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Venture Capital, Behavior and Performance of Stakeholders

The venture capital industry is structured on the management of assets carried out by third parties. This chapter will focus on the logic guiding the actions of the various different stakeholders to make venture capital an effective mechanism for financing innovation. The social practices that take place are done within three-way relationships between the following players.

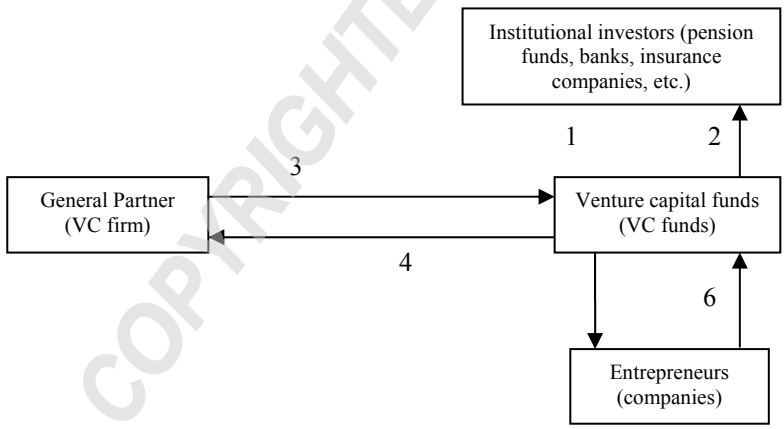

Figure 1.1. *Simplified diagram of venture capital activity: (1) collection of funds; (2) distribution of returns obtained; (3) low level of contribution; (4) management fees and payments; (5) investments; (6) end of the investment relationships (source: [RIN 11])*

We have identified three main areas of investigation: interactions between financed firms and venture capital (selection, investments,

strategies, exits), interactions between venture capital funds and institutional investors (collection of finances, distribution of returns), and finally the organization of venture capital firms and their relationships, including syndication. We adopt the point of view of the works of literature which considers the "General Partner" as a firm and the company as a start-up that receives funding. When we consider the financing chain for innovative start-ups, we may note two characteristics unique to France: first, the relative weakness of long-term funds, and second, the significant participation of the public sector [EKE 16]. For regulatory reasons (prudential ratios), investments by banks and insurance companies in long-term, high risk projects are necessarily limited. The influence of public intervention is given in Table 1.1.

	Germany (1)	United Kingdom (2)	Scandinavian countries (3)	France (4)
Public institutions	22.3	2.9	13.4	22.3
Family offices and individuals	18.8	6.5	6.9	19.1
Insurance companies	8.4	9.6	4.3	16.6
Funds of funds	15.5	18.6	22.1	14.7
Pension funds	21.5	36.3	27.4	11.0
Banks	6.1	2.2	5.6	7.2
Private companies	3.6	1.8	1.5	5.0
Sovereign wealth funds	0.7	15.4	10.5	2.7
Capital markets	0.2	1.6	1.5	0.8
Academic institutions, donations, and foundations	3.1	5.1	6.6	0.8
Total	100	100	100	100

Table 1.1. *Distribution of private equity funds raised, by type of investor (in %), 2012–2015: (1) = Germany + Switzerland and Austria; (2) = United Kingdom + Ireland; (3) = Denmark, Finland, Norway, and Sweden; (4) = France + Belgium and Luxembourg (source: [EKE 16, p. 5] from EVCA)*

Table 1.1 shows the funds raised by private equity. Despite the similarity of these statistics, venture capital must be considered as distinct from private

equity, even if these two financing mechanisms are of a comparable nature (illiquid and medium- to long-term investments). The two do not take the same approach to the problem of fundraising. In particular, with regard to venture capital in Europe, the difficulty of finding the right options for departure explains why this industry consistently underperforms. This would explain why the funds raised on the European venture capital market do not reach the levels of those raised on the private equity market.

With regard to venture capital, a recent article states that:

> "France is characterized... by the importance of venture capital financing through public funds, which represent more than a quarter of the amounts raised. This is partly due to the lack of pension funds and university foundations. In fact, the time scale of these investors, which spans a greater period than that of other institutional players (banks, generalist funds, etc.) and their greater capacity to take risks (compared to insurers, for example), makes them important players in other countries. France is also characterized by its smaller specialized funds. As an example, the largest French funds are about 10 times smaller than the largest American funds. This fragmentation poses a particular problem for the most important fundraising events, beyond the start-up phase, which are essential for supporting the growth of successful start-ups and keeping them within the territory" [FRA 17, p. 2].

It should be noted that the target company and the entrepreneur do not occupy the same position in these two configurations. In private equity- and particularly in buyouts – the company already exists, it is established, is often mature, and generally functions as part of the "old economy". Investors acquire existing companies, improve their business model (the targets are very often underperforming business units) by transferring modern managerial tools and financial techniques to them to increase their value. Poorly managed companies become attractive targets that can be transformed into profitable companies [MEY 06].

By contrast, in venture capital, the company does not exist at the beginning of the process. It is only a concept of a product, process, or service, which will be developed in the "new economy". The trade-off between seizing on an entrepreneurial opportunity and being employed in a

large company, given the entrepreneur's aversion to risks, often leads to the conclusion that entrepreneurial choice is not very profitable because of the specific risks faced by the start-up that is to be created. The risk of exposure to corporate volatility is much lower in later stages (development or transmission). On the other hand, managers of venture capital and development capital funds are exposed to the same difficulty of diversifying their portfolios.

Moreover, the financial flows do not have the same purpose. Venture capital represents an institutional and organizational innovation that makes it possible to organize young innovative companies and professionalize their management, so that – in the case of the most efficient among them – they can make it into the technology stock market (going public). Following the logic of private equity, opportunities for profit can be found when the funds become owners of mature companies in which operators identify opportunities to create value, by optimizing their business portfolio and restructuring the scope of these companies. To this end, companies are often removed from the stock market, their shares become the property of one (or more) funds and, since they are no longer listed, they cannot be bought on the stock exchange by the public: they "go private", hence the term *private equity*. A new model known as the "not publicly traded" model has emerged and developed rapidly in recent years, which contradicts the underlying logic of capitalism.

We will focus on three aspects. First, we will specify the framework for analyzing the relationships between venture capitalists and entrepreneurs. Then, we will analyze the real behavior of these two categories of actors. Finally, we will highlight the contributions made by venture capitalists to the performance of innovative companies.

1.1. The analytical framework

Academic literature essentially uses two approaches: the agency theory and the resource dependency approach.

1.1.1. *The contractual model and agency problems*

Over the lifespan of the company, a financing gap is created when potentially profitable investment opportunities cannot be taken advantage of

due to a lack of internal financing. Additional external capital might then be provided by shareholders, banks, venture capitalists, companies, etc. In the first stage of development, when the company does not yet exist and its business model is not defined, funds may be provided by the entrepreneurs themselves, their families, and/or their friends. In addition to this, they may receive public support (competitions, honorary loans) or support provided by incubators (see Box 1.1) or accelerators[1] [EKE 16]. The authors of the cited work distinguish the incubation phase from the seed phase (with funds usually provided by business angels, but also from public authorities or specialized funds) and the start-up phase, in which venture capitalists are very active[2].

"EuraTechnologies [is] an ecosystem where major digital firms and start-ups coexist... The path to creating a company is filled with challenges: deciphering the administrative process, convincing investors, building an address book of potential clients... To address these challenges, the incubator gives guidance and advising. It brings in lawyers, accountants, tax experts, managers... An army of experienced professionals, whose job it is to show newcomers the ropes before letting them take the wheel. Alongside the multitude of small businesses, digital giants such as IBM and Capgemini have created their own operations to 'directly access project leaders', says Massimo Magnifico [Chief Operating Officer of EuraTechnologies]. The presence of large laboratories, such as those of the *Institut national de la recherche consacré au numérique* (Inria) or the *Commissariat à l'énergie atomique* (CEA), continue to contribute to the richness of the site... The owners of a technology talk to companies who will 'potentally [find it] a practical application...'"

Box 1.1. *The EuraTechnologies incubator (source: [NUN 17, p. 18])*

1 Accelerators differ from incubators in the limited duration of their schedules, the provision of tutoring and training, and the payment of salaries. In addition, these programs are organized into cohorts, that is companies enter and exit these programs in groups [COH 14].

2 This does not prevent them from participating in the previous seed step as well. New methods have emerged in the start-up phase: "*crowdfunding"* (a call for private savings contributions: funds are raised from a large number of participants, each providing a very limited amount) or *crowd equity*, which allows large investors (banks, large companies, etc.) to select start-ups seeking external financing. More often than not, the start-up is acquired in this case.

The literature has often focused on the opacity of the information involving start-ups, particularly those that are technology-intensive [CAR 02]. In addition to the fact that coverage by the media only very rarely works in favor of young companies (except at international trade fairs), an innovative idea that can lead to a new product, process, or service is a strategic asset that the company must protect in order to receive future returns. In this sense, restricting information is a rational strategy for controlling intangible assets. Moreover, since these are innovation-based companies whose concept is based on R&D expenditures, their situation can be compared to what has become known as the "lemons market" and modeled by Akerlof in 1970. When projects involve long-term R&D investments, funders have more difficulty distinguishing between worthy projects and ones that are less so. The existence of such problems of information imbalances gives rise to three types of difficulties: adverse selection, moral hazards, and opportunism.

In its extreme version, adverse selection means that the market for R&D projects can disappear if the information imbalance is too severe. Indeed, if the cost of disclosing information to the market is very high, the quality of the signal surrounding the potential project is reduced [HAL 10]. The ambiguity is very strong in this case. According to Hall, this mechanism can be attenuated in two ways. First, if R&D expenditure is an observable signal that can be audited externally, and second, if the innovator is a *serial entrepreneur* whose reputation has been built through previously founded and successful start-ups.

Moral hazards occur when the entrepreneur – and venture capitalist do not share the same objective, with the former preferring to invest in activities that are rewarding for themselves, but not necessarily for the company. Regardless of this difference, the entrepreneur may have excessive confidence in a project and overestimate it, while the probability of success will only gradually become apparent over time. In this context, the entrepreneurs and the venture capitalists will disagree on the time commitment and the number of rounds of funding required. Venture capitalists face the dilemma of either having to wait too long to cancel a project or having to cancel it too quickly. However, it is possible to accelerate or slow down the project's financing rate, depending on the progress that has been made and the expectations formed at each stage. There is also nothing from preventing the venture capitalists from including a termination rule in the contract (based on certain criteria), thus eliminating

the possibility for opportunistic behavior by a contractor seeking to extend the duration of the project.

These considerations show that providing equity capital from external sources will be more difficult to achieve for innovative projects than for ordinary investments, and this difficulty is still greater for innovative start-ups. In this context, how can we mitigate agency problems?

Venture capitalists have several possibilities for doing so. In addition to a qualitative evaluation of the project to be carried out on the basis of the business model provided by the entrepreneur, investors pay the most attention to the composition of the management team during the evaluation phase. In addition, external cognitive resources can be mobilized within the "entrepreneurial support network" that has been formed [KEN 04], including those of experts whose intervention is necessary to assess the commercial potential of projects, and those of institutions specializing in work as technological intermediaries (legal advisors, intellectual property specialists) who act as interfaces between investors and technological start-ups. Finally, the practice of syndication multiplies the skills required to review a project, while spreading the financial risks over time during the investment phase:

> "This refers more generally to work on the advantages of a system called hierarchy, in which a project is accepted on the basis of the observations of several people in relation to the polyarchy characterized by independent decision-makers" [GUI 08, p. 103].

Indeed, the authors (Sah, Stiglitz, etc.) stress the difficulty for individuals to gather, absorb, and make use of large masses of information in a limited period of time, which gives rise to the idea that a deliberation within an information ecosystem is able to do better, which is to say, lead to better decisions, than a single individual whose capacity for attention is necessarily limited.

Guilhon and Montchaud also point out that the contract is necessarily the result of negotiations between the venture capitalists and the company's managers, seeking financing. The most notable aspects are regarding the financial package (amount of funds injected, types of securities used: convertible preference shares, contractual protection mechanisms, etc.) and the drafting of the shareholders' agreement (inclusion of the venture

capitalist(s) on the Board of Directors, granting of decision-making rights, financing in stages, incentive mechanisms, etc.). In particular, the allocation of decision-making rights and the exercise of these rights depend on observable measures of the financial and non-financial performance of companies.

In this way, the discretionary allocation of rights and the possibility of using performance incentive systems create the equivalent of a hierarchy in the sense described by Williamson: the ability to give orders and carry out the administrative management of the project. However, the intensity of the hierarchical relationship varies, and is exercised on a structure that is not very thoroughly integrated when considering the different *rounds of* funding. The hierarchical relationship varies in intensity and this expresses that:

> "The venture capital contract is a hybrid, a complex combination of equity and debt (and one that in fact frequently contains convertible priority securities or other similar investment vehicles) that more closely resembles debt when the company has poor performance (control is given to the investor) and more closely resembles equity when the company demonstrates good performance (control is transferred to the entrepreneur, which is consistent with the logic of incentive)" [HAL 02, p. 47].

As enticing, as it may be, contractual analysis through the agency relationship has several limitations. Despite the presence of mechanisms for flexibility that allow the relationships between these actors to change over time based on the company's performance and the information received, some elements are inevitably left out of contracts, which by definition are always incomplete. In addition, once the decision has been made to invest, agency costs can be mitigated through a cumulative learning process. Over time, as a result of investments already made in many areas and the experiences gained, venture capitalists learn to better interpret the observed performance of funded start-ups [DIM 08]. Dimov and Murray point out that the cumulative learning process allows the VC firm to form a group of experienced managers, that is "intangible and tacit human capital that represents a secure and inimitable source of advice for the less experienced managers of the companies in the portfolio" [DIM 08, p. 130]. The accumulation of expertise skills, the product of learning through practice, makes it possible to extract higher returns on investment and to engage in

projects with higher added value, in particular, the most innovative start-ups. In addition, more effective monitoring (advising, etc.) and governance processes are being adopted in the start-up (and possibly seed) activities, which are becoming more specialized.

Finally, despite the flexibility of the contract and the effects of learning, the oversight mechanisms present a negative image of the relationship between venture capital and the entrepreneur. In particular, the transfer of rights is punitive in nature. Moreover, this image is incomplete. By considering venture capital as the principal and the entrepreneur as the agent, we are ignoring the fact that venture capitalists, in addition to their oversight activities, are often very involved in the management of funded start-ups and that the company's manager(s) are not simply agents expected to perform tasks that the principal imposes on them. These two players have interdependent roles, and because of the relative imbalance of knowledge between them, "their relationship should be considered as one of mutual dependence based on the relationships of power" [PAR 16, p. 15].

1.1.2. *The resource-dependent approach*

An analysis of the different types of knowledge, and their placement within a scheme for the distribution of roles between venture capitalists and entrepreneurs, makes it possible to specify the way in which a resource dependency approach complements the logic of the contract.

As mentioned above, the business of venture capital involves two types of knowledge. The intangible means of production used within an activity process are qualified as *instrumental* knowledge. They are explicit (i.e. scientific and technological knowledge) and/or tacit in nature. In this case, they are procedural in nature (knowing how to do it). The second type refers to *interpretative* knowledge that helps to define situations, imagine representations of reality, and give meaning to a productive activity by integrating it into a value chain. This kind of knowledge works to reduce the ambiguity associated with certain real-world conditions, particularly in high-tech activities. The respective roles of these two categories of agents are not set in stone. When entrepreneurs develop representations of interpretative knowledge that are supposed to correspond to production opportunities and market opportunities, they are not always able to evaluate the information created by their innovation. That is how new certain ways of acting, consuming, or communicating may be. Therefore, it is important for

cognitive attention of financial decision-makers and experts to be focused, through producing a model that can present salient points. Indeed, since cognitive attention is limited, the different aspects of the project are sequenced.

The possible and conceivable activities that an innovative project may take cannot be superimposed on each other; there must be an intersection between these two sets of knowledge. The literature notes that venture capitalists and experts gain new knowledge and, as a result, develop capacities of expertise that improve their ability to evaluate projects, to appreciate intangible assets (patents, R&D expenditures), the viability of a business model, etc. Entrepreneurs actively participate in this legitimization process by using their technical skills to find a place in a market that fits the product, and by seeking to define a distinct space and identity so that the company and the market become synonymous.

Identity can be constructed from several mechanisms, such as by reproducing cognitive models that are easy to identify and have been implemented elsewhere, particularly by investors. In particular, in services related to the Internet, a cognitive model can be built around the notion of secure transactions, or the notion of trust. Similarly, patenting allows innovators to give investors an indication of their R&D spending, the capacity of their expertise, and technological lead in a given field. The actions taken jointly between these two groups of players are intended to reduce the ambiguity of the situation created by the innovative project. This ambiguity exists because players may assign different functionalities to a new technology. They have their own "cultural resources" (skills, theoretical diagrams, etc.) that focus the attention on certain aspects that become more salient to them than others [LEO 11]. According to Leonardi, technologies are "interpretatively flexible" [LEO 11, p. 349], thus venture capitalists and entrepreneurs may have different interpretations of the problems that a technology is supposed to solve. In this context, *innovation is not so much a process for solving problems, which are supposed to exist somewhere until they are solved, but rather a process for constructing problems*. When the problem is shared by the actors, ambiguity is reduced.

By contrast with the logic of a contract, the forms of involvement and the type of coordination between the actors are different. Relationships of mutual dependency produce a cooperative form of governance based on the implementation of reciprocal and complementary knowledge that, far from

demonstrating the preeminence of venture capital, generates strong interactions between themselves and the company's management. Their involvement depends on both the attitudes they share about the projects and the resources they control. Because of their innovations, start-ups face specific risks that depend on the newness of the innovation. While adhering to the same project, both actors may have a preference for risk, more so in the "early stage" phase, but that is different or changes over time when the company reaches a more advanced stage (a "late-stage venture". The start-up begins to grow, the viability of the product is proven, and the business activity focuses on marketing and sales). The interdependence or reciprocal influence exercised by each actor depends on the extent of the resource held by one player, on the performance of the other, and the extent of control that each player exercises over the resource or a replacement for that resource [PAR 16]. The knowledge and skills possessed create a situation of mutual dependence, since it is rare for either player to fully master all the elements required to perform an action or achieve the desired result.

1.2. From the theoretical framework to the empirical findings: observed behaviors

Kaplan and Stromberg argue that transitioning from theoretical modeling to practice does not pose any major difficulties: "Venture capitalists are real-world entities whose behavior is very similar to that of theoretical investors" [KAP 03]. These players are supposed to be able to solve what Gilson calls "the problem of simultaneity", that is bringing together entrepreneurs, investors and financial intermediaries at the same time. In fact, the behaviors observed through the empirical estimates run up against methodological difficulties. Taking note of these difficulties allows us to take a more cautious approach to theoretical predictions. Moreover, the relationships between these players vary based on the trade-offs they make, they change along the stages of the company's life, they are part of a social and economic context, and finally, for the venture capitalists, they represent an aversion to risk that can be reduced by syndication.

1.2.1. *Methodological problems*

The behaviors observed depend on the information contained in the databases that face sample selection problems [INR 11]. For these authors, it

is conceptually impossible to precisely define a company's date of birth. Should we favor the first stage of financing, or admit that entrepreneurs can make their projects mature well before they are taken over by a funder? Indeed, personal or family financing may have enabled them to pay research and development (R&D) expenses, develop a business model, or develop a new concept while working as an employee at a large company.

In addition, empirical estimates face the difficulty of isolating the effects of selection from the effects of treatment, also known as "coaching" effects. Selection effects appear from the moment when the empirical data only include firms that have obtained financing, neglecting those that have been refused financing or those that have refused an equity contribution. In the first case, the screening process excludes "the worst entrepreneurs" from receiving any financing. Assuming that the transaction is completed, it depends not only on the quality of the project, but also on the entrepreneurs' personality and their ability to anticipate demand – variables that are difficult to enter into any database, and yet raise a problem of endogeneity. Venture capitalist finances a project because the entrepreneur has chosen wisely regarding the field and year of creation of the start-up (market timing skill) [GOM 08][3].

Reverse causality means that expectations of future events can influence the behavior of agents. In particular, Da Rin *et al.* [RIN 11] point out that a quality project can quickly lead to an initial public offering (IPO) and motivate venture capital investment. Such investments hold convertible preference shares, while entrepreneurs hold ordinary shares. In the case of an IPO, the preference shares are converted into ordinary shares, which allows the funder to retain an interest in a successful company. The opposite causality can also play a role: the investment made can strengthen the quality of the entrepreneurial project and encourage an initial public offering at an early stage in the lifespan of the start-up.

If this now results in moving forward in terms of performance, (see section 1.3), a strong growth in the revenue of the start-ups that are financed can be attributed to selecting the right projects, or to the financial and non-financial support provided to the portfolio companies (treatment effect) [BER 11, VIC 11]. It should also be remembered that the selection effect is

3 Heckman-style models reduce problems of selection on variables that cannot be observed.

sometimes difficult to interpret when the reputation effects of the most experienced venture capitalists attract higher quality projects.

1.2.2. *The arbitrations made: the entrepreneurial risk*

Arbitrations are not always financially explicit. If we analyze the behavior of the three stakeholders shown in Figure 1.1 (investors, entrepreneur-founders, and venture capitalists), we find that the financial assessment mainly concerns investors, entrepreneurs, and venture capitalists who implement only small amounts of financial capital, but a great deal of human capital [HAL 07]. The authors consider that the "venture company" represents an option that can be expressed as follows: provide financial capital or allow the company disappear due to a lack of liquidity.

The data used by these authors are taken from the United States, over the period between 1987–2003. The database lists 54,699 rounds of financing and 13,049 exits for 19,434 companies. The 13,049 exits can be subdivided into 1,936 IPOs, 4,802 acquisitions, and 6,281 exits at zero value. The investors earn higher than market returns (payments are made 32 months after the investment). The 3% annual amount represents the return that exceeds the risk-adjusted cost of capital.

As far as the entrepreneurs are concerned, they are extremely exposed to the specific volatility of the company and the return obtained is that of the human capital they provide. If the exit is done through an IPO, the average value received by contractors is $22 million (in 2006 dollars), but the distribution of the values received is very skewed. It should be noted that 68% of start-ups provide no value, and only 0.2% of them have IPOs valued at $1 billion or more. In this model, entrepreneurs are confronted with the possible trade-off between the probability of obtaining the best result and a return that is much lower, but is guaranteed. Calculating this probability indicates that the expectation of receiving $21 million in earnings generates only $1 million in *effective wealth*. In other words, when a venture capitalist agrees to invest in the company, the entrepreneur would like to sell it for $1 million. These evaluations make it possible to estimate the entrepreneurial risk over the period: the effective gain represents only 4.7% of the gain expected by the entrepreneur. Nevertheless, the entrepreneur accepts this risk because the venture capital firm uses the value of the best exits, in order for the entrepreneur-founders to accomplish their tasks.

Venture capitalists receive two forms of compensation: 3% annual of the amount invested, plus 20% to 25% of the earnings at the time of the exit. Over the period under review, their average remuneration was $8.3 million [HAL 07].

There are several important conclusions to be drawn. First, venture capitalists are unable to control the efforts of entrepreneurs to commercialize their projects. This justifies the analysis in terms of moral hazards and explains the use of the exit value to motivate entrepreneurs, who face a "non-diversifiable entrepreneurial risk" [HAL 10b]. Second, venture capitalists establish a mechanism for self-selection among entrepreneurs, which explains why only those who are highly motivated and confident in the quality of their project apply for funding, knowing that the amount they receive in compensation may be negative. Finally, the workings of this mechanism also explain why entrepreneurs receive salaries lower than market rates during the early stages of the financing.

More recent data have made it possible to give updated results [HAL 10b]. These involve 22,004 start-ups financed over the period of 1987–2008. Included in this total are 2015 IPOs, 5,625 acquisitions, 3,352 exits at zero value, 4,220 exits over five years at zero value and 6,792 start-ups that have not yet attained their exit value. The estimates are based on a sample of companies that have been listed on the stock exchange. Just under 25% of entrepreneurs receive the full exit value ($91 million) and one-sixth of them receive less than 20% of this value. Those who own 20% of the shares receive less than one-fifth of $48 million, or about $9.2 million. All these calculations are made at constant 2006 dollars. In the sample selected by Hall and Woodward, if we exclude the 6,792 start-ups that have not yet completed their exit process, we see that the exits at zero value make up 49.8% (7,572/15,212) of the companies, or nearly half.

In total, the probability of earning millions of dollars is low, and "the economic advantage of entrepreneurship over an alternative career is not significant" [HAL 10b, p. 1177]. The gap between salaried employment and entrepreneurial employment is even greater, since the latter comes with few assets in the beginning. It is this economic agent who bears much of the burden of the risk specific to the company. By using a standard risk aversion coefficient of two, the authors observe that the advantage of entrepreneurial opportunity is generally low or negative. In other words, the higher the wages in salaried employment (in the case of highly qualified senior

executives in large companies), the more the advantage of entrepreneurial opportunity is lost, except in the case of entrepreneurs with significant assets.

In fact, significant fundraising events occurred in France in 2016 (investment in start-ups increased by 24% to €2.25 billion) despite a below-average performance in Europe (see Box 1.2). Worldwide, investments have trended downward. Several elements played a role in this trend. The difficulties in exiting investments did not allow for capital gains to be generated that could be reinvested in other projects:

> "At the same time, many start-ups have been negatively affected by the excessively high evaluations they obtained in 2014 or 2015. These young companies, most often unprofitable ones, had to accept very strict clauses that guaranteed that their investors to recover their investment share, or even double or triple it, in the event of a sale or IPO at a discount. In this context, the priority for start-ups then became to control costs. This resulted in cutbacks in areas ranging from benefits in kind to social plans" [CAS 17, p. 3].

Moreover, even if entrepreneurship is on the rise, particularly in Europe and France (when costs increase faster than earnings and taxes become heavier, new forms of activity replace a salaried work relationship [GUI 16a]), the skills of entrepreneurs should not be underestimated (see Box 1.3). This explains the high failure rate of start-ups, whose survival rate remains low. In a US study of data from 10 start-up accelerators, it appears that out of every 100 start-ups in ICT, 92 fail:

> "In the American entrepreneurial world, more than 25% of start-ups end up in liquidation, and the percentage of those that do not repay their full investment share is much higher still; in short, a few brilliant successes compensate for a large majority of failures" [EKE 16, p. 8].

In France, estimates place failure rates between 60 and 75%. On the other hand, it's worth noting that entrepreneurial activities are generating increasing returns. A successful exit provides significant gains and/or assets, which makes entrepreneurship more attractive than paid employment and "reduces the specific risk burden of a second start-up" [HAL 10b, p. 1184].

According to the *Association française des investisseurs pour la croissance* (AFIC), the average net internal rate of return (IRR) on venture capital over 10 years was -0.2% at the end of 2013, with the average of the top 25% at 11.8%. In Europe, the average net IRR was 1.68% in the same year, with the top 25% obtaining 15.5%. This difference in performance may also contribute to the low level of interest of foreign private capital in French venture capital. However, further studies should be carried out, given the fact that a 2015 report by the *fonds communs de placement dans l'innovation* (FCPI) and *fonds d'investissement de proximité* (FIP) shows an average net IRR of the sampled tax funds of -5.1% for 2014, well below the AFIC average, which would drive the average down. It would be useful to establish the net performance of French venture capital funds subscribed by institutional investors, without including tax funds such as FCPI/FIP, so that it can be assessed in comparison with other European funds. These low profitability figures in themselves suggest that there is no significant shortage of capital dedicated to start-ups in France.

Box 1.2. *Performances in France are below the European average (source: [EKE 16, p. 4])*

"It thus became obvious that these flexible, quick-moving 'start-ups', adept at new ways of thinking, would create jobs and bring down established companies – perhaps we should call them 'end-ups' – ... Why does it feel so good to sing the praises of start-ups while on the other hand signing death warrants for large companies? Because start-ups position themselves as a winning combination between three different areas: they are instilled with the creative drive of the liberal economy, they exalt the values of dynamism and entrepreneurial intensity, and they promote themselves based on the belief that 'small is beautiful'...

"However, not everyone is cut out to be an entrepreneur. An army of pseudo-Start-ups has sprung up, made up of small, twisted and malignant companies that 'hack' large companies. But how many hares are really racing against the tortoises [large companies, slow by definition], how many start-ups are offering true alternative and cheaper models? Very few. Blablacar perhaps, or Criteo, to give the most recent example. In reality, most start-ups do not compete with large corporations, they simply work their way into their own micro-markets... But, when all is said and done, how many jobs do they really create?

"The point here is not to discourage entrepreneurs, but to dim the spotlight that has been shined on them a bit so they don't get blinded".

Box 1.3. *Start-ups and large companies (source: [DUE 17, p. 7])*

1.2.3. *The change of the relationships over time*

Venture capital investment does not have the same effects at different stages in the company's life. The relationship of mutual dependence between venture capitalists and entrepreneurs changes. The former encourages the latter to take risks at the early stages of the company's life "as a means of increasing the market value of the company being funded" and discourages it from adopting risky behavior in later stages, in order to preserve the value of the innovations that have been achieved [PAR 16, p. 2]. In other words, the valuation of early stage companies depends on the newness of the innovation, while their valuation at the end of the period depends on the commercial viability of the innovations achieved.

As these authors find, it can be assumed that the initial period is one of high potential yields and a high probability of failure. However, both of these players have reasons to keep going. Entrepreneurs who benefit from equity contributions are often very confident and motivated. Venture capitalists, on the other hand, are able to withstand potential losses when the start-up begins, due to the low level of the sunk costs of the investments, particularly through adopting step-by-step financing and reducing risks through a moderate diversification of their portfolio.

In later stages, the company begins to develop, the product is marketed, and value is extracted, either from the existence of a tangible product or from intellectual property revenues. At this stage, venture capitalists are much more averse to risks. The failure of an R&D program is a much greater burden and adjustment costs have to be paid due to increased competition, partly as a result of the inevitable dissemination of knowledge. At the same time, R&D is an asset that is difficult to redeploy, and whose sunk costs increase with cumulative capital expenditures and are "higher than those of ordinary investments" [HAL 10a, p. 20].

Park and Tzabbar also find that that placing too much focus on innovation may come at the expense of other activities that bring value to the start-up, such as improving sales and marketing along a clearly defined technological line and, it would appear one that is recognized by the market. The aversion to capital risk increases as the start-up develops; the investment they make reinforces the creation of novelty in the "early stages" and slows it down later, especially when compared to companies that are not backed by

venture capital. In fact, in the context of mutual dependence, the attitudes of venture capitalists are mediated by the nature of the power of the company's management.

The management of the company (personal/collective) exercises two forms of power: structural power and technical power. Structural power is entrusted to the organizational structure and hierarchical authority: the stronger this power is[4], the more likely it is to reinforce positive attitudes towards innovation and risk-taking at the beginning of the lifespan of the start-up. The confidence managers have in their own judgments, the possibility to earn gains, and the reduction of potential threats, lead venture capitalists to believe that the knowledge held by the people bringing the project forward represents a highly feasible productive and commercial opportunity. Conversely, interests are opposed in the "late stage". For venture capitalists, the priority is no longer to strengthen innovation, but to promote sales and manage intellectual property. At the same time, they are encouraged to achieve their gains in order to redeploy their financing to other start-ups. The outlook of the entrepreneurs extends over the long term, confident that future gains will be greater than current gains. They can influence the more short-term prospects of venture capitalists and reduce the amount of spending on innovation.

The technical expertise of the entrepreneur-manager[5] is complementary to the knowledge provided by venture capitalists. The latter are influenced by entrepreneurs, the knowledge they hold tends to reduce the information imbalances that are an obstacle to their decision-making process. The entrepreneurs' technical expertise provides a balanced approach to innovation within an existing technological trajectory. Based on a realistic outlook, they weigh the opportunities and costs associated with taking risks and moderate the potential enthusiasm of venture capitalists in the early stages of the process. Conversely, they use their implicit knowledge to persuade venture capitalists of the importance of the calculated risks and, in the late stage, moderates their inclination towards commercialization and licensing at the expense of innovation.

4 Structural power is measured by the centralization of decision-making processes at the top of the organization.

5 Technical expertise is measured by the number of patents whose inventors are also directors of the start-up, and the impact they have.

The sample selected by Park and Tzabbar consists of 482 independent biotechnology start-ups, excluding subsidiaries and joint ventures, over a period of 30 years (1973–2003). The empirical results confirm their assumptions: venture capital financing has a positive effect on innovation in the early stages, while having the opposite effect on companies over 12 years old. In fact, the behavior of the venture capitalists changes as the company ages:

– the structural power of entrepreneur-managers reinforces the positive impact of venture capital on innovation and the level of novelty in the early stages, and reduces its negative effect in the late stage;

– technical expertise has the effect of reducing the enthusiasm of venture capitalists for innovation and moderating the negative impact of this type of financing on innovation during the late stage, by avoiding an excessive focus on marketing and commercialization.

In this model, the mutual dependence within a generally positive effect on innovation has the effect of smoothing out the innovation behavior of start-ups, avoiding both periods of uncontrolled growth and periods of abrupt contraction. Mutual dependence makes it possible to grasp more complex relationships between these two players, by rebalancing the power of venture capital with that exercised by company management, whether it has an organizational and formal origin or is produced by instrumental knowledge. In fact, this model forms part of an interplay between instrumental and interpretative knowledge. Structural power is more oriented towards the project of the start-up, it reinforces its quality by giving it meaning and legitimacy. Technical expertise is more focused on the element of time, smoothing out the jerkiness that may be caused by the venture capital financing and ensuring the survival of start-ups over the longer term, whose value tends to erode as they grow older and have to balance innovation and the protection of intellectual property.

1.2.4. *Behaviors of refusal*

First, let's consider the case of venture capitalists. Intellectual property is a source of income. Often, companies – especially larger ones – combine operations marketing a product with licensing operations, the sale of patents, or engineering services. Producers of knowledge are at the same time industrial producers, and specialization is said to be relative. Smaller

companies, especially start-ups, can specialize entirely in the production and sale of knowledge: this is known as absolute specialization [GUI 04].

In recent years, the development of commercial exchanges of knowledge has seen the emergence of companies that have specialized in the purchase/sale of knowledge and in challenging patents filed by other companies. The threat of a long and costly trial often leads small companies to compromise to avoid the potentially high costs of preparing a case and legal fees. Indeed, entities that challenge patents are not engaged in R&D or product manufacturing activities:

> "As a result, not only can they not be taken to court for infringing third parties' patents, but, in relation to the opposing party, they also pay charges that are generally less high due to legal proceedings that, for reasons of technological expertise, may involve exhaustive discovery requests." [LAL 17, p. 103].

It is tempting to see venture capitalists as having been caught up in this whirlwind of intellectual asset commodification [FEL 14]. In particular, venture capitalists would be attracted by the possibility of monetizing the patents of the start-up they are considering financing, in the case that the entrepreneurial project fails. This financial opportunity could motivate some venture capitalists to make the investment. In fact, studies done in the field based on surveys and interviews indicate that the vast majority of them do not consider the potential revenues that could come from the sale of patents to "patent trolls", whose main activity (if not their only activity) is licensing and patent litigation.

However, legal challenges can have the effect of damaging the image of a company that may potentially receive funding. In addition, they represent specific costs for the start-up, and management and engineers are mobilized to defend their intellectual property. "When companies incur expenses to defend their position, they do not develop, and when companies spend time and effort responding to these challenges, they do not invent" [FEL 14, p. 11]. This process may convince venture capitalists not to invest in a company whose patents are in dispute.

For the entrepreneurs, is it conceivable to refuse a venture capital transaction? These entrepreneurs' attitudes depend on the quality of the projects submitted, the way they make their judgements, and how confident

they are in their own judgments. In the literature, two attitudes have been identified to justify attitudes favoring refusal. On the one hand, the difficulty of appropriating the knowledge produced may lead entrepreneurs to seek other forms of external financing [CRO 16]. On the other hand, some venture capitalists practice active and restrictive monitoring, and "this managerial activism can be considered as an excessive intrusion into the management of their company" [CRO 16, p. 6]. Beyond these aspects, three socio-economic factors seem to explain attitudes of refusal: human capital, the size of the company, and the type of ownership.

The human capital of entrepreneurs represents the first potential area for friction. Will the technical knowledge and managerial skills they possess encourage them to conclude the transaction or encourage them to be cautious? This perspective is a clear departure from the idea of a complementary cognitive relationship between the technological knowledge held by entrepreneurs, and the strategic and entrepreneurial skills held by venture capitalists. The second element is the size of the firm. Is there a relationship between the size of the firm and the likelihood that they would refuse such financing? The authors hypothesize that the larger the size of the firm, the more likely it is that the firm would refuse this funding. The third element concerns the ownership structure and type of control. If family capital is used extensively, this can be an obstacle to the participation of venture capital.

The sample studied is extracted from the RITA database on Italian firms for the years 2002, 2004, 2007, and 2009. Financial and accounting data are available for the period from 1994 to 2009. The companies interviewed were asked whether they had received an offer to receive venture capital financing during their lifespan, whether they had refused and, if so, what was the basis for their refusal. The search of the database indicates that 120 companies received an offer to receive venture capital over the first years of their existence, 40 of them refused, and 80 accepted. The refusals were broken down into three categories: the lack of financial needs, the need to maintain ownership and control of the company, and the dissatisfaction with the valuation price and the terms of the contract.

Next, the authors obtained information on 103 of the 120 companies in the survey. Their preferred indicator is sales growth, and their estimates are intended to answer the question of whether the refusal to receive venture capital funds has influenced the route the company took to achieve growth.

There are several elements that would appear significant in the decision to refuse this funding, and the consequences of that decision:

– the type of ownership strongly motivates the decision to refuse. In this context, family ownership, which is highly developed in Italy (and in some other European countries), is an obstacle to the expansion of the venture capital industry, including for companies that have reached a certain size;

– the second reason concerns the characteristics of the human capital of the founding entrepreneurs. Those who have received advanced technical education and have managerial experience are often motivated to turn down this funding. By contrast, those with extensive economic training are better able to assess the benefits of venture capital financing and the costs and risks it involves;

– the companies that declined the offer for financing obtained a much slower growth rate than those that accepted it. The fear of potentially losing control of the company limits the development of the company and "entrepreneurs have a stronger attachment to the private benefits of control (including non-monetary benefits, such as a sentimental attachment to the company) than to growth rates that would be higher, but would be shared with a venture capital firm" [CRO 16, p. 9]. Opting for a growth rate that is less than optimal, but allows the entrepreneur greater control is a characteristic feature of the sample under study, which cannot be extended to other societal contexts without careful consideration.

All these elements represent obstacles to expanding this method of financing. Perhaps singling out high-tech companies from within this sample would have made for more interesting results, but this proved impossible. In any case, these results complement those obtained in the previous section to a certain extent. The power and technical experience of the entrepreneurs works not only to moderate the tendency of venture capitalists toward increased or decreased innovation, but also to reject their intrusion in order to promote a long-term vision of the company that is developing less rapidly, but that they fully assume.

1.2.5. *Risk aversion of venture capitalists*

There are several different mechanisms that can be implemented to reduce risk aversion among venture capitalists. The most frequently referenced are investment and syndication.

1.2.5.1. *Funding in stages*

In a previous paper [GUI 08], we highlighted that this method of financing is a hybrid, based on the relationship established between the venture capitalists and the entrepreneurs. The relationship between investor and innovator is based on a sufficiently flexible contractual arrangement that allows options for investment decisions to be changed and decision-making powers to be shifted. There are situations in which venture capitalists have the right to cut off funds to a project when they believe it has performed poorly. The control of the venture capitalist over the investment decision establishes a situation characterized by an investment organized in stages, in the form of a sequence of short-term investments. "Rounds" of financing are an instrument used to limit the risk assumed by venture capital, but they do so by creating potential conflicts between the entrepreneurs, initial investors ("insiders"), and potential investors ("outsiders"). On the other hand, step-by-step financing expresses the negotiating power of venture capitalists. There are other situations in which the level of performance achieved is justification for control to be held by the innovators/entrepreneurs. In this case, venture capital acts more like a shareholder, who is far from being passive, given the instruments at its disposal (convertible preference shares, etc.).

From an analytical standpoint, step-by-step financing is an incomplete contract [RIN 11, p. 40] and an initial contract could very well specify the introduction of more sophisticated clauses when the subsequent steps are reached. Empirically, the evaluation of investments made in stages only measures *ex-post* achievements, whose relationship to the company's performance is not clear. For example, shorter intervals between each stage could very well result from a deliberate intention of the venture capital firm, or they may be the result of good performance by a company that achieves its objectives faster than expected [RIN 11, p. 41].

The empirical work on this point can be approached in different ways. We have chosen the analysis proposed by Colombo *et al.* [COL 14], in which investors either finance entrepreneurial start-ups that have adopted open source software (OSS) by opening their business model, or start-ups that develop and sell proprietary software developed from internal R&D. The question is whether start-ups in the first category, which access external

knowledge through collaborations with software developers[6], benefit from a larger number of funding stages. The sample surveyed includes 524 entrepreneurial start-ups listed in the SDC Platinum database. Of these, 124 have adopted an OSS business model, while the remaining 390 used a proprietary model. The results indicate that high quality venture capitalists are associated with the financing of start-ups of the first type, while the second type benefit from a greater number of financing stages. The quality of venture capitalists is identified by their past experience (the number of contracts already completed), their specific industry experience, the number of financing rounds in start-ups exited through an IPO, the total amount already invested in entrepreneurial start-ups, and the position they occupy in syndication networks. Financing in stages reduces agency costs but also, and most importantly, it is better adapted to the higher risk and increased complexity of an investment in start-ups with an open business model. Indeed, an open-source system increases the difficulties of coordinating external sources of knowledge (e.g. those generated through collaborations) and modifies the mechanisms for creating value, which is often reduced due to the presence of unexpected costs (e.g. development costs).

Overall, financing in stages allows venture capitalists to monitor the company's progress while still allowing them the possibility to leave the project as a way to limit losses. For Gompers and Lerner, financing in stages has two advantages: "[it] keeps the owner/manager on a tight leash, and it reduces the potential losses inherent in making a wrong decision" [GOM 98, p. 140]. From this point of view, it helps to at least partially solve, the problems of information, reduce the ambiguity of the project, and allows the various rounds of financing to be adapted to the company's real needs.

1.2.5.2. *Syndication*

Syndication can be analyzed in different ways. It requires the venture capital firm that initiated the project to show interest and profit in order to persuade another venture capitalist to commit to the same project. It is generally observed that experienced and recognized venture capital funds have a preference to form syndication agreements with each other, particularly in the early stages. More recently, it has been shown that

6 These companies operate in the software business and participate in the free circulation of the basic version of open source software, but they also sell a premium version of the software that incorporates the technological advances they have made.

syndication agreements are often concluded with privileged partners from venture capital communities, which are often complex and different in size and influence, but homogeneous in the way they take action during specific stages.

In fact, the interpretation in terms of the knowledge held by the players involved leads to the conclusion that investors and networks built through syndication represent an important form of social capital that is useful to the companies receiving the financing [TER 16]. By syndicating, venture capitalists obtain information on various fields, which they are responsible for interpreting and applying to the company's specific project. In other words, the networks that are formed offer informational advantages to support investment decisions. More specifically, the social capital that investors build through their previous syndication experience is an important asset for both venture capitalists and the company receiving the financing. The resources created through these networks provide two types of benefits [TER 16, p. 396]:

– the value of the social capital for portfolio companies depends on their access to a variety of information on the basis of which venture capitalists carry out their advising activities. These groups must have both in-depth expertise in the sector and knowledge from the various fields in which they interact. A "heterogeneous syndication" creates links through which a domain of knowledge can be useful in another context by offering a new solution or adding a new perspective to the project being analyzed;

– social capital strengthens the ability to interpret how this broad range of information applies to the company's specific field. In practice, there may be "interpretative barriers" to understanding the information and assessing its value, which may limit the ability to interpret the various different types of information to be applied to the current project. It all depends on the configuration of the networks that have been built.

The most critical aspect is the level of redundancy of the information that the players involved access from the network. The direct links that form around the main players involved are characterized by being seen to a certain extent as "closed" (the players are directly connected to each other, the information is redundant), or as "open" (the other players are not connected, there are "structural holes", to use Burt's expression, the information is said not to be redundant). As these authors have found, it is recognized that redundant information reduces the likelihood that anything will be

misrepresented, while non-redundant information flows in open networks allow players who come into contact with other previously unconnected ones to access rich, diversified, and commercially useful information for their own benefit. In this context, networks of syndication must find a balance between the advantage of having redundant information and the advantages of the diversity of non-redundant information. Closed networks may be limited by the lack of information that is not redundant, where venture capitalists have difficulty challenging the representations acquired and tested within groups in which most participants have already co-invested in the past. In open networks, only a few venture capitalists have previously made syndicated investments.

In making their analysis, the authors take into account both the structure of the syndication network (open/closed) and the properties of the knowledge held by investors (diverse/specialized). The knowledge is similar when the players have previously worked on the same knowledge fields, and diverse when they specialize in different areas. Thus, by including the properties of this knowledge, it is possible to determine how these configurations can facilitate access to information that is both diverse and easy to interpret. In this sense, there are two types of networks that have emerged: closed and diversified networks, and open and specialized networks.

Closed and diversified networks have the advantage of greater diversity, which is combined with information that is easy to interpret, produced by a closed network. In this way, venture capitalists can gain access to best practices, and identify current trends and developments in the various sectors. Some players have co-invested in the past, but in different sectors, and this gives a wider range of alternatives. The interpretation of diverse information is possible because the connections that have been firmly established between players require them to use more time and effort. In addition, the connections between two players and third parties help to build trust in their relationships. A triangulation process takes place, making it easier to make interpretations through interactions that form a distributed cognitive process [TER 16, p. 400]. This approach encourages exchanges and analysis of the business models of different companies.

Open and specialized networks among venture capitalists are only "closed" to a very limited extent. Focusing on the same knowledge areas, these are rife with "structural holes", that is areas where the information is

non-redundant. Partners in the syndication have little previous co-investment experience but strong incentives to share information, and the similarity of knowledge increases their trust. The advantage of diversity is obtained by comparing different geographical contexts, which creates non-redundant information. As for requirement of specialization, this is related to the fact that the information everyone uses comes from a familiar field. Receivers are given an "interpretive scheme" [TER 16, p. 404] to assess the significance of the information obtained regarding the information they already have. In this context, venture capitalists do not have relationships with third parties, as was the case in previous networks. Syndicated networks of this type are able to provide high quality advice to funded companies.

The empirical estimates obtained from this conceptual map assess the success of a funded start-up when it obtains a second round of funding. The scope of application is made up of information technologies and the Internet industry (hardware, network hosting, searches, various applications, etc.), which encompasses 11 established sectors and 21 new emerging sectors, or 10,266 companies receiving financing, spread out over 34,146 rounds of financing, raised from 5,032 venture capital funds.

The most significant results confirm that closed/diversified and open/specialized syndicated networks are more effective. More specifically, new companies in established sectors are more likely to succeed (obtain a second round of funding) if their networks can be categorized as closed/diversified. By contrast, those operating in emerging sectors are more successful if they are backed by open/specialized networks. In addition, some estimates indicate that the informational benefits associated with social capital can be maximized if "the redundancy and non-redundancy of information coexist" [TER 16, p. 420]. Indeed, redundancy is effective in making interpreting information easier, and non-redundancy protects diversity through the triangulation with third parties. When these players are not similar in the knowledge they have within a network, the connections they share with third parties act as an important mechanism for interpreting information. In other words, it has been found that the effects produced by the structure of a network are not sufficient to explain the success or failure of the syndication of venture capital firms. It is also necessary to take into account the nature of both the instrumental and interpretative knowledge that venture capitalists possess in closed/diversified and open/specialized configurations. It can also be seen that diverse information comes either from the position of venture capitalists in networks with many "structural

holes", or from their position in networks composed of a varied mixture of actors (with dissimilar knowledge).

The results obtained confirm the relevance of the hypotheses that were proposed. In a way, they complement those obtained by Gompers *et al.* [GOM 08], who note that the influence of experienced venture capitalists is not always decisive. In emerging sectors in particular, their influence becomes decisive when they are able to attract critical resources by building syndication networks that allow them to interpret information and apply it to the projects they analyze. In this sense, syndication, as analyzed in terms of knowledge and network structure, makes it possible to select the best projects and shorten the time between the different rounds of financing. As a result, the effectiveness of financing in stages becomes a characteristic of syndication when it brings together knowledge and skills in the most appropriate configurations.

1.3. The contribution of venture capital to the performance of innovative companies

It is worth recalling the methodological difficulties that were already noted at the beginning of this chapter. A distinction must be made between the pairing of venture capitalists and entrepreneurs and the involvement of the former in the companies they finance. This pairing is considered a selection effect: the most experienced venture capitalists are able to select the most talented entrepreneurs. The effect of implication is an effect of treatment: the effects considered are the incremental effects of the actions of venture capitalists, that is the processes by which they add value to the companies in their portfolio. These two effects influence the performance of companies. Also to be considered are the "forward looking" selection effects, that is the fact that certain entrepreneurs seek out certain venture capitalists because of the services of added value they are likely to provide [RIN 11, p. 37]. More generally, the question of reverse causality also arises in the case of private equity. In this context, it is necessary to assess the approaches that seek to isolate the selection effects from the treatment effects [BER 11]. Having made these clarifications, two areas of performance will be analyzed. The first includes innovation, growth, and employment performance. The second involves the survival rate of entrepreneurial firms and the effects of persistence.

1.3.1. *Innovation, growth and employment*

The idea that long-term growth is closely related to a country's capacity for innovation is commonly accepted in the literature [AGH 16]. Many studies have concluded that the deficit of innovation in Europe is due to its limited ability to transform scientific knowledge into marketable products and services. Indeed, a large number of these potential innovations fall into what has become known as the "Valley of Death". It is possible to link the stages of technological innovation with the forms of financing that support them. The chain from R&D to a market launch does not function unambiguously, disruptions may occur, which of course may result from the technological obstacles encountered, but also because of the existence of "financing gaps" that hinder the transition from concepts to the creation of a prototype and demonstrations. The venture capital industry can potentially play a significant role in making it past these milestones, just as access to incubators facilitates the transition from research to product development.

First, the impact of venture capital on performance will be analyzed by providing a few macroeconomic benchmarks. We will then continue this reflection at the level of individual sectors, then at the microeconomic level by highlighting its influence on companies' innovation strategies.

To assess the effects of venture capital on innovation (estimated using patents), we use the work of Popov and Rosenboom [POP 11], which covers 21 European countries over the period 1991–2005. The authors estimate the doubling of venture capital investment led to an increase of about 2.5% in new patents[7]. In fact, the results vary widely between European countries. With the exception of countries with low venture capital investment, there is a significant effect on the propensity to patent since every dollar of venture capital investment is equal to three times that of every dollar invested in

7 Other research does not confirm this result. Lahr and Mina [LAH 16] find, from and examination of a sample of 940 American and British start-ups (2004–2005), that venture capital investments do not lead to an increase in new patents. Once the investment is made, venture capitalists do not seek to increase the knowledge base of invested firms, but develop an operating strategy by reducing the time it takes to bring inventions to a market. In this way, contribution of equity capital can allow more innovations and fewer patents to coexist. The progression from idea to sale on the market therefore has a negative effect on the decision to obtain a patent.

traditional R&D [POP 11, p. 20]. By considering venture capital spending within different national contexts, the results suggest that venture capital is more effective in creating innovation in countries where the barriers to entering the market are lower. Similarly, the effect of venture capital is more significant on the number of patents filed in countries where the labor market is more flexible and less highly regulated. Finally, it can be observed that the effect of venture capital on innovation is stronger in countries with a higher level of human capital training. In total, venture capital investment has accounted for about 10.2% of innovation flows in 15 European countries since the early 1990s.

The relationship between venture capital and innovation has been analyzed at the level of individual sectors by Bertoni and Tykvovà [BER 12]. These authors examine the type of investor (public versus private) and assess the influence exerted by the structure of the transaction (syndication versus non-syndication). To perform this analysis, they used the VICO database to construct a sample set of 865 European companies (159 of which were venture capital funded) operating in biotechnology (673) and pharmaceuticals (192). The companies backed by venture capital received their first round of financing between 1994 and 2004, and were significantly younger than firms that had not received this type of financing[8] (8.86 years for the first group, and 10.94 years for the second). The innovation output was measured through the number of patents obtained.

This econometric modeling led to six significant results:

First, venture capital investment has a positive relationship with the patents held one to five years after the investment was made. This increase is much higher than for the companies in the control group.

Second, syndication relationships led by private venture capitalists show a significant increase in the number of patents held by the companies financed compared to those of the control group from t +2 to t +5.

Third, syndication increases the innovation output to a much greater extent than autonomous transactions, either by public (government) or private venture capitalists.

8 These firms form the control group.

Fourth, the analysis of the transaction structures was refined to take into account the players involved in the syndication. The model considered separates syndicated transactions into two groups: heterogeneous (private and public venture capital) and homogeneous (private or public venture capital). The coefficient of heterogeneous syndication is very significant, and its influence is very strong, while the coefficient of homogeneous syndication is never significant.

Fifth, the model estimates the influence exerted by the syndication manager. When a heterogeneous syndication is organized, the innovation output increases more significantly through the action of private venture capital than through that of government-based venture capital.

Finally, a heterogeneous syndication led by private venture capitalists is the most effective form out of all transaction structures[9] for promoting innovation in biotechnology and pharmaceuticals.

This lends credence to idea that venture capital does not have the same effectiveness when applied to different types of investors or transaction structures. Instead of pitting private and public venture capital firms against each other, the authors show that:

> "The mode of investment used by governmental venture capital investors is also a key variable in the design in effective innovation policies. Specifically, to support innovation, governmental venture capital investors should not invest alone but should syndicate with private partners. In addition, private venture capital investors should be allowed by their governmental partners to lead the syndicate" [BER 12, p. 17].

The relationship between venture capital and innovation can also be assessed qualitatively by analyzing the influence on innovation strategy. Four strategies have been distinguished [RIN 13]: "No-Make-No-Buy", "Buy-only", "Make-only", "Make-and-Buy". The latter strategy represents the empirical dimension of the concept of absorptive capacity [COH 90], which the authors extend by introducing the idea of transformation [ZAH 02] produced through the recombination of internal and external knowledge.

9 Only private, only public, homogeneous private syndication, homogeneous government syndication, heterogeneous syndication led by public venture capital.

More precisely, this strategy involves the construction of the capacity for absorption[10]. The hypothesis tested is that there is a link between venture capital and the Make-and-Buy strategy, which involves companies whose innovations can quickly be put on the market. The sample tested consists of 10,000 Dutch companies, 161 of which are backed by venture capital (data from the CIS, ThomsonOne and PATSTAT).

One-third of companies adopt this strategy, and companies backed by venture capital achieve a higher percentage of sales from innovation and are committed to building capacity for absorption. By testing a smaller sample of firms before and after receiving venture capital financing, it appears that companies change their strategies after obtaining this type of financing (the probability increases by 17%). In this context, venture capitalists play an essential role in guiding companies towards the acquisition of external knowledge (R&D conducted under the contract, the purchasing of licences). In particular, those operating in high-tech industries (chemicals, pharmaceuticals, electronics, IT services, and R&D services) are more mature in terms of their technological development than those receiving only public funds, the latter of which are less subject to environmental pressures and the requirements to rapidly market the product in order to make it easier to list the company on the stock market or sell it after a few years.

The empirical estimates generally indicate that venture capital has a positive effect on the growth of companies. There are four arguments for this [GRI 14]. First, venture capitalists are often better able than other players in the capital market to select entrepreneurial companies with a high potential for growth. Second, venture capitalists bring added value to companies that are financed through managerial skills, behavioral control, and the monitoring of results. Third, receiving venture capital funding is seen by third parties as an indicator of a portfolio of high quality companies. Without this indicator, companies have difficulty accessing additional external financial resources and other abilities that often prove critical. Finally, companies that receive venture capital funding benefit from the networks of contacts they obtain through venture capitalists, both suppliers and institutional investors who form their entrepreneurial support network.

10 “Finally, Make-and-Buy is the strategy that combines the two innovation operations, internal R&D and external knowledge acquisition, and entails the creation of a capacity for absorption” [RIN 13, p. 13].

Based on the VICO database (made up of 7 countries, and 2 groups of companies: those that received venture capital funding, and others), Grilli and Martinu [GRI 14] monitored a cohort of 534 companies that received their first round of funding between 1994 and 2004. The research question was: does the growth rate of funded companies increase steadily after the first phase of funding? To refine their analysis, the authors distinguish between independent venture capital funds (private, IVC) that do not receive public funding, and government venture capital funds (GVC) managed by a "General Partner acting in representation of government authorities" [GRI 14, p. 1524]. The mission of the GVCs is to use public financial resources to provide the development and growth of economic projects with high impact.

In the general model tested by the authors, they find a positive and significant impact on sales growth, but the effect of venture capital on employment is not significant. When venture capital funds are differentiated between private and public ones, IVCs have positive effects on the growth of sales, whereas with GVCs, this effect is not significant. This observation leads the authors to question the ability of public entities to stimulate the growth of companies, particularly high-tech companies, through taking action directly on the finance market. The relative ineffectiveness of these entities is not only a product of the low availability of financial resources, but also of their lack of ability in carrying out value adding activities. In addition, the authors estimate the effects on growth when syndication partners are led by a public or private investor. Only one positive and significant effect is obtained on the growth of sales the public investor is not the leader of a syndicate.

In a more recent study [GRI 15], the authors look at the "high-tech" sectors in seven countries (Belgium, Finland, France, Germany, Italy, Spain, United Kingdom), for which they use a longitudinal database (VICO) over the period of 1984–2009. This database contains usable information from 8,391 start-ups in biotechnology, pharmaceuticals, ICT, etc. The originality of the study lies in its more in-depth analysis of the behavior of public players, which are broken down into government (PUVC) and academic (UVC) players. University funds operate through technology transfer offices.

Of the 8,391 start-ups, 761 are backed by venture capital. Private and public funds continue to have a positive overall effect on growth. The study confirms the positive effect of private funds alone, but the effect is more significant if the company is young. As far as public players are concerned,

government funds have a greater impact than university funds, both in terms of the growth in company sales and in employment. On the other hand, there are no effects on so-called mature companies.

The results obtained partly confirm those obtained over a shorter period (1994–2003) and only for Italian companies [BER 11]. The sample consists of 538 companies, 68 of which are backed by venture capital. This confirmation is only partial, since, as mentioned earlier, the venture capital industry is "underdeveloped" in Italy. The investments that are made have a stronger effect in the short term than in the long term, which is to say, much of the positive effect is obtained after the first financing stage. This effect was measured in the following manner: the size of the company (measured by the number of employees) at the end of the year following the first phase increased in comparison with a company that did not obtain such financing. The additional growth that can be attributed to venture capital financing is approximately 40% for employment and sales over the period. The effect on employment is very strong in the short term – the employment rate after the first round is 110% larger than it is without venture capital – and by the second year after the first round of financing, the rate of employment growth decreases. For sales, the effect is 87% when the same time benchmarks are used. By incorporating additional variables into their model, the authors find that the use of venture capital (a treatment effect)[11] makes it possible to professionalize the company's management, and obtain additional financial resources through an IPO. The results confirm Gibrat's law: small companies tend to grow faster than larger companies.

1.3.2. *Survival rates and entrepreneurial persistence*

It is difficult to address the issue of entrepreneurial start-ups without considering it within the environment in which these companies operate. Ecosystems of innovation that support entrepreneurial dynamics can have several configurations, ranging from localized "clusters" to incubators and science parks. According to these authors, the important thing is to consider the interplay of similar and dissimilar knowledge in the creation of new companies.

11 In this study, the selection effects (project quality, future growth prospects, etc.) were neutralized, they play no role in the positive relationship between venture capital investment and the company's growth.

On the one hand, the many different players and the variety of technological combinations within a given location lead to the creation of local knowledge bases. These knowledge bases make it possible for knowledge to be transferred and influence the number of venture capital funds and, in turn, the creation of innovative start-ups. On the other hand, venture capital start-ups benefit from the positioning of venture capitalists within information-rich networks of heterogeneous groups of players, often in a central role. The intersection of these two aspects makes it possible to broaden the role played by venture capitalists: not only do they play a role as discoverers, financiers, providers of advisory and control services, but they also play a "liaison role" in the formation of alliances involving a financed company and in the functioning of this alliance [JOL 16]. In particular, as Williamson considers, they lower transaction costs and provide effective protection against contractual risks (opportunism, knowledge leakage, etc.) in collaborations between firms.

New companies seek out alliances to strengthen their competitive position, but they lack the reputation, experience, contacts, and funding to mitigate the risks associated with forming an alliance, including the risk of finding the right partner. Venture capital firms influence the type of collaboration between start-ups (governance decisions) providing legitimacy for the alliances in two main areas:

– cognitive, due to the complementary nature of the knowledge the participants have;

– socio-political, with reference to the reputation and experience of venture capitalists, and the effectiveness of mechanisms of governance to mitigate contractual risks.

Jolink and Niesten [JOL 16] analyze a sample of 564 venture capital-backed start-ups over the period of 2009–2014. They find that, the start-ups studied are more likely to choose a *joint venture* financed by venture capital as the governance structure for a collaboration, and this effect is all the more pronounced as venture capitalists have become involved in syndication networks.

Outside of contractual protections, alliances accelerate the development of start-ups and allow them easier access to additional financial and non-financial resources. More specifically, they bring innovative start-ups into broad networks of knowledge production and technological development

that are made through the combination of relationships structured around R&D and networks organized around value chains.

However, the ability to attract greater and better resources explains the widening gap between entrepreneurs who have successfully validated their projects and others. Their success partly depends on the experience of venture capitalists. When venture capitalists have greater experience, their financing has a largely positive effect on whether or not an entrepreneur succeeds and becomes a serial entrepreneur [GOM 08]. From the perspective of venture capitalists, the persistence effect can be explained in two ways:

– either through establishing syndication networks configured to meet the needs of established or emerging sectors;

– or through the effects of specialization on a specific phase of the process (such as the early stage). These effects partly overlap with the previous explanation since, in this case, venture capitalists have better information and obtain a competitive advantage through the accumulation of resources that are difficult to imitate.

More broadly, the persistence of entrepreneurs also depends on the information that is available on the past actions of entrepreneurs. In this case, there is a wide range of alternatives available to them. In particular, they have the choice of financing their companies by using their own resources, by using bank loans, or by benefiting from equity contributions. By using their own resources, the attitudes of persistent entrepreneurs are embedded in national contexts characterized by innovative cultural behaviors. In the United States, because the persistence of entrepreneurs is self-sustaining, it tends to create an ecosystem:

> "Successful entrepreneurs often reinvest their earnings in other companies, creating a multiplier effect. They provide not only seed funding, but also entrepreneurial skills. This phenomenon is less prevalent in France, mainly because successful entrepreneurs leave for other countries" [EKE 16, p. 5].

1.4. Conclusion

The developments described above first draw attention to the theoretical approaches used to analyze the relationships between venture capitalists and

entrepreneurs, as well as the underlying logic behind them. The logic of oversight and penalization is at the basis of the contractual model, the logic of cooperation serves as a pillar of the scheme which postulates mutual dependence between the two actors, neither of which is able to exert unilateral and unbalanced influence on the behavior of innovative start-ups.

Venture capital is an expensive form of financing, given its large number of failures and disappointing investments (exits at zero value) and the significant amount of risk taken by entrepreneurs, which cannot be diversified. The existence of these risks explains the real dimensions of this industry. If we consider this in terms of flows, it is estimated that in 2008, only 1% of the 600,000 new companies created in the United States each year were given venture capital financing [BAL 08]. Puri and Zarutskie [PUR 11] estimate that only 0.11% of the new companies created over the period of 1981–2005 were financed by venture capital. This figure increased 0.22% over the period of 1996–2000. Other studies have confirmed these statistics: for example, the *Kaufman Survey* estimated in the early 2000s that 1% of all start-ups receive venture capital financing. Another study even estimates that, over the same period, less than 0.5% of new entrepreneurs were looking for this type of financing for their businesses. In Sweden, between 2002 and 2009, only 1.2% of the 46,000 companies created each year were financed by venture capital [SOD 12]. On the other hand, despite these low percentages, a large proportion of successful IPO start-ups (around 35%) were financed by venture capital.

The other important element that has been determined from this chapter is that the phenomena of serial entrepreneurs and entrepreneurial persistence that characterize venture capital today cannot be analyzed without taking into consideration the national contexts in which ecosystems develop and the activities around which they are organized. The unique conditions of each country make it possible to identify the institutional advantages obtained within different countries [HAN 99]. For new knowledge to be produced and new activities to form, specific institutional arrangements must be made, including deregulated labor markets, a high mobility of skilled labor, substantial rewards for inventors and innovators, and a sufficiently open capital market for venture capital to be freely accessible (see Chapter 3). An institutional architecture of this type multiplies the places where scientific and technological knowledge is created, encourages people to move between firms or between universities and firms, promotes the creation of new firms, and facilitates access to sources of financing. It is here where the core

rationale for venture capital can be found: it promotes companies' strategies for exploration.

Indeed, using a strict definition of property rights, the logic of a market economy stretches throughout the chain, from basic research to the creation of new companies, by putting universities, laboratories, and research centers, products, processes, and organizations in competition with each other and by providing the resources needed to finance radical innovations through the existence of sophisticated financial markets. In this context, entrepreneurial initiative and competition are the most effective mechanisms for achieving such innovations.

By contrast, the institutional architecture of most European countries, particularly Italy, favors less permissive cultural behavior in terms of innovation, resulting in a robust persistence of family capital and a strong attachment to traditional property values. These norms and values work to restrict innovative behavior intended to achieve objectives legitimized by the social system as a whole. The innovation of products and services is part of a slower, more incremental dynamic. Strengthening this dynamic requires new criteria for performance and rules of allocation that change the incentive structure of companies. In other words, making economic part of a process of acculturation, ultimately providing *new cultural resources* centered on a greater individualization of payment, rewards for inventors and innovators, a respected image of the entrepreneur-innovator within society, etc. This can be seen as a form of innovation, both organizational and institutional.

Once created, ecosystems for innovations in financing, gain efficiency by transforming the position system of the various actors. This is the case with *business angels,* who can be considered as informal venture capitalists [LAH 16]. Until recently, they were involved in the early stages of the lifespan of start-ups, which, on average, are 10 months old when they receive such funding – a time when they have not yet turned a profit. In addition, "business angels" invest in companies located within well-defined geographical areas for relatively small amounts, on average less than $1 million in the United States. In recent years, this community has been changing, and new players have emerged, described as "super angels" [EPS 09]. This term refers to serial entrepreneurs and investors who are able to invest large sums in start-ups, either directly or through funding structures and who have built a reputation for talent, qualifications, and integration into effective networks. These super angels work within a much wider

geographic area, sometimes internationally, financing companies that are technologically advanced and have high growth potential. The dynamics of the innovation financing ecosystem are a closed loop: venture capital products, past successes have allowed these super angels to generate enough gains to be able to provide new entrepreneurs with financial resources, as well as entrepreneurial skills.