BANCA D'ITALIA

EUROSISTEMA

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INNOVATIVE FIRMS UNVEILED: ECONOMIC AND FINANCIAL INSIGHTS FROM ITALIAN START-UPS

by Maria Giulia Cassinis*, Andrea Cintolesi*, Sara Formai*, Andrea Locatelli*, Francesco Manaresi*, Elisabetta Manzoli*, Giulio Papini*, Fabio Parlapiano*, Pasquale Recchia* and Simone Zuccolalà*

Abstract

This study analyzes the economic and financial characteristics of innovative firms in Italy from 2010 to 2024, focusing on two key groups: innovative start-ups as defined by the Italian 'Start-up Act' (INN-SUs) and venture capital-backed start-ups (VCB-SUs). Both groups are then compared with a broader group of young, limited liability companies (OTH-SUs). Despite representing a small share of the start-up population (2.2 per cent and 0.2 per cent, respectively), INN-SUs and VCB-SUs are disproportionately active in innovation, particularly in patenting. Their ownership structures are more diversified, with younger, predominantly male investors often located outside the firm's province. While initially smaller in revenues and employment, innovative firms exhibit higher asset intensity and a more robust long-term growth trajectory. Notably, VCB-SUs experience significant post-investment expansion, highlighting the role of venture capital in easing financial constraints and providing strategic support. The findings suggest that regulatory and market-based definitions of innovation capture complementary dimensions of entrepreneurial potential, with policy frameworks enabling broader access and VC investments signalling high-growth prospects.

JEL Classification: G3, G24, L2, O3.

Keywords: start-up, innovative firms, venture capital, firm performance.

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* Bank of Italy.

1. Introduction and results overview[1]

Start-ups play a crucial role in driving technological innovation and economic growth. Despite their small size, these companies account for a disproportionate amount of job creation (Haltiwanger et al., 2013), output growth (Haltiwanger, Jarmin and Miranda, 2016) and innovation (Kortum and Lerner, 2000). More importantly, start-ups are often the source of radical innovations that lead to creative destruction, fostering competition, benefitting consumers, and enhancing productivity growth (Gans, H. and Stern, 2002 and Akcgit and Kerr, 2018).

However, not all start-ups are innovative or present high growth potential and identifying these sub-groups *ex-ante* can be a challenging task. And yet, it would allow to calibrate policy interventions —such as tax incentives and public funding programs—aimed at nurturing innovation and enhancing firm-level competitiveness. Using Italian firm level data for the years 2010-24, this note describes the features of innovative firms using two groups as a reference: 1) "Innovative start-ups" (INN-SU), defined by the Italian law as those firms that upon meeting specific requirements have been eligible since 2012 to register in a special section of the Business Registry maintained by the Italian Chamber of Commerce; and 2) firms that received a venture capital (VC) financing round (VC-backed start-ups, VCB-SU) between 2010 and 2024. The latter group identifies firms that, whether or not in the Registry, are considered more innovative and with a higher growth potential by the market. For both groups of firms, the note compares firm-level information on patent ownership, shareholders structure, economic and financial information to a benchmark sample consisting of the other limited liability companies that started their operations since 2010 (other start-ups, OTH-SU).

Since 2012 approximately 31,000 firms have registered as INN-SU at various points in time. Over the same period, there have been about 3,000 VCB-SU, i.e. firms that have ever received at least one round of VC financing. More than 80 per cent of VCB-SU are also registered as INN-SU – though only 7 per cent of INN-SU are also VCB-SU – suggesting that the legislative definition of INN-SU broadly captures firms that the market also defines as innovative, but it includes also a wider array of firms.

Our analysis yields several results. First, both categories of innovative start-ups differ from the broader sample of other young firms along dimensions that are usually associated with greater dynamism, growth potential and innovation capacity. While some of these features are a natural consequence of the group definition in the case of INN-SU, they are particularly pronounced in VC-backed start-ups. More specifically, innovative start-ups: (i) are highly specialized in ICT and professional services (e.g. software, computer consulting, and R&D activities); (ii) provide a contribution to patent registration which is proportionally larger than their sample size; (iii) have a shareholder base which is broader and more diverse (comprising a mix of other corporations and financial investors); individual shareholders are also younger, predominantly male, and more frequently non-local (e.g. born in provinces different from the firm's location).

Second, the significant engagement of innovative firms in R&D projects translates into differences in balance-sheet composition: compared to OTH-SU, they possess a greater endowment of intangible assets and a more equity-intensive capital structure. The larger

[1] We are thankfull to Francesco D'Amuri, Federico Maria Signoretti, Roberto Torrini, Alessio de Vincenzo and Federico Cingano for their comments and suggestions.

capitalization observed among innovative firms is consistent with predictions from information asymmetries theory, which highlights the inherent opacity of investments in innovation. In such contexts, entrepreneurs typically possess superior information regarding the technological feasibility and market potential of their projects compared to external investors. This informational imbalance, coupled with the intangible nature of innovative assets, often limits access to traditional debt financing that relies on standard forms of collateral. As a result, innovative firms tend to rely more heavily on equity financing, leading to a larger capital base (Ackerlof, 1970; Spence, 1973; Stigliz, 1975; Hall and Lerner, 2010). At the same time, these firms, around the time of their registration in the special section of the business registry or prior to a venture capital deal, exhibit weaker *ex-ante* economic performance in terms of profitability, revenues and employment. This evidence underscores the uncertainties inherent in developing innovative projects, which more frequently expose early-stage ventures to negative economic outcomes.

Third, innovative firms display a distinctive trajectory in the stages of their life cycle. Compared to other young firms, they progressively widen their initial advantages in terms of total assets, share of intangible assets and equity. Conversely, their initial disadvantages in terms of revenues and employment tend to diminish within a ten-year span, while the productivity gap narrows substantially. For VC-backed start-ups, following the first round of venture capital financing, these dynamics are even more pronounced. Importantly, on the liabilities side, VCB-SU gradually reduce their reliance on external debt over a five-year period, suggesting a shift toward equity-based financing.

Finally, innovative firms do not necessarily have lower survival rates in the short-run. In fact, despite operating in sectors traditionally associated with higher business risk and recording weaker economic performance, **innovative start-ups are initially more likely to survive than their non-innovative counterparts**. **In the longer run however,** despite improvements in their economic performance, the selection increases and survival rates of innovative firms fall below those of other young firms. With respect to the subset of VCB-SU, this result aligns with evidence for the U.S., where venture-backed firms exhibit higher short-term survival rates, although their failure rates tend to converge with those of other start-ups after several years—coinciding with the typical investment horizon of venture capital funds.

Overall, the large contribution to patenting and risker profile of innovative firms documented in this work suggest that both the regulatory definition of innovative firms and the market benchmark set by venture capital investments are effective in identifying companies with stronger growth potential in the medium term.

2. Data

2.1 Innovative start-ups

This study utilizes a comprehensive set of firm-level data sources covering Italian companies over the period 2012–2024. The primary dataset is derived from the Innovative Start-ups Register, maintained by the Italian Chamber of Commerce. This register was established under the provisions of Law 221/2012, commonly referred to as the "Start-up Act," which introduced a dedicated legal framework to support the creation and growth of high-tech, innovation-driven start-ups in Italy.

Firms included in the register must meet a set of eligibility criteria. Specifically, qualifying firms are unlisted corporations, operational for less than five years, headquartered in Italy, and generate annual revenues below € 5 million. Additionally, they must not result from mergers, demergers, or business unit transfers, must refrain from profit distribution, and must have as their exclusive or primary objective the development, production, and commercialization of innovative goods or services with high technological value. Moreover, innovative start-up, must also satisfy at least one of the following conditions:

- allocate a minimum of 15% of their annual expenditures to research and development (R&D);
- employ a highly qualified workforce, with at least one-third of employees holding or pursuing a PhD or engaged in research, or at least two-thirds holding a master's degree;
- hold or license a registered patent or certified software.

The regulatory framework introduced a set of favourable provisions for innovative start-ups for the first five years of activity through a number of complementary instruments, including measures that cut red tape and facilitate entry and exit to the market; tax incentives; flexible labour regulations; support to flexible remuneration schemes; incentives for external equity investors and venture capitalists and, simplified procedures for accessing publicly guaranteed loans out of charge under the Guarantee Fund for small and medium-sized enterprises. Overall, this legal framework is aimed at providing support for the start-up creation and the scale up of newly founded companies with high innovation and technological standing.[2]

2.2 Venture capital backed start-ups

Information on venture capital (VC) financing deals is sourced from PitchBook, a commercial data provider specializing in detailed deal-level information on venture capital, private equity, and mergers and acquisitions (M&A) transactions. The dataset includes all VC deals involving Italian target firms—both in the financial and non-financial sectors—across the full spectrum of the investment cycle. This encompasses early-stage investments such as incubators and business angels, as well as later-stage financing rounds.

[2] In December 2024, the Italian government enacted the Competition Bill which introduced more stringent eligibility requirements for firms seeking to remain in the special section of the Business Register beyond their third year. Continued inclusion is now contingent upon meeting at least one of the following criteria:
(i) a minimum 25% increase in research and development (R&D) expenditures;
(ii) the execution of at least one experimentation contract with a public administration;
(iii) a 50% or greater increase in either revenues or employment between the second and third year of activity;
(iv) the establishment of a capital reserve exceeding €50,000, achieved through convertible financing or a capital increase with share premium involving a minority stake by a qualified third-party investor (e.g., certified incubator, accelerator, business angel, or equity crowdfunding platform);
(v) the registration of at least one patent.
Furthermore, the standard five-year limit for remaining in the special section may be extended by up to four additional years to support the transition to the scale-up phase. This extension is conditional upon meeting at least one of the following: (i) a capital increase with share premium exceeding €1 million by a collective investment undertaking; (ii) an annual revenue growth rate exceeding 100%. See also Banca d'Italia (2024) for a recent discussion and assessment of the legal framework concerning innovative start-ups, as well as Manaresi at al. (2021) and Accetturo (2022).

Our sample spans the period from 2010 to 2024, capturing the evolution of the Italian VC market from its nascent stages to a more structured, albeit still modest, ecosystem by European standards (Vacca, 2013; Bronzini et al., 2019). Over this period, VC investments in Italy involved approximately 3,300 target firms and 2,700 distinct investors. The pre-seed phase—comprising accelerators, incubators, and angel investors—accounts for the largest share of deals, representing 51% of the total number of transactions. However, due to the relatively small size of individual investments at this stage, the pre-seed phase absorbs only about 4% of the total capital invested, amounting to approximately €0.4 billion out of €8.9 billion (Table 1).

In contrast, the seed and early-stage phases attract most financial resources, capturing approximately 80% of total VC investment, despite accounting for only one-third of the total number of deals. This distribution pattern diverges from trends observed in other European countries and the United States, where later-stage VC rounds typically dominate both in terms of deal volume and capital allocation. The Italian VC landscape thus reflects a strong emphasis on early-stage financing, underscoring the ecosystem's developmental focus and the relative scarcity of scale-up capital. Furthermore, VC financing rounds are often bundled with other debt financing facilities. As enterprises progress through subsequent financing rounds, they tend to make increased use of debt instruments. Further details regarding the development of the VC market in Italy see Appendix A1.

Tab. 1 VC investments by deal type

Deal type	N. deals	N. firms	N. investors	Equity invested	Debt invested	Median N. of deals	Median N. of investors
Accelerator/Incubator	2,885	2,058	711	136	4	2	1
Angel (individual)	311	275	124	254	29	2	1
Seed Round	1,178	926	848	3,293	77	2	2
Early Stage VC	698	504	583	4,049	601	4	2
Later Stage VC	1,090	861	697	1,229	37	2	2
Total	6,162	3,321	2,730	8,961	748	2	1

Note: Authors' calculation on Pitchbook data. The dataset includes all completed VC deals involving Italian firms between 2010 and 2024. Grants are excluded from the analysis.

2.3 Ownership, innovation and financial information

To complement the aforementioned datasets, we incorporate firm-level information from the Italian Business Register, which provides comprehensive coverage of all limited liability companies founded from 2010 onward—defined in this study as young firms (i.e., less than 12 years old as of the final year in the dataset). This source offers detailed firm demographics, including year of incorporation and closure, sector of activity, and geographical location. Additionally, it provides granular data on shareholder structures, enabling insights into ownership patterns and governance.

We integrate data on patent registrations from the European Patent Office (EPO), which allows for the identification of firms engaged in formal innovation activities.[3]

Finally, balance sheet and financial statement information is sourced from Unioncamere and Cerved, the primary providers of financial data on Italian companies. These datasets collectively enable a multidimensional analysis of firm dynamics, innovation and performance across the Italian entrepreneurial ecosystem.

3. Innovative firms at glance: sectors, registered patents and shareholders

This section provides an overview of the profile of innovative firms, divided into two not mutually exclusive groups of limited liability companies:

1. INN-SU: innovative start-ups defined by the Italian "Start-up Act" and registered at any point in time between 2012 and 2024 in the special section of the Business Registry of the Chamber of Commerce;
2. VCB-SU: firms that secured a venture capital deal between 2010 and 2024.

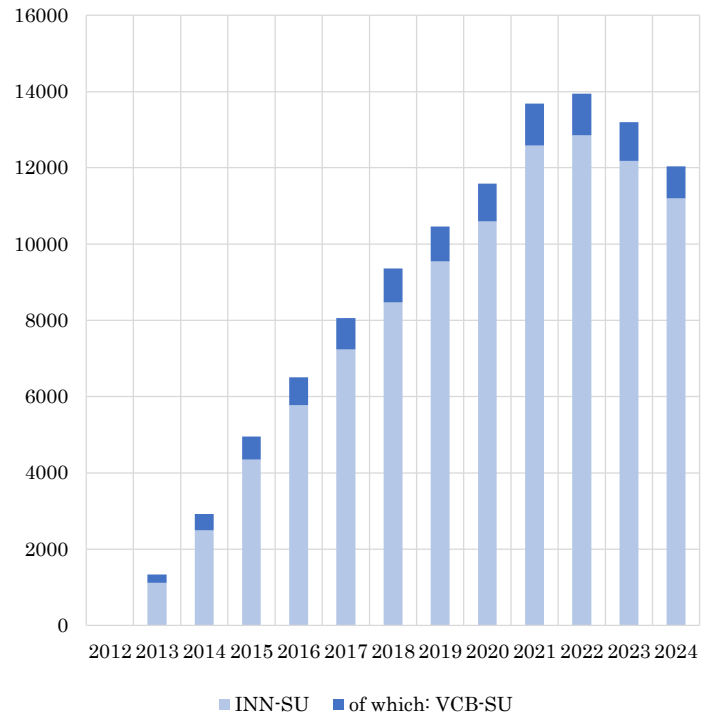
To benchmark innovative firms characteristics and their dynamics over time the other limited liabilities companies (OTH-SU) that started their operations since 2010 is used as control group.

Since the introduction of the Start-up Act, the number of registered innovative start-ups has steadily increased, reaching its peak in 2022 (Fig. 1). By the end of 2024, the number of innovative start-ups amounted to approximately 12,000. Among these, only around 7 percent (841) of INN-SU were also VC-backed—a share that has been gradually declining over the years.

During the entire 2012–2024 period, roughly 31,000 firms registered as innovative start-ups, representing 2.2 per cent of the population of young firms (OTH-SU). At the same time, 2,280 INN-SU were also VC-backed (7 per cent), accounting for approximately 80 percent of all VCB-SU.

Fig. 1 Registered Innovative start-ups

[3] The Unioncamere dataset, which includes firms' tax identification codes, is updated through 2023. However, when working with patent data, it is important to account for the inherent time lag in the patent granting process. Specifically, there is often a significant delay between the initial filing date—referred to as the priority year, which is typically the most economically meaningful date—and the publication date, when the patent becomes publicly available and is incorporated into datasets. To address this lag, a standard four-year window is typically applied, meaning that patent data are analyzed with reference to the priority date, but only up to 2019 to ensure completeness and reliability.



Note: Authors' calculation on InfoCamere and Pitchbook data. The height of each histogram represents the number of innovative start-ups registered in the special section of the Business Register at each year-end. The sample of VC-backed innovative SU (dark blue bar) includes those firms that received a VC-financing round anytime between 2010 and 2024 and, at the same time, result in the special section of the Business Register.

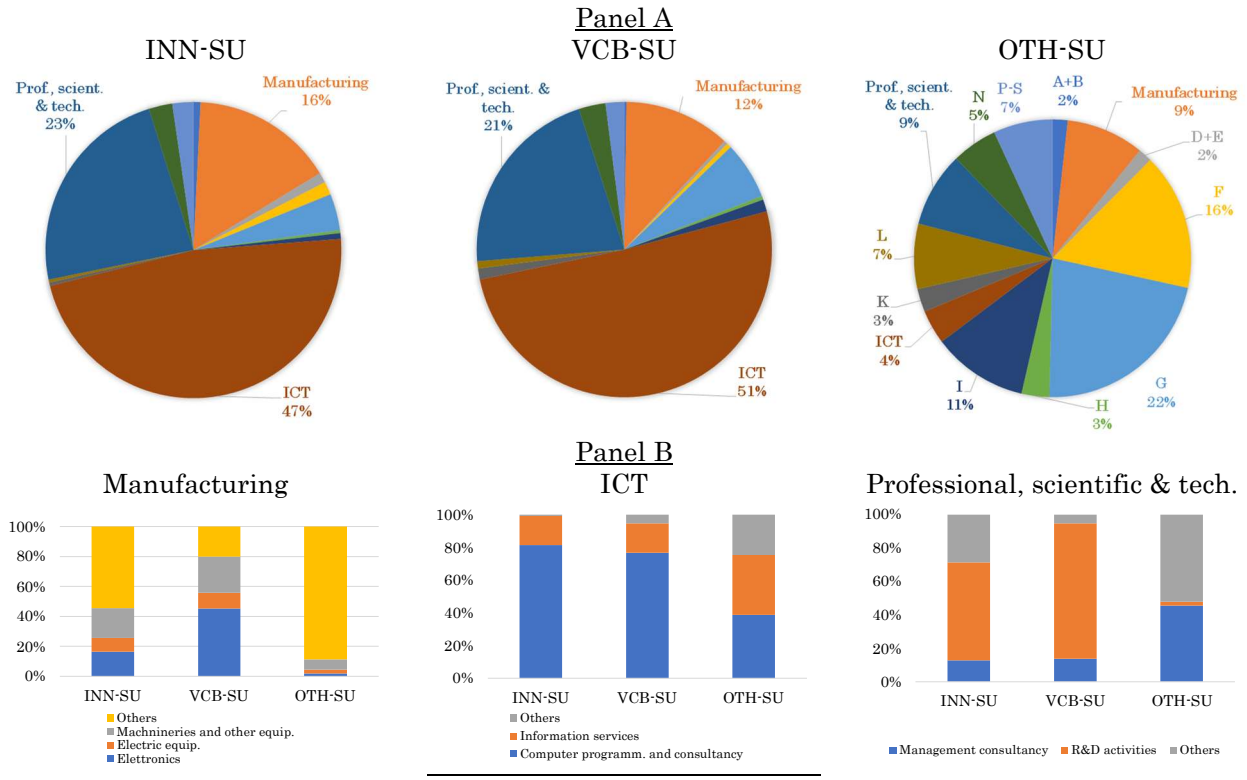
3.1 *Sectoral distribution*

The sectoral distribution of INN-SU and VCB-SU is very similar and highly concentrated in three main industries (Fig. 2 – panel A). At the latest available date (2023 year-end),[4] about half of active start-ups in these two groups operated in the ICT services, with 80 per cent specializing in computer programming and consultancy activities (Fig. 2 – panel B). Almost one-fourth were engaged in professional, scientific and technical activities, mainly research and development, and about 15 per cent were manufacturing firms in the electronics, electric equipment and other machineries industry group. This pattern has remained constant over the years, with firms in ICT increasing their share to the loss of firms in manufacturing (Table A1.1 in the Appendix). The most prominent difference between the two groups is that VCB-SU are relatively more specialized in ICT sectors.

Not surprisingly, OTH-SU present a broader sectoral composition, with retail services, construction, and accommodation and food service activities being the most represented. High knowledge-intensive industries, such as ICT and professional, scientific, and technical activities, account for only 4 and 9 percent of the population of young firms, respectively.

Fig. 2: Innovative firms by sector

[4] The figures refer to 2023 year-end data since sectoral classification is available only several months after the first registration in the Chamber of Commerce's register.



Note: Authors' calculation on Infocamere and Pitchbook data. Sectoral information is drawn from Infocamere using 2023 year-end data. The Ateco industry classification is as follows: A) agriculture; B) Mining; C) Manufacturing; D) Energy; E) Utilities; F) Constructions; G) Trade; H) Transports; I) Hospitality and restaurants; J) Media services; K) Telecom; L) Financial and insurance services; M) Real estate; N) Professional, scientific and technological activities; N) Admin services; P-S) all of the remaining sectors.

3.2 *Patenting*

In Italy, young firms (aged less than six) account for 20 percent of innovators – defined as firms that filed at least one patent within the European Patent Office between 2012 and 2019, and 15% in terms of patents filed.[5][6] Within this group, INN-SU and VCB-SU, exhibit even more pronounced patenting activity compared to OTH-SU. Over the 2012-19 period, about 5% of INN-SU have filed at least one patent compared to about 0.1% for OTH-SU. Furthermore, even if they account for only 2.3% of all limited liability companies of comparable age, INN-SU represent about 50% of innovators, accounting for about 44% of the total number of patents registered in the same period (Table 2 – panel A).[7]

[5] For the sub-sample of INN-SU for which we are able to retrieve employment and balance sheet data, we find that between 2012 and 2019 young firms account for 30 per cent of the total number of firms, 14 per cent of employment and 9 per cent of value added, 20 per cent of innovators and 14 per cent of patents fillings.

[6] Figure A in appendix, shows the distribution of firms and innovators by age. See Lotti and Nobile (2025) for evidence on relationship between firms' age and patenting.

[7] This suggests that within the selected and restricted group of patenting firms, INN-SU fill on average less patents (1.6) than OTH-SU (2.0). In other words, among OTH-SU, patenting activity is restricted to a very small share of big firms, each filling on average more patents than the average INN-SU. For instance, in 2019, looking at firms for which we have balance sheet and employment data, within the group of more than 350.000 OTH-SU with on average 6 employees, only 237 firms filled for a patent application, and these had on average more

In the case of VCB-SU this trait is even more pronounced. While their proportion over the total number of young firms is very small (about 0.2%) their contribution to innovation is marked, accounting for about 12% of both the total number of innovators and patents. In the US, VC-financed firms are also an extremely small percentage of all new firms created. They accounted for 0.22% over the period 1996–2000 (Puri and Zarutskie, 2012). These results are robust to controls for sectoral differences between the industries where innovative firms are predominantly active (Table 1 – panel B).

Tab. 2: Innovative firms sample size and their patents

(percent)

	(1) INN-SU	(2) VCB-SU	(3) OTH-SU
		Panel A: All firms	
% firms out of total	2.3	0.2	97.7
% firms out of patenting firms	50.2	11.7	49.8
% of patents	44.3	11.8	55.7
		Panel B: Top 20 sectors	
% firms out of total	4.7	0.5	95.3
% firms out of patenting firms	56.7	14.1	43.3
% of patents	49.8	14.1	50.2

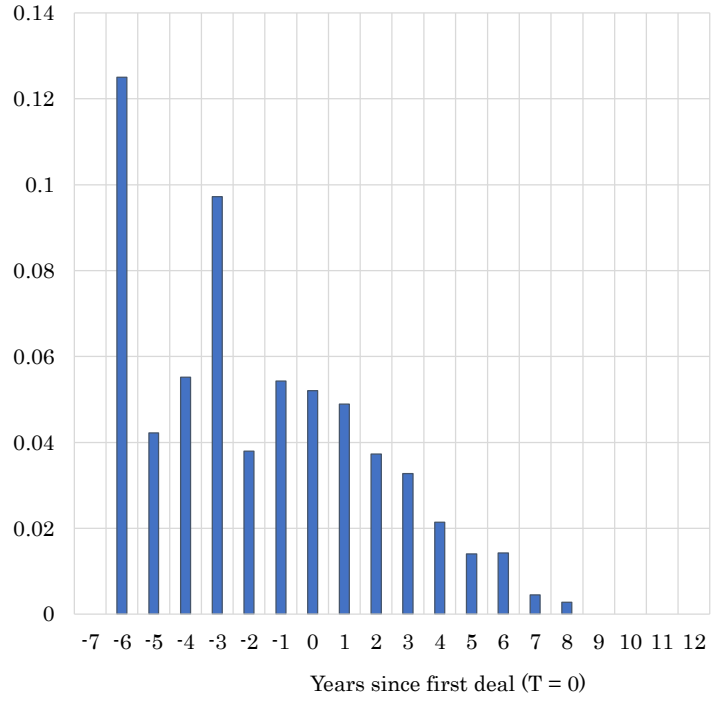
Note: Authors' computation on Unioncamere, InfoCamere and Pitchbook data. The total number of firms includes limited liabilities companies founded between 2012 and 2019; patenting firms are those that filed for at least one patent during the same time period and, total patents, is the total number of patents filled. Column 4 reports the shares of firms and patents out for VCB-SU that are also INN-SU.

Investments in innovative projects can benefit significantly from the easing of external finance constraints brought about by new equity investors. At the same time however, having already filed for a patent can signal the quality of a firm, thereby attracting new investors. Figure 3 illustrates the average number of patents filed in relation to the timing of the first venture capital deal. Interestingly, patenting activity appears to be more intense prior to this event.[8] This evidence aligns with both theoretical and empirical findings in the literature, suggesting that actively developing technologies—whether through R&D or patents—increases the likelihood of being acquired. This is partly due to their role in reducing information asymmetries between start-ups and investors (e.g., Phillips and Zhdanov, 2013). Amongst OECD countries there is evidence consistent with our findings that patents tent to be registered in the early stages of a firm lifecycle and, in particular, in the years preceding a VC investment round (Breschi et al., 2018).

than 150 employees. Within the group of 8394 INN-SU, these were 162 innovators with on average 6 employees.

[8] Only 14 per cent of the active VC backed start-ups did not fill a patent within the observed period.

Fig. 3: Patents prior and following a VC deal
(units)



Note: Authors' computation on Unioncamere, InfoCamere and Pitchbook data. The figure reports the average number of patents filed by VCB-SU in the years prior and following the firs VC deal.

3.3 Shareholders base

Private investors in innovative start-ups benefit from substantial tax incentives, which are likely to foster the availability of equity financing. These fiscal advantages reduce the effective cost of investment and enhance the attractiveness of allocating capital to early-stage ventures by a variety of investors, e.g. individual shareholders, corporates and financial institutions.[9]

To assess what differences are at play in the shareholder base of innovative firms, Figure 4 displays the coefficients β from the following regression:

$$y_{i,t} = \alpha_s + \delta_T + \beta D_i + \varepsilon_{i,t} \quad (1)$$

estimated separately for firms in their founding year (yellow bars) and for firms at the age of 6 years (purple bars). α_s and δ_T are respectively sector and cohort fixed effects and D is a dummy equal to

[9] Tax benefits for equity investments in innovative firms are not exclusive to Italy. These incentives vary in structure offering income tax deductions, capital gains exemptions, or matching public funds or grants. A few notable example include: (i) the UK, where the Enterprise Investment Scheme (EIS) and the Seed Enterprise Investment Scheme (SEIS) provide substantial income tax relief and capital gains tax exemptions for investments in qualifying early-stage companies; (ii) France, where the Madelin Law, allows individuals to deduct a portion of their investment in SMEs from their income tax; (iii) Germany which provides tax incentives for business angels and venture capital funds investing in innovative start-ups, including partial exemptions on capital gains; (iv) the United States, where the Qualified Small Business Stock (QSBS) exclusions allows for significant capital gains tax exemptions on investments held for more than five years and (v) Israel, which provides tax benefits for foreign and domestic investors in R&D-intensive firms.

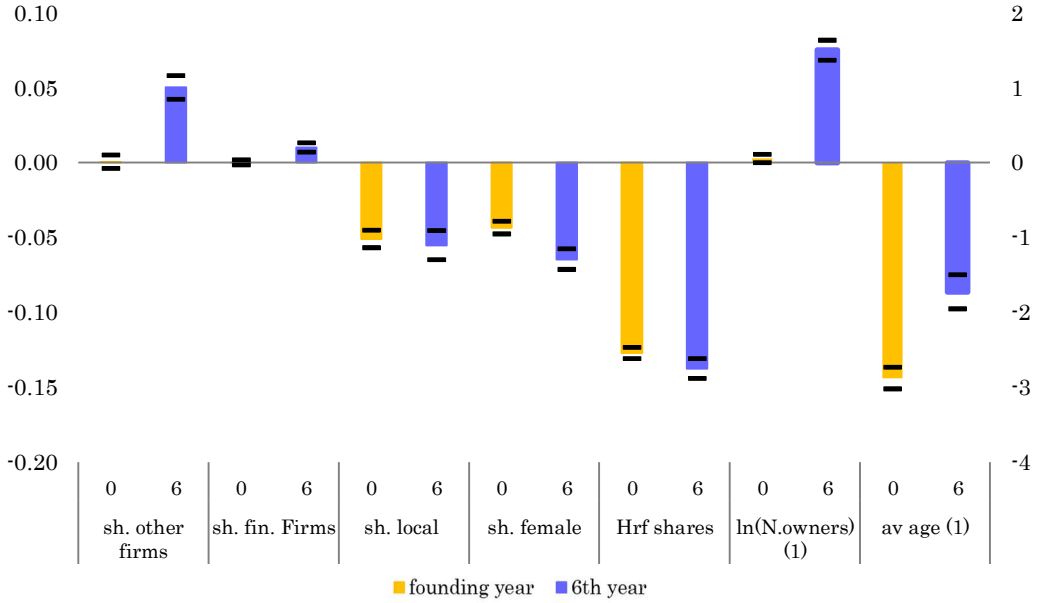
0 if a firm is a OTH-SU and equal to 1 if it is either (i) an INN-SU or (ii) VCB-SU. The coefficient β measures the average difference in the variable y (for instance, in years if y is the average age of owners, or in percentage points when the share of female owners is considered) between innovative firms and other firms, controlling for year of foundation and sector.

Starting from Figure 4 – panel A, the shareholder base of INN-SU at the funding year – as compared to OTH-SU (yellow bars) – is typically less concentrated (measured by a lower Herfindhal index of capital shares); it is composed by younger individuals (2.8 year younger on average); and has higher proportions of males and non-local shareholders (i.e. individuals born in provinces different from the firm's location). These differences become more evident by the age of six (purple bars), when innovative start-ups display a notably larger number of shareholders (on average 5 more than OTH-SU) and a significantly higher share of capital owned by other firms (5 percentage points more) including financial firms.

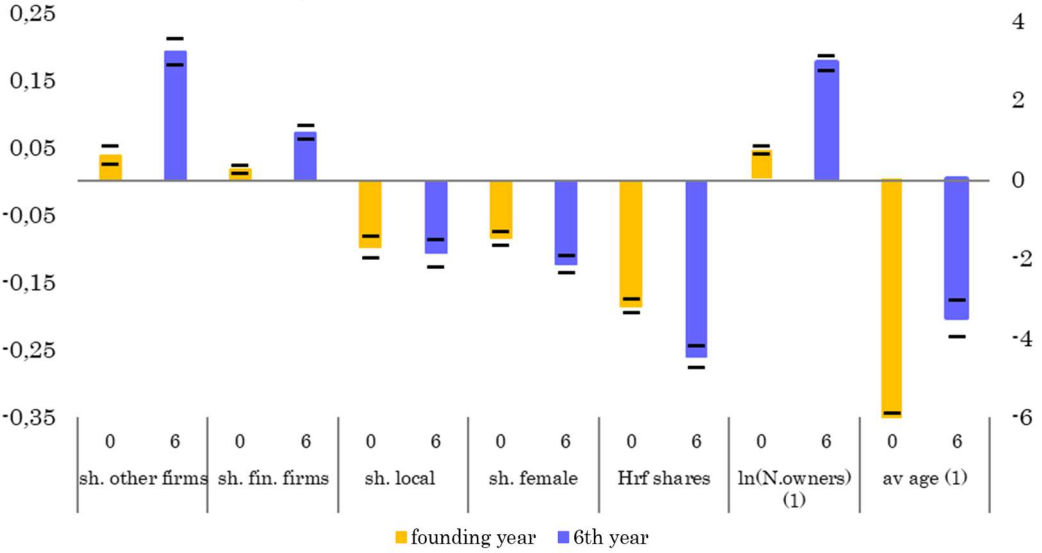
For VCB-SU these differences are even more pronounced (Figure 4 – panel B). Compared to OTH-SU, VCB feature a less concentrated ownership and a larger number of shareholders, especially after 6 years (around 18 more). The shares owned by other corporates, particularly financial firms, is higher and the gap widen over time (19 and 7 percentage points by the age of six). Additionally, capital holdings by male shareholders is higher and individual owners tend to be younger on average.

Fig. 4 Shareholders base

Panel A: Difference between INN-SU and OTH-SU



Panel B: *Difference between VCB-SU|INN-SU and OTH-SU*



Note: Authors' computation on Unioncamere and InfoCamere data. (1) right axes scale. The bars represent the regression coefficient for outcome variables on the x-axes on a dummy for the firm being an innovative SU (Panel A) or VC-backed (Panel B). The black bars represent the 95% confidence intervals. The control group is represented by the broader sample of OTH-SU. The regression includes controls for age cohorts and 2-digit industry fixed effects. The bars represent the difference between the 2 groups at the founding year (yellow) and six years after (purple). The outcome variables are: (i) the share of capital owned by other firms, (ii) the share of capital owned by financial firms, (iii) the share of capital owned by individuals that are resident in the same province where the firm is located, (iv) the share of capital owned by women, (v) the Herfindahl Index of capital shares, (vi) the log of the number of owners and (vii) the average age of owners.

4. The financial and economic profile of innovative firms

In this section, we extend the analysis with the aim of comparing the two groups of innovative firms (INN-SU and VCB-SU) to the benchmark group of OTH-SU across a range of balance-sheet economic

and financial variables drawn from the Cerved database, relative to limited liability firms. In this smaller sample, the fractions of INN and VCB start-ups are nonetheless identical to those in the extended sample (Table 3). In 2019 (the last available year in common to all the data sources), they represented a very small share of value added (1.14%) and employment (1.25%).[10] Still, their contribution to both new patents and the stock of patents filled was significantly higher.

First, we examine whether innovative firms—prior to receiving their first venture capital investment, in the case of VCB-SU, and at the time of the registration in the special section of the Business Registry in the case of INN-SU—differ amongst themselves and from the other limited liability start-ups.

Second, we analyse how the dynamics for a number of outcome variables evolve during the early stage of their life cycle so as to highlight potential convergence or divergence over time between these group of firms. Finally, for the group of VCB-SU we investigate the impact of VC investments on selected variables by exploiting the staggered timing of the deals, which allows us to address sample selection bias due to the non-random selection of firms into VC deals.

Tab. 3: Matched sample: innovative firms with financial information
(percent)

	N. Firms	Value added	Employment	New patents	Stock of patents
INN-SU	2.37	1.14	1.25	36.87	34.99
VCB-SU	0.23	0.44	0.35	15.13	10.60

Notes: Authors' computation on Cerved, Unioncamere and INPS data. Information refers to year 2019.

4.1 Firms' ex-ante characteristics

Innovative firms and the control group of other start-ups could differ in their economic and financial metrics partially owing to their differences in age, sector and size (descriptive statistics for the samples considered in this section are provided in Table A2.1 in Appendix A2). This consideration highlights the importance of comparing firms' *ex-ante* characteristics in a regression setting. We estimate a linear probability model (LPM), where the dependent variable is a treatment dummy variable ($D_{i,t}|1$) which is set to zero for the control group of young firms and to one for either INN-SU or the VCB-SU as in (2):

$$D_{i,t}|1 = \alpha_s + \delta_t + \gamma_a + \sum_n \beta_n * X_{i,t} + \varepsilon_{i,t} \quad (2)$$

[10] In comparison with the U.S. economy, Italian VCB-SUs represent a similar share of the total number of start-ups, yet their contribution to employment is significantly smaller—primarily due to their more limited average scale. In the United States, venture capital-backed firms accounted for approximately 5.3% to 7.3% of total employment during the 2001–2005 period, underscoring the relatively greater employment impact of VC financing in the U.S. context (Puri and Zarutskie, 2012).

and where: $X_{i,t}$ is a set of economic and financial variables and α_s, δ_t, γ_a are industry, time and age fixed-effects.

Since balance-sheet data are not always available in the year in which the registration in the Business Registry takes place, three years of data are included in the sample, from t-1 to t+1, with t being the year when the firm is registered as innovative start-up. Similarly, VCB-SU are observed from t-3 to t-1 with t being the year when the first VC deal takes place.

Estimates reported in Table 4 indicate that, compared to the control group, INN-SU (columns 1 and 2) and VCB-SU (columns 3 and 4) exhibit lower revenues and fewer employees, although their total assets are relatively higher. Moreover, in line with their stronger patenting activity and R&D expenditures (documented in Section 2), the share of intangible assets is significantly larger.

The financing sources of innovative firms differ systematically from those of other firms. We find that their reliance on financial debt is relatively lower; a finding consistent with capital structure theories, which suggest that firms with more intangible assets face higher bankruptcy costs due to the difficulty of pledging such assets as collateral. By reducing financial leverage, innovative firms aim to minimize these bankruptcy costs.

This result adds to previous evidence that innovative firms tend to have a more diverse shareholder base (see Section 2.3), which includes outsider corporate or financial investors with respect to the founders' entrepreneurs. These firms face greater informational asymmetries due to the inherent uncertainties of innovative activities which, in turn, increase the overall cost of external financing.

According to the pecking order theory (Myers and Majluf, 1984), firms prefer internal financing first, then debt, and resort to equity as a last option, since equity is typically more expensive due to adverse selection problems. Nevertheless, our findings suggest that, for innovative firms, informational asymmetries may have a less pronounced effect on the relative cost of equity compared to debt. This implies that, despite equity being generally more costly, innovative firms might not face as steep a penalty when issuing new equity relative to taking on new debt. In this context, there arise a role for VC investors in mitigating informational asymmetries and financing constrains in equity financing (Hall and Lerner, 2010). Our results align with Aghion et al. (2004) who present evidence for the UK that innovative firms, as indicated by the presence and extent of R&D expenditure, are more likely to raise funds by issuing shares than their non-innovative counterparts.

Finally, innovative firms present a mixed picture with respect to their economic performance: VCB-SU exhibit lower profitability while INN-SU lower labour productivity.

Overall, these findings suggest that, compared to other young firms, innovative companies exhibit weaker ex-ante economic performance. However, specific attributes -such as larger asset bases, a greater share of intangible assets, and a stronger focus on innovation—indicate the potential for high growth over time. In turn, patents can signal start-up quality to external investors in line with Spence (1973) model.

Tab. 4: The ex-ante features of innovative firms

Dependent Var.:	model 1 D | 1(SUI reg.)	model 2 D | 1(SUI reg.)	model 3 D | 1(VC deal)	model 4 D | 1(VC deal)
log(assets)	0.0041 *** (0.0001)	0.0109 *** (0.0002)	0.0019 *** (7.13e-5)	0.0032 *** (0.0001)
intangibles_share	0.0382 *** (0.0005)	0.0296 *** (0.0006)	0.0090 *** (0.0003)	0.0092 *** (0.0004)
leverage	-0.0044 *** (0.0003)	-0.0064 *** (0.0003)	-0.0010 *** (0.0002)	-0.0012 *** (0.0002)
log(revenues)	-0.0037 *** (7.93e-5)	-0.0057 *** (0.0005)	-0.0010 *** (5.13e-5)	-0.0030 *** (0.0003)
return on assets	-0.0149 *** (0.0012)	0.0164 *** (0.0012)	-0.0075 *** (0.0007)	-0.0032 *** (0.0007)
log(employees)	-0.0113 *** (0.0002)	-0.0137 *** (0.0005)	-0.0016 *** (0.0001)	-0.0007 ** (0.0003)
log(lab. productivity)		-0.0034 *** (0.0005)		0.0010 *** (0.0003)
log(patent ownership)		0.7622 *** (0.0230)		0.8512 *** (0.1004)
Fixed-effects	----------	----------	----------	----------
time	Yes	Yes	Yes	Yes
sector	Yes	Yes	Yes	Yes
age	Yes	Yes	Yes	Yes
S.E.: Clustered	by: codfisc	by: codfisc	by: firm	by: firm
Observations	1,369,658.00	1,097,850.00	1,346,594.00	1,081,098.00
R2	0.35	0.40	0.17	0.23

Notes: Authors' computation on Pitchbook and Cerved data. The table reports OLS estimates of Equation (1) using firm-age, sector, and time fixed effects. The dependent variable is a dummy equal to 1 for the set of treated firms, namely INN-SU and VCB-SU, observed from t-1 to t+1 with t being the year when the registration in the special section of the business registry takes place and between t-3 and t-1 with t being the year when the first VC deal takes place. Standard errors are clustered at the firm level. The estimation sample includes all innovative start-ups and all VC-backed firms with balance-sheet information available in the 2010-23 period. The broader control group of young firms includes all active limited liabilities companies founded since 2010 with positive assets. Leverage is the ratio between financial debt and the sum between financial debt and equity; return on assets is the ratio between Ebitda and total assets; labour productivity is the ratio between revenues and the number of employees.

4.2 *Evolution of the economic performance over time*

This section investigates the dynamic behaviour of a set of outcome variables for the groups of innovative firms with respect to the other start-ups in their early to later stages of their life cycle. In particular, we retrieve the average outcome for the two groups conditioning on firms' age and unobserved sectoral time varying heterogeneity using the following regression (3):

$$y_{it} = \alpha + \sum_j \beta_j \cdot D_{\{age=j\}} + \gamma \cdot \text{INN-SU}_i + \sum_j \delta_j \cdot \left(D_{\{age=j\}} \cdot \text{INN-SU}_i\right) + \phi_{\{sector \times t\}} + \varepsilon_{it} \quad (3)$$

where $D_{age=j}$ is a dummy equal to 1 for firms of age j, with age ranging from 0 to 12; INN-SU is a dummy for innovative start-ups, and $\phi_{\{sector \times t\}}$ denotes sector-year fixed effects. The parameters β_j measure the average value of the outcome variable y_{it} for the control group at age j. The coefficient γ represents the average difference of the variable between innovative start-ups and the control group at age j= 0, so that the average value of the variable for INN-SU of age j is given by $\beta_j+\gamma+\delta_j$. Unlike section 3.2, here we do not account for the full set of firm-level controls ($X_{i,t}$).

Figure 5 illustrates the estimated trajectory of the average outcomes for the two groups of innovative firms. To facilitate comparability, all values are expressed as deviations from the average of the

control group at age zero. Accordingly, the starting value for this group is normalized to zero.[11] The outcome variables considered include total assets, equity, revenues (all expressed in logarithmic form) as well as employment, the ratio of intangible capital to total assets and the Total Factor Productivity (TFP). This is estimated using a Cobb-Douglas revenue-based production function, with labour and capital as inputs and where the labour input is proxied by its cost rather than the number of workers; as a result, our approach is subject to data-related limitations. Firstly, the definition of "workers" is restricted to employees, thereby excluding firms with no employees from the analysis. This exclusion is non-trivial, as such firms account for approximately 30% and 40% of the OTH-SU and INN-SU groups, respectively. Secondly, a significant proportion of firms —11% in OTH-SU and 25% in INN-SU— report negative value added. This poses a methodological challenge, as it renders the commonly used metric of labour productivity (logarithm of value added per employee) undefined or misleading for these cases.[12]

INN-SU exhibit a faster capital accumulation over time. By age twelve, their average asset levels exceed those of the control group by approximately 50 percent. A similar pattern emerges for revenues: while INN-SU start smaller, they grow more rapidly and reach parity with the control group by age ten. In terms of number of employees, the convergence between the two groups occurs even earlier, around age six.[13] Starting from an average employment of 0.8 workers at the age 0, after ten years INN-SU reach an average size of 9 units, 3.6 more than the average OTH-SU.

Innovative startups also display consistently higher levels of equity and intangible capital ratios throughout their life cycle. In the case of equity, the gap with the control group is already present at the foundation year and widens over time —likely reflecting the impact of tax incentives for equity investments introduced under the Start-up Act. The difference in intangible capital ratios remains relatively stable over time, suggesting a persistent advantage in the accumulation of intangible assets.

TFP follows a different trajectory compared to other performance indicators. Innovative start-ups begin with substantially lower TFP levels relative to the control group. Although their productivity improves steadily over time, the gap remains open even by age twelve, indicating a persistent lag in efficiency. However, when labour productivity is used as an alternative measure the convergence between INN-SU and OTH-SU appears more pronounced (see Figure A3.4 in Appendix 3). These

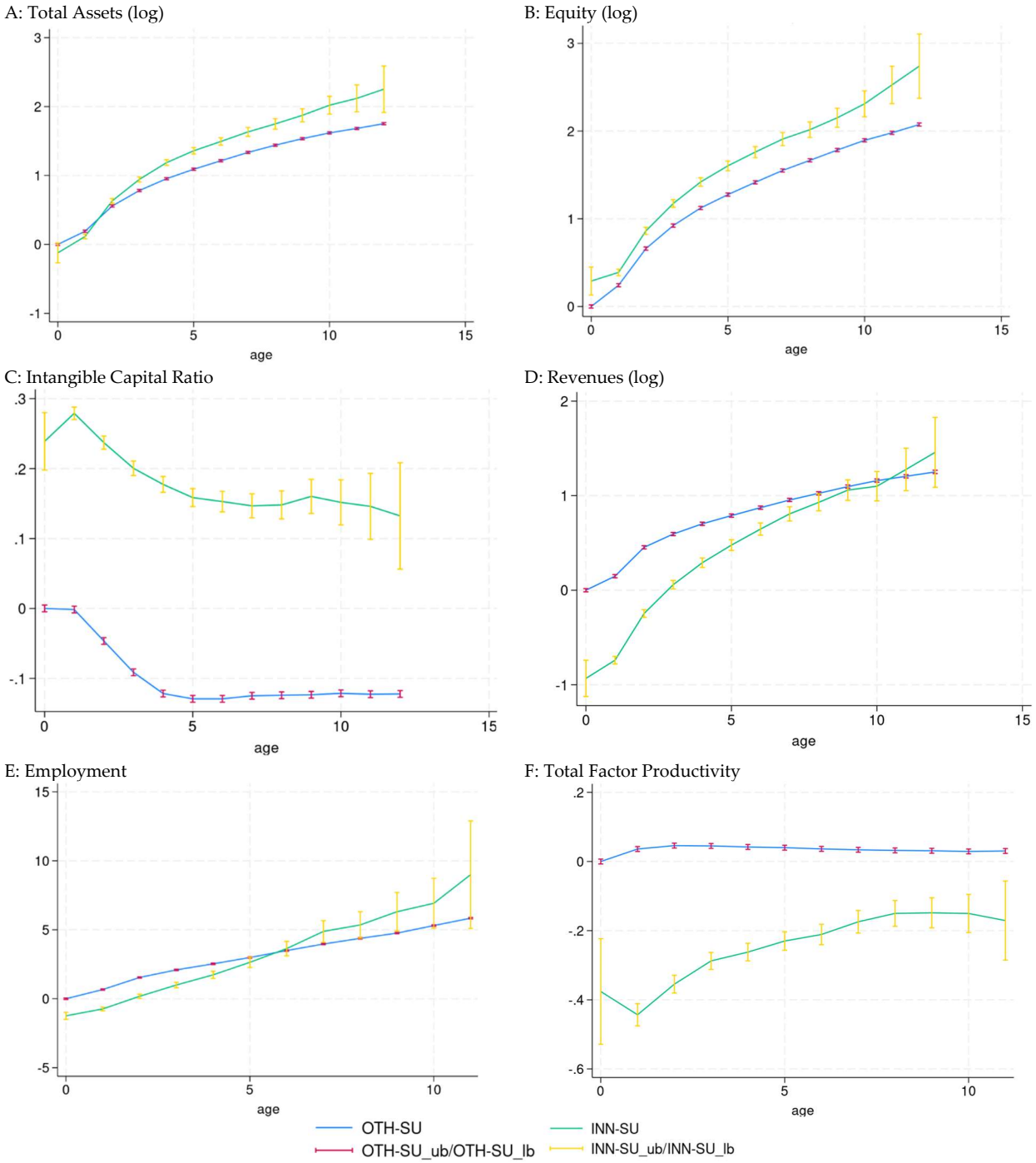
[11] Manaresi et al. (2020) perform a similar analysis restricted to the INN-SU sample. The empirical setting is different and designed to address both the selection bias as well as unobservable heterogeneity across treated (INN-SU) and untreated firms. The authors run DID regressions on a matched sample to test whether firms benefiting from the policy perform differently with respect to a set of outcome variables. The sample size is limited to 328 INN-SU observed for three consecutive years.

[12] In the Appendix A4 we report results based on alternative measures of productivity that try to address these issues. Results do not change qualitatively and are in line with those obtained using TFP.

[13] It is important to note that the results reported are based on an open sample, which includes all firms regardless of whether they survive over the 12-year observation period. As a result, the average evolution of the variables over time reflects both firm selection (i.e., the exit of weaker firms from the market) and changes in the performance of surviving firms. As a robustness check (available upon request), we repeated the analysis by restricting the sample to firms that survive for the entire 12-year period. The main results and conclusions remain broadly unchanged. However, consistent with the presence of selection effects, we observe that growth in most variables is more moderate over time, especially after the initial years. Moreover, although confidence intervals widen substantially, convergence tends to occur earlier. This pattern may suggest that performance plays a stronger role in the selection process among innovative startups.

results are in line with previous evidence in Manaresi et al. (2020), that provides an evaluation of the Start-up Act based on data for firms born between 2004 and 2014.

Figure 5: Firms' outcomes over time: INN-SU and OTH-SU

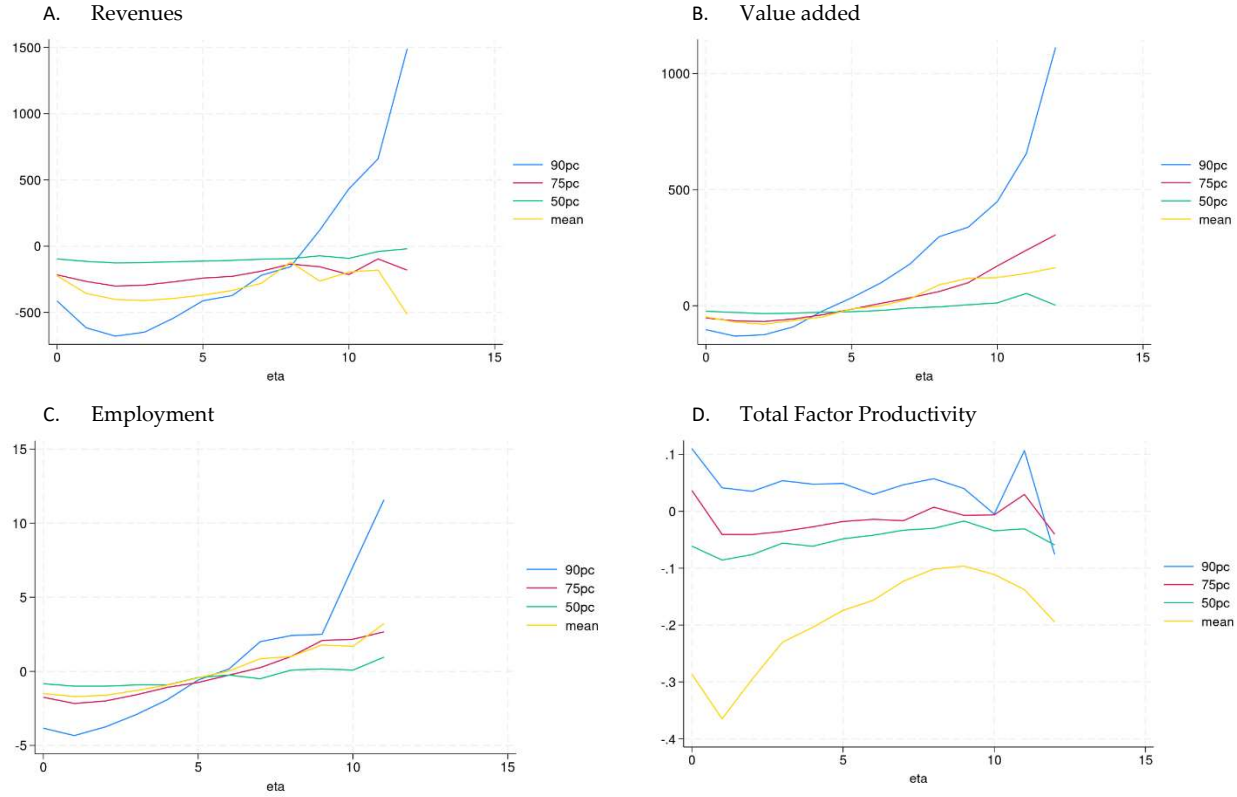


Notes: Authors' computation on Cerved data. The two lines represents the evolution of the economic variables over time for the group of innovative start-ups (green line) and that other young firms (blue line). The starting value for this group is always normalized to zero. The x-axes represent the age of the firm. The point values and the corresponding confidence intervals are obtained from estimating equation (3), which controls for year-sector fixed effects.

Overall, these results suggest that, despite weaker initial economic performance on some metrics, INN-SU tend to grow faster on average during their first 10 to 12 years of activity. However, this

improvement is not uniform across the distribution. Figure 6 illustrates differences in the moments of the distribution for each outcome variable between INN-SU and OTH-SU. The gap tends to improve over time for all moments, but more so for the top percentiles. In particular, INN-SU show stronger relative gains in terms of revenues, value added and employment when comparing the top 90 percent of the firms in each group; thus indicating that the most dynamic innovative start-ups drive much of the observed aggregate performance.

Figure 6: Firms' outcomes at different percentile of the distribution by age: INN-SU and OTH-SU



Notes: Authors' computation on Cerved data. The lines represent the difference by firm age in the moments of the unconditional distribution of y-outcomes between INN-SU and OTH-SU. The moments are computed within each age and type of startup-group.

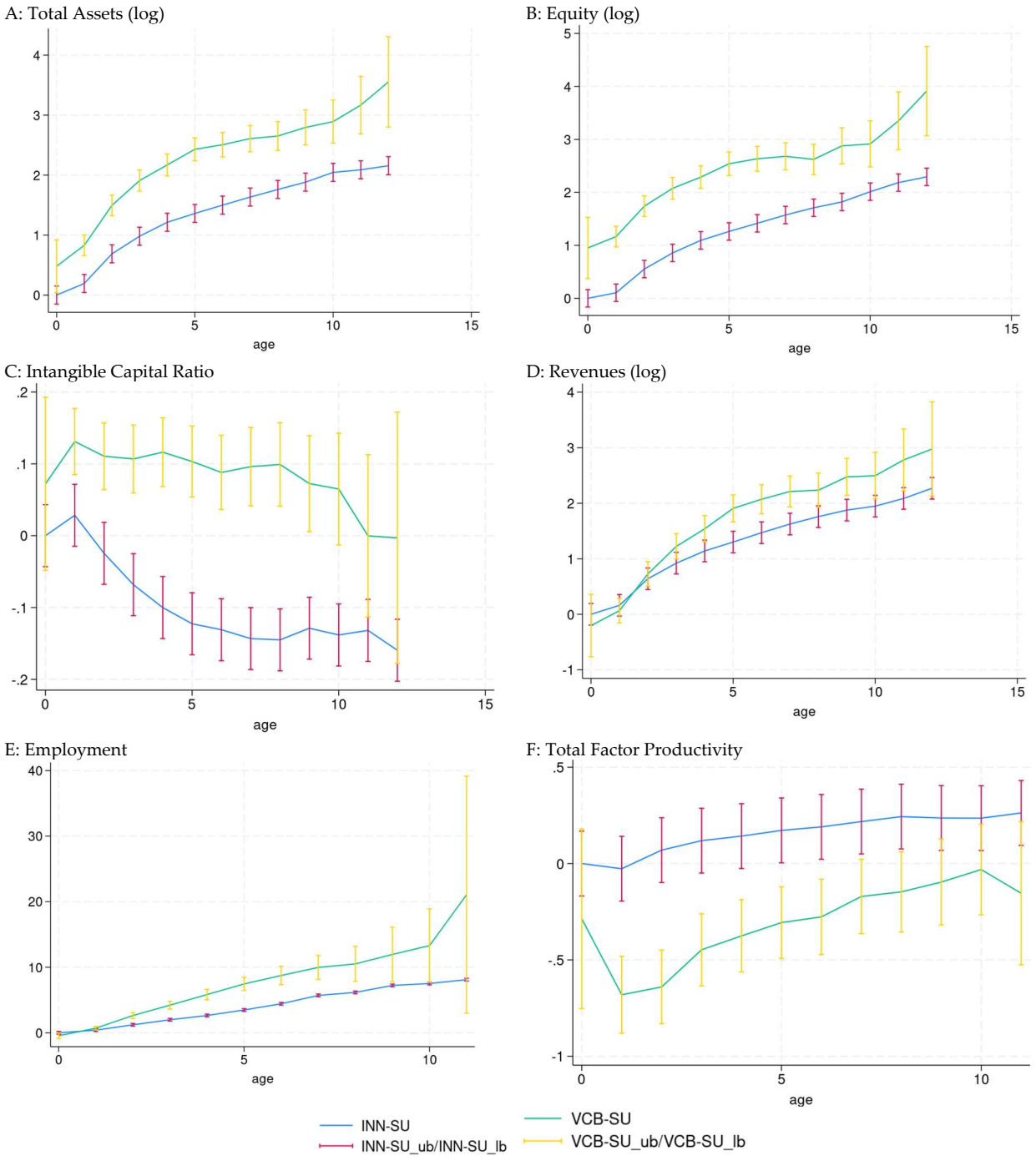
Within the group of innovative start-ups, those that received VC funding are compared to those that did not (Figure 7)[14]. From the outset, VCB-SU exhibit higher levels of total assets, equity, and intangible capital ratios. While total assets and equity continue to expand over time, the intangible capital ratio remains relatively stable. By the end of the 12-year period, the positive gap in these variables slightly widens in favor of VCB-SU.

This group also demonstrates faster growth in revenues and employment. At age 10, VC-backed INN-SUs have on average 6 more employees than other innovative start-ups and generate about twice the revenues. Moreover, VCB-SU begin their life cycle with lower levels of TFP. However, their productivity improves at a faster rate, and by the end of the observation period, the initial TFP gap closes and becomes statistically insignificant. As for INN-SU, VCB-SU show stronger relative

[14] See Figure A3.5 for the corresponding comparison between VCB-SU and the OTH-SU.

gains in terms of revenues, value added and employment when comparing the top percentiles of the firms in each group (see figure A3.6 in Appendix).

Figure 7: Firms' outcomes over time: VCB-SU and INN-SU



Notes: Authors' computation on Cerved data. The two lines represents the evolution of the economic variables over time for the group of VC backed innovative start-ups (green line) and that other innovative start-ups (blue line). The starting value for this group is always normalized to zero. The x-axes represent the age of the firm. The point values and the corresponding confidence intervals are obtained from estimating equation (2), which controls for year-sector fixed effects.

4.3 Firms' outcomes following VC financing

To complement the analysis in section 3.2, the effect on firms' outcomes for VCB-SU can be assessed relative to a specific point in time —the year of the first VC deal. However, the use of a standard difference-in-differences (DiD) model to compare post-VC investment outcomes of treated firms with those of the broader sample of young untreated firms may introduce selection bias in the recovering of causal estimates. If VCB-SU are significantly different from other young firms in terms of unobservable *ex-ante* growth prospects, they are also more likely to display faster growth (section 3.1), regardless of the timing of the initial VC investment. To address this concern, previous studies relied on propensity score matching to identify a comparable subset of start-ups to compare with those that received VC funding.

In this work, we exploit the availability of multiple treatment events (*i.e.* the sequence of investments by VCs) across the spectrum of VCB-SU is exploited by adopting a staggered DiD approach. In this framework, treated VCB-SU are compared to those firms belonging to the treated group but that have not yet received VC funding, enabling a more accurate identification of the average treatment on the treated (ATT) effects. The results presented in Table 5 indicate that, following the first VC deal, firms experience substantial growth in total assets, primarily driven by intangible assets. This result can be rationalized by the higher intensity of R&D expenses for VCB-SU as documented in Ando (2024).

Revenues, employment, and equity also show significant expansion. The drop in firms' indebtedness indicators, such as leverage and the debt-to-capital ratio, suggests that these expansions are predominantly financed through risk capital, either via retained earnings or capital increases. However, neither productivity nor patenting activity displays a significantly different trajectory compared to firms still awaiting their first VC round.

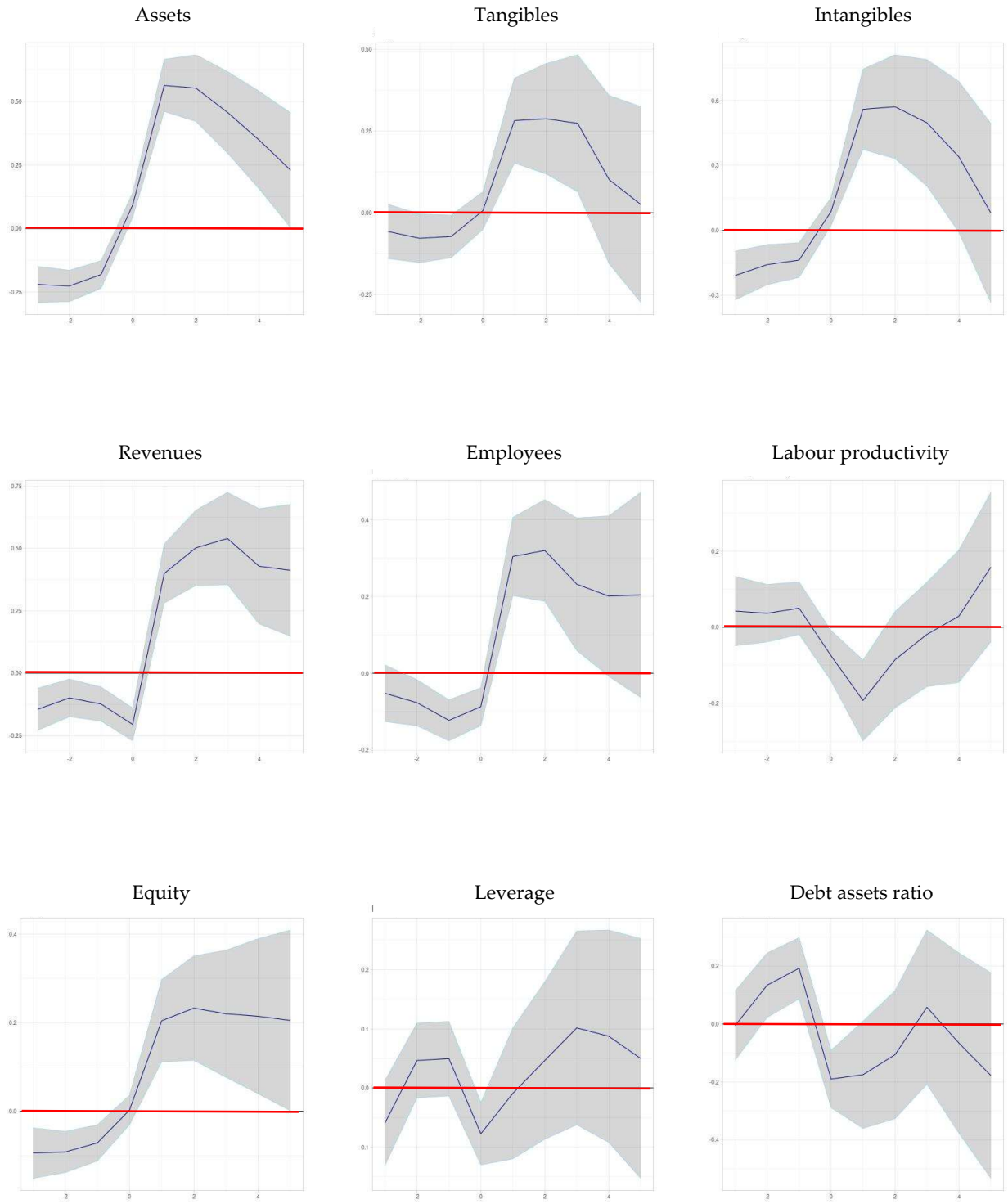
Table 5: The effect of VC investments on firms' outcomes

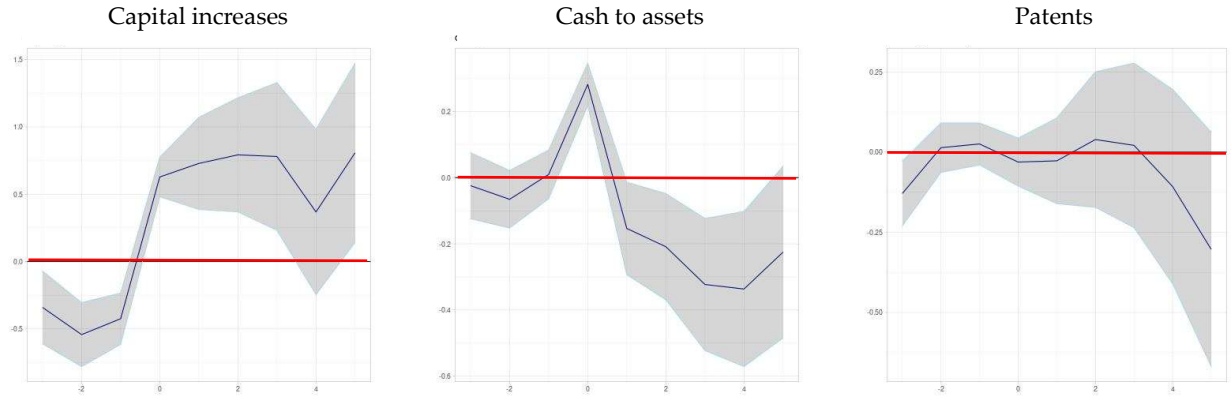
	model 1	**model 2**	**model 3**	**model 4**	**model 5**	**model 6**
Dependent Var.:	log(assets)	log(intangibles)	log(tangibles)	log(revenues)	log(employees)	log(lab. productivity)
post_deal_dummy	0.5448 *** (0.0418)	0.6053 *** (0.0650)	0.2211 *** (0.0522)	0.1521 *** (0.0443)	0.2146 *** (0.0388)	-0.0542 (0.0440)
Fixed-Effects:						
firm	Yes	Yes	Yes	Yes	Yes	Yes
year	Yes	Yes	Yes	Yes	Yes	Yes
S.E.: Clustered	by: firm	by: firm	by: firm	by: firm	by: firm	by: firm
Observations	17,276.00	15,288.00	14,125.00	15,090.00	17,287.00	15,090.00
R2	0.87	0.78	0.87	0.86	0.79	0.70
	model 7	**model 8**	**model 9**	**model 10**	**model 11**	**model 12**
Dependent Var.:	log(equity)	log(leverage)	log(debt_assets_ratio)	log(capital increases)	log(cash_assets)	(patents_ownership)
post_deal_dummy	0.1892 *** (0.0358)	-0.0265 (0.0396)	-0.2114 *** (0.0712)	1.230 *** (0.0816)	0.0916 * (0.0478)	0.0155 (0.0249)
Fixed-Effects:						
firm	Yes	Yes	Yes	Yes	Yes	Yes
year	Yes	Yes	Yes	Yes	Yes	Yes
S.E.: Clustered	by: firm	by: firm	by: firm	by: firm	by: firm	by: firm
Observations	16,792.00	9,265.00	9,265.00	16,982.00	16,544.00	17,287.00
R2	0.90	0.60	0.61	0.43	0.57	0.77

Notes: Authors' computation on Pitchbook and Cerved data. The table reports OLS estimates of the following equation: $y_{i,t} = \alpha_i + \delta_t + \beta * D_{i,t} + \varepsilon_{i,t}$ where: $y_{i,t}$ denoted firms' outcomes; $D_{i,t}$ is a dummy equal to one for a firm in the aftermath of a VC financing round and until the end of the sample period; β provides an estimate of the causal effect of treatment; α_i and δ_t are firm and time fixed effects. Standard errors are clustered at the firm level. The estimation sample includes all VC-backed firms with available financial information for the period 2010-23. Leverage is the ratio between financial debt and the sum between financial debt and equity; labour productivity is the ratio between revenues and labour costs.

The average treatment effect of VC investments on firms' outcomes can be decomposed further to capture their dynamics between t-3 and t+5 with t being the year when the first VC deal occur. Results in Figure 7 indicate that the expansionary effect of VC investments on firms' assets persist up to five years after. This is the case for most of the variables considered with the exception of productivity, patenting and indebtedness, for which the effects are short-lived around the first VC investment.

Figure 7: The dynamic effect of VC investments on firms' outcomes.





Notes: Authors' computation on Pitchbook and Cerved data. The table reports OLS estimates of Equation (2) using firm and time fixed effects. Standard errors are clustered at the firm level. The estimation sample includes all VC-backed firms. Leverage is the ratio between financial debt and the sum between financial debt and equity; labour productivity is the ratio between revenues and labour costs.

4.4 *Survival rates*

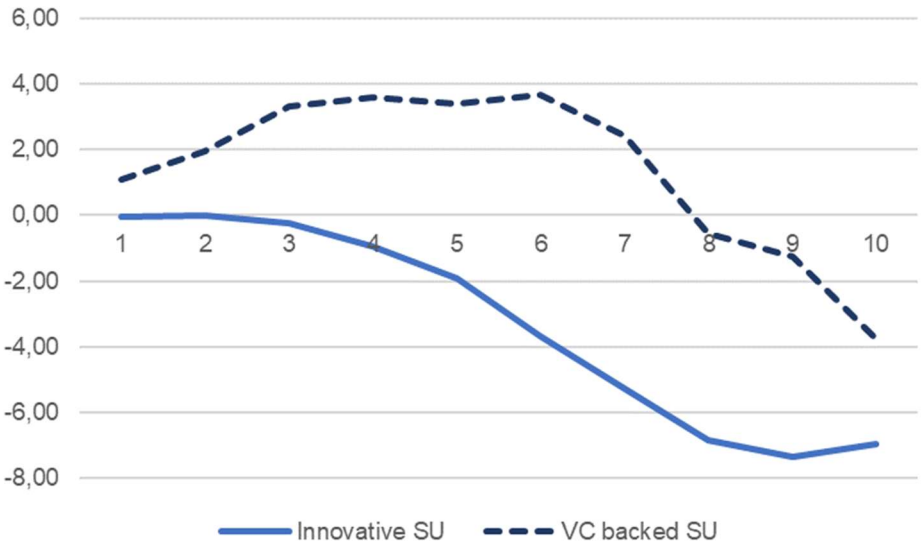
So far, our understanding about innovative firms involved those that were successful and survived. In this section we examine how innovative firms differ from the other young start-ups with respect to their likelihood of surviving up to age ten. Importantly, our analysis provides a lower bound estimate of the likelihood of surviving; due to data limitations we are not able to distinguish the case of a pure market exit from that where a merger takes place and the target company is acquired.

Although innovative firms tend to exhibit weaker economic metrics in their initial years and operate in sectors typically associated with higher business risk, they do not experience lower survival rates in the short run when compared to other young firms (Figure 8). In the first few years of activity, a period during which innovative start-ups may benefit from targeted national policy incentives, their probability of remaining in the market is similar to that OTH-SU. However, in the longer run, survival rates for the two groups begin to diverge, with innovative start-ups exiting the market at a faster pace. Eight years after their founding, the survival rate of innovative startups is approximately 7 percentage points lower than that of the control group.

VCB-SU, are consistently more likely to survive than INN-SU and the difference is particularly marked in the short run. However, eight years after the initial investment, their survival rate falls, dropping to below that of the control group. This evidence corroborates (Puri and Zarutskie, 2012) and may suggest that there is a time window, aligned with a VC investment horizon, within which VCs support firms' growth; however, once this period is over VCB-SU are equally likely to shut down.

Fig. 8 Differential in survival rates at different horizons

(percentage points)



Note: Authors' computation on InfoCamere data. The difference at each horizon with respect to the control group of OTH-SU is computed on the average survival rates among the cohorts born between 2012 and 2024.

Appendix

A.1 Venture capital investments in Italy

The Italian VC market has experienced rapid development over the past decade. From a virtually non-existent base in 2010, both the annual number of investments and the number of companies involved surpassed the average levels for the 2010–2024 period—approximately 400 deals and 300 firms per year, respectively—by 2015 (see Figure A.1.1, A.1.2). Market activity peaked in 2021–2022, with annual investment volumes exceeding €2 billion and involving over 700 companies.

Despite this recent growth, VC investment in Italy continues to face structural constraints. On the demand side, the market is limited by a relatively small pool of innovative and commercially viable business ideas. On the supply side, the domestic VC fund industry remains undersized compared to other European ecosystems. Additionally, market opportunities for successful exits—a critical component of the VC cycle—are still underdeveloped, further dampening investor incentives (Gallo et al., 2025).

Figure A.1:1 Developments in VC market

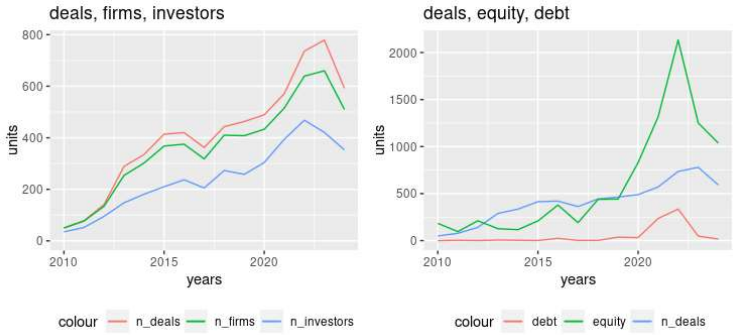
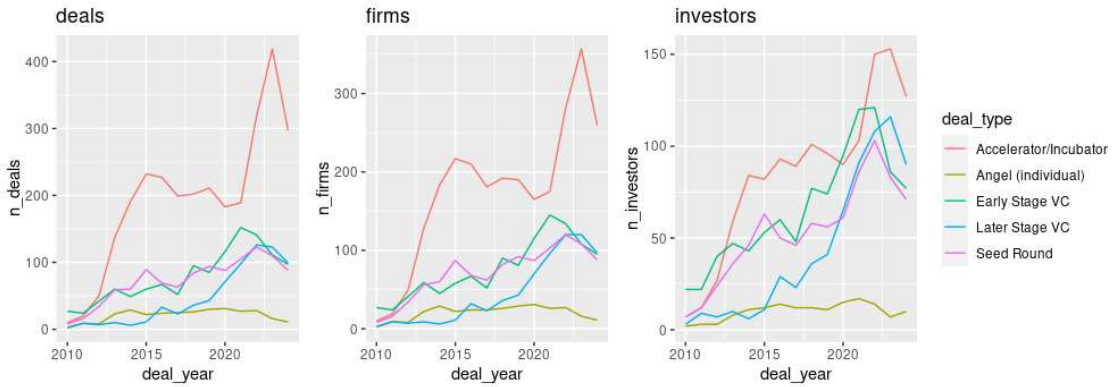
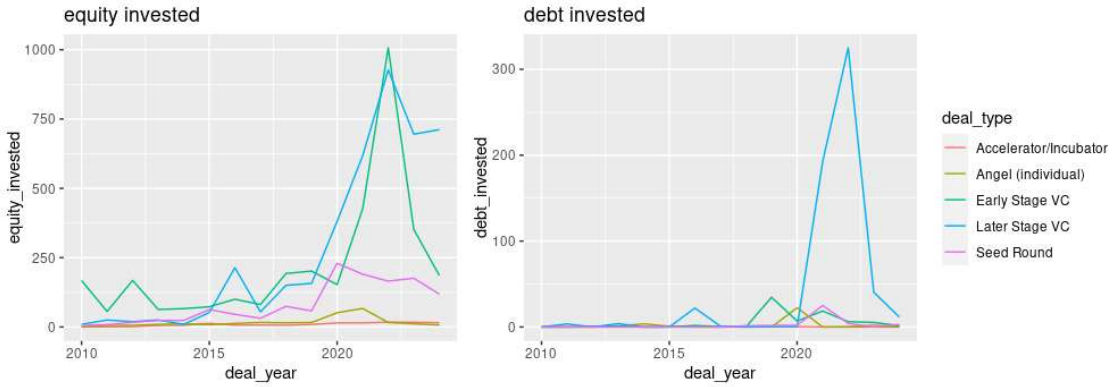


Figure A1.2: Trends by deal type





Notes: Note: Authors' computation on Pitchbook data. The figure illustrates general trends in VC market and by deal type. Completed deals involving Italian firms in the 2010-24 period from VC investors of any type are included. Grants are excluded.

A.2 Sample descriptives

Table A2.1 compares the *ex-ante* economic and financial characteristics across three groups of start-ups. Panel A focuses on VCB-SU, about 1.900 companies (starting from about 3.000 VCB for the whole period) for which financial information is available in the years before the investment takes place (from t-3 to t-1 with t being the year of the first investment). Panel B examines INN-SU, about 22.000 (starting from about 31.000 for the whole period) companies for which financial information is available around the year of the registration in the special section of the business registry (from t-1 to t+1 with t being the year of the registration). Finally, Panel C considers the OTH-SU, namely all active limited liabilities companies with positive assets in the 2012-23 period and foundation year from 2010 onwards.[15]

[15] Starting from 2010 allows the inclusion in our sample of firms aged 2 at the time when the innovative start-ups act entered into force. To exclude from the sample new entrants which are reasonably non-start-ups, all firms ages less than 2 with 50 or more employees were dropped from the sample.

Table A2.1: The economic and financial features of innovative firms

	assets	intangible share	equity	debt	leverage	revenues	profits	labour prod.	employees	age	patents
	thousands	percent	thousands	thousands	units	thousands	percent	units	units	units	units
Panel A: VC-backed											
mean	6268.8	69.7	439.3	1606.0	0.3	6849.3	-1.4	213.6	41.9	6.2	0.1
sd	52186.4	35.7	4999.6	12958.7	0.4	89879.8	18.4	428.0	242.9	8.9	1.0
P. 0.10	38.0	4.3	10.0	0.0	0.0	0.0	-26.7	0.0	1.0	2.0	0.0
P. 0.25	118.0	42.1	10.0	0.0	0.0	14.0	-17.9	10.0	2.0	2.0	0.0
P. 0.50	381.0	88.9	14.0	0.0	0.0	117.0	-0.1	60.7	6.0	4.0	0.0
P. 0.75	1321.0	99.0	54.0	146.5	0.8	652.0	10.4	186.9	16.0	6.0	0.0
P. 0.90	4503.0	100.0	220.4	975.8	1.0	2954.4	23.2	551.7	54.0	12.0	0.0
Panel B: Innovative SU											
mean	368.7	72.0	55.9	67.7	0.2	190.5	0.6	98.6	4.9	2.2	0.1
sd	1732.4	36.4	1171.4	432.2	0.3	1013.1	19.8	237.8	8.8	1.4	0.3
P. 0.10	10.0	4.3	1.0	0.0	0.0	0.0	-26.7	0.0	1.0	0.0	0.0
P. 0.25	30.0	46.2	10.0	0.0	0.0	0.0	-16.0	0.0	1.3	2.0	0.0
P. 0.50	98.0	94.4	10.0	0.0	0.0	28.0	0.0	25.0	2.6	2.0	0.0
P. 0.75	292.0	100.0	20.0	2.0	0.2	136.0	13.6	93.9	5.0	3.0	0.0
P. 0.90	789.0	100.0	100.0	108.0	0.9	408.0	32.1	232.3	10.1	4.0	0.0
Panel C: Control group											
mean	2208.0	24.1	190.3	736.6	0.4	1402.5	2.9	293.9	24.6	7.5	0.0
sd	79765.7	35.2	7214.3	28342.9	0.4	39390.6	13.7	549.1	224.7	5.3	0.0
P. 0.10	26.0	0.0	2.0	0.0	0.0	0.0	-14.0	0.0	1.0	0.0	0.0
P. 0.25	94.0	0.0	10.0	0.0	0.0	0.0	-1.5	0.0	2.5	0.0	0.0
P. 0.50	317.0	1.7	10.0	0.0	0.1	81.0	0.9	52.9	6.0	9.0	0.0
P. 0.75	974.0	40.9	35.0	149.0	0.9	454.0	9.1	276.0	14.0	12.0	0.0
P. 0.90	2672.0	96.7	100.0	798.0	1.0	1577.0	20.0	959.0	38.0	14.0	0.0

Notes: Authors' computation on Pitchbook, InfoCamere and Cerved data. The table compares descriptive statistics of selected financial variables, age and patenting metrics of about 1.900 VCB-SU (panel A), the sample of about 21.000 INN-SU (panel B) and the broad control group of about 440.000 OTH-SU (panel C). For VC-backed firms' observations are pooled between t-3 and t-1, with t being the year of the first investment while for the innovative start-ups, observations are pooled between t-1 and t+1, with t being the year of the registration in the special section of the Business Registry. The control group of young firms includes all active limited liabilities companies aged founded from 2010 onwards with positive assets. Leverage is the ratio between financial debt and the sum between financial debt and equity; profits is the ratio between Ebitda and total assets; labour productivity is the ratio between revenues and the number of employees.

INN-SU are – by construction – newly established enterprises (less than five years); in turn, their average sample age is two years which compares to six for both VCB-SU and OTH-SU. INN-SU are also smaller in terms of revenues, assets, and employees, with distributions for the indicators considered relatively narrower. Additionally, they tend to have lower levels of debt and leverage. However, their proportion of intangible assets relative to total assets outperforms that of the other groups.

VCB-SU do not typically resemble newly established or small-start-ups. These firms tend to be larger, in terms of total assets and revenues. Similarly to INN-SU, the composition of their asset shows a greater endowment of intangibles, owing also to their more frequent patenting activity. Profitability is on average lower, as the distribution is left-skewed, while average labour productivity is higher compared to INN-SU, it remains lower than that of other young firms.

A.3 Additional Table and Figures

Tab. A3.1: Sectoral distribution of innovative startups over time

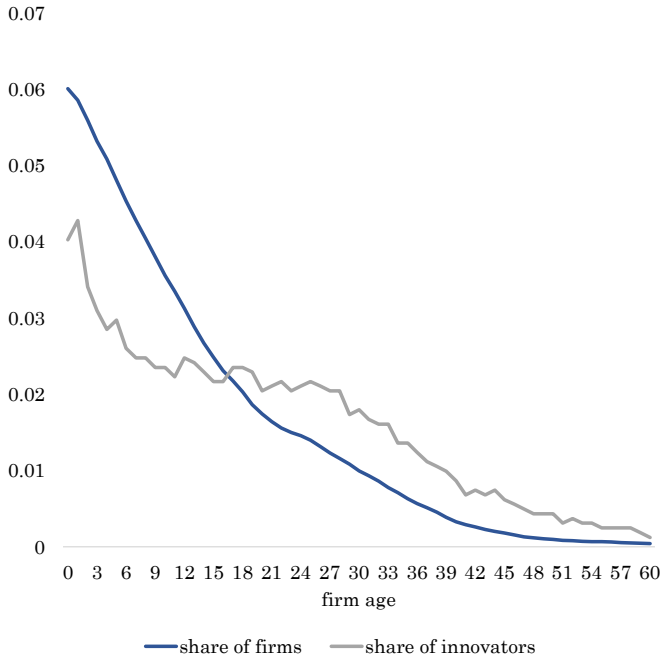
(percent)

Sector	2015	2019	2023
A	0,3	0,7	0,7
B	0,0	0,0	0,0
C	17,3	16,6	13,3
C 26	4,0	2,9	2,0
C 27	2,1	1,5	1,0
C 28	3,5	3,1	2,7
D	1,2	0,8	0,7
E	0,5	0,3	0,2
F	1,1	0,9	1,1
G	4,4	3,4	2,9
H	0,3	0,3	0,2
I	0,4	0,6	0,4
J	41,5	47,6	52,3
J 62	30,1	35,8	41,7
J 63	8,2	9,2	8,3
K	0,2	0,2	0,3
L	0,0	0,2	0,2
M	27,8	23,3	23,3
M 70	2,9	2,6	2,8
M 72	15,7	13,9	14,6
N	3,2	2,7	2,2
P	0,6	0,9	0,9
Q	0,5	0,6	0,5
R	0,3	0,5	0,4
S	0,4	0,3	0,3

Notes: Authors' elaboration on InfoCamere's data. Sectoral distribution of firms registered in the special section of the Italian business registry in 2015, 2019 and 2023.

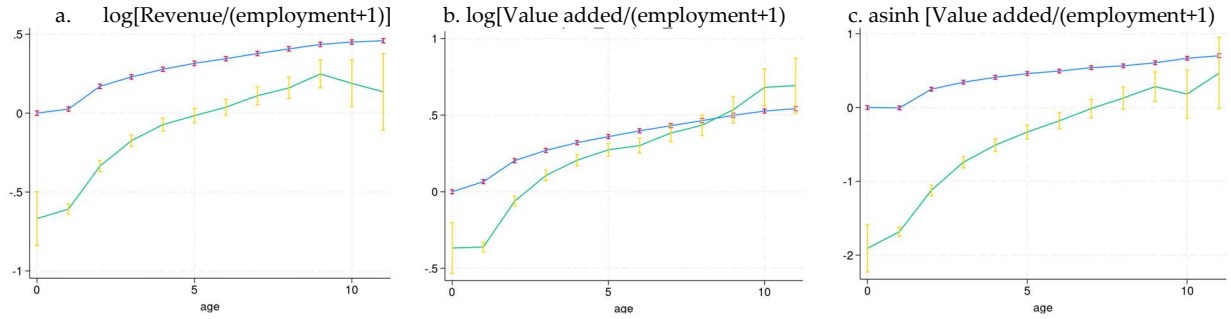
Fig. A3.2 Shares of firms and innovators by age

(percentage points)



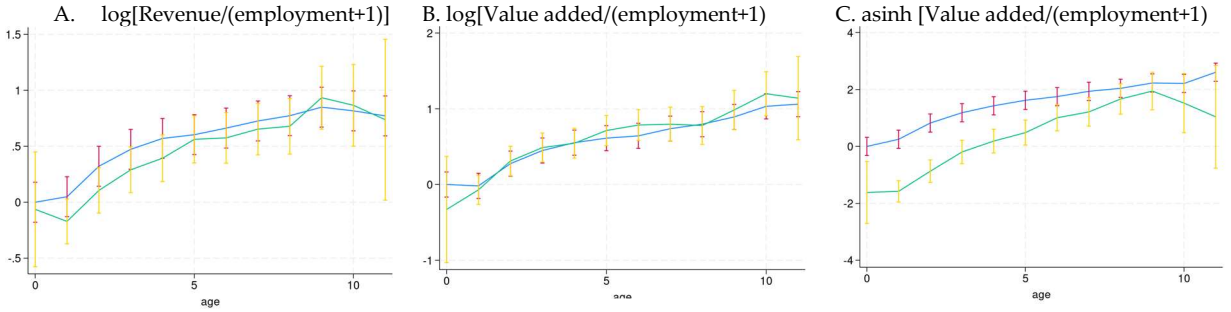
Note: Authors' computation on Unioncamere and InfoCamere data. The blue line is the share of firms of a given age in the population of limited liability companies, the gray one the share among those with a least one patent (*i.e.* patenting firms).

Figure A3.3: Labour productivity over the life cycle: INN-SU and OTH-SU



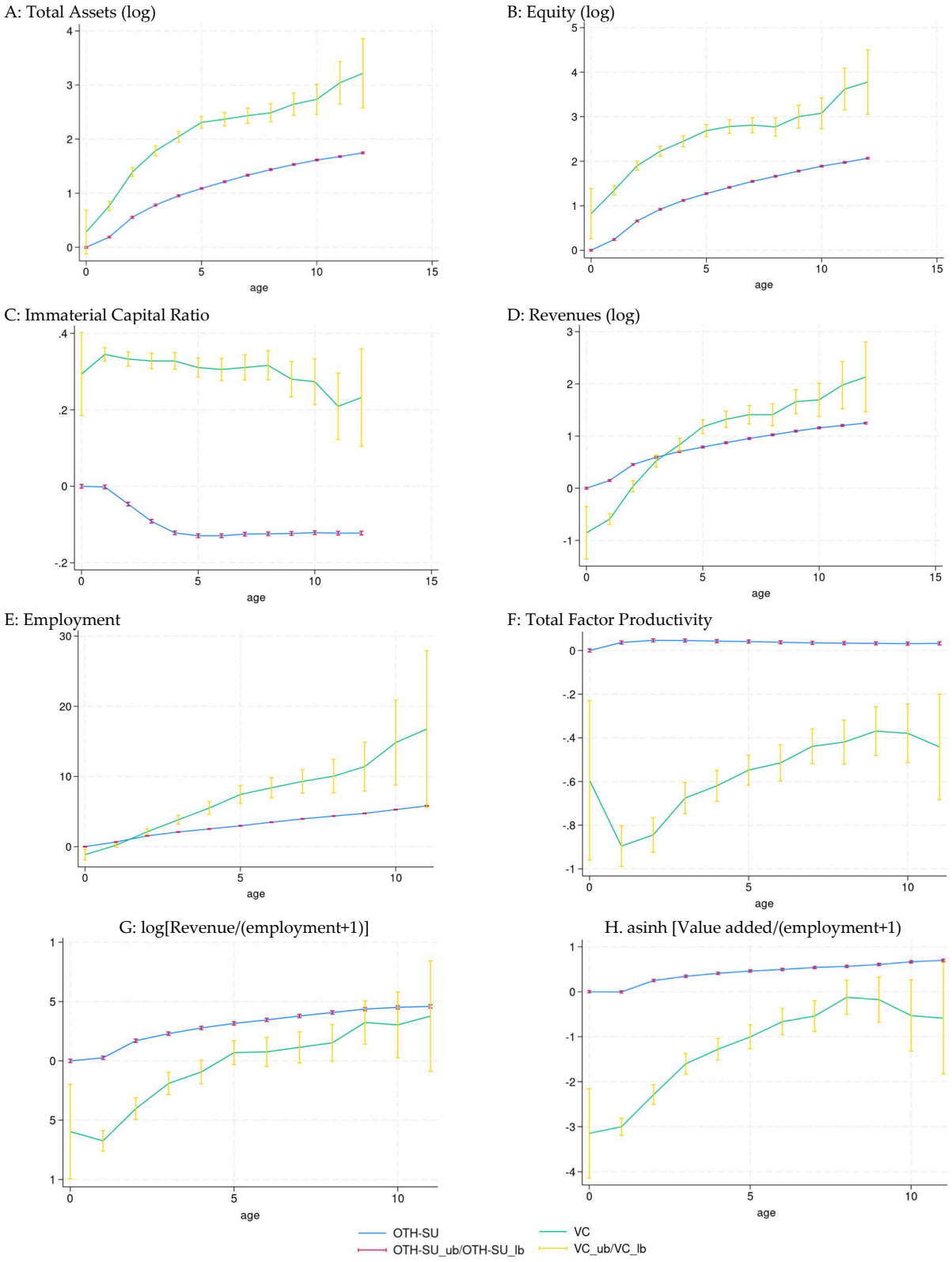
Notes: Authors' computation on Cerved data. The two lines represents the evolution of the economic variables over firm age for the group of INN-SU and that for OTH-SU (blue line). The starting value for this group is always normalized to zero. The point values and the corresponding confidence intervals are obtained from estimating equation (3), which controls for year-sector fixed effects. Employment is replaced by the transformation "employment+1" in order to avoid discharging all observation with employment equal to zero. Asinh is the inverse hyperbolic sine transformation to deal with value added less or equal to zero.

Figure A3.4: Labour productivity over the life cycle: VCB-SU and OTH-SU



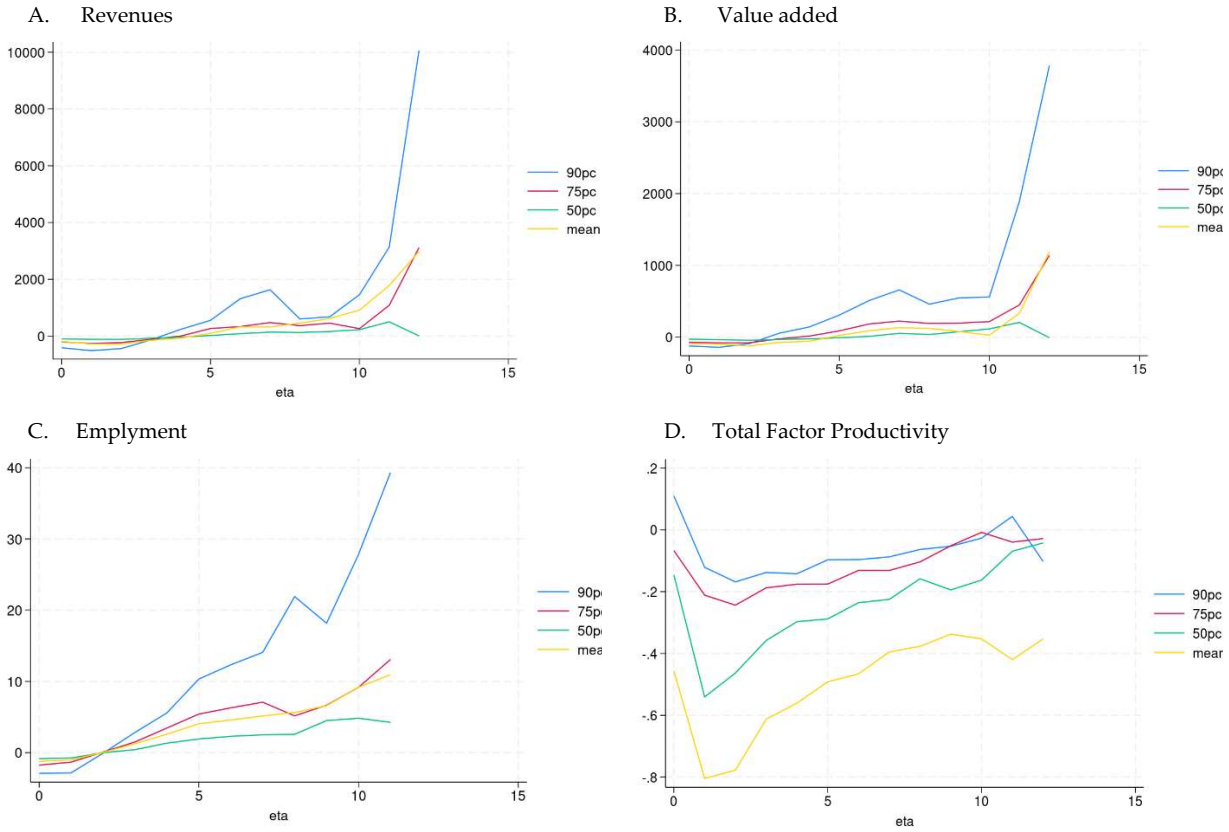
Notes*:* Authors' computation on Cerved data. The two lines represents the evolution of the economic variables over firm age for the group of VC backed innovative start-ups (green line) and that other innovative start-ups (blue line). The starting value for this group is always normalized to zero. The point values and the corresponding confidence intervals are obtained from estimating equation (3), which controls for year-sector fixed effects. Employment is replaced by the transformation "employment+1" in order to avoid discharging all observation with employment equal to zero. Asinh is the inverse hyperbolic sine transformation to deal with value added less or equal to zero.

Figure A3.5: Firms' outcomes over time: VCB-SU and OTH-SU



Notes: Authors' computation on Cerved data. The two lines represents the evolution of the economic variables over time for the group of VCB-SU (green line) and that of OTH-SU (blue line). The starting value for this group is always normalized to zero. The x-axes represent the age of the firm. The point values and the corresponding confidence intervals are obtained from estimating equation (3), which controls for year-sector fixed effects.

Figure A3.6: Firms' outcomes at different percentile of the distribution by age: VC-SU and OTH-SU



Notes: Authors' computation on Cerved data. The lines represent the difference by firm age in the moments of the unconditional distribution of y-outcomes between VC-SU and OTH-SU. The moments are computed within each age and type of startup-group.

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