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The investment strategies of publicly sponsored venture capital funds

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ABSTRACT

This paper investigates the effects of public ownership on the investment strategy of hybrid VC funds. We exploit a unique dataset containing data for all of the venture capital funds in Europe that received financial support from the European Investment Fund (EIF) during the years 1998–2007. The dataset includes 179 VC funds that invested in 2482 companies. We find that the level of public ownership shows a weak negative correlation with the likelihood of observing a write-off and that a higher public share is associated with a longer duration for the investment. The latter effect is more relevant for those investments that generate intermediate financial returns. The results are robust to the introduction of controls at the target firm level and for financial market conditions.

1. Introduction

It is well known that financial constraints are particularly acute for innovative entrepreneurial firms because their investment returns are uncertain, they have little collateral to secure debt, they are subject to higher informational frictions and their capital, which is mostly intangible, is difficult to redeploy and is characterized by relevant bankruptcy costs (Carpenter and Petersen, 2002; Hall, 2002).[1] As entrepreneurial activities increasingly contribute to innovation and economic growth, policy makers have focused on implementing policies that enhance financing offerings for entrepreneurs by influencing their incentives and payoffs. In particular, evidence that more available venture capital (VC) allows for an increase in successful entrepreneurial activity (see, for example, Levine, 1997; Kortum and Lerner, 2000) has led many governments and regional authorities worldwide to implement programs to mobilize venture capital.

The available evidence on this type of policy intervention shows that there is a high degree of heterogeneity in the models that are adopted to support the development of VC funds in specific regions/countries and a contingent lack of comprehensive evaluation of the effects that they have encouraged. However, several works in the field of entrepreneurial finance have attempted to assess the economic properties, the efficacy, the social desirability and the risks of using this type of policy as a tool to support entrepreneurship and innovation (Gompers and Lerner, 1998; Cressy, 2002; Lerner, 2002; Leleux and Surlemont, 2003; Armour and Cumming, 2006; Da Rin et al., 2006). A first stream of research has focused on the impact of public policies on the environmental conditions in which private VC firms operate, including tax regimes for private equity operators, legal requirements for IPOs and LBOs, corporate governance legislation and the level of development of the financial markets (Da Rin et al., 2006; Leleux and Surlemont, 2003; Gilson, 2003). A second stream of research has addressed a specific type of public policy intervention: the direct co-funding of venture capital funds. Vehicles by which independent VC firms are used to channel and allocate public financial support are often termed "hybrid funds" (Jääskeläinen et al., 2007; NESTA, 2009). The present study focuses on this second type of public intervention.

Direct public support of VC initiatives, in principle tailored to the specific institutional context of the economic region of interest,[2] has been aimed at increasing the aggregate pool of capital for entrepreneurs. In particular, the rationales often advocated for these policy interventions are that (i) the private sector provides insufficient capital to new, innovative firms and (ii) the government can drive the investment selection process towards investment opportu-

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[1] See Scellato (2007), Ughetto (2008), Ughetto (2009), and Crespi and Scellato (2010) among others for recent empirical analyses on firms' financial constraints.

[2] Among the most relevant examples worldwide are the Australian Innovation Investment Fund (2006), the Yozma Program in Israel (1993) and the Small Business Investment Companies Program (SBIC) in the US. In Europe, we find the High Tech Fund of Funds in the UK, the Danish fund Vækstfonden, the Fund for the Promotion of Venture Capital in France, the German fund ERP-EIF Dachfonds and the Dutch fund TechnoPartner Seed facility.

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nities that will ultimately yield high social returns (in addition to the private ones) (Lerner, 2002).

The present study investigates the effects of public ownership on the investment strategy of hybrid VC funds; these effects are ultimately reflected both in the ex-ante selection process for the target companies and in their post-acquisition management. The intensity of public ownership can have different implications along these two dimensions.

We use a dataset of 179 venture capital funds that received financial support from the European Investment Fund (EIF), the European Union body specializing in SME equity financing.[3] The primary advantage of the EIF dataset is the high reliability and the completeness of the information available on each deal. For its investment activity, EIF deploys either its own resources or resources mandated by its shareholders. EIF's investment in the analyzed funds is regulated by the Risk Capital Mandate (European Investment Bank). Target VC funds must be in compliance with the EIF's objectives and operational guidelines, as well as with the Risk Capital Mandate Investment Guidelines. Investments in eligible funds are made after a detailed due diligence is carried out on all aspects of the investment proposal. Particular attention is paid to the quality of the funds' management teams, to their degree of focus on the type of companies targeted by the Mandate facility and to their potential to contribute to the growth of these companies while, at the same time, generating returns consistent with market conditions.

The paper adds to the literature in two ways. First, due to the novelty and richness of the database at our disposal, we provide new evidence on the effects of the intensity of public ownership on venture capital investment strategies in Europe at an unparalleled level with respect to the extant studies in the field, which generally have a national focus or analyze limited samples.[4] Second, we contribute methodologically to identifying the different factors that affect the observed outcomes of the investment activity of hybrid VC funds. From a methodological perspective, this is far from an easy task when an empirical study is run on funds that are still operating at the time of the analysis.

The results indicate that even after controlling for the funds' and the portfolio firms' characteristics, as well as for the financial market's conditions, the level of public ownership affects the selection of investments and their subsequent management. In this paper, we use the incidence of write-offs to look at the ex-ante selection process for the target companies, while we focus on the timing of the exit to examine their post-investment management. We find that (i) the level of public ownership shows a weak negative correlation with the likelihood of observing a write-off, and (ii) a higher public share is associated with a longer duration for the investment. The latter effect is more relevant for those investments that generate intermediate financial returns. We argue that these firms are retained in a fund's portfolio – even if their return profile might not be completely satisfactory from a private investor's perspective – because they are expected to generate significant additional social returns.

The remainder of this paper is organized as follows. Section 2 discusses the previous research on the rationales and effects of direct public intervention in the VC industry. Section 3 clarifies our research setting and proposes testable hypotheses. Section 4 introduces the datasets and the summary statistics. Section 5 presents the econometric models used and discusses the results. In Section 6, we draw conclusions and explain the implications of our findings.

2. Rationales and effects of direct public intervention in the VC market

Public venture capital initiatives have been deployed in numerous countries to channel and allocate public financial support to entrepreneurial firms. A large body of research has contributed to identifying successful experiences, the critical aspects for designing effective policy initiatives and any possible distortions derived from public involvement in the venture capital market (Lerner, 1999; Maula and Murray, 2003; Avnimelech and Teubal, 2006; Cumming and MacIntosh, 2006; Cumming, 2007; Liu and Murray, 2009; NESTA, 2009).

Economic theory suggests two primary rationales for direct public intervention in the VC market. First, the presence of the public investor in a venture capital fund should enhance the capacity of the VC market to attract private capital resources (*seeding hypothesis*, Leleux and Surlemont, 2003). The seeding hypothesis implies a positive impact of public intervention along two dimensions: helping underdeveloped VC market to reach critical dimensions; certifying the quality of funds to private investors, thus lowering the informational asymmetries that might have otherwise precluded investments. The direct consequence of this effect is that the venture capital funds with public involvement will be more likely to attract capital inflows from private investors (Cumming, 2007). However, scholars have also pointed out that the direct involvement of public bodies in new venture investment might generate a risk of inadvertent market disruption through the potential misallocation of capital and the consequent "crowding out" of private investors[5] (Leleux and Surlemont, 2003; Armour and Cumming, 2006; Cumming and MacIntosh, 2006).

A second rationale emphasizes the role played by public investment in directing private capital towards investment opportunities that otherwise would have not been considered (*herding hypothesis*, Devenow and Welch, 1996). Herding behavior effects associated with the increasing presence of public capital affect the investment strategy of hybrid funds along two distinct dimensions. First, the presence of the public body can modify the selection process by increasing the quality of information about the investments (at least in specific areas) or by revealing different risk attitudes; in these cases herding behavior effects transform the distribution of financial returns. Second, government can identify investments that will ultimately yield high social returns or positive externalities (*spillover hypothesis*); in these cases, herding behavior effects transform the distribution of social returns. The preference for social returns might contrast with the investment strategy of private investors; the investment selection process of a hybrid venture capital fund could take into account several economic variables and is not restricted to considering financial returns as private investors would demand.[6] While private sector

[3] EIF is primarily owned by the European Investment Bank (61.9%) and the European Commission (30%). The remaining shareholding comes from public or private banks and financial institutions (8.1%). EIF conveys public financial resources into a large number of VC funds in Europe. By the end of 2010, the EIF had invested in over 350 VC and private equity funds, with net commitments of around 4.5 billion euros.

[4] The few attempts to compare different experiences in a greater number of countries are generally of a qualitative nature (Gilson, 2003; Maula and Murray, 2003) or based on simulations (Jääskeläinen et al., 2007). Most existing studies have analyzed public programs to support VC by assessing the program's characteristics at a point in time and in one particular country, thus yielding limited generalizable implications. The main reason for these limitations is that publicly sponsored VC funds differ in their underlying contractual structures and in the specific national institutional environments in which they operate. Moreover, the studies in this field do not evaluate the performances of publicly sponsored venture capital funds at the fund level; only aggregated data are analyzed or proxies for performance measures are used.

[5] If public initiatives finance firms at below-market conditions, a cream-skimming effect that adversely selects the residual opportunities left to private investors could emerge.

[6] The criteria that are used for allocating private capital – in particular from institutional investors – when VC funds are selected is surveyed in Groh and von Liechtenstein (2011).

investors have the exclusive goal of maximizing their net capital gain over the life of the fund, public investors might have specific preferences on the location of investments (e.g., in specific geographical areas or technological domains) or might impose peculiar conditions on contractual clauses for the allocation of the fund's profits and for the timing of the drawdowns.

The results from the empirical analyses do not provide robust and conclusive evidence supporting the various proposed hypotheses (i.e., the *seeding, herding* and *spillover hypotheses*). Cumming (2007) reports that the Australian Innovation Investment Funds (IIFs) have significantly contributed to the financing of start-up and early stage firms in Australia. He concludes that the IIFs are, on average, more likely to have one extra staged financing round and one extra syndicated partner than other types of funds. Moreover, his findings point to a spillover effect, in that prior to the introduction of the IIF program in 1997, there was scant start-up and early stage venture capital investment in Australia. Interestingly, managers that operate IIFs are found to be more likely to finance start-up and early stage firms than are managers for other types of private funds, even when managing privately raised companion funds, a behavior which might suggest a herding effect that goes beyond ownership constraints. The prevalence of a spillover effect is found in the implementation of the Small Business Innovation Research Program (SBIR) in the US and in some public venture capital programs in Europe. Lerner (1999) shows that the SBIR program has been quite effective in spurring growth and venture capital investment in the US. Additionally, the implementation of European public venture capital programs over the 1990–1996 period has led to an increase in venture capital funding in Europe (Leleux and Surlemont, 2003). NESTA (2009) analyzes the impact of investment from six UK government-backed venture capital schemes over the period 1995–2008 and reports a positive, although small, impact on the funded firms' performance. However, other experiences have proved to be unsuccessful and have consequently been phased out in many countries. Evidence in favor of a crowding out effect of public policy towards venture capital is, for example, found in Canada. Cumming and MacIntosh (2006) show that the Canadian Labor-Sponsored Venture Capital Funds (LSVCCs) have displaced other forms of venture capital organizations and have led to a reduction in the overall size of the venture capital pool, rather than achieving the goal of expanding the Canadian venture capital market.

3. Hypotheses and research setting

In this paper, we examine the impact of the intensity of public ownership on the investment strategies adopted by venture capital funds with respect to the previously outlined hypotheses. Because we have no information on the fundraising activity of our sample funds, we are not able to test the seeding hypothesis or the possible crowding out effect of private investments.

At the highest level of generality, this paper engages with two important issues.

First, we are interested in verifying whether a larger public presence among the investors of a venture capital fund is associated with different selection mechanisms for target firms. It is well known that different selection capabilities or preferences can affect the distribution of financial returns in various ways. We focus on the frequency of write-offs, which is a crucial dimension of this type of distribution because of its significant skewness, which primarily determines financial performance.[7]

[7] Examples of previous empirical studies examining write-offs while analyzing the investment performance of VC funds include Cumming and Johan (2010) and Cumming (2008). More in general, a survey of the empirical evidences on financial performances in the VC industry is provided in Metrick and Yasuda (2011).

Second, we want to examine whether the investment strategy conducted by hybrid venture capital funds might be distorted by the very nature of the public investor. The public investor is interested in sustaining investments that yield high social benefits to society as a whole, in some cases, to the detriment of the pure maximization of financial returns. A direct implication of this investment strategy is that firms with relatively lower expected profitability, but potentially beneficial to the social welfare, could be selected and kept in a portfolio for a longer period than private investors would choose. Because we do not have information on the benefits arising from spillovers, we test the idea that funds with higher public ownership might postpone the exit of portfolio firms (in particular, those showing a relatively lower expected profitability) by looking at the duration of the investments.

3.1. Public ownership and investment selection

Venture capital funds traditionally develop selection capabilities that help them to pick entrepreneurial companies that are likely to generate financial returns in the short run. The ability to identify profitable portfolio companies requires an understanding of changing market conditions, of the competitive environment, of evolving technological trajectories and of the industry setting. Given the different implications for the growth and welfare of public programs, the issue of investment selection becomes especially salient. According to the herding hypothesis, public bodies bring along with them information and preferences regarding the desirability of investments in specific areas. Accordingly, the public investor gives private investors an incentive to invest where their private insights would recommend otherwise. This intuition suggests that if the public subject has an objective function that includes social returns, the selection process for a hybrid fund should, ceteris paribus, be more concerned with avoiding target companies with a relatively higher ex-ante likelihood of later turning into write-offs. Consistent with this prediction, we hypothesize the following:

HP1. Venture capital funds with higher public ownership show a lower incidence of write-offs among the companies they have invested in.

3.2. Public ownership and investment duration

The spillover hypothesis predicts that the public entity acting as a VC investor could be primarily concerned with the generation of indirect positive externalities on society as a whole. According to this perspective, the objective pursued by policy makers would be to sustain those investments that potentially deliver strategic and socially optimal outcomes in the long-run, even if their expected performances are below the private hurdle rate of return. These investments would certainly remain unexpressed without public intervention. In fact, a public entity that emphasizes the strategic and socially oriented implications of its investments is more likely to take an approach in its investment strategy that will be reflected not only in a selection process that is biased toward investments that generate higher spillovers or localized public benefits, as discussed in Section 2, but also in a more patient attitude toward their divestment strategies, which allows the exit timing from those portfolio companies that exert a positive impact, *latu sensu*, on the economic system to be postponed, even if the companies are showing relatively lower growth opportunities. This logic leads to the following hypothesis:

HP2. Investment duration will be longer as the public share increases, all else being equal, in particular for those investments that are expected to generate intermediate financial returns.

3.3. Research setting

The research agenda outlined in the two previous paragraphs builds on the intuition that a hybrid fund manager – as compared to a private fund manager – could have information and preferences that reduce the incidence of write-offs in his portfolio and that delay exits, in particular for those investments showing uncertain financial prospects. In principle, testing such a hypothesis would simply require a comparison between the frequency of write-offs or the average duration of the investments in the funds' portfolios and the size of the public share.

The translation of the research hypotheses proposed above into specific empirical analyses, however, is not an easy task. These intuitions are only valid under specific conditions, and the variables of interest are correlated, which makes it difficult to disentangle the two phenomena (for example, portfolios with a lower incidence of write-offs will show a longer average investment duration).

Actually, HP1 and HP2 can be tested independently – through the analysis of, respectively, the frequency of write-offs and the duration of the investments – only in a simplistic setting where the investor controls unlimited resources (either financial or managerial) and the average duration is measured along a complete investment cycle. In this simple case, the manager of the fund invests in all of those ventures that exhibit expected returns higher than a minimal threshold (or risk-variance frontier); as soon as the VC manager receives a signal that contradicts the initial belief, the investment is dismissed. As a consequence, at the end of the investment cycle, ceteris paribus, an investor who systematically perceives higher returns (as in the case of a public investor, who considers social returns in addition to financial returns) will obviously maintain his investments for a longer period of time than an investor who perceives lower returns. This investor can be said to be "more patient."

However, the intuition becomes less clear-cut when the investor is resource constrained. When this is the case, in every moment, the investor maintains current investments only if they are more profitable than the target threshold *and* they cannot be replaced by more profitable investments available on the market. Consequently, it might not always hold true that investors receiving higher returns will be more patient. The timing of the exit depends also on the (imperfect) signals concerning the current market conditions and on the risk attitude of the investor himself. Moreover, if one observes the portfolio of a more patient investor *before* the end of the investment cycle (because long-term investments are more likely to still be active), the average duration of closed deals is not necessarily higher than the duration observed for funds managed by less patient investors.

In Annex A, we propose a simple model for the timing of exit decisions when resources are limited, aimed at understanding the correlation between the above cited variables and investment duration and write-off frequency. Given the specific goal of this analysis, the model neglects a number of crucial dimensions in the VC financing process, such as the managerial actions of the VC staff in favor of the target firm after the initial investment and different modes of divestment, among others.

The model assumes that the fund manager selects from among uncertain investment opportunities that could generate high returns, low returns or a write-off. The returns for each investment are gradually revealed after the investment. The fund can manage a limited number of deals per period. Because defaults are dismissed as soon as this information is disclosed and high return investments are, in any case, maintained in the portfolio for an appropriate period, the alternative strategies that are admissible are, in principle: (i) divesting low return investments as soon as possible and trying to replace them with high return deals (impatient strategy) or (ii) keeping low return investments in the portfolio for a suitable period (patient strategy).

The results of the model show that an impatient strategy, which aims at divesting as soon as possible any investments of intermediate value to maximize the probability of getting high return deals in the future, is more attractive when[8]:

1. the return of high-return type investments is much higher than the return of low-return type investments, i.e., when the premium that is obtained by correctly selecting the investment with high returns is particularly high;
2. the probability of correctly selecting high-return type investments is high, which happens when good investment opportunities are frequent in the population of firms in which the VC invests and/or when the fund has a strong selection ability;
3. the proceeds from an early divestment are sufficiently high with respect to the expected proceeds that can be obtained at the end of a more appropriate period.

A corollary of these (not surprising) results is less obvious: at the end of the life of a VC fund, one should not expect a higher probability of default for the more impatient investors. In fact, funds adopting an impatient strategy should show a higher number of failures, but also a higher number of investments per unit of time. Consequently, the evidence of a lower incidence of write-offs has to be attributed to the ex-ante selection mechanisms and not to either a patient or an impatient strategy.[9] At the same time, a selection mechanism that limits the number of defaults determines a higher duration for the investments (point 2).

If the public investor's utility function values not only financial but also social benefits (spillover hypothesis), then the public investor perceives, as said, broader returns than a private investor. These returns are not yet sufficient to predict a more or less patient behavior. However, if we reasonably assume that social benefits are less skewed than financial profits (for example, employment effects for low return deals are not significantly lower than employment effects for high return deals), we can argue that a public investor values the premium that is obtained by correctly selecting a high-return type investment (point 1) relatively less. In this sense, he can be more disposed to adopt patient strategies.

In the empirical section of the paper, we can test the public investor's propensity toward patient behavior using an analysis of the average duration of the funds' investments, by correctly taking into account the problem of the censored duration of active investments. Unfortunately, as stated above, the duration of investments will also be higher, on average, when the selection process allows for a reduction in the probability of investing in unsuccessful ventures (write-offs). The effect of a selection process that results in avoiding defaults, however, increases the average duration of every non-defaulted firm, while the adoption of a patient strategy increases, in particular, the duration of mid-quality

[8] In the literature, investment duration analysis addresses, in particular, asymmetric information problems, which are ignored in our model. A large stream of literature emphasizes asymmetries between VC managers and entrepreneurs, focusing on contract design and, in particular, on the structure of sequential financing stages. Another stream of literature highlights asymmetries between the VC managers and the potential acquirers of the firm at the time of the exit. The contributions of this type (see, in particular, Cumming and MacIntosh (2001); Giot and Schwienbacher, 2007; Cumming and Johan, 2010) share with our approach the implicit assumption that VC funds have limited resources and the explicit analysis of the effect of market conditions (both on the demand and on the supply side of investment opportunities) on the timing decisions of exit.

[9] Actually, the failure frequency measured at a portfolio level before the expiration of every fund provides over-estimated results because higher quality investments have a longer duration, thus leading to overrepresentation among the ongoing investments. Because impatient strategies imply a higher average number of deals per period, in this case the frequency of write-offs will result in less overestimation. This second order effect, however, can be reasonably ignored at an empirical level.

Table 1
Number of funds and related investments by classes of public share.

	Public share (%)							
	0–10	10–20	20–30	30–40	40–50	50–60	60–70	>70
Number of funds	37	42	35	20	12	9	8	16
% of funds	20.7	23.5	19.6	11.2	6.7	5.0	4.5	8.9
Number of firms	616	690	452	196	122	100	93	213
% of firms	24.8	27.8	18.2	7.9	4.9	4.0	3.7	8.6

investments. Of course, favorable market conditions – both on the supply (point 2) and demand sides of firms (point 3) – will determine both lower frequencies of failure and lower average investment durations.

4. Dataset and variables

4.1. Dataset

The dataset includes 179 funds that invested in 2482 European companies between 1998 and 2007. Each of these funds raised part of its invested capital from the European Investment Fund (EIF).[10] The data were collected as of December 31, 2007. At that date, only 5 of the 179 funds were closed. The fact that nearly all the EIF funds were still active at the time of the analysis necessitates the adoption of *ad hoc* methodological approaches for data treatment that will be discussed in the following paragraphs.

EIF data on the VC funds and deals were complemented by information from Thomson One Banker, a commercial dataset provided by Thomson Financial. For each fund, we have data on every deal performed and on a set of contractual aspects at the fund level (public ownership, fund duration, end of investment period, geographical and sectoral focus, committed capital and hurdle rate). Because detailed and reliable information on funds' ownership cannot be obtained from the private commercial databases that are usually available to scholars, no comparison with control samples of privately held VC funds was possible.

The average size of the funds measured in committed capital is 88.4 million euros, and their average duration is 9.6 years. Out of 2482 deals in the sample, in 1228 cases there was an exit before 31 December, 2007. The analyzed funds show a significant variance in the level of public ownership. More specifically, 16 funds show over 70% public ownership, while 37 funds have a public ownership stake of between 1% and 10% (Table 1).

The funds are located in more than 15 European countries (Table 2). The most frequently represented countries are the U.K. (44 funds), France (30 funds), Germany (21 funds), Italy (14 funds) and Spain (12 funds). The geographic focus of the investments is, for the majority of the considered funds, their country of origin (81%), whereas 19% have a multi-country focus. Table 2 reports the geographic distribution of the funds and target companies.

The majority of the funds specialize in specific sectors (62% of the sample), whereas others follow a generalist approach, diversifying their investments across a variety of industries. Table 3 presents the distribution by sector of the portfolio companies of the analyzed funds.

4.2. Variables and summary statistics

To assess the investment strategy of our sample funds, we calculated the internal rate of return (IRR) generated by each deal that included an exit (1228 deals). For the companies that were still controlled by the funds, we used the end of the period (FY 2007) net asset value. However, the high heterogeneity across the funds in the methods used to compute the net asset value of the companies that were still in the portfolio forced us to focus only on the exit cases.[11]

Data on the distribution of the IRRs for the sub-sample of 1228 deals reveal that for 31.9% of the exits there was a full write-off (defined as a deal that ends with null proceeds for the investing fund, i.e. an IRR = −1), for 32.8% of the exits there was an IRR between −1 and 0, and 35.3% of the exits generated a positive IRR. In 26.4% of the cases the deals generated an IRR higher than the investing fund's hurdle rate. Graph 1, we report the distribution of IRRs in the sample. Note that the graph does not represent the distribution of the financial performance at the fund level for the analyzed funds because firm performances are not weighted by

Table 2
Geographic distribution of the funds and target firms.

Country	Funds (%)	Firms (%)
United Kingdom	24.58	20.79
France	16.76	21.92
Germany	11.73	13.66
Italy	7.82	5.32
Spain	6.70	3.63
Finland	5.03	6.16
Sweden	5.03	4.59
Austria	3.35	1.89
Belgium	3.35	2.50
Ireland	3.35	4.59
Netherlands	3.35	2.18
Denmark	1.68	2.74
Other countries	7.26	10.03
Total	100.00	100.00

Table 3
Distribution of target firms by sector.

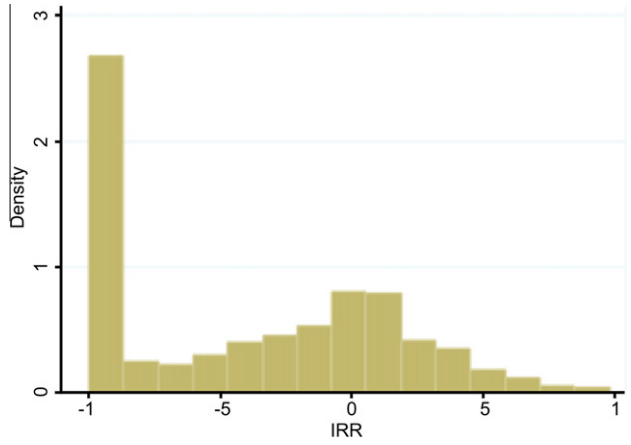
Sector	Number of firms	%
Computer-related	808	32.55
Biotechnology	354	14.26
Communications	336	13.54
Electronics-related	214	8.62
Medical/health-related	198	7.98
Consumer-related	147	5.92
Industrial products and services	83	3.34
Other services	83	3.34
Other manufacturing	73	2.94
Financial services	71	2.86
Chemicals and materials	33	1.33
Industrial automation	31	1.25
Construction	18	0.73
Transportation	14	0.56
Energy	10	0.40
Other	9	1.44
Total	2482	100.00

[10] The dataset includes only those deals characterized by a total investment by the VC fund that is greater than 50,000 euros and minimum six month duration for the investment. These selection criteria were used to avoid possible outliers in annualized returns and peculiar financial transactions. Overall, we excluded 25 observations.

[11] In a large number of cases, the NAV just reported the cost incurred for the acquisition of the participation in the target company, with no subsequent mark-to-market procedures.

Table 4
Incidence of write-offs and of exits with negative IRR for funds with different levels of public ownership.

	Public share < 50%	Public share > 50%	Public share > 70%
Write-off (IRR = −1)	32.88%	27.27%	14.74%
−1 ⩽ IRR < 0	67.22%	53.11%	45.26%



Graph 1. Distribution of IRRs for the sample of companies with an exit (1228 deals).

the size of the investments and because data are censored for active investments. In Table 4, we report the incidence of write-offs and of exits with a negative IRR by the level of public ownership in the investing funds.

In general, a higher public stake seems to be associated with a lower incidence of write-offs and negative returns. However, this summary evidence might be due to unobserved variables that are correlated with the intensity of public ownership in the investing funds (e.g., size, stage specialization, country/sector focus of the investing funds). Moreover, for a proper interpretation of the data on the incidence of write-off cases, we need to account for the fact that 174 out of 179 funds were still active at the time of data collection. This fact implies a potential censoring effect (i.e., we do not observe the future expected IRRs of the target firms that are still in the portfolios of the investing funds) that can have a relevant and non-obvious impact on the observed incidence of write-offs and negative returns. The empirical analysis presented in Section 5 aims to disentangle these effects through the introduction of appropriate controls, both at the fund and the target company levels.

Concerning fund-level control variables, we use the size of the VC fund, its duration in years, its geographical and stage focus and the hurdle rate. As company-level controls, we include the stage of development of the target companies, their sector and whether they owned patents before the investment of the VC fund. We also control for the timing of the VC investment with respect to the residual life of the fund, to capture variations across time in the risk attitude of the fund managers. Because we have a sample of deals across different European countries, we control for the state of the stock markets at the time of the investments by including in the model specifications the Morgan Stanley Capital International (MSCI) average stock market index for SMEs in the investment year. A listing of the variables used in the empirical analysis, along with their definitions and related summary statistics, are provided in Tables 5 and 6.

5. Empirical analysis and results

The empirical analysis is based on two complementary approaches. First, we perform a set of probit models to investigate the impact of the level of public ownership (in the related VC funds) on the probability that a target company results in a write-off. This modeling approach is meant to capture the criteria that underlie the investment selection process by hybrid funds, controlling for contingent factors that are related to the characteristics of target firms, the investing funds and the financial market conditions. Second, we analyze the impact of the level of public ownership on the duration of the investments through survival models. Following the spillover hypothesis, this latter set of models aims to test whether hybrid funds characterized by a higher public stake show a tendency to postpone the exit of their portfolio companies. In particular, we focus the analysis on cases of exits with intermediate levels of IRRs.

In Table 7, we report the estimates for a set of probit models on the likelihood of write-offs. All of the models are based on the sub-sample of 1228 target firms with an exit. The baseline model specifications I and II show that, as expected, the likelihood of a write-off is higher for those companies that are younger, operate in high-tech sectors, or are funded by specialized seed-money VC funds. All else being equal, a higher hurdle rate is associated with a higher probability of write-off, although with limited statistical significance. Companies owning patents are less likely to end up being written-off. We cannot find a significant effect for the size of the VC fund on the probability of observing a write-off.

Even after controlling for the investment year, we observe a positive effect from the variable INVESTMENT PERIOD, which captures the timing of the investment with respect to the fund life (higher values of the variable mean that the investment was made in the later stages of the life of the investing fund). This evidence might reflect that riskier investment strategies are adopted in the early phases of a fund's life. When we substitute for the investment year dummies with an indicator of the financial markets' conditions (model II), we observe a higher likelihood of write-offs for those deals taking place in years that are characterized by a better stock market index.

Model specifications III–IV in Table 7 introduce our key variable, the level of public ownership. The results from Model III indicate the presence of a negative relationship between public ownership and the likelihood of a write-off. On average, even after controlling for different factors that could potentially affect the likelihood of write-offs, the estimates appear to confirm the summary evidence presented in Table 4 of a significant reduction in the incidence of write-off cases for those funds that have higher levels of public ownership.

It is important to stress that this result does not imply an absolute superior "selection capability" of publicly-sponsored VC funds. Rather, the evidence suggests that, on average, funds with a higher incidence of public ownership tend to select *ex-ante* less risky investments. The results of the probit models might be affected by a censoring problem because we have a large number of companies that are still in the portfolios of the analyzed VC funds. However, as discussed in Section 3, without censoring the active investments, we would still have found a negative relationship between the public share and the likelihood of write-off, with coefficients of larger magnitude. This finding is due to the fact that the share of potential write-offs is, in expected value, smaller in the sub-sample of still active investments (see the model in Annex A for an analytical derivation of this effect).

The relationship between public ownership and the VC funds' investment behavior is further analyzed by examining the determinants of the duration of the deals. We initially examine the impact of public ownership on the duration of the deals, irrespective of the levels of the IRRs that they eventually generated. We then run a set of competing risk models to investigate the effect of the levels of the public stake on the duration of the subsets of exited companies, defined by different intervals for the IRRs. The

Table 5
Variables used in the empirical analysis.

Variable	Definition
Company-level variables	
Write-off	Dummy variable that equals 1 for those companies with an exit showing an IRR = −1; 0 otherwise
High-tech	Dummy variable that equals 1 for those companies operating in high-tech sectors; 0 otherwise
Start-up	Dummy variable that equals 1 for those companies founded fewer than 6 years before the first investment by the VC fund; 0 otherwise
Investment duration	Duration in years from the initial investment to the exit. For the deals without an exit, this measure amounts to the duration in months from the initial investment to December 31, 2007
Investment period	The timing of the investment with respect to the start date of the fund. The variable is defined as follows: (Date of first investment in company i – start date of the investing fund)/duration in years of the investing fund. The variable consequently ranges from 0 to 1
Patents	Dummy variable that equals 1 if the target company has been granted patents before the investment. We consider patents granted by the European Patent Office (Source: Thomson Innovation)
Fund-level variables	
Public share	Percentage of public ownership in the investing fund
Fund size	Logarithm of the amount of committed capital in the VC fund
Seed fund	Dummy variable that equals 1 for those funds specializing in seed money; 0 otherwise
Fund duration	Duration in years of the fund investing in company i
Hurdle rate	Dummy variable that equals 1 for those funds with a hurdle rate higher than 8% (top 25% of the distribution of hurdle rates in the sample); 0 otherwise
Market-level variables	
SME stock index	Normalized MSCI average stock market index for SMEs in Europe in the year of the investment in company i

Table 6
Summary statistics for the variables used in the empirical analysis.

Variable	Mean	Median	Min	Max	Std. dev
Write-off[a]	0.319	0	0	1	0.466
High-tech	0.709	1	0	1	0.454
Start-up	0.485	0	0	1	0.499
Investment duration[a]	3.698	3.50	0.5	9	1.836
Investment period	0.159	0.133	0	0.52	0.130
Patents	0.289	0	0	1	0.453
Public share	0.278	0.190	0.012	1	0.259
Fund size	10.835	10.998	7.310	13.491	1.146
Seed fund	0.048	0	0	1	0.215
Fund duration	9.59	10	6	17	0.030
Hurdle rate	0.107	0	0	1	0.309
SME stock index	1.606	1.678	1.150	1.921	0.247

[a] Summary statistics include only the companies with an exit.

competing-risk models are based on the semiparametric proportional hazard regression method for survival data developed by Fine and Gray (1999). In the case of a research setting in which just one type of failure event can take place a standard Cox model (Cox, 1972) is appropriate. However, the Cox approach will produce effects of covariates that are not easily quantified and interpreted in the presence of competing failure events that impede the event of interest. The Fine and Gray approach is based on the use of cumulative incidence functions. The baseline subhazard function – which generates failures under competing risks – is left unspecified, and covariates act multiplicatively on the baseline subhazard.[12] In our case, the competing risk models focus on cases of exits with intermediate levels of IRRs. We estimate the impact of covariates on the duration of this sub-sample of deals, controlling simultaneously for censored observations (i.e., those companies that were still in the funds' portfolios) and the so-called "competing risk", which, in our case, is represented by those exits that show higher or lower levels of IRRs with respect to the analyzed sub-sample.

In Table 8, we present the results for the duration models. For all specifications, we report the coefficients of the underlying exponential model. Hence, positive values for the estimated coefficients are associated with lower durations.[13]

Table 7
Probit models. The dependent variable equals 1 for write-offs (IRR = −1) and 0 otherwise. Sample restricted to 1228 companies with an exit.

Models	I	II	III	IV
Public share			−0.514**	−0.459*
			(0.260)	(0.247)
High-tech	0.265***	0.269***	0.251**	0.256***
	(0.099)	(0.098)	(0.099)	(0.099)
Start-up	0.364***	0.369***	0.349***	0.357***
	(0.084)	(0.084)	(0.085)	(0.084)
Patents	−0.242**	−0.237**	−0.239**	−0.233**
	(0.106)	(0.105)	(0.105)	(0.105)
Size fund	−0.061	−0.062	−0.143**	−0.134**
	(0.046)	(0.046)	(0.062)	(0.060)
Seed fund	0.441**	0.413**	0.382**	0.362*
	(0.189)	(0.187)	(0.191)	(0.189)
Investment period	−0.756*	−0.746**	−0.903**	−0.756**
	(0.424)	(0.357)	(0.430)	(0.357)
Hurdle rate	0.106	0.108	0.102	0.109
	(0.095)	(0.094)	(0.095)	(0.094)
SME stock index		0.514***		0.510***
		(0.175)		(0.175)
Constant	0.736	0.001	1.827	0.826
	(1.082)	(1.093)	(1.210)	(1.177)
Country dummies (fund)	Yes	Yes	Yes	Yes
Country dummies (company)	Yes	Yes	Yes	Yes
Investment year dummies	Yes	No	Yes	No
Observations	1228	1228	1228	1228
Chi2	136.8***	132.4***	140.7***	135.9***
LogLik	−686.4	−688.5	−684.4	−686.8
Pseudo Rsq	0.091	0.088	0.093	0.090

Standard errors in parentheses.
* Significance levels: 90%.
** Significance levels: 95%.
*** Significance levels: 99%.

[12] For a discussion of the statistical properties of competing risk methods see also Gichangi and Werner (2005) and Pintilie (2006). All competing risk models have been run using the software Stata 12 and the stcrreg routine. Similarly to the Cox model, the Fine and Gray competing risk model is based on the assumption of proportionality of subhazards. We have performed a test for the proportionality assumption on the different specifications. Such test consists in introducing in the model specification also interaction terms between covariates and the time variable. The proportionality assumption holds if such interactions turn to be non-statistically significant. Results confirm the appropriateness of the selected method.

[13] A positive (negative) coefficient means that the effect of increasing that covariate is to increase (decrease) the subhazard and thus increase (decrease) the cumulative incidence function, resulting in a lower (higher) duration.

The results obtained for Model I indicate that, on average, higher levels of public ownership are associated with longer durations for the investments, irrespective of the IRR of the deal. This first evidence appears to be in favor of a more "patient" investment strategy for publicly sponsored VC funds and, hence, for the spillover hypothesis. However, this average postponement effect could also be caused by the initial selection process by hybrid VC funds. If VC funds showing a higher public ownership tend to have a lower propensity to invest in higher-risk target firms that are, in turn, more likely to result in write-offs, this would generate – ceteris paribus – a positive correlation between public ownership levels and observed investment duration. Hence, taking into consideration the results of the probit models in Table 7, evidence of an average undifferentiated postponement effect (Model I in Table 8) is not a sufficient condition to determine the validity of the spillover hypothesis.

To account for this potentially relevant confounding effect, we run a set of competing risk models. These competing risk models allow us to exclude the possibility that the observed postponement effect is driven by the selection process if we observe that the public ownership variable has a specific delaying effect for deals with intermediate financial returns. Models II–IV in Table 8 suggest that the postponement effect of the public ownership level is still present – and with relatively higher magnitude – once we focus on the specific intervals of IRRs that exclude both the write offs and the cases with an IRR that is above the VC fund's hurdle rate. These results are robust to the inclusion of the variable INVESTMENT PERIOD among the regressors. This is relevant because the distribution of durations is also affected by the fact that VC funds must exit from all of their portfolio companies before their closing date.

The overall evidence from the two typologies of duration models is compatible with the spillover hypothesis and with the theoretical intuition of the exit model presented in Annex A. More specifically, we find that a higher level of public ownership is positively related to duration, in particular for those deals that are not default cases and that show a positive, although not extreme, value for the IRR. This evidence appears to be compatible with the presence of investment objectives that also include, for those funds with a higher public stake, some form of additional social return. We can assume that this social return is null in the case of write-offs and is positive for the other types of exit, and it increases with the performance of the deal, but less than proportionally to the financial returns. Under this assumption, we can jointly interpret the evidence of the two sets of analyses based on the probit and the duration models as an indication that the investment strategies of VC funds for increasing the values of public ownership are, on average, characterized by a more patient approach and a more "risk-averse" selection process.[14]

Table 8
Standard duration model and competing risk models. Dependent variable: duration of the investment. Coefficients reported.

	Duration model	Competing risk models		
	Risk: any IRRs	Risk: IRR < 0	Risk: −1 < IRR < hurdle rate	Risk: 0 ⩽ IRR < hurdle rate
	Model I	Model II	Model III	Model IV
Public share	−0.538***	−0.912***	−1.115***	−2.358***
	(0.163)	(0.212)	(0.265)	(0.654)
High-tech	0.073	0.173*	0.074	0.230
	(0.070)	(0.091)	(0.113)	(0.251)
Start-up	−0.096	0.300***	−0.100	−0.787***
	(0.062)	(0.079)	(0.100)	(0.225)
Patents	−0.577***	−0.814***	−0.575***	−0.164
	(0.075)	(0.096)	(0.114)	(0.231)
Fund size	−0.156***	−0.161***	−0.110*	−0.394***
	(0.040)	(0.050)	(0.060)	(0.124)
Seed fund	0.103	0.428**	−0.156	−0.697
	(0.140)	(0.166)	(0.255)	(0.669)
Investment period	−0.030	−0.560*	−0.218	0.422
	(0.247)	(0.331)	(0.370)	(0.762)
SME stock index	0.250**	0.756***	0.397*	−0.062
	(0.127)	(0.165)	(0.208)	(0.442)
Country dummies (fund)	Yes	Yes	Yes	Yes
Country dummies (company)	Yes	Yes	Yes	Yes
Investment year dummies	No	No	No	No
Observations	2482	2482	2482	2482
Failures	1288	796	511	107
Number of competing events	–	432	717	1121
Censored	1254	1254	1254	1254
LogLik	−2336.4	−5654.1	−3639.984	−743.838

Standard errors in parentheses.
* Significance level: 90%.
** Significance level: 95%.
*** Significance levels: 99%.

6. Conclusions

In this paper, we investigate the impact of public ownership levels on the investment strategies of hybrid VC funds. In particular, the empirical analysis is focused on observing the likelihood of write-offs and the timing of exits. The results suggest that different levels of public ownership are associated with significantly different investment patterns. More specifically, the joint observation of the results from the probit and the duration models suggest that higher public stakes are significantly correlated with a lower incidence of write-offs and a longer duration for the investments, particularly in the case of deals that are characterized by intermediate levels of financial returns.

We argue that this evidence is compatible with the objective function of a public investor, which is not simply restricted to financial returns, as private investors would demand, but also includes additional factors related to the spillover effects of entrepreneurship. From this perspective, our evidence also suggests that the hybrid funds seem to compete with private funds in not perfectly overlapping segments of potential target firms. In this sense, the problem of potential crowding out effects of public direct support in the VC industry seems to be mitigated.

We have deliberately focused the analysis on the funds' investment strategy rather than on the financial returns generated at the fund level. VC funds that contain a larger public stake appear to have a more risk averse and "patient" investment strategy. We argue that our approach contributes to the extant literature, which, when addressing the impact of public funding, has adopted a standard financial fund-level perspective that could have induced a more negative evaluation of the role of public support to VC. We are aware that the generalization of our findings is not straightforward because our database includes only funds that received public money from a specific institutional subject. However, this paper also provides a theoretically grounded methodology to allow the replication of the analysis on other samples of publicly sponsored VC funds.

[14] Note that we are not investigating whether these components of the investment strategy are correlated to higher or lower aggregated financial returns at the fund level.

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Appendix A. A simple model of VC exit strategy when resources are limited

In this Appendix we propose a simple model for the timing of exit decisions from a VC investment. The key assumption is that the VC fund is resource constrained – that is it can simultaneously manage only a limited number of ventures – and it can choose whether to maintain an intermediate-return investment or to replace it with a new uncertain investment, hopefully offering a superior performance. In order to highlight the effects of limited resources and market conditions on the preference for more or less patient strategies, the model neglects a number of crucial dimensions in the VC financing process, such as the managerial actions of the VC staff in favor of the target firm after the initial investment and different modes of divestment, among others.

We are particularly interested in obtaining from the model specific predictions concerning the distribution of the quality of the investments and their duration before the end of the investment cycle of the fund, as a function of the exit strategies undertaken. Indeed, scholars are often forced to measure such variables during the entire life of the fund, when good investments are more likely to be still active, while bad and short-term investments are over-represented in the sample of closed deals. In this case, the natural intuition that less patient investors will present a lower investment duration could be wrong.

Let us assume the investment of a certain quantity of capital – normalized to 1 – being the amount that must be employed for every investment.[15] The distribution of the return-factors (R_i) from one period investment is associated with three possible outcomes for the initial unitary investment – F, L and H – that represents, respectively, a case of write-off ($R_F = 0$), a low (positive) return (R_L), and a high return (R_H), so that $1 < R_L < R_H$. The investment lasts at most two periods. At the beginning ($t = 0$), the VC manager gathers information (i_0) upon which it selects a firm from the population of available investment opportunities. At the end of the first period ($t = 1$), the VC receives a new signal about the characteristics of the target company. On the basis of this signal, the VC manager can decide to liquidate the investment at $t = 1$ or keep it in the portfolio for one additional period and sell the firm at $t = 2$. The VC fund can start a new investment round after the divestment in $t = 1$ or after selling the firm in $t = 2$. Let us define p_H, p_L, $p_F = 1-p_H-p_L$ as the distribution (which is common knowledge) of the investment typologies in the population and π_H, π_L, $\pi_F = 1-\pi_H-\pi_L$ as the subjective distribution in $t = 0$, which is updated by the VC manager given the signal i_0, namely $\pi_k = \text{prob}(k|i_0)$, with $k = F, L, H$. The quality of the information signal i_0 depends on the selection capabilities of the investor. Obviously, all else being equal, the higher is p_i, the higher will be π_i.[16]

At time $t = 1$, the VC receives a second signal i_1 that allows the information to be perfectly refined. Therefore, i_1 assumes three values – f, l and h – that perfectly reveal the nature of the investment made in $t = 0$.[17] At time $t = 1$, the write-off signal f implies a compulsory liquidation of the assets, which as said generates null returns, while a signal equal to h implies to maintain the investment (no better firm can be found on the market). Only a signal equal to l can give rise to a discretionary choice between:

- selling the company immediately for a value $A > 0$, after which it is possible to make a new round of investment, or
- waiting one more period and obtaining R_L^2 in $t = 2$.

We introduce now two additional simplifications that allow to easily compare the payoffs associated with the two alternative strategies of exit: (i) the investment cycle of the VC fund has an indefinite duration and (ii) after each divestment, the generated returns are distributed to the fund's shareholders and the fund starts the collection (without additional costs) of a new unit of capital, that will give rise to a new round of investment.

Let us compare the payoff for the VC fund if it adopts the strategy consisting of divesting (D) in $t = 1$ when the signal is l (Π^D) and the payoff of the strategy consisting of maintaining (M) the company in the portfolio when the signal is l (Π^M). The payoffs can be obtained in a recursive way thanks to the infinite life of the fund.[18] Given the discount factors δ requested by the VC shareholders under the two strategies,[19] it is possible to obtain the value of the fund in $t = 0$.

$$\Pi^M = \delta^2\pi_H(R_H^2 - 1 + \Pi^M) + \delta^2\pi_L(R_L^2 - 1 + \Pi^M) + \delta\pi_F(-1 + \Pi^M) \quad (1)$$

$$\Pi^D = \delta^2\pi_H(R_H^2 - 1 + \Pi^D) + \delta^2\pi_L(A - 1 + \Pi^D) + \delta\pi_F(-1 + \Pi^D) \quad (2)$$

From the previous equations, we can derive the two expressions for the payoffs at time $t = 0$ in the case of strategy M and D:

$$\Pi^M = \delta\frac{\delta\pi_H(R_H^2 - 1) + \delta\pi_L(R_L^2 - 1) - \pi_F}{(1-\delta)(1 + \delta(\pi_H + \pi_L))}$$

$$\Pi^D = \delta\frac{\delta\pi_H(R_H^2 - 1) + \delta\pi_L(A - 1) - \pi_F}{(1-\delta)(1 + \delta\pi_H)}$$

From the above expressions, it is possible to obtain the internal rate of return (IRR) of the investment under the two strategies, given that the initial value of the investment is equal to 1.

$$IRR_M = \sqrt{\pi_H R_H^2 + \pi_L R_L^2} - 1 \quad (3)$$

$$IRR_D = \frac{2\pi_H R_H^2}{\sqrt{4\pi_H R_H^2 + \pi_L^2 A^2} - \pi_L A} - 1 \quad (4)$$

A.1. Prediction of investment duration

As can be obtained by directly comparing Eqs. (3) and (4), the prevalence of a "patient" (M) or "impatient" (D) strategy is not easy to understand, since it depends on several interacting variables. A more impatient strategy, which aims at divesting as soon as possible those investments of intermediate value in order to maximize the probability of getting a high return deal in the future, is more attractive when:

1. R_H is high compared with R_L;
2. π_H is high compared with π_L and π_F is relatively low;

[15] We simplify matters by assuming that, because of constraints on financial resources, the VC fund can make only one investment at a time. Results are unchanged if we model a portfolio composed of different investment units.

[16] The fact that the distribution of probabilities π differs from that of p can also be attributed to expected effects of the managerial actions in favor of the target firm after the initial investment.

[17] Clearly, both returns and associated probabilities must comply with the participation constraint of the VC fund. Modeling imperfect information even at $t = 1$ does not improve the generality of the results.

[18] In Eqs. (1) and (2), this implies that we add to the amount discounted under the different probabilistic outcomes the same value Π^k (with $k = M$ or D).

[19] Actually, the discount factor would be different in the two cases because the risk associated with the two strategies is not the same. In particular, the divestment strategy is riskier (the company does not know the quality of the new target firm that will be selected after the divestment in $t = 1$). Ceteris paribus, we then expect that $\delta_M > \delta_D$.

3. A is relatively high with respect to the expected proceeds at time $t = 2$.

In other words, investors will be impatient when they value the return of the high quality investments much more than the return of intermediate quality investments, when the offer of new ventures is favorable and when the proceeds that can be obtained on exit are high.[20]

Different characteristics of the two investment strategies, M or D, can then be derived. The funds that adopt the impatient strategy D should show a higher number of investments per unit of time. Accordingly, the expected duration of the investments is obviously different for the two strategies and equals $\tau_M = 1 + \pi_H + \pi_L$ and $\tau_D = 1 + \pi_H$, meaning that the average number of investments per unit of time is different. If one measures the duration of the investments after few investment rounds, however, no significant differences could be found since longer investments – more frequent when the M strategy is adopted – are still in place and their presence among closed deals results consequently lower.

A.2. Prediction of write-off frequency

The expected frequency of the investments of type H, L and F over a sufficiently long time horizon will be exactly equal to π_H, π_L, $\pi_F = 1-\pi_H-\pi_L$ for both strategies, because every new investment is independently drawn – more or less frequently depending, respectively, on the adoption of a D or M strategy – from the same distribution.

Accordingly, those funds adopting an impatient strategy should show a higher number of investments per unit of time and therefore, comparatively, also a higher number of write-offs. The expected values for the number of defaults, conditional on the strategy, are in fact:

$$number(F|D) = \frac{\pi_F}{1+\pi_H} \quad number(F|M) = \frac{\pi_F}{1+\pi_L+\pi_H}$$

Nonetheless, as said, such a higher number of write-offs is associated with an identical frequency π_F. Consequently, one should not expect a higher probability of default for the more impatient investors.

When funds are analyzed in a date before their expiration, the frequency of write-offs will result over-estimated, since in active deals longer and better investments are over-represented. Since the D strategy presents a higher number of investments per unit of time, overestimation of write-offs which arises in the sub-sample of closed deals is likely to be, ceteris paribus, more relevant for patient investors. Nonetheless this is a second order effect, which can be reasonably neglected on empirical grounds.

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[20] A further determinant of impatience is a relatively limited risk aversion, i.e. δ_M is not too much higher than δ_D.