR 2 million
- Other measures not included in the original 2012 "Start-up Act":
  - Smart&Start Italia: allocation by EUR 267 million; pre-assigned resources EUR 159 million; resources actually lent by 30 June 2017: EUR 14.6 million
  - Invitalia Ventures matching fund: total public allocation: EUR 50 million

Therefore, a back-of-envelope calculation gives an aggregate fiscal cost of around EUR 30 million for the period 2013-16 for the 9 000 start-ups that have ever been registered into the policy up to 30 June 2017, which corresponds to around EUR 3 300 for each start-up. This estimate excludes the last two measures not included in the original 2012 "Start-up Act".

An early evaluation of the policy – based on balance sheet data until year 2014 – has already been carried on by Finaldi Russo, Magri, and Rampazzi (2016). The analysis compared innovative start-ups that joined the policy with other start-ups, and found that start-ups in the policy have a higher incidence of investment in intangible assets and longer time to market. Firms in the policy also report higher investment rates and stronger growth in sales and assets, while their financial structures are characterised by

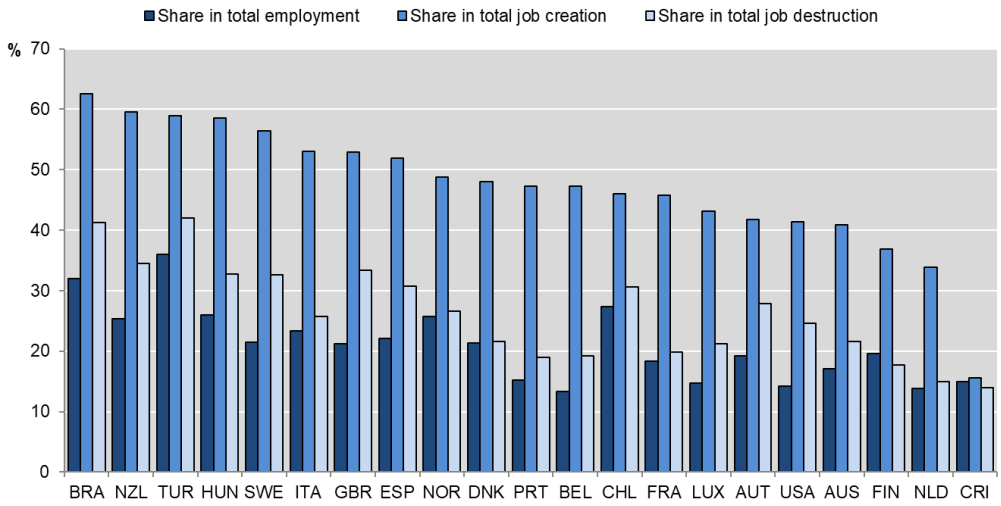
higher capitalization and greater availability of liquid assets. A more detailed comparison with a control group of similar firms (based on propensity score matching), show that start-ups in the policy raise more external funding, both debt and equity.

2. Why a start-up policy?

2.1. The role of young and innovative firms

Enabling start-ups to enter the market and grow is a policy priority across all OECD member countries, motivated by the empirical evidence that young and new firms are pivotal in creating new jobs. Recent work by Criscuolo, Gal and Menon (2014) shows that the contribution of young firms to job creation is much higher than their share in total employment (Figure 1). On average, firms five years old or younger account for only 21% of total employment, but are responsible for 47% of job creation. The aggregate figure, however, masks a fair degree of heterogeneity: it is only a tiny fraction of start-ups that substantially contribute to job creation, while the majority either fail in the first years of activity, or remain very small. The mechanism through which young firms positively influence aggregate job creation is firstly through firm entry, and secondly through the growth of young incumbents, especially those that are less than 3 years old (Calvino, Criscuolo, and Menon, 2016).

Figure 1. Young firms contribute disproportionally to job creation in all countries



Note: The graph shows the share of young firms (less than six year old) in total employment, total gross job creation, and total gross job destruction, respectively. Data cover manufacturing, construction, and non-financial business services. Figures for Chile are preliminary. Owing to methodological differences, figures may deviate from officially published national statistics.
Source: OECD (2016)

The dynamism of young entrants is also an important driver of aggregate productivity growth (Henderson, 1993; Tushman and Anderson, 1986). Jointly with the simultaneous expansion and contraction of incumbent businesses, firm entry and exit are the mechanisms through which labour and capital are reallocated away from sluggish inefficient firms to growing highly productivity firms, raising overall aggregate productivity. While the majority of start-ups is typically less productive than average incumbent firms (see e.g. Haltiwanger, Lane, and Speltzer, 1999), the exceptional growth of a few high-potential "gazelles" more than compensate for the

start-ups that stagnate (Shane, 2009; Calvino, Criscuolo, and Menon, 2016). However, the extent to which resources can be reallocated from inefficient firms to efficient ones differs considerably across countries (Berlingieri et al., 2017). For example, in the USA allocative efficiency explains more than 50% of productivity growth while in Slovenia only 4% (Bartelsman et al., 2013).

There is some, albeit, limited evidence that start-ups innovate more than incumbents. For example, the age of the firm appears to be negatively correlated with the technical quality of innovation (Balasubramanian and Lee, 2008). In the UK being a start-up in the services sector increases the likelihood of product innovations, but this is not the case for manufacturers (Criscuolo et al., 2012). Young firm also appear to obtain larger performance benefits from R&D at the upper quartile of the growth rate distribution but face declines at the lower quartile (Coad et al., 2014). However, according to more recent evidence for Italy (Cucculelli, 2018), incumbents are as good as new firms in introducing new products, when the CEO's tenure and the product maturity are properly taken into account. This in turn may suggest that young firms are not drivers of innovation *per se*, but rather they are the means through which younger managers start operating.

Above and beyond the private market benefits of innovative entrepreneurship, innovative start-ups can play a disproportionately important role in meeting broader environmental and social objectives.[2] More specifically, innovative entrepreneurship can promote inclusiveness, which is currently high in the policy agenda given growing concerns that economic inequality may undermine social cohesion. For instance, there is evidence that innovative entrepreneurship fosters social mobility in the United States (Aghion et al., 2016), while minority communities, particularly those of South/East Asian origin, have played increasingly important roles in USA science and technology sectors (Stephan and Levin, 2001; Chellaraj et al., 2008; Stuen et al., 2012). At the same time, the gender gap in entrepreneurship is striking and persistent, with men being three times more likely than women to own a business with employees across OECD countries; furthermore, evidence on gaps in sales and profits between female and male-owned firms suggests that many women entrepreneurs are not yet able to fulfil their productive and innovative potential (Piacentini, 2013).

2.2. The importance of experimentation: let one hundred flowers bloom

Given the importance of start-ups for job creation, innovation, technology diffusion, and productivity, policy makers are keen to identify policies that encourage the success of innovative entrants. However, only a tiny proportion of start-ups successfully grows and innovates. In light of that, Shane (2009) in a provocative essay argues that encouraging more people to become entrepreneurs is "bad public policy". Rather, "policy makers should stop subsidizing the formation of the typical start-up and focus on the subset of businesses with growth potential".

Following this line of reasoning, the crucial policy question becomes whether and how policy makers can identify high-potential start-ups. The issue, however, of whether start-ups' growth can somehow be reliably predicted based on observable characteristics is highly debated in the economic literature, particularly since the increased availability of firm-level data (Geroski, 2002; Birch, 2006; Coad, 2009; Guzman and Stern, 2015; Ng and Stuart, 2016). Despite best efforts from econometricians, there has been limited success in identifying firm (or entrepreneur) characteristics which predict subsequent growth dynamics. The combined explanatory

power of independent variables is usually low, typically less than 10% (Coad, 2009). A number of academics have argued that the systematic components of growth and performance are by far overshadowed by its randomness (Geroski, 2002; Coad, 2009; McKelvie and Wiklund, 2010). Some even suggest that the factors that are expected to explain firm growth path so far are quite erratic and not very meaningful (Coad, Frankish, Roberts, and Storey, 2013). Therefore, these scholars maintain that the actual firm level determinants of growth are still somewhat of an unknown (Roper and Hart, 2013).

One of the difficulties in identifying successful entrants is the lack of detailed data on the characteristics of firms and entrepreneurs "ex-ante", i.e. at the moment in which they create the new company. Since many of these firms are very small entities, very limited public information is available from administrative sources. In addition, comprehensive measures of "success" are also not readily available from traditional sources, especially when innovation is deemed to be an important component. However, advances in communication technology have opened up an era of big data, making information on both firm characteristics at entry and subsequent performance more accessible. At the same time, advances in information processing hardware and software make it easier for machine learning tools to analyse the growing accumulation of data. This enables the identification of complex relationships and clusters of similar firms, which may be used to more effectively identify successful high growing entrants.

As a consequence of these improvements on the data side, a growing number of scholars have begun to challenge the idea that growth is random and unidentifiable (Guzman and Stern, 2015; Astebro and Tag, 2017; Guzman and Stern, 2016). Guzman and Stern (2016) for example state that while luck and unobservable characteristics influence the success of entrepreneurs, the divergence in performance and the effects on various entrants can be explained by observable differences in ex-ante firm characteristics. The authors employ data on entrepreneurs at a similar stage of their entrepreneurial career to design measures of firm characteristics linked to entrepreneur quality.[3] Using these measures, they estimate the relationship between growth outcomes (firms which achieve an IPO or high value acquisition within six years of entry) and initial start-up characteristics, and find that a few characteristics allow for the construction of predictive models that determine entrepreneurial quality. The method used in this paper is thus able to identify a set of firm characteristics that are related to instances of high growth spurts of entrants.

Similarly, Ng and Stuart (2016) demonstrate how the use of machine learning with datasets containing hundreds of thousands of observations on entrepreneurial characteristics and a narrow definition of what it means to be a successful entrant can be used to accurately categorise high and low growth firms in the USA tech sector. Effective entrepreneurs are defined as those who received VCs or Business Angel finance while less dynamic entrants are defined by slow growth entrants which predominately carryout freelance/consultancy tasks. The authors are then able to show that the human capital and employment experiences between these two groups are significantly different. The results suggest that using a precise definition of what it means to be a successful entrepreneur, along with information on entrepreneur education and career path can be used as determinants of high growth start-ups.

However, two conditions are required for these "ex-ante" predictors of high-growth firms to be useful for better policy targeting. First, the predictors should not be easily manipulable by the entrepreneurs in order to strategically gain eligibility. Second, they

should not introduce unfair discriminations in the market, e.g. by preventing eligibility to certain socio-demographic groups – i.e., they should be politically "acceptable" as eligibility criteria. Furthermore, the relevant question for the policy maker is not "which are the high-growth start-ups", but rather "which are the high-potential start-ups that do not grow because of the existence of market failures that the policy is seeking to correct". In principle, answering the latter question requires performing a predictive exercise both in presence and in absence of the market failures. This is quite far from what has been done up to now in the economic literature. Therefore, while this area appears to be extremely promising for future research, the discussion is still too preliminary to draw useful conclusions at this stage.

Assuming that predicting growth potential is impossible or excessively complex, an alternative solution would be to adopt a "let one hundred flowers bloom" approach. Within this framework, potentially successful entrepreneurs should be enabled to experiment with various innovative strategies and technologies while having the ability to scale up or down, in the event of productivity shocks.[4] The role of the policy maker, in this context, would be to streamline both the entry and the exit of businesses, also by designing an insolvency regime that is not perceived as too "punitive". In practice, however, this entails a number of policy trade-offs which are not easy to resolve. For instance, insolvency procedures which are "pro-entrepreneur" and allow for a "fresh-start" would facilitate exit on the one hand, but, on the other hand, they also increase risk for lenders, thus restricting access to financial resources for prospective entrants.

2.3. Low productivity growth and weak demand for innovation: the Italian challenges

Before entering into a discussion of the details of the policy, it is important to stress that an effective start-up policy is not a sufficient condition for Italian start-ups to thrive. Italy has been suffering from a lack of productivity growth since the mid 1990's. There are several historical institutional frictions that have resulted in a fragmented productive system, where firms are smaller and older than their counterparts in other developed economies (Criscuolo, Gal and Menon, 2015) and resources are less efficiently allocated (Andrews and Cingano, 2014). They display limited attitude to innovation and internationalization, have poor management skills and are financially vulnerable. These firms did not benefit from the ICT revolution, and were negatively impacted by globalization trends in the 1990s and early 2000s (Brandolini and Bugamelli, 2009). Because of their fragility, they suffered acutely from the credit crunch and demand shocks during the Great Recession (Cingano et al., 2016).

While some of these frictions have been the object of policy interventions in recent years, such as the product market and labour market reforms enacted since 2012, significant improvements are needed in terms of efficiency of the public sector (in particular, for what regards red-tape costs and the length of civil judicial trials), and enforcement of the rule of law (eradicating corruption, tax evasion, and criminal organizations) (Bugamelli and Lotti, 2017). Young innovative start-ups are greatly affected by these frictions. Indeed, the strength of contract enforcement and the efficiency of civil justice are found to be important factors in explaining firm dynamics (Calvino, Criscuolo, and Menon, 2016), while tax evasion and corruption deter firm entry and innovation (Bobbio, 2016). As a result, young firms in Italy grow less and for a shorter period of time with respect to other countries, signified by subdued "up-or-out" dynamics (Criscuolo, Gal, and Menon 2014; Manaresi, 2015).

The structural characteristics of the Italian business sector tend to depress the domestic demand for innovative goods or services. The afore-mentioned small average size of Italian firms, as small firms are less likely to acquire innovative goods and service because they lack the resources to bear the risk of innovation. (Pagano and Schivardi, 2003). Moreover, most small and medium enterprises in Italy are family-owned and family-managed (Cucculelli and Micucci, 2008). Family firms, for example tend to perform fewer innovation efforts and are less inclined to turn to external sources of innovation than non-family firms (Nieto, Santamaria, Lopez-Fernandez, 2015). Anecdotal evidence also suggests that larger Italian corporations and business groups, which could partly compensate for that, may also be less likely to acquire goods and services from innovative start-ups.

Finally, the last actor that could potentially be an important acquirer of innovative goods and services is the public sector. Public procurement can be an important driver of innovation (Appelt and Galindo-Rueda, 2016), in particular in the sectors of health, defence, education, and public administration. The OECD Survey on Public Procurement in 2016 found that 50% of respondent countries have a procurement policy in place to encourage innovation. Amongst these countries, 26% rely on a stand-alone procurement action plan while 24% of countries use procurement as part of the country's general innovation strategy.5 An example of innovation-oriented public procurement in Italy is the national research plan proposed by the Ministry of Education, University and Research. The policy attempts to support research through the promotion of public demand for innovative solutions, by making pre-commercial procurement an integral part of the policy. However, in Italy the public sector is extremely unlikely to represent a sizeable market for start-ups, because of burdensome and complex bureaucratic procedures (also aimed at minimizing corruption risks, which is still an endemic problem in Italy). While there are not regulatory obstacles for newly-established businesses to participate in public calls for bids, the tenders are often structured in a way that discourages the participation of young firms. In absence of domestic revenues, Italian start-ups also struggle to reach the minimum scale to penetrate foreign markets.

2.4. A strong case for "horizontal" structural reforms

While direct policy interventions are important to encourage entry, growth and dynamism, horizontal structural reforms are needed to ensure an overall business environment conducive to entrepreneurship. Start-ups should be able to attract resources and to scale-up if successful, and to exit smoothly if unsuccessful. Policy bottle-necks that are generally detrimental for all businesses can be particularly harmful for small start-ups. This may be particularly true for start-ups with risky and high potential business strategies. Recent work by Calvino, Criscuolo, and Menon (2016) finds, for example, that start-ups in high growth and volatile sectors are more receptive to national policies and framework conditions than start-ups in other sectors. This highlights the importance of promoting policies explicitly aimed at lowering risk (e.g. improving access to, and the terms of, finance) on the one hand, and, on the other hand, tackling policy failures that are implicitly imposing an extra-cost on risk (such as weak contract enforcement).

Moreover, empirical evidence suggests that start-ups are more exposed than incumbents to the policy environment (Calvino, Criscuolo, and Menon, 2016). This might reflect the fact that due to credit constraints and weaker resilience relative to

incumbents, start-ups are more subject to the vagaries of the policy environment. At the same time, the policy environment may have been implicitly designed with the needs and conditions of incumbents in mind, meaning that horizontal structural reforms which are particularly helpful to start-ups are delayed or not implemented. This may also depend on regulation being tailored to the prevailing technology adopted by incumbents, rather than to the innovative technology used by the start-ups.

Because start-ups are small and relatively less organised in comparison to incumbents, it may be difficult for them to communicate their needs directly to policy makers. In the United States, EU and France, for example, a number of advocacy groups have been established to help facilitate dialogue between start-ups and government officials. In the United States, the Center for American Entrepreneurship, a policy and advocacy organisation works to educate federal, state and local policy makers on the importance of entrepreneurship and inform them of key challenges facing start-up in the USA (CAE, 2014). Similarly, in France, France Digitale is attempting the bridge the knowledge gap between policy makers and tech start-ups in order to establish a business environment that encourages entrepreneurship and growth in France (France Digitale 2015) while European Tech Alliance hopes to raise local policy issues, particularly those which impact tech start-ups in Europe (European Tech Alliance, 2017).

The policy debate in Italy, however, appears to focus more on saving distressed firms, rather than favouring the birth of new ones. However, there are many examples of "horizontal" policy areas in Italy that still have room for improvement in order to create a better business environment for innovative start-ups. These include: contract enforcement, bankruptcy and insolvency, wage rigidities, access to finance, education and skills, telecommunication infrastructure, and utilization of digital technologies. While it is beyond the scope of this work to discuss specific policy recommendations to address these issues, several OECD studies, including notably the most recent editions of the OECD Economic Survey of Italy, are very useful references to this respect. In the following, only a few examples are mentioned.

One area that is often invoked as being in urgent need for reforms is civil justice. Judicial proceedings – including those related to insolvency cases – are considerably more expensive and much longer for firms in Italy than for those in many other OECD countries. For instance, in the contract enforcement indicator of the World Bank "Doing Business" Italy ranks 30th out of OECD members (for which data is available). According to the indicator, in Italy it takes on average 1 120 days to resolve a commercial dispute (through a local first-instance court), in comparison to an average of 510 days in Spain and 395 days in France (World Bank 2017a). Similarly, it takes on average 1.8 years for a firm to go through insolvency – i.e. the period of time from a company's default until the payment of some or all of the money owed to the bank. The overall rank of Italy's insolvency processes is 21st amongst OECD member countries (World Bank 2017a).[6]

The high level of taxation may also be a barrier to growth for productive business, in particular because of a high level of social security contributions and income taxes, which add to labour costs. With a tax-to-GDP ratio of 42.9% compared with the OECD average of 34.3%, Italy ranked 6th out of 35 OECD countries in terms of the tax-to-GDP ratio in 2016. Relative to the OECD average, the tax structure in Italy is characterised by higher revenues from taxes on personal income, profits and gains, social security contributions, and goods and services taxes (excluding VAT/GST);

equal to the OECD average from property taxes; and a lower proportion of revenues from taxes on corporate income and gains and value-added taxes.[7] For nascent innovative start-ups, the statutory minimum of social contributions to be paid by each operating shareholder (around EUR 3600) is perceived as being particularly burdensome, and may constitute a non-trivial entry barrier for some specific types of high-potential start-ups (e.g., start-ups created by students or by academic researchers).

The role of the government as an efficient and effective provider of services is also an important factor for firm growth (Angelopoulos et al., 2008; Oto-Peralias and Romero-Avila, 2012). Giordano et al. (2016) find that the efficiency of public service provision is an important determinant of firm productivity in Italy, with efficiency at national level more impactful for productivity than that provided by local governments.

Over the last three years, Italy has also made some improvements in terms of educational performance. Based on the recent PISA results, the average science score of Italian students increased from 479 to 481, and their mathematics mark rose from 483 to 490.[8] However their science scores are still 12 points below the OECD average score of 493 (OECD, 2016b).[9] In comparison, Spain and France's current average science scores are 493 and 495 and average math scores are 486 and 493, respectively. In addition to general skill metrics, the availability of IT skills in Italy (measured by the proportion of employees which use programming language daily at work), is only 2.6% of workers in comparison to roughly 5.8% in France in 2014. In terms of advanced software use, 35.9% of firms in Italy use enterprise resource planning technology as opposed to 56.5% in Germany and 39.3% in France. Conversely, 21% of Italian firms use cloud computing as of 2016, which is more than in France (17.1%), Spain (18.3%), and Germany (16.3%). This may however be explained by the smaller average size of businesses in Italy (OECD, 2017c), as larger firms are typically more likely to have their own servers.

3. The evaluation: data and methodology

3.1. The goal: an independent and useful evaluation

The aim of this report is to provide an independent and comprehensive evaluation of the Italian "Start-up Act". This endeavour is articulated in a number of different tasks, which are all essentially quantitative in nature. The ultimate aim is to provide useful information to policy makers that could possibly be used to increase the effectiveness and efficiency of the policy, both by increasing its impact and by reducing its cost.

A crucial part of the analysis consists in a counterfactual evaluation exercise (illustrated in Section 4), which compares the outcomes of targeted firms with the outcomes of a group of otherwise similar firms, using appropriate econometric techniques. The aim of this analysis is to understand what would have happened to the beneficiary firms if the policy was not in place; the impact of the policy is estimated accordingly.

To be fully informative, the counterfactual analysis described above needs to be framed within a larger policy context, and other specificities and broader outcomes of the policy have to be addressed. As such, Sections 5 and 6 present and discuss a number of empirical analyses that present robust descriptive evidence on broader outcomes of the policy, both at aggregate and at firm level. These analyses have the advantage of taking a "holistic" approach to the evaluation exercise, considering also outcomes that are generally difficult to quantify (e.g., the cultural impact of the policy). This comes at the cost of adopting methodologies that require stronger assumptions to interpret the estimated effects as causal.

In particular, Section 5 looks at the aggregate effect of the "Start-up Act", comparing Italy with other OECD countries. The outcomes taken into account are the number and amount of VC investments, and the volume of Google web searches related to start-ups (used as a proxy measure for broader cultural change related to entrepreneurship). Section 6 exploits micro-data from different sources, to look at whether registering into the policy is associated with higher probability of receiving VC investments, and the extent to which the different policy instruments of the "Start-up Act" are appreciated and used by specific groups of start-ups.

The analyses of Section 5 and 6 also provide some suggestive evidence regarding possible substitution effects, which would undermine the "additionality" of the policy. Substitution effects are mechanisms through which positive outcomes of enrolled firms are counterbalanced by specular negative outcomes of other, similar firms not benefitting from the policy. In the extreme case in which substitution effects are equivalent and opposite to the direct effects of the policy, the intervention has no additional impact on the aggregate population of firms. In the case of the Italian "Start-up Act", this would happen if e.g. the equity investments on start-ups enrolled into the policy were entirely counterbalanced by reduced investments in other start-ups not enrolled into the policy. In this extreme example, the net effect of the policy could even be negative, to the extent that it distorts the market mechanism and leads investors to choose a sub-optimal portfolio allocation. Substitution effects may be detectable both at aggregate and at firm level. In the first case, they may result in aggregate effects which are equal or lower than the sum of the individual effects on beneficiary firms. In

the second case, they could be inferred by negative outcomes on non-beneficiary firms, estimated with adequate econometric techniques.

There are two specific factors of complexity in analysing the impact of the Italian "Start-up Act" just five years from its first implementation. The first one is the definition and the measurement of start-up "success" within such a short time-span. While available evidence suggests that most unsuccessful start-ups tend to fail within the third year of activity (Calvino, Criscuolo, and Menon, 2016), a successful start-up may require more time to thrive and create value. Furthermore, this value may take many different forms, which are not equal and easy to measure. Some start-ups may grow in employment and value added, or become very productive: these phenomena can be captured by balance-sheet data, although with some noise. Other start-ups may see an increase in their equity value, which can also be observed e.g. with data on acquisitions. However, other start-ups may create value under the form of social mobility opportunities and inclusiveness, of increased competition and consumers' welfare in the market, of disruptive innovations in fields that are important for the society as a whole, like e.g. health or climate change mitigation. While these forms of value may have some repercussions on balance-sheet data, the full effect may be extremely hard to measure accurately.

A further and more banal – but equally binding – data limitation exists in the time-frame with which firm-level data (especially balance sheets) are made available. At the time of writing (November 2017), the balance sheets for the fiscal year 2016 are only starting to become available in a usable format for the econometric analysis. The Italian "Start-up Act" was fully implemented in the first half of 2013 and since typically new firms do not publish a balance-sheet for their first year of activity, only the first three balance-sheets can be observed for the oldest participants. This leaves one with a three-year window that, while should be sufficient to detect some important indicators of success, is inevitably noisier and less precise than a longer time horizon.

3.2. The data

The analysis discussed in this report exploit a number of different data sources. Several of those are maintained or collected by MISE to comply with their policy monitoring duties – as mentioned earlier, the wealth of freely available data is indeed one of the assets of the policy. These sources are combined with several other datasets coming from both administrative and commercial data providers, as well as by the Bank of Italy and the European Patent Office (EPO). Overall, the resulting database allows one to assess the impact of the policy on many potential outcome variables, covering a multitude of different dimensions of start-up operations and growth patterns.

3.2.1. The start-up registry

The special section of the Business Registry dedicated to innovative start-ups (henceforth "start-up registry") provides information on participants in the *"Start-up Act"* policy framework, and can therefore benefit from all the fiscal incentives and specific regulations granted by the programme. The registry is updated weekly, allowing an on-time monitoring of the policy, with data accessible in open format and for free. This is definitely one of the "best practices" related to the policy that should be commended. As of the 3rd of July 2017, there were 7 045 firms registered. The majority of firms participating in the programme are operating in information and communication services (42%), professional and scientific activities (25%), and

manufacturing (18%). The average firm has 3.35 employees, with nominal output and share capital worth EUR 123 000, and EUR 53 000, respectively.

The variables of interest provided by the start-up registry include the eligibility criteria that qualified firms to enter into the policy, their age at entry, in addition to a number of balance sheet firm characteristics including employment and revenue.

3.2.2. The survey

Along with the start-up registry, this research also uses information from a survey conducted by MISE (from March to May 2016, referring to the status on December 31st, 2015) on start-ups participating in the programme. 44% of registered start-ups participated in the survey (up until that time) thus the sample includes 2 275 observations. The survey is a very useful complement to the registry, as the questions cover areas including human capital and social mobility (founders and non-shareholder employees, professional backgrounds, education and family situation), funding (structure of shareholders, propensity for entrepreneurs to obtain business finance through various channels) and innovation (innovative activities and sources of external knowledge). Importantly, the survey also provides information on which policy tools firms used and what their overall satisfaction with each policy tool. This survey data is valuable to the analysis as it allows for the assessment of the effects of adopting various policy tools on the performance of start-ups within the programme. A full list of policy tools can be found in Box 1. More information on the survey can be found in MISE-ISTAT (2018).

3.2.3. Crunchbase

The main source of data for VC activity is Crunchbase.[10] Crunchbase is a commercial database on innovative companies maintained by Crunchbase Inc. The original database was created in 2007 by Techcrunch, but its scope and coverage has increased significantly over the past few years. As reported by Kaufmann Foundation (2017), the database is increasingly used by the venture capital industry as a "premier data asset on the tech/Start-up world". Dalle, den Besten, and Menon (2017) present a detailed discussion of the database and its potential for economic, managerial, and policy-oriented research. Compared to commercial databases covering similar information and frequently used for economic research (see e.g. Da Rin, Hellman, and Puri, 2011, for an overview of available data sources), Crunchbase has major advantages: access to the data is free to academic research (conditional on applying for a license and on complying with the terms of use); it is partially crowd-sourced, i.e., users can add and revise contents, which adds to the comprehensiveness and timeliness of the database; it is updated on a daily basis; it contains cross-linked information on companies, their funders, and their staff; and, it is structured in an accessible way. Furthermore, it lists both companies that have received VC and start-ups that have not been funded yet but that are presumably actively looking for funding. This permits a meaningful comparison between the two groups of firms. However, there are also important caveats that should be considered while using the database, including undefined coverage and measurement error affecting self-reported information.

Academic interest in Crunchbase has recently grown and research using this database has been published in major journals. Examples include (but are not restricted to) Alexy, Block, Sandner, and Ter Wal (2012), Bertoni and Tykvovà (2015), and Block, Fisch, Hahn, and Sandner (2015). For a more detailed literature review, see Dalle, den

Besten, and Menon (2017), who discuss more than 80 academic studies in the field of economic, managerial, and entrepreneurship research based on the Crunchbase data.

In the version used for this report, downloaded in January 2017, the database contains information on more than 490 000 distinct entities located in 199 different countries; 2 500 entities are located in Italy. The historical dimension of the database is mainly limited to the snapshot of companies that have remained active until recently. Data on individual companies have been matched to the start-up registry with a fuzzy-matching procedure based on the company name and location.

3.2.4. ORBIS

Orbis is a commercial balance-sheet repository maintained by Bureau Van Dijk. For Italy it contains detailed accounting data for around four million companies.

3.2.5. Other data

While much of the empirical analysis is related to economic outcomes, the paper also assesses the potential social implications of the policy. In particular, analysis is undertaken on whether there are any cultural spill-overs caused by the policy. To do so, this research exploits publicly-available data from Google Trends, to examine whether there is any link between web browsing history in Italy before and during the start-up programme.

The Credit Register reports all loans granted by banks operating in Italy to borrowers for which the overall exposure of the bank is above EUR 30 000. The data include information on both loan granted and guarantees provided to the borrower. Loans are divided into three categories: credit lines, term loans and loans backed by receivables.

INPS, the National Social Insurance Institute, provides information on private firms operating in Italy about the average number of employees and their average monthly wage.

4. The causal impact of the policy: a counterfactual analysis

This Section summarises the findings of a counterfactual analysis aimed at estimating the causal effects of the policy. A more detailed explanation of the empirical approach is contained in a dedicated background paper (DeStefano et al., Forthcoming).

Overall, the main findings of this analysis show that the policy has a positive effect on both firm outputs and inputs, as well as on their ability to obtain bank credit. More precisely, the average results are driven from (at least) two types of firms: those that benefit from the bank guarantee fund (*Fondo di Garanzia*, FG) and those that benefit from other policies, supposedly increasing internal equity financing. The former experience stronger increase in revenue, value added, book value of capital, and total assets. They are likely to exploit the FG by increasing leverage. The increase in assets outweighs the increase in earnings. As a result, earnings before interest and taxes (EBIT) over assets decline. This reduction of the so-called returns of total assets may signal the easing of credit constraints. Consistent with this conjecture, we observe the quantity of credit to increase for firms accessing the FG. For firms not using the FG, results are less clear-cut. The estimates point to an increase in assets and capital mostly from raising equity and internal sources of finance, as suggested by the slight increase in net worth. The structure of capital of both groups also displays a change in its components. In particular, intangible capital increases as a share of total capital. This reflects – at least partially – an increase in patenting behaviour.

These results originate from a difference-in-differences model that accounts for unobserved firm heterogeneity that is fixed overtime, and it is robust to the existence of pre-treatment trends specific to treated firms, or other confounding factors. It does not rule out reverse causality, though. Namely, it may be possible that an "innovation" shock (a new project popping up in entrepreneurs' mind, or a VC injection) may contemporaneously induce a firm to participate in the policy and change its growth trajectory. This in turn would imply that some of the aforementioned effects of the policy are spurious. An instrumental variable (IV) strategy is put in place to account for this alternative explanation, and the main results are broadly confirmed.

4.1. Empirical challenges

The objective of the analysis is to identify the *average treatment effect on the treated* (ATT), where the "treated" firms are those that register into the policy. The ATT corresponds to the difference in the outcome of the average treated firm with and without the policy, respectively. The identification of the ATT is challenging, as the counterfactual outcome for treated firms is never observed, and firms that registered into the policy are likely to be systematically different from firms that did not. A *naïf* comparison of the two groups – treated and untreated – may therefore lead to the wrong conclusions on the effects of the policy.

Part of these differences between treated and untreated firms are observable, e.g. from balance sheet variables. Assuming that their effect can be captured by a parametric formulation, these differences can be partialled-out by including the appropriate set of control variables in the model. However, it is more likely that most of these differences are unobservable (or unmeasurable). For instance, data on R&D expenditures are not available for most firms, thus the eligibility criterion based on this measure cannot be

discerned. Furthermore, treated firms may plausibly have a management that is better informed, have a more ambitious strategy, etc.

In the applied econometric literature, these identification challenges are preferably addressed exploiting some discontinuities or "quasi-experiments" that introduce a degree of randomness in the probability of firms being treated. However, in the setting under scrutiny these are not readily available since the policy is relatively young and the number of treated firms is not very large, especially in the first years (2013 and 2014). Propensity score matching (PSM) techniques can also be viable options in certain cases, provided that the unobservable component is on average constant within groups of firms sharing similar values of observable variables. However, in this case preliminary explorations suggested that firms that *ever* enter into the policy are systematically very different from those that *never* enter into the policy, even *before* the policy was implemented.

4.2. Solutions

A suitable empirical strategy should therefore control also for unobservable heterogeneity across treated and untreated firms. The adopted solution is therefore a panel fixed-effect estimation, which allows to partial-out the time-invariant component. The identification therefore rests only on the comparison of the value of each variable in a given point in time with the average value of the same firm over the full period of time. However, this could still not be enough, to the extent that treated firms are also dynamically different, i.e., they follow a different trend over time. In order to partial-out also the dynamic heterogeneity, the model includes a set of control variables for the trend of the specific group of firms *ever* entering into the policy, exploiting the fact that a significant share of treated firms in the sample registered in the policy only in 2015, 2016, or 2017. Therefore, identification arises from the comparison of firms that registered in the policy at different points in time. Furthermore, the analysis also controls for cohort-, age-, and regional- specific shocks over time.

Operationally, the estimation is based on the following model:

$$Y_{it} = \alpha + \beta T_{it} + \gamma_i + Year_t * Age_{it} + Year_t * EverTreated_i + Age_{it} * EverTreated_i + \epsilon_{it} \quad (1)$$

Where Y is a given outcome variable, T is a time-variant dummy equal to one whenever the firm is registered into the policy, γ is a firm fixed effect, *Cohort* and *Age* are year-specific fixed effects for firms incorporated in the same year and having the same age, respectively, and *EverTreated* is a time-invariant dummy variable that is equal to one for firms that have been registered into the policy at any point in time. The interaction of the *EverTreated* dummy with the *Age* indicator variable controls for a time trend specific to firms in the policy. It is worth noticing that, while the model is estimated on the whole sample of treated and control firms to increase efficiency, given the fixed-effect structure the identification of the treatment effect is essentially only driven by the sample of "ever treated" firms.

The estimation strategy based on Equation (1) takes into account and addresses the main concerns discussed above. Nevertheless, the estimated ATT can still be inconsistent if firms that enter early into the policy (in 2013 or 2014) follow a systematically different trend compared to firms that register later (in 2015 or 2016). To take this into account, the robustness of the results is tested by controlling for a time trend specific to early treated firms. Furthermore, the "ATT" is also estimated for each

year before and after the firm joins the policy, i.e., assuming that the firm registers at time *t*, the ATT is estimated at t-2 or earlier; t-1; t; t+1; t+2; t+3. If the ATT becomes significantly positive only starting from time *t* and stays roughly constant afterwards, this reassures on the absence of a pre-existing trend for firms entering into the policy.

There are a number of limitations associated with this estimation strategy. First, given the inclusion of a firm fixed-effect in the estimation, the identification arises only from the subsample of firms that can be observed both with and without the policy. Moreover, because firms do not provide a balance sheet in their entry year (i.e., age zero), the effect of the policy is identified only for firms that register into the policy at age two or more.

4.2.1. Matching estimators for firm exit and credit applications

The panel fixed-effect model (1) can be estimated for all outcome variables that are identified overtime for the same firm. Some relevant outcome variables, like e.g. survival probability or having the first credit application accepted, though, are only measured once. For these outcomes, the analysis has to rely on matching techniques. The first step is to run a logit model

$$\Pr(T_i = 1|X_i) = \Phi\{X_i, \beta\}$$

where Φ denotes the logistic cumulative density function and X_i is a vector of firm characteristics observed before registering into the policy. Second, firms in treated and control groups are matched on the basis of the estimated propensity score, using kernel matching. The alternative approach of minimum distance matching to reduce potential bias from model misspecification is also implemented, as suggested by King and Nielsen (2016).

To study the effect of the policy on firm survival, the probability of exit in the first three years of life is compared across treated and control firms. The estimation of the impact of the policy on accessing the credit market is instead based on the probability that the first credit application made by the firm is accepted.[11] While these estimators impose stronger identification assumptions than those of model (1), as they cannot control for unobserved time-invariant firm heterogeneity, several indirect checks corroborate the validity of the results. First, their robustness holds across various changes in the vector of controls for which the propensity score is computed, and this shows that all results are remarkably stable. Second, a placebo test shows that there are not significant differences in outcome variables for *prospective firms*, i.e. in the years before they enter.

4.3. Results

4.3.1. Baseline estimations

The analysis shows that the policy has a positive effect on a number of balance sheet variables, including assets, book value of capital, investment, the ratio of intangible investment over tangible, and value added (the derived variables are described in Table 1). The productivity (measured as the log of valued added over total number of employees) also increases – although the result is marginally significant – as well as the probability to file a patent. The full set of results is reported in Table 2. All the dependent variables (except the patent dummy) are reported in logarithmic form, so the

coefficient can be interpreted as semi-elasticities (e.g., the policy leads to an 11.6% increase in assets on average over the years in which the start-ups are registered).

Table 1. Derived variables definition

Variable name	Definition
Leverage	Bank debt over Assets
Tangibility	Intangibles over tangibles assets
Productivity	Value added over total number of employees
Patent dummy	Binary variable equal to one if the company has filed a patent in the given year at the European Patent Office (EPO)

Table 2. Regression results, baseline

Panel fixed-effect regressions

Dep. var.:	Employees	Assets	Revenues	Value added	Patent dummy
Treated	-0.003	0.110***	0.073*	0.111**	0.006***
	(0.041)	(0.027)	(0.042)	(0.047)	(0.002)
No. of obs.	398 510	804 590	804 765	723 304	804 765
Dep. var.:	**Book value K**	**Wage bill**	**Tang. ratio**	**Productivity**	**Leverage**
Treated	0.139***	-0.023	0.178***	0.115*	-0.008
	(0.041)	(0.051)	(0.058)	(0.067)	(0.021)
No. of obs.	690 373	573 059	521 911	382 285	792 427
Dep. var.:	**Investment/Assets**	**Net worth**	**Cash-flow/Assets**	**Liquidity ratio**	**Equity injections**
Treated	0.098	0.086*	0.019	-0.014	0.019
	(0.061)	(0.039)	(0.051)	(0.049)	(0.021)
No. of obs.	528 565	709 427	629 953	625 391	800 013

Note: All regressions include the following fixed effects: firm; age-year; cohort-year; ever treated-age; ever treated – year. All dependent variables are expressed in logarithmic form (except the patent dummy). *** p<0.01, ** p<0.05, * p<0.1. Standard errors clustered at the firm-level in parenthesis.

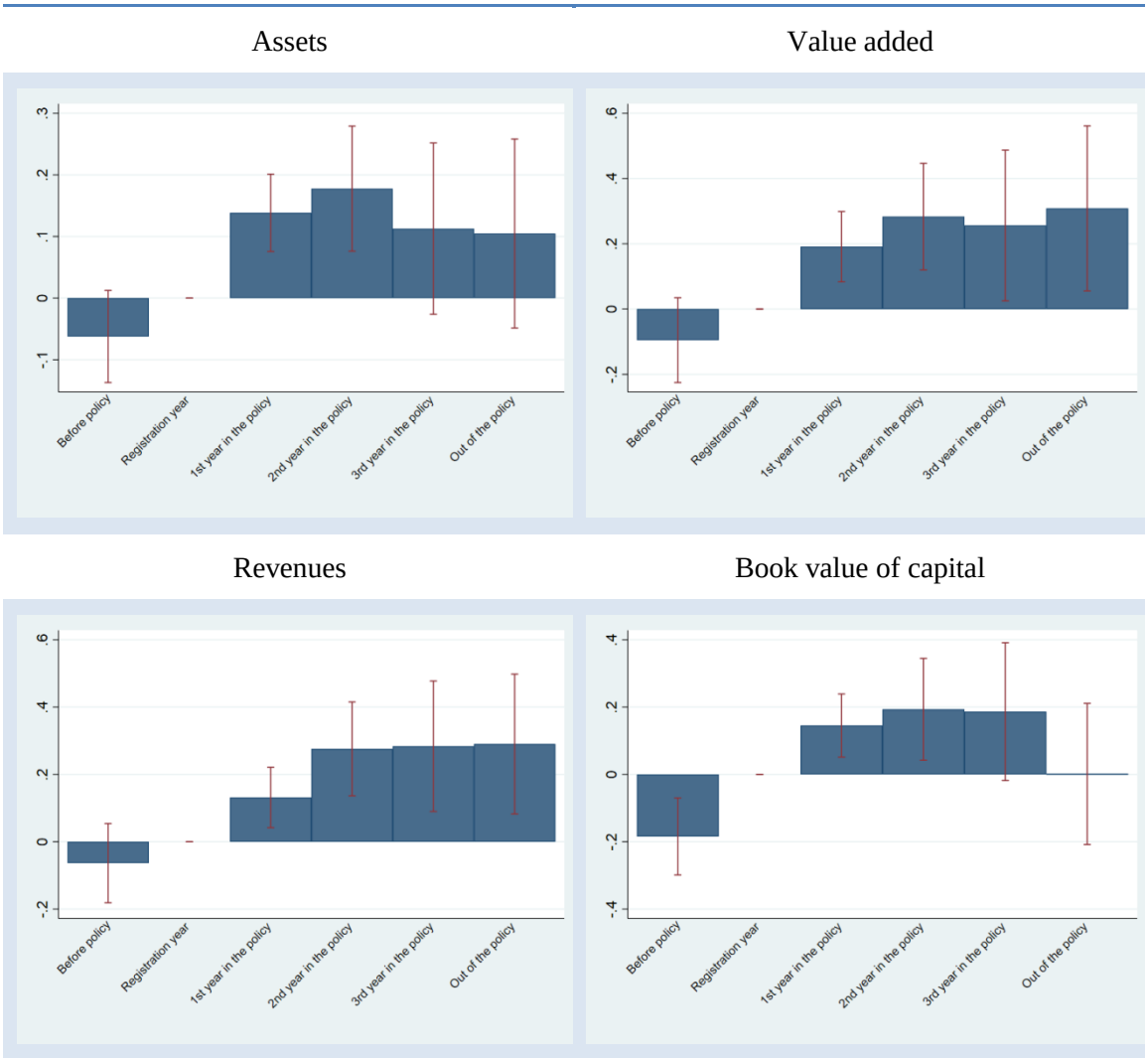
Figure 2 reports the treatment effect decomposed by the distance in time from the registration, i.e.: two or more year before entering into the policy; one year before; in the first; second; and third year; and after losing eligibility. The baseline group is the year before registering. Firms may lose eligibility if they become more than five years old, or if they do not comply anymore with other eligibility criteria. Only the figures for the variables for which coefficients are statistically significant are reported.

The results reported in Figure 2 indicate that the positive treatment effect materialises in the first year in which firms register into the policy. In the case of assets, it increases

slightly in the second year, to become not statistically significant afterwards. In the case of both value added and revenues, the positive effect remains approximately constant starting from the first year. Finally, firms that enter into the policy appears to have a slighter lower book value of capital before registering than otherwise similar firms of the same cohort and age, but the gap is more than compensated once they register into the policy.

Figure 2. Treatment effect over time

Relative to the year of registration into the policy



Note: The graphs report the ATT coefficients for each year before and after registering into the policy. The excluded baseline category is "registration year". In all other aspects, the regression models are identical to those reported in Table 15. The red whiskers report 90% confidence intervals.

4.3.2. Heterogeneous effects: guarantee fund and eligibility criteria

This section explores firstly whether the treatment has heterogeneous effects depending on whether the registered start-ups receives a bank loan backed by the public guarantee fund (*Fondo di Garanzia*, FG). The results (Table 3) indicate that that start-ups backed by the FG tend to have higher inputs and outputs, however the difference of the coefficients is seldom statistically significant.

Table 3. Heterogeneous effects: bank credit guarantee scheme

Panel fixed-effect regressions

Dep. var.:	**Assets**	**Revenues**	**Book Value of K**	**Tangibility**
w/o guarantee	0.089***	0.068	0.119***	0.163***
	(0.027)	(0.042)	(0.041)	(0.058)
w/ guarantee	0.354***	0.132*	0.358***	0.329***
	(0.044)	(0.070)	(0.065)	(0.088)
No. of obs.	804 590	804 765	690 373	521 911
Dep. var.:	**Investment/Assets**	**Net worth**	**Cash-flow/Assets**	**Liquidity/Assets**
w/o guarantee	0.080	0.094*	0.028	-0.005
	(0.061)	(0.039)	(0.051)	(0.049)
w/ guarantee	0.290***	-0.005	-0.142*	0.167**
	(0.092)	(0.070)	(0.081)	(0.080)
No. of obs.	528 565	709 427	629 953	625 391

Note: All regressions include the following fixed effects: firm; age-year; cohort-year; ever treated-age; ever treated – year. All dependent variables are expressed in logarithmic form. *** p<0.01, ** p<0.05, * p<0.1. Standard errors clustered at the firm-level in parenthesis.

A second source of heterogeneity taken into account is the eligibility criteria used by the firm to gain access to the policy: having at least 15% expenditures in R&D over total cost or turnover; being the owner, depositary or licensee of a registered patent; or employs highly qualified personnel. The results (Table 4) show that there are not sizeable differences on the impact of the policy across the three groups of firms. Again, the main exception is net worth, for which the coefficient is significantly higher for those start-ups that are eligible because they employ highly qualified personnel.

Table 4. Heterogeneous effects: eligibility criteria

Panel fixed-effect regressions

Dep. var.:	Assets	Revenues	Book Value of K	Tangibility
R&D	0.119***	0.037	0.181***	0.247***
	(0.042)	(0.066)	(0.064)	(0.093)
Patent	0.083	0.124	0.194**	0.135
	(0.054)	(0.081)	(0.090)	(0.119)
Degree	0.205***	0.185**	0.142	0.200
	(0.062)	(0.083)	(0.088)	(0.143)
No. of obs.	797 540	797 540	684 302	516 393
Dep. var.:	**Investment/Assets**	**Net worth**	**Cash-flow/Assets**	**Liquidity/Assets**
R&D	0.090	0.067	0.036	-0.028
	(0.092)	(0.062)	(0.093)	(0.076)
Patent	0.211*	0.009	-0.008	-0.014
	(0.117)	(0.088)	(0.095)	(0.112)
Degree	0.053	0.202**	0.096	0.186*
	(0.138)	(0.083)	(0.096)	(0.108)
No. of obs.	522 889	702 924	624 552	742 065

Note: All regressions include the following fixed effects: firm; age-year; cohort-year; ever treated-age; ever treated – year. All dependent variables are expressed in logarithmic form. *** p<0.01, ** p<0.05, * p<0.1. Standard errors clustered at the firm-level in parenthesis.

4.3.3. Results for exit rates and credit applications

Exit rates are an important indicator of success for innovative start-ups. Because the event of death only happens once for each firm, the matching estimator is used for this variable. Given the short time-span of analysis, the analysis focuses on the probability of being dead by age three. The robustness of our estimates is assessed by comparing results from two different matching models: in the restricted model, treated and control firms are matched *exactly* on age at entry, year of entry, and industry, while probabilistic matching applies to initial revenues and initial assets. In the full model, exact matching on quartiles of initial revenues and assets is also included, as well as probabilistic matching on revenues, assets, fixed capital, and value added.

Table 5 shows the results of the matching estimators on the probability of exit. The policy induces a significant decline in the exit rates. Notably, the decline (around five percentage points within three years of life) is robust to different model specifications. Additional results, not reported here for brevity, confirm the lower relative risk of exit for treated firms by using duration models (parametric and non-parametric) which also account for firm-level heterogeneity (frailty).

4.3.4. Results for access to credit market

Thanks to the availability of the Credit Register data, it is possible to study in depth how the policy affects the linkages between innovative start-ups and the banking sector. Innovation is usually found to be difficult to finance via bank credit, because intangible innovative capital such as patents are hardly collateralisable, and because innovative firms are relatively more risky borrowers (Mann 2014). Some of the policies encompassed by the "Start-up Act" (such as the FG credit) may allow firms to reduce the collateral constraint to access bank credit. Others, such as the equity incentives, may allow innovative firms to reduce their reliance on debt financing, easing access to equity and self-financing.

The analysis is devised in three steps. First, the extensive margin is taken into account: by exploiting information on loan applications, it is assessed whether the policy changes the probability of asking for credit and the likelihood that applications are accepted (conditional on being made). The second part of the analysis assesses whether, conditional on the application being accepted, the quantity of credit, its characteristics (such as the share of drawn to granted credit), and the interest rate charged are affected by the policy. The last question to be addressed is whether the effect is heterogeneous depending on whether firms benefit of the FG scheme. The analysis of loan applications relies on matching estimators, while for the analysis on the quantity and quality of bank credit is based on the baseline panel fixed-effect model.

The first panel of Table 6 shows the estimated effect of the policy on the probability of applying for credit. No statistically or economically significant effect can be discerned. The second panel shows that the first credit application made by the firm is accepted by banks. The effect is positive and sizeable: ranging from 8 to 16 percentage points (p.p.), corresponding to around one third of the average probability of acceptance for young firms (33%).

The first panel of Table 7 shows the results of a difference-in-difference model on the quantity, price, and characteristics of credit granted to firms. It shows that participation into the policy is positively correlated with an increase in total credit (by around 8 p.p.), which is entirely explained by an increase in loans (by more than 14 p.p.). Credit lines are not affected in terms of granted amounts. Conversely, column 3 shows that the share of drawn to granted credit lines declines significantly (by 27%), showing that, thanks to the policy, firms are less likely to use bank credit to finance working capital. Finally, the increase in loans quantity is coupled by a reduction in interest rate charged (by around 1%), which signals that firms are facing an easing of credit supply.

The second panel of Table 7 provides some evidence on the role of FG scheme in explaining these results. The increase in loan quantity and the reduction in its price are entirely explained by firms accessing the FG scheme. Conversely, the reduction in the drawn-to-granted credit ratio mostly stems from firms not accessing FG scheme. This may signal that innovative firms that are not in need for bank credit, thus exploiting other policies than FG, would be able to increase their self-financing, thus not having to rely on (more costly) credit lines to finance their working capital.

4.3.5. Robustness checks

The sensitivity of the estimation results described above has been tested through a number of different robustness checks, which leaves the main conclusions and results unaffected, and are summarised in this sub-section. The full results are not reported

for reasons of brevity but are available from the authors upon request and are also reported in DeStefano et al. (Forthcoming).

Although the baseline models control for firm-specific time-invariant, there might be the possibility that the point estimates are influenced by shocks specific to sectors and regions in particular years. In light of this, the models were augmented by including time-sector as well as time-region fixed effects.

As shown in the following section, cohorts of start-ups born just before or during the first two years of the "Start-up Act" joined the policy at a much slower pace if compared with the following cohorts. In order to address potential differences across these two groups of treated firms, a time-invariant dummy taking the value of 1 if a start-up has joined the policy in 2013-14, and 0 otherwise was generated. Two interactions between this dummy and, respectively, years and age fixed effects were included in the models so to control for trends that are specific to this group of early treated firms.

A potential concern relative to the econometric approach is that one cannot rule out the possibility that results are at least partly driven by self-selection into the policy. In order to address this aspect, a PSM-weighted panel analysis was performed, thus allowing to control for both self-selection into treatment as well as firm unobserved heterogeneity. PSM-weighting entails estimating and applying weights to statistically balance observables pre-treatment characteristics across treated vs. untreated firms (Hirano et al, 2003). As shown by Hirano et al. (2003), PSM-weighted regressions lead to unbiased estimates of ATT. To this end, the probability of ever joining the policy (p) was estimated using a range of balance-sheet variables observed at age 1 for each firm. Each treated firm receives a weight of one, whereas untreated firms receive a weight of $p/(1-p)$. Untreated firms with similar observable features to treated firms are assigned higher weights while the contrary applies for firms with dissimilar characteristics. Subsequently, the panel fixed effects analysis was performed by using these estimated weights to balance observables across treated vs. untreated firms.

To check whether the estimation results are influenced by the presence of outliers, all dependent variables were winsorised at the 2% on both sides of the distribution.

Table 5. Exit probability

Propensity score matching (PSM) estimators results

Dep. Var.	**Probability of Exit within 3 years of Birth**			
Model:	**Propensity Score Matching**		**Minimum Distance Matching**	
Treated	-0.017***	-0.016***	-0.021***	-0.010***
	(0.005)	(0.005)	(0.004)	(0.004)
Controls	Restricted	Full	Restricted	Full
No. of obs.	69 347	30 851	151 010	151 010

Note: In the restricted model, treated and control firms are matched *exactly* on the basis of age at entry, year of entry, and industry, while we perform probabilistic matching (using either of the two estimators) for initial revenues and initial assets. In the full model, it is also required exact matching on quartiles of initial revenues and assets, and probabilistic matching on revenues, assets, fixed capital, and value added. Standard errors in parenthesis. *** p<0.01, ** p<0.05, * p<0.1.

Table 6. Exit probability and credit applications

Propensity score matching (PSM) estimators results

Dep. Var.	**Probability of Applying for Credit within 3 years of Birth**			
Model:	**Propensity Score Matching**		**Minimum Distance Matching**	
Treated	-0.009	-0.004	0.003	0.001
	(0.010)	(0.007)	(0.004)	(0.005)
Controls	Restricted	Full	Restricted	Full
No. of obs.	37 043	36 023	37 043	36 023
Dep. Var.	**Probability of Acceptance of First Credit Application**			
Model:	**Propensity Score Matching**		**Minimum Distance Matching**	
Treated	0.079**	0.159***	0.083*	0.164***
	(0.04)	(0.39)	(0.05)	(0.06)
Controls	Restricted	Full	Restricted	Full
No. of obs.	1 185	1 061	1 185	1 061

Note: In the restricted model, treated and control firms are matched *exactly* on the basis of age at entry, year of entry, and industry, while we perform probabilistic matching (using either of the two estimators) for initial revenues and initial assets. In the full model, it is also required exact matching on quartiles of initial revenues and assets, and probabilistic matching on revenues, assets, fixed capital, and value added. Standard errors in parenthesis. *** p<0.01, ** p<0.05, * p<0.1.

Table 7. Regression results, credit quantity, price and characteristics

Panel fixed-effect regressions

Dep . Var.	Total Credit Growth (%)	Loans Growth (%)	Drawn/Granted Credit Lines (%)	Interest Rate on Loans (%)
Treat	7.901**	14.334**	-26.921*	-1.014*
	(3.738)	(7.115)	(14.843)	(0.613)
No. of obs.	414 031	308 538	254 232	70 476
Dep . Var.	**Total Credit**	**Loans**	**Drawn/Granted Credit Lines**	**Interest Rate**
w/o FG	3.976	7.008	-28.338*	-0,952
	(3.672)	(7.054)	(14.910)	(0.625)
w/ FG	29.586***	50.536***	-17.955	-1.177*
	(4.322)	(7.559)	(19.357)	(0.654)
No. of obs.	414 031	308 538	254 232	70 476

Note: All regressions include the following fixed effects: firm; age-year; cohort-year; ever treated-age; ever treated – year. All dependent variables are expressed in logarithmic form. *** p<0.01, ** p<0.05, * p<0.1. Standard errors clustered at the firm-level in parenthesis

4.4. Instrumental variable strategy

As discussed above, a possible source of inconsistency for the baseline estimates rests on the possibility that an idiosyncratic exogenous shock at firm level could drive both the sudden increase in inputs and outputs and the likelihood for a company to register into the policy. An example of such event could be for instance a VC injection, as investors may urge the start-up to register into the policy in order to benefit of fiscal incentives for equity investment. While it is highly unlikely that this or related events could explain the whole set of results presented above (e.g., a VC injection would not typically have effects on revenues in the short term), the concern that some estimates are not consistent cannot be ignored.

A preliminary instrumental variable strategy is developed in order to address this issue. The main underlying intuition is that, within the group of treated firms, the timing of entering into the policy entails an exogenous component. Indeed, as shown in Figure 3, the policy take-up had been rather slow in the first couple of years, i.e. in 2013 and 2014, with a large number of eligible firms apparently not registering into the policy until 2015 or 2016, therefore "leaving money on the table". A more detailed visual inspection show that the registration into the policy has been much more gradual over time for the cohorts of firms born in 2011, 2012, and 2013, than for those born in 2014, 2015, or 2016, with the latter group predominantly registering in the same year after of incorporation.

Anecdotal evidence suggests that this variability in the timing of registration into the policy for the older cohorts is due to two main factors: the heterogeneous outcome of the local chamber of commerce's decision on whether the start-up mission statement was "innovation oriented", due to the discretionary nature of this requirement; and the erratic spread of information about the policy over the national territory via "word of

mouth" and other informal channels (e.g., accountants). Both factors point to significance variation at province level in the probability of registering into the policy, which is arguably irrelevant for other firm-level outcomes, once the rich set of fixed effects included in the baseline estimations is controlled for. Therefore, a measure of the share of "early registered" firms in all registered firms at province level may have the characteristics of a valid instrumental variable, i.e., being correlated with the endogenous treatment variable, and not having an independent effect on the dependent variables (conditional on all other controls).

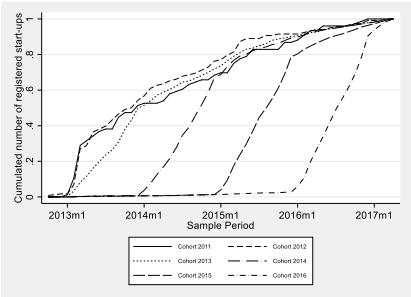
Given that the endogenous treatment variable is binary, the IVE strategy follows a 3-stage approach known as "Procedure 18.1" and described in Wooldridge (2002), and applied, amongst others, by D'Ignazio and Menon (2013) and Adams, Almeida, and Ferreira (2009). The instrumented treatment variable is only relative to start-ups registering in 2013, as is arguably the year in which exogenous variation in treatment probability across provinces was the highest. The procedure consists in first running a Probit regression of the endogenous treatment variable on a full set of province dummies, and subsequently estimating a standard two-stage least square (2SLS) estimation in which the predicted probability from the Probit regression is the excluded instrument. As the IV variable is grouped at province level, the standard errors are also clustered at province level in the first and second stages of the 2SLS. More details on the 2SLS estimation, including a falsification test to corroborate its validity, are reported in DeStefano et al. (Forthcoming).

The preliminary results, reported in

Table 8, indicate that the positive effects of the policy are confirmed, with all coefficients maintaining their sign and even increasing in magnitude in most cases. However, as it is not uncommon with IV estimates, the estimates have much larger standard errors, which imply that coefficients are often not significant. However, significance is preserved in the case of assets and book value of capital. The first-stage F-test on the excluded instrument is always above the "rule-of-thumb" value of 16, indicating that the instrument is strong enough to avoid a weak-instrument bias. Refined estimations based on the instrumental variable strategy are reported in DeStefano et al. (Forthcoming).

Figure 3. Monthly cumulated number of registered start-ups

By cohort of birth; April 2017=100



Source: Authors' elaboration on MISE start-up register.

Table 8. Preliminary instrumental variable results

Two-stage least squares (2SLS) panel fixed-effect regressions

	Assets	Revenues	Book Value of K	Tangibility	Leverage
Treated 2013	0.457*	0.362	0.858**	0.126	0.153
	(0.246)	(0.495)	(0.359)	(0.640)	(0.281)
Later treated	0.175***	0.075	0.260**	0.363**	0.036
	(0.058)	(0.127)	(0.112)	(0.154)	(0.061)
N	792 115	792 115	680 225	513 104	780 147
	Value added	**Investments/ Assets**	**Net worth**	**Liquidity/ Assets**	**Patent dummy**
Treated 2013	0.383	0.974	-0.036	-1.008**	-0.021
	(0.449)	(0.694)	(0.322)	(0.500)	(0.097)
Later treated	0.121	0.319**	0.036	-0.229	-0.011
	(0.124)	(0.166)	(0.089)	(0.157)	(0.020)
N	712 903	519 586	698 361	737 234	792 115

Note: The first stage F-test on the excluded instrument range from 21.33 to 76.41. All regressions include the following fixed effects: firm; age-year; cohort-year; ever treated-age; ever treated-year; region-year. All dependent variables are expressed in logarithmic form (except the patent dummy). *** p<0.01, ** p<0.05, * p<0.1. Standard errors clustered at the province in parenthesis.

5. Is Italy a country for young firms? The Italian start-up ecosystem

5.1. The profile of Italian start-up founders: a cross-country comparison

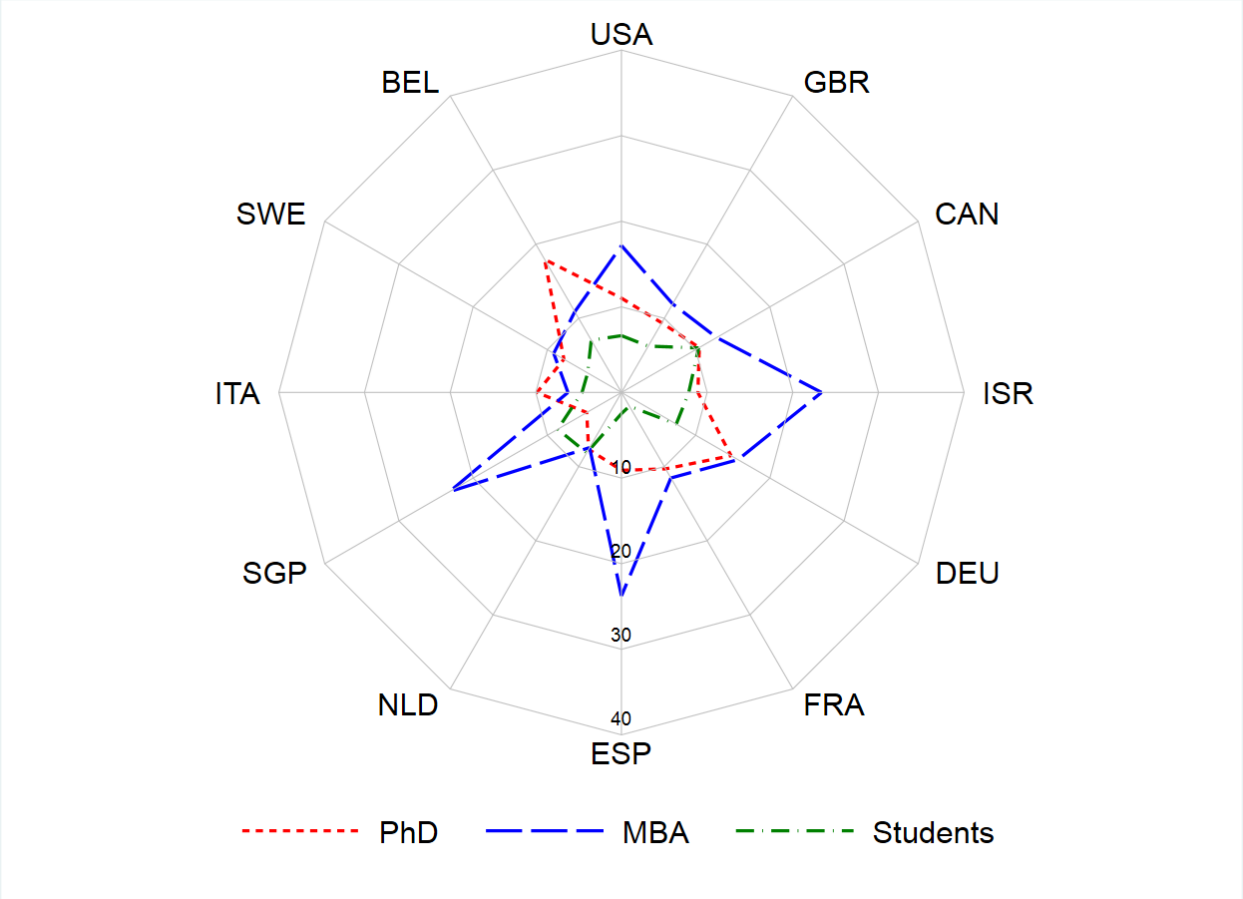
Together with funding, the people willing to engage in a new business venture are another important "ingredient" of a thriving start-up ecosystem. Data available from Crunchbase[12] allow to investigate the characteristics of start-up founders across countries (see Breschi, Lassébie, and Menon, 2018, for a detailed analysis). This sub-Section briefly summarises the main similarities and differences of Italian start-up founders compared to a few other selected OECD countries.

In terms of education background, Italian "start-uppers" tend to hold a Master in Business Administration (MBA) less frequently, while the share of founders holding a PhD, at around 10%, is not very dissimilar from the cross-country average (Figure 4). Conversely, the share of student entrepreneurs – i.e., individuals who started undergraduate education less than four years before they founded their start-up – appear to be rather low in comparison to other economies, although the value is close to those of France and Spain. The shares of serial and academic entrepreneurs, respectively at 24% and 6%, are equal to the average values of the other economies reported in the graph (Figure 5). The share of female founders, at 11%, is slightly higher than the average, while the share of founders who are also patent inventors, at 3%, is significantly lower than the majority of other countries: e.g., the share is equal to 15% in Israel and to 13% in United States and Sweden (Figure 6).

Although these statistics are only suggestive, the evidence that both students and patent inventors are under-represented among start-up founders compared to the benchmark countries may point to a larger disconnect between Italian academic and research institutions on the one hand, and start-up and entrepreneurship in general on the other hand. This could be an interesting avenue for future research. However, overall these statistics suggest that the supply of innovative entrepreneurs is not very different in Italy in comparison to its peers. The scarcity of VC deals in Italy, therefore, seems to be driven mostly by a lack of supply of funding, rather than by a lack of demand for it.

Figure 4. Start-up founders' profile: education

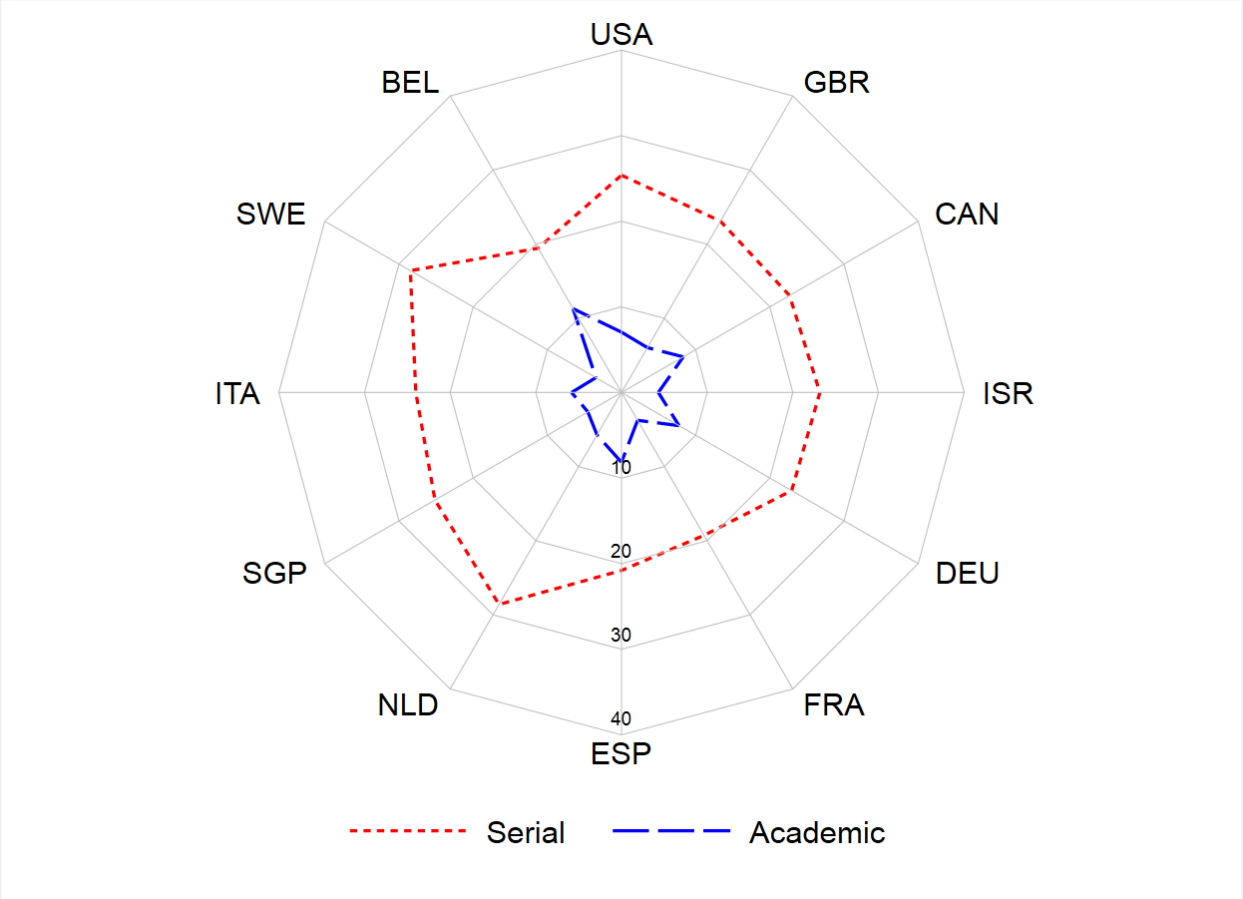
Share of founders with a PhD, an MBA, or who are students at the time the start-up is founded



Note: Student founders are defined as those who created the start-up within four years since the beginning of undergraduate education.
Source: Breschi, Lassébie, and Menon (2018) based on www.crunchbase.com data

Figure 5. Start-up founders' profile: previous occupation

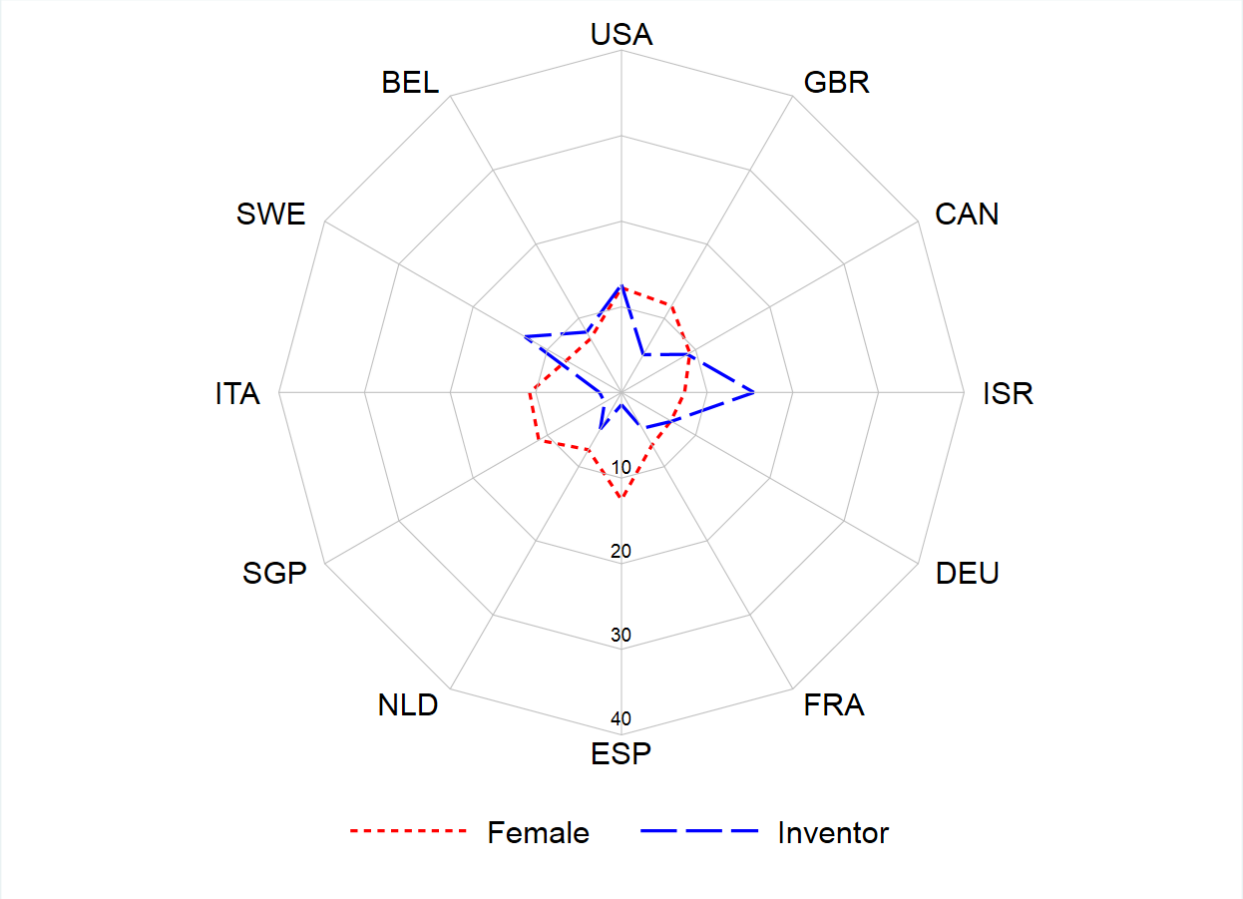
Share of founders with previous entrepreneurial or academic experience



Note: Serial entrepreneurs are defined as founders who report a previous work experience as founder or entrepreneur (self-employed are excluded). Academic entrepreneurs are founders who report a previous work experience as professor, post-Doc researcher, or lecturer.
Source: Breschi, Lassébie, and Menon (2018) based on www.crunchbase.com data

Figure 6. Start-up founders' profile: gender and patent authorship

Share of female founders or who are patent inventors



Note: Inventors are founders who are listed in the inventor field of at least one IP5 patent filed for before the company was founded.
Source: Breschi, Lassébie, and Menon (2018) based on www.crunchbase.com data

5.2. Finance for innovative start-ups in Italy

Finance is an essential component for start-up growth and it may take two main forms: external equity or debt. Innovative start-ups with high growth potential – but also facing higher risk – are generally considered to be more suited to seek equity financing rather than debt (Cosh et al., 2009), mainly through venture capital investments. However, as will be discussed in the following, the venture capital market in Italy is still underdeveloped. This therefore leads to the discussion of whether debt could be a suitable alternative in the Italian context, an issue which is summarised in Section 5.2.4.

While these considerations only involve the supply side of financing, demand side factors may also play a role. For instance with reference to the role of entrepreneurial cognition in financing/investment decisions (Fraser, Bhaumik, and Wright, 2015; Wright and Stigliani, 2013), entrepreneurs may not be able to properly assess the pros and cons of different opportunities. This may be particularly binding in a country like

Italy that is characterised by relatively low levels of financial education (OECD 2017b; Guiso and Viviano, 2014). Cognitive biases may change over time as the entrepreneur gains experience (Fraser and Greene, 2006).

Related to that, it can be conjectured that a possible reason for the lack of venture capital in Italy is a different perception and pricing of risk, relative to other industrialised countries. The venture capital market builds on the high-risk / high-return combination, and its targets are therefore to be found in the group of very risky start-ups. If Italy had a comparative disadvantage in risky economic activities, then highly mobile financial resources would target other economies, and the relative share of less risky forms of (debt) funding would be higher. The hypothesis of a relative "specialisation" of Italy in debt finance, rather than in equity, is supported by the data. The debt-to-equity ratio of non-financial corporations has historically been higher in Italy than in most OECD countries (Pisu, 2017).

Why would Italy suffer from comparative disadvantage in risky economic activities? The following factors may all play a role: weak contract enforcement; a low level of interpersonal trust; policy uncertainty; and fundamental risk aversion. The negative effects of weak contract enforcement, for instance, can be particularly relevant for VC deals, which typically 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). In particular, this could be particularly deterring for foreign investors, who are not endowed with the necessary "relational capital" to compensate for weak contract enforcement, and for which information asymmetry is higher. For instance, an influential paper by Lerner and Schoar (2005) analyses a sample of 210 developing country private equity investments to find that investments in weak enforcement countries have a lower performance. This is partly due to the fact that investors in countries with more effective legal enforcement rely on specific contractual forms that shift control rights depending on the performance of the investment and enable investors to separate cash flow and control rights, which proves to be beneficial for both entrepreneurs and investors.

More generally, weak contract enforcement and lengthy and unpredictable judicial procedures imposes an extra-cost on risk (Calvino, Criscuolo, and Menon, 2016), especially for contract-intensive activities (Nunn, 2007). This can be further exacerbated by the relatively low level of interpersonal trust and social capital that characterise the Italian population (Guiso, Sapienza and Zingales, 2010). This has been shown to be relevant, for instance, for angel investments (Ding, Au, and Chiang, 2015). Political uncertainty and frequent policy reversals may be another factor that negatively affects risk pricing in Italy. As all these factors determine a more uncertain economic environment, entrepreneurs may choose to specialise in less risky industries, and to develop a governance structure that reduces risk at the expense of growth, such as family owned and managed firms (Michelacci and Schivardi, 2011). Another reason could be the low risk propensity of the Italian population and economic actors (Consob, 2017), which may create a difficult environment for the growth of innovative and risky start-ups. Combined with the conservativism of Italian consumers (Rubera, Ordanisi, and Griffith, 2011), it may also reduce the domestic market potential for innovative products.

It is therefore not surprising that large business groups in Italy are unlikely to acquire start-ups and to invest in start-up equity at early stage (corporate VC). One way in which policy makers could try to increase successful exit opportunities for start-ups

would be to provide tax breaks to large corporations for acquiring domestic start-ups. However there does not appear to be many examples of countries adopting this approach, and there are also possible side effects to be taken into account. While under certain circumstances acquisitions can increase competition, start-up acquisitions may also limit competition between incumbents and start-ups thereby reducing firm dynamism and potentially productivity growth (OECD, 2017; Federgruen and Pierson, 2011).

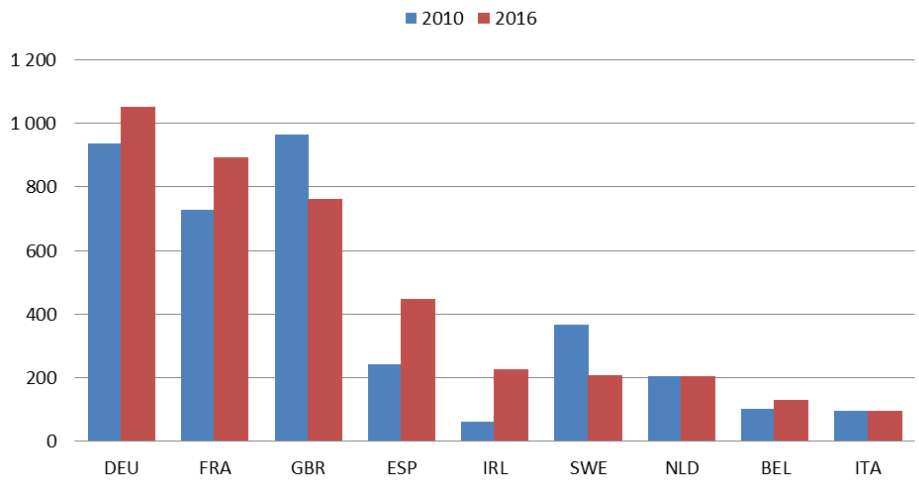
5.2.1. A venture capital market still in its infancy

A key component for innovative start-ups to thrive is a dynamic venture capital (VC) market. While only a tiny fraction of new firms receive VC funding, VC-backed companies have been shown to be responsible for a major contribution to economic growth over their life cycle. According to estimates by Strebulaev and Gornall (2015), while VC funds invest in only around 0.3% of new U.S. businesses, 43% of U.S. public companies founded between 1979 and 2013 are VC-backed, and they account for 82% of the total research and development (R&D) expenditure of public companies founded in the same period. Similarly, Puri and Zarutskie (2012) calculate that the amount of employment generated by VC-backed firms accounts for nearly 10% of employment creation in the United States in the late 1990s and early 2000s, steadily rising from about 5% in the 1980s. The emergence of industries such as semiconductors, biotechnology, and the internet, as well as the introduction of several innovations across a spectrum of sectors, has been driven in large part by VC investments (Kerr, Nanda, & Rhodes-Kropf, 2014). Recent evidence for Italy (Bronzini, Caramellino and Magri, 2017) shows that start-ups financed by venture capitalists experience a faster growth in size and become more innovative, compared to a control group of start-ups rejected by VC at the very last stage of the screening process. VC-backed firms also show a much larger increase in equity and a reduction in their leverage.

The following section provides an overview of venture capital activities in Italy, in comparison with other large European economies. Figure 7 illustrates that the value of investments (millions USD) are considerably different across countries. It should be noted, however, that the value of VC investment excludes VCs from corporations, which will be assessed in the following of the Section. In 2016, firms operating in Germany and France received the greatest amount of VC in the sample, roughly USD one billion and USD 894 million, while the Netherlands, Belgium, and Italy only received USD 204, USD 130 and USD 96 million in VC financing, respectively.[13] In relative terms, Italy receives the least amount of VCs as a proportion to GDP. e.g., in France, the percentage of VC investment to GDP is more than six time larger than in Italy (0.03% vs. 0.005%). From 2010-16, Germany, France, Spain and Ireland experienced an increase in the value of VCs, while the UK and Sweden witnessed a marked decline. Italy however saw little change in VC financing over the last six years.

Figure 7. Venture capital investments

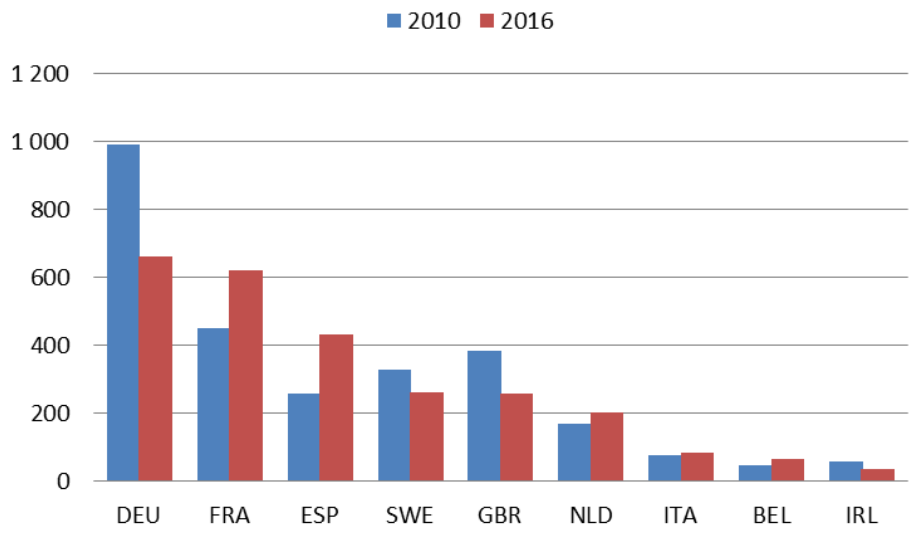
USD million nominal, 2010 and 2016



Note: Venture capital investment includes only venture capital investments (seed, start-up and later stage) by formal fund managers including private equity funds making direct private equity investments, mezzanine private equity funds, co-investment funds or rescue/turnaround funds; investments by business angels, incubators, infrastructure funds, real estate funds, distress debt funds, primary funds-of-funds or secondary funds-of-funds are excluded; the investment amount only captures the equity amount that is invested by formal fund managers and not the value of the entire financing round. Growth capital or buyout investments in current or formerly venture capital-backed companies are also not included. Venture capital from the public sectors is also excluded.
Source: OECD, 2017a.

It is also informative to assess changes in the number of VC deals over this period to complement the picture provided by investment amounts. Figure 8 illustrates considerable differences in the number of VC-backed companies across and within countries overtime. Similar to the figure above, the statistics do not include firms which are backed by corporate VCs. Germany and France are the countries with the highest number of VC-backed companies, where the former experienced a decrease in the number of contracts and the later saw an increase. Both Spain and Italy witnessed an increase in the number of firms backed by VCs but Spain is markedly outperforming Italy in both periods.

Figure 8. Number of venture capital-backed companies



Note: Venture capital-backed companies (portfolio companies or investee companies) are new or young enterprises that are (partially or totally) financed by venture capital.
Source: OECD, 2017a.

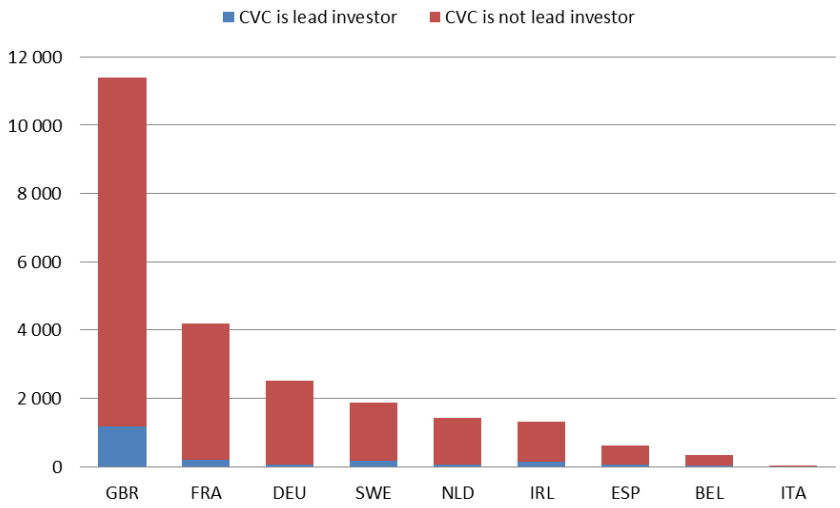
Another important source of VC funding comes from corporations. Using data from Crunchbase, the paper next assesses the extent to which corporations are providing financial support in the form of VCs to the same set of countries. In particular, Figure 9 illustrates the total amount of corporate VC funding (millions USD) between 2007 and 2016 and accounts for whether the corporate backer is a lead investor or not. The UK is clearly the largest recipient of corporate VC funding receiving roughly USD 11.3 billion, USD 1.2 billion of which the corporate backer is the lead investor. Out of the sample, Italy receives the least amount of corporate VC funding (USD 40 million) and there are no cases where a corporation is lead investor. In comparison, Spain receives more than 10 times more corporate VC financing (USD 580 million), of which USD 50 million are invested in deals where a corporation is lead investors.

The number of corporate VC deals is also considerably different across countries (See Figure 10), and Italy again ranks at the bottom of the sample. Italy's USD 40 million in corporate VC funding went to only two firms, while in Spain they went to 76 firms, eight of which the corporation was the lead investor.

Summing up, the size of the Italian VC market is still very small and there is not a clear upward trend. As documented elsewhere in this report, this seems to depend more on the demand of innovation, rather than on the supply. Investors do not foresee high returns because the final internal market for the start-up output is inadequate. In addition, further elements may hamper VC investments, particularly those originating from foreign investors. As discussed earlier, judicial proceedings which deal with enforcement of contracts and resolving bankruptcy are considerably less efficient in Italy than in other highly developed economies making firms in Italy less attractive to investors.

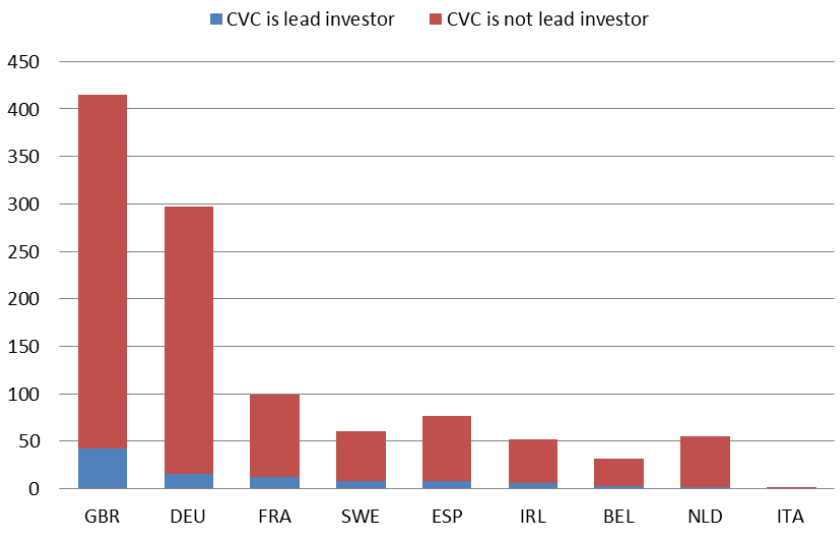
Figure 9. Total amount of corporate VC funding

USD million nominal, total values 2007-16



Note: The amount of VC funding refers to the total amount of funding received for each country between 2007-16 from the following sources: angel business, private equity, seed funding, secondary market and venture capital. Country refers to the location of the start-up and not the investor.
Source: Calculations by authors based on Crunchbase data (www.crunchbase.com).

Figure 10. Number of deals with corporate VC investors



Note: The amount of VC deals refers to the number of investment deals received for each country between 2007-16 from the following sources: angel business, private equity, seed funding, secondary market and venture capital. Country refers to the location of the start-up and not the investor.

Source: Calculations by authors based on Crunchbase data (www. crunchbase.com).

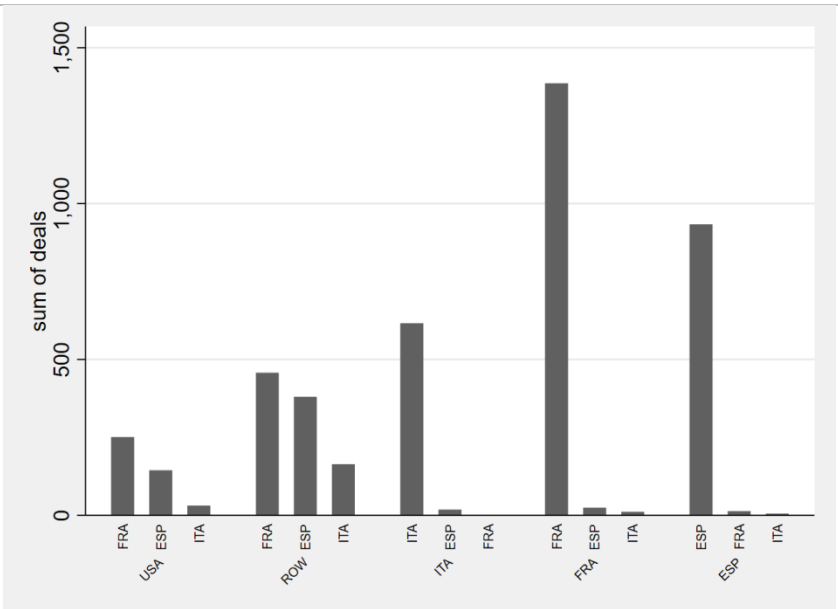
5.2.2. Who are the venture capital investors in Italian start-ups?

Since the VC market in Italy is considerably smaller in comparison to other neighbouring economies, it is insightful to explore in greater depth the sources of venture capital investments and how they differ relative to a similarly sized economy. Figure 11 illustrates both the number of deals and the amount of VC received by start-ups in Italy, France, and Spain from domestic investors, or from the United States and the rest of the world, over the period 2010-16. Not surprisingly, French, Italian, and Spanish investors invest more in firms based in the same country. However, French and Spanish investors are investing considerably more in their domestic firms, both in terms of the number of deals and value. Moreover, firms in France – and, to a lesser extent Spain (despite the smaller economy size) - attract more investment from the United States and the rest of the world than Italy, further illustrating the disparities in the size of the VC markets in these respective countries.

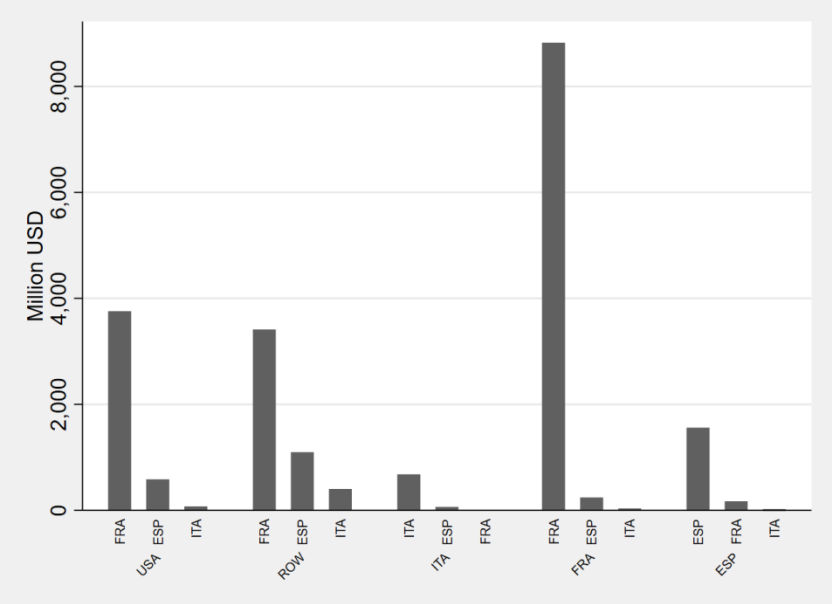
In order to further qualify the sizeable difference in invested amounts across the three countries, Figure 12 groups the amount invested and the number of deals by type of investor. France and Spain, in comparison to Italy, received more VC support (both in number of deals and amount) from all types of investors, particularly venture capital firms, private equity investors, and individuals (with the exception of government VC, for which Italy show a slightly higher value than Spain).

Figure 11 Venture capital activities by start-up and investor country

Panel A: Number of deals



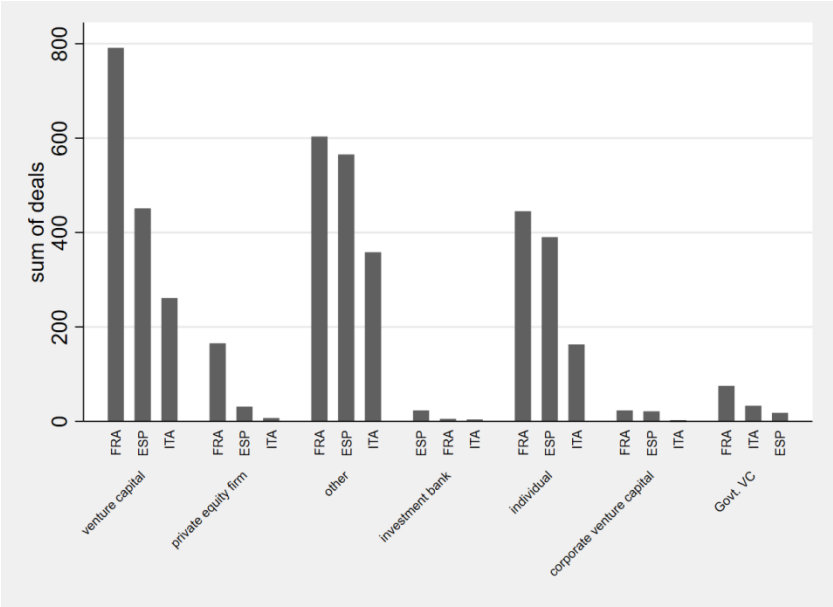
Panel B: Investment amount



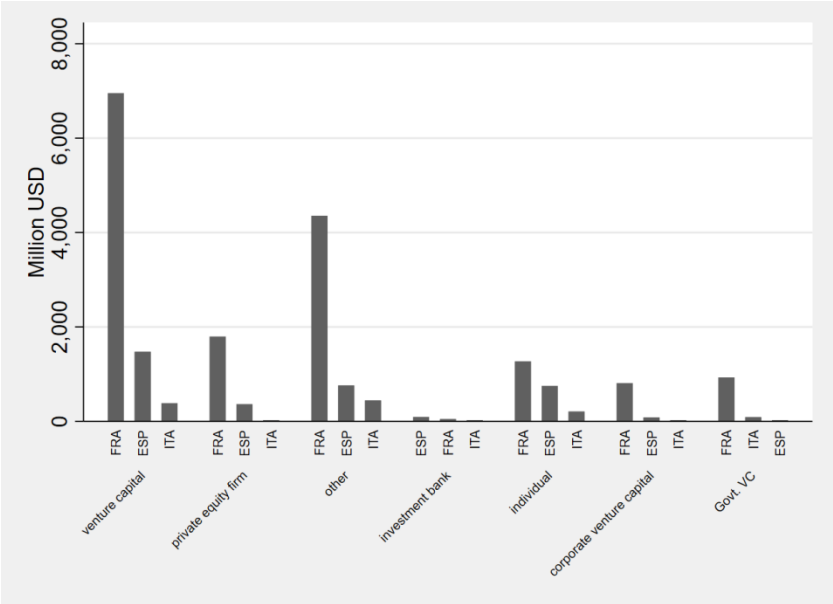
Note: The graph shows the total number of deals or USD amount invested in French, Spanish, and Italian start-ups by US, French, Spanish, Italian, and rest of the world investors. E.g., the first bar reports the investment by USA investors in French start-ups. Aggregated values over the period 2010-16.
Source: Calculations by authors based on Crunchbase data (www.crunchbase.com).

Figure 12. Venture capital by investor type for Italy and France, number of deals and values

Panel A: Number of deals



Panel B: Investment amount



Note: The graph shows the total number of deals or USD amount invested in French, Spanish, and Italian start-ups by different investor types. E.g., the first bar reports the investment by VC investors in French start-ups. Aggregated values over the period 2010-16. For the definition of government VC see Breschi et al., Forthcoming.
Source: Calculations by authors based on Crunchbase data (www.crunchbase.com).

5.2.3. Government venture-capital: opportunities and risks

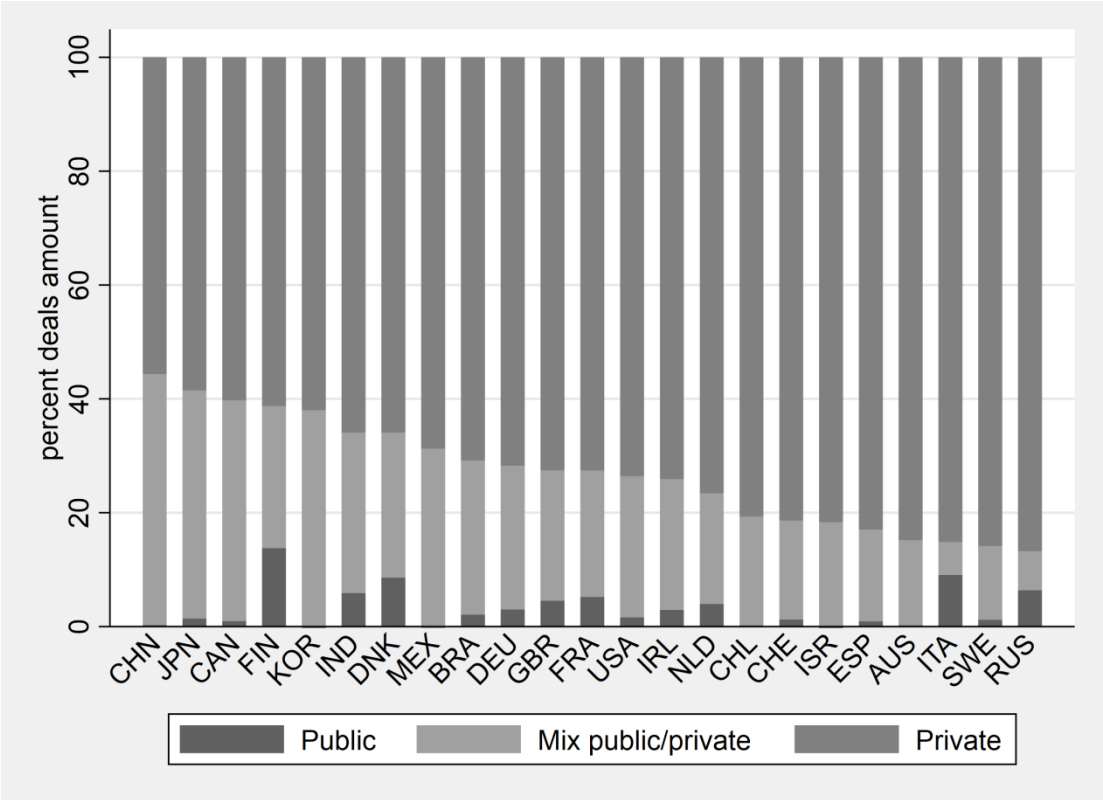
Confronted with the relatively small size of the venture capital market in Italy and in Europe, some observers advocate for a stronger role for governments as investors in high-risk equity assets of innovative start-ups, pointing also to "success stories" in other OECD countries.[14] Government intervention in the VC market is justified by the existence of market failures of the private VC market. Indeed, innovations introduced by VC-backed start-ups may bring about important social benefits, often exceeding private ones. Given the public good nature of innovations, start-ups are likely to be underfunded compared to the welfare-maximising level of funding. This is particularly true for young firms developing innovations which take longer to get to market, or those that generate further social benefits (e.g. inclusive start-ups, start-ups developing green technologies, start-ups in the health sector). Additionally, government venture capital initiatives can target companies for which they have informational comparative advantage (e.g. in the sectors of health and defence) and signal start-up quality to traditional investors (Lerner, 2002).

However, there are also some important risks associated with government VC investments. For instance, government VC may displace private investments if they are targeting the same kinds of start-ups (Brander, Du and Hellman, 2015). Leleux and Surlemont (2003) provide evidence against the "crowding-out" hypothesis: across countries, government VC funding seems to cause greater amounts of money to be invested as a whole, both at the industry and firm level. However, it should be noted that studies of the Canadian case find evidence for the crowding-out hypothesis (Cumming and MacIntosh, 2006; and Brander, Egan, and Hellman, 2010). Another possible risk associated with government VC is an excessive evaluation of start-ups at early stage, where public intervention is mostly concentrated, although to the best of the authors' knowledge there is not empirical evidence on that yet. This in turn would make it more difficult for start-ups to raise funding at later investment stages.

The evidence on the impact of government VC on firm performance is still quite limited, and conclusions are mixed. Private VC-backed companies appear to perform better than public VC-backed companies in terms of total investments and successful exits (Brander, Du and Hellman, 2015), innovation output (Bertoni and Tykvová, 2015), sales and employee growth (Grilli and Murtinu 2014). These studies also show that the form of investment associated with the best companies' performance consists in heterogeneous syndicates composed of both public and private investors.

Some preliminary statistics extracted from Crunchbase allow for the quantification of the incidence of government VC across countries.[15] Figure 13 shows that in Italy the share of VC invested in deals in which all investors are public, or in which the investors are a syndicate of public and private entities, is rather low in the international comparison. Also considering that the absolute value of aggregate VC investment in Italy is significantly lower than in most other countries, this might suggest that there is some room for further increasing the public investment in VC. However, this could be risky if the increase in government VC is not accompanied by complementary measures aimed at streamlining access to the domestic and foreign market for innovative Italian start-ups. Otherwise, a surge in public investment may lead to an increase in early-stage evaluation of funded start-ups that would not correspond with commensurate growth prospects.

Figure 13. Amount of VC investment by type of investor



Note: see Breschi et al. (Forthcoming) for further details on the classification of government VC investments. Data are preliminary.
Source: Authors' elaboration on Crunchbase data (www.crunchbase.com).

5.2.4. Is debt compensating for the scarcity of equity?

Is debt, rather than equity, the most suitable source of funding for Italian innovative start-ups? By way of introduction it is important to highlight that the economic literature is quite unanimous in underscoring the advantages of equity financing, compared to debt, for young innovative companies.

Equity is considered to be "patient" capital, which can be used to support long-term development plans, without imposing the burden of interest rate and debt repayment on nascent businesses. In particular, venture capital (VC) is generally considered as the most appropriate source of external financing for innovative start-ups (Sahlman, 1990; Gompers & Lerner, 2001; Kaplan & Strömberg, 2001; Denis, 2004). VC investors are specialised in scouting the best investment opportunities; provide mentorship and advice; keep owner-managers under pressure giving them correct incentives to exert effort and consequently alleviate possible opportunistic behaviours; and, provide a network of business contacts (Hellmann and Puri, 2002; Gompers and Lerner, 2004; Ueda, 2004). The positive signal that access to external VC financing conveys to outsiders also makes it easier for innovative start-ups to team up with other firms that possess complementary resources and capabilities (Colombo et al., 2006; Hsu, 2006). Furthermore, the backing of venture capitalist firms act as a signal of the quality of a

new venture (Brav & Gompers, 1997; Brav & Gompers, 2003; Carter & Manaster, 1990; Stuart, Hoang, & Hybels, 1999).

There is clear evidence that in the United States, where the VC market has been operating at large scale for at least two decades and therefore the middle- and long-term repercussions on the economy can be assessed, VC-backed firms have represented the backbone of the disproportionate contribution of start-ups to job creation, innovation, and productivity growth. For instance, Puri and Zarutskie (2012) calculate that the employment generated by VC-backed firms accounts for nearly 10% of employment in the United States in the late 1990s and early 2000s, steadily rising from about 5% in the 1980s. Beyond financial backing to entrepreneurs, there is also evidence that VC investors help recruit talented managers, formulate new strategies, and use their networks to garner resources for the company (Gompers and Lerner, 2004). After closing a VC deal, start-ups typically experience sales growth, initial public offerings, and acquisitions (e.g., Arikan and Capron, 2010; Gulati and Higgins, 2003; Lee, Lee, and Pennings, 2001; Ozmel, Reuer, and Gulati, 2013; Pollock and Gulati, 2007; Ragozzino and Reuer, 2011). Hellmann and Puri (2000 and 2002) show that VC backed companies aim at more radical innovations, are significantly faster in introducing their products to the market, and pursue more aggressive market strategies than other start-ups.

The economic literature also lists several reasons why debt may not be the most appropriate source of financing for innovative start-ups. First, innovative start-ups are generally too risky and failure rates are too high to suit banks' lending portfolio (Coad and Rao, 2008); they often rely on intangible assets, that hardly can be used as collateral for lending (O'Sullivan, 2005); and, as mentioned above, they need money for the long run, and they do not typically generate revenues early enough to pay the interest rates and to refund the loan.

However, some Italian specificities need to be taken into account. Italian firms have traditionally been more reliant on bank debt than in other European countries (European Central Bank, 2013). This in turn contributes to explain the underdevelopment of the equity financial market, on both the supply and demand side. External equity injections are a much rarer event in Italy than elsewhere, even for the most successful firms; innovative start-ups are not an exception in terms of source of financing. This does not imply that the policy makers should not address the issue, nor that debt is more suitable for innovative start-ups in Italy than elsewhere. However, it may explain why the share of high-potential innovative start-ups that rely on debt financing rather than on equity is higher than expected, despite the incentives provided by the "Start-up Act".

Among the 9 314 innovative start-ups that ever transited in the innovative start-up registry (thus including also those that lost the status or ceased activity) as of July 2017, 1 282 of them received at least one bank loan backed by the public guarantee fund (Fondo di Garanzia), for a total of 1 971 loans of a median amount of EUR 88 000, and a median length of 60 months. The default rate is extremely low, less than 1%, but this is also due to the fact that only 10% of the loans had reached maturity.

5.2.5. Promising recent developments: peer-to-peer lending and crowdfunding

While traditional sources of debt and equity are essential sources of finance for start-ups, there are a number of new digital platforms on which firms can also raise funds, such as peer-to-peer lending and crowdfunding. Crowdfunding refers to the practice of raising outside financial support from a large number of actors, as opposed to several

specialised investors (such as individuals, banks and/or corporations), where each actor gives a small portion of the funding requested (OECD, 2015). In general crowdfunding is classified according to three different categories: donations, reward based, lending and equity (Vulkan et al., 2016).

Crowdfunding has continued to grow in popularity since the middle of the 2000s. Anecdotal evidence also suggests that these types of finance may offer new lending opportunities to start-ups and SMEs. The use of crowdfunding as an alternative source of finance for SMEs has therefore attracted some interest from policy makers in recent years (OECD, 2015). It is also important to note however that these financial services appear to serve specific projects rather than a business, and may therefore not be always a reliable source of finance.

Nevertheless, over time, crowdfunding has become an alternative source of funding across many other sectors, and it is increasingly used to support a wide range of for-profit activities and businesses (Catalini et al., 2016; Vulkan et al., 2016; Beauhurst, 2015). There are also other opportunities from crowdfunding (particularly in the form of gifting and loans), since individuals looking to invest small sums are becoming increasingly more induced to crowdsourcing due to a higher expected return on their investment in comparison to interest earned from a savings account (Belleflamme et al., 2013). Moreover, as of May 2016 the pool of potential investors in the USA has increased dramatically since the passage of Title III of the Jobs Act which allows firm entrants to obtain funds from any individual for shares through online platforms (Ivanov and Knyazeva, 2017).

At the same time, there are a number of issues which may hinder the effectiveness of crowdsourcing as an alternative to traditional sources of finance. While advances in online systems improve transparency of an investment, it is not always easy to assess the quality of a potential deal (Tomboc, 2013).The start-ups, themselves may try to influence the perceived quality of the investment online by being the first one to invest in their own project (Franzoni et al., 2014). In addition, unlike more formal sources of investments which can exhibit influence control on the way in which the firm is run (Lane, 1993), and provide a host of entrepreneurial expertise (Hellmann and Puri, 2002; Gompers and Lerner, 2004; Ueda, 2004) funders within peer-to-peer models tend to have on average less business expertise.

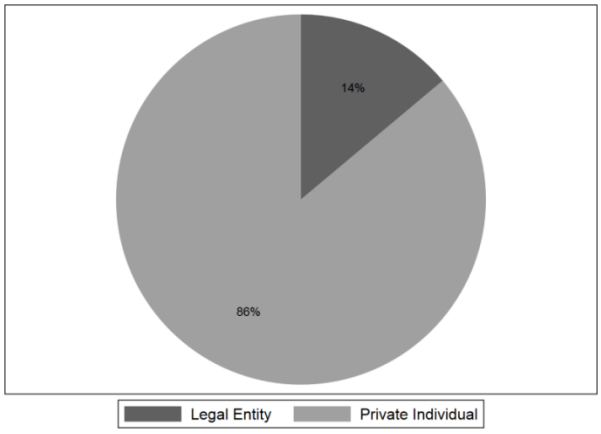
5.3. Characteristics of the equity investors

In addition to the ability to link the survey data with balance sheet information, the richness of the data collected in the survey enables one to assess a range of different characteristics of equity investors – both founding investors and those who join with later equity acquisitions – and how they are engaging with start-ups. These includes the average number of investors by start-up, what types of financiers are in the sample, geographic proximity between investors and firms and so on. In addition we can also examine the kinds of start-ups that serial investors are targeting such as their sector, region and whether there are performance differences between start-ups supported by serial investors in comparison to non-serial investors.[16]

Out of all the financiers backing start-ups registered in the policy (thus including founding partners), 86% are private individuals and 14% are legal entities (see Figure 14). On average, each start-up has 3.59 investors who are private individuals and 0.58 that are legal entities. In terms of the proportion of share capital provided, funds are

also more likely to come from private individuals than legal entities, roughly 84% and 15%, respectively. Individuals are clearly the main source of investment however variation across start-ups does exist, as illustrated in Table 9.

Figure 14. Types of equity investors



Note: The figure refers to the proportion of investors who are legal entities or private individuals which supported participants in the Italian "Start-up Act".
Source: Authors' calculation on MISE data.

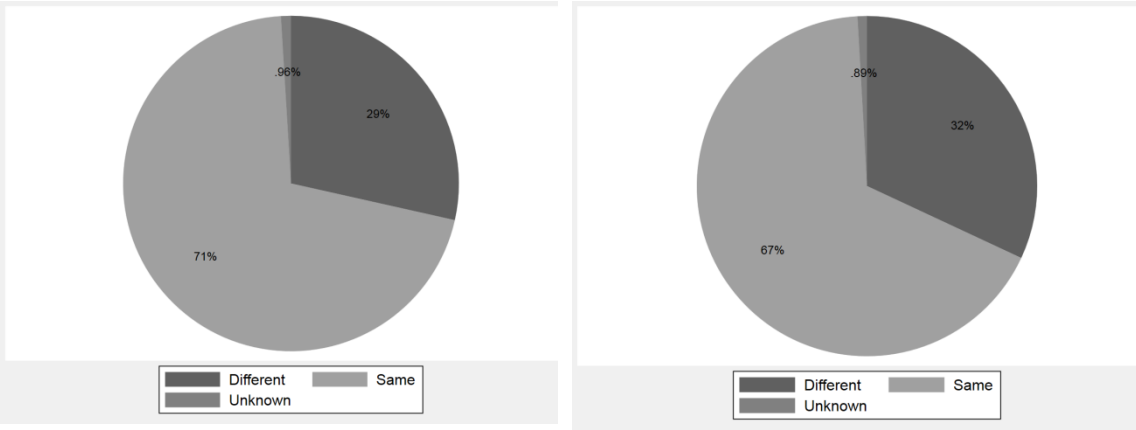
Table 9. Average number of equity investors and share of ownership by type

	Mean	Median	SD	Max	Min
Count					
Private individual	3.59	2	12.89	774	0
Legal Entity	0.58	0	1.34	37	0
Unknown	0.03	0	0.21	6	0
Share					
Private individual	84.32%	100%	29.84	100%	0%
Legal Entity	14.96%	0%	29.12	100%	0%
Unknown	0.72%	0%	7.19	100%	0%

Note: The following table provides sample statistics on the number and share of equity investors supporting policy entrants.
Source: Authors' calculation on MISE data.

Most founders and investors belong to the same territory in which the start-up is located. For example, 71% of equity investors come from the same municipality as the start-up. This is consistent with the regional similarities between employees and start-ups where the majority of these parties are located within the same regions, 67% coming from the same municipality (Figure 15).

Figure 15. Share of partners (left) and employees (right) residing in same municipality as start-up



Note: The above figure illustrates the share of partners (on the left) and employees (on the right) that reside in the same municipalities as the start-up participants. Unknown refers to instances where information regarding the municipality of the partner or employ is absent from the survey.
Source: Calculations by authors based on MISE data and Survey MISE.

Investment characteristics are considerably different across financiers. While many investors in the dataset invest in only one start-up, there are some that actively support multiple firms. It should be noted that amongst all the investors in the policy, much less than 1% (0.37%) own a majority stake in more than one start-up. Serial financiers are thus more the exception than the rule. Serial partners may be more experienced in identifying successful start-ups and therefore may be targeting particular types of firms. Understanding the characteristics of firms which benefit from the support provided by serial investors, as well the characteristics of the investors themselves, may therefore be informative. In the following, the characteristics of the top 10 serial partners are inspected, looking also at the types of start-ups that they support.

Table 10 illustrates that much of their support appears to be concentrated within a few industries: four sectoral classifications accounts for more than 62% of these start-ups. A majority of the start-ups supported by serial investors are involved in scientific and/or IT related fields; in particular *computer programing, consultancy and related activities*, 21.78% in *scientific, research and development*, 21.78% in *other professional, scientific and technical activities, 9.90% and in information services, 8.91%*. Furthermore, investors appear to target the same sectors in which they also operate – predominantly the professional, scientific and computer related sectors. Conversely, only 0.99% of serial investors are in the finance and insurance sectors, which is consistent with the low proportion of firms in Italy who receive VC funding. Interestingly, the sectoral coverage of serial investors is quite similar to non-serial investors, particularly amongst the top five most supported industries.

Table 10. Sectors serial investors are targeting vs non-serial investors

ISIC	Sector	Percent of Serial Investors	Percent of Non-Serial Investors
62	Computer programming, consultancy and related activities	21.78	32.23
72	Scientific research and development	21.78	15.99
74	Other professional, scientific and technical activities	9.9	2.95
63	Information service activities	8.91	9.13
1	Crop and animal production, hunting and related service activities	6.93	0.31
26	Computer, electronic and optical products	4.95	3.62
35	Electricity, gas, steam and air conditioning supply	4.95	1.52
27	Electrical equipment	2.97	1.70
28	Machinery and equipment n.e.c	1.98	3.05
32	Other manufacturing	1.98	1.42
82	Office administrative, office support	1.98	1.93
2	Forestry and logging	0.99	0.11
20	Chemicals and chemical products	0.99	0.64
29	Motor vehicles, trailers and semi-trailers	0.99	0.49
30	Manufacture of other transport equipment	0.99	0.89
38	Waste collection	0.99	0.45
41	Construction of buildings	0.99	0.30
43	Specialised construction	0.99	1.04
58	Publishing activities	0.99	2.10
61	Telecommunications	0.99	0.46
64	Financial service activities, except insurance and pension funding	0.99	1.22
66	Activities auxiliary to financial service and insurance activities	0.99	0.07
88	Social work activities	0.99	0.26
O	Other	0.00	18.12

Note: The above table refers to proportion of start-ups by sector that received finance from a serial investor. The sectoral classification is ISIC rev.4.
Source: Calculations by authors based on MISE data and the start-up registry.

Another important question is whether the types of firms supported by serial investors exhibit greater performance potential than firms that are supported by non-serial investors, such as differences in average output, employment and amount of share capital they receive. Additional information on whether the firm operates in the energy sector, whether they are predominantly young, employ females in addition to how they qualified into the start-up programme is also assessed below. Although these measures are not perfect proxies for future performance, they provide insights into the types of start-ups these partners are investing in.

Interestingly, the data suggest that overall serial investors are supporting firms that are smaller both in terms of output and employment (see Table 11). In addition, the firms these partners are investing in receive less share capital than other firms in the sample. At the same time, Table 12 illustrates that serial investors are much more likely to invest in firms that operate in the energy sector and who own a patent. This is consistent with the fact that serial investors are targeting mostly firms in research, scientific and IT related sectors.

Table 11. Size dimensions of start-ups supported by a serial investor or a non-serial investor

Variable	Mean	Median	SD	Min	Max
Start-ups owned by serial investor					
Output	71 378	3 659	216 105	0	1 715 244
Share Capital	47 269	10 000	247 957	100	2 479 000
Employment	4	3	3	1	10
Start-ups owned by non-serial investor					
Output	121 161	22 343	336 105	-13 094	6 532 759
Share Capital	145 481	10 856	969 445	1	42 200 000
Employment	5	3	8	0	136

Note: This table compares sample statistics of entrants supported by serial investors to those supported by non-serial investors. Output and share capital are reflected in EUR.
Source: Authors' calculations based on MISE data and the start-up registry.

Table 12. Start-up characteristics, supported by a serial investor or a non-serial investor

Variable	Owned by serial investor	Owned by non-serial investor
Energy sector	24%	17%
Female	13%	19%
Young	25%	36%
Foreign	0%	4%
R&D	53%	60%
Degree	10%	32%
Patent	39%	22%

Note: This table compares start-up characteristic of entrants supported by serial investors to those supported by non-serial investors. Output and share capital are reflected in EUR.
Source: Authors' calculations based on MISE data and the start-up registry.

6. The Italian innovative start-ups: descriptive evidence

6.1. A snapshot of the start-ups registered in the policy

The following section presents some simple descriptive statistics on start-ups that participated in the "Start-up Act". The reader should note that a detailed description of the information contained in the register is published each year by MISE in its report to the Italian Parliament (see e.g. MISE, 2014, 2015, 2016 and 2017). The analysis is based on a snapshot of the start-up business registry dataset in May 2017, which covers the period from October 2012 to April 2017. In total the data contains 7 044 entities operating throughout Italy, with the majority of firms concentrated in the north of the country. The average firm has three employees, an output of EUR 123 131, share capital worth of EUR 52 528 and are 112 days old at the time of entry into the policy (see Table 13). While there is considerable variation in the output, share capital and age between firms, there is less difference across start-up employment.

Qualifications for entering into the programme require the start-ups to either invest considerably in R&D (at least 15% of companies expenditures), have a high level of human capital (at least 1/3 of employees have or are obtaining a PhD or 2/3 of workers hold a Master's degree), or own intellectual property (holder, depositary and/or licensee of a registered patent or owner and author of registered software). Most start-ups (63%) qualified into the programme due to their investment in R&D whereas 28% and 19% were eligible because of their education levels and patenting activities, respectively (see Table 14). At the time of entry, 91% of start-ups fulfilled one qualification while (although not necessary for entering the policy) only 2% of firms declare to satisfy all three requirements. However, start-ups have no incentive to declare to meet more than requirement, even if this is actually the case, therefore these percentages are not necessarily informative of their real situation.

Table 13. Descriptive statistics of start-up participants

Variable	Mean	Median	SD	Max	Min
Output	123 131	22 510	355 343.00	1 627 459	0
Employment	3	2	5.32	19	1
Share Capital	52 528	10 000	584 780.80	700 000	1
Age	3.73	0.78	7.76	37.5	0
Output	123 131	22 510	355 343.00	1 627 459	0

Note: Age refers to the number of months from incorporation. Output and share capital are reflected in EUR.
Source: Authors' calculations based on the start-up registry

Table 14. How start-ups qualified into the programme

Qualification	Percent
R&D	63%
Degree	28%
Patent	19%
1 Qualification	91%
2 Qualifications	7%
3 Qualifications	2%

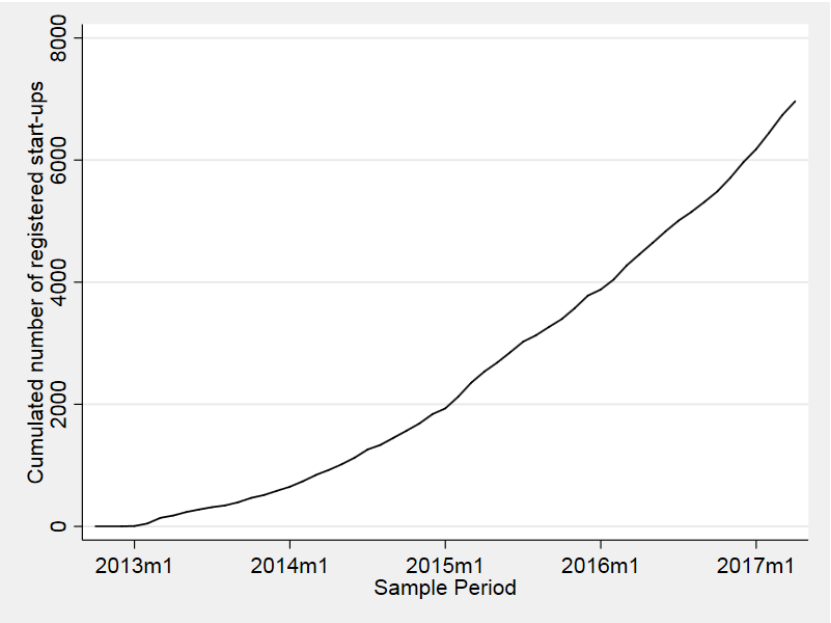
Note: The following table illustrates how entrants qualified into the programme, either by R&D activities, percentage of employees with Masters, PhDs or researchers, and/or patenting experience. Please refer to Section 1.1 for additional discussion on the qualifications of the Italian "Start-up Act". The table able also lists the proportion of firms who qualified for one or more of the classifications.
Source: Authors' calculations based the start-up registry.

6.2. Enrolment into the policy

From October of 2012 until early 2017, there has been a constant and steep increase in the number of entrants participating in the Italian "Start-up Act". As illustrated in Figure 16, participation started off relatively slowly and picked up considerably from 2014. This trend is further demonstrated in Figure 17, which demonstrates that the number of monthly subscriptions into the policy is increasing over time.

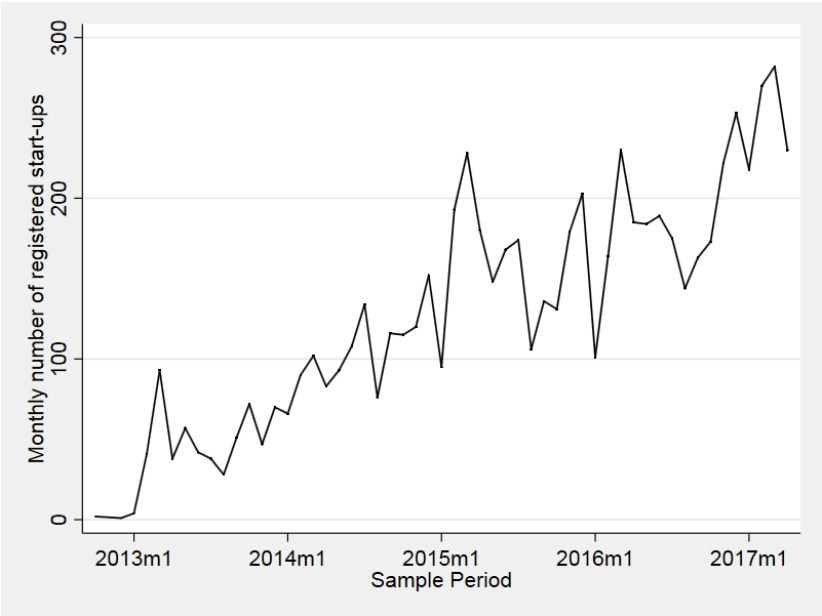
Slow uptake at the beginning might be partially explained by the lack of awareness of the policy by qualified entrants throughout the country. For example, according the results of the MISE-ISTAT start-up survey, one of the main ways in which firms heard about the policy was through their accountant.

Figure 16. Total number of registered start-ups, 2013-17



Note: This figure shows the monthly accumulation of start-up participants into the Italian "Start-up Act" from October 2012 to April 2017, excluding those that abandoned the policy.
Source: Authors' calculations based on the start-up registry.

Figure 17. Number of start-ups registering into the policy by month



Note: This figure shows the number of monthly entrants into the Italian "Start-up Act" from October 2012 to April 2017, excluding those that abandoned the policy.
Source: Authors' calculations based on the start-up registry.

6.3. The appreciation of different policy instruments and its correlation with start-ups' growth

As described in Section 2, the Italian "Start-up Act" encompasses 19 different instruments, which are somewhat heterogeneous in nature. The survey administered by MISE in 2016 asked the start-ups' managers to declare, for each instrument, whether they were aware of its existence, whether they used it, and what was their appreciation of the instrument, on a scale from zero to five. While these questions were not answered by all survey respondents, [17] they are extremely useful to have an indication of the different perceived usefulness of the several instruments covered by the policy framework.

For each policy tool, Table 15 reports the share of companies that declared themselves to be aware of the measure and have used it.[18] The reduction of registration fees appears to be the most popular instrument, with 63% of start-ups declaring having benefited from it. The *ad hoc* regulations on flexible corporate structures, investment incentives, and the guarantee fund for SMEs are also relatively popular, with a take-up ratio of 25%, 19%, and 18%, respectively. The remaining instruments however are used by less than 15% of respondents.

Table 16 shows that the take-up of the different instruments is distributed quite evenly across companies, with a rather weak correlation across the different instruments, with few exceptions. Table 17 finally, shows the correlation of the appreciation of each instrument with the growth rate of the following balance-sheet variables: revenues,

assets, value added, total wage bill, and intangible assets. A positive and significant coefficient means that the start-ups with a relatively higher growth rate tend to indicate more frequently that they use or know about the instrument, or, symmetrically, that low-growth start-ups tend not to be aware about that policy instrument. Conversely, a negative coefficient implies that the association is reversed, i.e., high-growth start-ups do not use or know about the given instrument, while low-growth start-ups know and use it.

The only instrument that is significantly and positively associated with all growth variables is the *R&D tax credit*. Conversely, the use of *financial loss assistance* is negatively associated with four outcome growth variables (all but intangible capital). Furthermore, *VAT compensation, Stock options, Investment incentives, SME fund, and Italia start-up visas* are particularly associated with growth in assets and intangible capital; while *Investment incentives, Italia start-up visas*, and again *VAT compensation* are associated with wage bill growth. While these correlations are only suggestive, as they likely reflect the endogenous choices of entrepreneurs – which in turn are based on the quality of their project –nonetheless they provide a first indication of the appreciation of the different instruments by different groups of start-ups.

Table 15. Average take-up of policy instruments

Share of respondent that declared to know and have used the instrument

Policy instrument	Mean
Start-up charge reduction	62.9%
Flexible corporate structure	25.0%
Investment incentives	18.5%
SME public guarantee fund	18.3%
VAT compensation	14.0%
R&D Tax credit	12.1%
Financial loss assistance	11.5%
Smart Start Italy	10.8%
Flexible employment contracts	9.7%
Smart Start	7.3%
CIPAQ	7.1%
no operational tests	6.8%
International services	5.9%
Stock options	4.4%
Dynamic wages	3.5%
Patent box	3.5%
Crowdfunding	1.7%
Italia start-up visas	1.0%
Italia start-up hub	0.5%

Source: Survey MISE

Table 16. Correlation between policy instruments

	Start-up charge reduction	Flexible corp. structure	Ease of recovery loss	no operat-ional tests	VAT compen-sation	Flexible empl. contracts	Dynamic wages	Stock options	CIPAQ	Invts. incentives	Crowd-funding	SME fund	Int. services	Smart Start Italy	Smart Start	Italia start-up visas	Italia start-up hub	Tax credit	Patent box
Start-up charge reduction	1.00																		
Flexible corporate structure	0.23	1.00																	
Ease of recovery loss	0.14	0.28	1.00																
no operational tests	0.09	0.18	0.38	1.00															
VAT compensation	0.11	0.20	0.30	0.24	1.00														
Flexible employment contracts	0.06	0.16	0.16	0.11	0.30	1.00													
Dynamic wages	0.07	0.11	0.13	0.07	0.16	0.28	1.00												
Stock options	0.06	0.09	0.10	0.08	0.12	0.16	0.21	1.00											
CIPAQ	0.10	0.05	0.09	0.04	0.13	0.12	0.12	0.12	1.00										
Investment incentives	0.16	0.18	0.19	0.18	0.15	0.10	0.09	0.21	0.12	1.00									
Crowdfunding	0.04	0.09	0.08	0.07	0.14	0.11	0.14	0.19	0.11	0.15	1.00								
SME public guarantee fund	0.08	0.11	0.16	0.11	0.19	0.09	0.09	0.13	0.14	0.20	0.15	1.00							
International services	0.06	0.07	0.07	0.02	0.13	0.09	0.12	0.09	0.08	0.08	0.08	0.15	1.00						
Smart Start Italy	0.07	0.10	0.07	0.01	0.12	0.09	0.09	0.11	0.12	0.08	0.10	0.17	0.08	1.00					
Smart Start	0.02	0.07	0.01	0.01	0.07	0.14	0.06	0.12	0.05	0.03	0.10	0.07	0.07	0.49	1.00				
Italia start-up visas	0.06	0.12	0.18	0.11	0.04	0.08	0.09	0.10	0.09	0.12	0.14	0.13	0.08	0.04	0.07	1.00			
Italia start-up hub	0.04	0.07	0.13	0.09	0.07	0.09	0.10	0.09	0.15	0.06	0.27	0.08	0.13	0.07	0.07	0.55	1.00		
R&D Tax credit	0.11	0.14	0.16	0.10	0.19	0.17	0.06	0.12	0.57	0.21	0.10	0.20	0.08	0.09	0.07	0.19	0.15	1.00	
Patent box	0.06	0.07	0.07	0.08	0.11	0.09	0.09	0.05	0.16	0.08	0.08	0.08	0.09	0.07	0.06	0.14	0.14	0.32	1.00

Source: Survey MISE

Table 17. Appreciation of individual policy instruments and 2016 outcome

Entrants in 2013; partial correlations calculated with OLS regressions.

Dependent variables	Revenues	Wage bill	Value added	Assets	Immat. K
Start-up charge reduction	-0.0664	-0.115	0.0609	-0.229*	-0.508***
	(0.161)	(0.183)	(0.173)	(0.125)	(0.187)
Flexible corporate structure	-0.236	-0.0307	-0.182	-0.101	-0.142
	(0.213)	(0.229)	(0.222)	(0.160)	(0.227)
Ease of recovery loss	-0.677**	-0.616*	-0.522*	-0.403*	0.152
	(0.264)	(0.334)	(0.296)	(0.231)	(0.322)
No operational tests	-0.177	-0.0795	0.508	0.110	-0.0960
	(0.305)	(0.286)	(0.332)	(0.263)	(0.324)
VAT compensation	-0.0112	0.503**	0.353	0.445**	0.787***
	(0.221)	(0.228)	(0.239)	(0.189)	(0.248)
Flexible employment contracts	0.724***	0.314	0.544**	0.0899	0.0398
	(0.225)	(0.220)	(0.223)	(0.189)	(0.250)
Dynamic wages	0.497	0.0322	0.224	0.390	-0.145
	(0.338)	(0.362)	(0.348)	(0.294)	(0.483)
Stock options	-0.622	0.285	-0.155	0.403	0.916**
	(0.424)	(0.378)	(0.478)	(0.322)	(0.411)
CIPAQ	0.730***	0.462	1.008***	0.407**	-0.233
	(0.254)	(0.285)	(0.251)	(0.207)	(0.309)
Investment incentives	0.193	0.566***	0.297	0.579***	0.841***
	(0.212)	(0.203)	(0.220)	(0.152)	(0.214)
Crowdfunding	-0.837	-2.099***	-1.736*	-0.148	0.859
	(0.635)	(0.565)	(0.992)	(0.505)	(0.628)
SME public guarantee fund	0.124	-0.0525	0.0771	0.538***	0.850***
	(0.200)	(0.224)	(0.199)	(0.147)	(0.207)
International services	-0.637**	-0.502	-0.221	-0.285	0.144
	(0.299)	(0.352)	(0.275)	(0.176)	(0.267)
Smart Start Italy	0.244	-0.0597	-0.0263	0.158	0.839**
	(0.351)	(0.357)	(0.294)	(0.256)	(0.332)
Smart Start	0.173	0.266	0.810**	0.103	-0.549
	(0.422)	(0.429)	(0.335)	(0.308)	(0.451)
Italia start-up visas	-0.735	1.956***	0.280	1.167*	2.452***
	(2.107)	(0.662)	(0.797)	(0.694)	(0.617)
Italia start-up hub	1.860	-1.056	-0.843	-1.817**	-4.044***
	(2.149)	(0.832)	(1.061)	(0.774)	(0.732)
R&D Tax credit	0.467*	0.542**	0.615***	0.465**	0.574**
	(0.239)	(0.253)	(0.225)	(0.186)	(0.265)
Patent box	-0.612*	-0.351	-0.365	-0.331	-0.343
	(0.322)	(0.288)	(0.281)	(0.223)	(0.352)
Observations	495	352	392	495	457
R-squared	0.152	0.214	0.244	0.246	0.257

Note: Fixed effects for the region, year of start-up incorporation, and year of registration in the start-up registry included in all regressions. *** p<0.01, ** p<0.05, * p<0.1. Standard errors in parenthesis.

6.4. For which start-ups is the policy the most useful? Evidence from companies registering at birth

As shown in Figure 14 and discussed in Section 4, the policy take-up was rather slow in the first months after the policy implementation. This means that a large number of eligible start-ups were not registering – therefore "leaving money on the table" given that the policy framework provides only incentives and benefits at no cost – simply because their management were not aware that the policy existed. As a result, there is substantial variation in the delay with which individual companies registered into the policy, i.e., in the difference between the incorporation date and the date of registration into the start-up registry. Most of this delay is probably due to idiosyncratic factors, especially for companies that were already operating. For instance, the survey shows that for the majority of start-ups the primary source of information about the policy is their accountant. The data also show that the diffusion of the policy over the national territory was rather scattered in the initial period, where in some areas the "word of mouth" was more pervasive than in others. Furthermore, the local chambers of commerce at the province level had to assess the mission statement of each start-up in order to validate its innovative scope, and this subjective judgement also inevitably introduced some "random" variability across Italian provinces.

However, for start-ups that were created after the policy was put in place, data on this delay may also contain useful information. For instance, it is plausible to assume that some of the companies that registered into the policy at birth (i.e., immediately after incorporation) were those for which the policy was particularly impactful – i.e., start-ups that would have not been created without the policy, and start-ups for which the policy incentives and benefits were deemed particularly important. Of course this relationship is not bijective: while it is fair to assume that the policy plays an important role for all start-ups that registered at birth, the opposite is not necessarily true, as some start-ups that would have benefited from registering at birth did not do so for the idiosyncratic reasons mentioned before. However, despite some shortcomings, this variable can provide a useful indication on whether particular groups of start-ups have found the policy framework particularly impactful.

This analysis focuses in particular on start-ups that are considered to have a wider societal impact beyond their contribution to employment and economic growth. These include start-ups founded by women, young entrepreneurs, and foreign citizens, as well as start-ups with a "social entrepreneurship" mission (*start-ups a vocazione sociale*). In order to assess whether the policy framework has also fostered social mobility, an additional indicator taken into account is whether the founders have one parent who worked as a blue collar (*operaio*). Finally, given the innovation focus of the policy and the related importance of human capital and formal education, a last relevant group is composed by start-ups founded by a PhD holder. All indicators are set equal to one if at least one founder complies with the prerequisite. The sources for these variables are the start-up register and the start-up survey. Importantly, the analysis controls for fixed effects a province level, in order to partial-out the geographical variation stemming from the discretionary decision of the local chambers of commerce on the companies' mission statement.

The results are reported in Table 18. The regressions also include province, year of birth, and sector (1-digit) fixed effects, in order to partial-out some of the nuisance factor that may affect the independent variable. The results show that registering at birth appear to be robustly correlated with the probability of having a PhD and with the

probability of having at least one foreigner founder. The latter variable loses significance in the regression in which all regressors are included (col. 5), however further tests confirmed that this is due to the restriction of the sample to those start-ups for which survey data are available.

These results therefore suggest that the policy might have been instrumental for individual with higher human capital endowment to help them start their own business. Interestingly, these results are consistent with the findings of Grilli, Mrkajica, and Giraudo (2017), who also found that the "Start-up Act" has increased the propensity of high human capital individuals to become entrepreneurs. In addition, the correlation appears to be somewhat stronger – although the difference is not statistically significant – for founders who are both a PhD holder and have a blue-collar parent. This result seems to suggest that innovative entrepreneurship may be an effective channel to leverage on human capital accumulation to foster social mobility – which is an interesting avenue for future research.

Table 18. Probability of registering at birth by type of company

Logit regressions

Dependent variables	Registered at birth					
young	0.121					0.120
	(0.090)					(0.181)
woman		0.089				0.148
		(0.102)				(0.218)
PhD			0.688***			0.668***
			(0.197)			(0.207)
parent blue collar				-0.181		-0.209
				(0.175)		(0.177)
Foreign					0.384**	-0.437
					(0.158)	(0.503)
Number of obs.	3 566	3 566	936	869	3 566	868

Note: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. All regressions also include as a control variable the log of the total population in the local labour area (SLL), 1-digit sector dummies, as well as province and year of birth fixed effects.

However, the results also show that female founders are not more likely (i.e., the coefficients are not statistically different from zero) to register at birth into the policy than other groups of entrepreneurs. This could suggest that the policy is not perceived as particularly supportive of inclusive entrepreneurship, at least in the period for which the data used for this analysis refer to. More recent data suggest that the number of applications to the "start-up visa", i.e. the fast-track process for self-employment visas for prospective entrepreneurs, has been growing rapidly over 2016 and 2017, which is contributing to increase the number of foreigners among start-up founders.

7. Cross-country evidence: venture-capital deals and web searches

This Section describes three empirical exercises assessing whether the "Start-up Act" is associated with more dynamism in the Italian VC market, as well as with more interest in start-ups by the Italian internet user. In all the three cases, the comparison is relative to other OECD countries in the same period. The first and third models are "difference-in-difference" estimations, while the second is a "survival analysis".

The evidence discussed in this Section goes in the direction of taking a "holistic" approach to the evaluation of the policy, broadening the focus with respect to the counterfactual exercise described in Section 4. This comes at the costs of important methodological limitations and caveats related to the adopted measures. For instance, in the case of the first difference-in-difference exercise, the results can be interpreted as causal, conditional on the assumption that the "Start-up Act" has been the only major change intervening in Italy over that period for firms younger than six year old. Other caveats to be kept in mind relate to the data sources. While being one of the most comprehensive sources for micro-data on VC deals, Crunchbase is a commercial database that has not been built for statistical purposes (Dalle, Den Besten, and Menon, 2017) and is therefore a selected sample. Furthermore, the matching with the start-up register is based on the name and the location of the start-up through a fuzzy matching procedure, which inevitably entails a margin of error.

7.1. Aggregate cross-country assessment

This Section illustrates the result of a "difference-in-differences" exercise that exploits VC data from Crunchbase to assess whether the policy is associated with an increase in VC deals and in the number of start-ups looking for funding. The comparison is relative to other OECD countries before and after the implementation of the policy – which explains the "difference-in-difference" label. The results can be interpreted as causal conditional on the assumption that the "Start-up Act" has been the only major change intervening in Italy over that period. Other caveats to be kept in mind relate to the data sources.

7.1.1. Hypotheses to be tested

As described in Section 5.2.1, the Italian VC market is significantly underdeveloped in comparison to other European and OECD countries. Has the "Start-up Act" helped to narrow the gap? This empirical exercise is aimed at answering this question.

More specifically, the econometric model tests whether in Italy there has been an increase in VC activity "at the extensive margin" for the population of eligible firms since the policy has been established. The extensive margin is measured in terms of new start-ups or new VC deals. Eligible firms are start-ups less than six years old. This is an approximation of the real eligibility criteria, which also include additional conditions like e.g. owning intellectual property rights or having at least a 15% of R&D expenditure ratio (see Section 1.1 which describes the eligibility criteria in detail). However, given that firms registered in Crunchbase are typically innovative ventures receiving – or actively looking for – VC funding, it is plausible to assume that the age condition is by far the most important binding eligibility condition.

7.1.2. The analytical model

The model is estimated on a database aggregated at the level of country (c), quarter (t), and start-up age (a) class (less than six year old; six year or more), covering the period 2004q1 to 2016q4 and OECD member countries. The estimated equation is the following:

$$Y_{cta} = \alpha + ITA * POST * YOUNG + YOUNG + k_c + \theta_t + \varepsilon_{cta} \quad (1)$$

Where ITA is dummy variable equal to one for Italy, POST is a dummy variable equal to one for all quarters after the policy became operational (starting in 2013q3), and YOUNG is a dummy equal to one for start-ups that are less than six years old. Note that the traditional difference-in-difference estimation would also require the ITA and POST to be included individually, however this is superfluous in the light of the inclusion of k and θ, which are a full set of country and year-quarter fixed effects, respectively. The country fixed effects absorb the impact of all time-invariant country-specific factors, like e.g. the industrial structure and the geographical position; the quarter fixed effects neutralise all idiosyncratic shocks that affect all countries in the same way (e.g., a global demand increase). As an additional robustness test, the specifications also include country-specific polynomial trends (including linear, quadratic, and cubic components) and the following control variables at country-year level taken from the World Bank Doing Business database: strength of legal rights (getting credit); ease of shareholder suit (protecting investors); cost of a claim (enforcing contracts); and recovery rate (resolving insolvency). The outcome variables Y are alternatively: the number of VC deals; the total amount of funding; and the number of new start-ups registered in Crunchbase. The coefficient of interest is the one attached to the triple interaction ITA * POST * YOUNG, which shows whether the outcome related to eligible start-ups is significantly different in Italy after the implementation of the policy. Standard errors are clustered at country-quarter level.

7.1.3. Findings

The results show that, since the "Start-up Act" was implemented in Italy, there has been a significant increase in the number of VC deals involving start-ups five year old or less. However, there is no evidence that this has translated into an increase in the total funding amount, or in the number of start-ups registering in Crunchbase (Table 19).

Table 19. The "Start-up Act" and VC activity

Difference-in-difference regression analysis; OECD member countries

	(1)	(2)	(3)
	Total VC funding (log)	Number of deals (log)	Number of new start-ups registered in Crunchbase (log)
Italy # After March 2013	-2.490	-0.0440	-0.0566
	(2.685)	(0.242)	(0.292)
<6 year old	1.260***	0.814***	0.380***
	(0.250)	(0.0270)	(0.0272)
Italy # <6 year old	0.238	-0.0327	0.0212
	(1.770)	(0.123)	(0.119)
After March 2013 # <6 year old	0.271	0.549***	-0.0451
	(0.515)	(0.0627)	(0.0603)
Italy # After March 2013 # <6 year old	**-0.892**	**0.435****	**0.319**
	(2.239)	**(0.176)**	**(0.235)**
Country control variables	YES	YES	YES
Country-specific polynomial trends	YES	YES	YES
Observations	1,793	1,793	1,793
R-squared	0.437	0.909	0.926
Fixed effects		quarter; country	

Note: Ordinary Least Squares (OLS) regressions. *** p<0.01, ** p<0.05, * p<0.1. Standard errors clustered at country-quarter level in parenthesis.

7.2. Entrant probability of receiving VC: registered vs. non-registered firms

This second subsection summarises the evidence for micro-econometric analysis on Italian start-ups included in the Crunchbase data. This analysis at firm level explores the only variable for which the aggregate model delivers significant results, i.e., the likelihood of concluding a VC deal. The aim of the analysis is assessing whether start-ups that appear in the policy registry are more likely to receive VC funding than start-ups that do not appear in the registry.

7.2.1. Hypotheses to be tested

The conditional probability of a VC deal taking place is modelled using survival analysis methods. Indeed, VC data fit quite naturally the survival analysis framework: the start-up founding is assimilated to the birth event, while the first VC deal represents the death, or failure, event – i.e. failure is a positive outcome in this case. The estimated parameters approximate the distribution of the probability that a start-up receives funding at time t + 1, given that the start-up has not received funding up to time t, and possibly conditional on a set of start-up characteristics. This is conceptually very similar to traditional applications of survival analysis, e.g. estimating the probability that an engine will fail at time t+1, given that it has been working up to time *t* since

time zero, and conditional on other characteristics (model, make, etc.). The survival econometrics toolkit is also well suited to properly handling data censoring issues, which in our case arise because start-ups that are not funded at the end of the observation period may eventually be funded in the future.

In order to take into account the fact that "beneficiary" start-ups that register into the policy at birth (i.e., at the beginning of 2013 at earliest) have three years to receive VC before the end of 2016, when the coverage of the database ends, the analysis is limited to VC deals taking place within three years since the founding of the company.

7.2.2. The analytical model

The second estimated model is a Cox proportional hazards model where the participation into the policy is assumed to "accelerate" the probability of receiving VC. Other control variables are the year and the country in which the start-up has been founded (included as two sets of dummy variables), and the sector in which the start-up is operating. Beyond Italy, the sample of countries also included the following European economies: Spain, France, Germany, Austria, Belgium, Netherlands, and Sweden. The results limited to Italian start-ups only, however, are extremely similar, as well as results obtained from a sample containing all OECD countries. The start-ups listed in Crunchbase that are participating in the policy are identified via a fuzzy-matching procedure with the innovative start-up register.

One possible concern about this estimation strategy is that results could be at least partially driven by the fact that VC investors may urge funded start-ups to register into the policy in order to benefit from tax rebates for equity investments. In order to control for that, the model is also estimated with a policy indicator that is "switched on" only if the start-up registered in the policy within 15 days since it was founded. As few start-ups receive VC so early, this reduces the risk that the results are driven by observations on start-ups that register in the policy before they receive VC, rather than the opposite.

Another possible concern relates to intellectual property (IP) ownership, which has been shown to be an important determinant of receiving VC funding (see e.g. Breschi, Lassèbie, and Menon, 2018). As IP ownership is one of the eligibility criteria and therefore is positively correlated by construction with policy enrolment, not accounting for this variable may spuriously attribute its effect to the policy. In order to take this into account, the regressions also control for two patenting dummy variables, equal to one if the company filed for a patent, or had a patent granted, respectively.[19]

7.2.3. Findings

The results show that firms that registered into the policy are more than twice as likely to receive VC financing within the first three years since the start-up has been founded (Table 20). Interestingly, the graphical analysis in Figure 18 also shows that Italian firms that are not beneficiaries of the policy follow the same trajectory of start-ups in other countries, with around 75% of firms not receiving any VC funding within the first three years of activity. Conversely, start-ups registered into the policy appear to receive funding more often and much faster. In particular, they appear to be much more likely to receive VC – than both Italian start-ups not in the policy or non-Italian start-ups – within 50 days from founding. However, the curve is also steeper until approximately 16 months since founding (500 days). Therefore, there is clear evidence that, in the sample covered by Crunchbase, start-ups registered into the policy achieve a first VC deal more frequently and sooner than start-ups not in the policy (operating in Italy or

in other countries). However, it is worth stressing that this robust association is not necessarily *causal*, i.e., this analysis cannot demonstrate that VC funding is an *effect* of the policy, as there could be other unobserved characteristics that are actually driving the estimated effect.

Table 20. Survival analysis estimates of the probability of receiving VC

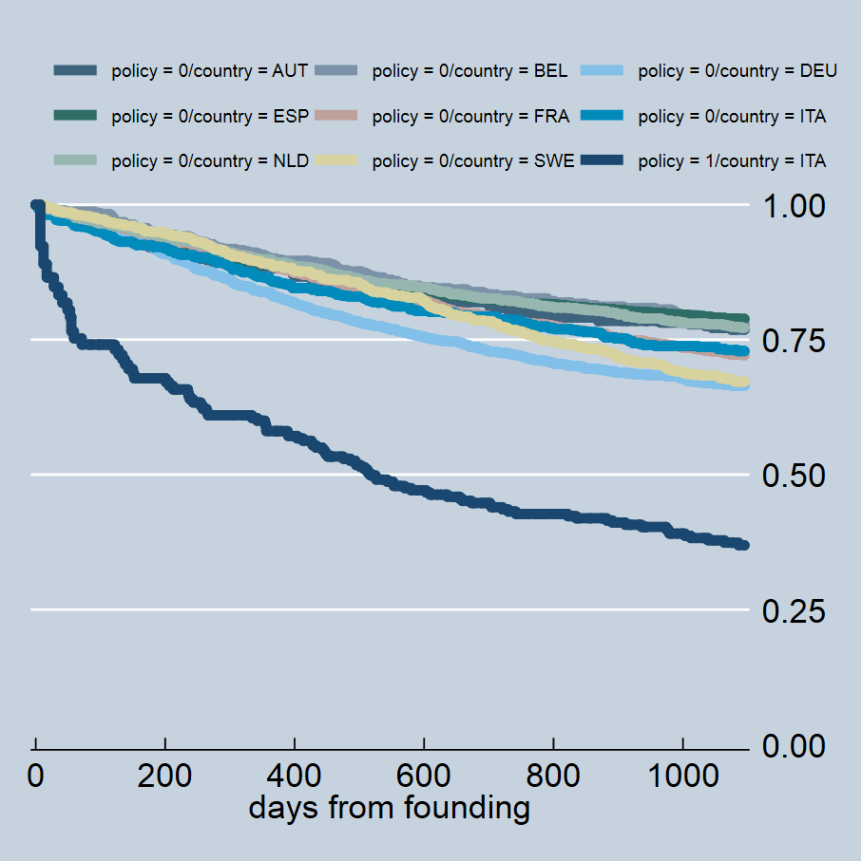
Hazard rates; stratified Cox regression estimates

	Baseline	Robust
Registered in the policy	2.721***	2.668***
	(0.458)	(0.671)
Dummy patent(s) filled before the deal	1.556***	1.696***
	(0.232)	(0.252)
Dummy patent(s) granted before the deal	0.774	0.712
	(0.345)	(0.317)
Observations	9 356	9 201
Strata	Country, sector, founding year	

Note: Standard errors in parenthesis. The "robust" model excludes from the sample the start-ups that registered in the policy more than 15 days after their date of birth. *** p<0.01, ** p<0.05, * p<0.1.

Figure 18. Proportion of firms that do not receive VC

Kaplan-Meier survival estimates by country and policy status



Note: Figure reads as follows: "500 days after Italian start-ups in the policy was created, around 50% of firms had not received a round of VC". The estimates are obtained with a Cox proportional hazards model.
Source: Authors' elaboration on www.crunchbase.com and MISE data

The sample is limited to a selection of European countries to ease visualisation, but the results are robust to different selections of the period under analysis (e.g., starting in 2007 instead of 2004), and set of countries.[20]

7.3. Cultural spill-over effects

The last empirical exercise in this Section focuses on the "cultural" impact of the policy, assessing whether since its activation the Italian internet users have been more interested in start-ups. Given the inherent difficulty of measuring cultural outcomes, the analysis rests on a "second-best" solution. The estimation uses publicly available data from Google Trends to understand whether the activation of the policy is linked to an increase of interest toward start-ups, as measured by web searches. Google Trends data are only indicative of general "interest" in start-ups, as they represent the preferences of a relatively small and highly selected population of active internet users.

It is worth stressing that this analysis is preliminary and experimental, therefore results should be interpreted with particular caution. Data on web searches are not

representative of the full population, and are typically used for descriptive purposes, rather than for statistical and econometric analysis.

7.3.1. Hypotheses to be tested

The estimation is again a "difference-in-differences" model, as it assesses whether in Italy after the introduction of the policy the interest of internet users on start-ups has increased, compared to other OECD countries in the same period, as well as to Italy before the introduction of the policy.

7.3.2. The analytical model

The empirical model (see Equation 2), analysing Google trends data, is similar to the country difference-in-difference estimation in Section 5.1.2, the only difference being that the distinction of being eligible vs. non-eligible is dropped:

$$Y_{ct} = \alpha + ITA * POST + k_c + \theta_t + \varepsilon_{ct} \quad (2)$$

The outcome variable Y in this case are the number of Google searches of the word "start-up" – which is widely used in its English form also among speakers of most other European languages, including Italian – and its variations (start-ups, startup, startups) in a given trimester and country. As the debate about the policy became public a few months before its actual enforcement, the "start" period is set to July 2012; the results are however unaffected if the start period is kept identical to the previous estimation, i.e., in April 2013. In all other respects, the model is identical to Equation (1).

7.3.3. Findings

The results show that the policy is associated with a substantial increase in web searches for "start-up". The increase in Italy since July 2012 – compared to both Italy before and other OECD countries in the same period – ranges from 36% to 59%, depending on the model, and it is highly statistically significant (Table 21). This implies that the "Start-up Act" is clearly associated with a concomitant surge in the interest in start-ups by Italian internet users.

The results are robust to different period selections under analysis (e.g., starting in 2007 instead of 2004), and set of countries (e.g. including BRICS, or limiting to European countries). Attempts to estimate similar associations with other keywords that are typically expressed in English in most languages and therefore allow an international comparison (e.g., venture capital; pitch) are not conclusive. However, the limited number of searches involving these alternative keywords is much more limited, and this might at least in part explain the lack of statistically significant results.

Table 21. The cultural effect of the "Start-up Act": evidence from web searches data

Difference-in-difference regression analysis; OECD member countries

	(1)	(2)
Dependent variable	Web searches for "start-up" with Google	
Italy X After June 2012	**0.592*** **	**0.367*** **
	(0.0531)	**(0.0241)**
Country F.E.	YES	YES
Quarter F.E.	YES	YES
Country-specific polynomial trends	NO	YES
Observations	1.960	1.960
R-squared	0.921	0.974

Note: Ordinary Least Squares (OLS) estimates. Standard errors clustered at country and quarter level in parenthesis. *** p<0.01, ** p<0.05, * p<0.1.

8. Summary of the main findings and policy recommendations

This document provides a comprehensive evaluation on the economic and social impact of the Italian "Start-up Act". The policy framework encompasses a variety of different policy instruments aimed at supporting small innovative start-ups, and became operational at the end of 2012. The evaluation combines different empirical methods and data sources, aimed not only at understanding the impact and effectiveness of the specific policy under scrutiny, but also at framing it within the general start-up ecosystem in Italy.

The overall evidence on the effect of the "Start-up Act" is positive, also in light of its relatively small cost. However, the policy is still "young" and therefore these are early findings, which should be corroborated by further analysis in the future. In this respect, the efforts of the Italian Ministry for Economic Development in collecting data and in monitoring the policy should be commended, and are aligned with the best practices at OECD level. At the same time, the findings of this analysis provide ground for a number of general recommendations aimed at improving the effectiveness and the "value for money" of the policy. Given the very general scope of this evaluation, it is important to stress that the following recommendations should not be interpreted as a list of precise and technical prescriptions, but rather as a broad set of guiding principles for future adjustments and revisions of the current policy setting, to be considered in conjunction with the other findings contained in this report as well as in other empirical analyses of the policy.

A first set of conclusions relates to the specific evaluation of the "Start-up Act". A counterfactual analysis shows that the policy leads to significant effects both on the input and output side. The magnitude of the estimated causal effects is sizeable: e.g., the policy allows firms to increase by about 10-15% their revenues, value added, and assets, relative to similar start-ups that do not benefit from it, or benefit at a later stage. Access to credit also significantly improves the magnitude of the effects. The average results are driven by two types of firms: on the one hand, those that benefit from the bank public guarantee fund for bank loans to SMEs (*Fondo di Garanzia*); and, on the other hand, those that benefit from other policies, supposedly those that favour equity financing. The former group of companies experience stronger increase in revenues, value added, book value of capital, and total assets. For the latter group of companies, the results are less clear-cut although the estimates point to an increase in assets and capital mostly from raising equity (as suggested by the slight increase in net worth). The structure of the capital of both groups also displays a change in its components. In particular, intangible capital increases as a share of total capital. This reflects – at least partially – an increase in the number of patent applications, which contribute to form intangible assets.

Secondly, additional descriptive evidence, which should not be interpreted as causal, also shows that the policy is associated with a higher number of venture capital (VC) deals and with a higher probability of receiving VC within the first three years of life at the company-level.[21] However, there is no evidence of an increase in the total amount of VC funding. The analysis also uncovers some evidence that founders with a doctorate are more likely to register earlier in the policy, suggesting that this group of founders may have particularly benefited from the streamlining of the procedures to start a business, consistent with the findings of Grilli, Mrkajica, and Giraudo (2017).

The findings from the different analyses lead to a number of directions for possible improvements to the policy, which are listed in Box 2. These recommendations can be grouped into four different areas:

- The first area focuses on the need to balance the support of equity versus debt financing. While the large majority of start-ups in the policy appear to benefit substantially from the public guarantee fund for bank loans, the economic literature suggests that equity financing is more suited to high-growth and high-risk innovative start-ups. The provision of debt guarantees should therefore be closely monitored and evaluated, not only because it employs a substantial amount of public capital, but also in order to avoid the risk that easier access to credit, relative to equity, might induce high potential start-ups to opt for a slower growth path, based on debt financing rather than on equity injections. This concern is consistent with the analysis of Giraudo, Giudici, and Grilli (2016), who find some preliminary evidence that once start-ups receive a guaranteed bank loan, they become less likely to attract VC funding.
- The second area relates to the eligibility criteria, which could be further refined and fine-tuned in order to increase the impact of the policy by targeting the set of start-ups that is most in need of policy support.
- The third area is related to marketing and signalling: the "Start-up Act" can be used as a successful "brand" with the aim of informing actual and potential entrepreneurs that the ecosystem has become supportive. In addition, it could create a positive reputation for individual start-ups that happen to be particularly successful. This could also help to put innovative entrepreneurship more central in the Italian policy debate. Furthermore, the start-up register could also be used to select some firms that may benefit from a sort of "fast-track" access for innovative start-ups to public procurement for innovation.22 This would help innovative start-ups reach their final market quicker and to accelerate their revenue flow, which in turn could provide more incentives for venture capitalists to invest in Italian start-ups at early stage.
- The fourth area is related to making innovative entrepreneurship also accessible to "outsiders", for example female, young, and foreign entrepreneurs. Entrepreneurship can act as a powerful engine of social mobility and inclusiveness, something that is particularly needed in Italy. The policy framework already contains some important instrument in this context – like e.g. the "start-up visa" for non-EU entrepreneurs, and further tools could possibly be considered. At the same time, the report highlighted that academic entrepreneurship seems to be less developed in Italy than in other major European economies, therefore actions aimed at further lowering entry barriers may also tackle this issue. In Box 2 the specific example of the statutory minimum social benefit contributions – which must be paid by all operating shareholders even in absence of revenues – is mentioned. While the amount is limited (around EUR 3 600 per year) it can constitute a non-trivial obstacles for individuals who do not have any previous experience in entrepreneurship, or which business idea is particularly experimental.

Widening the scope beyond the specific effects of the policy, this document emphasises very clearly that an effective start-up policy is not enough to create a supportive environment for innovative entrepreneurship. As highlighted by Calvino, Criscuolo, and Menon (2016), horizontal reforms that create a more favourable business environment are disproportionally beneficial for young and small businesses. Conversely, small start-ups are more strongly hampered by market failures that impose an extra-cost on risk, compared to established businesses. The inefficiency of the judicial system is a very illustrative example of an Italian weakness that, if properly addressed by effective reforms, would significantly unleash the growth potential of innovative start-ups. The document lists a few other areas where further policy action is required.

Box 2. Summary of the main policy recommendations related to the "Start-up Act"

- Maintain (and possibly expand, within the limits set by the EU regulations on State Aid to risk finance) the incentives for equity financing, as this funding channel is critical for the expansion of high-potential and high-risk start-ups. However, consider that tax incentives for equity can be effective at the margin only if investors anticipate promising opportunities. Therefore, their implementation needs to be accompanied by a general improvement of the start-up ecosystem.
- Assess the need for further public investments in VC by exploring a bolder commitment and sponsorship of existing and newly-established government-backed matching funds and funds-of-funds, in the light of the very limited size of the Italian VC market and the dearth of specialised investment management teams, particularly beyond the "angel" segment and the "seed" and "early" stages. Such a strategy should however be accompanied by complementary and synergic polices aimed at facilitating the access to the market and at removing the growth barriers for the high-potential start-ups.
- Constantly monitor and evaluate the performance of the partial public guarantee fund (*Fondo di Garanzia*) for SMEs and start-ups, given the sizeable public resources invested. Consider also that this instrument is expected to have little effect on the early stage development of the few start-ups with very high growth potential, as they typically are too risky for bank credit, even with a public guarantee.
- Consider replacing, or even removing**,** the eligibility criterion related to the firm's statutory mission (*oggetto sociale*) with a less discretionary condition. While this requirement is essential in order to select start-ups with an innovative potential, in its current form it may leave excessive discretion to local chambers of commerce, limiting the predictability of their decisions and their uniformity across the national territory.
- Consider introducing a further eligibility criterion, which should be additional to the three innovation-related criteria among which at least one has to be met, which is more market-driven; e.g., it could be linked to raising a significant

equity investment from an institutional independent and professional investor. This is in line with the need for a stronger focus on equity investment.

- Increase the communication outreach of future initiatives within the policy framework, e.g. with adequate investments in human capital in the dedicated institutions (the MISE and the chambers of commerce). It appears that the slow take-up of the policy in the first years of implementation is due to many start-ups not being aware that the policy existed. Similarly, many potential successful entrepreneurs may still not fully aware today of the functioning of the policy.
- Consider introducing some forms of "fast-track" access for innovative start-ups to public procurement for innovation and to pre-commercial procurements, in line with the guidelines on Innovation Procurement of the European Commission (European Commission, 2018). In particular, the guidelines mention instruments aimed at "helping start-ups and innovative SMEs launch and grow" (ch. 1.1.4). This can be particularly effective especially in areas where the government is an important buyer (like e.g. health or defence).
- Consider the introduction of targeted instruments aimed at better connecting the academic and research institutions with innovative businesses, in line with similar initiatives being experimented in other European countries (e.g., the EXIST programme of the German Federal Ministry for Economic Affairs and Energy, or the partnership between Bpifrance and Hello Tomorrow in France).
- Persist in the effort of reducing the fiscal and bureaucratic burden and "red tape" on start-ups, in order to facilitate experimentation and entrepreneurship by high-skill individuals with no or little entrepreneurship experience; in particular, consider introducing further fiscal and bureaucratic exemptions for micro start-ups.
- Consider the introduction of policy instruments to reduce the gender gap in entrepreneurship and VC financing (e.g., by incentivising female participation in the boards of government sponsored VC investors); consider also the adoption of other instruments aimed at making innovative entrepreneurship an engine of inclusiveness and intergenerational equality, by supporting the entrepreneurial activity of foreign and young citizens. E.g., a reduction or partial exemption of the statutory minimum social benefit contributions of operating shareholders (EUR 3 600 per year, normally due regardless of the fact that start-ups have started to sell their products or service and make income) of innovative start-ups that do not make profits may be particularly effective in increasing the number of start-ups' founders among the underrepresented groups.
- Embed counterfactual policy evaluation in the design phase of next modifications of the policy. This may also include conducting a second survey on policy participants and on a random sample of non-participants, in order to facilitate future assessments of the effect of the policy against a suitable control group.

More investments in government VC funds are also advocated as a possible solution to the persistent and striking underdevelopment of the VC market in Italy, also in light of positive experiences in other countries. Government intervention in the VC market is justified by the existence of market failures of the private VC market and by the lack

of a "critical mass". However, there are also some important risks associated with government VC investments, for example the possibility of saturating the market and crowding out of private investments. Up till now, the evidence on the impact of government VC on firm performance is still quite limited, and conclusions are mixed (see e.g. Breschi et al., Forthcoming, for a review of existing literature).[23] In the case of Italy, it can be argued that such a strategy should be accompanied by complementary and synergic polices aimed at facilitating the access to the market and at removing the growth barriers for the high-potential start-ups that have been discussed in Section 5.

Finally, compared to other OECD countries, innovative start-ups in Italy appear to suffer also from a "cultural" bias against innovation and a lack of advocacy in the public debate. While in countries like the United States and France advocacy groups for innovative entrepreneurship are becoming increasingly influential, in Italy the policy debate seems to be much more responsive to the needs of established incumbents that go through temporary – or sometimes even chronic – distress, rather than to the instances of young companies.

References

Adams, R., H. Almeida, and D. Ferreira (2009), "Understanding the relationship between founder–CEOs and firm performance", *Journal of empirical Finance*, 16(1), pp. 136-150.

Aghion, P. et al. (2015), "Innovation and Top Income Inequality", *NBER Working Paper* n. 21247

Alexy, O., J.H. Block, P. Sandner, A.L.J. Ter Wal. (2012), "Social capital of venture capitalists and start-up funding", *Small Business Economics*, Vol 39(4) pp. 835-851.

Andrews, D., and F. Cingano (2014), "Public policy and resource allocation: evidence from firms in OECD countries", *Economic Policy*, 29(78), April 2014, pp. 253-296.

Angelopoulos, K., A. Philippopoulos, and E. Tsionas (2008), "Does public sector efficiency matter? Revisiting the relation between fiscal size and economic growth in a world sample", *Public Choice*, 137(1-2), pp. 245-278.

Appelt, S. and F. Galindo-Rueda (2016), "Measuring the Link between Public Procurement and Innovation", *OECD Science, Technology and Industry Working Papers*, 2016/03, OECD Publishing, Paris. http://dx.doi.org/10.1787/5jlvc7sl1w7h-en

Arikan, A., and L. Capron (2010), "Do newly public acquirers benefit or suffer from their pre-IPO affiliations with underwriters and VCs?", *Strategic Management Journ*al., Vol 31 (12): pp. 1257–1289.

Astebro, T. B. and J. Tag (2017), "Gross, net, and new job creation by entrepreneurs". *Journal of Business Venturing Insights*, Vol. 8, November, pp. 64-70.

Balasubramanian, N., and J. Lee (2008), "Firm age and innovation", *Industrial and Corporate Change*, Vol 17 (5), 1 pp. 1019–1047.

Bartelsman E., S. Scarpetta, and F. Schivardi (2003), "Comparative analysis of firm demographics and survival: micro-level evidence for the OECD countries", *OECD Working Paper*, n. 348.

Bartelsman, E., J. Haltiwanger, and S. Scarpetta (2013), "Cross-Country Differences in Productivity: The Role of Allocation and Selection", *The American Economic Review* 103 (1), pp. 305–34.

Belleflamme, P., T. Lambert, and A. Schwienbacher (2014), "Crowdfunding: Tapping the right crowd", *Journal of Business Venturing*, Vol 29: pp. 585–609.

Berlingieri, G., et al. (2017), "The Multiprod project: A comprehensive overview", *OECD Science, Technology and Industry Working Papers*, No. 2017/04, OECD Publishing, Paris. http://dx.doi.org/10.1787/2069b6a3-en

Bertoni, F., and T. Tykvová (2015), "Does governmental venture capital spur invention and innovation? Evidence from young European biotech companies", *Research Policy*, Vol 44(4), pp. 925-935.

Block, J., Fisch, C., Hahn, A., and P. Sandner (2015), "Why Do SMEs File Trademarks? Insights from Firms in Innovative Industries", *Research Policy*, Vol. 44 (10): pp. 1915–1930.

Bloomberg (2008), "Entrepreneurs Turn Business Failure into Success", https://www.bloomberg.com/news/articles/2008-10-16/entrepreneurs-turn-business-failure-into-success (accessed 20 November 2017).

Bobbio E. (2016), "Tax evasion, firm dynamics and growth", *Questioni di Economia e Finanza*, n. 357, Banca d'Italia.

Brandolini A. and M. Bugamelli M. (eds) (2009), "Rapporto sulle tendenze del sistema produttivo italiano", *Questioni di Economia e Finanza*, n. 45, Banca d'Italia.

Brav, A., and P. Gompers (2003), "The Role of Lockups in Initial Public Offerings" *The Review of Financial Studies*, Volume 16(1): pp. 1-29.

Brav, A., and P. Grompers (1997), "Myth or Reality? The Long-Run Underperformance of Initial Public Offerings: Evidence from Venture and Non-venture Capital-Backed Companies", *The Journal of Finance*, Vol 52 (5): pp. 1791–1821.

Breschi, S., J. Lassébie and C. Menon (2018), "A portrait of innovative start-ups across countries", *OECD Science, Technology and Industry Working Papers*, No. 2018/02, OECD Publishing, Paris. DOI: http://dx.doi.org/10.1787/f9ff02f4-en

Breschi, S, N. Johnstone, J. Lassebie, C. Menon. (Forthcoming), "Never walk alone? A cross-country analysis of governments venture capital investments", *OECD Science, Technology and Industry Policy Papers*, Forthcoming.

Bugamelli M. and F. Lotti (eds) (2018), "Productivity growth in Italy: a tale of a slow-motion change", *Questioni di Economia e Finanza*, n. 422, Banca d'Italia.

Calligaris, S., et al. M. Del Gatto F. Hassan, G.I.P. Ottaviano, F. Schivardi (2016),"Italy's productivity conundrum: A study on resource misallocation in Italy", *European Economy Discussion Paper* N30-2016, European Commission.

Calvino, F., C. Criscuolo and C. Menon (2016), "No Country for Young Firms?: Start-up Dynamics and National Policies", *OECD Science, Technology and Industry Policy Papers*, No. 29, OECD Publishing, Paris. Doi: http://dx.doi.org/10.1787/5jm22p40c8mw-en

Carter, R., and S. Manaster (1990), "Initial Public Offerings and Underwriter Reputation", *The Journal of Finance*, Vol *45*(4): pp. 1045-1067.

Center for American Entrepreneurship (2017), "Mission and activities", online at: http://www.Start-upsusa.org/mission-activities/

Chellaraj, P., K. Maskus, and A. Mattoo (2008), "The contribution of international graduate students to US innovation", *Review of International Economics*, Vol 16(3), pp. 444-462.

Cingano, F., F. Manaresi and E. Sette (2016), "Does credit crunch investments down? New evidence on the bank lending channel", *Review of Financial Studies*, Vol 10(1): pp. 2737-2773.

Coad, A. (2009), *The growth of firms: A survey of theories and empirical evidence*. Edward Elgar Publishing.

Coad, A., and R. Rao (2008), "Innnovation and firm growth in high-tech sectors: a quantile regression approach", *Research Policy*, Vol 37 (2008): pp. 633-648.

Coad, A. et al. (2013), "Growth paths and survival chances: An application of gambler's ruin theory". *Journal of Business Venturing* 28 (5), pp. 615-632.

Coad, A., A. Segarra, and M. Teruel (2016), "Innovation and firm growth: Does firm age play a role?", *Research Policy* 45(2), pp. 387–400.

CONSOB (2017), "Report on financial investments of Italian households". *Statistics and analyses*, Rome, Italy.

Cosh, A. et al. (2009), "SME finance and innovation in the current economic crisis", Centre for Business Research University of Cambridge, https://www.cbr.cam.ac.uk/fileadmin/user_upload/centre-for-business-research/downloads/special-reports/specialreport-smefinanceandinnovation.pdf (accessed 12 December 2017).

Criscuolo C., P. Gal and C. Menon (2015), "Dynemp: a routine for distributed microdata analysis of business dynamics", *The Stata Journal*, Vol 15(1): pp. 247-274.

Criscuolo, C., P. N. Gal and C. Menon (2014a), "The Dynamics of Employment Growth: New Evidence from 18 Countries", *OECD Science, Technology and Industry Policy Papers*, No. 14, OECD Publishing.

Criscuolo, P., Nicolaou, N., and A. Salter (2012), "The elixir (or burden) of youth? Exploring differences in innovation between start-ups and established firms", *Research Policy* 41(2), pp. 319–333.

Cucculelli, M. (2018), "Firm age and the probability of product innovation. Do CEO tenure and product tenure matter?", *Journal of Evolutionary Economics*, 28:1, January

Cumming, D., Jefery MacIntosh (2006), "Crowding out private equity: Canadian evidence", *Journal of Business Venturing*, Vol 21 (5): pp. 569-609.

Da Rin, M. T. Hellmann, and M. Puri (2011), "A survey of venture capital", *NBER Working Paper* No. 17523.

Dalle, J., M. den Besten and C. Menon (2017), "Using Crunchbase for economic and managerial research", *OECD Science, Technology and Industry Working Papers*, No. 2017/08, OECD Publishing, Paris. Doi: http://dx.doi.org/10.1787/6c418d60-en

Decker, R.A., J. Haltiwanger, R.S. Jarmin, and J. Miranda (2016), "Declining business dynamism: Implications for productivity?", *Hutchins centre working paper, Brookings Institution*, August.

DeStefano, T., K. De Backer and L. Moussiegt (2017), "Determinants of digital technology use by companies", *OECD Science, Technology and Industry Policy Papers*, No. 40, OECD Publishing, Paris. http://dx.doi.org/10.1787/a9b53784-en

Ding, Z., Au, K., & F. Chiang (2015), "Social trust and angel investors' decisions: A multilevel analysis across nations", *Journal of Business Venturing*, 30(2), pp. 307-321.

Egli, F., N. Johnstone and C. Menon (2015), "Identifying and inducing breakthrough inventions: An application related to climate change mitigation", *OECD Science, Technology and Industry Working Papers*, No. 2015/04, OECD Publishing, Paris. Doi: http://dx.doi.org/10.1787/5js03zd40n37-en

European Central Bank, 2013, "Corporate Finance and Economic Activity in the Euro Area. Structural Issues Report 2013", *Occasional Paper* no 151, August.

European Tech Alliance (2017), "About us", online at: http://eutechalliance.eu/?page_id=16744

Federgruen, A. and M. Pierson (2011), "The impact of horizontal mergers and acquisitions in price competition models", *Harvard Business School Working paper* No. 12-031

Finaldi Russo, P., S. Magri, and C. Rampazzi, (2016), "Innovative Start-Ups in Italy: Their Special Features and the Effects of the 2102 Law" *Politica economica*, 32(2), pp. 297-330.

France Digitale (2016), "Our missions", online at: http://en.francedigitale.org/

Fraser, S., S. Bhaumik, and M. Wright. (2015), "What we know about entrepreneurial finance and its relationship with growth?", *International Small Business Journal*, Vol 33(1): pp. 70-88.

Fraser, S., and F. Greene.(2006), "The Effects of Experience on Entrepreneurial Optimism and Uncertainty", *Economica*, Vol 73 (290), pp. 169–192.

Geroski, P. A. (2002), "The growth of firms in theory and in practice". *Competence, governance and entrepreneurship*, Vol 1, pp. 168-186.

Giraudo, E., G. Giudici, and L. Grilli, (2016). "Industrial policy and the financing of young innovative companies: evidence from the Italian Startup Act." In *AiIG-XXVII Riunione Scientifica Annuale*, pp. 1-41.

Giordano, R. et al. (2015), "Does Public Sector Inefficiency Constrain Firm Productivity: Evidence from Italian Provinces". *Working paper* No. 15-168, International Monetary Fund.

Gompers, P., and J. Lerner (2001), "The Venture Capital Revolution." *Journal of Economic Perspectives*, Vol 15(2): pp. 145-168.

Gornall, W., and I. Strebulaev (2015), "The economic Impact of Venture Capital: evidence from public companies", *Stanford University Graduate School of Business Research Paper* No. 3362

Grilli, L., and S. Murtinu. (2014), "Government, venture capital and the growth of European high-tech entrepreneurial firms", *Research Policy*, Vol *43*(9), pp. 1523–1543.

Grilli, L., B. Mrkajic, and E. Giraudo, (2017). "Do the rules of the game determine who is playing? Institutional Change, Entrepreneurship and Human Capital. " *In 44th Annual Conference of the European Association for Research in Industrial Economics* (EARIE, pp. 1-40.

Guiso, L., and E. Viviano. (2014), "How much can financial literacy help?", *Review of Finance*, Vol 19(4), pp. 1347-1382.

Gulati, R., and M. Higgins (2003), "Which ties matter when? the contingent effects of inter-organizational partnerships on IPO success", *Strategic Management Journ*al, Vol 24(2): pp. 127–144.

Guzman, J. and S. Stern (2016), "Nowcasting and placecasting entrepreneurial quality and performance". In Haltiwanger J., Hurst E., Miranda, J., and Schoar, A. (eds), *Measuring Entrepreneurial Businesses: Current Knowledge and Challenges*. University of Chicago Press, September.

Guzman, J. and S. Stern (2015), "Where is silicon valley?", *Science*, Vol. 347 (6222), pp. 606-609.

Haltiwanger, J,. C., Lane, J., and J. Spletzer (1999), "Productivity Differences across Employers: The Roles of Employer Size, Age, and Human Capital." *American Economic Review*, 89(2), pp. 94-98.

Hellmann, T,. and M. Puri (2002), "Venture Capital and the Professionalization of Start-Up Firms: Empirical Evidence", *The Journal of Finance*, Vol 57 (1): pp. 169–197.

Hellmann, T., and M. Puri (2000), "The interaction between product market and financing strategy: the role of venture capital", *Review of Financial Studies* Vol 13 (4): pp. 959-984.

Henderson, R. (1993), "Underinvestment and Incompetence as Responses to Radical Innovation: Evidence from the Photolithographic Alignment Equipment Industry", *RAND Journal of Economics* 24(2), pp. 248–270.

Hirano, K. et al. (2003), "Efficient estimation of average treatment effects using the estimated propensity score." *Econometrica* 71.4, pp. 1161-1189.

Hsu, D. (2004), "Venture capitalists and cooperative start-up commercialisation strategy", *Management Science*, Vol 52(2): pp. 204-219.

IFC. (2013), "IFC Jobs Study. Assessing Private Sector Contributions to Job Creation and Poverty Reduction". *Working paper*.

Italian Ministry of Economic Development (2016), "Annual report to parliament on the implementation of legislation in support of innovative start-ups and SMEs", Rome.

Kaplan, S., and P. Stromberg (2001), "Venture Capitals As Principals: Contracting, Screening, and Monitoring." *American Economic Review*, Vol 91(2): pp. 426-430.

Kauffman Foundation (2017), "State of the Field: Distilling the universe of entrepreneurship research: Venture Capital." Accessed online on 11/10/2017.

Kerr, W., Ramana, N., and M. Rhodes-Kropf (2014), "Entrepreneurship as Experimentation." *Journal of Economic Perspectives*, Vol 28(3): pp. 25-48.

King G. and R. Nielsen (2016), "Why propensity Scores should not be used for matching". *Working paper*, mimeo.

Lee, C., K. Lee, and J.Pennings (2001), "Internal capabilities, external networks, and performance: a study on technology-based ventures". *Strategic Management Journ*al., Vol 22 (6-7): pp. 615–640.

Leleux, B., and B. Surlemont (2003), "Public versus private venture capital: seeding or crowding out? A pan-European analysis", *Journal of Business Venturing*, Vol 18(1): pp. 81-104.

Lerner, J., and A. Schoar (2005),"Does Legal Enforcement Affect Financial Transactions? The Contractual Channel in Private Equity", *The Quarterly Journal of Economics*, Vol. 120:1, February, pp. 223–246.

Mann, W. (2014), "Creditor rights and innovation: Evidence from patent collateral". *Working paper*, mimeo.

McGrath, R. (2013), "The Pace of Technology Adoption is Speeding Up", *Harvard Business Review*, November 25 2013: https://hbr.org/2013/11/the-pace-oftechnology-adoption-is-speeding-up/

McKelvie, A. and J. Wiklund (2010), "Advancing firm growth research: A focus on growth mode instead of growth rate". *Entrepreneurship theory and practice*, Vol 34 (2), pp. 261-288.

Ng, W., and T. Stuart (2016), "Of hobos and highfliers: disentangling the classes and careers of technology-based entrepreneurs", Haas School of Business, UCLA.

MISE-ISTAT (2018), "Startup Survey 2016: la prima indagine sulle neoimprese innovative in Italia". Available online at http://www.istat.it/it/archivio/209704

Nieto, M. J., L. Santamaria, and Z. Fernandez (2015), "Understanding the Innovation Behaviour of Family Firms". *Journal of Small Business Management*, 53: 382–399. doi:10.1111/jsbm.12075

Nunn, N. (2007), "Relationship-Specificity, Incomplete Contracts, and the Pattern of Trade". *Quarterly Journal of Economics* 122 (2), pp. 569-600

OECD (2017a), *Entrepreneurship at a Glance 2017*, OECD Publishing, Paris. http://dx.doi.org/10.1787/entrepreneur_aag-2017-en

OECD (2017b), G20/OECD INFE report on adult financial literacy in G20 countries. OECD Publishing, Paris. http://www.oecd.org/daf/fin/financial-education/G20-OECD-INFE-report-adult-financial-literacy-in-G20-countries.pdf

OECD (2017c), *OECD Digital Economy Outlook 2015*, OECD Publishing, Paris. DOI: http://dx.doi.org/10.1787/9789264232440-en

OECD (2017d), *Public Procurement for Innovation: Good Practices and Strategies*, OECD Publishing, Paris. Doi: http://dx.doi.org/10.1787/9789264265820-en

OECD (2016a), "No Country for Young Firms?", Policy Note, Directorate for Science, Technology and Innovation Policy Note, June 2016.

OECD (2016b), *PISA 2015 Results (Volume I): Excellence and Equity in Education*, OECD Publishing, Paris. http://dx.doi.org/10.1787/9789264266490-en

OECD (2015a), *New Approaches to SME and Entrepreneurship Financing: Broadening the Range of Instruments*, OECD Publishing, Paris, Doi: https://doi.org/10.1787/9789264240957-en.

OECD (2015b), *OECD Science, Technology and Industry Scoreboard 2015: Innovation for growth and society*, OECD Publishing, Paris. Doi: http://dx.doi.org/10.1787/sti_scoreboard-2015-en

Oto-Peralías, D., and D. Romero-Ávila (2013). "Tracing the link between government size and growth: the role of public sector quality". *Kyklos*, 66(2), pp. 229-255.

Ozmel, U., J. Reuer, and R. Gulati (2013), "Signals across multiple networks: How venture capital and alliance networks affect inter-organizational collaboration", *Academy of Management Journal*, Vol 56(3): pp. 852-866.

Pagano P. and F. Schivardi (2003), "Firm size distribution and growth", *Scandinavian Journal of Economics*, Vol 105(2): pp. 255-274.

Piacentini, M. (2013), "Women Entrepreneurs in the OECD: Key Evidence and Policy Challenges", *OECD Social, Employment and Migration Working Papers*, No. 147, OECD Publishing, Paris. Doi: http://dx.doi.org/10.1787/5k43bvtkmb8v-en

Pisu, M. (2017), "Promoting a private investment renaissance in Italy", *OECD Economics Department Working Papers*, No. 1388, OECD Publishing, Paris. Doi: http://dx.doi.org/10.1787/1d22b8b1-en

Pollock, G., and R. Gulati (2007), "Standing out from the crowd: The visibility-enhancing effects of IPO-related signals on alliance formation by entrepreneurial firms", *Strategic Organization*, Vol 5(4): pp. 339-372.

Puri, M., and R. Zartskie (2012), "On the Life Cycle Dynamics of Venture-Capital- and Non-Venture-Capital-Financed Firms", *The Journal of Finance*, Vol 67 (6): pp. 2247–2293.

Ragozzino, R. and J. J. Jeffery Reuer (2011), "Geographic distance and corporate acquisitions: signals from IPO firms", *Strategic Management Journ*al, Vol 32(8): pp. 876–894.

Roper, S. and M. Hart (2013), Supporting sustained growth among SME policy models and guidelines. *ERC White Paper* (7).

Rubera, G., A. Ordanini, D.A. Griffith (2011), "Incorporating cultural values for understanding the influence of perceived product creativity on intention to buy: An examination in Italy and the US" *Journal of International Business Studies*, 42(4), pp. 459-476.

Sahlman, W. (1990), "The Structure and Governance of Venture Capital Organizations': *Journal of Financial Economics*, Vol 27 (2): pp. 473-521.

Salvatore, L. (2013), "Restructuring in SMEs: Italy", Eurofound No. ef124720

Schumpeter, J. (1942), *Capitalism, Socialism, and Democracy*. New York: Harper & Bros.

Shane, S. (2009), "Why encouraging more people to become entrepreneurs is bad public policy". *Small Business Economics*, 33 (2), pp. 141–149.

Stephan, P., and S. Levin (2001), "Exceptional contributions to US science by the foreign-born and foreign-educated", Population research and policy review, Vol 20 (1-2). pp. 55-79.

Stuart, T., H. Hoang, and R. *Hybels (*1999*)*, "Inter-organizational Endorsements and the Performance of Entrepreneurial Ventures", *Administrative Science Quarterly*, vol 44(1): pp. 315-349.

Stuen, E., M. Mobarak, and K. Maskus (2012), "Skilled immigration and innovation: evidence from enrolment fluctuations in US doctoral programmes", *The Economic Journal*, Vol 122 (565). pp. 1143–1176.

Tomboc, G. (2013), "The lemons problem in crowdfunding", *The John Marshal Journal of Information Technology and Privacy Law*, Vol 30(2), pp. 253-280

Tushman, M., and P. Anderson (1986), "Technological discontinuities and organizational environments", *Administrative Science Quarterly* 31, pp. 439–465.

Ueda, M. (2004), "Banks versus Venture Capital: Project Evaluation, Screening, and Expropriation", *The Journal of Finance*, Vol 59(2): pp. 601–621.

Wooldridge, J. (2002), *Econometric Analysis of Cross Section and Panel Data*. MIT Press.

World Bank (2017), "Ranking of Economies - Doing Business." http://www.doingbusiness.org/rankings.

World Bank. (2017), "Methodology for Doing Business - World Bank Group." http://www.doingbusiness.org/methodology

Wright, M., and I. Stigliani (2013), "Entrepreneurship and growth", *International Small Business Journal*, Vol 31(1): pp. 3–22.

Notes

1 For additional details about the start-up survey please refer to the data section.

2 See Egli, Johnstone, and Menon (2015) for the case of climate change mitigation technologies.

3 Quality measures include if the founder names the start-up after him/herself, if the start-up purchased or carried out attempts to protect intellectual property (such as a registered trademark or patent) and if the firm has a legal form oriented toward equity financing (i.e. undergoing incorporation or locating in Delaware).

4 There is considerable empirical evidence which suggests that firms need space to experiment with various innovative ideas. Instances of failing in the past are common amongst successful start-ups (Bloomberg 2008).

5 See OECD (2017d) for a discussion of the data and public procurement activities across OECD countries.

6 Please refer to the World Bank (2017b) Doing business for an explanation of the methodology and measurement of the above rankings.

7 Source: OECD Revenue Statistics 2017, http://www.oecd.org/tax/tax-policy/revenue-statistics.htm.

8 The average trend is reported for the longest available period; since PISA 2006 for science and from PISA 2009 PISA 2003 for mathematics.

9 See OECD (2016) for additional discussion and details on the methodology used in PISA

10 The database can be accessed at www.crunchbase.com

11 We also checked whether the policy affected the probability of applying for credit. Results, not reported here for brevity, fail to identify any significant effect.

12 See Section 3.2.3 for a description of the Crunchbase data.

13 To put this into a global context, the largest recipient for VCs was the USA in 2016, valued at over USD 66 billion, which accounts for roughly 84% of all global VC financing.

14 E.g,, in Israel government funding and support has been crucial in driving their venture capital industry (Pisu, 2017); in France, the government VC investor BpiFrance is also responsible for a significant share of VC deals in the country.

15 See Breschi et al. (Forthcoming) for a detailed explanation of the methodology used to define government VC investors.

16 Serial equity investor refers legal entities that provide a majority percentage of share capital to the most number of start-ups within the policy. The cut off used in the report is the top ten serial investor.

17 The response rate to the MISE survey was 44% with an absolute number of 2 250 respondents.

18 The figure is based on the assumption that if a company provided an answer for at least one instrument, then all other missing answers for the same company are equated to negative answers (i.e., they did not know about the instrument).

19 The dummy variables are restricted to IP5 patents. See Breschi, Lassebie, and Menon (Forthcoming) for further details.

20 These results are not reported for brevity but are available from the authors upon request.

21 An experimental exercise using publicly available Google searches data also show that after the implementation of the policy the interest of internet users on start-ups increased.

22 This however should take into account the need not to distort competition in public procurement, also in observance of European regulations.

23 Ongoing OECD research under the aegis of the Committee for Innovation, Industry, and Entrepreneurship (CIIE) is looking at the subject in detail, with the aim of understanding under which circumstances investments in government VC can be effective.