Are Technology VCs a Distinct Species on the Investment Market?

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Abstract

We address the question: do technology investors differ from traditional investors? Employing a conjoint methodology, we identified 28 technology investors from a sample of 68 European early stage investors. Comparing the two groups of investors we found that: (1) technology investors were not more likely to receive public funding than traditional investors; (2) technology investors had more investment management experience than traditional investors; and (3) technology investors had more consulting experience than traditional investors. Our research has implications for public policy, aimed at resolving the market failure for high tech investments, high tech entrepreneurs looking for VC (venture capital) funding, and VC funds.

Introduction

Approximately 90% of all venture capital (VC) investment in the US and Canada are in technology investments (Cumming, 2007). In contrast, until the early 1990s there was very little venture capital activity in Europe (Bottazzi and Da Rin, 2002). The European venture capital industry that existed at the start of the 1990s was largely non-technology focused and dominated by management buy-outs and other later-stage development activity (Lockett et al., 2002). As the venture capital industry has increased in size, the share of early stage and high tech investments has also increased, moving closer to the position in the US (Da Rin et al., 2006). However, the number of venture capital operating in Europe still remains considerably smaller than in the US (Da Rin et al., 2006). Murray and Lott (1995), and subsequently Lockett et al. (2002), indicate that in the EU, by the year 2000, the venture capital industry has evolved to a robust and highly international, specialist investment community. Both studies however indicate that venture capital firms in the UK have a bias against investment in new technology based firms. This study aims at understanding what the drivers for technology investing are and how technology VCs differ from the more traditional VCs.

In order to distinguish technology investors from traditional investors we examine the investment selection behaviour of early stage VCs. Existing research has identified a number of important criteria on which VC investors base their investment selection decisions. First, the "human capital" of the entrepreneur and the entrepreneurial team, which includes: (a) the ability of management, whether it is management skill, quality of management, characteristics of the management team or the management track record (Shepherd and Zacharakis, 1998); (b) the management skills of the entrepreneur (Tyebjee & Bruno, 1984; MacMillan et al., 1985; 1987); and (c) the heterogeneity of the entrepreneurial team (Keeley and Roure, 1989). Second, the market environment, which includes the characteristics of the market/industry (Hisrich and Jankowitz, 1990), environmental threats to the business (Tyebjee and Bruno, 1984; Meyer et al., 1993), the level of competition (Hutt and Thomas, 1985; Kahn, 1987; Muzyka et al., 1996) and the degree of product differentiation (Tyebjee and Bruno, 1984; Hutt and Thomas, 1985; Kahn, 1987; Hisrich and Jankowitz, 1990). Third, are characteristics of the product / service (Macmillan et al., 1987). Fourth, are financial criteria and exit opportunities (Macmillan et al., 1987).

Interestingly, and to our knowledge, no research has focused on what distinguishes technology investors from traditional investors. We find this position surprising given that many authors (e.g. Lockett et al. (2002), Murray and Lott (1996), Baum and Silverman (2004)) have suggested that technology investing is different from non-tech investing. Therefore, in this paper we address the question: do technology investors differ from traditional investors?

Consistent with Muzyka et al. (1996), we analyze the investment behaviour of VCs by investigating the trade-offs made by them at the moment they take the decision as to further investigate an initial proposal or not, using conjoint methodology. Next to the traditional selection criteria, we however also add high tech related investment criteria. As such, this research starts from the premise that high tech investing is different from non high tech investing. Besides, in contrast to Muzyka et al. (1996), this research takes into account that early stage investing was found to be different from late stage investing (Elango et al., 1995; Sapienza et al., 1994), and focuses on early stage VCs only. According to the European Venture Capital Association, early stage VCs are VCs investing in a seed and start-up stage. In other words, we provide in this paper an update and check for external validity of the Muzyka et al. (1996) study, but take into account new insights from the received literature.

The remainder of the paper unfolds as follows. First, we develop a theoretical framework for explaining differences between technology and traditional investors. Second, we outline our method, data and analytical approach. Third, we present the results of our analyses. Finally, we conclude and provide directions for further research.

Theory and hypotheses

Theory provides a number of indications of how technology VCs could differ from others. Following Knockaert et al. (2010), our theoretical framework takes into account that both fund and investment manager's characteristics may affect selection behavior. In what follows, we build on agency and human capital theory.

Agency theory

VCs are often viewed as the primary source of finance for inventive high-tech start-up companies (Gompers and Lerner, 1999; 2001) and many researchers have pointed out that venture capital is a form of financial intermediation that is particularly well suited to support the creation and growth of early stage high tech companies (Hellmann and Puri, 2000; 2002; Kortum and Lerner, 2000). The received literature (Murray and Lott, 1995; Lockett et al.,

2002) has however shown that VCs may be reluctant to invest in early stage high tech business proposals. This reluctance can be explained from an agency theory perspective. Venture capitalists typically operate in situations where asymmetric information is significant (Amit et al., 1998). There are two major forms of informational asymmetry. The first, sometimes referred to as "hidden information" occurs when one party to a transaction is aware of relevant information that is not known to the other party (Amit et al., 1998). Entrepreneurs, by virtue of being intimately involved in their venture, are likely to possess greater information about it than are VCs who may find it difficult to access this information even with extensive due diligence. The market may subsequently become crowded by low-quality projects because investors find it hard to distinguish between bad-quality and low-quality projects. This phenomenon is called "adverse selection" (Carpenter and Petersen, 2002; Hall, 2002) . The second, often described as "hidden action", may occur when one party to the transaction cannot observe relevant actions taken by the other party (Amit et al., 1998). For instance, the entrepreneur provides unobservable (or at least unverifiable) effort that is important to the entrepreneurial venture's performance (de Bettignies and Brander, 2007). By reducing effort, the entrepreneur reduces the probability of success and hence the efficiency of the employed capital (Bergemann and Hege, 1998). Alternatively, the entrepreneur can "shirk" and decide to (partially) withhold the investment and divert the capital to his or her private ends. Although the entrepreneur can autonomously take certain decisions, part of the costs resulting from these decisions will be borne by the remaining shareholders (Jensen and Meckling, 1976). This problem leads to "moral hazard": the informed party has an incentive to act out of self interest, even if such actions impose high costs on the other party (Amit et al., 1998). These information asymmetries may thus lead to agency conflicts (Gompers, 1995).

Agency conflicts and costs may be especially important in high tech companies, where investors usually cannot evaluate the technology and have difficulties in assessing the commercial implications of strategic choices (Cumming, 2007; Knockaert et al., 2006). Even though VCs may develop specific abilities in selecting entrepreneurial projects, they tend to favor projects that have minimal information asymmetries (Lockett et al., 2002), which often causes high tech start-ups to be deprived of funding. The lack of funding for early stage high tech companies has typically been referred to as "the equity gap" (Murray, 1998) and has justified public intervention in the venture capital market (Di Giacomo, 2004; Lerner, 1999).

Governments can rectify market imperfections by using a large number of instruments, ranging from the establishment of public funds to providing financing to private funds, over refinancing and guarantee schemes to the provision of fiscal incentives and incubation schemes (Wright et al., 1996). Given the high suitability of venture capital financing for early stage high tech companies, governments have to a large extent either provided VC financing directly by setting up private funds, or indirectly, by investing in private VC funds (Cumming, 2007).

Building on agency theory, there is a clear indication that market failures take place in the case of early stage high tech investments. Given that policy makers aim at providing adequate funding for these high tech ventures, assuming their importance for achieving economic growth and job creation, we offer the following hypothesis:

H1: Technology VCs will to a larger extent be publicly funded than traditional VCs

Human capital theory

Lockett et al. (2002) indicate that the scale and cost of due diligence may be disproportionately high for early stage high tech investments. This cost is related to particular problems arising from the newness and complexity of the technology and the products/markets involved.

One way for VCs to reduce potential agency risks and costs is by attracting public financing. An alternative way may relate to strengthening the VC's human capital in order to mitigate these risks and costs. First, VCs may develop abilities in selecting entrepreneurial projects, which decrease the chance of encountering adverse selection and moral hazard problems caused by information asymmetries (Amit et al., 1998). Second, VCs may engage in extensive monitoring and follow-up on investments made, in order to minimize potential agency costs. Indeed, Dimov and Shepherd (2005) indicate that one key factor contributing to risk perception is problem domain familiarity. There is less perceived risk in familiar domains than in unfamiliar ones (Sitkin and Pablo, 1992), therefore suggesting that a key ingredient to accurately assessing risk is knowledge. However, as Spender (1996) suggests, not all knowledge is unique…it is especially the tacit component of knowledge that renders a unique advantage. According to Dimov and Shepherd (2005), it is the domain specific components of knowledge and human capital that makes a difference. Two key demographic characteristics, education and experience, underlie the concept of human capital (Becker, 1975). Applying the human capital concept in a VC context, Dimov and Shepherd (2005) distinguished between general and specific human capital. General human capital refers to overall education and practical experience, while specific human capital refers to education and experience with a scope of an application limited to a particular activity or context (Becker, 1975; Gimeno et al., 1997). In a VC context, Dimov and Shepherd define specific human capital as education and experience that is directly related to the tasks of the VC. They define education and experience in business, law and consulting to be specific to the pre-and post-investment value adding activities of VCs, while education in humanities and science, along with entrepreneurial experience is categorized as general.

Therefore, VCs that have higher levels of specific capital may be better placed to assess the risk connected to high tech investment proposals, and be better placed to provide support to these ventures after investment. They may feel more confident in assessing potential agency risks connected to this type of proposals and may therefore be less reluctant to invest in high tech ventures. Based on agency and human capital theory, we offer the following hypotheses:

H2: The degree of specific human capital of the investment manager will be higher in the case of technology investors

H3: The degree of general human capital of the investment manager will not distinguish technology investors from traditional investors

Research methodology

The sample

Given that none of the publicly available databases and information sources on VC activity in Europe, such as VentureEconomics or VentureOne could provide sufficiently detailed information on the level we required, namely fund characteristics and investment management characteristics, we constructed our own dataset of European early stage VCs.

A stratified sample of 68 early stage VC investors was drawn from different regions across Europe. As our research focus is on early stage VC investors, we needed to obtain an international dataset because the number of potential respondents within any one country, outside of the US, would have been too small. We selected the seven regions across Europe that had the highest R&D intensity and venture capital presence. The seven regions were: Cambridge/London region (UK), Ile de France (France), Flanders (Belgium), North Holland (the Netherlands), Bavaria (Germany), Stockholm region (Sweden), Helsinki region (Finland). In each region, we wanted to have a representation of small and large funds with various degrees of public funding. A random sample based upon the most widespread available sample frame, i.e. the EVCA-filings, would have resulted in a sample biased towards the larger private venture capital firms. Therefore, we created our own sample frame, collating the directory information from EVCA with those of the various regional venture capital associations and information obtained through contacts we had with academics with specific regional expertise and contacts. We left venture capitalists that had not existed for more than one year and had not made more than 10 investments in early stage companies out of this dataset. This resulted in a population of 220 funds across the 7 regions. The sample frame was stratified into different groups or subpopulations according to the scale of the funds (small funds versus mega funds) and their institutional investors and subsequently a random selection was made in each of the strata, resulting in a dataset of 68 VCs. In terms of scale, 33 funds were small, 21 were large and 14 were mega funds[1]. With respect to institutional

[1] Venture funds having a fund size between 100 million Euro and 250 million Euro are considered to be large funds for venture investments. Mega funds are those funds having a size of more than 250 million Euro, small funds have less than 100 million Euro under management (EVCA definition)

investors, 6 funds were private equity arms of banks, 9 funds were public funds, 12 were public/private partnerships and the others are private funds.

Research design

The interviews were conducted from January to December 2003. Each interview lasted on average 90 minutes and involved two components of data capture. Stage 1 of the research design was the conjoint analysis on the investment behaviour of investment managers, which informed our analysis as to who was, and who was not a technology investor. Stage 2 of the research involved collecting data relating to characteristics of the VC firm and the human capital of the investment manager.

Stage 1: Conjoint analysis

To date the most common methodological approach employed in studying the selection behaviour of investment managers has been a post hoc approach, asking why investment managers had invested in certain business proposals. However, this method is problematic because it can potentially generate biased results because people are poor at introspection (Shepherd and Zacharakis, 1998), are often motivated to bias results in a post hoc rationalisation (March and Feldman, 1981), and have limited capacity to recall what has happened (Fischhoff, 1982). As a reaction to these post hoc methods, researchers started to experiment with real time methods such as verbal protocol analysis. For example, Hall and Hofer (1993) presented a number of protocols for assessment to VCs. They found that VCs screen and assess business proposals very rapidly, which makes it unlikely that they can persistently evaluate their decisions post hoc. Furthermore, the subjectivity of analysis and interpretation involved in verbal protocol techniques, without being supplemented with other techniques such as computer algorithms, has been questioned by Riquelme and Rickards (1992). They argue that verbal protocol analysis is more an art than a science; suggesting instead the use of conjoint analysis as a technique for the analysis of VCs' decision making. Echoing this research, in a review of studies into investment selection criteria Shepherd and Zacharakis (1999) argue that in order to overcome the weaknesses of post hoc methodologies and real time methods, conjoint analysis is highly suitable.

Using a conjoint method we presented the venture capitalists with a number of fictitious business proposals that differ across a range of attributes. The first stage of the analysis was to identify the different attributes that would be at the heart of the fictive business cases. The attributes were selected as follows. First, we synthesized the criteria that had been used in previous research, namely human capital characteristics, financial criteria and product/technical characteristics. Second, we drew on the insights of two VC and one business angel investors active in the early stage high tech sector and in addition three VC experts in order to draw up a list of criteria that were important to them, in order to make sure that high tech selection criteria were included. The high tech selection criteria that were included are protectability and general purpose technology. Protectability was defined as the ability to protect the technology by patents or trade secrets. General purpose technology was defined as a broad technology with lots of different applications.

Finally we synthesized the two lists into a set of criteria that we then pre-tested with the experts, which they agreed were the criteria that are employed when selecting investments. As a result of this process we identified twelve different attributes which included: team, entrepreneur, contact with the entrepreneur, uniqueness of the product, protection of the product, market acceptance, general purpose technology, location, size and growth of the targeted market, time to break-even and return on investment.

These twelve attributes were used to construct a range of possible events that would form the basis of the fictitious business proposals. In line with the conjoint analysis philosophy, and consistent with Muzyka et al. (1996), potential events were matched to the different attributes, as shown in Table 1. Twenty nine events (or levels) were developed conceptually based upon the twelve attributes. For instance, team complementarity and experience are two important characteristics of the attribute "team". Business start-up teams can thus be categorized into three attributes: not complementary but having business experience; complementary with experience; or having neither complementarity nor business experience. For other attributes such as uniqueness, only two events are allowed: either it is unique or not.

<<Insert Table 1 about here>>

The possible events associated with the twelve attributes summarized in the table can then be combined into 'business proposals' (or profiles). Theoretically any combination of 12 (number of attributes) out of 29 potential events is possible. This would result in more than 1000 theoretically feasible business proposals or profiles. The total number of profiles resulting from all possible combinations of the levels would become too great for respondents to score in a meaningful way. Therefore, a fractional factorial design using Addelman's basic plans (Addelman, 1962) for designing an orthogonal main effects plan was chosen. This resulted in 27 business proposals that were presented to the respondents (VC investment managers). The 27 proposals were printed on cards that were used during the interviews. Respondents were asked to judge the proposals on a five-point Likert scale (from 1= bad investment opportunity I would certainly not invest; to 5= major investment opportunity, large chance of investing). Using a conjoint analysis these scores were then translated into derived utility scores for each attribute. Utility scores are measures of how important each characteristic is to the respondent's overall preference of a product. The output of the conjoint analysis enabled us to identify whether or not an investment manager was a technology investor.

Stage 2: Model testing

A binary logistic regression model was used in order to assess differences between technology investors and traditional investors (as informed by the conjoint analysis outlined above). The measures used are described below.

Dependent variable

Using the output of the conjoint analysis, namely the utility scores on the attributes and its levels as a starting point, we identified technology investors as those investors that were either in the top quartile of the sample for the utility attached to protectability of technology or in the top quartile of the sample for the utility attached to the fact that the technology was a general purpose technology. In this way, 28 of the 68 VCs were labelled "technology investors".

Independent variables

Percentage public capital. This variable ranges between 0% and 100%, with 100% indicating that the fund is entirely funded by public means. 46 out of 68 funds were not funded by public means, 10 were 100% publicly funded, and the other funds were partially publicly funded.

Specific human capital. Following Dimov and Shepherd (2005), we labelled financial, investment management, consulting and management experience as "specific human capital". Financial experience is measured as the number of years of experience in commercial, investment, and merchant banking, both in public and private markets, but not including investment management. For investment management experience, a separate variable was created which measured the number of years of investment management experience. The investment managers interviewed had on average 2.64 years of financial experience and 4.86 years of investment management experience. Consulting experience is measured as the number of years working for a company designated at providing consulting services, which is on average 1.02 years for the investment managers in the sample. In addition, we constructed a variable which we labelled "management experience". The variable is measured as the number of years in general management, on average 4.05 years in our sample. This differs from Dimov and Shepherd (2005)'s definition of human capital. Whereas Dimov and Shepherd defined an extra variable that measured experience in the law industry, only one investment manager in our sample had such experience. On the other hand, 30 investment managers had experience as a manager in the industry, which made it more relevant to define "management experience" as an extra variable. Finally, business administration education is measured as a dummy variable. 46 of the 68 interviewed investment managers had this education.

General human capital. The variables capture whether or not the investment manager had a technical education, and had academic or entrepreneurial experience.

Academic experience measures whether or not the investment manager had academic experience through means of a PhD or a research position at a university or research institute. On average, the investment managers in our sample had 1 year of academic experience. The majority of investment managers (58) had not had any academic experience. "Technical education" measures whether or not the investment manager has a science education (all bachelor and master degrees in mathematics, natural sciences and engineering), and takes the form of a dummy. 34 investment managers had a science education.

Entrepreneurial experience reflected the number of years the investment managers had previously been involved in a new venture as entrepreneur or founder. In our sample, the average number of years of entrepreneurial experience is 1.15 years, with 15 investment managers having had this experience.

Control variables

Sector specialization. Gans et al. (2002) showed that patents are relatively effective in protecting intellectual property in the biotechnology industry. Therefore, we constructed a variable to measure the biotech focus. We classified an investment manager as "biotech investor" if he or she indicated to consider biotech investments. The degree of focus on biotech was then determined by using the function biotech investor (0/1)/number of investment sectors. The investment manager indicated whether or not he or she would consider investing in each of the investment sectors, which were defined using the EVCA industry classification in 8 sectors[2]. Therefore, investment managers that would only consider biotech investments would score high on the measure for biotech focus. Investment managers involved in a diversified set of sectors would score low. The average score for biotech focus was .26.

Fund age. First, we controlled for the age of the fund, on average 8.06 years in our sample.

Fund size. Second, we controlled for the fund size, measured as the total capital managed, on average 269.49 million Euros in our sample.

Results

Stage 1: Conjoint analysis

[2] Communications, computer related, other electronics related, biotech, medical/health related, energy, chemicals and materials, industrial automation

From the scores investment managers gave to the 27 business proposals, conjoint analysis derived utility scores for each attribute. Utility scores are measures of how important each characteristic is to the respondent's overall preference of a product. Based on these utility scores importance scores were computed by taking the utility score for the particular factor and dividing it by the sum of all utility scores. Using the importance scores, relative rankings of the investment decision criteria per respondent could be made. The model proved the internal validity of the data (high Pearson's R and Kendall's tau statistics).
Descriptive statistics for the importance scores of each criterion are given in Table 2.

<< Insert Table 2 about here>>>

The results show that the potential return on investment, and people characteristics, such as the ability of the entrepreneur and the characteristics of his/her team were the most important selection criteria overall. Size and geographical breadth of the market (global or regional) and whether or not a technology is a general purpose technology have little impact on the VC's decision. Further, univariate tests showed that traditional investors attach more importance to the leadership potential of the entrepreneur, the uniqueness of the product and time to break-even compared to technology VCs. Based on the definition, these attach more importance to protection and whether or not the technology was a general purpose technology, but also seem to attach more importance to the contact they have with the entrepreneur.

Stage 2: Model testing

Table 3 provides an insight into the descriptives of variables used and the correlation between these variables. Correlations between independent variables were all below 0.6. In order to make sure that multicollinearity was not an issue, VIF factors were calculated, and were found to be below 3.0, suggesting that multicollinearity was not an issue (see Hair et al, 1998).

<<Insert Table 3 about here>>

Table 4 presents the results of the binary logistic regression analysis, with as dependent variable a dummy (0/1) indicating whether or not the investor was classified a technology investor or not. This classification was based upon the utility of high tech selection criteria for investment managers during the selection process.

<<Insert Table 4 about here>>

The base model for the binary logistic regression was statistically significant (R^2 =0.294, P<.001). So was the full model (R^2=.56; P<.0001). In the full model, positive significant coefficients were found for investment management experience (B=.26, P<.05), consulting experience (B=.30, p<.10) and the biotech focus of the investment manager (B=3.27, P<.01).

Therefore, we can conclude that we do **not find support for H1**, hypothesizing that technology investors are to a larger extent publicly funded than traditional investorss. We find **partial support for H2,** hypothesizing that specific human capital characteristics will distinguish technology investors from traditional ones. We do find that more experienced investment managers and managers with a higher degree of consulting experience are more likely to be technology investors. Further, we do not find any evidence of technology investors disposing of different general human capital compared to traditional ones, therefore providing **support for H3**.

Further, given that researchers have noted that the selection procedure and criteria put forward by investment managers during their research is different from the actual procedure and criteria used, we deemed it necessary to additionally test whether or not classification used matched with the in use decision policy of the investment manager. Or, as Shepherd (1999) puts it, there is a gap between “In Use” and “Espoused” decision policies used by VCs. First, this gap is caused by the fact that it is difficult for VCs to truly understand their intuitive decision process because of all the noise caused by information overload (Zacharakis and Meyer, 1998). Second, investment managers suffer from overconfidence. As Zacharakis and Shepherd (2001) point out, more information should enable the VCs to assess any potential pitfalls, however, it also makes the decision more complex. Thus, more information creates greater confidence, but it also leads to lower decision accuracy.

In order to test whether the observed selection behavior using conjoint methodology matched the in use decision policy, we asked the 68 investment managers to provide us with a list of portfolio companies for which they had been involved in the selection process. 37 investment managers provided us with this list, resulting in 168 portfolio companies. For these investee companies, we looked up the number of patents before and after investment. The number of patents post-investment correlated significantly positive with the utility the investment managers attached to protectability of technology (correlation of .40, P<.05). No significant correlation was found for the number of pre-investment patents (correlation of .13, P>.10). This is not surprising, given that we only surveyed early stage funds and that it takes a number of years before a patent is granted, which however does not prohibit the investment manager from assessing the patentability of technology. Therefore, we find an extra indication that the observed selection behavior is in line with the in use selection behavior by the investment managers interviewed.

Conclusions

So far, many researchers have used the term technology investing and have indicated that technology investing is different from traditional investing, however without providing a definition to technology investing, nor providing an indication for the differences between these investors and traditional investors. Using a hand collected, unique dataset of early stage European VCs we analyzed to which extent technology investors are different from traditional ones based on the emphasis investment managers placed on high tech selection criteria, such as protectability and general purpose technology.

First, publicly funded funds do not emphasize technology-related criteria more than traditional investors. Second, we do find that the specific human capital of investment managers is significantly different between technology investors and traditional ones, especially at the level of previous investment management and consulting experience. Investment managers with higher levels of these types of human capital tend to emphasize high tech related criteria to a larger extent. Third, we do not find that it are the "older" and often more reputated funds that have turned to high tech investing, which would suggest a gradual evolution in the industry. Clarysse et al. (2007) indicate that the valuation of patents or tacit knowledge at the early stage of product development is quite uncertain and poses particular problems for traditional venture capital firms. This problem is exacerbated since there is typically little information about the acceptability of the product in the market or the size of the market (Manigart et al., 2000). Therefore, it may be that only the most experienced investment managers, who know how to deal with market uncertainty and team related uncertainty, have the capacity to deal with technological uncertainty, which is in line with agency theory.

Implications and directions for further research

This paper has a number of important implications for policy makers, VC funds and investment managers and entrepreneurs.

First, this research does not allow concluding that publicly funded funds emphasize high tech criteria to a higher extent than private funds. Even though the results show a positive effect of public funding on technology investing, the effect is not significant. This however does not allow us to conclude that policy makers are not succeeding in their attempt to alleviate a market failure with respect to technology financing. At most, it means that, if these publicly funded funds consider high tech investing, they do not employ other selection criteria when assessing them. Further, this research clearly shows that human capital has some impact on the extent to which investment managers select high tech deals. It shows that it are mainly experienced investment managers who turn to high tech investing. Even though, at first sight, this indicates that the selection process for high tech deals will be in experienced hands, it has to be noted that high tech investing has only recently emerged in Europe, and therefore, even the most experienced investment managers will only be experienced in traditional investing. As Lockett et al. (2002) indicate, high tech investing requires specialist technology skills. This research does not indicate that people with specialist technology skills are the ones investing in high tech deals. Therefore, policy makers should focus on how, apart from selecting high tech proposals, investment managers can be recruited that have specialist technology skills on the one hand and investment management skills on the other.

Second, this research has a number of implications for VC funds. It indicates that investment managers are not biased by their own technical background while analyzing high tech proposals. This may indicate that they align to a large extent to the investment policy set by the VC fund. It further links specific human capital to a higher inclination towards technology investing.

Third, this research has a number of implications for entrepreneurs looking for VC financing. From this research it is clear that technology investors, who stress strong technological criteria in the business plan, exist. This may be of interest to many early stage high tech companies, often lacking first customer contracts, a well-established entrepreneurial team or clearly identifiable financial prospects. Besides, entrepreneurs operating in the biotech industry should be aware of the importance attached by investment managers responsible for biotech investing to high tech criteria such as protectability of technology.

This research has a number of limitations that could be addressed by further research. First, our research did not aim at understanding the impact of a focus on traditional or technology selection criteria on fund performance. Further research should indicate to which extent technology investors outperform traditional investors. A second limitation relates to the fact that only one investment manager per fund was interviewed. Further research should indicate whether differences in selection behavior between investment managers within one fund exist, and should shed light on the extent to which the fund's selection procedure is the primary focus of the investment manager, hereby overruling any human capital-related selection behavior. Finally, other factors may affect whether or not the investor remains a traditional one, or turns into technology investing. One of these factors may be the social capital of the investment manager, or the external expertise the fund can access. By building a network of technology experts, the fund could for instance try to limit potential agency risks and costs. Even though social capital was not the focus of our research, it is clearly an interesting avenue for further research.

Despite these limitations, this paper contributes to the venture capital and entrepreneurship literatures in a number of ways. First, it sheds light on how technology investors can be distinguished from traditional ones, using a relatively new technique, conjoint analysis. Second, it shows how organizational level and individual level characteristics can be united to provide a better understanding of VC behavior and calls for future VC research uniting both levels throughout the analysis. Finally, by showing that technology investing is different from traditional investing, it calls for research that specifically focuses on technology or traditional investing, or research controlling for the investment type throughout the analysis.

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Table 1: Trade-off table conjoint analysis

Characteristics of…	Attribute	Levels (potential events)
A) Team	1) Team	1) non complementary and no business experience
		2) complementary and business experience
		3) non complementary and business experience
B) Entrepreneur	2) Entrepreneur	4) leader: yes
		5) leader: no
		6) perseverance: yes
		7) perseverance: no
	3) Contact	8) contact with VC: good
		9) contact with VC:bad
C) Proposed product or service	4) Uniqueness	10) product is unique
		11) product is not unique
	5) Market acceptance	12) product is accepted by the market
		13) product is not accepted by the market
D) Technology	6) Protection	14) protection is possible
		15) protection is not possible
	7) General purpose	16) it is a general purpose technology
		17) it is not a general purpose technology
E) Targeted market	8) Geography	18) the market is regional
		19) the market is global
	9) Size	20) it is a niche market
		21) it is a mainstream market
	10) Growth	22) the market is seemingly high growth
		23) the market is low growth
F) Financial forecast	11) Time to break-even	24) expected time to breakeven is less than 1,5 years
		25) expected time to breakeven is more than 3 years
		26) expected time to breakeven is between 1,5 and 3 years
	12) Return on investment	27) expected return is less than 30%
		28) expected return is more than 50%
		29) expected return is between 30 and 50%

Table 2: Results of conjoint analysis (importance scores)

Mean (standard deviation)	Traditional investors (n=40)	Technology investors (n=28)	Total sample (n=68)
Importance team	12.44 (6.72)	11.00 (5.36)	11.85 (6.19)
Importance leadership entrepreneur**	14.68 (8.43)	9.71 (6.17)	12.64 (7.92)
Importance contact*	7.30 (8.96)	8.53 (6.01)	7.81 7.85)
Importance product uniqueness*	9.18 (4.32)	7.60 (4.17)	8.53 (4.30)
Importance market acceptance	6.71 (5.90)	6.26 (4.79)	6.52 (5.44)
Importance protection****	4.97 (2.79)	11.75 (8.01)	7.76 (6.45)
Importance general purpose technology****	3.08 (2.72)	7.83 (3.41)	5.03 (3.81)
Importance geography market	5.02 (4.08)	5.62 (3.62)	5.27 (3.88)
Importance market size	4.09 (2.66)	4.81 (4.15)	4.39 (3.34)
Importance market growth	9.16 (5.95)	8.38 (5.04)	8.84 (5.57)
Importance time to break-even**	8.61 (4.25)	6.69 (2.32)	7.82 (3.69)
Importance return on investment	14.77 (9.93)	11.81 (6.37)	13.55 (8.71)

Kruskal Wallis Test for differences between traditional and technology investors. Levels of significance: *=0.10; **=0.05; ***=0.01; ****=0.001; n=68

Table 3: Descriptive statistics and correlations

	Mean	S.D.	1	2	3	4	5	6	7	8	9
1. Percentage public capital	21.68	36.57	1.00								
2. Financial experience	2.64	5.41	.32*	1.00							
3. Investment management experience	4.86	3.83	.33*	-.08	1.00						
4. Consulting experience	1.02	2.22	-.07	-.10	-.23	1.00					
5. Management experience	4.05	6.35	.03	-.25*	-.03	.04	1.00				
6. Entrepreneurial experience	1.15	3.00	.18	-.09	.06	-.06	.05	1.00			
7. Biotech focus	.26	.36	-.03	-.11	-.03	-.13	.22	-.24	1.00		
8. Fundage	8.06	9.45	.04	.05	.25*	-.08	-.10	-.10	.11	1.00	
9. Fund capital (million Euro)	269.49	649.36	-.17	-.08	-.09	-.05	-.07	-.11	.02	.41*	1.00

Note: Pearson correlation for continuous variables, *correlations are significant at p>0.05, n=68

Table 4: Binary Logistic Regression Analysis (0=traditional investor; 1=technology investor)

	Base model	Full model
Public intervention		
Percentage public capital		.016
		(.11)
Specific human capital		
Financial experience		-.15
		(.14)
Investment management experience		.256**
		(.127)
Consulting experience		.297*
		(.172)
Management experience		.042
		(.056)
General human capital		
Entrepreneurial experience		-.025
		(.127)
Academic experience		1.339
		(1.728)
Technical education		-.068
		(.835)
Control variables		
Biotech focus	2.888***	3.561**
	(.906)	(1.140)
Fund age	-.047	-.126
	(.044)	(.055)
Fund capital	.001	.003
	(.001)	(.02)
Constant	-1.015**	-3.544**
	(.426)	(1.209)
Model		
Chi-Square	16.745***	36.061****
Concordant Ratio	73.5%	82.1%
-2Log Likelihood	75.40	55.01
Cox & Snell R^2	.218	.416
Nagelkerke R^2	.294	.560

Note: Levels of significance: *=0.10; **=0.05; ***=0.01; ****=0.001; n=68