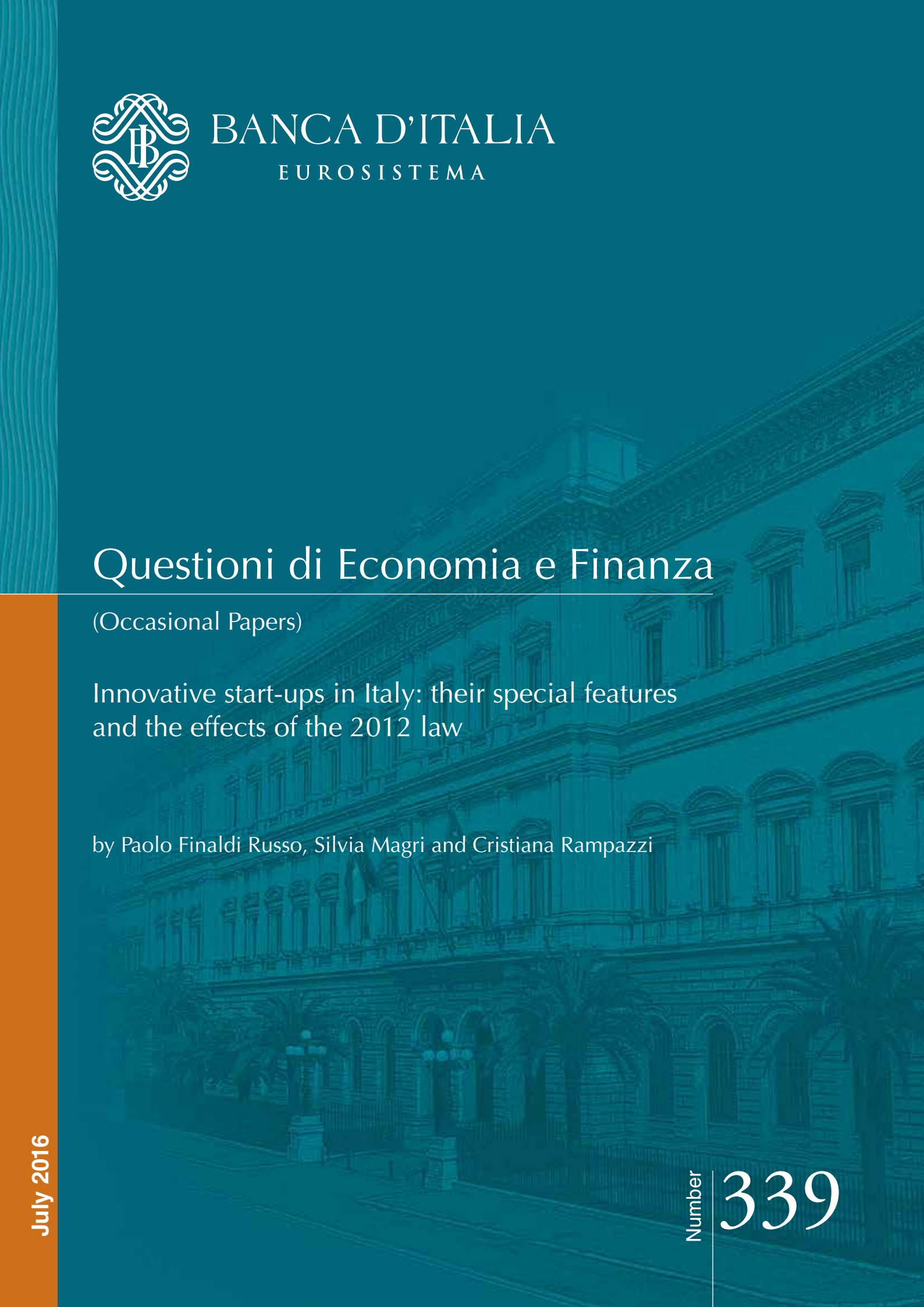
BANCA D'ITALIA
EUROSISTEMA

Questioni di Economia e Finanza

(Occasional Papers)

Innovative start-ups in Italy: their special features and the effects of the 2012 law

by Paolo Finaldi Russo, Silvia Magri and Cristiana Rampazzi



July 2016

Number 339

BANCA D'ITALIA
EUROSISTEMA

Questioni di Economia e Finanza

(Occasional papers)

Innovative start-ups in Italy: their special features and the effects of the 2012 law

by Paolo Finaldi Russo, Silvia Magri and Cristiana Rampazzi

Number 339 – July 2016

The series Occasional Papers *presents studies and documents on issues pertaining to the institutional tasks of the Bank of Italy and the Eurosystem. The* Occasional Papers *appear alongside the* Working Papers *series which are specifically aimed at providing original contributions to economic research.*

The Occasional Papers *include studies conducted within the Bank of Italy, sometimes in cooperation with the Eurosystem or other institutions. The views expressed in the studies are those of the authors and do not involve the responsibility of the institutions to which they belong.*

The series is available online at www.bancaditalia.it .

ISSN 1972-6627 (print)
ISSN 1972-6643 (online)

Printed by the Printing and Publishing Division of the Bank of Italy

INNOVATIVE START-UPS IN ITALY: THEIR SPECIAL FEATURES AND THE EFFECTS OF THE 2012 LAW

by Paolo Finaldi Russo*, Silvia Magri* and Cristiana Rampazzi*

Abstract

In 2012 the Italian Parliament introduced into Italian law a special section in the Companies Register and a large number of financial incentives to create a favorable environment for the development of 'innovative start-ups' (ISUPs). In this paper we compare ISUPs with other start-ups. In accordance with the eligibility criteria established by law, ISUPs show a striking capacity for innovation apparent in a higher incidence of intangible assets and the longer time it takes to begin selling their products. ISUPs also report higher investment rates and stronger growth in sales and assets, while their financial structures are characterized by higher capitalization and greater availability of liquid assets. Based on propensity score matching, we also highlight some direct effects of the 2012 law on their financial structures, almost exclusively on ISUPs operating in the service sectors: their external funding, either debt or equity, increases more than for other similar firms; a stronger rise in investment rates is specifically associated with a larger upsurge in their capital.

JEL Classification: G24, G32, H81, O38.
Keywords: start-ups, financing innovation, equity, financial structure.

Contents

* Bank of Italy, Financial Stability Directorate.

1. Introduction[1]

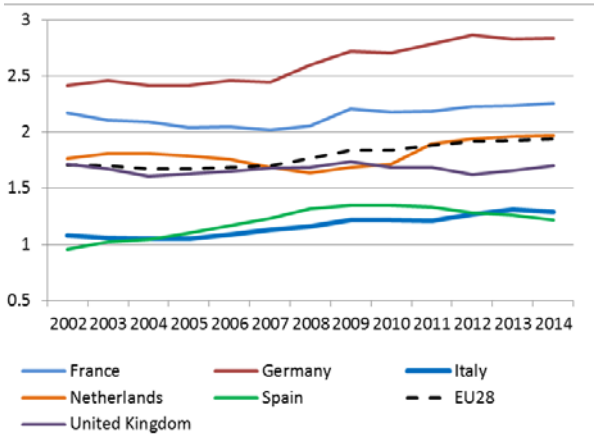
Innovation is a crucial item for enhancing productivity and economic growth. A growing branch of the literature highlights specifically the importance of new small firms in spurring innovation through investments in riskier and more cutting-edge projects, with incumbent larger firms focusing a greater share of their effort on internal innovations aimed at improving existing products (Baumol, 2004, Kerr and Nanda, 2014, Akcigit and Kerr, 2012 and Acs and Audretsch, 1987). Recent research therefore suggests that well-equipped, innovative start-ups may be an important stimulus for economic growth, while the effect of non-innovative new business, which replicate already existing products and processes, is rather small or even negative (Audtresh, Falck, Heblich, and Lederer, 2011).

Italy has been characterized by an innovative gap that contributed to explain the stagnant productivity and the low rate of growth in the last 20 years. Although the fraction of Italian firms who declare to make innovations is comparable to that of other European countries (Community Innovation Survey), the innovative breakthrough is much lower: the evidence is clear when looking at patents and R&D indicators (Figure 1).

Figure 1: Innovation in Europe

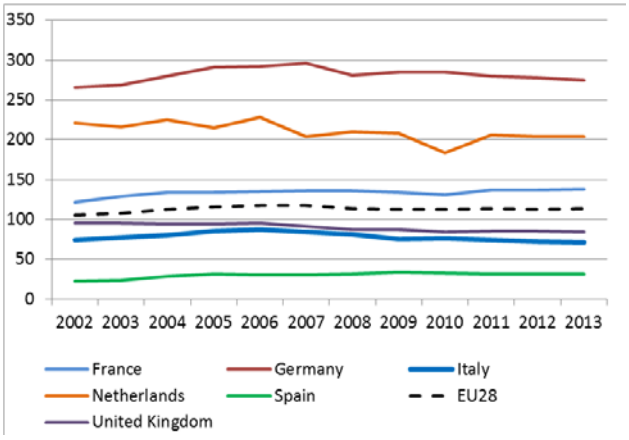
(a) **R&D Expenditures**

(as a percentage of GDP)



(b) **Patent applications**

(per million inhabitants)



Source: (a) OECD; (b) Patent applications to the European patent office (EPO), Eurostat.

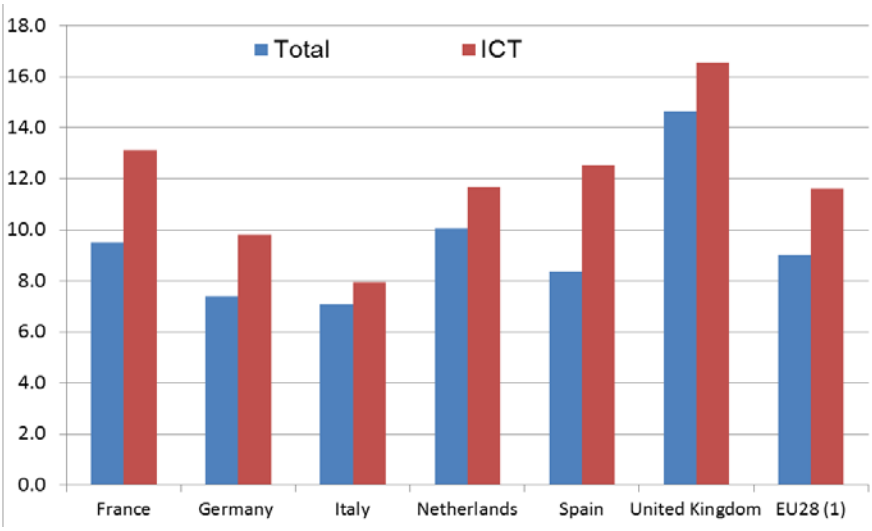
[1] Mirko Moscatelli provided excellent research assistance. The authors thank two anonymous referees, Giorgio Gobbi, Mariana Mazzucato, Fabrizio Onida, Enrico Sette, and Gianfranco Viesti. The views expressed in this paper are those of the authors and do not necessarily reflect those of the Bank of Italy. The paper has been accepted for the publication in the Politica Economica/Journal of Economic Policy.

Different factors play a role in determining this innovative gap: a multitude of micro and small firms unable to bear the high fixed costs of R&D investments, managerial teams of family firms reluctant to implement clear-cut innovative projects, underdeveloped equity markets that are well-tailored to finance innovation (Bugamelli, Cannari, Lotti e Magri, 2012). Another reason that likely helped to keep this gap was the lower rate of start-ups in innovative sectors.

In the last decade, about 400,000 new Italian firms have been entered each year on the Business Register of the Italian Chamber of Commerce: this number is not insignificant compared with that of other large European economies. In relative terms, the birth rate of Italian firms is around 7 per cent as in Germany, only 1 percentage point less than in Spain and 2 points than in France (Figure 2).

Figure 2: Firms' birth rates in Europe

(percentages of total firms by sectors; year 2013)



Source: Eurostat. (1) Data refer to the year 2012.

The gap becomes by far larger when only ICT firms are considered: the birth rate is equal to 8 per cent in Italy, about 10 per cent in Germany, and 13 per cent in Spain and France. The large differences in the birth rates of ICT firms, which typically have more innovative attitudes and higher growth potentials, have likely negatively affected the Italian economy in terms of innovation and, ultimately, economic growth.

Against this background, at the end of 2012 the Italian policymaker decided to improve the context for the birth and the activity of innovative start-ups (ISUPs henceforth), having in mind the policies implemented in the main European countries,

specifically in the UK, where under the Seed Enterprise Investment Scheme relevant benefits are given to investors in innovative starts-ups (Magliocco e Ricotti, 2013).[2]

A special section of the Business Register has been established for new firms that meet several eligibility criteria mostly based on size, age and innovativeness. The registered innovative start-ups are given a large set of benefits: lower administrative costs, better financing conditions and fiscal treatment and more simplified and favorable company laws (see Section 2.1 for details). Among these benefits, the 2012 law specifically introduced important tax incentives for investors in start-up capital in order to increase equity in their financial structure, a preferred source for financing innovation with respect to debt (Rajan, 2012, Brown, Fazzari and Petersen, 2009, Acharya and Xu, 2013, and Magri, 2014). Moreover, the law also gave ISUPs a simplified and free access to the public guarantees, provided by the Central Guarantee Fund for SMEs, so that they could get more easily loans from banks. ISUPs financial structure is a very crucial issue: one of the main tasks of a policy trying to create favorable conditions for innovative start-ups is to assure the availability of external funds that these new ventures require (Lerner, 2009).

The aim of this paper is twofold. In the first part, we highlight the special features of Italian ISUPs against all other start-ups and specifically those operating in the high-tech sectors.[3] We aim at evaluating whether, given also the eligibility criteria settled on innovation, the asset composition and financial structure of innovative start-ups are different from those of the other young firms. In the second part of the paper, we aim at singling out the effects of the 2012 law, specifically on firms' financial structures, independently from those related to the eligibility requirements. First, we consider, as a term of comparison for ISUPs only very innovative high-tech start-ups to reduce the impact of powerful innovation on the results. Secondly, on a lower sample of firms, we use a propensity score matching in 2012, before the law was implemented, to create a control sample for ISUPs with firms of very similar characteristics; we then compare their financial structures and output dynamics in 2014 for the two groups.

Some of the detected differences between ISUPs and other start-ups are a direct consequence of the eligibility criteria settled by the policymaker. In fact ISUPs show a striking capacity of innovation, even when compared with other high-tech start-ups, which

---

[2] A specific comparison with the policies adopted in other countries is beyond the scope of this paper. An initial evaluation of the fiscal incentives in the main European countries shows that the most favourable schemes are in the UK and in France, and the effects of the new Italian tax incentives, set in 2011 and 2012, are in line with the British and the French schemes (Magliocco and Ricotti, 2013).

[3] For the definition of high-tech sectors we use the Eurostat definition; see the Appendix, Section B, for more details.

reflects in a larger incidence of intangible on total assets and lower sales, connected to delayed commercialization of their "truly" new services or products. The intense innovation activity could also explain higher levels of ISUPs' capital and liquid assets. ISUPs also show higher investment rates and stronger growth in sales and assets; intense accumulation and expansion have been financed with a larger increase in external funding, equity and above all financial debt.

This paper also provides first evidence that some of these results might have been enhanced by the new environment created by the 2012 law specifically through channels helping ISUPs in gathering external funding. Capital, liquid assets and investment rates are indeed higher for ISUPs even when they are compared with other very innovative high-tech start-ups: these results are hence not explained only by the high level of ISUPs' innovation. Evidence from the propensity score matching also points at important effects of the 2012 law on ISUPs financial structures, concentrated in service sectors[4]: their external funding increases much more than for firms in the control sample, either through financial debts, mainly bank loans, or equities. Specifically, the strongest effects arise for ISUPs in non-high-tech service sectors for which the investment rate, total assets and equity raise more.

This paper contributes to the literature on new firms, specifically on their financial structure, which is quite scant due to the paucity of data. Berger and Udell (1998) provided a framework where start-ups initially rely on the internal finance, trade debt and equity financing typically provided by business angels; only later in their life does access to external debt become easier. On the contrary, they found that bank debt plays a very important role for US firms even when they are in their infancy. Robb and Robinson (2014) recently confirmed this evidence in the US and similar results have been found for Italian start-ups (Bonaccorsi and Nigro, 2015). One specific issue examined in this paper is to evaluate whether equity is actually more important in the initial stages of life at least for innovative firms that are inherently much riskier than others (Carpenter and Petersen, 2002; Brown, Fazzari and Petersen, 2009; Kerr, Lerner and Schoar, 2011). In examining some of the effects of the 2012 law, we also contribute to the copious literature on policy evaluation which has analysed many benefits introduced in Italy in the past years for different types of firms; most of the fiscal incentives or benefits were connected either to debt (De Blasio et al., 2016; Boschi et al., 2014; Zecchini and Ventura, 2009; D'Ignazio

[4] Firms have been split in four sectors: high-tech and non-high-tech service and high-tech and non-high-tech manufacturing.

and Menon, 2013). grants (Bronzini and Piselli, 2016) or equity (Caiumi and Di Biagio, 2015).

The paper is organized as follows. The next section describes the policy and the data used in the analysis, while Section 3 investigates the characteristics of innovative start-ups with respect to other start-ups, specifically those in the high-tech sectors. Section 4 provides first evidence on the effects of the 2012 law on ISUPs financial structures and economic performance, while Section 5 concludes.

2. The policy and the database

2.1 Description of the policy

At the end of 2012, Decree Law No. 179 (converted into Law No. 221/2012) established a special section of the Business Register of the Italian Chamber of Commerce for "innovative start-ups", defined according to the following criteria:

- unlisted corporations with a branch or a production plant in Italy;
- less than 4 years old;[5]
- production value lower than 5 million of euro;
- do not pay dividends;
- not deriving from firms' spillovers or company's splitting;
- the exclusive or prevailing business purpose described in the company's statute is the development, production and commercialization of innovative goods or services with high technological value;
- *one* of the following three conditions:
  - R&D expenditures equal at least to 15 per cent of the highest value between the cost and the production value;[6]
  - at least one third of the employees need to have a PhD in research activity (or they should be in a PhD program) or they have a degree and have been working as researchers for at least three years or at least two thirds of employees have a degree;
  - the firm owns industrial property, such as either patents or brands, concerning its specific business purpose.

[5] A more recent law (24 March 2015, n.33) has increased the maximum working period for being included in the special section of the register to 5 years.

[6] The minimum percentage of R&D was initially set by the law at 20 per cent, and was reduced to 15 per cent by Law No. 99, 9 August 2013.

Registered companies enjoy a large number of benefits, gradually extended since the 2012 law and aimed at creating a protected environment for their initial growth:

- simplified and less expensive administrative procedures for setting up firms;
- exceptions to corporate regulation mostly aimed at increasing the contribution of equity shareholders;
- tax benefits for investors in their equity;[7]
- simplified and no-cost access to the public guarantees provided by the Central Guarantee Fund for SMEs;
- zero-interest rate loans from the public Invitalia Agency (subject to evaluation of business plans).
- authorization to gather capital through crowd-funding platforms;[8]
- more flexibility in the use of short-term employment contracts and the payment of salaries;
- tax credit for hiring highly qualified employees;
- support for firms' internationalization through a wide range of consulting services provided by the public agency ICE;
- more favourable fiscal treatment in case of losses and for VAT obligations;
- exemptions from bankruptcy law ("fail-fast");

Implementing several of these benefits required some time. The ministerial decree for "fast track" access to the Central Guarantee Fund for SMEs was only adopted in May 2013. Tax benefits for investors have been available since the onset of 2014 and will last until 2016. The possibility to obtain zero-interest rate loans from Invitalia dates from February 2015.

---

[7] For individuals, 19 per cent of their investment in start-ups can be used to scale down the amount of tax to be paid; companies can deduct 20 per cent of their investment in start-ups from their income. The beneficial fiscal treatment applies both to direct and indirect investments that are kept for at least two years. The fiscal framework provided by Law 221/2012 has been analysed by Magliocco and Ricotti (2013) specifically with regard to the tax incentives to venture capitalists. They argue that these incentives are quantitatively important, though the fact that they are temporary limited could reduce their impact.

[8] Until January 2015, ISUPs were the only Italian companies authorized to gather equity funds through crowd-funding platforms. Decree Law No. 3/2015 ("Investment compact") has extended this possibility to "innovative SMEs".

2.2 Data

The analysis is based on firms' balance-sheets data drawn from Cerved dataset[9]. We collect the balance sheets of firms included in the ISUP register: out of the 5,143 firms registered at the end of 2015, we were able to match 1,758 firms with balance sheets either in 2013 and 2014 or only in 2014, the most recent year for which data are fully available[10]. The difference with the total number of ISUPs enrolled in the register at the end of 2015 is mainly due to the fact that many firms started their activity during 2014 or 2015 and have no balance-sheet for the year 2014. Moreover, we exclude from the analysis some sectors with a very limited number of ISUPs (agriculture, energy and construction): this exclusion allows us to drastically reduce the numerical disproportion between the sample of ISUPs and that of the other start-ups. Notwithstanding these exclusions, the composition of the ISUPs sample is very similar to that of the whole ISUPs register in terms of geographic areas, economic activity, size classes, and the number of innovation criteria set by the law and satisfied by the firms; in particular the share of firms belonging to high tech sectors is quite high, about 60 per cent, in both cases (Table A.1 in the Appendix).[11]

The sample of other start-ups includes more than 134,000 firms from the Cerved database with few characteristics similar to those required for being registered as an innovative start-up: i) firms younger than 4 years; ii) with sales (proxy of the production value) lower than 5 million of euro; iii) with total assets higher than 0; iv) micro and small-sized. Table 1 shows some differences in the composition of the two samples.

---

[9] Cerved collects and standardizes the balance sheets of all Italian corporations. See Appendix B for more details on the data and indicators used in the analysis.

[10] A minority of firms has a balance sheet only in 2013. In detail, among the 957 ISUPs with balance sheets in 2013, 891 have a balance sheets also in 2014; 801 ISUPs have a balance sheets only in 2014. We only consider annual (12 months) balance sheets with total assets higher than 0 so as to analyze only active firms.

[11] See the Appendix, Section B, for the definition of high-tech sectors.

Table 1: Sample composition

	Start-ups				
	ISUPs		Others		difference(1)
	No.	%	*No.*	%	
Number of firms	**1,758**		**134,261**		
2013 only	*66*		*99,057*		
2014 only	*801*		*35,204*		
2013 and 2014 (2)	*891*		*78,704*		
SECTOR					
Manufacturing	317	18.0	20,070	14.9	***
of which: *HT(3)*	*95*	*5.4*	*617*	*0.5*	***
Services	1,441	82.0	114,191	85.1	***
of which: *HT (3)*	*947*	*53.9*	*8,958*	*6.7*	***
HIGHTECH	*1,042*	*59.3*	*9,575*	*7.1*	***
AREA					
North	1,044	59.4	58,780	43.8	***
Centre	400	22.8	35,881	26.7	***
South and Islands	314	17.9	39,600	29.5	***
SIZE (4)					
Micro	1,712	97.4	131,223	97.7	
Small	46	2.6	3,038	2.3	
AGE					
1-2 years old	1,156	65.8	68,440	51.0	***
3-5 years old	602	34.2	65,821	49.0	***
Total observations	*2,649*		*212,965*		

(1) Differences between the mean: *, ** and *** indicate a significance level of, respectively, 10, 5 and 1 per cent. (2) For start-ups with balance sheet in both years data refer to 2013. (3) Eurostat definition of high-tech sector; see the Appendix for more details. (4) See the Appendix, Section B, for size classification.

Not surprisingly, the largest difference is relative to the share of firms in high-tech sectors (59 and 7 per cent, respectively), specifically in high-tech service industries; the share of manufacturing firms is also slightly higher among ISUPs (18 and 15 per cent). ISUPs are more frequently located in the Northern regions (59 and 44 per cent) and are comparatively younger than other start-ups: 66 per cent are 1-2 year old (51 per cent in the control sample). This last difference could be interpreted as a likely effect of introducing the special ISUP register, that has accelerated the birth of new innovative firms.[12]

[12] This interpretation has been confirmed by some venture capital and business angel investors. Another reason could be that "older" innovative firms (3-4 years old) have fewer incentives to enroll in the register as the period for benefiting from the incentives is shorter.

3. The special features of innovative start-ups

3.1 Size and the amount of external funding

The share of ISUPs that have not yet started selling their products is about 20 per cent, twice as much as for the other start-ups (Figure A.1 in the Appendix). Even when controlling for zero-values, in terms of both turnover and total assets ISUPs are smaller than other young firms (Table 2): the mean values of total assets are respectively 247,000 and 306,000 euro; for the turnover, the corresponding values are 165,000 and 459,000 euro. Median values provide similar evidence (Table A.2 in the Appendix). Albeit reduced, these differences arise even if the comparison is made between ISUPs and start-ups only in high-tech sectors, which are more likely to have an innovative attitude.

Throughout this section, we verify whether the differences between ISUPs and other start-ups depend on some observable characteristics for which we can control in a multivariate analysis. The dependent variables of the estimated equations are, in this case, total assets and turnover; the control variables include a set of dummies aimed at identifying geographic areas, economic sectors, and firm age. The estimated coefficient of the ISUPs dummy represents, on average, the remaining difference in the dependent variable between ISUPs and other start-ups after controlling for the included firm characteristics.[13] In Table 2 (and in the subsequent similar tables for other indicators), we report the estimated coefficients of the ISUP dummy in the OLS regressions: the results confirm that, ceteris paribus, ISUPs' sales and total assets are lower than those of the other start-ups. The differences are much larger for sales and, though smaller, hold even when the comparison is with start-ups operating in high-tech sectors.

Innovative start-ups are presumably pursuing truly new projects that require time to reach the commercialization phase: this would explain the high share of companies without a positive value for turnover and the much lower value of turnover itself, also in comparison with start-ups belonging to high-tech sectors.

As for the amount of external funding, after controlling for some firm characteristics, though smaller, ISUPs have a significantly larger amount of equity (around 15,000 euro more), while there are almost no significant difference for the amount of

[13] See Appendix C for a detailed description of the econometric exercises. Specifically for industry controls, in the regression considering all start-ups we also include a high-tech dummy to capture the effects of belonging to high-tech sectors for ISUPs and for other start-ups. This dummy is obviously excluded when considering only high-tech start-ups and *all ISUPs*: in this case we include only dummies for manufacturing and services non-high tech that measure the difference in the indicators under analysis for ISUPs that are not in high-tech sectors.

financial debts and bank loans. A detailed analysis on financial structure indicators is in the final part of this section.

Table 2: Firm size and amount of external funding
(thousands of euros)

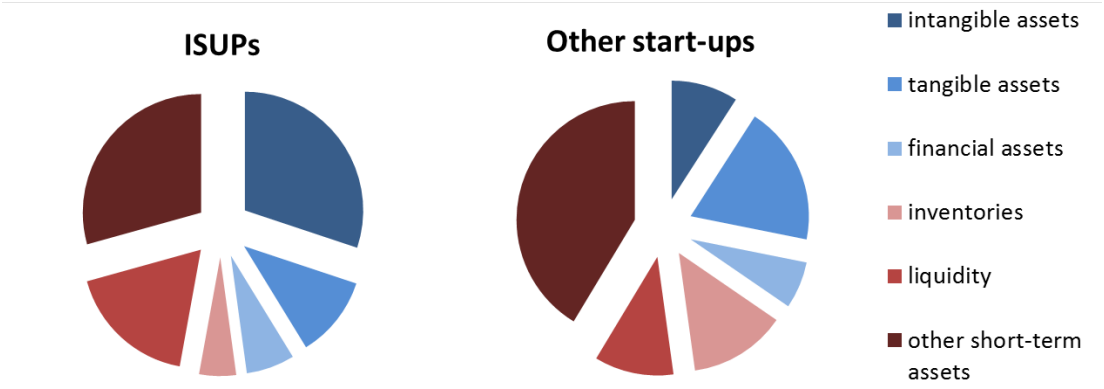
	Mean					ISUP dummy (1)	
	ISUPs	Others	diff	Others only HT	diff	All sectors	HT sector
			all firms				
total assets	247.4	306.1	***	239.1		-41.45***	-13.85*
sales	132.1	418.0	***	262.1	***	-229.8***	-161.8***
equity	55.4	38.2	***	40.3	***	14.54***	14.82***
financial debt	64.8	69.2	*	46.4	***	3.399	5.314*
bank loans	27.4	32.4	***	18.5	***	-0.611	2.235
			only firms with indicators > 0				
sales	165.1	459.0	***	292.1	***	-239.5***	-165.3***
equity	60.7	44.3	***	44.6	***	14.76***	15.47***
financial debt	96.4	99.7		77.2	***	1.630	5.267
bank loans	72.4	77.1		59.5	***	-3.146	1.971

(1) Estimated coefficients of the ISUP dummy; see Appendix for more details; *, ** and *** indicate a significance level of, respectively, 10, 5 and 1 per cent.

3.2 Asset composition

Intangible assets and liquidity account for a higher share of the total assets for ISUPs compared with other young firms (Figure 3).

Figure 3: Asset composition



As for intangible assets, the large difference (about 20 percentage points, Table 3) is likely to reflect the ownership of industrial properties (such as patents or brands), which

is one of the eligibility criteria of the programme. The OLS regressions confirm the higher share of intangibles on total assets, with the estimated coefficient of the dummy ISUP equal to 16 points. The difference rises to more than 25 points when intangible assets are scaled over fixed assets. Interestingly, these gaps remain large also when the comparison is only with start-ups in high-tech sectors, suggesting that the presence of a large share of intangible assets does not simply reflect the higher degree of innovativeness of the high-tech sectors firms, but is a distinctive feature of ISUPs.

Table 3: Asset composition
(percentages)

	Mean					ISUP dummy (1)	
	ISUPs	Others	diff	Others only HT	diff	All sectors	HT sector
			all firms				
liquidity / total assets	21.4	17.3	***	20.4	**	2.885***	1.782***
tangible fixed assets / total assets	7.4	14.6	***	9.7	***	-3.901***	-3.396***
intangible assets / total assets	31.2	10.1	***	12.1	***	15.97***	15.82***
intangible assets/ total fixed assets	74.3	41.6	***	49.8	***	27.86***	25.93***
			only firms with indicators > 0				
liquidity / total assets	24.3	19.2	***	23.0	**	3.489***	2.197***
tangible fixed assets / total assets	10.9	18.7	***	13.7	***	-4.440***	-4.197***
intangible assets / total assets	33.6	12.5	***	15.5	***	16.55***	16.45***
intangible assets/ total fixed assets	77.4	48.1	***	58.9	***	23.60***	20.74***

(1) Estimated coefficients of the ISUP dummy; see Appendix for more details; *, ** and *** indicate a significance level of, respectively, 10, 5 and 1 per cent.

Tangible assets are symmetrically lower for ISUPs when related to total assets, even when the comparison is made with start-ups in high-tech sectors: the difference is about 4 percentage points. Less physical capital to be used as collateral with a bank clearly has negative effects in terms of availability of banking loans. This is one of the reasons why the 2012 law offered ISUPs a free and rapid procedure to get a public guarantee on their loans.

The liquidity ratio of innovative start-ups is about 3-4 percentage points higher than for other start-ups. This gap is probably due to precautionary motives: the economic literature underlines that cash holdings are positively correlated with the need for external finance (for instance in the case of high growth opportunities or cash flow variability), especially when firms are financially constrained. Several empirical studies confirm that

liquidity is higher for firms with R&D expenditure[14]. Innovative start-ups, which have both higher growth opportunities and cash flow variability, could prefer to maintain substantial cash holdings to be sure of affording future investment expenses even without the support of external funding. The differences with other start-ups are confirmed by the results of the econometric analysis, both for the whole sample and for the high-tech sector alone.

3.3 Investments, growth and profitability

ISUPs are more likely to invest than other start-ups: 77 per cent of them have a positive value for investment expenditures compared with a bit more than 60 per cent of other new firms (Figure A.1 in the Appendix). Moreover, Table 4 shows that the ratios of investments over total assets or fixed assets are distinctly higher among ISUPs, even when only investing firms are considered: among those making investments, the investment rate (investment over assets) for ISUPs is twice as much as for the other start-ups[15].

Table 4: Investment and growth
(percentages)

	Mean					ISUP dummy (1)	
	ISUPs	Others	diff	Others only HT	diff	All sectors	HT sector
			all firms				
investments / total assets	15.4	6.2	***	6.6	***	8.645***	8.530***
investments / total fixed assets	47.4	31.6	***	35.1	***	12.31***	11.53***
sales growth (2013-14)	53.1	16.2	***	20.0	***	35.03***	32.34***
total asset growth (2013-14)	40.1	19.9	***	24.1	***	18.16***	17.71***
equity growth (2013-2014)	32.2	16.4	***	20.9	***	12.89***	10.57***
financial debt growth (2013-2014)	50.9	22.9	***	24.3	***	26.41***	32.11***
			only firms with indicators > 0				
investments / total assets	22.1	10.1	***	11.4	***	11.01***	10.65***
investments / total fixed assets	60.7	46.0	***	52.9	**	9.480***	6.843***

(1) Estimated coefficients of the ISUP dummy; see Appendix for more details; *, ** and *** indicate a significance level of, respectively, 10, 5 and 1 per cent. Total assets are always greater than 0 as a condition for being in the sample of firms analysed. For the other variables, when the initial value is 0, percentage changes cannot be calculated and are therefore excluded.

The results of the multivariate analysis confirm these differences: the gap in the ratio of investment over total assets is about 11 percentage points both with all start-ups and for those in the high-tech sectors, when considering only firms that actually make investments.

[14] See Opler et al. (1999), Bates et al. (2009) and Falato et al. (2013). See also Denis (2011) for a review of recent studies analysing the impact of financial frictions on corporate cash holdings.

[15] More than four times higher when considering median values: 19 compared with 4.3 per cent, see Table A4 in the Appendix.

Consistently with the higher investment rates, we find that the indicators of firm growth between 2012 and 2013 (calculated both on assets and sales) are significantly higher among ISUPs than for other new firms: the mean values of the percentage change in total assets are 40 per cent for ISUPs, 20 for all start-ups and 24 for high-tech start-ups. The corresponding values for the growth in sales are 53, 16 and 20 per cent; when considering median values the evidence is similar.[16]

The ISUPs' faster growth has been financed both with equity and financial debts that increase by far more for ISUPs than for other start-ups. Specifically, equity capital, more suitable to finance innovation, raises more for ISUPs even with respect to other high-tech start-ups that are supposed to be quite innovative (11 percentage points more in the regression framework). Nonetheless, the biggest differences in the rate of growth are for financial debts (51 per cent for ISUPs versus 23-24 per cent for other start-ups).

Table 5: Profitability and cash flow
(percentages)

	Mean					ISUP dummy (1)	
	ISUPs	Others	diff	Others only HT	diff	All sectors	HT sector
			all firms				
EBITDA / total assets	-1.5	6.3	***	10.2	***	-9.867***	-11.85***
cash flow / toal assets	0.1	1.3	***	3.3	***	-2.540***	-3.120***
ROE (2)	-8.0	26.2	***	27.8	***	-37.57***	-36.49***

(1) Estimated coefficients of the ISUP dummy; see Appendix for more details; *, ** and *** indicate a significance level of, respectively, 10, 5 and 1 per cent. (2) ROE is calculated only for firms with positive net worth.

The analysis of profitability for young firms is very tentative, because the initial period of their life frequently implies high costs and low or no revenues; for innovative projects, reaching the break-even point could take even more time. Both descriptive statistics and econometric analysis point out that ISUPs are less profitable and enjoy a lower cash flow, even when compared with other high tech start-ups.

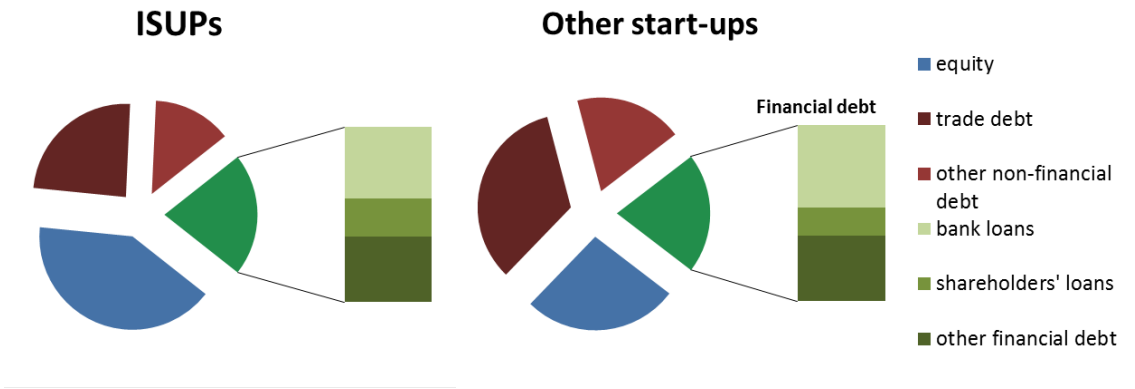
Taken together, this evidence indicates that ISUPs are intensely involved in making investments while they still are at a very early stage in their activity. The innovativeness of their business is likely to require a more costly and prolonged period of phasing up, but the intense injection of capital and debt and the liquidity provisions seem to have helped them counterbalancing the low revenues and internal finance of this initial period.

[16] The analysis of the growth indicators is based on a restricted sample because changes in assets and sales can be calculated only for firms with balance sheets relative to both 2012 and 2013. The number of observations is almost half compared with the sample in 2013, both for ISUPs and other firms.

3.4 Financial structure: debt versus equity

On aggregate, the composition of ISUPs' liabilities is mainly characterized by a higher share of equity and a lower weight of trade debt (Figure 4).

Figure 4: Financial structure



The higher level of capitalization of ISUPs is confirmed when looking at the differences in debt-to-assets ratio: the mean value of this indicator for ISUPs is between 8 and 10 points lower than for other start-ups (Table 6a). However, the incidence of financial over total debt is much higher for ISUPs: among firms with financial debts, the ratio is over 50 per cent, more than 10 points higher than for other new firms. Consequently, the differences in leverage (the ratio of financial debts over the sum of financial debts and equity) are smaller. When controlling for other firms' characteristics, leverage is lower for ISUPs by around 3 points compared with all start-ups, while the difference with the high-tech start-ups is not statistically significant.

Table 6a: Financial structure and debt composition
(percentages)

	Mean					ISUP dummy (1)	
	ISUPs	Others	diff	Others only HT	diff	All sectors	HT sector
			all firms				
total debt / total assets	59.0	73.1	***	63.9		-9.560***	-8.068***
financial debt / total debt	35.9	28.4	***	24.4	***	9.650***	9.043***
leverage	38.6	44.4	***	33.6	***	-0.638	1.231
			only firms with indicators > 0				
total debt / total assets	60.5	74.6	***	65.6	***	-9.602***	-8.092***
financial debt / total debt	53.7	41.1	***	40.9	***	12.88***	12.01***
leverage	57.5	63.8	***	55.7	*	-2.775***	-0.747

(1) Estimated coefficients of the ISUP dummy; see Appendix for more details; *, ** and *** indicate a significance level of, respectively, 10, 5 and 1 per cent.

As for leverage and for the comparison with all start-ups, the smaller difference when controlling for other variables with respect to those observed in the descriptive statistics largely depends on the inclusion of the "high-tech" dummy among the control variables. This dummy, whose coefficient is significantly negative and large in absolute value (about -12 percentage points), absorbs the effect of innovativeness on financial structure, confirming that high-tech activities are correlated with a higher contribution of equity and lower leverage[17]. As a matter of fact, when comparing ISUPs with only high-tech start-ups, which are likely to be more innovative than all start-ups, there is no remaining difference: leverage is lower for ISUPs and high-tech start-ups than for the whole sample of start-ups.

Theoretical literature on firms' financial structure suggests and empirical research finds that innovative firms should indeed rely less on financial debt and more on equity because their projects are difficult to evaluate for external investors and are typically characterized by uncertain flows of revenues and large time mismatches between investment expenses and returns. Moreover, the opaqueness of the innovative activity could increase entrepreneurs' moral hazard and make access to external debt more difficult; innovative firms also typically lack tangible assets that can be used as collateral. On the demand side, they could be prone to using more equity because it does not involve regular payments to shareholders.[18]

3.5 Financial structure: other components of debt and debt maturity

Figure 3 shows that ISUPs are characterized by a lower share of non-financial debt, specifically trade debt. When controlling for other firms' characteristics, the trade debt-to-total debt ratio is lower for ISUPs than for other start-ups by around 3 percentage points, while the difference is not statistically significant when the comparison is made only with high-tech start-ups (Table 6b). This result fully depends on the still limited volume of ISUPs' activity: in fact, scaled on sales that are a good proxy for firms' purchases, trade debt becomes significantly higher among ISUPs.

Moreover, ISUPs' financial debts are characterized by a lower share of bank loans: around 6-7 percentage points for firms with bank loans when controlling for other firms'

[17] The exclusion of this dummy determines a larger and more significant estimated coefficient of the ISUP dummy, which becomes equal to -7.

[18] See Hall and Lerner (2010), Brown, Fazzari and Petersen (2009), Magri (2014), Atanassov et al. (2007) and Rajan and Zingales (2003).

characteristics. This gap in bank loans could perhaps derive from banks' reluctance to finance highly innovative and risky projects: in previous paragraphs we have shown that ISUPs have fewer tangible assets to be used as collateral and still have, on average, negative returns. These features could make ISUPs' access to credit even more difficult than for other young firms, which could justify the "fast track" put in place by the policymaker for obtaining public guarantees from the Central Guarantee Fund for SMEs. ISUPs rely less on bank loans even with respect to high-tech start-ups. This could be a further indication, after the one related to intangible assets, that high-tech start-ups, though innovative, are characterised by less risky projects than ISUPs, which are more likely to be financed by banks.

Table 6b: Other debt component and debt maturity
(percentages)

	Mean					ISUP dummy (1)	
	ISUPs	Others	diff	Others only HT	diff	All sectors	HT sector
			all firms				
trade debt / total debt	40.9	46.0	***	41.4		-2.757***	-0.397
trade debt/sales	50.1	33.0	***	31.1	***	18.50***	18.10***
bank loans / financial debt	40.9	46.7	***	40.9		-4.537***	-3.229*
shareholders' loans/financial debt	19.4	16.5	***	16.0	***	3.153***	6.177***
short term fin. debt / financial debt	61.6	65.3	**	70.0	***	-6.183***	-10.58***
short term bank loans / bank loans	69.9	70.7		75.9	***	-4.101***	-5.301***
			only firms with indicators > 0				
trade debt / total debt	43.8	48.9	***	45.2	*	-3.019***	-0.633
trade debt/sales	53.5	34.6	***	33.6	***	19.93***	19.64***
bank loans / financial debt	73.3	77.3	***	79.3	***	-5.854***	-7.205***
shareholders' loans/financial debt	72.4	70.2		76.9	**	0.336	2.34
short term fin. debt / financial debt	77.4	80.1	***	85.2	***	-5.022***	-7.034***
short term bank loans / bank loans	79.2	81.4	*	85.7	***	-4.290***	-4.735***

(1) Estimated coefficients of the ISUP dummy; see Appendix for more details; *, ** and *** indicate a significance level of, respectively, 10, 5 and 1 per cent.

As for debt maturity, more than half of both groups of firms rely exclusively on short-term debt (Table A.6 in the Appendix). More specifically, the share of short-term debt over financial debt is lower among ISUPs; similar evidence arises for bank loans (in the range of 5-10 percentage points). One possible explanation of this result is that ISUPs end up with a higher proportion of long-term loans because they have more important long-term investment projects to finance: we have seen before that ISUPs investment rate is much higher than for other start-ups. Moreover, short-term debt is typically used to

finance the operating activity (sales, inventories), which is still in the infant stage for these firms.

4. Initial evidence of the effects of the 2012 law

The fiscal benefits for investors in ISUPs, introduced by the 2012 law, were intended to be a key incentive for equity investors and, ultimately, for start-ups' investments and growth. On a similar line, the "fast track" that ISUPs have for public guarantees from the Central Guarantee Fund might have helped them in obtaining bank loans and in financing their higher investment expenditures. The effects on firms' financial structures are clearly different in the two cases. The first incentive would increase equity, while the second bank loans and financial debts.

In this section we try to evaluate the importance of these benefits by analyzing ISUPs indicators first in comparison with a narrower group of start-ups, i.e. those in high-tech sectors, but with a very high level of intangible assets, which make them more similar to ISUPs as for their intense degree of innovation. Secondly, in order to make a cleaner evaluation policy analysis, we use a propensity score matching to build a control sample of firms that have very similar observable characteristics to ISUPs in 2012, before the law was acted. We then evaluate financial structures and output indicators for ISUPs and firms in the control sample in 2014, the latest year for which balance-sheets are available.

4.1 Comparison between ISUPs and very innovative high-tech start-ups

In order to remove at least part of the effects on ISUPs financial structures and their results deriving from their high level of innovation, in this sub-section we restrict the comparison of ISUPs to very innovative high tech start-ups. In the balance-sheets we cannot elicit the R&D expenditures and the nature of labour force. The unique indicator of firm innovation available is the one connected to intangible assets, which strictly reflects the third eligibility criteria set by the law, concerning industrial properties that are normally included in intangible assets. We consider only high-tech start-ups with a ratio of intangible to total assets greater than 6, a threshold corresponding to the 25th percentile calculated for ISUPs only[19].

Results are reported in Table 8. We first notice that the investment ratio is still higher (by 4 percentage points) for ISUPs compared with very innovative high-tech start-

[19] This threshold corresponds to the 75th percentile of the ratio distribution calculated for the other start-ups.

ups. This result is helped by higher liquidity ratios (by 5 points) whereas the contribution of internal financial sources is clearly limited by the worse profitability.

When focusing on financial structure indicators, specifically on external funding, we find evidence that ISUPs leverage is lower by around 5 percentage points. When controlling for other firms' characteristics, equity is indeed much higher (around 20,000 euro) for ISUPs than for the other very innovative high-tech start-ups (Table 8), while financial debts are lower (all firms) or not different (for firms using debt)[20]. Moreover, the ratio of bank to financial debts is lower for ISUPs (by 4 points).

Overall, it seems that between the two incentives on external funding set by the 2012 law, the one connected with increasing equity for ISUPs had more effects than that aimed at increasing bank loans through the public guarantee. However, we should also notice that the share of short-term bank loans is still lower for ISUPs than for very innovative high-tech new firms: it could be that ISUPs desire a longer debt maturity to finance their investment projects, inducing them to prefer capital to bank loans. Different channels – supply and demand - could therefore be at work.

Table 7: Comparison among ISUPs and other very innovative high-tech start-ups
(percentage)

	Mean			**ISUP dummy** (1)
	ISUPs	Restricted HT start-ups(2)	diff	
	only firms with indicators > 0			
liquidity / total assets	24.3	19.7	***	5.580***
investments / total assets	22.1	17.9	***	3.958***
total debt / total assets	60.5	66.0	***	-8.369***
leverage	57.5	60.7	***	-5.409***
financial debt / total debt	53.7	48.4	***	4.803***
short term fin. debt / financial debt	77.4	83.7	***	-5.497***
bank loans / financial debt	73.3	76.3	**	-4.370**
short term bank loans / bank loans	79.2	83.6	***	-3.087*

(1) Estimated coefficients of the ISUP dummy; see Appendix for more details; *, ** and *** indicate a significance level of, respectively, 10, 5 and 1 per cent. (2) Very innovative high-tech start-ups with intangible assets / total assets>25th percentile of the ratio calculated for the ISUP sample.

[20] When considering all firms, the coefficient of the ISUPs dummy – capturing the effects for ISUPs in high-tech sectors - in negative and large (-9,000 financial debts for ISUPs); descriptive statistics show similar average for financial debts due to higher financial debt for ISUPs in manufacturing non-high tech sectors.

Table 8: Comparison among ISUPs and other very innovative high-tech start-ups
(thousands of euros)

	Mean			ISUP dummy (1)
	ISUPs	Restricted HT start-ups (2)	diff	
	all firms			
total assets	247.4	255.8		-26.45***
sales	132.1	233.3	***	-126.1***
equity	55.4	37.9	***	17.33***
financial debt	64.8	62.4		-9.058***
bank loans	27.4	24.9		-3.756**
	only firms with indicators > 0			
sales	165.1	282.0	***	-144.5***
equity	60.7	43.0	***	17.24***
financial debt	96.4	91.6		-6.312
bank loans	72.4	70.7		-6.751

4.2 Propensity score matching

In order to evaluate more accurately the effects of the 2012 law, specifically on ISUPs financial structures, we build a control sample of firms having in 2012, before the law was enacted, very similar observable characteristics to firms that will enroll as ISUPs. We consider 366 ISUPs that enrolled in the register in 2013 and 2014 (263 and 103 respectively) with a balance sheet in 2012. We create a matching control sample using the nearest neighbor method in this year; the control sample has therefore the same number of firms as the group of ISUPs. The further condition we apply is that these firms have balance sheets for the years 2013 and 2014 in order to evaluate the effects of the law on their financial structures and, ultimately, on their performance since they enroll in the register. We indeed focus our attention on the evidence for the year 2014 when *all* ISUPs in the sample could have enjoyed the more favorable environment set by the law [21].

In order to improve the similarities, the control sample is built by stratifying the matching in four macro industries: high-tech manufacturing and services and non-high-tech manufacturing and services. Any given ISUP *i* in each of these four sectors is hence associated to another firm in the same sector and with an estimated probability of being an ISUP, given by the propensity score as of year 2012, which is very similar to that of ISUP *i*. In the probit estimations of the propensity scores we use a wide range of firm observable

[21] For ISUPs that enrolled in 2014 in the register the effects could be visible only in the year 2014. We do not consider firms enrolling in the special register in 2015 and 2016, for which the effects of the law would not be detectable in the 2014 balance sheets.

characteristics: age, sales, total assets, tangible and intangible assets, intangible ratio, investment rate, Ebitda ratio, liquidity ratio, equity, and dummies for geographic areas.[22] [23]

Overall, the balancing properties for an even larger group of firm characteristics (age, size, investment rate, intangible asset ratio, and above all a wide array of financial structure indicators) and for the whole sample of firms are good: there are no significant differences for all the indicators reported in Table 9, but for the value of bank loans. In any case, we evaluate the results in 2014 using a diff-in-diff regression set-up, where the dummy $ISUP_i$ controls for any residual difference between ISUPs and firms in the control sample before the law was enacted and for each result we evaluate.

Table 9: Balancing properties between ISUPs and the control sample
(average values in 2012)

	Mean		t-test	
	ISUPs	Control sample	t	p > | t |
age (years)	2.56	2.54	0.240	0.810
total assets (000 euro)	293.32	558.40	-1.190	0.236
intangible assets (000 euro)	78.74	193.67	-1.070	0.284
intangible assets / total assets	0.274	0.263	0.550	0.585
sales (000 euro)	137.42	163.20	-1.200	0.231
investments / total assets	0.208	0.190	0.540	0.591
EBITDA / total assets	-0.198	-0.010	-0.130	0.896
cash flow / toal assets	-0.047	-0.034	-0.130	0.894
liquidity / total assets	0.240	0.256	-0.820	0.413
leverage (1)	0.370	0.381	-0.390	0.695
financial debt / total assets	0.268	0.282	-0.320	0.750
equity (000 euro)	96.15	231.06	-0.890	0.374
financial debt (000 euro)	97.78	81.15	0.600	0.548
bank loans (000 euro)	39.06	19.69	1.910	0.057
bank loans / financial debt	0.360	0.351	0.210	0.831
area: northwest	0.317	0.333	-0.470	0.636
area: northeast	0.287	0.235	1.600	0.110
area: center	0.232	0.257	-0.770	0.440
area: south	0.150	0.161	-0.410	0.684

Only ISUPs registered in 2013 and 2014, with balance sheets in the years 2012, 2013 and 2014 and in the common support in the propensity score matching (366 ISUPs). Control sample has the same number of firms. Significance levels: 1 per cent (***), 5 per cent (**), 10 per cent (*). (1) leverage is calculated as financial debts/(financial debts+equity).

[22] We change slightly the list of the variables used in the estimations across the four different sectors in order to get the best balance within each sector.

[23] Like in the analysis of the previous section, negative equity is substituted for with equity equal to 0 when calculating leverage, i.e. the maximum level of leverage is 100 per cent and leverage cannot be negative. We do not apply this substitution when calculating the average value of equity.

The estimated equation is the following:

$$Y_{it=const+\beta_1(post_t)+\beta_2(ISUP_i)+\beta_3(post_t*ISUP_i)+\beta_4 area\ dummies+\beta_5 sector\ dummies+\varepsilon_{it}}$$

where the dummy $ISUP_i$ controls for differences in the indicator Y_{it} before the treatment, the dummy $post_t$ measures the change in the indicator in the year 2014 for all firms and the interaction term $post_t * ISUP_i$ is the one of interest, measuring the additional change in Y_{it} for the year 2014 for ISUPs; standard errors are clustered at firm level. To preserve space and clarity, in Table 10 only the coefficients of the $post_t * ISUP_i$ interaction terms are reported: they measure the additional change in the post-treatment period, i.e. in the year 2014, for ISUPs versus the control sample for each indicator analyzed. This should be an estimation of the effects of 2012 law on firms' characteristics and outputs.

Results are reported for the whole sample and for the different four sectors used for the matching as we detect very important industrial heterogeneity. Overall, we find that investment ratio increases for ISUPs almost 6 percentage points more than for the control sample. ISUPs strongest investment attitude, found in previous section, is therefore confirmed. Given that before the law was enacted, treated and control firms had similar investment ratios (Table 9), this difference is a likely effect of the 2012 law.

Table 10: Diff-in-diff estimations: effects of the 2012 law on different indicators
(coefficients of the interaction term post*ISUPs)

	leverage	equity (000 euro)	financial debt (000 euro)	bank loans (000 euro)	bank loans / financial debt
All firms (732)	0.053	42.76	-25.22	27.24	0.079
	(0.029) *	(29.34)	(72.25)	(11.16) **	(0.0455) *
by sector					
- Manifacturing not HT	0.050	-17.3	-305.8	48.7	0.232
(106)	(0.067)	(80.9)	(444.4)	(60.3)	(0.110) **
- Manifacturing HT	-0.082	54.1	-125.8	-16.6	0.040
(58)	(0.108)	(63.0)	(115.4)	(43.0)	(0.159)
- Services not HT	-0.007	50.4	40.3	21.5	0.026
(169)	(0.059)	(23.5) **	(24.2) *	(12.2) *	(0.080)
- Services HT	0.104	54.1	42.6	31.0	0.056
(374)	(0.040) ***	(49.9)	(21.0) **	(10.0) ***	(0.070)

	investments / total assets	liquidity / total assets	cash flow / toal assets	total assets (000 euro)	sales (000 euro)
All firms (732)	0.058 (0.029) **	-0.024 (0.018)	0.116 (0.170)	196.4 (165.5)	-97.8 (141.0)
by sector					
- Manifacturing not HT (106)	0.006 (0.064)	-0.077 (0.047)	-0.170 (0.100) *	787.9 (1112.9)	-891.5 (955.4)
- Manifacturing HT (58)	0.024 (0.066)	-0.031 (0.055)	-0.573 (0.584)	2.2 (154.9)	-16.2 (93.6)
- Services not HT (169)	0.104 (0.037) ***	-0.032 (0.031)	0.698 (0.578)	119.9 (59.5) **	10.3 (38.2)
- Services HT (374)	0.054 (0.051)	-0.004 (0.027)	0.001 (0.110)	98.6 (65.7)	58.4 (37.1)

The diff-in-diff regression is run only for the years 2012 and 2014. The number or observations is therefore equal to 366*2 years and for 2 groups, ISUPs and control sample (1464 observations). Each row by sector reports the number of observation in each sector. Standard errors are clustered at firm level. Significance levels: 1 per cent (***), 5 per cent (**), 10 per cent (*).

We then focus on the financial structure to evaluate possible channels explaining higher ISUPs' investment ratios. As for the whole sample, we find a large array of results that are difficult to bring together until we look at the different industrial evidence. All in all, leverage increases more for ISUPs (by 5 percentage points) as bank loans raise more for them (by 27,000 euro); similarly, the increase in the ratio of bank to financial debts is 8 percentage points higher for ISUPs. We also detect a higher growth in equity for ISUPs (by 43,000 euro), which is almost statistical significant (p-value equal to 0.15).

It is very interesting that almost all the results arise for ISUPs in the service sectors, either high-tech or non-high-tech. The strongest investment attitude is only for ISUPs in non-high-tech service industries (97 firms; the investment ratio raises by 10 points more for ISUPs in this sector) for which both equity and financial debts, specifically bank loans, increase more (respectively by 50,000 and 40,000 and 22,000 euro). As a consequence of the stronger expansion in all types of external funding, in these industries ISUPs also register a higher growth in total assets, by more than 100,000 euros.

ISUPs in high-tech service sectors (187 firms) are characterized by a stronger increase in bank loans and financial debts (31,000 and 43,000 respectively) and by a larger upsurge in leverage (by 10 points), which echoes in the results for the whole sample due to the large number of firms belonging to these industries. In high-tech service sectors, ISUPs tend to have larger increase in assets and sales, though the differences are not statistically significant, albeit marginally (p-values between 0.12 and 0.13). It is worth noting that for ISUPs in both service sectors, for which we find evidence of a stronger increase in bank loans after the 2012 law, the balancing properties in the pre-treatment period were

satisfied, i.e. there were not significant differences between the average bank loans for ISUPs and control samples in 2012.

The stronger rise in the ratio of bank to total debt, observed for the whole sample, arises significantly only in manufacturing non-high-tech firms (53 firms) and is entirely explained by a higher reduction in financial debts with respect to the control sample. As for the few ISUPs in non-high-tech manufacturing industries (29 firms) no differences are singled out between treated and control samples.

We verify the robustness of the results for some variables, i.e. assets and equity, for which the initial values in 2012 for ISUPs were lower, though not significantly. To take into account the lower initial values, we calculate percentage changes.[24] When considering an average of percentage changes measured at firm level, no differences arise among treated and control firms; when evaluating the percentage change of the mean value of the indicators for the whole sample, we find some evidence that total assets growth is higher for ISUPs in the service sectors. The evidence is therefore similar to the one previously commented.

Overall, it seems that the 2012 law had important effects on ISUPs in the service sectors, enhancing their external funding either bank loans, likely through the public guarantee of the Central Guarantee Fund, or equity, for which investors had fiscal incentives. The effects appear to be stronger for ISUPs in the non-high-tech service sector, for which investment rate increases by far more than for firms in control sample, which also benefitted of a significant higher rise in their equity.

5. Conclusions and discussion of the results

When comparing innovative start-ups defined by the 2012 law with other start-ups, we find that they have important special features. Specifically, the law was able to select start-ups with a striking potential of innovation, which the literature rates as crucial for their effects on improving the productivity and growth of a country. ISUPs are indeed characterized by a much higher ratio of intangible on total assets (around 16 percentage points more), the unique indicator of innovation available in the balance sheets; this result holds even when ISUPs are compared with other start-ups in high-tech sectors. Their likely cutting-edge projects could also explain their lags in sales: compared with other start-ups,

[24] The trade-off is that we need to replace some negative and 0 values in equity with a very small number in order to calculate the percentage changes; we try different small numbers for robustness.

ISUPs arrive later at the commercialization of their products or services and their sales are much lower.

This trend mirrors in a worse profitability and internal funding. Despite these characteristics and thanks to their higher capital and liquid assets, ISUPs are aggressive in terms of the investment rate (investment over assets), which – among firms making investments - is twice as much as for the other start-ups (11 percentage points more). More radical innovations and higher investments rate echo also into faster expansion. We detect some evidence of higher growth rates in sales and assets between 2013 and 2014, which has been financed both by equity and financial debts, which increase by far more for ISUPs than for other start-ups.

In the second part of the paper, we aim at singling out some specific effects of the 2012 law on ISUPs' financial structures and, ultimately, on their economic performance. First, we try to disentangle the effects of the law from those of high innovativeness, which strictly depends on the eligibility criteria settled by the policymaker. We find that ISUPs have still higher capital even when compared with other very innovative high-tech start-ups (with quite high intangible asset ratio) not included in the register; ISUPs also have higher liquidity ratio and investment rates.

Finally, in the cleanest policy evaluation exercise, based on a propensity score matching control sample made in 2012 before the law was enacted, we find important effects on ISUPs financial structures operating in the service sectors: either financial debts, above all bank loans, and equity increase more than for other very similar firms. It is nonetheless true that a much higher rise in investment rates (10 percentage points more) and total assets are recorded only for ISUPs that have a stronger upsurge in their capital, i.e. those working in non-high-tech service sector. No or limited effects arise for the few ISUPs working in manufacturing, either high-tech or non-high-tech.

Overall, it appears like both the incentives to increase bank loans, through the Central Guarantee Fund, and those for equity investors have played a role in increasing the external funding for ISUPs. The 2012 law was therefore efficient in this respect. Much higher investment rates for ISUPs seem specifically connected with higher equity in their financial structures, confirming that capital is likely the best source of financing innovation, as most of the literature has underlined.

Accurate evaluations of the policy for innovative start-ups, which is specifically required in the 2012 law itself, are important in order to identify possible measures aimed at further improving the business environment for innovation. For instance, policy-

evaluation studies could have helped the design of the new intervention put in place at the beginning of 2015 for extending most of the ISUPs benefits to the so-called "innovative SMEs" with an audited financial statement, but far weaker standards of innovation compared with those of ISUPs. Fiscal incentives to equity investments have been limited to innovative SMEs with no more than 7 years of activity or even more if they present plans for developing innovative products or services[25]. Up to June 2016, only around 190 innovative SMEs registered in this special section. One possible reason for this small number is that it takes time and money to get an audited financial statement, while the tax incentives for equity are supposed to last until 2016. On the other hand, our study shows that strict criteria for innovation for ISUPs were crucial to get very innovative start-ups. In a period when public expenditure is particularly constrained, we wonder about the trade-off between the new "less innovative SMEs" policy and one of the possible alternatives of leaving the fiscal incentives only to ISUPs and extending them after 2016, the last year for which they are currently envisaged.[26] This alternative measure would ensure equity over a longer period of time, perhaps forever, for those very highly innovative start-ups, which are more likely to be characterized by radical new ideas of production or of organizing inputs.

Future policy evaluation exercises will be able to use more balance sheets for the same firm and hence test long-term effects of the 2012 law. This will also help evaluating how many years ISUPs require to reach profitability so that internal financial sources could be available. This topic is extremely important also to consider a possible extension of the minimum holding period required in the 2012 law to benefit of the fiscal incentives for equity investors, currently equally to two years.

---

[25] In the law (Investment Compact Law, Decree Law No. 3/2015 converted into Law No. 33/2012) the conditions for innovation have been weakened in this way. At least two (one for ISUPs) of the following criteria need to be satisfied: 1) R&D expenditures equal to least to 3 per cent (15 per cent for ISUPs) of the highest value between the cost and the value of the production; 2) at least one fifth of the employees (one third for ISUPs) need to have a PhD in research activity (or they should be in a PhD program) or they have a degree and have been working as researchers for at least three years or at least one third (two thirds for ISUPs) of the employees have a degree; 3) the firm owns industrial property, such as either patents or brands, concerning the specific business purpose (unchanged compared to ISUPS).

[26] The funds allocated for the fiscal incentives to ISUPs for the period 2013-2016 were equal to around 180 million of euro; for the extension to innovative SMEs the funds are around 160 million.

References

Acharya, V., and Xu Z. (2013), "Financial dependence and innovation: the case of public versus private firms", NBER, Working Paper No. 19708.

Audretsch D.B., Falck O., Heblich S., Lederer A. (2011), "Handbook of Research on Innovation and Entrepreneurship", Edward Elgar Publishing Limited, Willinston, US

Acs, Z.J. and Audretsch D.B. (1987), "Innovation, market structure and firm size", The Review of Economics and Statistics, 69, 4, pp. 567-574.

Akcigit, U. and Kerr W.R. (2012), "Growth through heterogeneous innovations", NBER Working Paper No. 16443.

Atanassov, J., V. Nanda, and A.Seru (2007), "Finance and Innovation: The Case of Publicly Traded Firms", University of Chicago Working Paper.

Baumol W.J., (2004), "Entrepreneurial enterprises, large established firms and other components of the free-market growth-machine", Small Business Economics, 23, pp. 9-21.

Bates T.W., Kahle K.M., and Stulz R. (2009), "Why do US firms hold so much more cash than they used to?", The Journal of Finance, 64, 5, pp. 1985-2021.

Berger, A., and G. F. Udell (1998), "The Economics of Small Business Finance: The Roles of Private Equity and Debt Markets in the Financial Growth Cycle", Journal of Banking & Finance, 22, pp. 613–73.

Bonaccorsi, E., and Nigro, V. (2015), "The financial structure of new firms: evidence from Italy", Bank of Italy, manuscript.

Boschi, M., Girardi. A. and Ventura, M. (2014), "Partial Credit Guarantees and SMEs Financing", Journal of Financial Stability, 15, issue C, pp. 182–194.

Bronzini, R., Caramellino G., and Magri, S. (2015), "Venture Capitalists at Work: What Are the Effects on the Firms They Finance?", Bank of Italy, manuscript.

Bronzini,R., and Piselli, P. (2016), "The Impact of R&D subsidies on Firm Innovation", Research Policy, Vol. 45, No.2,, pp.442-257

Brown, J., Fazzari, S. and Petersen, B. (2009), "Financing innovation and growth: cash flow, external equity, and the 1990s R&D boom ", The Journal of Finance, Vol. 64, No.1

Bugamelli, M., Cannari L., Lotti F, and Magri, S. (2012), "The innovation gap of Italy's production system: roots and possible solutions", Bank of Italy, Occasional papers, No. 121.

Caiumi, A., and Di Biagio L., (2015), "Corporate Effective Taxation in Italy Using a New Microsimulation Model", Istat Working Paper, No. 13.

Carpenter, R.E., and Petersen, B. (2002), "Capital Market Imperfections, High-Tech Investment, and New Equity Financing ", The Economic Journal, Vol. 112, pp.54-72.

De Blasio, G., De Mitri S., D'Ignazio A., Finaldi Russo, P., and Stoppani L. (2016), "Public Guarantees to SME Borrowing. A RDD Evaluation", Bank of Italy, Working Papers, forthcoming.

Denis, D.J. (2011), "Financial flexibility and corporate liquidity", Journal of Corporate Finance, 17, 2011, pp. 667-674.

Diamond, D.W. (1991), "Debt Maturity Structure and Liquidity Risk", The Quarterly Journal of Economics, 106, 3, pp. 709-737.

D'Ignazio, A., and Menon, C. (2013), "The Causal Effect of Credit Guarantees for SMEs: Evidence from Italy", Bank of Italy, Working Papers, No.900.

Falato, A., Kadyrzhanova, D. and Sim, J.W. (2013), "Rising Intangible Capital, Shrinking Debt Capacity, and the US Corporate Savings Glut", FEDS, Working Paper No. 67.

Falato, A. and Sim, J.W. (2014) "Why Do Innovative Firms Hold So Much Cash? Evidence from Changes in State R&D Tax Credits", FEDS, Working Paper No. 72.

Hall, B. and Lerner, R. (2010), "The Financing of R&D and Innovation", in Hall, B. H. and N. Rosenberg (eds.) Handbook of the Economics of Innovation.

Kerr, W.R. and Nanda, R. (2014), "Financing Innovation", NBER, Working Paper No. 20676.

Kerr, W.R., Lerner J., and Schoar, A. (2011), "The Consequences of Entrepreneurial Finance: Evidence from Angel Financing", Review of Financial Studies, Vol. 27, No.1, pp.20-55

Lerner J, (2009), "Boulevard of Broken Dreams: Why Public Efforts to Boost Entrepreneurship and Venture Capital Have Failed--and What to Do About It", Princeton University Press, USA.

Magliocco, A., and Ricotti G. (2013), "The new framework for the taxation of venture capital in Italy", Banca d'Italia, Occasional Paper No. 167.

Magri, S. (2014), "Does issuing equity help R&D activity? Evidence from unlisted Italian high-tech manufacturing firms", Economics of Innovation and New Technology, Vol. 23, No.8.

Myers, S.C. (1977), "Determinants of corporate borrowing", Journal of Financial Economics, Vol.5

Opler, T., Pinkowitz, L., Stulz, R. and Williamson, R. (1999), "The determinants and implications of corporate cash holdings", Journal of Financial Economics 52, 1999, pp. 3-46.

Rajan, R. and Zingales, L. (2003), “The great reversals: the politics of financial development in the twentieth century”, Journal of Financial Economics, 69,1, pp. 5-50.

Rajan, R. (2012), “The corporation in finance”, The Journal of Finance, 67,4, pp. 1173-1217.

Robb, A., and Robinson, D. T. (2014), “The Capital Structure Decisions of New Firms”, Review of Financial Studies, 27, 1, pp. 153-179.

Zecchini, S., and Ventura, M. (2009), “The Impact of Public Guarantees on Credit to SMEs”, Small Business Economics, 32, 2, pp. 191-206.

Appendix

(A) Tables and figures

Table A.1: Comparison between all innovative start-ups in the Business Register at the end of 2015 and the sample matched with the Cerved dataset

	All ISUPs	ISUPs sample
No. of start-ups	5,143	1,758
Sector		
Manufacturing	19.0	18.0
Services	76.2	82.0
High-tech	*59.8*	*59.3*
Others	4.8	0.0
Area		
North	55.4	59.4
Centre	21.7	22.8
South and Islands	22.8	17.9
Size		
equity: (000 euro)		
1-50.000	88.3	84.3
50.000-100.000	5.5	7.1
100.000-250.000	3.6	5.0
250.000-500.000	1.1	1.7
more than 500.000	1.5	1.9
production value (000 euro):(1)		
0-100.000	83.8	77.2
100.000-500.000	11.6	15.1
500.000-1mln	3.8	6.4
>1mln	0.8	1.3
Law requirements (2)		
1° R&D expenditures>15%	65.1	62.5
2° team (1/3 with PhD or 2/3 with degree)	29.6	31.6
3° industrial property	19.7	25.4

Source: Infocamere.
(1)Percentages calculated only on firms with non-missing values (50% of all ISUPs, 60% of ISUPs sample). (2) Firms can satisfy 1 or more requirements.

Table A.2: Firm size and amount of external funding *(thousands of euros)*

	Median				
	ISUPs	Others	diff	Others only HT	diff
		all firms			
total assets	105.0	150.0	***	97.0	*
sales	37.0	187.0	***	102.0	***
equity	21.0	16.0	***	17.0	***
financial debt	11.0	14.0	*	3.0	***
bank loans	0.0	0.0	***	0.0	***
		only firms with indicators > 0			
sales	63.0	225.0	***	124.0	***
equity	25.0	20.0	***	20.0	***
financial debt	39.0	42.0		23.0	***
bank loans	31.0	39.0	**	24.0	***

Table A.3: Asset composition (percentages)

	Median				
	ISUPs	Others	diff	Others only HT	diff
		all firms			
liquidity / total assets	12.0	8.9	***	12.0	
tangible fixed assets / total assets	1.9	5.9	***	3.1	***
intangible assets / total assets	23.8	2.2	***	2.4	***
intangible assets/ total fixed assets	92.3	32.1	***	50.0	***
		only firms with indicators > 0			
liquidity / total assets	16.1	11.0	***	14.9	*
tangible fixed assets / total assets	4.9	10.3	***	6.6	***
intangible assets / total assets	26.9	4.0	***	4.8	***
intangible assets/ total fixed assets	93.5	42.1	***	60.3	***

Table A.4: Investment and growth (percentages)

	Median				
	ISUPs	Others	diff	Others only HT	diff
		all firms			
investments / total assets	10.7	1.3	***	1.3	***
investments / total fixed assets	47.5	14.9	***	20.3	***
sales growth (2013-14)	34.2	4.1	***	5.3	***
total asset growth (2013-14)	22.0	7.0	***	10.9	***
equity growth (2013-2014)	11.9	9.1	*	10.0	
financial debt growth (2013-2014)	3.8	-1.2	***	0.0	***
		only firms with indicators > 0			
investments / total assets	19.0	4.3	***	5.0	***
investments / total fixed assets	60.9	37.5	***	50.0	***

Table A.5: Profitability and cash flow (percentages)

	Median				
	ISUPs	Others	diff	Others only HT	diff
		all firms			
EBITDA / total assets	1.2	7.3	***	10.3	***
cash flow / toal assets	2.6	4.0	***	5.3	***
ROE (2)	0.0	27.9	***	27.3	***

Table A.6a: Financial structure and debt composition (percentages)

	Median				
	ISUPs	Others	diff	Others only HT	diff
		all firms			
total debt / total assets	62.5	81.7	***	68.9	
financial debt / total debt	28.8	16.5	***	7.5	***
leverage	28.6	42.5	***	14.3	***
		only firms with indicators > 0			
total debt / total assets	63.4	82.4	***	69.9	***
financial debt / total debt	57.3	36.1	***	34.3	***
leverage	63.3	71.3	***	58.4	**

Table A.6b: Other debt component and debt maturity (percentages)

	Median				
	ISUPs	Others	diff	Others only HT	diff
		all firms			
trade debt / total debt	33.3	44.2	***	36.4	**
trade debt/sales	30.4	21.3	***	17.3	***
shareholders' loans/financial debt	0.0	0.0	***	0.0	***
short term fin. debt / financial debt	100.0	100.0		100.0	
bank loans / financial debt	10.7	39.1	***	5.2	
short term bank loans / bank loans	100.0	100.0		100.0	
		only firms with indicators > 0			
trade debt / total debt	36.9	47.3	***	40.6	**
trade debt/sales	33.3	22.6	***	19.3	***
shareholders' loans/financial debt	96.8	92.6		100.0	
short term fin. debt / financial debt	100.0	100.0		100.0	
bank loans / financial debt	96.2	99.6	*	100.0	
short term bank loans / bank loans	100.0	100.0		100.0	

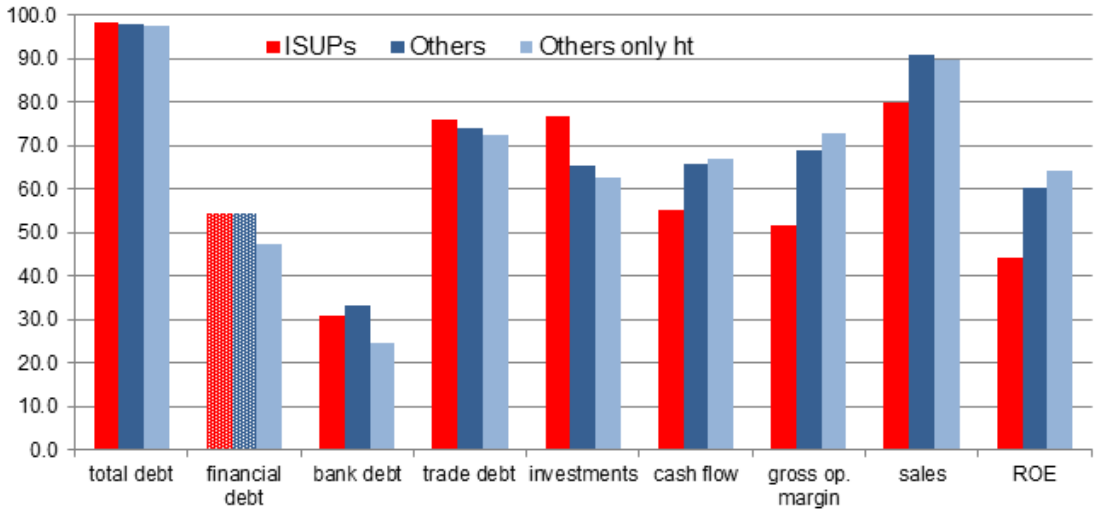
Table A.7: Comparison among ISUPs and other very innovative high-tech start-ups *(percentage)*

	Median		
	ISUPs	Restricted HT start-ups(1)	diff
	only firms with indicators > 0		
liquidity / total assets	16.1	11.1	***
investments / total assets	19.0	12.7	***
total debt / total assets	63.4	70.0	***
leverage	63.3	66.7	**
financial debt / total debt	57.3	47.3	***
short term fin. debt / financial debt	100.0	100.0	
bank loans / financial debt	96.2	100.0	**
short term bank loans / bank loans	100.0	100.0	

Table A.8: ISUPs and other very innovative high-tech start-ups: firm size and amount of external funding*(thousands of euros)*

	Median		
	ISUPs	Restricted HT start-ups(1)	diff
	all firms		
total assets	105.0	82.0	***
sales	37.0	56.0	***
equity	21.0	13.0	***
financial debt	11.0	8.0	**
bank loans	0.0	0.0	**
	only firms with indicators > 0		
sales	63.0	95.0	***
equity	25.0	16.0	***
financial debt	39.0	33.0	***
bank loans	31.0	37.0	

Figure A.1: Firms with positive values of indicators
(percentages)



(B) Data and balance-sheet indicators

The CEBI-CERVED dataset collects annual reports for all Italian limited liability firms. The Centrale dei Bilanci (CEBI) was founded as a joint agency of the Bank of Italy and the Italian Banking Association in the early 1980s to assist in supervising the risk exposure of the Italian banking system. Today part of CERVED, the leading group in business information services in Italy, CEBI was a private company during the sample period, owned by major Italian banks which exploited its services in gathering and sharing information about firms. The long-term institutional role of CEBI ensures high data quality, thereby substantially limiting measurement errors.

Size:

Micro firms: firms with fewer than 10 employees and with sales or total assets no greater than € 2 million

Small firms: firms with fewer than 50 employees and with sales or total assets no greater than € 10 million

Sectors:

For classifying sectors of economic activity we rely on *Ateco 2007*.
The high-tech sector definition is based on the Eurostat classification:

- High-tech classification of manufacturing industries: Manufacture of basic pharmaceutical products and pharmaceutical preparations (21); Manufacture of computer, electronic and optical products (26); Manufacture of air and spacecraft and related machinery (30.3).
- High-tech knowledge-intensive services: Motion picture, video and television programme production, sound recording and music publishing activities (59); Programming and broadcasting activities (60); Telecommunications (61); Computer programming, consultancy and related activities (62); Information service activities (63); Scientific research and development (72)

Indicators:

All Indicators are winsorized at the 5th and 95th percentiles.

Financial structure indicators:
Leverage: financial debt/(financial debt + equity)
Profit indicators:
ROE is only calculated for firms with positive net worth.

(C) The econometric analysis

In Section 3, we used OLS estimates in order to compare innovative start-ups with firms included in the control sample. The results of the regression provide a robustness check for the differences in median and mean values between the two groups.

For each balance sheet indicator we estimated the following equation:

1) All ISUPs versus all start-ups

$$Ind_i = \alpha + \beta_1 ISUP + \beta_2 D\_2014 + \beta_3 GEO + \beta_4 SIZE + \beta_5 AGE + \beta_6 SECT + \beta_7 HTECH + \varepsilon_i$$

2) All ISUPs versus high-tech start-ups

$$Ind_i = \alpha + \beta_1 ISUP + \beta_2 D\_2014 + \beta_3 GEO + \beta_4 SIZE + \beta_5 AGE + \beta_6 SECT + \beta_7 \ SNOHT + \beta_8 MNOHT + \varepsilon_i$$

where the independent variables are dummies defined according to the following scheme.

Dummy variable	**1**	**0**
ISUP	Innovative start-ups	Other start-ups
DUMMY2014	Year of balance sheet: 2014	Year of balance sheet: 2013
GEO1	Firms located in central regions	Firms located in other regions
GEO2	Firms located in southern regions	
SIZE	Micro firms	Small firms
AGE	Firms active for 1 or 2 years	Firms active for 3 or 4 years
SECT	Manufacturing firms	Services firms
HTECH	High-tech sectors	Other sectors
For high-tech sector HTECH has been replaced by:		
SNOHT	Service no high-tech sectors	Other sectors
MNOHT	Manufacturing no high-tech sectors	Other sectors

In this way, the estimated value of the coefficient β_1 measures the difference in the dependent variable between innovative start-ups and firms included in the control sample, taking into account the firms' characteristics identified by the other dummies included in the equation.

To take into account the presence of possible outliers we always windsorized the balance-sheet indicator used as a dependent variable at the 5th and 95th percentiles.

Correlation among dummies

	ISUP	D_2014	GEO1	GEO2	SIZE	AGE	SECT	HTECH
ISUP	1							
D_2014	0.0229	1						
GEO1	-0.0105	0.0033	1					
GEO2	-0.0283	-0.0134	-0.3797	1				
SIZE	-0.0048	-0.0034	0.0126	0.0206	1			
AGE	0.0278	-0.0246	0.0101	0.0199	0.0336	1		
SECT	0.0118	0.0049	-0.0336	-0.0324	-0.0771	-0.0109	1	
HTECH	0.2129	0.0067	0.0187	-0.0472	0.0118	-0.0001	-0.0672	1