FACULTEIT ECONOMIE EN BEDRIJFSKUNDE

VAKGROEP BELEIDSINFORMATIE, OPERATIONEEL BEHEER EN TECHNOLOGIEBELEID

Does Venture Capital Matter for High Tech Start-ups? An analysis of European Early Stage Investors

Mirjam Knockaert

Submitted to the Faculty of Economics and Business Administration in partial fulfilment of the requirements for the degree of Doctor in Applied Economics

Advisor: Prof. dr. Bart Clarysse

Co-advisor: Dr. Andy Lockett

2005

Acknowledgements

Completing a Ph D degree is an intense, demanding process. I believe combining research work and consulting activities made it even more demanding. On the other hand, I have been very happy with the interaction between the practitioner's world and the academic world, as it provided me with insights that I would not have had as a full time researcher or consultant. However, it often meant applying different ways of thinking, looking at things from other perspectives, and within other timeframes at the same time.

I realize that the fact that I combined research and consulting also made guiding me through the doctoral process much more demanding for my advisors. Therefore, above all, I wish to acknowledge and thank Bart Clarysse and Andy Lockett for guiding me through the process, and for the time and effort they put into this guidance. I extremely appreciate the effort they put into discussing, working with me, providing feedback, and pushing me to 'think the academic way'. I thank Bart for giving me the opportunity to do this Ph. D, and for participating in quite a lot of the VC interviews, which has shown to be extremely important in order to enhance discussions afterwards. I also thank Jean-Jacques Degroof, member of my graduate committee, for his feedback and support.

I thank the VCs that participated in this research. Without their interest in this research topic conducting this study would have been impossible. Beside their interest, their enthusiasm about the research methodology, their feedback on research outputs and their willingness to provide us with more information, more details etc. has been very encouraging to me. I also thank the entrepreneurs who participated in this research.

I also thank the whole team of dedicated and enthusiastic researchers at our research and consulting team: Johan, Frederike, Kristien, Freek, Ans, Nathalie, Sven, André (Spit), Iris, Els, Caroline and Ine. Their support, feedback and often 'small talks' helped me a lot during this research process. I also owe special thanks to Vicky Van Den Haute who unfortunately left our research team, but who has added a lot during the field research of this thesis. I will never forget the hours, days we spent rushing from one VC to the other,

discussing what we learnt from the interviews, and enjoying the discovery of other cultures in the meanwhile. Also thanks to Annelies Bobelyn who has done a great job collecting VC backed company data.

Beside our own research group there are a number of people I would like to thank for their support. Special thanks to professor Mike Wright for providing me with feedback and for his support and interest in my work. I also would like to thank professor Sophie Manigart and her research team for providing me with useful feedback during research meetings and beyond. Thanks to Dirk De Clercq for reading parts of my work and for providing a listening ear now and then.

Thanks to the University of Ghent and Vlerick Leuven Gent Management School that financed the final part of this study, which was necessary to provide me with some time to focus on this research.

I thank family and friends who have been very supportive, often without realizing it themselves or considering their support as a 'natural thing to do'. I especially thank my parents and Stoffel's parents, as their faith and support, and care for the ones I love have been invaluable to me. Thanks to the TEW gang and the girls (and coach) of the volleyball team, who have helped me to put my mind off work now and then, and helped me to find the new energy that I needed so often.

And last but not least, I thank my husband Stoffel and our children Sara and Robbe for their unconditional support. Their presence made me put things into perspective at the time it was needed. And to those people that keep on asking how I combined a family life with the hard work a Ph D is, I can only repeat what I said so many times over the past years: "I could not have done this without them".

Mirjam Knockaert- April 2005

Samenvatting

Deze doctoraatsthesis is een studie van Europese risicokapitaalverschaffers, die investeren in hoogtechnologische bedrijven die zich in een vroege fase van ontwikkeling bevinden. Alhoewel slechts een beperkt percentage van jonge high tech bedrijven venture capital of risicokapitaal kan aantrekken in een vroege fase van ontwikkeling, blijkt het toch een belangrijk financieringsalternatief voor deze bedrijven. Dit heeft vooral te maken met het feit dat weinig andere financieringsalternatieven voor handen zijn. Banken schrikken er immers vaak van terug om leningen aan deze ondernemingen te verstrekken, aangezien ze slechts beperkte, of geen garanties en waarborgen kunnen voorzien. Daarnaast is geld van familie en vrienden (in the jargon 3F genoemd) slechts in beperkte hoeveelheden beschikbaar, en schrikken business angels er dikwijls van terug om te investeren in projecten met een zekere complexiteit, wat hoogtechnologische projecten meestal kenmerkt.

De resource-based view, die stelt dat het succes van een onderneming bepaald wordt door de middelen waarover de onderneming beschikt, beschouwt venture capital als een financieringsbron voor hoogtechnologische bedrijven. Naast de puur financiële middelen die door de VC aangereikt worden, zijn er een aantal andere indicaties waarom bedrijven die gefinancierd zijn met venture capital beter kunnen performeren dan bedrijven die geen gebruik maken van dit type financiering.

Ten eerste heeft het selectieproces van de VC een impact. Vooraleer risicokapitaalverschaffers beslissen om middelen te investeren screenen ze uitgebreid de achtergrond van de oprichters en hun bedrijfsconcepten. Risicokapitaalverschaffers worden geacht precies die projecten te selecteren die het potentieel hebben om sterke groei te realiseren. Ten tweede spelen VCs een actieve rol in hun portfoliobedrijven, en zijn ze betrokken in activiteiten die waarde toevoegen aan de onderneming. Ze zijn met andere woorden naast financier ook consultant voor de onderneming. Ten derde versterkt het feit dat venture capital aangetrokken wordt de reputatie van de onderneming. Een geslaagde financieringsronde bevestigt en versterkt de kwaliteit van de onderneming en

vermindert de onzekerheid over het potentieel succes van de onderneming. Hierdoor zijn potentiële werknemers sneller geneigd om bij het bedrijf aan de slag te gaan, gezien de positieve reputatie die het aantrekken van risicokapitaal meebrengt.

In deze thesis analyseren we eerst het selectiegedrag van deze vroege fase, hoogtechnologische investeerders, en bestuderen we de factoren die dit gedrag kunnen beïnvloeden. In tweede instantie analyseren we het opvolggedrag van deze risicokapitaalverschaffers, en bestuderen we welke factoren dit gedrag kunnen sturen. Ten derde brengen we deze selectie-en opvolgeffecten samen en bestuderen we de impact van venture capital op groei van de portfolio bedrijven.

De analyse van het selectiegedrag van Europese vroege fase, hoogtechnologische investeerders toont aan dat er duidelijk verschillen zijn tussen de VCs onderling. We vinden dat er één groep van investeerders is, de technologie-investeerders, die de klemtoon legt op technologische criteria, zoals beschermbaarheid en uniciteit van de technologie. Een tweede groep investeerders, de people investeerders, legt de nadruk op menselijke factoren, zoals de karakteristieken van het team van ondernemers en het leiderschap van de ondernemer. Een derde groep legt de focus vooral op financiële criteria, zoals het potentieel rendement van de investering en de tijd die het bedrijf nodig heeft om rendabel te worden. We vinden dat verschillen in de sectorfocus van deze fondsen, de oorsprong van de financiële middelen van de fondsen en de ervaring van de investeringsmanagers verklarend zijn voor deze verschillen tussen VCs. Technologie-investeerders ontvangen significant meer financiële middelen van publieke bronnen. De investeringsmanagers in deze fondsen hadden geen doorsnee-profiel in vergelijking met de rest van de VC industrie: ze blijken veel meer dan andere investeringmanagers vorige ervaring in de academische wereld opgedaan te hebben. People investeerders hebben investeringsmanagers die significant meer ervaring hebben in de financiële wereld en die meer ervaring hebben bij andere fondsen.

In tweede instantie onderzoeken we de intensiteit en aard van post-investeringsactiviteiten en welke factoren een impact hebben op deze factoren. We

vinden geen indicatie dat de betrokkenheid door de investeringsmanager bij ‘controlerende’ activiteiten bepaald wordt door factoren met betrekking tot het fonds of de investeringsmanager. Met betrekking tot een tweede type post-investeringsactiviteiten, namelijk activiteiten die toegevoegde waarde bieden aan de high tech onderneming, vinden we dat factoren die verband houden met de eigenschappen van de investeringsmanager als mens een belang hebben. In dit verband vinden we dat eerdere consulting ervaring en ervaring als ondernemer leiden tot een sterkere betrokkenheid in deze waarde toevoegende activiteiten. We vinden dat investeringsmanagers die investeren voor publieke fondsen of filialen van banken en diegene die geconfronteerd zijn met een hoge graad van fondsdiversificatie tussen industrieën minder betrokken zijn. Daarnaast vinden we dat de investeringsmanagers van deze publieke fondsen en grotere fondsen significant minder tijd spenderen met hun portfolio bedrijven. Daarnaast spenderen meer ervaren investeringsmanagers meer tijd in opvolgactiviteiten.

In derde instantie brengen we deze factoren samen die de groei van VC-gefinancierde bedrijven kunnen beïnvloeden, namelijk opvolg-en selectiegedrag. We gaan na in hoeverre verschillen tussen VCs bepalend zijn voor verschillen in groei van portfoliobedrijven. We vinden dat VCs die veel belang hechten aan marktcriteria in hun selectieproces, en die vooral die projecten selecteren die niche markten en snel groeiende markten willen bespelen, portfoliobedrijven hebben die sneller groeien. Daarnaast vinden we dat de fondsgrootte een significante impact heeft op groei van de portfoliobedrijven. Dit kan enerzijds veroorzaakt zijn door het effect van de reputatie van de VC dat sterker is wanneer grotere fondsen investeren. De analyse duidt evenwel aan dat dit ook veroorzaakt kan zijn doordat grote fondsen betere kansen hebben om die snel groeiende projecten te selecteren. Dit kan doordat ondernemers eerst proberen bij grotere fondsen financiering te vinden, en pas na afwijziging door deze grotere fondsen bij de kleinere terecht komen. Daarnaast blijken grotere fondsen hun investeringsvoorstellen dikwijls aangereikt te krijgen door andere VCs, waarmee zij bij voorkeur syndiceren. Deze bevinding doet grote vragen rijzen over de overlevingskansen van deze kleinere VCs.

Deze thesis maakt een aantal contributies, zowel naar de onderzoekswereld, als naar ondernemers, investeerders en overheid. Tot nu toe heeft weinig onderzoek zich exclusief tot vroege fase, hoogtechnologische investeerders gericht. Dit is verbazingwekkend, aangezien eerder onderzoek uitgewezen heeft dat investeren in een vroege fase verschillend is van investeren in late fase, en dat investeren in technologie anders is dan investeren in niet-technologische dossiers. Deze specifieke focus maakt dit onderzoek interessant voor ondernemers met een hoogtechnologisch bedrijfsidee. Voor hen is het immers belangrijk te begrijpen hoe een financier zijn investeringsbeslissing maakt, hoe deze na investering waarde kan toevoegen aan de onderneming, en wat de impact van de VC op bedrijfsgroei kan zijn. Een beter begrip van deze factoren helpt de ondernemer om de meest aangewezen investeerder te selecteren, en verhoogt zijn of haar kansen om effectief financiering te vinden. Dit onderzoek is relevant voor beleidsmakers, die sterk geïnteresseerd zijn in de factoren die ondernemingsgroei en werkgelegenheidsniveaus kunnen stimuleren. Daarnaast duidt dit onderzoek aan welke investeringsvoorstellen gefinancierd worden via (deels of volledig) publieke middelen, en duidt het aan hoe publieke fondsen hun portfoliobedrijven opvolgen en begeleiden. In laatste instantie is dit onderzoek interessant voor venture capital bedrijven die de bevindingen rond de impact van de achtergrond van de investeringsmanager in beraad kunnen nemen bij het uitbouwen van hun investeringsteams. Daarnaast geeft dit onderzoek hen inzicht in wie potentiële syndicatiepartners zijn en met wie ze in de toekomst zullen concurreren voor gelijke deals. Dit onderzoek geeft hen daarnaast een indicatie van hoe ze groei van portfoliobedrijven kunnen beïnvloeden, en op die manier waarde van de portfolio bedrijven kunnen verhogen, wat uiteindelijk hun grootste bezorgdheid is.

Summary

This dissertation is a study of early stage high tech venture capital in Europe. Even though only a limited number of high tech companies seem to be able to attract venture capital during their early years of existence, it proves to be an important financing alternative to these companies. This is caused by the fact that only little other financing alternatives are available. Indeed, banks are reluctant to provide loans to these companies that often can not provide any collateral. Besides, money from family and friends is only available in limited amounts, and business angels tend to provide financing for projects that are not too complex.

From a resource-based view, venture capital is a source of finance to high tech ventures, helping them to overcome the liability of newness. Besides the purely financial resource that VC funding, just as other types of funding, represents, venture capital literature has indicated how venture capital can affect portfolio company growth and why VC-backed firms can be expected to have higher average growth rates than early stage firms without this type of financing.

First, the selection process of the VC matters. Before making an investment, VCs carefully scrutinize the founders and their business concepts, and are expected to select those proposals that have the potential to obtain high growth and a management pursuing high growth. Second, VCs play an active role in their portfolio companies and are involved in value-adding activities. Besides their financial role, they often take the role of consultant in the portfolio company. Third, VCs bring a reputation effect that facilitates growth. A round of financing confirms the quality of the high tech company and decreases the uncertainty about its potential success, enhancing the likelihood of potential employees joining the company.

In this research, we first analyse selection behaviour of early stage high tech investors in Europe, and look at what drives this selection behaviour. Second, we analyse follow-up behaviour of these VCs, and look at what factors drive this follow-up behaviour. Third,

we unite selection behaviour, follow-up behaviour, and study their impact on portfolio company employee growth.

First, the analysis of selection behaviour shows that European early stage high tech investors exhibit heterogeneity in their selection behaviour. We found one group of investors, the technology investors, which mainly focused on technological criteria, such as protectability and uniqueness. A second group of investors was called people investors, as they stressed human capital criteria, such as team characteristics and leadership potential of the entrepreneur during their selection process. A third group mainly focused on financial criteria, such as return on investment and time to break-even, and was called the group of financial investors. We found that differences in sectoral focus of these funds, the origin of the funds, and the experience of the investment manager could explain the differences in selection behaviour. We found that technology investors invested significantly more in biotech proposals, and less in ICT proposals. This group of investors received significantly more funding from public sources than the other investors did. The investment managers in these funds have a profile that is not common for the VC industry: they tend to have worked in the academic world more often than investment managers working at other funds. People investors have investment managers that have significantly more experience in the financial world and that have had experience with other VC funds before.

Second, we examine both the intensity of follow-up behaviour and the nature of post-investment activities and what determines the nature of an investment manager's involvement. We find no indication that involvement in monitoring activities by the investment manager is determined by either fund or human capital characteristics. In relation to value-adding activities, human capital variables matter, with previous consulting experience and entrepreneurial experience contributing to a higher involvement in value-adding activities. We find that investment managers of captive funds and those confronted with a large degree of fund diversification across industries were less involved. We find that captive funds and larger funds spent significantly less

time with their portfolio companies. Besides, more experienced investment managers spend less time in follow-up activities.

Third, we unite these factors that are likely to influence growth of VC-backed companies, being selection and follow-up behaviour, and look at how differences between VCs on these aspects translate through in differences in portfolio company growth. We find that VCs that put high importance to market selection criteria such as market growth and niche markets have portfolio companies that grow faster. Besides, the VC fund size was found to impact portfolio company employee growth. This may be caused by the signaling effect, which is larger when larger VCs invest. However, further analysis shows that larger funds are more likely to have the opportunity to invest in the business proposals with higher growth potential. Entrepreneurs may first try to find finance with larger and established funds, and may only come to smaller funds after rejection by these larger VCs. The analysis also shows that larger funds may get investment proposals presented to them by other VCs, which are syndication partners. This finding raises questions on the survival chances of smaller funds.

This dissertation offers several contributions to management science and has important implications for practitioners. So far, little research has focused on early stage high tech investing only, which is surprising, given that previous research has shown that early stage investing is different from late stage investing, and that high tech investing is different from non-tech investing. This specific focus makes this research extremely interesting to high tech entrepreneurs. Understanding how the VC makes a selection decision, can add value during the post-investment phase, and could affect company growth, is of major concern to the entrepreneurs. A better understanding of these factors can help the entrepreneur to select the appropriate investor and may increase his/her chances of finding finance. This research is also of particular interest to European policy makers, concerned about increasing employment levels. Besides, this research shows what kind of business proposals public money is injected in and how these publicly funded funds follow up on their investments. And finally, this research can help venture capital firms to build their investment management teams with a human capital

consideration in mind, and may give indications on potential syndication partners. It also gives an indication of how they could affect portfolio company growth, and thus increase company value, which is of major concern to them.

List of publications and conference presentations based on this doctoral research

Articles

Knockaert M., Lockett A., Clarysse B., Wright M. (2005). Do Human Capital and Fund Characteristics Drive Follow-up Behaviour of Early Stage High Tech VCs? Provisionally accepted in the *International Journal of Technology Management*, special issue on Venture Capital.

Conference Proceedings

Clarysse B., Knockaert M., Lockett A. (2005). Selection behaviour of early stage high technology investors. A pan-European study. Forthcoming in: *Frontiers of Entrepreneurship Research*, Babson Center for Entrepreneurial Studies, Wellesley, MA.

Book Chapters

Knockaert M., Clarysse B. (2004). Hoofdstuk 3. Waar kan een innovatieve starter geld vinden om zijn droom te verwezenlijken? Een kijk op risicokapitaal in Vlaanderen en Europa. In: Clarysse B. Eéndagsvlieg of pionier: welke ondernemer redt onze economie? Leuven, Garant. ISBN 90-441-1540-5.

Working papers

Knockaert M., Lockett A., Clarysse B., Wright M. (2005). Do Human Capital and Fund Characteristics Drive Follow-up Behaviour of Early Stage High Tech VCs? Working Paper Series Universiteit Gent and Vlerick Leuven Gent Management School.

Clarysse B., Knockaert M., Lockett A. (2005). How do Early Stage High Technology Investors Select their Investments? Working Paper Series Universiteit Gent and Vlerick Leuven Gent Management School.

Other proceedings

Knockaert M., Clarysse B., Vandenhaute V. (2003). Europese benchmark studie naar overheidsinitiatieven die het overbruggen van de equity gap beoogen. Steunpunt ondernemerschap, ondernemingen en innovatie.
http://www.ondernemerschap.be/documents/pdf/st_europese_benchmark.pdf

Conference presentations

June 3-5, 2004	BKERC, Babson Kauffman Entrepreneurship Research Conference, University of Strathclyde, Glasgow, UK
November 11-12, 2004	G2G Specialized Workshop on Venture Capital, IESE, Barcelona, Spain – Best Paper Award

Table of contents

List of Figures

List of Tables

1 Introduction

New Technology-Based Firms (NTBFs) in general, and high tech start-ups specifically, have received a lot of attention from academics in the last two decades (e.g. Bollinger et al., 1983; Utterback et al., 1988; Roberts, 1991; Storey and Tether, 1998; Autio and Yli-Renko, 1998; Shane, 2001).

This is caused by the fact that New Technology-Based Firms are especially seen as offering a significant potential contribution in four cardinal areas of economic activity: innovation, new employment creation, export sales growth, and regional development (Rothwell and Zegveld, 1982; Freeman, 1983; Oakey et al., 1988; Keeble, 1989; Roberts, 1991; Murray, 1996).

Although there is consensus about the important role that these companies play in a national innovation system, there is confusion about the individual performance of these companies, especially at a European level. Rickne and Jacobsson (1999) found that the vast majority of high tech start-ups established between 1975 and 1993 in Sweden, remained very small. Also Autio and Yli-Renko (1998) reported that most NTBFs in Finland did not grow at all. Similar findings were reported in France (Mustar, 1997; Delapierre et al., 1998), Italy (Chiesa and Piccaluga, 2000) and Germany. However, several researchers have indicated that high tech start-ups, once they have reached a certain critical mass, exhibit faster average employment growth rates than non-high tech starters (Licht and Nerlinger, 1998; Storey and Tether, 1998). Since there is consensus about the growth rates after critical mass, the basic question seems to be related to the probability and speed at which these high tech start-ups reach this mass, which is usually interpreted as the liability of newness (Oakey, 1995; Storey and Tether, 1998).

In order to understand why some high tech start-ups are performing well and others are not, and why some high tech start-ups reach critical mass faster than others, quite a lot of attention has been paid to what drives early stage high tech venture growth. Since the original “theory of the growth of the firm” in Penrose (1959), where managerial resources

played a pivotal role, several factors have been suggested as affecting growth. Some factors are external to the organization, such as market forces and environmental carrying capacity (Aldrich, 1990; Singh and Lumsden, 1990). Other factors are internal, such as capabilities, culture, strategy and finance, and have been addressed from the resource-based view of the firm (Barney, 1991; Chandler and Hanks, 1994; Zahra et al., 2000; Canals, 2000).

The analysis of growth of early stage high tech ventures, and the drivers of this growth have been of major importance to policy makers worldwide, and have been a major concern to European policy makers in particular (e.g. Lisbon European Union Summit 2000). This concern has come about through the differences that exist between Europe and the US with respect to early stage high tech venture growth. While the US has pioneered a new technological revolution based on large numbers of new small enterprises, the European Union, meanwhile, has lagged behind in the growth of 'new economy' high-tech activity. Compared to the US, innovative small and medium enterprises appear to find it more difficult to get started and grow (Gill et al., 2000; Martin et al., 2002). As mentioned above, some researchers even indicate that high-tech start-ups do not grow at all. The dominant view is that this is due to the nature of capital markets and the problems of raising finance for small risky businesses (Martin et al., 2002).

Empirical research in the US has shown that VC backed firms are more innovative and produce more and more valuable patents (Kortum and Lerner, 2000). They are faster in developing their products and introducing them to the market (Hellman and Puri, 2000). They have a higher rate of executive turnover, reflecting faster managerial professionalization (Hellman and Puri, 2000, 2002). Bottazzi and Da Rin (2002) indicate that a wide consensus exists among economists, business leaders and policy-makers that a vibrant venture capital industry is a cornerstone of America's leadership in commercialization of technological innovation. On the other hand, Gompers and Lerner (2001) indicate that demonstrating a causal relationship between the presence of venture capital investment and innovation or job growth is a challenging empirical problem. Besides, the success of the US VC industry is not easily duplicated in other countries. A

recent empirical study suggests that European VC has grown vigorously in terms of volume invested but seemingly had not much influence on growth and employment of their portfolio companies (Bottazzi and Da Rin, 2002). Bottazzi and Da Rin (2002) conclude that the quality of European VC is a more urgent issue than sheer quantity.

In general, opinions vary about how successful VCs are in allocating resources. Amit et al. (1998) build on agency theory to explain why VCs exist in the first place, showing that informational asymmetries are the key to understanding the venture capital industry. They state that there are two major forms of informational asymmetry. The first is called adverse selection or "hidden information". In this case, the entrepreneur is better informed about the new product development than the potential financing party, and may have an incentive to mispresent this information to the venture capitalist. The entrepreneur may for instance overstate the potential of the new product development, which causes that it is hard for investors to distinguish between good-quality and low-quality projects. The second form of informational asymmetry is called "hidden action", leading to "moral hazard". In this situation, one party cannot observe relevant actions taken by the other party, which may have an incentive to act out of self interest, and causing the first party to run high costs. Besides, Sapienza and Korsgaard (1996) point out that entrepreneurial CEOs will have an incentive to delay or obscure performance results when things are going poorly as most investment agreements contain provisions for the removal of the CEO by the board of directors if certain performance indicators are not met (Gladstone, 1988).

Both adverse selection and moral hazard may arise in any investment environment, but Amit et al. (1998) point out that they are particularly acute in entrepreneurial finance. Entrepreneurial early stage firms lack collateral and have not developed a reputation, which may mitigate the negative effects of moral hazard and adverse selection. Venture capitalists try to reduce the problems arising from informational asymmetries by staging the investment (Sahlman, 1990) or by syndicating with other financial parties (Lerner, 1994). Amit et al. (1998) state that VCs emerge exactly because they develop specialized abilities in selecting and monitoring entrepreneurial projects. They become skilled at

selecting good projects in environments with hidden information and are good at monitoring and advising entrepreneurs who might otherwise be vulnerable to moral hazard problems. Therefore, according to Amit et al. (1998), VCs will operate in environments where their relative efficiency in selecting and monitoring investments and providing value-enhancing services gives them a comparative advantage over other investors. Therefore, VCs are expected to be prominent in industries where informational concerns are important, such as biotech, ICT etc. Within these classes of projects where VCs have an advantage, VCs will still prefer projects where the costs of informational asymmetry are less severe, being firms with some track record rather than pure start-ups.

Also other authors, like Chan (1983) and Sahlman (1990), argue that the presence of a VC encourages efficient capital allocation. Amit, Glosten and Muller (1990), however state that the most promising entrepreneurs will not seek venture capital financing, and are likely to make slower progress in the development and commercialization of emerging technologies. They further state that VC-backed firms are less likely to succeed in developing their ventures because of their relatively low ability. Some recent research results seem to support this view. A recent study by Heirman and Clarysse (2005) of 220 Flemish high tech start-ups indicates that non VC-backed companies are outperforming some VC-backed ones. A study by Manigart et al. (2002) shows that VC backed companies have a lower probability of survival and a significantly higher probability of going bankrupt than non-VC backed companies, which they attribute to either an adverse selection problem or either an inherent part of the investment process (with the VC liquidating living deads and focussing on star investments). Interestingly, these researchers concluded that receiving VC from the right backer is perhaps more important than receiving VC per se. Schoonhoven et al. (1990) show that US high tech start-ups that receive VC are even worse performing than those that do not and that they need more time to ship their first product for revenues. This finding is attributed by the authors to the slack that is the result of the more comfortable cash position of VC backed start-ups.

From a resource-based view, venture capital is a source of (external) finance to the high tech venture. Several researchers (Romanelli, 1989; Schoonhoven et al., 1990) indicate

that the lack of financial resources is a key component of the liability of newness that high tech start-ups are faced with. Lee et al. (2001) indicate that there is a positive relation between the amount of financial resources of technological start-ups and their performance.

Besides the purely financial resource that VC funding, just as other types of funding, represents, venture capital literature has indicated how venture capital can affect portfolio company growth and why VC-backed firms can be expected to have higher average growth rates than early stage firms without this type of financing. According to Amit et al. (1998), venture capitalists are financial intermediaries with a comparative advantage in working in environments where informational asymmetries are important, and may lead to costly problems, such as moral hazard and adverse selection . According to them, VCs emerge because they develop specialized abilities in selecting and monitoring entrepreneurial projects.

First, before making an investment, VCs carefully scrutinize the founders and their business concepts (Fried and Hisrich, 1994). Besides, VCs are expected to select those start-ups that have potential to obtain high growth and a management pursuing high growth (Zacharakis and Meyer, 1998, 2000). Several researchers indicate that formal venture capital contributes to the sustainability of the financial resources (Tyebjee and Bruno, 1986; MacMillan et al., 1985, 1987; Hall and Hofer, 1993; Fried et al., 1998; Rah et al., 1994).

Second, VCs play an active role in their portfolio companies and are involved in value-adding activities (Sapienza et al., 1996; Fried et al., 1998; Hellman and Puri, 2000; Schefczyk and Gerpott, 2001; MacMillan et al., 1988; Gorman and Sahlman, 1989; Bygrave and Timmons, 1992). Researchers studying the effect of involvement on portfolio company performance have however found contradictory results. MacMillan et al. (1988) found no straightforward significant differences in portfolio company performance between clusters of different support intensities, but found that various VC activities correlated with performance. On the other hand, Sapienza (1992), Sapienza and

Timmons (1989) and Schefczyk (2001) detected positive correlations between VC management support intensities and portfolio company performance. More recently, Baum and Silverman (2004) pointed out that VCs act as “scout” identifying future potential and as “coach” that can help realize it.

Third, VCs may bring a reputation effect that facilitates growth. According to Davila et al. (2003), a round of financing confirms the quality of the company and decreases the uncertainty about its potential success. Based on a sample of both VC-backed and non-VC backed firms, Davila et al. (2003) showed that the funding event provides a strong signal that reduces the risks that potential employees may perceive and, accordingly, enhances their likelihood of them joining the company. Diamond (1991) posits in his reputation-based theory that inside investors, such as VCs, can transmit valuable signals to outside parties, such as personnel, suppliers and customers.

So far, entrepreneurship research has mainly included VC as a dummy variable (Davila et al., 2003; Hellman and Puri, 2000; Baum and Silverman, 2003), next to the amount of finance that was raised by the companies studied. Capturing the effect of venture capital by including a dummy variable may however be problematic as it does not allow to account for differences that exist between VCs with respect to their resource bases, selection and follow-up behaviour. Therefore, part of this study aims at understanding what VC characteristics, selection behaviour or follow-up behaviour are affecting growth of early stage high tech ventures. In this research, we will first study whether European early stage high tech VCs exhibit heterogeneity in their selection behaviour, and if so, what is driving these differences. Second, we will investigate whether differences in follow-up behaviour between early stage high tech investors exist, and what factors drive this behaviour and differences. And finally, we will study the impact of venture capital on portfolio company growth, taking into account differences that were found with respect to selection behaviour, follow-up behaviour and VC characteristics.

The current study, focusing on European early stage high tech investors, is of particular interest to policy makers, venture capitalists, entrepreneurs and academics.

First, policy makers are interested in understanding which factors VCs base their investment decision on, and in understanding which factors drive this selection behaviour. Besides, it is interesting to them to know whether public funds behave differently from non-public and public/private partnerships, both with respect to selection and follow-up behaviour. And finally, understanding how venture capital could affect company growth is of major concern to European policy makers, trying to increase employment levels, and concerned about the lagging behind of Europe in comparison to the US.

Second, venture capitalists can learn from how they can obtain a portfolio of high growing companies, be it through selecting the deals with higher growth potential (selection behaviour), encouraging growth (follow-up behaviour) or by initiating a signaling effect. Company growth, and more specific employee growth, is what is of major importance to them given the positive correlation that was found to exist between employee growth and company valuation (Davila, 2003). Besides, it is of particular interest to them to understand how other VCs select their investments, and what criteria they stress during selection. This will provide them insight into which VCs could be potential syndication partners or which VCs they could be competing with on specific deals. Next, it is interesting to them to understand how human capital and fund characteristics can affect follow-up behaviour. This knowledge may for instance lead to building investment management teams with a human capital consideration in mind. Or it may help them to select those funds that are likely to be complementary to them with respect to follow-up behaviour.

Third, this research is interesting to entrepreneurs. Understanding what criteria matter to VCs during the selection phase, and what factors drive this selection behaviour is of major importance to the entrepreneur. It can help him/her to better select the appropriate investor, and may increase his/her chances of finding VC financing. Also a better understanding of what drives VC follow-up behaviour is important to the entrepreneur, and may help him to better select the appropriate investor, which may be a hands-on or

hands-off investor. Finally, understanding how venture capital can affect company growth is of major interest to the entrepreneur. This understanding can allow him to select the investor that is likely to fit the business plan growth perspectives best, and may increase his/her chances of finding the right venture capitalist for the business. What makes this research particularly interesting to high tech early stage entrepreneurs is that it focuses specifically on this group of investors that are interested in investing in high tech early stage ventures, whereas previous research has studied the venture capital industry as a whole.

Fourth, this research is interesting to academics and can make an important contribution to management science. Little research has focused on early stage high tech investing only, which is surprising, given that previous research has shown that early stage investing is different from late stage investing (Elango, 1995; Sapienza et al., 1994), and that high tech investing is different from non-tech investing (Lockett et al., 2002; Murray and Lott, 1995). This may be caused by the fact that VC research so far has mainly been carried out in the US, where venture capital seems to stick to its traditional role of investing in early stage high tech companies (Bishop, 1996). This seems to be less the case in the EU, with MBO investments taking a major part of all venture capital investments (see 2.3.1). This lack of European research is caused by the fact that, in comparison to the US, little data on European venture capital is publicly available. Besides, European venture capital has emerged only quite recently in comparison to the US.

The doctoral thesis takes the following structure.
In chapter 2, we provide an overview of early stage high tech venture capital in Europe. First, we provide a general overview of which kind of financing is available to the high tech venture, which is, amongst others, dependent on the stage the company is in. Second, we discuss the availability of early stage high tech venture capital in Europe. Third, we provide an overview of the sources of early stage high tech venture capital in Europe.

In chapter 3, we describe how the sample frame was built and provide an overview of the sample used to carry out this study. Next, we provide an insight into the methodology used during data collection, and data collected.

Chapters 4, 5 and 6 present the core of this thesis, and present three studies.

In chapter 4, we present the results of the first study, analyzing the selection behaviour of European high tech early stage investors.

In chapter 5, we analyse the follow-up behaviour of European high tech early stage VCs, and look at which factors, such as fund and human capital characteristics drive this behaviour.

In chapter 6, we analyse how venture capital can affect growth of early stage high tech ventures, uniting selection behaviour and follow-up behaviour.

Chapter 7 is a concluding chapter, providing, next to the conclusions, an overview of implications of this research, limitations, and indications for further research.

1.1 References

Aldrich H. (1990). Using an ecological perspective to study organizational founding dates. *Entrepreneurship Theory and Practice*. Spring, 7-24.

Amit R., Glosten L., Muller E. (1990). Entrepreneurial ability, venture investments, and risk sharing. *Management Science*. 36(10): 1232-1245.

Amit R., Brander J., Zott C. (1998). Why do venture capital firms exist? Theory and Canadian evidence. Journal of Business Venturing. 13: 441-466.

Autio E., Yli-Renko H. (1998). New, technology-based firms in small open economies. An analysis based on the Finnish experience. *Research Policy*. 26: 973-987.

Barney J.B. (1991). Firm resources and sustained competitive advantage. *Journal of Management*. 17(1): 99-120.

Baum J.A.C., Silverman B.S. (2004). Picking winners or building them? Alliance, intellectual and human capital as selection criteria in venture financing and performance of biotechnology. *Journal of Business Venturing*. 19(3): 411-425.

Bishop B. (1996). Venture capital in the United Kingdom. *OECD Working Papers*. Volume IV Venture capital and innovation. No. 98. Paris: OECD.

Bollinger L., Hope K., Utterback J.M. (1983). A Review of Literature and Hypotheses on New Technology-Based Firms. *Research Policy*. 12(1): 1-15.

Bottazzi L., Da Rin M. (2002). Venture capital in Europe and the financing of innovative companies. *Economic Policy* 34: 231-269.

Bygrave W., Timmons J.A. (1992). Venture capital at the Crossroads. Harvard Business School Press. Boston, MA.

Canals J. (2000). Managing corporate growth. Oxford University Press, New York.

Chan Y. (1983). On the positive role of financial intermediation in allocations of venture capital in a market with imperfect information. *Journal of Finance*. 38(5): 1543-1561.

Chandler G., Hanks S.H. (1994). Market attractiveness, resource-based capabilities, venture strategies and venture performance. *Journal of Business Venturing*. 9(4): 331-349.

Chiesa V., Piccaluga A. (2000). Exploitation and diffusion of public research: The case of academic spin-offs in Italy. *R&D Management*. 30(4): 329-340.

Davila A., Foster G., Gupta M. (2003). Venture capital financing and the growth of startup firms. *Journal of Business Venturing.* 18:689-708.

Delapierre M., Madeuf B., Savoy A. (1998). NTBFs- The French case. *Research Policy*. 26(9): 989-1004.

Diamond D. (1991). Monitoring and reputation: the choice between bank loan and directly placed debt. *Journal of Political Economy*. 99(4): 689-721.

Elango, B., Fried, V.H., Hisrich, R.D., Poloncjek, A. (1995). How Venture Capital Firms Differ. *Journal of Business Venturing* 10: 157-179.

Freeman C. (1983). The economics of industrial innovation. Cambridge, MA: MIT Press.
Fried V., Hisrich R. (1994). Toward a model of venture capital investment decision making. *Financial Management*. 23(3): 28-37.

Fried V.H., Bruton G.D., Hisrich R.D. (1998). Strategy and the board of directors in venture capital-backed firms. *Journal of Business Venturing.* 13(6): 493-504.

Gill D., Martin C., Minshall T., Rigby M. (2000). Funding Technology: Lessons from America. London: Wardour Publications.

Gladstone D. (1988). Venture capital handbook. Englewood Cliffs. NJ: Prentice-Hall.

Gompers P., Lerner J. (2001). The Venture Capital Revolution. *Journal of Economic Perspectives*. 15(2): 145-168.

Gorman M., Sahlman W.A. (1989). What Do Venture Capitalists Do? Journal *of Business Venturing*. 4(4): 231-249.

Hall, J., Hofer, C.W. (1993). Venture Capitalists' Decision Criteria in New Venture Evaluation. *Journal of Business Venturing*. 8: 25-42.

Heirman A., Clarysse B. (2005). The initial resources and market strategy to create high growth firms. Forthcoming in: Academy of Management Best Paper Proceedings, 2005.

Hellmann T., Puri M. (2000). The interaction between product market and financing strategy: the role of venture capital. *The Review of Financial Studies*. 13(4): 959-984.

Hellmann T., Puri M. (2002). Venture capital and the professionalization of start-up firms: Empirical evidence. *The Journal of Finance*. 57(1): 169-198.

Keeble D.E. (1989). High-technology industry and regional development in Britain: the case of the Cambridge phenomenon. *Environment and Planning*. 7: 153-172.

Kortum S., Lerner J. (2000). Assessing the contribution of venture capital to innovation. *The Rand Journal of Economics*. 31(4): 674-693.

Lee C., Lee K., Pennings J.M. (2001). Internal capabilities, external networks, and performance: a study on technology-based ventures. *Strategic Management Journal*. 22: 615-640.

Licht G., Nerlinger E. (1998). New technology-based firms in Germany: A survey of the recent evidence. *Research Policy*. 26(9): 1005-1023.

Lockett, A., Murray G., Wright M. (2002). Do UK venture capitalists still have a bias against investment in new technology firms. *Research Policy*. 31. 1009-1030.

MacMillan, I.C., Siegel, R., Subbanarashima, P.N. (1985). Criteria used by venture capitalists to evaluate new venture proposals. *Journal of Business Venturing*. 1: 119-128.

MacMillan, I.C., Zemann, L., Subbanarashima, P.N. (1987). Criteria distinguishing successful from unsuccessful ventures in the venture screening process, *Journal of Business Venturing*. 2: 123-137.

MacMillan I., Kulow D., Khoylian R. (1988). Venture capitalists involvement in their investments: extent and performance. *Journal of Business Venturing*. 4: 27-47.

Manigart S., Baeyens K, Van Hyfte W. (2002). The survival of venture capital backed companies. *Venture Capital*. 4(2): 103-124.

Martin R., Sunley P., Turner D. (2002). Taking risks in regions: the geographical anatomy of Europe's emerging venture capital market. *Journal of Economic Geography*. 2(2): 121.

Murray G. (1996). A synthesis of six exploratory, European case studies of successfully exited, venture capital-financed, new technology-based firms. *Entrepreneurship Theory and Practice*. Summer. 41-60.

Murray, G., Lott, J. (1995). Have UK venture capitalists a bias against investment in new technology-based firms? *Research Policy*. 24: 283-300.

Mustar P. (1997). Spin-off enterprises. How French academics create hi-tech companies: the conditions for success and failure. *Science and Public Policy*. 24: 37-43.

Penrose E.T. (1959). The theory of the growth of the firm. New York: Wiley.

Oakey R. (1995). High Technology New Firms: Variable Barriers to Growth. Paul Chapman Publishing Ltd. London.

Oakey R.O., Rothwell R., Cooper S. (1988). Management of innovation in small firms. London: Francis Pinter.

Rah J., Jung K., Lee J (1994). Validation of the venture evaluation model in Korea. *Journal of Business Venturing*. 9(6): 509-525.

Rickne A., Jacobsson S. (1999). New Technology-Based Firms in Sweden- A study of their direct impact on industrial renewal. *Econ. Innov. New Techn*. 8: 197-223.

Roberts E.B. (1991). Entrepreneurs in High Technology. Oxford University Press. New York.

Romanelli E. (1989). Environments and Strategies of Organization Start-Up: Effects of Early Survival. *Administrative Science Quarterly*. 34: 369-387.

Rothwell R., Zegveld W. (1982). Industrial innovation and small and medium sized firms. London: Francis Pinter.

Sahlman W. (1990). The structure and governance of venture-capital organizations. *Journal of Financial Economics*. 27(2): 473-521.

Sapienza H.J., Korsgaard M.A. (1996). Procedural justice in entrepreneur-investor relations. *Academy of Management Journal*. 39(3):544-574.

Sapienza H.J., Timmons J.A. (1989). The roles of venture capitalists in new ventures: what determines their importance? *Academy of Management Best Paper Proceedings*. 74-78.

Sapienza H.J. (1992). When do venture capitalists add value? *Journal of Business Venturing*. 7: 9-27.

Sapienza, H.J., Amason, A.C., Manigart, S. (1994). The level and nature of venture capitalist involvement in their portfolio companies: a study of three European countries. *Managerial Finance*. 20(1): 3-17.

Sapienza H.J., Manigart S., Vermeir W. (1996). Venture capitalist governance and value added in four countries. *Journal of Business Venturing*. 11: 439-469.

Schefczyk M. (2001). Determinants of success of German Venture Capital Investments. *Interfaces*. 31:43-61.

Schefczyk M., Gerpott T.J. (2001). Management support for portfolio companies of venture capital firms: an empirical study of German venture capital investments. *British Journal of Management*. 12: 201-216.

Schoonhoven, C.B., Eisenhardt, K.M., Lyman, K. (1990), 'Speeding products to market: Waiting time to first product introduction in new firms'. *Administrative Science Quarterly*. 35(1): 177 – 207.

Shane S., Venkatarman S. (2000). The promise of entrepreneurship as a field of research. *Academic Management Review*. 24(1): 217-226.

Singh J., Lumsden C. (1990). Theory and research in organizational ecology. *Annual Rev. Sociology*. 16: 161-195.

Storey D.J., Tether B.S. (1998). Public policy measures to support new technology-based firms in the European Union. *Research Policy*. 26: 1037-1057.

Tyebjee, T.T., Bruno, A.V. (1984). A model of VC investment activity. *Management Science*. 30: 1051-1066.

Utterback, J.M., Meyer, M., Roberts, E., Reitberger, G. (1988). 'Technology and industrial innovation in Sweden: A study of technology-based firms formed between 1965 and 1980'. *Research Policy*. 17(1): 15-26.

Zacharakis A.L., Meyer G.D. (1998). A lack of insight: do venture capitalists really understand their own decision process? *Journal of Business Venturing*. 13: 57-76.

Zacharakis A.L., Meyer G.D. (2000). The potential of actuarial decision models: can they improve the venture capital investment decision? *Journal of Business Venturing*. 15: 323-346.

Zahra S.A., Ireland R.D., Hitt M.A. (2000). International expansion by new venture firms: international diversity, mode of market entry, technological learning, and performance. *Academy of Management Journal*. 43(5): 925-950.

2 Early stage high tech venture capital

2.1 Introduction

The current study aims at understanding how early stage high tech venture capital could affect portfolio company growth, and at understanding how these VCs select their investments and follow-up on their portfolio companies. The study analyses early stage high tech venture capital in Europe. Therefore, it is necessary to first provide an insight into early stage high tech venture capital in this region.

Below, we first provide an overview of sources of finance available to high tech companies, and comment on their availability in a European context. Understanding what other sources of finance beside VC exist for these companies allows to assess the importance of venture capital for these early stage high tech companies. Next, we focus on venture capital only, and discuss the availability of early stage high tech venture capital in Europe. Finally, we provide an overview of the sources of VC funds in Europe.

2.2 Linking company stage to financing alternatives for high tech companies

Entrepreneurs can start up their businesses in different ways. According to Heirman and Clarysse (2004) most innovative entrepreneurs start up their business without external financing. They start up as consultant and their first project generates sufficient cash to start up their company. As these entrepreneurs start up with little or no employees, and use a consulting business model, they do not need extra financing. Heirman and Clarysse (2004) call these entrepreneurs ‘prospectors’. Another group of start-ups have enough money of their own, or start up with money from friends or family in order to survive the first years after start-up. This group, was called ‘transitional starters’. ‘Product based start-ups’ do need financing. They have to recruit people in order to bring their product to the market, may outsource production and often need resources to further develop their product. They often use supplier’s credit or have social debts in order to cover their first

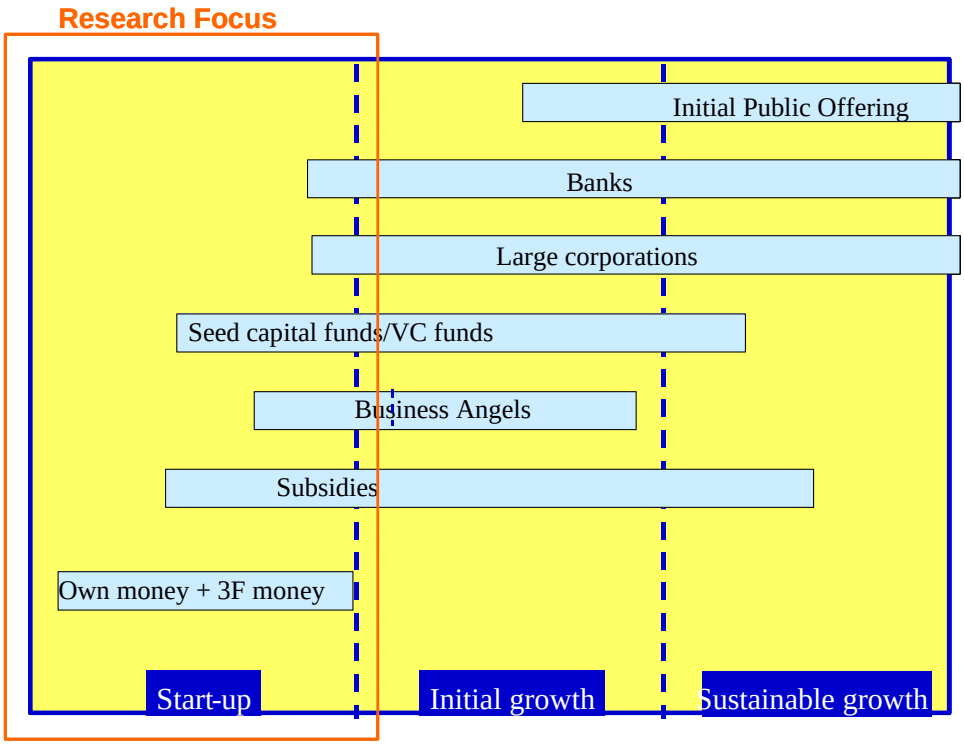
financing needs. This however makes that solvency of these companies is very bad, and that banks are reluctant to provide loans.

A last group is the group of 'venture capital backed' companies. This group uses external capital in order to bridge the period during which cash is burnt.

The group of 'venture capital backed' companies accounts for about 10% of all start-ups, according to Heirman and Clarysse (2004). Similar findings on the proportion of new technology based firms receiving venture capital were reported by Burgel and Murray (1998), who found 11% of their sample of Anglo-German NTBFs to be venture capital backed.

The sources of finance that are available to high tech companies are dependent on the stage the company is in. This is illustrated in the following figure:

Figure 1: Company stage and sources of finance



Source: based on Roberts (1991)

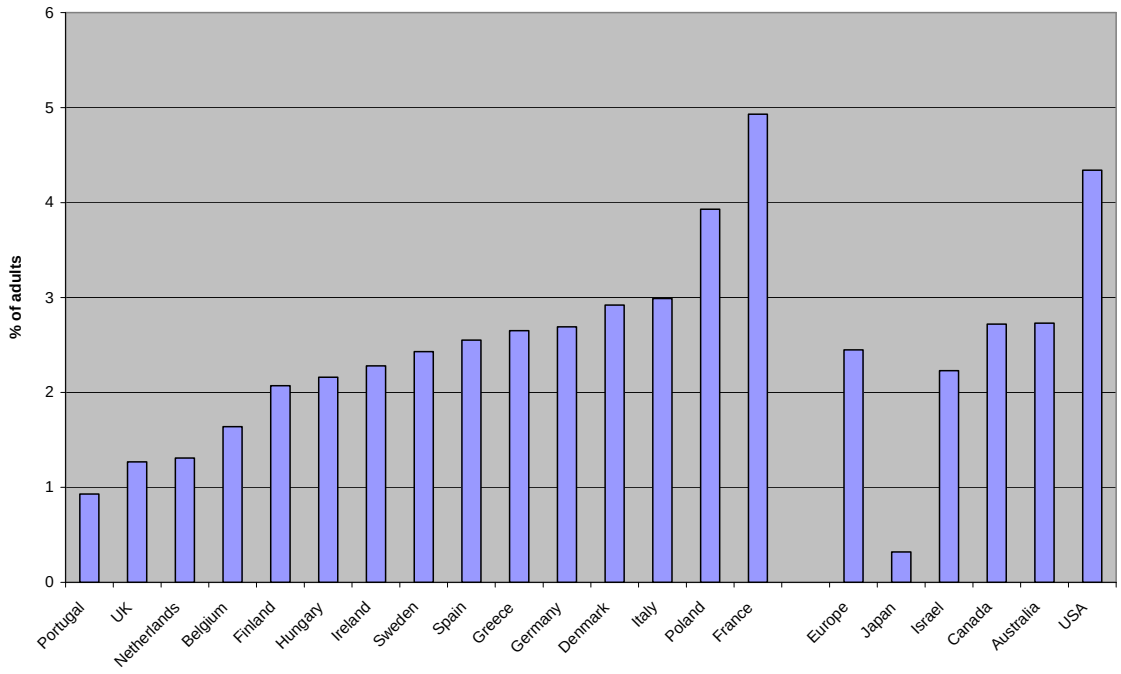
In the **start-up phase**, there are a number of financing alternatives, such as own money and 3F money, subsidies, business angel financing, bank financing and venture capital financing.

As long as the entrepreneur has not got a proof on concept, demonstrating the technical and economic feasibility of his/her idea, it is difficult to find external financing. The entrepreneur will have to finance his business by **own means**, or call upon the financial help from friends or family. This money is called **3F** (Fools, Friends and Family) **money**. With this money, the entrepreneur can finance the technical validation of his idea, the set-up of industrial partnerships, the development of a business case or writing of a business plan.

During this phase, also **business angels** are potential financing parties. They are often ex-entrepreneurs who want to invest in their own region. They are not only looking for interesting financial returns, but also want to be involved in the new venture, and enjoy building new businesses. Some business angels join business angel networks that try to match business angels with entrepreneurs. Some business angels go one step further, and set up a fund together with other business angels, managed by one or few investment managers.

The GEM (2004) study, which is undertaken yearly in Europe, shows that only a small proportion of these friends or family and business angels support entrepreneurs (Figure 2). Next to this, friends and family tend to provide financing for projects that are not too complex, as research by for instance Bollingtoft et al. (2003) report.

Figure 2: Informal investors: proportion of adults that invested 3F money, 2004



Source: De Clercq et al. (2005): GEM report, 2004

In most countries, governments provide **subsidies**, which are however usually to be used exclusively for financing of technological research and development.

Banks may provide loans in a start-up phase of a company. They may however only give loans to start-ups on the condition that these loans can be based on personal collateral of the entrepreneur, which may only be available in a limited number of cases. Besides, it increases the risk the entrepreneur runs.

Research has shown that 3F money, own finance and bank loans are often either insufficient or inappropriate to exploit fully the rapid growth potential of a new technology (Oakey, 1984; Westhead and Storey, 1995; Berger and Udell, 1998). Researchers have argued that, in these circumstances, the provision of risk capital by venture capital firms may be the most suitable form of external finance (Murray and Marriott, 1998). So even though only 10% of start-ups make use of **venture capital**, it may still be an important way of financing, given that little alternatives exist.

According to EVCA, venture capital is professional equity co-invested with the entrepreneur to fund an early stage (seed and start-up) or expansion venture. A venture capital fund is a vehicle for enabling pooled investment by a number of investors. The classic role of venture capitalism is regarded as the supply of capital to risky new, small and innovative enterprises that have difficulty raising such capital from other sources (Bishop, 1996).

Quite a lot of differences exist between these venture capital funds with respect to their sources of finance (public, private, public/private partnerships), their technological focus (some VCs specialize in one technology, others build a diversified portfolio), their stage focus (some VCs are only investing in an early phase, other reserve only a proportion of their fund for early stage investments), average investment sizes, size of the fund etc. Some universities have set up seed capital funds, which provide financing for research, and assessing and developing an initial concept before a business has reached the start-up phase.

In the **initial growth phase** it becomes easier for a company to attract financial means. The company has acquired a place in the market and is profitable. The company is looking for financing in order to target new markets. Not only **VCs** but also **larger companies** are interested in investing in this phase. Given the financial position of the company and its track record, it is getting easier to attract other than equity capital. Companies in this phase can appeal to **banks** that will finance for instance working capital.

In the **sustainable growth phase**, the company has proven its profitability in its home market, and may be planning to go international. Only few start-ups survive the sustainable growth phase as independent company. Most innovative companies are bought before or at the beginning of this phase by larger corporations. The amounts of financing the company needs in this phase are significant, and therefore business angels and smaller VCs will not invest in this phase anymore. **Larger VC funds, corporations** and **banks** are the financing parties. Only few companies can raise money through an

IPO, or **Initial Public Offering**. In the nineties, quite a lot of high growth stock markets were set up (f.i. Neuer Markt, EuroNM, Easdaq) in order to increase the supply of financing for companies in this stage, and even in an earlier stage. Due to the technology crisis, a lot of these stock markets have disappeared or became part of existing stock markets.

In this study, we will only focus on VC funds that are investing in an early stage of the high tech venture, which is suggested by Bishop (1996) to be the classical role of VC, and shown in Figure 1. This phase is similar to the phase during which early phase investments take place, according to venture capital practice, which split up the investment stages between early phase, expansion phase and replacement capital, and buyout. In this study, we focus on early phase investments.
According to EVCA, early stage financing can be either seed financing, start-up financing or other early stage financing. Seed financing is defined as financing provided to research, assess and develop an initial concept before a business has reached a start-up phase. Start-up financing is financing provided to companies for product development and initial marketing. Companies may be in the process of being set up or may have been in business for a short time, but have not sold their product commercially. Other early stage financing is financing to companies that have completed the product development stage and require further funds to initiate commercial manufacturing and sales. They will not yet be generating a profit.

Given that the study analyses European early stage high tech venture capital, we first provide an overview of early stage high tech venture capital in Europe.

2.3 Early stage high tech Venture Capital in Europe

First, we look at the availability of VC financing to early stage high tech ventures in Europe. Second, we look at the sources of VC financing in Europe.

2.3.1 Availability of VC funding to early stage high tech ventures in Europe

As indicated above, the classic role of venture capitalism is the supply of capital to risky new, small and innovative enterprises that have difficulty raising such capital from other sources (Bishop, 1996).

However, quite a lot of researchers have indicated that, compared to the US, European venture capitalists have a bias against investing in early stage high tech companies (Martin et al., 2002; Bottazzi and Da Rin, 2002; Lockett et al., 2002). European VCs prefer to invest in later, less risky stages and impose more stringent selection criteria to technology projects compared to non high tech projects (Lockett et al., 2002). So it seems that the average European VC is not really taking on the classical role of venture capital when investing. Venture capital in the US however has had a much longer tradition than it has had in Europe. In what follows, we describe how the EU VC industry has evolved, and highlight the differences that exist between the US and EU with respect to the development of the VC industry and early stage financing by venture capital firms. Next, we discuss the availability of VC funding in Europe, with an emphasis on funding for early stage high tech companies, and how it has evolved over the last years. And finally, we provide some indications on why European VCs are not taking on a classical VC role.

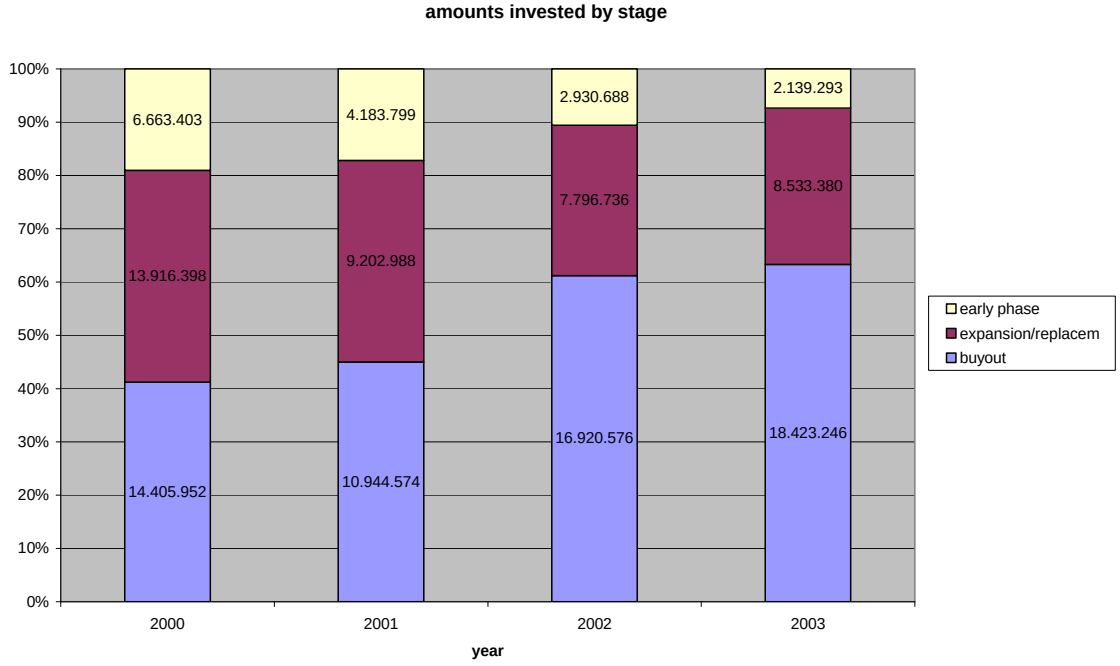
Venture capitalism in Europe- including the UK- got under way in a significant form only in the late 1980s. Most of the growth of the industry occurred since the mid-1990s and especially at the end of that decade. The European VC industry obtained its record level in 2000, raising 48 billion Euro. The UK still represents by far the largest venture capital market, accounting for around 44% of the total in 2001 (Martin et al., 2002), and the most similar with respect to size, maturity and type of VCs to that in the US (Sapienza et al., 1996).

The venture capital market in the US first developed in the 1950s and 1960s. It grew slowly in the 1970s, but then began to take off in the 1980s (Gompers and Lerner, 2001). In recent years it expanded dramatically, investing a total of 104.3 billion dollars in 2000. It is estimated that between a third and a half of US venture capital funds have been

invested in high-technology sectors. Venture funds for MBOs in the US typically account for less than 5% of total venture investment (Martin et al., 2002), even though differences between the US and UK should be interpreted with caution given that most US statistics only take into account early stage and development industry, with the EU data covering the whole private equity industry. As Murray and Marriott (1998) indicate, it is the ability of the US venture capital industry to continue to invest predominantly in young technology based ventures which differentiates them from its major European counterparts.

The proportion that the European industry devotes to management buy-outs is much larger than the US amount. In the US, venture capital usually refers to equity for seed, start-up and expansion activity. Even taking into account these definition differences, we can say, as Murray (1999) notes, that the European venture capital industry is basically a 'development capital' industry. This is supported by an analysis of the EVCA data (EVCA, 2004). The following figure shows the amounts invested per investment stage over the last years.

Figure 3: Amounts invested in Europe per stage



Source: EVCA (2004)

The industry invested a total of 29 billion Euro in 2003. Only 2.14 billion Euro (or 7%) went to companies in their early stage of development, and 6.95 billion Euro (or 24%) was diverted towards high tech investing. About 5.9 % of the funds raised in 2003 were expected to be allocated to early stage high tech investments.

The European high tech venture capital industry is cyclical by nature. Due to the dotcom and internet debacle, investments in and amounts raised for high tech investing fell sharply. For instance, in 2001, funds raised expected to be invested in early-stage high technology companies decreased by 35 percent to 5.6 billion Euro, compared to 6 percent for funds directed to non high-tech companies the year before. The reluctance towards investing in early stage companies, and the fact that the IT crisis has impacted the VC investment preferences with respect to stage, is clear from Figure 3. The internet debacle seems to have affected the entire VC industry with total amounts invested dropping from 34.9 billion Euro in 2000 to 29 billion Euro in 2003. It seems that the industry has shifted from investments in early stage companies and companies in the expansion phase towards the less risky MBO business.

Some researchers indicate that, given the disappointing risk adjusted returns to early stage high tech investments, this reluctance towards early stage high tech investing may have been quite rational (Sahlman, 1990; Amit et al., 1990; Lockett et al., 2002). Murray and Marriott (1998) report, based on a study of Venture Economics and Bannock Consulting (1997), pooled IRRs for early stage investments of 5.7% per year, and 17.6% for MBO funds. If we compare these reported IRRs to the last available ones, from a similar study by Thomson Venture Economics and EVCA (2004) over the year 2003, we find that the situation has deteriorated due to the Internet and dotcom crisis. Pooled IRRs per year for early stage investments were 1.9% compared to 12.2% for MBO funds.
Lockett et al. (2002) compared the attitudes of UK venture capital firms towards early stage high tech investments in 1991 to 1999, and found that, despite material improvements, a bias is likely to remain against VC firms' involvement in the earliest stages of the technology investment cycle. They indicate the penal effects of indivisible fixed costs on small scale investments as one of the reasons for this reluctance towards

early stage high tech investing, just as Murray and Marriott (1998) indicate that funds with fewer than 25 million Euro under management are of increasing economic vulnerability. Next, Lockett et al. (2002) mention the higher risks and uncertainties associated with early stage high tech investments as another reason for the reluctance towards this type of investment. And finally, Amit et al. (1998) point out that VCs will still prefer projects where monitoring and selection costs are relatively low or where the costs of informational asymmetry are less severe. Therefore, they are expected to favour firms with some track records over pure start-ups.

Besides these micro-economic reasons for reluctance towards early stage high tech investing at fund level, Martin et al. (2002) provide an overview of macro-economic and socio-cultural factors that are argued to slow down the development of venture capital across the EU as a whole, especially in comparison to the US. First, there are different attitudes to entrepreneurship, firm ownership and finance, reflecting traditional differences in national financial systems. Second, these are closely related to variations in stock market development. And third, there continue to be significant differences in relevant legal, fiscal and regulatory infrastructures between European countries.

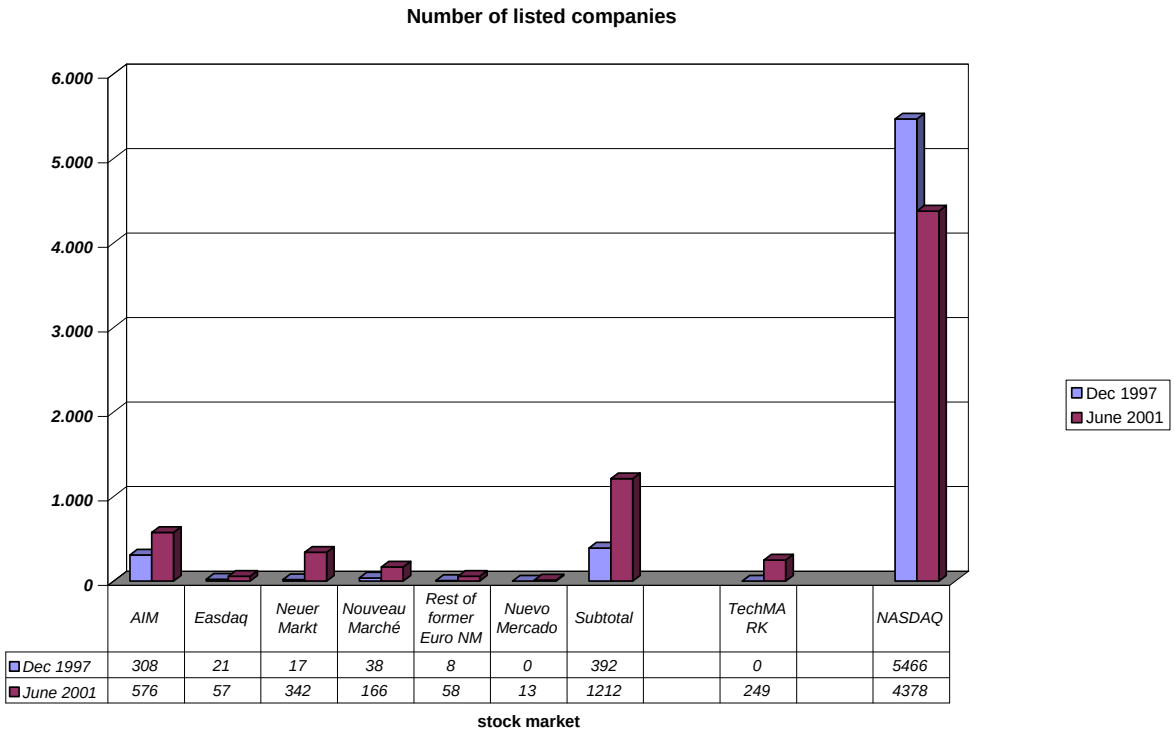
First, as Martin et al. (2002) argue, many European venture markets are influenced by traditional attitudes to firm ownership. Many European companies, which have largely been family owned, prefer to rely on bank loans, and retain their financial independence. In some countries, such as Italy, searching for equity capital has been seen as potentially damaging the firm's reputation. Besides, entrepreneurs themselves suffer from a relatively low social status. Many commentators have however argued that globalisation and integration are at last undermining such traditional financial patterns and preferences in the EU (Kluth and Andersen, 1999; Turner, 2001; Harding and Paterson, 2000). Besides, the new wave of younger owners is more likely to be inclined towards international markets and the role of equity investment (Bowley, 1998).

Second, Martin et al. (2002) argue that there is a lack of active stock markets in European countries. Like Black and Gilson (1998) indicate, well-developed stock markets are

crucial to the existence of a flourishing VC market. Indeed, many researchers (Bygrave and Timmons, 1992; Sutton and Benedetto, 1988; Dimov and Shepherd, 2005) indicate an IPO to be one of the most attractive ways of exit for the venture capitalist. As Martin et al. (2002) indicate, the situation improved at the end of the nineties with the creation of second tier stock markets for high-growth firms, such as the UK's AIM in 1995, the French Nouveau Marché in 1996, Frankfurt's Neuer Markt in 1997, the Dutch NMAX in 1997, the British TechMark (part of London Stock Exchange) in 1999 and Milan's Nuovo Mercato in 1999. Besides, in 1996, Easdaq was created as the European equivalent of the US Nasdaq, which has played a major role in financing the recent wave of fast-growing American high tech companies (OECD, 1996). Euro NM was created in 1997 as an agreement between the Paris, Brussels, Frankfurt, Amsterdam and Milan Stock Exchanges and was intended to promote the cross-listing and trading of their members. While the capitalisation of EuroNM has grown rapidly over the years, this was largely due to the success of the Neuer Markt.

Figure 4 shows how these stock markets, specifically targeting high tech, small companies, have developed over the period 1997-2001. The total number of companies listed on AIM, Easdaq and the Euro NM markets grew from 7% of the Nasdaq total to 27% in three and a half years.

Figure 4: Evolution of the number of listed companies at European stock exchanges 1997-2001



	AIM	Easdaq	Neuer Markt	Nouveau Marché	Rest of former Euro NM	Nuevo Mercado	Subtotal		TechMARK		NASDAQ
Dec 1997	308	21	17	38	8	0	392		0		5466
June 2001	576	57	342	166	58	13	1212		249		4378

Source: Fulghieri and Turner (2001)

With respect to market valuation, these new European markets obtained a market capitalisation of 900.9 billion Euro (June 2001) compared to 20 billion Euro (January 1998). Apart from the TechMARK which was part of the LSE, the Neuer Markt had the largest capitalisation (67 billion Euro).

While Martin et al. (2002) were optimistic about the evolution on the European stock markets in their 2002 study, a closer look into the current situation shows that large changes have occurred on the European stock markets. Nowadays, most of these stock markets are closed or have lost their value. Germany's Neuer Markt, which was the largest market in terms of market capitalisation, was closed in 2002 after losing nearly all of its value during the period 2000-2002 due to the internet stock bubble's deflation, as Figure 5 shows. Easdaq never really took off, just as the smaller NMAX and Euro NM, which were closed in 2000. Easdaq was renamed Nasdaq Europe in 2001. In 2000,

Euronext merged the Paris, Brussels and Amsterdam exchanges. However, Euronext is a general stock exchange, not specifically targeting early stage high tech companies.

Figure 5: Evolution of Neuer Markt index since founding

Source: BBC News (2002)

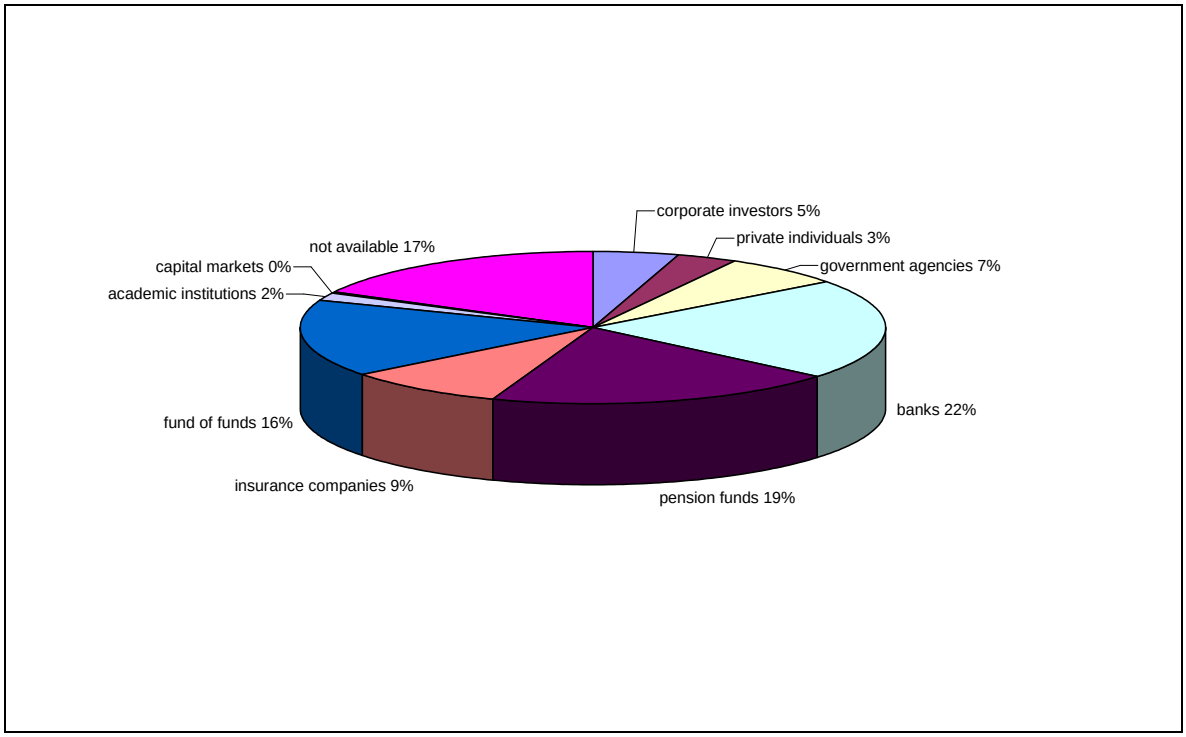
Third, Martin et al. (2002) argue that the complex fiscal and regulatory contexts of many European states have stifled the demand for and the supply of venture capital. However, as the authors indicate, major reforms have taken place and are still under development in order to decrease the impediments to venture capital.

2.3.2 Sources of European VC funds

While Martin et al. (2002) found that there are large differences between the European states with respect to fiscal and regulatory issues, there also seem to exist quite a lot of differences with respect to the sources of VC funds in Europe. Most European VC funds get financed by banks, pension funds and fund of funds, as shown in Figure 6. Banks provided 22% of a total amount of 26 billion Euro of private equity[1] raised in 2003, pension funds provided 19% and fund of funds 16%. Government agencies provided 7% of the total amount raised in Europe.

[1] According to EVCA, private equity provides equity capital to enterprises not quoted on a stock market. Private equity can be used to develop new products and technologies, to expand working capital, to make acquisitions, or to strengthen a company's balance sheet. It can also resolve ownership and management issues. A succession in family-owned companies, or the buyout and buyin of a business by experienced managers may be achieved using private equity funding. Venture capital is, strictly speaking, a subset of private equity and refers to equity investments made for the launch, early development, or expansion of a business.

Figure 6: Private equity raised by source



Source: EVCA (2004)

There are however apparent differences in the way in which venture capital finance is raised in different states. In the UK, Finland, Denmark and Sweden, pension funds have been the major players, supplying a third or more of new funds for investment. Most European countries, however, lack large institutional pension funds (Martin et al., 2002), and instead VCs rely much more on banks for finance. This is for instance the case in Germany, Italy, Austria, France, the Netherlands and Spain, where banks supply more than one third of new funds. In general, corporate investors are not major sources, which they are increasingly becoming in the US.

Most European countries have raised their funds domestically, except for the UK, where American pension funds have recently been the largest investor in UK venture capital (Martin et al., 2002). Of the 14 billion Euro raised in 2003, 45% was provided by non-EU investors.

2.4 Conclusion

This chapter provided an insight into venture capital in a European context. Only about 10% of high tech start-ups make use of venture capital. However, given that little alternatives exist for high tech companies that require financing in an early stage, it is an important financing alternative. However, European venture capitalists, that mainly raise funds from banks, pension funds, and fund of funds, seem to be reluctant towards early stage high tech investing. The major proportion of European venture capital is still invested in MBOs, and this proportion has even increased due to the Internet crisis. There seem to be both micro-economic and macro-economic reasons for this. On a micro-economic level, returns of European funds were much higher over the previous years for MBO investments compared to early stage high tech investments, making it quite natural that European VCs have mainly focused on MBO investing. On a macro-level, the traditional attitudes towards firm ownership, the lack of active stock markets, and the complex fiscal and regulatory contexts of many European states seem to have stifled both demand and supply of traditional venture capital.

2.5 References

Amit R., Glosten L., Muller E. (1990). Entrepreneurial Ability, Venture Investments and Risk Sharing. *Management Science*. 1232-1245.

BBC News (2002). Germany's Neuer Markt to Close. http://news.bbc.co.uk.

Berger A.N., Udell G.F. (1998). The economics of small business finance: the roles of private equity and debt markets in the financial growth cycle. *Journal of Banking and Finance*. 22: 613-673.

Bishop B. (1996). Venture capital in the United Kingdom. *OECD Working Papers*. Volume IV Venture capital and innovation. No. 98. Paris: OECD.

Black B., Gilson R. (1998). Venture capital and the structure of capital markets: banks versus stock markets. *Journal of Financial Economics*. 47(3): 243-278.

Bollingtoft A., Ulhoi J.P., Madsen H., Neergaard H. (2003). The effect of financial factors on the performance of new venture companies in high tech and knowledge-intensive industries: an empirical study in Denmark. *International Journal of Management*. 20(4): 535-547.

Bottazzi L., Da Rin M. (2002). Venture capital in Europe and the financing of innovative companies. *Economic Policy* 34, 231-269.

Bowley G. (1998). Germany: getting stronger and more sophisticated, survey- European Private Equity. *The Financial Times*. 27 November. 5.

Bygrave W. and Timmons J.A. (1992). Venture capital at the Crossroads. Harvard Business School Press. Boston, MA.

Burgel O., Murray G.C. (1998). The internationalisation of start-up companies in high-technology sectors: differences between internationalisers and non-internationalisers. *Proceedings of the Frontiers of Entrepreneurship Research Conference*, MA: Babson College.

De Clercq D., Manigart S., Crijns H., De Cock K., Verzele F. (2005). Global Entrepreneurship Monitor. Rapport voor België en Vlaanderen 2004.

Dimov P.D., Shepherd D.A. (2005). Human capital theory and venture capital firms: exploring "home runs" and "strike outs". *Journal of Business Venturing.* 20: 1-22.

EVCA (2004). Annual survey of Pan-European private equity and venture capital activity. EVCA Yearbook 2004. Brussels.

Fulghieri P., Turner P. (2001). Publication by 3i Venturelab. http://www.insead.edu/entrepreneurship/3i_venturelab.htm.

Gompers P., Lerner J. (2001).The Venture Capital Revolution. *Journal of Economic Perspectives*. 15(2): 145-168.

Harding R. and Paterson W. (2000). The Future of the German Economy: An End to the Miracle? Manchester: Manchester University Press.

Heirman A., Clarysse B. (2004). How and why do research-based start-ups differ at founding? A resource-based configurational perspective. *Journal of Technology Transfer*. 29(3): 247-268.

Kluth M.F., Andersen J.B. (1999). Globalisation and financial diversity: the making of venture capital markets in France, Germany, and UK. In D. Archibugi, J. Howells, and J. Michie: Innovation Policy in a Global Economy. Cambridge: Cambridge University Press.

Lerner J. (1994). The syndication of venture capital investment. *Financial Management*. 23(3): 16-27.

Lockett, A., Murray G., Wright M. (2002). Do UK venture capitalists still have a bias against investment in new technology firms. *Research Policy*. 31: 1009-1030.

Martin R., Sunley P., Turner D. (2002). Taking risks in regions: the geographical anatomy of Europe's emerging venture capital market. *Journal of Economic Geography*. 2(2): 121-145.

Murray G. (1999). Early stage venture capital funds, scale economies and public support. *Venture capital,* 1(4) : 351-384.

Murray G.C., Marriott R. (1998). Why has the investment performance of technology-specialist, European venture capital funds been so poor? *Research policy*. 27: 947-976.

Oakey R. (1984). Finance and Innovation in British Small Independent Firms. *International Journal of Management Science*. 12: 113-124.

OECD (1996). Government Programmes for Venture Capital. Working Group on innovation and technology policy. Paris: OECD.

Roberts E.B. (1991). Entrepreneurs in High Technology. Oxford University Press. New York.

Sahlman W.(1990). The structure and governance of venture capital organisations. *Journal of Financial Economics*. 27: 473-521.

Sapienza H.J., Manigart S., Vermeir W. (1996). Venture capitalist governance and value added in four countries. *Journal of Business Venturing*. 11: 439-469.

Sutton D., Benedetto M. (1988). Initial Public Offerings: A Strategic Planner for Raising Equity Capital. Probus, Chicago, IL.

Thomson Venture Economics and EVCA (2004). Pan-European Survey of Performance – From Inception to 31 December 2003. www.evca.com.

Turner A. (2001). Just Capital: The Liberal Economy. London: Macmillan.

Venture Economics and Bannock Consulting (1997). International Investment Benchmarks Report. Venture Economics, Newark, NJ/Bannock Consulting, London.

Westhead P., Storey D. (1995). Financial constraints on the growth of high technology small firms in the United Kingdom. *Applied Financial Economics*. 7: 197-201.

3 Sample frame, sample and methodology

In order to carry out this study, information was needed on the selection and follow-up behaviour of investment managers and the fund characteristics of the funds they worked for. Besides, information was needed on the portfolio companies invested in and followed up by the investment manager interviewed. In what follows, we first explain how we built a sample frame of early stage high tech VCs. Next, we discuss how the sample was built and provide an overview of the type of investors that were interviewed. Besides, we discuss the sample of portfolio companies that was built based on the information received from investment managers. Finally, we provide an insight into the methodology used in order to collect information on selection behaviour, follow-up behaviour and portfolio company data.

3.1 Sample frame

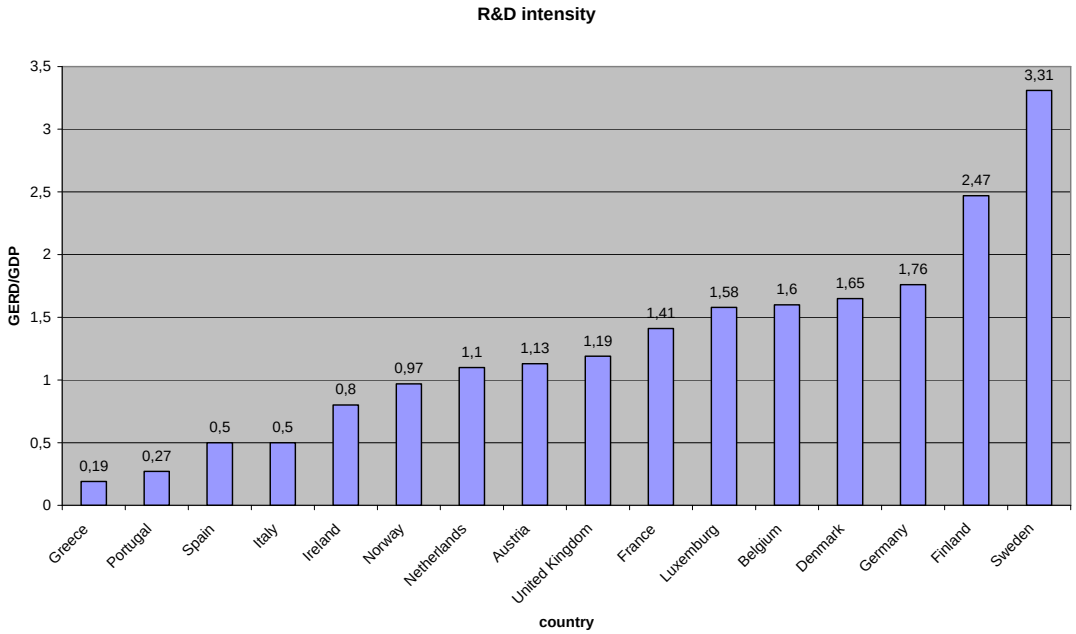
Given that this study focuses on early stage high tech VCs in Europe, we selected those regions that had high R&D intensity and a high VC presence in order to carry out our field research.

Based on Eurostat data, we first made an overview of R&D intensities in European countries (R&D intensity expressed as Gross Domestic Expenditure on R&D/Gross Domestic Product (GERD)/GDP), as shown in Figure 7.

Based on Eurostat data, we selected those countries that had the largest proportion R&D expenditure compared to GERD in Europe. Denmark was left out of the analysis for practical reasons. Within these countries, we selected those regions that had the highest R&D intensity and that had a representation of early stage high tech investors in their region. Average R&D intensity for the Europe 15-region is 1.3.

These regions were: Ile-de-France (France), Helsinki region (Finland), Stockholm region (Sweden), Flanders (Belgium), Bavaria- Münich region (Germany), South-East England (UK), North-Holland (the Netherlands).

Figure 7: Overview of R&D intensities of European countries

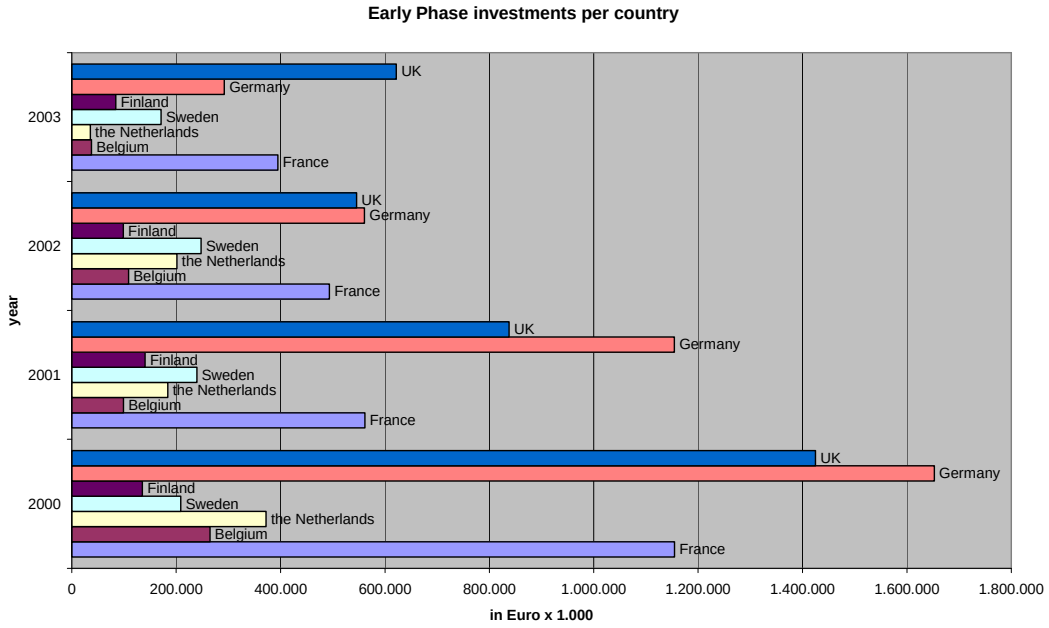


Source: Eurostat data. Years: Austria: 1998; Greece: 1999; Luxemburg: 2000; Belgium, Denmark, Germany, Spain, France, Ireland, Italy, the Netherlands, Portugal, Finland, Sweden, UK: 2001.

The following figure gives an overview of the involvement of the selected countries in early phase investing.

Again, we find the same evolution of the availability of early phase VC. Early stage venture capital in the selected countries seems to have suffered from the Internet bubble deflation, just as it has in Europe as a whole.

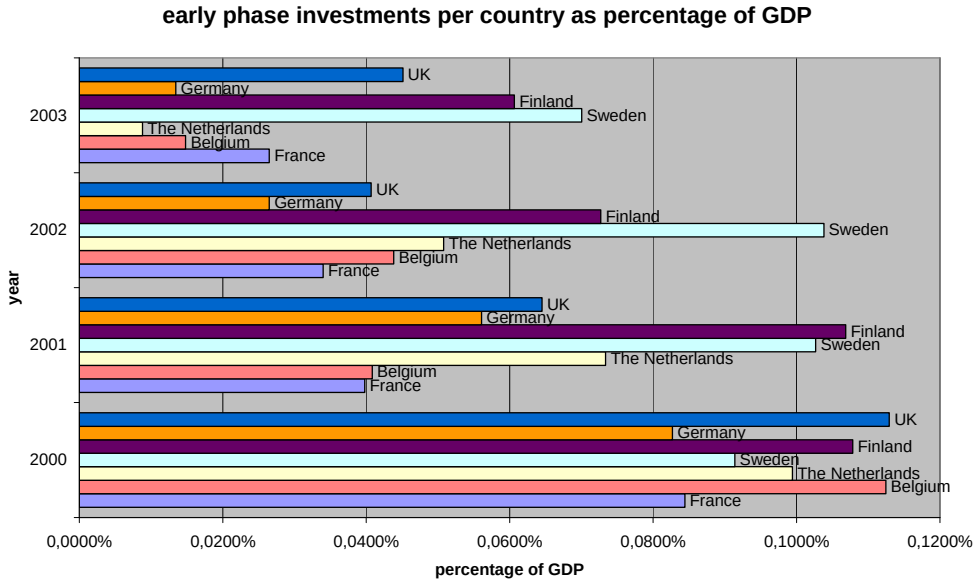
Figure 8: Early phase investments per selected country



Source: EVCA, 2004

The following figure provides an overview of the relative importance of these countries in the supply of early stage venture capital, taking into account the GDP of these countries.

Figure 9: Early phase investments as percentage of GDP



Given that no complete database of early stage high tech investors in the selected regions was available, a dataset was constructed using several sources.

We used the EVCA-directory as a starting point. This is the directory of the European Venture Capital Association. EVCA runs conferences in the domain of venture capital, provides training to venture capital professionals and carries out research among its members and in the European VC community in general. It has an online directory of its members.

Using the EVCA (European Venture Capital Association) directory as only source would have biased the sample as it is well known that it is mostly the larger funds that are member of this association. Membership fee is quite large compared to the membership fees of local organisations, causing mainly larger funds to be part of it. Next to this, very little government funds seem to be member of this association.

Therefore, the EVCA data was supplemented with information from local and national venture capital associations (for instance: Swedish Venture Capital Association), government website information (for instance: www.anvar.fr) and information from independent parties (for instance: academics, government representatives,…). Next to this, a previous study on government initiatives (Knockaert et al., 2003) was consulted in order to make sure that government initiatives were also included in the dataset.

We left venture capitalists that had not existed for more than one year and had not made more than 10 investments in early stage high tech companies out of this dataset. Given that corporate funds have a very specific investment focus (following up on market trends for instance), we decided to leave corporate funds out of the analysis. The sample frame consisted of 220 VC funds over the seven selected regions.

3.2 Sample

3.2.1 Characteristics of the sample of European high tech VCs

The sample frame was stratified in different groups or subpopulations according to the scale of the funds and their institutional investors (private equity arms of banks, private funds, public funds, private/public partnerships).

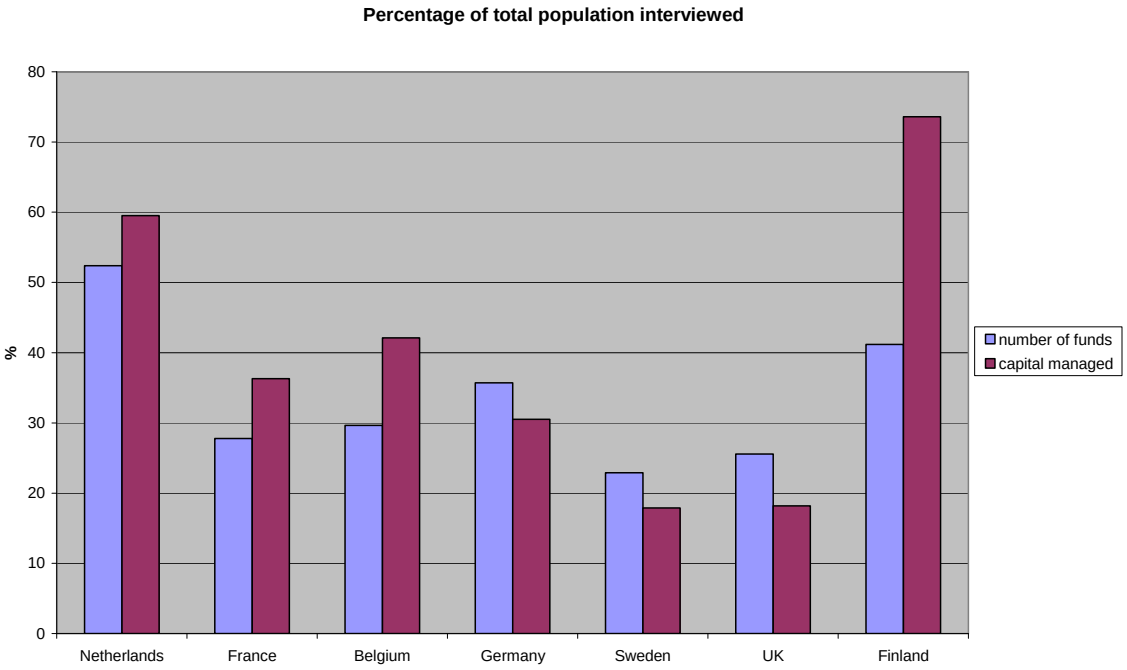
Within strata, funds were selected at random. In total, a stratified sample of 68 VCs was drawn from the sample frame. These VCs were interviewed over the period January 2003-December 2003. All interviews were carried out by at least 2 persons and were fully transcripted. Appendix 8.1 provides a summary of the transcripts and the data collected. The following table indicates the number of VCs that were interviewed per region.

Table 1: Distribution of interviewed VCs by region

Region	Country	Number of interviews carried out
Ile-de-France	France	10
Helsinki region	Finland	7
Stockholm region	Sweden	11
Flanders	Belgium	8
Bavaria (Münich region)	Germany	10
South-East England	UK	11
North-Holland	The Netherlands	11
		68

Figure 10 shows the representativeness of these funds in comparison to the total number of funds in high tech and early stage and their capital managed per region, selected in our database.

Figure 10: Sample of European early stage high tech investors compared to total population



The sample consisted of 45 funds that had not received any public funding. 9 funds were entirely funded by public means, and 12 had received some public funding, next to private sources. Of the 68 funds in the dataset, 6 were private equity arms from banks.

Using the EVCA classification of small, large and mega funds[2], the funds in our sample follow the following distribution: 33 funds were small funds, 21 were large funds and 14 were mega funds.

Response rates were high: in Finland, Sweden and Belgium, a 100% response rate was obtained, in Germany and France, 91% of the contacted VCs agreed to participate, in the Netherlands the response rate was 92%. In the UK, 68% of the contacted VCs agreed on participation, which may be caused by the fact that the UK VC industry is the most established one, and probably the most investigated one. The reasons for the high

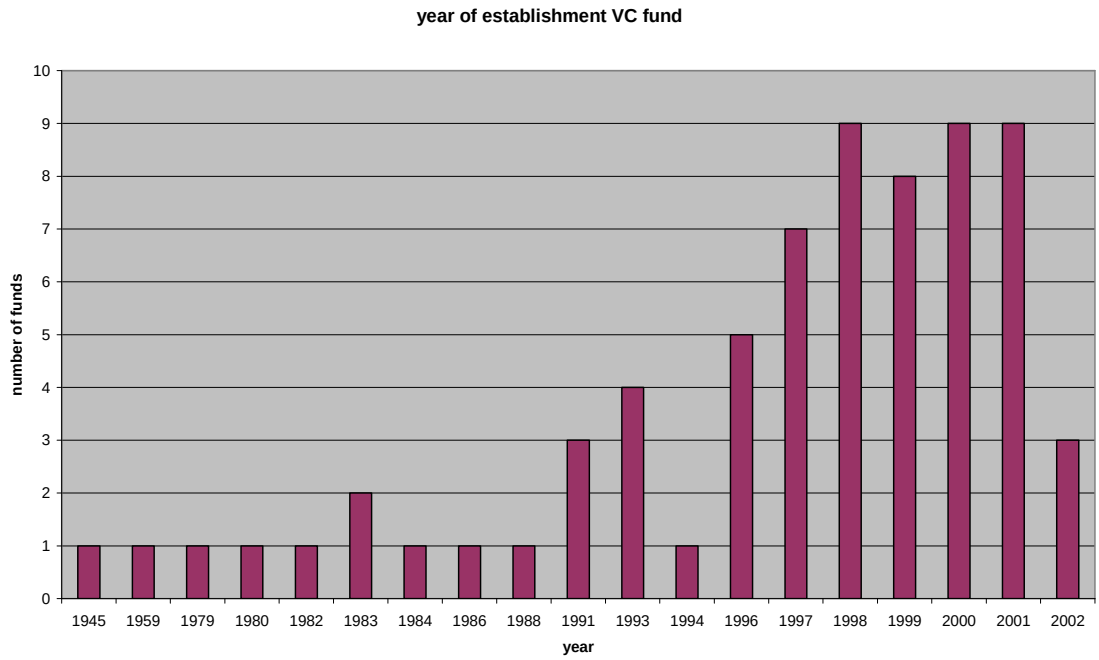
[2] Venture funds having a fund size between 100 million Euro and 250 million Euro are considered to be large funds for venture investments. Mega funds are those funds having a size of more than 250 million Euro, small funds have less than 100 million Euro under management.

response rates lie most probably in the fact that face-to-face interviews were conducted and that we positioned the interview more as a 'game' than as a traditional 'question/answer' interview. With respect to the strata that were used to build the sample, a response rate of 94% of the contacted small funds was obtained. For large funds, this response rate was 91%, compared to 78% for the mega funds. Next to the stratification based on the fund size, a stratification was made based on the institutional origin of the funds managed. Response rates were 100% for public funds, private equity arms of banks and for public/private partnerships. A response rate of 85% was obtained for the private funds contacted. Below, we provide more insight in the sample of funds interviewed.

3.2.1.1 Fund age

The following figure gives an overview of year of establishment of the VC funds interviewed.

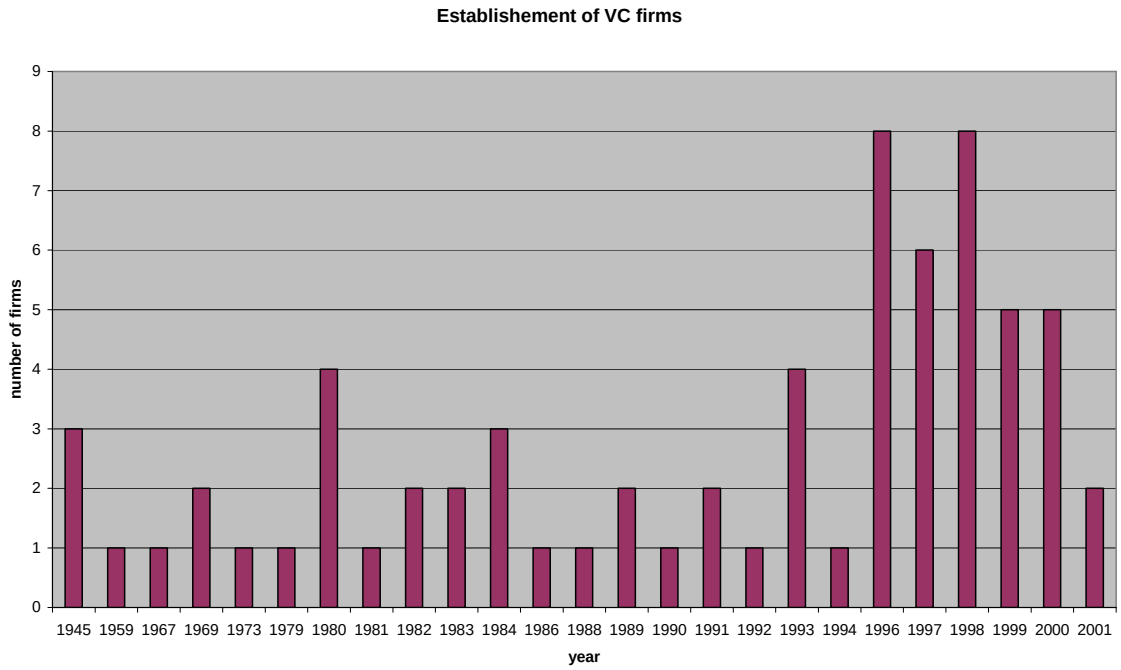
Figure 11: Year of establishment of the VC funds interviewed



Most funds were only established recently with the boom of the European VC industry as the figure shows. In this context, it is important to distinguish between VC fund and VC firm. Even though the unit of analysis of this study is the VC fund, it has been taken into account whether the fund studied was an independent fund or was established within an

existing VC firm. For convenience, we also provide an overview of the dates of establishment of the VC firms. 27 of the VC funds interviewed belonged to a holding, and are part of a group of funds that are established within the VC firm. The others were independent funds.

Figure 12: Year of establishment of VC firms interviewed



The following table gives an overview of the age of the funds at the time of interview, according to the fund size stratification.

Table 2: Fund distribution with respect to fund age (number of years)

	Number of observations	Minimum	Maximum	Mean	Median	Standard Deviation
Overall sample	68	1	58	8.06	5.00	9.45
Small funds	33	1	20	6.12	5.00	4.01
Large funds	21	1	23	6.05	4.00	5.93
Mega funds	14	2	58	15.64	9.50	17.00

The table shows that the mega funds are the most established funds. The average age of the complete sample is 8 years, with the oldest fund being in business for 58 years.

3.2.1.2 Fund size

Table 3 shows how the sample was distributed with respect to fund size.

Table 3: Distribution of funds with respect to fund size

	Number of observations	Minimum (mio Euro)	Maximum (mio Euro)	Mean (mio Euro)	Median (mio Euro)	Standard Deviation
Overall sample	68	0.9	4400.0	269.0	111.6	654.2
Small funds	33	0.9	99.5	32.6	21.9	28.5
Large funds	21	111.6	225.0	159.9	145.0	35.6
Mega funds	14	300.0	4400.0	1045.5	500.0	1233.8

The largest fund manages 0.9 million Euro, whereas the largest fund has a size of 4400 million Euro.

The following table gives an overview of the size of the funds, measured as the number of investment managers that are employed.

Table 4: Distribution of funds with respect to number of investment managers

	Number of observations	Minimum	Maximum	Mean	Median	Standard Deviation
Overall sample	68	1	48	7.94	5.00	9.30
Small funds	33	1	11	3.87	3.00	2.18
Large funds	21	4	48	9.56	6.50	10.05
Mega funds	14	3	37	16.89	9.00	13.82

The largest fund in the sample is managed by a team of 48 investment managers, whereas the smallest fund is managed by a single investment manager. The funds interviewed on average employ about 8 investment managers. If we take into account that these funds belong to VC firms, and calculate the investment management staff for the VC firms, we find that the average VC firm is managed by 40 investment managers, with a fund of 300 investment managers (3i) being the largest one.

3.2.1.3 Sources of funds

Information was collected on the sources of funds. 6 funds were private equity arms of banks, 9 funds were public funds, and 12 were public/private partnerships. The table below provides an overview of the distribution of the funds according to the percentage of public finance in their capital.

Table 5: Distribution of funds with respect to percentage of public capital

	Number of observations	Minimum	Maximum	Mean	Median	Standard Deviation
Overall sample	68	0%	100%	20.83%	0.00%	35.72%
Small funds	33	0%	100%	26.81%	0.00%	39.13%
Large funds	21	0%	100%	16.90	0.00%	32.65%
Mega funds	14	0%	100%	12.42%	0.00%	31.33%

The funds interviewed on average have 21% of public funding. The small funds have on average the highest percentage of public capital, the mega funds have the least.

3.2.1.4 Diversification versus specialisation

Some funds use a diversified approach, others are specialized funds (that operate independently, or that are part of a larger VC firm that may be specialized or not). Specialized funds focus on one or few technologies or industries. An example of such a fund is BioAm in France, focussing on biotechnology only. We use the industry classification of EVCA to determine the degree of diversification/specialisation of a VC fund. EVCA identifies the following eight high tech sectors: communications, computer related, other electronics related, biotech, medical/health related, energy, chemicals and materials, industrial automation. The following table gives an overview of the diversification across these sectors for the VC funds interviewed.

Table 6: Distribution of funds with respect to the number of industries managed

	Number of observations	Minimum	Maximum	Mean	Median	Standard Deviation
Overall sample	68	1	8	4.09	3.00	2.30
Small funds	33	1	8	4.58	4.00	2.53
Large funds	21	1	8	3.29	2.00	2.03
Mega funds	14	1	8	4.14	4.00	1.92

3.2.2 Characteristics of the sample of investment managers interviewed

3.2.2.1 Educational background

During the interviews, we collected information on the educational background of the investment manager. We made a distinction between investment managers with a business background (45 interviewees), investment managers with a technical background (36 interviewees), and investment managers who had both (16 interviewees).

3.2.2.2 Professional experience

Information was collected on the professional experience of the investment managers. Some had been consultants before joining the venture capital industry, others had been active in the academic world, others had worked at banks or audit/accounting firms, whereas others had been managers in industry. Some had been entrepreneurs themselves. We coded these experience variables with dummy variables (0= has not had this type of experience, 1= has had this type of experience) on the one hand. On the other hand, we also collected the number of years they had been active in business, the financial world or as consultant. Besides, the number of years they had been active as investment manager was collected and whether or not they had worked at other funds than the one they worked at the time of the interview (dummy variable). 7 investment managers had worked in academia, 18 had worked as consultant, 23 had been active in the financial world, 39 had been managers in industry, and 10 had been entrepreneurs themselves. 14 of them had previous experience with other VC funds. The following table provides the descriptives for the number of years experience. People from the financial world had on average worked for 6.6 years in either a bank, audit firm or as accountant. Investment

managers who had worked in consulting before joining the VC industry had on average 3.9 years experience in consulting. Investment managers after a career as managers in a company had on average 8 years of experience. The investment managers in our sample had on average 4.85 years of experience as investment manager.

Table 7: Descriptive statistics for the professional experience of investment managers interviewed

	Number of observations	Minimum	Maximum	Mean	Standard Deviation
Consulting experience	68	0.00	10.00	1.02	2.03
Financial experience	68	0.00	30.00	2.23	4.65
Business experience	68	0.00	25.00	4.55	6.07
Investment management experience	68	0.00	17.00	4.85	3.99

3.2.3 The sample of portfolio companies

Mid 2004, all of the interviewed investment managers were asked to provide us with a list of portfolio companies. We asked them to include only those companies for which they had been involved in the selection phase, and that were currently being followed up by them. We received responses from 37 out of the 68 interviewed VCs. There are two reasons why only part of the initially interviewed investment managers co-operated on this part of the research. First, the interviews were carried out in 2003. During these interviews, no information on portfolio companies was collected as it was felt that a relationship built on trust with the interviewees had to be built, especially as we were asking for information on the portfolio companies they were personally managing. We kept in touch after the interview and provided the interviewees with our research results (parts on selection and follow-up behaviour). When we contacted the investment managers again in 2004, 10 of the VCs were either out of business, or either the investment manager interviewed had left the VC firm. Other investment managers preferred not to co-operate in this part of the research.

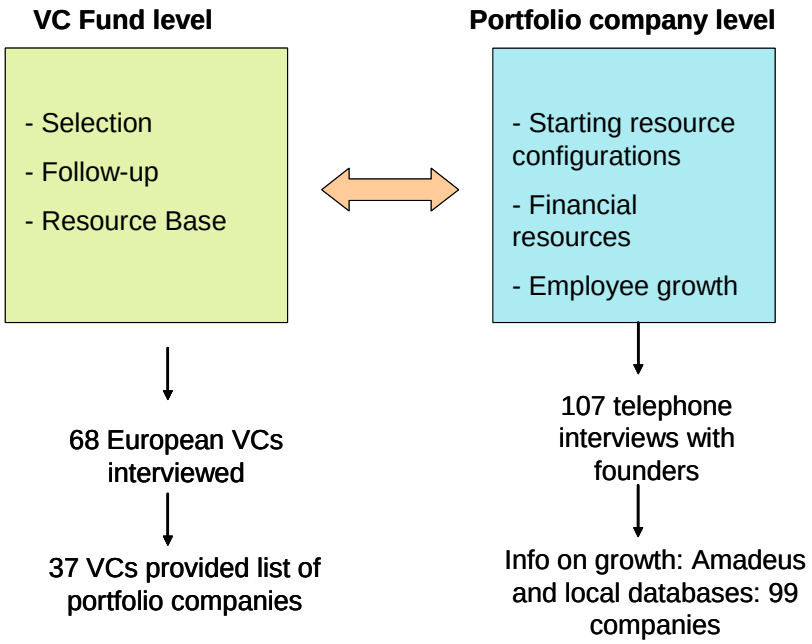
This resulted in a database of 172 high tech firms that had been financed by 5 Dutch, 4 British, 5 German, 4 French, 7 Belgian, 7 Swedish and 4 Finnish VC funds. Those firms

that had only been in the VC's portfolio since 2003 or later were excluded from the analysis, resulting in a database of 140 firms.

3.3 Methodology: data collection

Figure 13 summarizes the methodology used in order to collect data.

Figure 13: Overview of methodology used in data collection



In what follows, we first present how data at VC level was collected, both with respect to selection and follow-up behaviour. For more detailed information on methodology used for data analysis, we refer respectively to chapter 4 for selection behaviour and 5 for follow-up behaviour. Second, we discuss the collection of portfolio company information. For more detailed information on the methodology used for data analysis, we refer to chapter 6.

3.3.1 VC information

Interviews were carried out during the period January 2003-December 2003 in the selected regions. Interviews took on average 1.5 hours. During the interviews, information on selection behaviour, follow-up behaviour and fund and investment management characteristics was collected. Below, we describe the methodology used in order to collect this specific information.

3.3.1.1 Selection behaviour

So far, the most common approach to study selection behaviour was a post hoc method which consisted of asking why investment managers had invested in certain proposals. This method could however 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 on these post hoc methods, researchers started to experiment with real time methods such as verbal protocol analysis (where VCs think 'aloud' during the screening process), which was in turn criticized for its subjectivity of analysis and interpretation. Riquelme and Rickards (1992) argue that verbal protocol analysis is more an art than a science. Consistent with their suggestions, we use conjoint analysis as a technique for the analysis of VCs' decision making.

Conjoint analysis is a general term referring to a technique that requires respondents to make a series of judgements, based on profiles, from which their 'captured' decision processes can be decomposed into its underlying structure. The profiles in this case were 27 business proposals that were presented to the investment manager and judged on a five point Likert scale. The profiles were drawn from 12 attributes (team, entrepreneur, contact with the entrepreneur, uniqueness of the product, protection of the product, market acceptance, platform technology, location, size and growth of the targeted market, time to break-even and return on investment) with several levels (Table 8 in Chapter 4). These attributes and levels were compiled from previous research and after consultation with practitioners. Using a fractional factorial design based on Addelman's basic plans (Addelman, 1962) for designing an orthogonal main effects plan resulted in 27 profiles or

business proposals. From the investment manager's scores, conjoint analysis derived utility scores for each attribute, indicating how important each characteristic is to the respondent's overall preference of a product. For a detailed description of the conjoint methodology used, we refer to chapter 4.

3.3.1.2 Follow-up behaviour

With respect to follow-up behaviour, we first asked the investment managers interviewed to estimate the average time spent per portfolio company per month.

Second, we assembled information on the involvement in monitoring and value-adding activities. In order to do so, we first identified the activities that VCs undertake. We took existing research from Sapienza et al. (1996), Sapienza (1992), Pruthi et al. (2003) and MacMillan et al. (1989) as a starting point. The latter focused on all follow-up activities, whereas the first focused on value-adding activities only. Pruthi et al. (2003) give an overview of all follow-up activities, but focus their analysis on monitoring activities. A synthesis of this research resulted in five monitoring activities, and 14 value-adding activities. The pilot interviews identified three additional value-adding activities for inclusion in the list, all of which were specific to high tech investing. These were: "negotiating intellectual property rights", "recruiting the head of R&D" and "forming the Advisory Board". This resulted in 22 follow-up activities. We refer to Table 15 in Chapter 5 for an overview of follow-up activities identified.

The investment managers were asked to score these follow-up activities on two scales: frequency and importance. Investment managers scored the frequency of each of the activities on a five point Likert scale which ranged from 1= never carry out this activity for portfolio companies and 5= always carry out this activity for portfolio companies. They also scored the importance that they attached to the activities on a scale ranging from 1=little important follow-up activity to 5= very important follow-up activity. Multiplying both importance and frequency scores of follow-up activities resulted in 'involvement indicators' for each of the 22 follow-up activities, with scores ranging between 1 and 25, with 1 being low involvement for the follow-up activity, and 25 being very high involvement for the follow-up activity.

For an analysis of the early stage high tech VC's follow-up behaviour, we refer to Chapter 5.

3.3.1.3 General fund information and investment manager characteristics

Before having the interview, we collected general information on the fund (fund size, date of establishment, number of funds managed by the holding, number of investment managers,…) from the fund's website, if available. This information was checked during the interview and additional information was obtained. This information includes the date of establishment of a fund or a holding, sector of investment (based on the EVCA classification for high tech), capital managed by fund or holding, sources of funds, percentage public capital, geographical focus of the fund, minimum and maximum investment sizes, maximum investment per company, average investment size, number of investments since founding, number of investment managers. We refer to 3.2.1 for an overview of the characteristics of the sample and descriptives of the data collected. We refer to the appendix, section 8.1 for the profiles of the VCs interviewed, including the general fund information.

Besides the general information on the fund, specific information was collected concerning the investment manager. We both collected information on the educational background of the investment manager (technical education /business education), the experience of the investment manager (consulting /academic /finance /business /entrepreneurial /in investment management) and collected the number of years he or she had been involved with each of the activities. We refer to 3.2.2 for an overview of the information collected.

3.3.2 Portfolio company information

Mid 2004, all of the interviewed investment managers were asked to provide us with a list of portfolio companies. We asked them only to include those companies for which they had been involved in the selection phase, and that were currently being followed up by them. We received responses from 37 of the 68 interviewed VCs.

This resulted in a database of 172 high tech firms that had been financed by 5 Dutch, 4 British, 5 German, 4 French, 7 Belgian, 7 Swedish and 4 Finnish VC funds. Those firms

that had only been in the VC's portfolio since 2003 or later were excluded from the analysis, resulting in a database of 140 firms.

3.3.2.1 Starting resource configurations, financial resources

Information on the starting resource configurations of the portfolio companies was collected through telephone interviews conducted during the second half of 2004. 107 founders of portfolio companies were interviewed concerning their starting configurations (such as founding team, commercial experience of the founders), the activities of the company and the evolution of the company's financial resources over its lifetime.

3.3.2.2 Portfolio company growth

In order to collect information on portfolio company growth, we relied in first instance on a European database of annual accounts of companies, called Amadeus. The Amadeus' data were supplemented by information retrieved from national databases, including Fame (UK), Belfirst (Belgium), REACH (The Netherlands) and Hoppenstedt Firmendatenbank (Germany).

This resulted in a unique dataset of 99 firms for which both annual account, starting resource information, and information on the VC investing were available. These 99 firms had received financing from 32 different European VCs. 5 companies were based in the Netherlands, 14 in the UK, 11 in Germany, 8 in France, 25 in Belgium, 19 in Sweden, 12 in Finland, and 5 in other European countries, Israel or the US.

To judge whether the final sub sample (32 VCs) used in this study could be used to make inferences about the whole sample (68 VCs), t tests and chi-square tests were performed on all VC variables, being variables on selection behaviour, follow-up behaviour, and fund characteristics. Differences were insignificant for selection behaviour and fund characteristics (such as fund size). With respect to follow-up behaviour however, the sub sample showed a higher involvement than the remaining VCs, which we will take into account during the analyses.

We studied employee growth as a measure for growth. Delmar et al. (2003) argue that there is no best way of measuring high tech venture growth. Several scholars argue that

traditional accounting-based indicators of profitability are inappropriate for early stage RBSUs (e.g. Lee et al., 2001). Delmar et al. (2003) for instance indicate that assets and employment will grow before any sales will occur. Therefore, resource-based view scholars value employment and assets based measures as a highly suitable indicator of firm growth (Penrose, 1959; Kogut and Zander, 1992). Researchers studying the liability of newness have emphasized the importance for early stage high tech companies of reaching critical mass as soon as possible in order to bridge this liability (Oakey, 1995; Storey and Tether, 1998). Besides, policy makers are especially interested in identifying firms that contribute most to job creation. Besides, the focus on employee growth makes this research particularly interesting to VCs as researchers have provided evidence on a positive association between employee growth and value creation over successive rounds of financing (Davila et al., 2003).

Employee growth of early stage portfolio companies was derived from annual accounts. The growth measure studied in this study is yearly absolute post-investment employee growth, calculated as

$$\left(FTE_t - FTE_{i-1}\right)/(t-i-1)$$

With FTE_t the number of employees at the end of the last available year (t) (2002 or 2003), FTE_{i-1} the number of employees at the end of the last year before investment (i-1) by the VC.

3.4 References

Addelman S. (1962). Orthogonal Main-Effect Plans for Asymmetrical Factorial Experiments. *Technometrics*. 4(1): 21-46.

Davila A., Foster G., Gupta M. (2003). Venture capital financing and the growth of startup firms. *Journal of Business Venturing.* 18:689-708.

Delmar F., Davidsson P., Gartner W.B. (2003). Arriving at the High-Growth Firm. *Journal of Business Venturing*. 18: 189-216.

EVCA (2004). EVCA Yearbook. Annual Survey of Pan-European Private Equity & Venture Capital Activity.

Fischhoff B. (1982). For those condemned to study the past: heuristics and biases. In: Hindsight, Judgement under uncertainty: heuristics and biases. Cambridge University Press.

Knockaert M., Clarysse B., Vandenhaute V. (2003). Europese benchmark studie naar overheidsinitiatieven die het overbruggen van de equity gap beoogen. Steunpunt ondernemerschap, ondernemingen en innovatie.
http://www.ondernemerschap.be/documents/pdf/st_europese_benchmark.pdf

Kogut B. and Zander U. (1992). Knowledge of the Firm, Combinative Capabilities, and the Replication of Technology. *Organization Science*. 3 (3): 383-397.

Lee C., Lee K., Pennings J.M. (2001). Internal capacilities, external networks, and performance: a study on technology-based ventures. *Strategic Management Journal*. 22: 615-640.

MacMillan I.C., Kulow D.M., Khoylian R. (1989). Venture capitalists involvement in their investments: extent and performance. *Journal of Business Venturing*. 4: 27-47.

March J.G., Feldman, M.S. (1981). Information in organisations as signal and symbol. *Administrative Science Quarterly*. 26: 171-186.

Oakey R. (1995). High Technology New Firms: Variable Barriers to Growth. Paul Chapman Publishing Ltd. London.

Penrose E.T. (1959). The theory of the growth of the firm. New York: Wiley.

Pruthi S., Wright M., Lockett A. (2003). Do foreign and domestic venture capital firms differ in their monitoring of investees? *Asia Pacific Journal of Management*. 20: 175-204.

Riquelme H., Rickards T. (1992). Hybrid conjoint analysis: an estimation probe in new venture decisions. *Journal of Business Venturing*. 7: 505-518.

Sapienza H.J. (1992). When do venture capitalists add value? *Journal of Business Venturing*. 7: 9-27.

Sapienza H.J., Manigart S., Vermeir W. (1996). Venture capitalist governance and value added in four countries. *Journal of Business Venturing*. 11: 439-469.

Shepherd D.A., Zacharakis A. (1998). Conjoint analysis: a new methodological approach for researching the decision policies of venture capitalists, *Venture Capital*. 1(3): 197 – 217.

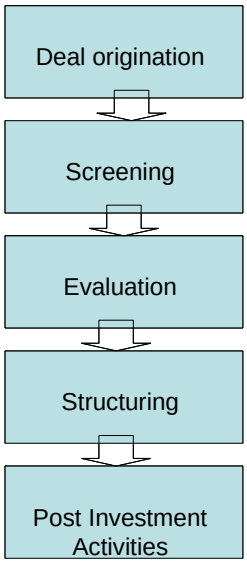
Storey D.J., Tether B.S. (1998). Public policy measures to support new technology-based firms in the European Union. *Research Policy*. 26: 1037-1057.

4 Selection behaviour of early stage high tech VCs

4.1 Introduction

Tyebjee and Bruno (1984) describe the activities of venture capitalists as an orderly process involving five sequential steps. They present this process as follows:

Figure 14: Decision process model of venture capital investment activity



Source: Tyebjee and Bruno, 1984

During the deal origination, VCs become recognizant of potential investment activities. During the second step, the screening process, the VC seek to concentrate on a manageable set of potential deals. According to Tyebjee and Bruno (1984), their screening criteria reflect a tendency to limit investments to areas with which the VC is familiar. They state that this initial screening is based upon four criteria: (1) the size of the investment and the investment policy of the venture fund, (2) the technology and market sector of the venture, (3) the geographic location of the venture and (4) the stage of financing.

The evaluation step involves an assessment of the potential return and risk of a particular deal. If the outcome of the evaluation process is a favourable one, the VC enters into a

negotiation process in order to structure the deal. Post-investment activities include setting up controls to protect the investment, providing consultation to management and finally, helping carry out the exit.

This chapter focuses on the selection process of the VC, containing in Tyebjee and Bruno (1984)'s visualisation the stages of screening and evaluation. In what follows, we will mainly look at the screening made by VCs at the moment they take the decision as to whether or not to further investigate an initial proposal. Therefore, selection studied in this chapter contains the screening phase, but only limitedly the evaluation phase. The due diligence phase, as part of the evaluation phase, is not part of this study. This due diligence is highly dependent on the type of company and the targeted market of the evaluated proposal, and is an in-depth study of the proposal's potential by the VC.

As Kaplan and Strömberg (2001) state, the investor can engage in information collection before deciding to invest, in order to screen out ex ante unprofitable projects and bad entrepreneurs. This screening and selection phase is carried out in order to try to limit the costs incurred from adverse selection and moral hazard that are caused by information asymmetries (see chapter 1).

Issues as to how venture capitalists select which proposals to invest in has been a major topic of research over the past two decades. Previous research has identified a number of important criteria on which venture capital firms base their decision to invest. First, the "human capital" of entrepreneurial teams was found to be an important decision factor. Human capital 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). A second stream of research identified the market environment in which the venture starts up as one of the major decision factors. This environment 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). Other factors which have been found to be important criteria used by venture capitalists to evaluate venture proposals are: financial criteria and exit opportunities (Macmillan et al., 1987) and the product/service characteristics (Macmillan et al., 1987; Muzyka, 1987).

Virtually all of the above mentioned studies have been undertaken with US-based venture capitalists. Furthermore, Muzyka et al. (1996) emphasize that these studies were exploratory in terms of their data collection techniques and assume a single hierarchy of decision criteria. To overcome these limitations Muzyka et al. (1996) explored trade offs in decision criteria among European Venture Capitalists. They found three groups of VCs in Europe: those primarily concerned with investing nationally, those who focus solely upon the deal, and mainstream investors who consistently, and instinctively, rank management team criteria as their primary criteria. The Muzyka et al. (1996) study was a first attempt to synthesize and hierarchically classify the selection criteria found by the first wave of VC studies. The results, however, were rather meagre, having one cluster with only four VCs and a very large one where – consistent with the previous studies – the "human factor" is the utmost important one.

Since the Muzyka study in the mid-nineties, the venture capital industry in Europe has grown significantly. In parallel, VC scholars have emphasized that the VC industry is fragmented into different segments. A number of studies have found that early stage VCs differ from late stage VCs (e.g. Elango et al., 1995; Sapienza et al., 1994); and that high tech and non-high tech VCs differ (Lockett et al., 2002; Murray and Lott, 1996; Baum and Silverman, 2003). Therefore, the fact that, to date research on investment selection behaviour of VCs has only focused on the venture capital industry as a whole may be problematic. In this chapter we start from the premise that high tech investing is different from non-high tech investing (Lockett et al., 2002), and focus only on those venture capitalists for whom investing in high tech is core business. High tech investors play a

key role in funding high tech companies that can accomplish technological renewal, and thus create economic growth.

This study departs from the idea that not all venture capitalists use the same hierarchy of decision criteria for selecting investment proposals. In particular, we address two main research questions:

RQ1: Do early stage high tech venture capitalists differ in their investment selection behaviour?
RQ2: What drives the differences in behaviour across early stage high tech venture capitalists?

Consistent with Muzyka et al. (1996), we test this idea by investigating the trade offs made by early stage high tech venture capitalists, across Europe, at the moment they take the decision as to whether or not to further investigate an initial proposal. By focusing only on the population of early stage high tech venture capital firms in Europe we are able to generate a degree of homogeneity in terms of the VC firms we investigate.

The chapter is structured as follows. First, we outline the theoretical background and develop hypotheses. Second, we outline the method used, focusing on the use of conjoint analysis. Third, we present a cluster analysis of the venture capital firms according to their investment selection behaviour and then link the cluster results with the characteristics of the funds. Finally, we draw conclusions from our results.

4.2 Theoretical background and hypotheses

4.2.1 The heterogeneity of VC investment behaviour

As outlined above, many studies have examined the selection criteria of venture capitalists. The early studies in the 1980s to mid 1990s found that for the average venture capitalist the “human factor” is the most important criterion. This human factor can be found in the entrepreneurial experience, the management skills and the business

experience, which are allocated to the founding team (see: Hall and Hofer, 1993, for a review of these early studies). Sandberg et al. (1988) suggest a contingent relationship among the criteria used by VCs. As with most studies at that time, they argue that deals are selected based upon the human resource criteria in combination with the characteristics of the industry, the proposed strategy or business model and the structure of the deal.

Although these early studies revealed interesting and useful insights, they were criticized for using simple methodologies in assessing the evaluation criteria. In short, the most common approach was a post hoc methodology which consisted effectively of asking why investment managers had invested in certain business proposals. This method, however, is problematic as 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 on these post hoc methods, researchers started to experiment with real time methods such as verbal protocol analysis. For example, Hall and Hofer (1993) presented four venture capitalists six protocols for assessment. They found that VCs screen and assess business proposals very rapidly which makes it unlikely that they can persistently evaluate their decisions post hoc. Also, key criteria used by the VCs are related to the financial and economic conditions of the business plan such as long term growth and profitability. Surprisingly they found a lack of importance placed on the entrepreneur or his/her team. To date, this is the only study which has found financial criteria to be of utmost importance.

In a further development, 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. Conjoint analysis is not new, it is a general term referring to a technique that requires respondents to make a series of judgements, based on profiles, from which their 'captured' decision

processes can be decomposed into its underlying structure. A profile is simply a combination of all the attributes where each attribute is described by one of its levels. It has been used in other fields of research, especially in marketing.

Muzyka et al. (1996) followed Riquelme and Rickards' (1992) pioneering work, to use conjoint analysis in assessing the decision criteria used by VCs. In a more sophisticated analysis, they analysed the key criteria used by European VCs in evaluating potential investments characterized by 53 profiles (each profile required the respondent to make a trade-off between a pair of independent criteria). To determine which attributes were to be included in the conjoint analysis, open-ended interviews with VCs were carried out. The venture capitalists made 53 pair wise trade-offs with multiple levels. They found that among the first seven, five management team criteria were ranked and product-market criteria appeared to be moderately important; fund and deal criteria were at the bottom of the rankings. Over 75 percent of the venture capitalists in their study conformed to this profile. Zacharakis and Meyer (2000) refined this use of conjoint analysis to let venture capitalists invest in 50 ventures in an experimental setting. They found that team factors were much less high in the hierarchy of importance, and a significant group of VCs ranked market and competition variables as being the most important.

To summarize, the above studies have identified three groups of venture capitalists. One group, which is called by Muzyka et al. (1996), the mainstream venture capitalist, focuses on human resources, followed by product market and financial criteria such as exit possibilities. A second group, identified by researchers using real life protocols, are investors which place most importance on the financial aspects of the business plan such as growth, time to break-even and profitability. Finally, a new stream of research using conjoint analysis seems to recognize a group which is much more concerned about the product market characteristics of the business plan than of the management and entrepreneurial team criteria.

As outlined above, previous research has shown that the venture capital industry is not homogeneous in its investment focus. Lockett et al. (2002) found that, as with the Murray

and Lott study (1995), a bias remained against VC firms' involvement in the earliest stages of the technology investment cycle. We have reason, therefore, to believe that the high tech VC industry is a distinct market in itself and that firms may behave differently from their non-tech counterparts. It is for this reason that our research only focuses on those venture capitalists investing in early stage high tech proposals. Previous research focusing on the entire VC industry has found that VCs exhibit heterogeneity in their selection behaviour. We have no reason to believe that this would not be the case with early stage high tech investors only, and do expect to find differences between VCs focusing on market, financial, human or product characteristics. We take the heterogeneity of the VC's selection behaviour as a point of departure.

In the next section we examine what may drive these differences in behaviour.

4.2.2 What drives differences in investment selection behaviour?

The investment decision of the investment manager with respect to a specific project may be a determinant of 1) the investment strategy of the VC and 2) the result of a screening of the potential deal. This research focuses on the screening of the potential deal.For previous research on the strategy employed by the VC (for instance, diversification and specialisation issues), we refer to De Clercq et al. (2001).

An important influence on VC investment selection behaviour may be the **source of funds** the VC has to invest. The source of funds may affect investment strategy of the fund, which may in turn affect the investment decision on specific deals. Hellman (2002) develops a theory on strategic investment, indicating that private equity arms of banks seek complementarities between their venture capital and lending activities. Therefore, it seems natural that they will base their investment decision on other criteria than non-strategic investors. The same goes for public funds. Investment managers investing funds from public initiatives may have other objectives rather than purely financial ones (Manigart et al., 2002). For instance, they may be focusing more on the capacity of technological breakthrough and renewal of a project, as this may influence economic growth. A second reason for funds to behave differently according to their sources of

finance lies in the incentive system that is in place for their investment managers. Investment managers at non-captive VC companies are more under pressure to generate high profits compared to captive VCs. Weber and Dierkes (2002) show that profit-oriented VCs more frequently offer carried interest to investment executives than public sector owned VCs, which aligns their interests in generating profits with those of the investors. A high profit orientation of VCs makes it likely that they will provide greater post-investment management support in order to increase the chances of achieving these performance targets (Engel, 2004).

Mayer et al. (2005) find that venture capitalists invest in different types of business proposals according to their own sources of funds. For instance, bank and pension fund backed VC firms are inclined towards late stage investments in low tech domestic sectors whereas government backed VC funds invest in early stage domestic high tech sectors. Although this study does not specifically look at the investment criteria used, it indicates that the institutional structure has an important effect on the decisions which are made by the investment manager. In other words, it suggests that the investment criteria are indeed different. Therefore, we offer the following hypothesis:

H1: Differences in sources of funds will lead to differences in importance attached to selection criteria

A second factor that may be important in terms of accounting for differences in the investment selection behaviour of VC firms is the human capital of its investment managers, and more specifically their **experience and background** (Shepherd et al., 2002). The basic tenet of human capital theory is that the larger, both in qualitative and quantitative sense, the human capital, the better the performance at a particular task (Becker, 1975). Individuals with more or higher human capital achieve higher performance in executing relevant tasks such as screening and the pre-and post-investment activities of the venture capital process (Dimov and Shepherd, 2005). Shepherd et al. (2002) examined whether more specific experience in the venture capital industry resulted in better decisions. The results show that experience is beneficial to VC

decision-making, but only up to a point (14 years of experience), which indicates that the selection behaviour varies with the experience of the investment manager.

There are at least two theoretical explanations that suggest that the human capital of investment managers may influence their selection behaviour: information processing theory and self-efficacy theory.

First, information processing theory (Galbraith, 1973) holds that the structure of joint decision making depends upon task uncertainty. Task uncertainty will be high when the decision context is complex or novel or when the decision makers possess less information of relevance to the decision context (Sapienza et al., 1995). This suggests that the less relevant human capital the investment manager possesses, the larger his task uncertainty will be and the less able he will be to process information, which could impact his or her selection behaviour.

Second, taking a self-efficacy perspective, Wood and Bandura (1989) point out that people perform activities and pick social environments they judge themselves capable of managing. The more experience one has in a certain task will increase one's self-efficacy in that task. Because of this self-efficacy experienced people usually do better and behave in a different way. Therefore, as experience contributes to the development of a strong sense of efficacy through mastery experience, it seems natural that experience in selecting investment proposals will affect self-efficacy, and affect the selection process of the investment manager.

The more human capital (relevant education and experience) an investment manager possesses, the higher his or her self-efficacy will be, and the more able he or she will be to process information, and the less uncertain he or she will be on the selection task. The investment manager possessing a higher degree of human capital will therefore act differently from the investment manager with a lower degree of human capital. Therefore, we offer the following hypothesis:

H2: Differences in the experience and education of the investment manager will lead to differences in importance attached to selection criteria

A third factor may be the business sector of the investment proposal. Many scholars study high tech start-ups in particular environments such as biotechnology (Stuart et al., 1999; Baum and Silverman, 2003), computers (Eisenhardt and Tabrizi, 1995) and software and dot-coms (Amit and Zott, 2001). The underlying rationale for studying companies in a specific environment is that the technological regime influences to a large extent the business model a start-up can follow. Therefore, some researchers study VCs investing in specific technologies only (e.g. Baum and Silverman (2003) focus on biotech investing). Baum and Silverman (2003) indicate that there are three broad types of signals that may affect VCs' assessments of start-ups in biotech: alliance capital, intellectual capital and human capital. So, even though early stage high tech investors may be a quite homogeneous subset of the VC industry, we still believe differences may occur with respect to the sectors of investment. VCs investing in biotechnology projects may stress the protectability of the technology, while this is much less the case in ICT, where software is hard to protect. Having a team with strong commercial skills and a good network may matter more in ICT businesses where knowledge is hard to protect and time to market is crucial. Next to this, biotech companies looking for early stage finance hardly ever have a product that is already accepted by the market. We may then assume that market acceptance will be of little importance to biotech investors.

Therefore, we offer the following hypothesis:

H3: The sector in which the business proposal is situated will have a significant effect on the importance attached to selection criteria

4.3 Method

As outlined above, most of the studies into VC's decision making have relied on post-hoc methods of data collection. These methods include the use of questionnaires, surveys and interviews to collect data on the VC's decision policy. Sandberg et al. (1988), Hall and Hofer (1993) and Zacharakis and Meyer (1995) attempt to overcome these problems by using verbal protocols. Verbal protocol analysis has the advantage of being real time

experiments where VCs ‘think aloud’ while a business plan is being screened. The problem with these real time studies is that it is difficult to analyse the data in a consistent way and sophisticated computer algorithms are needed to detect patterns. In this study, we build upon the positive aspects of both the post hoc and the real time studies. Post hoc studies have the advantage of measuring complex issues in an easy to analyse way. Real time studies have the advantage of observing the decisions at the moment they are made.

Instead, we presented the venture capitalists with a number of fictive business cases that differ on attributes. These attributes were selected in two steps. First, we constructed a synthesis of the criteria that had been used in previous research. In addition, we drew on the insights of two VCs, one business angel investing in early stage high tech and three VC experts in order to draw a list of criteria that were important to them. We deemed this a necessary process given that no research had been conducted with high tech investors exclusively. Finally we synthesised the two lists into a set of criteria that we then pre-tested with the experts, which they accepted as being the criteria they judged on when screening a business plan in reality. From this process we ended up with four main categories of selection criteria: team, market, product and finance. In total, twelve different attributes were included: team, entrepreneur, contact with the entrepreneur, uniqueness of the product, protection of the product, market acceptance, platform technology, location, size and growth of the targeted market, time to break-even and return on investment.

In line with the conjoint analysis philosophy, and consistent with Muzyka et al. (1996), potential events were matched to the different attributes (see Table 8). Thirty levels (or events) were developed conceptually based upon the twelve attributes. For instance, team complementarity and experience are two important characteristics of the attribute “team”. A business start-up team can then be not complementary but have business experience, can be complementary and have experience, or can have none of both. This means that three different combinations are possible for the attribute “team”. For other attributes such as uniqueness, only two levels are allowed: either it is unique or not.

Table 8: 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 with the entrepreneur	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) Platform technology	16) it is a platform technology
		17) it is no platform technology
E) Targeted market	8) Location	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	27) expected return is less than 30%
		28) expected return is more than 50%
		29) expected return is between 30 and 50%

The possible events associated with the twelve attributes summarized in Table 8 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 (investment managers). These 27 proposals were printed on 'cards' used during the interviews (see Figure 15 for example of such a business proposal). Investment managers were asked to judge the proposals on a five-point Likert scale (1= bad investment opportunity, I would certainly not invest; 5= major investment opportunity, large chance of investing). From these scores, 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.

Figure 15: Example of a business proposal scored by the investment manager

4.3.1 The sample

A stratified sample of 68 VC firms was drawn from different regions across Europe, namely Cambridge/London region (UK), Ile de France (France), Flanders (Belgium), North Holland (the Netherlands), Bavaria (Germany), Stockholm region (Sweden),

Helsinki region (Finland). We refer to chapter 3, section 3.2.1 for a description of the sample.

4.3.2 Data collection

The interview consisted of two parts and took on average 1.5 hours. Data were collected during the period January 2003-December 2003. First, we collected information about the resource-based characteristics of the venture capital firm, and the investment manger interviewed. Information that we obtained before the interview, such as website information was verified and completed during the interview. This includes information on fund size, origin of the funds, number of years since establishment, number of investments made in early stage high tech, sectors of investment etc. Information on the investment manager included information on education, experience (as an entrepreneur, in business, as an investment manager) and his/her sectoral focus. Second, we studied how these investment managers select projects using the 27 business proposals. Before the respondents scored the proposals, we showed them a fictive business card (see Figure 15), so that they would understand the criteria we combined in the cards, and outlined the definitions used (see Table 9). This allowed us to make sure that each respondent had the same understanding of a criterion. The investment managers judged the business proposals on a 1-5 scale. In addition, all respondents were asked to provide a justification for the scores. This allowed us not only to get an insight into the selection process and the importance of certain criteria, but also to get an insight into the reasoning behind the respondents' decision process. In this way, we could both collect quantitative and qualitative data on the selection process, in contrast to previous research using conjoint analysis. Quantitative analysis allowed us to examine the relative importance of the different selection criteria, and the qualitative data permitted us to interpret the results obtained from the analysis.

Table 9: Definitions of selection criteria

Selection criterion	Definition
Complementary team	Both technical and commercial competencies are in the team
Business experience	At least one of the entrepreneurs has commercial experience in the sector
Entrepreneur is leader	Entrepreneur can motivate people, can be in charge
Entrepreneur is perseverant	Entrepreneur goes on, even if things get tougher
Good contact with the entrepreneur	You get along, you are on the same wavelength with respect to his business ideas
Regional market	Submarket of the world market (for instance: Europe)
Niche market	Small, specialised market with small number of players
Mainstream market	Large market with a lot of players
Unique product	The customer has the perception that there are no alternatives for the product
Protected product	Protection by patent or trade secrets
Market acceptance	First sales have been realised by the company or its competitor
Platform technology	Broad technology with lots of different applications
Break-even	Point at which cash is in balance (cash-out equals cash-in)
Return	Yearly return on investment

4.4 Results

4.4.1 The heterogeneity of early stage high tech VC investment selection behaviour

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).

Figure 16 provides an insight into the ranking given by early stage high tech investors to selection criteria.

Descriptives for the importance scores of each criterion are given in Table 10. 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 platform technology have little impact on the VC's decision.

Figure 16: Importance of selection criteria to early stage high tech investors

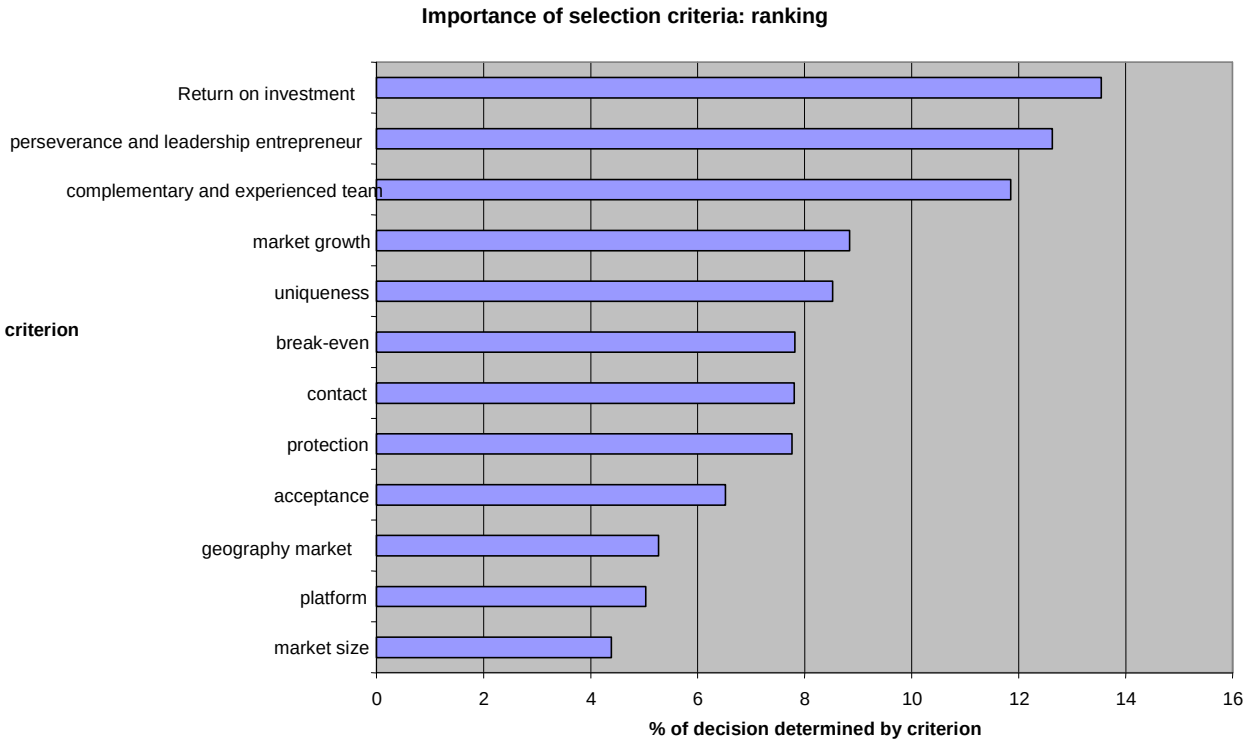


Table 10: Descriptive statistics of importance scores (results of conjoint analysis)

	Minimum	Maximum	Mean	Std. Deviation
Importance team	.97	29.14	11.85	6.19
Importance entrepreneur	1.85	33.33	12.64	7.92
Importance contact	.00	46.19	7.81	7.85
Importance market size	.00	20.43	4.39	3.34
Importance market growth	.00	26.25	8.84	5.57
Importance geography market	.00	17.24	5.27	3.88
Importance platform	.00	14.49	5.03	3.81
Importance protection	.00	30.14	7.76	6.45
Importance uniqueness	.00	17.59	8.53	4.30
Importance acceptance	.00	25.81	6.52	5.44
Importance break-even	.00	19.93	7.82	3.69
Importance ROI	.00	44.71	13.55	8.71

In order to examine the extent to which this group of early stage high tech investors exhibits heterogeneity in terms of their investment selection processes we employed a cluster analysis. Cluster analysis encompasses a number of different classification algorithms, which can be classified into two broad families: hierarchical and non-hierarchical clustering. Ketchen and Shook (1996) suggest using both procedures as complements to each other: first a hierarchical procedure can be used as an exploratory methodology to determine the desired number of clusters and as input to the non-hierarchical step. We follow this two-step approach. To perform the hierarchical cluster analysis, we follow Ward's procedure with squared Euclidean distance as linkage measures (Hambrick, 1983). We used the output of the conjoint analysis presented in Figure 16, being the importance scores derived from the interviewee's responses. Importance scores link to the following criteria: characteristics of the team, characteristics of the lead entrepreneur, contact with the lead entrepreneur, market size, market growth, geography of the market, platform technology, protect ability of the product, uniqueness of the product, market acceptance, time to break-even and return on investment. Following the criteria of Hair et al. (1992), we find a three clusters-solution

as the most appropriate for our data. Subsequently, we performed a k-means clustering with three clusters as the predefined number of clusters and the same variables as inputs.

For ease of interpretation, each cluster was given a name, indicating the selection behaviour of its members. The F-statistic of the variance analysis and the descriptive statistics for each cluster are given in Table 11. We found that 6 decision criteria were significantly different at the 0.05 level for the three groups. First, the importance given to the human resource variables as a reason to invest was significantly different between the clusters (complementarity of the venture team, competence of the lead entrepreneur and contact with the VC). Second, the market location (local versus global) was significantly different. Third, the importance given to the protect ability of the technology characterized certain investors. Finally, the financial part of the deal such as ROI was significantly different. The specific cluster characteristics are discussed below.

Table 11: Selection profile (means and standard deviations): results from cluster analysis[3]

Selection criterion	Financial Investors	Technology Investors	People Investors	F (p)
Venture Team	11.91	8.42	14.71	7.3***
	(5.22)	(3.74)	(7.17)	(0.001)
Competence Lead entrepreneur	8.69	7.77	19.78	34.28****
	(5.91)	(3.32)	(6.79)	(<0.001)
Contact with the VC	4.37	11.70	7.16	5.32***
	(3.60)	(10.90)	(5.69)	(0.007)
Market Size	4.04	5.13	4.02	0.81
	(2.48)	(4.40)	(2.88)	(0.449)
Market Growth	10.02	9.54	7.34	1.59
	(6.49)	(5.92)	(4.21)	(0.211)
Market Location	4.01	7.68	4.19	7.53***
	(3.16)	(4.31)	(3.10)	(0.001)
Platform Technology	4.94	6.12	4.18	1.57
	(4.14)	(3.65)	(3.59)	(0.215)
Protection Ability	6.12	12.45	5.06	11.45****
	(4.79)	(8.04)	(3.31)	(<0.001)
Uniqueness	7.80	9.29	8.44	0.62
	(3.92)	(4.23)	(4.68)	(0.536)
Market Acceptance	5.85	5.74	7.69	0.98
	(6.29)	(3.46)	(6.06)	(0.379)
Time to Break-even	7.99	6.82	8.53	1.32
	(3.65)	(2.55)	(4.41)	(0.274)
Return on Investment	24.25	9.33	8.88	57.61****
	(6.82)	(4.60)	(4.49)	(<0.001)
Cluster Size	20	22	26	

Levels of significance: *=.10; **=.05; ***=.01; ****=.001

[3] The table reports means and standard deviations of importance scores for each selection criterion. Importance scores can range between 0 and 100, with 0 being no importance attached to the criterion and 100 meaning that only that specific criterion is important. Importance scores for all selection criteria for one respondent add up to 100

CLUSTER 1 (20 VCs) we term the cluster of the **financial investors**. This group of investors emphasizes the potential return set out in the business plan. As shown in Table 11, the ROI criterion receives an importance score of 24 out of 100. Business plans that do not show sufficient potential return are not selected. Next to this financial criterion, these investors also find the team complementarity and the market forecast important. These investors mainly invest in complementary teams with strong leaders that are focussing on fast growing markets. If we add the importance scores attached to the entrepreneurial team, competence of the lead entrepreneur, market growth and potential return on investment, we get an importance score of 55 out of hundred (Table 12). This means that these investors base their investment decision on a very rational logic which is based on a limited set of quasi objective factors such as ROI, growth and team completeness. In line with this, it is the group that attaches the least importance to the contact with the entrepreneur. It looks as if these investors want to have complementary teams with good leadership potential, but do not bother much about getting along with the entrepreneur. It looks as if they feel confident that a well established team will generate the financial return they are aiming for, without too much interference or coaching from them.

CLUSTER 2 (22 VCs) we term the cluster of the **technology investors**. These investors make a much more balanced analysis of a business proposal than the previous group. This means that they take into account much more criteria than the other VCs. Many criteria receive an equal weight in the final decision and only the degree to which the technology can be protected and the contact the investment manager has with the entrepreneur receive an importance score of more than 10 out of 100. This group of investors also emphasizes the “uniqueness” of the product. Next to these factors, also potential market growth, return on investment and uniqueness of the product matter. Protection ability and contact with the entrepreneur are factors on which they differ from other investors: they attach much more importance to these criteria than the other groups of VCs.

CLUSTER 3 (26 VCs) we term the cluster of the **people investors**. Most important factors in the selection process are human factors, such as leadership capacities of the entrepreneur and the quality (complementarity and experience) of his team. Financial criteria come in at a second place. Closely connected to these human factors, is the contact with the entrepreneur. However, it is less important than for the technology investors. This cluster also attaches the least importance to the ability to protect the technology. The selection behaviour that this group demonstrates comes close to the findings of studies based on post-hoc data collection methods which found that the quality of the entrepreneur is the most important selection criterion (Wells, 1974; Poindexter, 1976; Tyebjee and Bruno, 1984; MacMillan et al., 1985; 1987).

Table 12: Conjoint analysis results[4] by investor type[5]

	Financial investors	Technology investors	People investors
Venture Team	**11.91**	7.77	**14.71**
Competence Lead entrepreneur	8.69	8.42	**19.78**
Contact with the VC	4.37	**11.70**	7.16
Market Size	4.04	5.13	4.02
Market Growth	**10.02**	**9.54**	7.34
Market Location	4.00	7.68	4.19
Platform Technology	4.94	6.12	4.18
Protection Ability	6.12	**12.45**	5.06
Uniqueness	7.80	**9.29**	8.44
Market Acceptance	5.85	5.74	7.70
Time to Break-even	7.99	6.82	**8.53**
Return on Investment	**24.25**	**9.33**	**8.88**

We find a considerable degree of heterogeneity in the way in which early stage high tech VCs select their investments. In particular, we find a group of investors, which emphasize

[4] Percentage of the investment decision which can be attributed to this criterion. The criteria which make up for 50% of the decision are displayed in bold

[5] The table reports means and standard deviations of importance scores for each selection criterion. Importance scores can range between 0 and 100, with 0 being no importance attached to the criterion and 100 meaning that only that specific criterion is important. Importance scores for all selection criteria for one respondent add up to 100

the human resource or team characteristics; a group which puts most emphasis on the financial data (in line with real time studies); and a group which stresses the technology characteristics such as patent ability of the technology and the degree to which the technology can be protected. Furthermore not only do we identify key differences between the focus of different VC firms in terms of their selection behaviour we also identify differences between how balanced the firms selection criteria are. Financial and people investors tend to make their investments very focused on few criteria, where as the decision made by technology investors tends to be very balanced, taking into account several criteria, and making a balanced evaluation of the business proposal as a whole.

4.4.2 What drives differences in VC investment selection behaviour?

To test propositions 1, 2 and 3 we constructed a multinomial logistic model. In this model, we estimate a set of coefficients $\beta^{(1)}, \beta^{(2)}, \beta^{(3)}$ corresponding to each outcome category. Outcome category 1 is the cluster of "financial investors". Outcome category 2, the cluster of "technology investors" and outcome 3 the cluster of "people investors".

$$P(y=1) = \frac{e^{X\beta^{(1)}}}{e^{X\beta(1)} + e^{X\beta^{(2)}} + e^{X\beta(3)}}$$

$$P(y=2) = \frac{e^{X\beta^{(2)}}}{e^{X\beta(1)} + e^{X\beta^{(2)}} + e^{X\beta(3)}}$$

$$P(y=3) = \frac{e^{X\beta^{(3)}}}{e^{X\beta(1)} + e^{X\beta^{(2)}} + e^{X\beta(3)}}$$

The model, however, is unidentified in the sense that there is more than one solution to $\beta^{(1)}, \beta^{(2)}$ and $\beta^{(3)}$ that leads to the same probabilities for y=1, y=2 and y=3. To identify the model, one of $\beta^{(1)}, \beta^{(2)}$ or $\beta^{(3)}$ is arbitrarily set to 0- it does not matter which. That is, if we arbitrarily set $\beta^{(1)}$=0, the remaining coefficients $\beta^{(2)}$ and $\beta^{(3)}$ would measure the change relative to the y=1 group. If we instead set $\beta^{(2)}$=0, the remaining coefficients

$\beta^{(1)}$ and $\beta^{(3)}$ would measure the change relative to the y=2 group. The coefficients would differ because they have different interpretations, but the predicted probabilities for y = 1, 2 and 3 would still be the same. The results that are reported in Table 14 have as a default the cluster of "people investors" as a control group. In addition, we tested a model which had cluster 2, the "technology investors" as a base group. Doing so, this allows us to interpret eventual differences between cluster 1, "the financial investors" and cluster 2, "the people investors".

As aforementioned, previous studies have argued that the institutional origin of the venture capital fund might have an impact on the kind of deals that the fund selects. This argument was the basis for hypothesis 1, in which we position that the source of funds of the high tech, early stage European venture capitalists will have a significant effect on the selection criteria used by these VCs. For instance, publicly funded VCs may not only focus on realizing a considerable return, but may also take into account other factors such as employment and technological renewal. Bank funded VCs may be inclined to following rules of thumb existing at the bank level, and may put much more weight on financial forecasts, given the financial culture at the bank.

Hypothesis 1 stipulates that institutional origin affects VC investment selection behaviour. Institutional origin was operationalized in the following ways. First, we made a distinction between funds that are part of a larger management holding and those that are not. A fund is considered to be part of a holding if it is part of a group of funds such as follow-up funds or funds with different investment focuses, or if it is set up as a subsidiary (for instance from a bank). Second, we made a distinction between private equity arms of banks or not. These funds are a 100% private equity subsidiary of a bank or financial institute. Finally, we analysed the degree of public capital in the fund structure. Public capital can be provided by European (f.i. EIF), national or regional authorities.

Table 13: Univariate Statistics

	Financial Investors	Technology Investors	People Investors	Overall
Origin of Funds				
Holding	45%	27%	46%	40%
Private equity arm of bank	15%	0%	4%	6%
% public capital**	8%	32%	22%	21%
Sectoral				
Biotech*	45%	77%	50%	57%
ICT**	95%	68%	92%	85%
Industrial Automation**	10%	27%	50%	31%
Other	15%	36%	29%	29%
Investment Manager				
Business Education*	55%	57%	83%	66%
Academic Experience*	5%	23%	5%	11%
Banking Experience**	25%	13%	46%	29%
Entrepreneurial Experience	15%	14%	17%	15%
Prior Experience as manager of other funds	20%	10%	33%	21%

Chi-Square Test. Levels of significance: *=.10; **=.05; ***=.01; ****=.001

The results of the univariate analysis are included in Table 13. Since the number of private equity arms of banks (n=6) is too small, we decided to omit this variable in the multivariate model, presented in Table 14.

Table 14: Multinomial regression model

	Base model I	Base model II	Base model III	Base model IV	Full model
Comparison between financial and people investors (=comparison group)					
Constant term	-0.581	-0.511	-0.305	-1.600	-0.432
Origin of funds					
Holding		0.274			-0.435
Percentage public money		-0.177			-0.009

Experience/educ of VC					
Business education			0.006		-0.168
Academic experience			1.959		3.205
Banking experience			-0.880		-1.007
Entrepreneurial exp.			0.293		0.787
Other fund experience			-0.601		-1.200
Sector					
Biotech				0.810	0.833
ICT				1.055	1.225
Industrial automation				-2.741***	-3.161****
Control variables					
Fund size	-0.000	-0.001	0.000	-0.001	-0.001
Fund age	0.050	0.069	0.066	0.054	0.070
Comparison between technology and people investors (=comparison group)					
Constant term	-0.390	-0.210	0.602	0.045	0.229
Origin of funds					
Holding		-0.745			-1.660
Percentage public money		0.006			0.027*
Experience/educ of VC					
Business education			-0.247		-0.393
Academic experience			4.412***		5.512**
Banking experience			-1.809**		-2.401**
Entrepreneurial exp.			0.476		1.019
Other fund experience			-2.739**		-3.782**
Sector					
Biotech				1.471*	2.409*
ICT				-0.951	0.572
Industrial automation				-1.539*	-3.294**
Control variables					
Fund size	-0.002	0.000		-0.000	-0.001
Fund age	0.038	0.022		0.045	-0.051
Adjusted R^2	0.0135	0.062	0.1881	0.154	0.3644

Levels of significance: *=.10; **=.05; ***=.01; ****=.001

After controlling for age and size (operationalized by the capital managed), we do not find a significant difference with respect to holding structure although the funds that belong to a holding tend to be less prevalent among the technology investors. Second, we examined the difference in the degree of public money, which these funds have access to. Table 14 shows that among the technology investors, the availability of public money is significantly larger than among the people investors. However, the percentage of public money used by the financial investors is not significantly larger than that used by the people investors. This suggests that it is especially the technology investors which make significantly more use of public money.[6] The venture capitalists that belong to these investors have over 30% of their money from public funds such as national government initiatives or the European Investment Fund. Financial investors however make the least use of these public sources (Table 13). Only 8% of their fund structure is on average of public origin. We can thus conclude that H1 receives mixed support. The source of funds of the technology investors is different from that of the financial and people investors. The percentage of public capital is significantly different, however we do not receive sufficient support to conclude that the holding structure is also different.

Hypothesis 2 stipulates that the background and experience of the investment manager will significantly affect the way in which the selection is performed. To operationalize this we examined three different kinds of experience or background. First, we made a distinction between those investment managers with a business degree (MBA) and those without. Second, we measured whether they had experience in previous jobs and if so, what kind of job they had done. If they worked in a bank or accountancy firm, we classified this as having financial experience. If they had worked at university after graduating, we labelled this academic experience. If they had worked as a consultant, this was coded as consulting experience. If they had been entrepreneurs themselves, we coded this as having entrepreneurial experience. Finally, if they had some overall experience in a company, we labelled this business experience.

[6] This is confirmed by the additional analyses using technology investors as a base group. The two other clusters have signicantly less public money in their capital.

Few investment managers have entrepreneurial experience. This is surprising since the funds in our sample specifically focus on early stage investments. Neither did we encounter a lot of investment managers with prior experience in other VC funds. Only one out of five of the investment managers had prior experience. This indicates that the emergence of European early stage high tech venture capitalists is a pretty new phenomenon.

Most of the investment managers have an MBA, however, the MBA variable is not significantly different between the categories of investors. In terms of experience, we find that bank and other fund experience is significantly higher among the people investors than among the technology investors, while academic experience is much less. Financial and people investors, however, do not significantly differ on these categories, nor do financial and technology investors[7]. This means that investment managers, who have worked in previous funds or in a banking environment, tend to find the people characteristics most important. The financial investors lie somewhere in between, while the technology investors excessively recruit academics. This is in line with the expectations since this category of venture capitalists tends to be specialized in seed investments and is often linked to universities and/or public research labs. It seems then logic that the prevalence of academics among these investors is highest.

We conclude that H2 receives mixed support. People investors seem to be the most experienced investment managers, but this is only significant in comparison to the technology investors, which inversely tend to recruit particularly less experienced managers. Among them, academic experience is rated the highest.

Hypothesis 3 stipulates that the sectoral focus of the fund will play a role. To operationalize this sectoral focus, we use the sectoral distinctions which are most often made by the VCs themselves. We make a difference between biotech, ICT, industrial automation and other.

More than half of the funds invest in biotech, which is not surprising since they are high tech venture capital funds and biotechnology is considered to be a large and attractive

[7] Additional analyses with group 3, the technology investors as a base group for comparison do not show any differences between the financial investors and the technology investors.

high tech domain. Again, the differences between technology investors and people investors are the largest and the only significant ones. The percentage of technology investors investing in biotech is significantly higher than within the group of people investors. The financial investors are somewhat in the middle. People investors invest significantly more in industrial automation than their colleagues in the two other categories do. Each category of investors seems to invest in ICT.
We conclude that H3 receives support, but only for biotech and industrial automation, and not for ICT investing.

4.5 Conclusions and implications

In this chapter, we analysed how high tech early stage venture capitalists in Europe select deals to invest in. To do so, we used a methodology which combines the advantages of the post hoc studies and the real time studies. The post hoc studies have the advantage that they generate well codified results that are easy to analyse, the real time studies offer insights in decision criteria, which might be more implicitly taken into account than explicitly remembered. The post hoc studies usually conclude that team variables are the most important ones, while real time studies indicate that other variables such as financial and product market expectations might be much more important than initially thought.

Whereas most real time and post hoc studies make only a listing of the criteria, which are found to be important, studies based upon conjoint analysis techniques go one step further and propose a hierarchy of decision criteria used. In line with these studies, we also propose a hierarchy of decision criteria in this chapter. Further, we limited the analysis to early stage, high tech venture capitalists in Europe. There are several reasons for this: first, the venture capital industry in Europe has boomed since the mid-nineties and several specialized early stage venture capital funds have been created. Second, most studies find a difference in selection criteria between early and later stage venture capitalists. Our focus of interest is specifically on early stage deals and the differences among these investors. Finally, investment in high tech companies has emerged as a

specific business in itself, attracting a number of investment managers and newly created funds which would else not have been in the venture capital industry.

Using a cluster analysis, we find that the 68 funds are equally spread over three clusters, which we labelled the “financial investors”, the “people investors” and the “technology investors”. The people investors correspond most to the investors found in the post hoc studies. They emphasize the team and leadership potential of the founders. However, we also find the financial variables to play an important role to them. Market size and growth are much less important. People investors tend to have the most experienced and educated investment managers. It might well be that they are the longest in industry and therefore it is not surprising that they correspond most to the profile found in the older studies. A second group, which can be clearly distinguished, are the financial investors. 25% of their investment decision is based upon expectations about ROI. The market prospect is also for them quite unimportant. The funds in this group are managed by the least experienced investment managers. Finally, we detected the category of technology investors. For this category, the extent to which the technology can be protected and the contact they have with the prime founder of the start-up are key. However, they also look at other variables such as ROI, market prospects and founder characteristics. After all, they make the most balanced due diligence.

We further developed hypotheses in the chapter about how to explain the differences in selection behaviour. Previous studies indicated that institutional background, the sector in which the venture capital fund is active and the background of the investment manager plays a role. Indeed, we find differences that can be related to these three groups of variables. First, we find that the extent to which these funds use public capital is different. Especially technology investors make use of different public forms of support. We can thus conclude that the availability of public capital on the venture capital scene has attracted some funds with a deviant way of looking at investment opportunities. We also find clear sectoral differences. Technology investors more frequently have a focus on biotechnology than people investors. People investors focus on industrial automation. Finally, we looked at the background and education of the investment managers

interviewed. People investors tend to be the most experienced and have obtained the highest degree. Technology investors often have an academic background. Overall, technology investors tend to be different from people investors while financial investors fall somewhat in between.

From a public policy perspective, we find most public money invested in the funds of the technology investors. Given that these investors focus the most on the technological strength of a business plan, it looks as if this money is targeted to technological renewal and stimulation of economic growth. This public money is managed by investment managers that have a profile that is not common in the VC industry. Quite a lot of these investment managers have academic experience, working as research assistant or Ph. D. student in a technological domain before coming to the VC industry. Very little of them have prior experience as manager of other funds, and are thus new in business. They are more than other funds involved in biotech investing, and less in ICT investing. As these investors are active in a very early stage more frequent than the other groups (and often provide seed financing), it is acceptable that they are helping to overcome the market failure high tech entrepreneurs are confronted with.

This study has important implications for practitioners.

As our results show that the background and experience of investment managers can influence the individual's selection behaviour, VCs may build their investment teams with a human capital consideration in mind. Next to this, it is interesting to VCs to know which VCs have similar selection patterns and thus to know which VCs they will be competing with on specific deals, or could be potential syndication partners.

Also high tech entrepreneurs can benefit from a better knowledge of selection behaviour by VCs. It is particularly interesting to them to know how selection behaviour is driven by the source of funds, the investment manager that is in front of him/her, and the sector the investment proposal is in. This knowledge may enable him to approach the appropriate investor for his proposal and may increase his/her chances of finding finance. For instance, an entrepreneur with a proposal that builds upon a strong proprietary technology but that lacks an experienced team may have more chances of finding finance

with a public fund than with a private one. What makes this research particularly interesting to high tech entrepreneurs is that it focuses on a subset of the European VC industry and focuses on those investors they will call upon when looking for finance for their early stage high tech projects.

Finally, understanding of differences in selection behaviour is interesting to fund investors, and more specifically to investors of public money. The results indicate that public money is used for investing in business proposals with a strong technological basis. This may be viewed as an attempt to overcome problems associated with perceived market failures that exist for early stage high tech funding.

4.6 References

Addelman S. (1962). Orthogonal Main-Effect Plans for Asymmetrical Factorial Experiments. *Technometrics*. 4(1): 21-46.

Amit R., Zott C. (2001). Value creation in e-business. *Strategic Management Journal*. 22: 493-520.

Baum J.A.C., Silverman B.S. (2004). Picking winners or building them? Alliance, intellectual and human capital as selection criteria in venture financing and performance of biotechnology. *Journal of Business Venturing*. 19(3): 411-425.

Becker G.S. (1975). Human capital. Chicago University Press, Chicago, IL.

Dimov P.D., Shepherd D.A. (2005). Human capital theory and venture capital firms: exploring "home runs" and "strike outs". *Journal of Business Venturing*. 20:1-22.

Eisenhardt K., Trabrizi B.N. (1995). Accelerating adaptive processes: product innovation in the global computer industry. *Administrative Science Quarterly*. 40: 84-110.

Elango B., Fried V.H., Hisrich R.D., Poloncjek A. (1995). How Venture Capital Firms Differ. *Journal of Business Venturing*.10: 157-179.

Engel D. (2004). The performance of venture-backed firms: the effect of venture capital characteristics. *Industry and Innovation.* 11(3): 249-263.

Fischhoff B. (1982). For those condemned to study the past: heuristics and biases. In. Hindsight, Judgement under uncertainty: heuristics and biases. Cambridge University Press.

Galbraith J.R. (1973). Designing complex organisations. Reading, MA: Addison)Wesley.

Hall J., Hofer C.W. (1993). Venture Capitalists' Decision Criteria in New Venture Evaluation. *Journal of Business Venturing*. 8: 25-42.

Hellman T. (2002). A theory of strategic venture investing. *Journal of Financial Economics*. 64: 285-314.

Hisrich R.D., Jankowitz A.D. (1990). Intuition in venture capital decisions: an exploratory study using a new technique. *Journal of Business Venturing*. 5: 49-62.

Hutt R.W., Thomas B. (1985). Venture capital in Arizona. Frontiers of Entrepreneurship Research. 155-169.

Kahn A.M. (1987). Assessing venture capital investments with noncompensatory behavioural decision models. *Journal of Business Venturing*. 2: 193-205.

Kaplan S.N., Strömberg P. (2001). Venture Capitalists as Principals: Contracting, Screening and Monitoring. Per. American Economic Review. 91(2): 426-431.

Keeley R.H., Roure J.B. (1989). Determinants of new venture success before 1982 and after a preliminary look at two eras. Frontiers of Entrepreneurship Research. 274-287.

Lockett A., Murray G., Wright M. (2002). Do UK venture capitalists still have a bias against investment in new technology firms. *Research Policy*. 31: 1009-1030.

MacMillan I.C., Siegel R., Subbanarashima P.N. (1985). Criteria used by venture capitalists to evaluate new venture proposals. *Journal of Business Venturing*. 1: 119-128.

MacMillan I.C., Zemann L., Subbanarashima P.N. (1987). Criteria distinguishing successful from unsuccessful ventures in the venture screening process. *Journal of Business Venturing*. 2: 123-137.

Manigart S., Baeyens K., Van Hyfte W. (2002). The survival of venture capital backed companies. *Venture Capital*. 4(2): 103-124.

March J.G., Feldman M.S. (1981). Information in organisations as signal and symbol. *Administrative Science Quarterly*. 26: 171-186.

Martin R., Sunley P., Turner D. (2002). Taking risks in regions: the geographic anatomy of Europe's emerging venture capital market. *Journal of Economic Geography*. 2: 121-150.

Mayer C., Schoors K., Yafeh, Y. (2005). Sources of funds and investment activities of venture capital funds: evidence from Germany, Israel, Japan and the UK. *Journal of Corporate Finance*. Forthcoming 2005.

Meyer G.D., Zacharakis A.L., De Castro J. (1993). A post-mortem of new venture failure: an attribution theory perspective. Frontiers of Entrepreneurship Research. 256-269.

Murray G., Lott J. (1995). Have UK venture capitalists a bias against investment in new technology-based firms? *Research Policy*. 24: 283-300.

Muzyka D., Birley S., Leleux B. (1996). Trade-offs in the investment decisions of European Venture Capitalists. *Journal of Business Venturing*. 11: 273-287.

Riquelme H., Rickards T. (1992). Hybrid conjoint analysis: an estimation probe in new venture decisions. *Journal of Business Venturing*. 7: 505-518.

Sapienza H.J., Amason A.C., Manigart S. (1994). The level and nature of venture capitalist involvement in their portfolio companies: a study of three European countries. *Managerial Finance*. 20(1): 3-17.

Sapienza H.J., Manigart S., Vermeir W. (1995). A comparison of venture capitalist governance and value-added in the U.S. and Western Europe. *Academy of Management Journal*. 105-109.

Sandberg W.R., Schweiger D.M., Hofer C.W. (1988). Use of verbal protocols in determining venture capitalists' decision process. *Entrepreneurship Theory and Practice*. 13: 182-196.

Shepherd D.A., Zacharakis A. (1998). Conjoint analysis: a new methodological approach for researching the decision policies of venture capitalists. *Venture Capital*. 1(3): 197-217.

Shepherd D.A., Zacharakis A. (2002). Venture capitalists' expertise: a call for research into decision aids and cognitive feedback. *Journal of Business Venturing*. 26(3): 81-91.

Shepherd D.A., Zacharakis A., Robert A.J. (2003). VCs' Decision Processes: Evidence suggesting more experience may not always be better. *Journal of Business Venturing*. 18: 381-401.

Stuart T.E., Hoang H., Hybels R.C. (1999). Interorganizational Endorsements and the performance of entrepreneurial ventures. *Administrative Science Quarterly*. 44: 315-349.

Tyebjee T.T., Bruno A.V. (1984). A model of VC investment activity. *Management Science*. 30: 1051-1066.

Weber C., Dierkes M. (2002). Strukturmerkmale klassischer Venture-Capital-Gesellschaften und Corporate-Venture-Capital-Gesellschaften in Deutschland im Vergleich. *Finanzbetrief*. 4: 545-553.

Wood R., Bandura A. (1989). Social Cognitive Theory of Organizational Management. *Academy of Management Review*. 14(3): 361-384.

Zacharakis A.L., Meyer G.D. (1995). The venture capitalist decision: understanding process versus outcome. *Frontiers of Entrepreneurship Research*. 465-478.

Zacharakis A., Meyer G.D. (1998). A lack of insight: do Venture Capitalists really understand their own decision process? *Journal of Business Venturing*. 13: 57-76.

Zacharakis A., Meyer G.D. (2000). The potential of actuarial decision models: can they improve the venture capital investment decision? *Journal of Business Venturing*. 15: 323-334.

5 Follow-up behaviour of early stage high tech VCs

5.1 Introduction

Increasing concern about the performance of early stage high tech firms has focused on their ability to access to two key resources, finance and human capital expertise. In principle, venture capital (VC) firms can provide both these resources, but there are major questions about the extent to which this occurs (Lockett et al., 2002). This concern is particularly prevalent in Europe where the VC market and high tech firms have been slower to develop than in the US and where there has traditionally been more emphasis on later stage investments (Martin et al., 2002; Murray, 1999; EVCA, 2003). Only 5.9 % of the VC funds raised in 2003 were expected to be allocated to early stage high tech investments (EVCA, 2004).

Previous research has focused on the nature of post-investment follow-up behaviour and in particular monitoring and value adding activities. This research has mainly considered the portfolio company and has focused on the innovation and development stages of the company (Sapienza et al., 1994; Gomez-Meija et al., 1990; Sapienza and Amason, 1993), the business experience and/or background of the CEO/entrepreneur (Sapienza et al., 1994; Gomez-Meija et al., 1990), venture performance (Gomez-Meija et al., 1990; Lerner, 1995), agency risks and uncertainty (Sapienza et al., 1996) etc.

The venture capital literature has shown that VCs add value to the companies in which they invest (Sapienza et al., 1995; Van den Berghe and Levrau, 2002; Schefczyk and Gerpott, 2001). A major omission is that little research has been carried out focusing on the human capital of VC investment executives and the characteristics of VC funds as determinants of post-investment follow-up behaviour. Some research has contrasted VCs that are more versus less closely involved (MacMillan et al., 1989; Sweeting and Wong, 1997), while Dimov and Shepherd (2005) have recently considered the link between human capital and VC investment performance.

Researchers have mainly focused on the venture industry as a whole. Yet, both the skills of VC funds and the needs of investee companies are heterogeneous. The early stage high tech sector raises particularly important issues relating to the involvement of VCs. Characterized by major uncertainties, firms in this sector need relationships with VCs to access human capital and financial resources that will help them to realize opportunities and meet the challenges of entering or creating new markets. Not all VC firms may be able or willing to provide the specific resources that firms in this sector require to achieve competitive advantage (Lockett et al., 2002). Thus, it is important for entrepreneurs to be aware of the differences within the early stage high tech venture capital industry that will help them identify the right investor for their needs.

A major gap in the literature concerns understanding of the determinants of the differences in post-investment follow-up behaviour by VCs. This chapter aims to fill this important gap in research on the post-investment behaviour of VCs. This chapter focuses on an examination of the extent to which human capital and fund characteristics are determinants of follow-up behaviour in early stage high tech investments with respect to the nature of their involvement. When studying the nature of follow-up behaviour, it is important to distinguish between monitoring and value adding activities. Monitoring financial and operating performance is mainly carried out to address information asymmetries and agency conflicts, whereas VCs are involved in post-investment value-adding activities in order to improve outcomes of investments. Differences in human capital and fund characteristics may be influential in determining the extent and effectiveness of these activities.

This chapter unfolds along the following lines. We begin with an outline of the theoretical background of the study and formulation of the hypotheses. Second, we discuss the methodology used. Third, we present the results. The chapter ends with a discussion of the conclusions and implications.

5.2 Conceptual framework

In this section, we provide an overview of the conceptual issues relating to the nature and intensity of VC involvement and the influence of human capital and fund characteristics on post-investment follow-up involvement.

5.2.1 The nature and extent of venture capitalist involvement

An agency theory perspective is appropriate to examine the involvement by venture capital firms with their investees (Bruton et al., 1998). Agency theory applied to listed corporations with diffuse ownership and control recognizes that, because of incomplete contracts, there is a need to check self-serving behaviour by managers (Hart, 1995). This perspective distinguishes between decision management, which refers to the initiation and implementation of decisions, and decision control, which concerns the ratification and monitoring of lower level decisions (Fama and Jensen, 1983). This separation enables management/entrepreneurs with specific skills to run the enterprise while outside investors assist in the making of unbiased decisions.

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. This information asymmetry leads to agency conflicts (Gompers, 1995). Agency theory suggests that although the entrepreneur can autonomously take certain decisions, part of the costs resulting from these decisions will be borne by the remaining shareholders, giving rise to problems of moral hazard. Agency 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. With significant equity blockholding, VCs have the incentive to become active in decision control (Wright and Robbie, 1998) which includes exerting costly effort to improve outcomes (Kaplan and Strömberg, 2001).

The main reason for VCs to be involved in **value-adding** activities is not to avoid agency costs but to improve outcomes (Repullo and Suarez, 1990). Cable and Shane (1997) argue that some degree of mutual co-operation between entrepreneurs and venture capitalists is a necessary (though not sufficient) condition for the successful post-

investment performance of VC-backed start-ups. While entrepreneurs specialize in the development of knowledge about combining resources to exploit new opportunities (Kirzner, 1973) and in the day-to-day development of new business activities (MacMillan et al., 1989), VCs focus mainly on creating networks to reduce the cost of acquiring capital, to find customers and suppliers and to establish the venture's credibility (MacMillan et al., 1989; Lam, 1991). VCs also advise their ventures, helping entrepreneurs to formulate and adhere to their business strategy, and identifying the appropriate management for the company (Steier and Greenwood, 1995).

Agency and resource based theories offer some rationale as to why VCs involve themselves in monitoring and value adding activities. Although some descriptive and usually atheoretical studies have analyzed which specific monitoring and value-adding activities certain VCs undertake, few researchers have focused on the questions whether VCs differ in their emphasis and time commitment to follow-up activities and how it can be explained.

To explore these questions further, we consider two factors that differentiate between VCs: first the human capital of the investment manager and second, the characteristics of their funds. We subsequently explore the nature of these factors and their possible relation with follow-up behaviour.

5.2.1.1 Human capital and venture capital involvement

Human capital is an important contributor to organizational strategy and performance (Dahlqvist et al., 2000; Gimeno et al., 1997; Ucbasaran et al., 2003). Dimov and Shepherd (2005) demonstrate the importance of human capital in their study of the relationship between the education and experience of the top management teams of VCs and their firms' performance. The skills of VC executives influence their ability both to identify suitable high tech investments and to monitor and add value to them subsequently (Lockett et al., 2002). Human capital theory suggests that individuals with greater human capital achieve higher performance in executing relevant tasks (Dimov and Shepherd, 2005). Greater human capital, both qualitatively and quantitatively, is

associated with better performance at a particular task (Becker, 1975). Human capital can be divided into two: general human capital concerns the overall education and practical experience of an investment manager, while specific human capital refers to education and experience within a particular activity (Gimeno et al., 1997; Becker, 1975; Ucbasaran, 2003). While the quantitative effects of human capital on organizational performance have been studied, there has been relatively little attention to the qualitative specific and general dimensions, especially in respect of the contribution of VCs to their investee portfolio companies (for exceptions in relation to habitual entrepreneurs see Ucbasaran et al. (2003) and for VCs see Dimov and Shepherd (2005)). It is especially pertinent, therefore, to adopt a human capital perspective in examining the behaviour of investment executives.

We build on self-efficacy theory to explain how the human capital of investment managers may influence their follow-up behaviour. Self-efficacy theory suggests that people who think they can perform well at a task do better than those who think they will fail (Gist and Mitchell, 1992). Thus, people perform activities and pick social environments they judge themselves capable of managing (Wood and Bandura, 1989). More experience in a certain task will increase self-efficacy in that task. This contributes to the development of a strong sense of efficacy through mastery experience. In the context of this study, self-efficacy theory posits that individuals with greater experience achieve higher performance in executing pre-and post-investment activities. In an early stage high technology venture capital context, we argue that experience will relate to experience of specific industry sectors. That is, an investment manager who focuses on a more narrow range of industries will have greater experience of those industries than an investment manager who has a more diversified portfolio. This is because experience is often more relevant to the individual when it occurs in similar circumstances (Wood and Bandura, 1989). In addition, specialization at the investment management level may lead to information and networking advantages through the development of social capital.

5.2.1.2 Fund characteristics and venture capital involvement

Again, two theories provide guidance into why funds might have a different policy in following up on their portfolio companies: strategic investment (Hellman, 2002) and portfolio theory.

First, strategic investment theory suggests that shareholders of funds may have different objectives, and different measures for assessing a fund's success. For instance, public shareholders in high tech VC funds mainly focus on creating technological renewal, as this is expected at a macro level to increase employment rates and stimulate economic growth. Financial institutions for instance look for complementarities between their venture capital and lending activities and therefore measure the success of the fund not only by the return of the fund itself but also by the returns on other activities generated by the investment (Hellman, 2002).

A second reason for funds to behave differently according to their sources of finance lies in the incentive system that is in place for their investment managers. Investment managers at non-captive VC companies are more under pressure to generate high profits compared to captive VCs. Weber and Dierkes (2002) show that profit-oriented VCs more frequently offer carried interest to investment executives than public sector owned VCs, which aligns their interests in generating profits with those of the investors. A high profit orientation of VCs makes it likely that they will provide greater post-investment management support in order to increase the chances of achieving these performance targets (Engel, 2004).

Second, portfolio theory suggests that the purpose and benefit of building up a portfolio of investments is to minimize the risk of the investments while maximizing the overall return on the portfolio. In constructing a portfolio of investments there are basically two strategies the VC can follow. Traditionally, finance theory has advocated that portfolio diversification is the right investment strategy, reducing total portfolio risk. The resource-based view, however calls for portfolio specialization in order to minimize the risk of individual investments (Manigart et al., 2002; Sapienza and Gupta, 1994). A company can have a sustained competitive advantage relative to its competitors if it controls resources that are valuable, rare, imperfectly imitable and non substitutable. In this context, investors should specialize by constructing a portfolio of investments that are

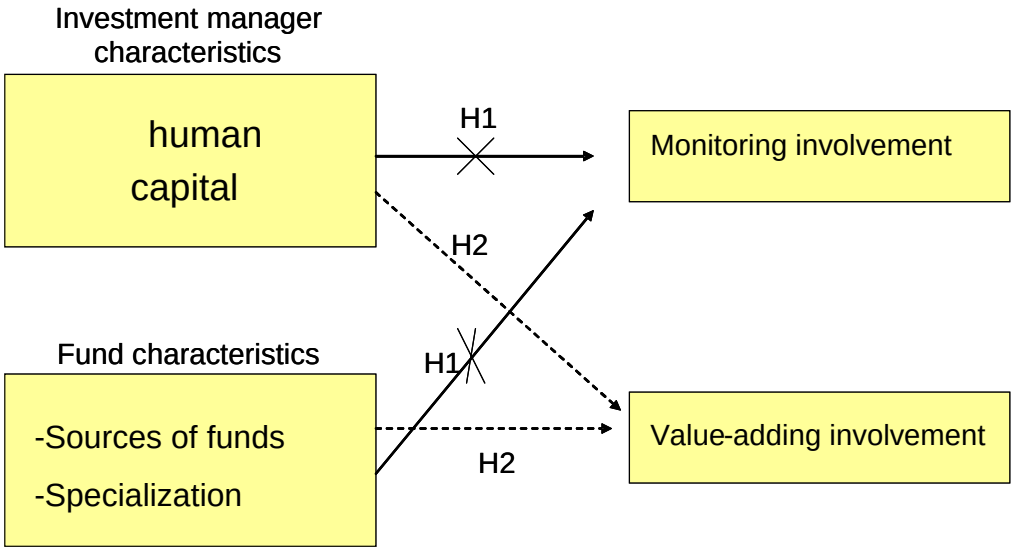
within their specific technical and product expertise (Manigart et al., 2002). Murray (1998) indicates that, given the complexities of technologies, it is critical that the professional investor is highly informed on both technical and commercially related issues. A specialization strategy in terms of industry scope may help VCs control for agency risk, by protecting themselves against adverse selection and moral hazard problems (Eisenhardt, 1989). Thus, a number of VCs manage risk by becoming specialist in one or a small number of technology areas rather than by diversification across several technologies.

Thus, we can conclude that the degree of specialization has an impact on the involvement in following up on portfolio companies.

5.3 Model and hypotheses

In this section, we build hypotheses drawing on the theoretical perspectives elaborated above. We formulate hypotheses for the involvement in specific follow-up activities, being monitoring activities and value-adding activities. The conceptual framework behind the different hypotheses is summarized in Figure 17.

Figure 17: Conceptual framework



5.3.1 Involvement in monitoring activities

The degree to which a VC performs its monitoring role is closely related to the portfolio company itself. VCs tend to spend little time monitoring well-performing investments, whereas they may be highly involved in monitoring worse performing investments (Lerner, 1995). However, there is no theoretical or empirically valid reason to relate "monitoring activities" to the human capital and financial characteristics of the VC firm. Rather, monitoring is seen by the VCs as a necessary investment to avoid bankruptcy or excessively high cash losses, but not a sufficient activity to create value added. As such it is an institutionalized professional feature of the VC industry (Bruton et al, 2005), adopted by each VC. The European Venture Capital Association Book of Guidelines (chapter 4, p. 40) on 'The Management of an Investment' clearly indicates the degree of institutionalization. It provides procedural guidelines with respect to monitoring of investments which state: "monitoring should allow the manager to confirm that the investment is progressing in accordance with the relevant business plan and should provide sufficient information to identify any failures to meet targets or milestones and to formulate remedial plans where necessary". Studies have also suggested that a common feature of behaviour across VCs is the monitoring of investees (e.g. Mitchell et al., 1997; Pruthi et al., 2003). Hence:

H1: Involvement in portfolio firm monitoring is not influenced by human capital or firm characteristics of the VC.

5.3.2 Involvement in value-adding activities

As explained in the previous section, self-efficacy theory (Wood and Bandura, 1989) suggests that individuals with more successful previous experience will be more involved in post-investment value adding activities, because they consider themselves to be very good in this direction. Dimov and Shepherd (2005) differentiate between the specific and general experience embodied in the human capital of the investment manager. 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. Furthermore, we

argue that it is also important to focus on the investment manager's specific experience in relation to the industry sectors in which he/she is investing. The more specialized the portfolio, the more likely it is that the investment manager will have developed specific human capital in relation to his / her investments. Conversely, the more diversified the investments in the portfolio, the less likely it is that the investment manager will have developed specific human capital in relation to his / her investments.

The degree of specific human capital will be positively related to the chance of obtaining mastery experiences and thus the degree of self-efficacy. This will lead to a higher involvement in value-adding activities that require specific expertise. Similarly, general human capital, especially entrepreneurial experience, may enable the VC manager to assist the entrepreneur by drawing on the experience of the steps required to successful negotiate the hurdles along the development trajectory. Therefore:

H2a: Involvement in value-adding activities is positively related to specific human capital

H2b: Involvement in value-adding activities is positively related to general human capital

Fund characteristics and policy may also impact the follow-up behaviour of the investment managers. As aforementioned, strategic investment theory suggests that the shareholders of the funds might have different expectation levels concerning fund performance which may feed through into involvement in value-adding activities. More specifically, it is argued that fund objectives may differ between captive (in this case: private equity arms of banks or public funds) and non-captive funds. Non-captive funds have a higher profit-orientation associated with seeking higher returns (Manigart et al., 2002), and have incentive systems that are based on profit generation and profit sharing. As such they are likely to be closely involved in value adding activities in order to achieve their rate of return targets. In contrast, investment managers at captive funds are likely to be less involved with value-adding activities that are expected to increase financial outcomes of investments.

Hence:

H2c: Involvement in value-adding activities is negatively related to captive funds

Second, portfolio theory explains the degree to which funds strategically choose to specialize or not. Traditional finance theory suggests that funds should deal with risk through diversification. In contrast, resource-based theory suggests that those VCs that specialize might cumulate specific skills and resources and obtain a competitive advantage over their competitors. Information and networking advantages are likely to occur when VC funds specialize as they are able to deepen their knowledge of particular markets (Manigart et al., 2002). These advantages should enable investment managers to be more involved in value-adding activities. Hence:

H2d: Involvement in value-adding activities is negatively related to the degree of diversification

5.4 Research methodology

5.4.1 The sample

A stratified sample of 68 VC firms was drawn from different regions across Europe, namely Cambridge/London region (UK), Ile de France (France), Flanders (Belgium), North Holland (the Netherlands), Bavaria (Germany), Stockholm region (Sweden), Helsinki region (Finland). We refer to chapter 3, section 3.2.1 for a description of the sample.

5.4.2 Research design

Interviews with investment managers were carried out between January and December 2003. During these interviews, information on the resource-based characteristics of the venture capital firm were collected, just as information on the investment manager (mainly asking for information on previous experience). Information was also collected

on the investment manager's follow-up behaviour. More specifically, information was assembled on the involvement in monitoring and value-adding activities.

In defining the activities that may be undertaken by the VCs it was first necessary to examine existing research, in particular, the work of: Sapienza et al. (1996) and Sapienza (1992), Pruthi et al. (2003) and MacMillan et al. (1989). The latter focused on all follow-up activities, whereas the first focused on value-adding activities only. Pruthi et al. (2003) give an overview of all follow-up activities, but focus their analysis on monitoring activities. A synthesis of this research resulted in five monitoring activities, and 14 value-adding activities. The pilot interviews identified three additional value-adding activities for inclusion in the list, all of which were specific to high tech investing. These were: "negotiating intellectual property rights", "recruiting the head of R&D" and "forming the Advisory Board". This resulted in 22 follow-up activities which are presented (together with references to previous research) in Table 15.

Table 15: Overview of follow-up activities

	Sapienza et al. (1992 and 1996)	Pruthi et al. (2003)	MacMillan et al. (1989)	Pretests
Monitoring activities				
Have a look at the financial overview regularly		X	X	
regularly check sales figures and pipe		X	X	
restrictions on changes in ownership		X		
restrictions on additional borrowings		X		
restrictions on CEO's remuneration		X		
Value-adding activities				
have a seat on Board of Directors	X	X		
Form an advisory Board				X
Determine the composition of the Board		X		
contact potential customers	X	X	X	
open doors (network)	X	X	X	
meet the entrepreneurs regularly	X		X	
hire the head of marketing and sales	X	X	X	
hire a CFO	X	X	X	
hire the R&D head				X
hire a CEO	X	X	X	
negotiate important contracts	X			
find additional financing	X	X	X	

hire new employees	X	X	X	
negotiate intellectual property rights				X
strategic planning	X	X	X	
act as a sounding board	X	X	X	
daily management (operational tasks)	X	X	X	

The investment managers were asked to score these follow-up activities on two scales: frequency and importance. Investment managers scored the frequency of each of the activities on a five point Likert scale which ranged from 1= never carry out this activity for portfolio companies and 5= always carry out this activity for portfolio companies. They also scored the importance that they attached to the activities on a scale ranging from 1=little important follow-up activity to 5= very important follow-up activity. Multiplying both importance and frequency scores of follow-up activities resulted in 'involvement indicators' for each of the 22 follow-up activities, with scores ranging between 1 and 25, with 1 being low involvement for the follow-up activity, and 25 being very high involvement for the follow-up activity.

Individuals were asked to justify motivate their scores. This allowed us to understand the situation of VC industry at the time of interview better. This part of the interview took about half an hour per respondent. 68 answers with respect to follow-up behaviour were collected.

5.4.3 Measures

5.4.3.1 Dependent variables

5.4.3.1.1 Involvement in monitoring and value-adding activities

We combined the involvement indicators that we received for each of the five monitoring activities and the 17 value-adding activities into summated scales. In order to check consistency of the scales, we used Cronbach's Alpha. All summated scales met the 0.60 value for acceptability (Hair et al., 1998)[8].

Exploratory factor analysis was carried out in order to make sure that none of the monitoring activities loaded on value-adding activities and vice versa. This was not the case, allowing us to use the initial subdivision of activities in monitoring and value

[8] Cronbach Alpha of 0.65 for monitoring activities, 0.774 for value-adding activities.

adding. Given the relatively small sample, relatively high factor loadings (larger than .70) would have been required in order to use factor scores in the analysis. This was not the case, therefore, the summated scales as mentioned above were retained. Factor analysis however showed similar type of follow-up activities identified by previous research, namely strategic roles, networking roles, operational roles and interpersonal roles. Monitoring activities proved to load on a different factor. Board membership, which can be classified as both monitoring activity and strategic involvement, loaded only on the strategic factor, thus indicating that our group of investors regarded this membership mainly as strategic. This was supported by the interviews, where investment managers mentioned that it was more time- and cost-efficient to monitor a portfolio company by regularly telephoning the entrepreneur and asking him to send the financial overview, instead of spending time at board meetings looking into the financial and operational performance of the company. Table 16 gives an overview of the descriptives of each follow-up activity by category.

Table 16: Descriptives of follow-up activities (frequency, importance and involvement indicator)

	Frequency		Importance		Involvement indicator (frequency*importance)	
Monitoring activities	**Mean**	**Standard Deviation**	**Mean**	**Standard Deviation**	**Mean**	**Standard Deviation**
Have a look at the financial overview regularly	4.80	.50	4.58	.73	22.12	4.65
Regularly check sales figures and orderbook	4.44	.99	4.45	.79	20.14	6.20
Restrictions on changes in ownership	4.41	1.04	4.10	1.15	18.60	7.23
Restrictions on CEO's remuneration	3.52	1.48	3.43	1.32	16.98	7.26
Restrictions on additional borrowings	4.13	1.09	3.94	1.09	13.29	8.35
Monitoring average	**4.26**	**1.02**	**4.1**	**1.02**	**18.25**	**4.43**
Value-adding activities	**Mean**	**Standard Deviation**	**Mean**	**Standard Deviation**	**Mean**	**Standard Deviation**
Meet the entrepreneurs regularly	4.67	.71	4.62	.82	21.88	5.43
Strategic planning	4.24	.95	4.41	.87	19.35	6.20
Have a seat on Board of Directors	4.17	1.09	4.29	1.09	18.77	7.33
Act as a sounding board	4.24	.98	4.24	1.03	18.75	6.76
Find additional financing	4.00	.98	4.47	.95	18.41	6.57
Open doors (use network)	4.17	1.05	4.15	.95	17.92	6.75
Determine the composition of the Board	3.88	1.14	4.09	.99	16.62	7.03
Hire a CEO	2.92	1.03	4.41	1.25	13.33	6.07
Contact potential customers	3.08	1.22	3.26	1.23	10.94	6.80
Hire a CFO	2.74	.90	3.52	1.18	10.02	4.76
Hire the head of marketing and sales	2.52	.97	3.42	1.27	9.18	5.48
Form an advisory Board	2.38	1.21	2.77	1.32	7.94	7.13
Negotiate important contracts	2.30	1.16	2.94	1.45	7.92	6.60
Negotiate intellectual property rights	2.24	1.23	3.14	1.47	7.92	6.57
Hire the R&D head	1.77	.80	2.82	1.40	5.53	4.14
Hire new employees	1.74	1.06	1.68	.88	3.42	3.60
Daily management (operational tasks)	1.65	.79	1.80	1.14	3.31	3.09
Value-adding average	**3.10**	**.94**	**3.53**	**1.13**	**12.63**	**2.66**

Table 16 shows that early stage high tech investors seem to be the least involved in operational roles and networking activities. They tend to be more involved in activities that were defined as monitoring activities, strategic activities and interpersonal roles by previous researchers.

Also Sapienza et al. (1996) found that, with respect to value-adding activities only, that strategic roles were the most important, followed by the interpersonal roles, whereas the networking roles were the least important. We find no indication that early stage high tech investors behave differently with respect to follow-up behaviour from non-high tech or mixed investors samples explored by other researchers.

5.4.3.2 Independent variables

5.4.3.2.1 Human capital

With respect to the human capital of the venture capitalist, we collected information on the previous experience of the VC. The investment managers interviewed had either worked at a bank, consulting firm, in industry, in the academic world, or had been entrepreneurs themselves before joining the VC industry. Consulting experience, financial experience, business experience and investment management experience were, consistent with Dimov and Shepherd (2005), labelled 'specific human capital'.

We asked for the number of years they had worked at a bank, audit or accountancy firm before joining the VC industry, and coded this as the degree of financial experience. The number of years they had worked as consultant (e.g. Mc Kinsey, BCC group) was coded as consulting experience. The number of years experience in a management function in industry was coded as business experience.

We also asked for the number of years they had been active in the VC industry as investment manager. People from the financial world had on average worked for 6.6 years in either a bank, audit firm or as accountant. Investment managers who worked in consulting before joining the VC industry had on average 3.9 years experience in consulting. Investment managers after a career as manager in a company had on average eight years of experience. The investment managers in our sample had on average 4.85 years of experience as investment manager, ranging from 1 year for the least experienced investment manager to 17 years for the most experienced.

A further specific dimension of specific human capital is whether the investment executives manage diversified or specialized portfolios of companies with respect to industry focus. To construct this measure, the EVCA industry classification was used, identifying eight high tech sectors.[9] This results in a score of 1 to 8 for each investment manager, 1 being the most specialized and 8 the most diversified.

Both academic and entrepreneurial experience was considered as general human capital, following Dimov and Shepherd (2005). If the investment managers had worked on a PhD. at university after graduating, we labelled this academic experience (1=academic experience, 0=no academic experience). If they had been entrepreneurs themselves, we coded this as having entrepreneurial experience (1=entrepreneurial experience, 0= no entrepreneurial experience). Seven of the investment managers interviewed had academic experience, ten had been entrepreneurs themselves.

5.4.3.2.2 Fund characteristics

Fund characteristics were measured by two variables. First, we asked for the origin of funds. Funds that were 100% funded by public means or that were private equity arms from banks were classified as "captive funds", others were not (1=captive; 0=not captive). 15 out of our sample of 68 were classified as "captive funds", including six private equity arms from banks and nine public funds.

We measured the degree of specialization at fund level using the same EVCA industry classification mentioned above. This resulted in each fund being assigned a score from 1 to 8.

5.4.3.3 Control variables

We employ control variables in respect of VC fund sizes and location of funds.

First, we controlled for the location of the funds. The UK was the first established VC market in Europe and is nowadays the most mature VC market in the EU, with the largest amounts of VC money invested (Martin et al., 2002; La Porta et al., 1997). The UK VC industry is distinctive as a large amount of invested money goes to buy-outs (70% of the

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

amounts invested in 2001 (EVCA, 2002). The Scandinavian market is geographically distinct from other European regions, and venture capital activity in these Scandinavian countries (Finland and Sweden in our study) has grown extraordinarily at the end of the 1990s (EVCA, 2002). Therefore, two dummy variables were created, one indicating whether the fund was located in the UK or not (0=non-UK, 1=UK), and one indicating whether the fund was located in Scandinavia or not (0=non-Scandinavia, 1=Scandinavia). Second, we controlled for the size of the fund, measured as the capital managed, which was found to be influencing the behaviour of VC firms in previous research. For instance, Elango et al. (1995) found that the large firms provide the least, and the medium-sized firms the most assistance to portfolio companies.

5.5 Results

The correlations and descriptive statistics for the variables are presented in Table 17.

Table 17: Descriptive statistics and correlations

	Mean	S.D.	1	2	3	4	5	6	7	8	9
1. Consulting experience	1.02	2.03	1.00								
2. Financial experience	2.23	4.65	-.06	1.00							
3. Business experience	4.55	6.07	-.03	-.25*	1.00						
4. Investment managem exp	4.85	3.99	-.24	-.01	.11	1.00					
5. Diversification by investment manager	3.21	2.42	.21	.31*	.00	.00	1.00				
6. Diversification at fund level	4.09	2.30	.18	.19	.00	.10	.78	1.00			
7. VC Fund size[a]	269.04	654.25	.06	-.14	-.03	-.10	-.22	-.05	1.00		
8. Monitoring involvement	18.25	4.43	.05	.02	-.10	-.13	-.03	-.05	.00	1.00	
9. Value-adding involvement	12.63	2.66	.05	-.40*	.14	-.02	-.46	-.37	.05	.04	1.00

[a] indicates the capital managed by the VC fund, measured in millions of Euros

Pearson correlations, * correlations are significant at P<.05, n=68

Collinearity diagnostics showed that all variance inflation values were below 3.0, suggesting that multicollinearity was not an issue (Hair et al, 1998). We used regression analysis (OLS) in order to test the hypotheses elaborated earlier. We conducted several diagnostic tests to ensure the data did not violate the assumptions of normality, linearity, and homoscedasticity necessary for OLS regression estimation. Using Z scores and a visual inspection of histograms, we found all dependent variables to be normally distributed. Residuals were tested for independence, normality and constant variance. All necessary conditions were met.

5.5.1 Involvement in monitoring activities (H1)

The result of the analysis for H1 is given in Table 18. We find **support for H1**. The model is not statistically significant for monitoring activities, indicating that the variance in the predictor variables does not have any explanatory power for the variance in the dependent variable, involvement in monitoring activities. Neither human capital variables nor fund characteristics seem to be important determinants of the degree to which the investment manager is involved in monitoring activities. Therefore, we find support for H1, that monitoring is not affected by human capital or fund level characteristics.

Table 18: Regression analysis for involvement in monitoring activities

	Base model	Base model + specific human capital	Base model + fund characteristics	Full model
Investment manager characteristics				
Specific human capital				
Consulting experience		.051		.045
Financial experience		-.031		.002
Business experience		-.158		-.166
Investment management exp		-.166		-.183
Diversified portfolio experience by investment mgr		.058		.082
General human capital				
Academic experience		-.015		-.017
Entrepreneurial experience		.100		.110
Fund characteristics				
Captive fund				-.137
Diversification at fund level				.030
Control variables				
UK-based	.077	.108	.078	.110
Scandinavia-based	.096	.121	.074	.111
VC fund size	.017	-.021	.004	-.017
Constant	17.797****	11.825****	14.077****	11.207****
Model				
F statistic	.221	.413	.346	.394
R^2	.011	.078	.028	.091
Adjusted R^2	-.038	-.110	-.054	-.141

Levels of significance: *=.10; **=.05; ***=.01; ****=.001; n=63

5.5.2 Involvement in value-adding activities (H2)

Table 19 presents the results of the analysis for H2a-d. The base model, only including control variables, was statistically significant. Adding human capital and fund characteristics variables increased the significance of the model. The full model was significant at the .001 level, with 36.8% of the variance explained. The full model had significant coefficients for consulting experience ($P<0.10$), the industry diversification at investment manager level ($P<0.10$), entrepreneurial experience ($P<0.10$) and the captive fund variable ($p<0.05$). These results indicate that both human capital variables and fund characteristics impact involvement in value-adding activities by the investment manager. A higher level of consulting experience indicates a higher involvement in value-adding activities. Investment managers that had been entrepreneurs were more involved in follow-up activities than others. Investment managers that specialize in one or a small number of sectors are more involved in these value-adding activities. The only fund level characteristic which was found to be statistically significant was captive funds, which was negatively related to involvement in value adding activities.

In summary, we find partial support for H2a: consulting experience has a significant positive effect on value-adding involvement. Furthermore, the more specialized the portfolio of an investment manager the greater the involvement in value-adding activities. Financial experience and the other specific human capital variables were not found to have a significant impact. We find partial support for H2b, that general human capital is positively related to value-adding activities. In particular, entrepreneurial experience has a significant positive effect on value-adding involvement but academic experience has a non-significant effect. We find support for H2c, captive funds are less involved in value-adding activities. Finally, we do not find support for H2d, therefore, the degree of diversification of a fund has no significant impact on value-adding involvement.
value-adding activities. First, investment managers working at captive funds tend to be much less involved in value-adding activities. Second, investment managers that are confronted with a higher degree of diversification in their fund and/or own portfolio are less involved in these kinds of activities.

Table 19: Regression analysis for involvement in value-adding activities

	Base model	Base model + specific human capital	Base model + fund characteristics	Full model
Investment manager characteristics				
Specific human capital				
Consulting experience		.246*		.229*
Financial experience		-.160		-.089
Business experience		.134		.111
Investment management exp		.070		.043
Diversified portfolio experience by investment mgr		-.493****		-.335*
General human capital				
Academic experience		.068		.065
Entrepreneurial experience		.215		.222*
Fund characteristics				
Captive fund			-.345***	-.321**
Diversification at fund level			-.207*	-.050
Control variables				
UK-based	-.044	-.037	-.012	-.028
Scandinavia-based	.303**	.058	.240**	.051
VC fund size	.087	.040	.047	.061
Constant	12.065****	17.410****	21.122****	17.802****
Model				
F statistic	2.330*	3.518**	5.579****	3.862****
R^2	.103	.418	.321	.496
Adjusted R^2	.059	.299	.263	.368

Levels of significance: *=.10; **=.05; ***=.01; ****=.001; n=63

5.6 Conclusions

Using a unique, hand collected dataset, this study has examined neglected aspects of VC behaviour relating to early stage high tech ventures: to what extent do VCs play a role in their portfolio companies and what determines the differences between VCs in the way they approach their portfolio companies after investment?

From a theoretical perspective, we found two different dimensions of the VC that could impact its follow-up behaviour: the human capital of the investment manager responsible for the portfolio company and the policy adopted by the fund. Neither human capital characteristics nor fund characteristics were found to influence monitoring behaviour. We believe the reasons for this to be twofold. First, monitoring portfolio companies is institutionalized into the European VC industry such that VCs' *monitoring roles* are standardized in terms of regular procedures to allow the manager to confirm that the investment is progressing both financially and operationally in accordance with the business plan and to obtain sufficient information to identify any failures to meet targets and to formulate appropriate remedial plans(Mitchell et al., 1997; Pruthi et al., 2003). Second, differences in the types of *monitoring mechanisms* seem to be determined more by the performance and risk profile of the portfolio companies, and the expected agency costs (Sapienza et al., 1994; Lerner, 1995). Hence, as our sample related to early stage high tech investments, a high degree of monitoring was expected to be prevalent. Cross-country studies show considerable commonality in the relative importance of the different formal (i.e. contractual and informational) and informal (relational) *monitoring mechanisms* that are used as VCs follow professional norms, although there are a small number of differences related to local institutional factors in particular countries (Kaplan and Strömberg, 2001; Mitchell et al., 1997; Pruthi et al., 2003; Ray, 1991; Wright et al., 1999; Farag et al., 2004). These findings emphasize the importance of the agency perspective as a major determining factor in monitoring behaviour.

We found that both human capital characteristics (hypotheses H2a and H2b) and fund characteristics (hypotheses H2c) determine the VC's involvement in value-adding follow-up activities. Concerning human capital characteristics, specific human capital in terms of consulting and general human capital in terms of entrepreneurial experience

were related to value adding activities. Besides, specialization by the investment manager with respect to industry focus was found to positively impact value-adding involvement. These findings are consistent with the self-efficacy aspects of human capital which suggest that more experience in performing certain relevant tasks will enable actors to perform more effectively. The significance of the consulting variable suggests that investment managers with this experience will be more able to add value to high tech ventures by both identifying markets and helping ventures achieve competitive advantage in those markets. General human capital relating to entrepreneurial experience may be important as the self-efficacy gained from undertaking previous entrepreneurial ventures may help new venture entrepreneurs to negotiate the hurdles involved in successfully commercializing their ventures. Further, we found that the degree of diversification at investment management level has a negative impact on involvement in value adding activities. This is expected since it is difficult for investment managers to keep track of strategic information and build a network in different sectors and industries.

Concerning fund characteristics, we found a difference between captive funds and others (H2c). Investment managers at captive funds were less involved in value-adding managers to develop activities. This is especially surprising for public funds since they typically invest in seed stage ventures with high risk and uncertainty, incomplete teams of entrepreneurs, and far from market-ready technology. Since these portfolio companies need a lot of coaching, one would expect high value-adding involvement by the VC. It may be that, as public funds invest relatively small amounts of money in a large number of companies in very different technologies, their diversification may not allow investment managers to develop skills or a complementary network. In addition, these funds tend to be smaller in size and smaller in the amount of management fee they can spend. This can result in the attraction of investment managers with less experience and a smaller team of investment managers for a larger and more diversified portfolio of companies.[10]

[10] Additional tests on our sample show that public funds are smaller (average capital managed 83.8 million Euro compared to 297.8 million Euro for non-public funds; difference significant at P<.10), construct diversified portfolios and have less investment managers per sector managed (.80 compared to 3.09 for non-public funds; difference significant at P<.01), and that investment managers at public funds manage

5.7 Policy and management implications

The findings have interesting implications for investment managers, entrepreneurs and policy makers.

Our study shows that the degree to which a deal is monitored and the kind of monitoring activities performed do not differ between early stage, high tech VCs or between their investment managers, on average (Hypothesis H1). This means that agency theory based "monitoring" as such does not lead to differences in performance between VC funds. In contrast, early stage high tech VC funds tend to differentiate their involvement in value-adding activities (Hypotheses H2-H2d). With respect to fund characteristics, our results suggest that specialized, private VC firms typically investing in early stage projects tend to invest most in value adding activities afterwards. In contrast, public funds that invest in earlier stages spend less effort in value adding activities. This is surprising since one would expect an even larger involvement in these earlier stages.

Even within funds, our findings provide more fine-grained analysis than previous research with respect to human capital (Lockett et al., 2002) by indicating that investment managers as individuals differ in the way they deal with the portfolio companies they manage. Investment managers with human capital relating to a consulting background tend to be most intensively involved in following up their deals from a value-adding point of view. Besides, if they specialize in a limited number of sectors, they are more involved in value-adding activities. Additionally, investment managers with a background as entrepreneurs tend to be more involved with value-adding activities. This implies that the investment manager's prior experience determines to a large extent his/her management style once he/she enters into the VC world[11]. This observation has important implications for the recruitment policy of VC companies and is an interesting signal to entrepreneurs who look for "smart" money.

If an entrepreneurial team is confident that it does not require advice or detailed value adding assistance from a VC investor, it may seek to be funded by a public or captive

---

more investments at a time than their non-public counterparts (9.40 investments per investment manager compared to 4.09 for non-public funds; difference significant at $P<.05$)

[11] Interaction terms involving consulting and investment management experience were tested and found to be not significantly positive. Interaction terms involving financial and investment management experience were also found to be not significantly positive.

fund. Alternatively, where it does need advice, it may better to seek investment with an independent, specialist VC firm.

Our results also have important policy implications. Government attempts to bridge the equity gap for high tech start-ups and academic spin-outs in particular have involved the setting up public-private partnership funds. The private partners in these funds are usually captive private equity arms of large financial institutions who are often asked to manage the fund. These financial institutions have the slack capacity to invest in government relations and the geographical coverage to set up different public/private partnerships in a particular country. The drawback, as our evidence shows, is that these funds typically engage less in value adding activities.

This study points to several interesting questions for future research. An interesting extension would be to interview more than one investment manager per fund in order to determine whether the importance of fund characteristics still hold when looking at the entire group of investment individuals involved in a VC fund. It would also be interesting to investigate whether involvement in value-adding activities has a positive impact on portfolio company growth. This would then contribute to the recent debate of whether venture capital is an art of building winners or picking them (Baum and Silverman, 2004). Finally, linking involvement in monitoring activities to performance of the portfolio companies followed up by the investment manager could shed light on our view that the degree of monitoring will be linked to portfolio company performance.

5.8 References

Baum J.A.C., Silverman B.S. (2004). Picking winners or building them? Alliance, intellectual and human capital as selection criteria in venture financing and performance of biotechnology. *Journal of Business Venturing*. 19(3): 411-425.

Becker G.S. (1975). Human capital. Chicago University Press, Chicago, IL.

Cable D.M., Shane S. (1997). A prisoner's dilemma approach to entrepreneur-venture capitalist relationships. *Academy of Management Review*. 22(1): 142-177.

Bruton G., Fried V. and Hisrich R. (1998) Venture Capitalists and CEO Dismissal. *Entrepreneurship Theory and Practice*. 21: 41-54.

Bruton G., Fried V., Manigart S. (2005). An institutional view of the development of venture capital in the US, Europe and Asia. *Entrepreneurship Theory and Practice*, forthcoming.

Baum J.A.C., Silverman B.S. (2004). Picking winners or building them? Alliance, intellectual and human capital as selection criteria in venture financing and performance of biotechnology. *Journal of Business Venturing*. Vol. 19(3): 411-430.

Dahlqvist J., Davidsson P. and Wiklund J. (2000). Initial conditions as predictors of new venture performance: a replication and extension of the Cooper et al. study. *Enterprise and Innovation Management Studies*. Vol. 6: 67-84.

Dimov P.D., Shepherd D.A. (2005). Human capital theory and venture capital firms: exploring "home runs" and "strike outs". *Journal of Business Venturing.* 20: 1-22.

Eisenhardt K.M. (1989). Agency Theory: an assessment and review. *Academy of Management Review*. 14: 57-74.

Elango B., Fried V.H., Hisrich R.D., Poloncjek A. (1995). How Venture Capital Firms Differ. *Journal of Business Venturing*. 10: 157-179.

Engel D. (2004). The performance of venture-backed firms: the effect of venture capital characteristics. *Industry and Innovation.* 11(3): 249-263.

EVCA. Evca guidelines. P. 1-159. Downloadable at www.evca.com

EVCA (2002). EVCA Yearbook. Annual Survey of Pan-European Private Equity & Venture Capital Activity.

EVCA (2003). EVCA Yearbook. Annual Survey of Pan-European Private Equity & Venture Capital Activity.

EVCA (2004). EVCA Yearbook. Annual Survey of Pan-European Private Equity & Venture Capital Activity.

Fama E., Jensen M. (1983). Separation of Ownership and Control. Journal of Law and Economics. 26: 301-326.

Farag H., Hommel U., Witt P., Wright M. (2004). Contracting, monitoring, and exiting venture investments in transitioning economies: A comparative analysis of Eastern European and German markets. *Venture Capital*. Vol. 6(4): 257-263.

Galbraith J.R. (1973). Designing complex organisations. Reading, MA: Addison-Wesley.

Gimeno J., Folta T.B., Cooper A.C., Woo C.Y. (1997). Survival of the fittest? Entrepreneurial human capital and the persistence of underperforming firms. *Administrative Science Quarterly*. 42(4): 750-784.

Gist M.E., Mitchell T.R. (1992). Self-efficacy: a theoretical analysis of its determinants and malleability. *Academy of Management Review*. 12(2): 183-211.

Gomez-Meija L.R., Welbourne T.M., Wiseman R.M. (1990). The role of risk sharing and risk taking under gainsharing. *The Academy of Management Review*. 25(3): 492-108.

Gompers (1995). Optimal Investment, Monitoring, and the Staging of Venture Capital. *Journal of Finance*. 50(5): 1461-1489.

Hair J.F., Anderson R.E., Tathum R.L., Black W.C. (1998). Multivariate data analysis with readings. Macmillan, New York.

Hart O. (1995). Firms, Contracts and Financial Structure,.Oxford, Clarendon Press.

Hellman T. (2002). A theory of strategic venture investing. *Journal of Financial Economics*. 64: 285-314.

Kaplan S., Strömberg P. (2001). Venture Capitalists as Principals: Contracting, Screening and Monitoring. *American Econ. Review*. Vol. 91(2): 426-430.

Kirzner I. (1973). Competition and entrepreneurship. University of Chicago Press.

Lam S. (1991). Venture capital financing: a conceptual framework. *Journal of Business Finance and Accounting*. 18(2): 137-149.

La Porta R., Lopez-De-Silanes F., Shleifer A. and Vishny R. (1997). Corporate ownership around the world. *Journal of Finance*. 54: 471-517.

Lerner, J. (1995). Venture capitalists and the oversight of public firms. *Journal of Finance*. 50(1): 301-318.

Lockett A., Murray G., Wright M. (2002). Do UK venture capitalists still have a bias against investment in new technology firms? *Research Policy*. 31: 1009-1030.

MacMillan I.C., Kulow D.M., Khoylian R. (1989). Venture capitalists involvement in their investments: extent and performance. *Journal of Business Venturing*. 4: 27-47.

Manigart S., De Waele K., Wright M., Robbie K. (2002). Determinants of required return in venture capital investments: a five-country study, *Journal of Business Venturing*. 4: 27-47.

Martin R., Sunley P., Turner D. (2002). Taking risks in regions: the geographic anatomy of Europe's emerging venture capital market. *Journal of Economic Geography*. 2: 121-150.

Mitchell F., Reid G., Terry, N. (1997). Venture capital supply and accounting information system development. *Entrepreneurship Theory and Practice*. 21(4): 45-62.

Murray G. (1998). A policy response to regional disparities in the supply of risk capital to new technology-based firms in the European Union: The European Seed Capital Fund scheme. *Regional Studies*. 32(5): 405-420.

Murray G. (1999). Early stage venture capital funds, scale economies and public support. *Venture capital*. 1(4) : 351-384.

Pruthi S., Wright M., Lockett A. (2003). Do foreign and domestic venture capital firms differ in their monitoring of investees? *Asia Pacific Journal of Management*. 20: 175-204.

Ray D. (1991). Venture capital and entrepreneurial developments in Singapore. *International Small Business Journal*. Vol. 10(1): 11-26.

Repullo R., Suarez J. (1990). Venture Capital Finance: a security design approach. Working paper, centre for monetary and financial studies, Madrid, Spain, 1999.

Sapienza H.J. (1992). When do venture capitalists add value? *Journal of Business Venturing*. 7: 9-27.

Sapienza H.J., Amason A.C. (1993). Effects of Innovativeness and Venture Stage on Venture Capitalist-Entrepreneur Relations. *Interfaces*. 23(6): 38-51.

Sapienza H.J., Gupta A.K. (1994). The impact of agency risks and task uncertainty on venture capitalist-CEO interaction. *Academy of Management Journal*. 37(5): 1618-1632.

Sapienza H.J., Amason A.C., Manigart S. (1994). The level and nature of venture capitalist involvement in their portfolio companies: a study of three European countries. *Managerial Finance.* 20(1): 3-17.

Sapienza H.J., Manigart S., Vermeir W. (1995). A comparison of venture capitalist governance and value-added in the U.S. and Western Europe. *Academy of Management Journal*. 105-109.

Sapienza H.J., Manigart S., Vermeir W. (1996). Venture capitalist governance and value added in four countries. *Journal of Business Venturing*. 11: 439-469.

Schefczyk M., Gerpott T.J. (2001). Management support for portfolio companies of venture capital firms: an empirical study of German venture capital investments. *British Journal of Management*. 12: 201-216.

Shepherd D.A., Zacharakis A. (2003). Venture capitalists' expertise. A call for research into decision aids and cognitive feedback. *Journal of Business Venturing*. 17: 1-20.

Steier L., Greenwood R. (1995). Venture capitalist relationships in the deal structuring and post-investment stages of new firm creation. *The Journal of Management Studies*. 32(3): 337-358.

Sweeting R., Wong C. (1997). A UK hands-off venture capital firm and the handling of post-investment investor-investee relationships. *Journal of Management Studies*. 34(1): 125-152.

Ucbasaran D., Lockett A., Wright M., Westhead P. (2003). Entrepreneurial founder teams: factors associated with member entry and exit. *Entrepreneurship Theory and Practice*. 28(2): 107-134.

Ucbasaran D., Wright M. and Westhead P. (2003). A longitudinal study of habitual entrepreneurs: starters and acquirers. *Entrepreneurship and Regional Development*. Vol. 15: 207-228.

Van den Berghe L., Levrau A. (2002). The role of the venture capitalist as monitor of the company: a corporate governance perspective. *Corporate Governance-An International Review*. 10 (3): 124-136.

Weber C., Dierkes M. (2002). Strukturmerkmale klassischer Venture-Capital-Gesellschaften und Corporate-Venture-Capital-Gesellschaften in Deutschland im Vergleich. *Finanzbetrief*. 4: 545-553.

Wood R., Bandura A. (1989). Social Cognitive Theory of Organizational Management. *Academy of Management Review*. 14(3): 361-384.

Wright M., Robbie K. (1998). Venture Capital and Private Equity: A Review and Synthesis. *Journal of Business Finance and Accounting*.25 (5/6): 521-570.

Wright M., Karsai J., Dudzinski Z., Morovic J. (1999). Transition and active investors: venture capital in Hungary, Poland and Slovakia. *Post-Communist Economies*. Vol. 11(1): 27-46.

Wright M., Lockett A. (2003). The structure and management of alliances: syndication in the venture capital industry. *Journal of Management Studies*. 40(8): 2073-2104.

6 The effect of venture capitalists on the early stage growth of high tech ventures

6.1 Introduction

Understanding the growth of high tech ventures has increasingly become an important area for research due to the contribution these ventures are expected to make in terms of employment and technological and economic development (Storey and Tether, 1998; Rothwell and Zegveld, 1982; Freeman, 1983; Oakey et al., 1988; Keeble, 1989; Murray, 1996). Despite the romantic belief among practitioners and policy makers that many of these high tech start-ups are potential gazelles, several scientific studies (Autio and Yli-Renko, 1998; Mustar, 1997) indicate that most high tech start-ups *do not grow at all*. Still, some more recent studies indicate that those high tech start-ups that succeed in attracting venture capital tend to outperform those that do not in terms of time to market (Hellman and Puri, 2000), innovative activity (Kortum and Lerner, 2000) and employment/revenue growth (Heirman and Clarysse, 2005). But even for this category of firms, evidence seems to be mixed. Schoonhoven et al. (1990) show that US high tech start-ups that receive venture capital are even worse performing than those that do not and that they need more time to ship their first product for revenues. A finding which is attributed by the authors to the slack that is the result of a more comfortable cash position that most VC backed start-ups have. Ruhnka et al. (1992) indicate that some of the VC's portfolio companies are what they call "living deads".

Most of the aforementioned studies treat the presence of venture capital as a dummy variable. This means that each VC is assumed to have the same selection capacity and competence to play a post-investment role (Davila et al., 2003; Hellmann and Puri, 2000; Baum and Silverman, 2004). However, the venture capital literature shows a very different story. In fact, the venture capital industry is a rather fragment industry with different approaches in selection and follow-up behaviour (Muzyka et al., 1996; MacMillan et al., 1985; 1987; Sapienza et al., 1994). This is also shown in chapter 4 and

5). Heirman and Clarysse (2005) suggest that there might be a link between the *amount* of capital that a high tech start-up is able to raise and its later on performance. In short, they argue that start-ups which are not able to attract between 2 and 3 mio VC within 18 months after founding do grow significantly less than those start-ups which do not look for external capital at all. This finding suggests that some VCs systematically choose to invest in so-called living deads, which they are not able to grow after investment either.

The confusion about the role of VCs in growing companies can be partially related to the relatively simplistic view the aforementioned studies have on the role of VCs. Despite the large heterogeneity in the VC industry with respect to selection and follow-up behaviour and despite the large differences between VC funds in terms of size, focus, shareholder structure and age, they are considered to be a homogeneous group of firms. A better understanding is needed about how differences between VCs funds, both with respect to their characteristics and in terms of selection and follow up behaviour lead to selecting the highest growth potentials and realizing the potential.

We investigate the relation between VC involvement and portfolio company growth using a unique dataset of European VCs and 99 of their portfolio companies across Europe.

This chapter is structured as follows. First, we outline the theoretical background. We examine the determinants that are expected to lead to growth. Further we analyse their relation with the venture capital industry. Second, we develop a hypothetical framework about how VCs might have an effect on their portfolio companies. Third, we discuss the methodology used to draw a representative sample of VCs and to collect the data both for the VCs and their portfolio companies. Fourth, we analyse and discuss the results. Finally, the chapter ends with a concluding section.

6.2 Theoretical background: explaining new venture growth

In this section we summarize the theoretical explanations that have been given to explain growth. Within the strategic management literature, we analyse the resource based view, which has mainly focused on internal firm factors that might explain growth. Second, we analyse the Porterian or market view which has mainly focused on external market conditions that explain growth. Finally, we summarize the neo-classic economic view on growth.

6.2.1 The Resource based view

The analysis of firm-specific factors that lead to growth goes back to Penrose's (1959) ground-breaking work. She highlighted the importance of managerial resources to firm expansion. In particular, she emphasized that a lack of managerial resources causes problems that are a constraint for further growth– i.e. the so-called Penrose effect. Wernerfelt (1984) redirected the attention towards Penrose's original resource based explanation of firm growth. To the original theory, he added the imperfect working of markets as a critical element in explaining how resources generate competitive advantage. Resources are only valuable if they are difficult to trade or imitate on the spot market. His seminal article was the start of a stream of research which is called the Resource Based View. Researchers in this stream argue that success is depending on the characteristics of the firm's resource bundle (e.g. Barney, 1991). They recognize that a firm's initial resources are an important antecedent to current capabilities and opportunities. These researchers have studied the multidimensional construct that firm resources represent, and have studied different aspects of a firm's resource base. Its human resources include the founding team and entrepreneur (e.g. Utterback et al., 1988; Shane and Stuart, 2002); its technical resources encompass its product and technology (Utterback et al., 1988; Roberts, 1991), its organisational resources (Wernerfelt, 1984; Teece et al., 1997) and financial resources (Hellmann and Puri, 2000). Human capital, financial capital, organisational resources and technology are all instrumental in the development of an initial resource base and are considered key to the survival and success of new ventures (Roberts, 1991).

Previous research on high tech new ventures in the stream of the resource-based view shows that firms that start with market ready products significantly outperform those that begin as consultants or R&D contractors (Roberts, 1991; Delapierre et al., 1998). Hence, technical resources at start-up do matter in terms of potential growth path. Roberts' finding is further elaborated by Mc Cann (1991) and Lee et al. (2001), who highlight the importance of technological protection through patents to create value in high tech new ventures. Their argument is that the future of some of these new ventures does not lie in the commercialisation of a product and the related realisation of organic growth. Instead, value is created through building up a patent portfolio which then can lead to a trade sale. They indicate that intellectual property rights allow new ventures to commercialize the toils of their new product development efforts, seize market opportunities, and differentiate themselves from incumbents.

Besides the technology/product characteristics of the new venture, firm-specific human capital has been thoroughly examined. Welbourne and Andrews (1996) indicate that firm-specific human capital in new firms is embodied in the management know-how and experience of the founding team. Also on the empirical side, several researchers report that the entrepreneur's skills and experience are positively related to new firm success (Roberts, 1991; Cooper et al., 1994). Hellman and Puri (2000; 2002) highlight the importance of obtaining sufficient executive turnover in order to increase professionalization within new ventures and to enhance growth.

Finally, financial resources have been suggested as a way to overcome the liability of newness in small firms and hence realise success (Cooper et al., 1994; Hellman and Puri, 2000). Insufficient financial resources are often cited as a primary reason why new ventures fail (Lee et al., 2001). Most research that highlight the financial dimension emphasize the *lack* of resources as a critical inhibitor of not realising growth. Lee et al. (2001) are among the first to indicate that there is a *positive* relation between the amount of financial resources which technological start-ups have and their performance, measured by sales growth. These findings are in line with the VC literature, which describe two roles fulfilled by venture capitalists that turn money into 'smart-money'.

First, VCs are trained to select the high growth potentials (Tyebjee and Bruno, 1984; MacMillan et al., 1985, 1987; Hall and Hofer, 1993; Fried et al., 1994; Zacharakis and Meyer, 1995) and second, they play an active role in realizing this growth potential (Sapienza et al., 1995; Van den Berghe and Levrau, 2001; Schefczyk and Gerpott, 2001).

6.2.2 The market view

During the past decade, the resource based framework has been the most popular conceptual model to study sources of competitive advantage and, related, company growth. However in the seventies and eighties, the Bain-type Porterian framework was the dominant model to study. Both theories find their roots in the fifties with respectively Bain (1962) as a pioneer of the Porterian framework (Porter, 1980) and Penrose (1959) pioneering the resource based theory. In the seventies and eighties, most attention was given to the Porterian hypothesis that structural industry conditions determine performance differences between firms.

In line with this tradition, industrial organisation scholars have analysed the impact of first mover advantages, innovative activity and market opportunities on growth (for reviews, see Kamien and Schwartz, 1982; Cohen and Levin, 1988; Acs and Audretsch, 1990). This stream converges on the idea that firms grow fastest in markets where there is relatively little competition. At the theoretical site, Jovanovich (1982) developed a model, which predicts that, if price is constant over time and if incumbents choose to produce less on average in the next period due to expected decreases in efficiency, then increases in demand should be met by new entrants (these two conditions are very likely to be met if no technological breakthroughs take place which affect both expected efficiency and price and if the industry is not subject to ever increasing returns to scale). In the particular case of ever increasing returns to scale (or natural monopolies), Baumol et al.'s (1983) contestable market theory might be applied. Consistent with Jovanovich (1982), this theory predicts that large increases in demand are likely to be met by new entrants in the industry which occupy (temporarily) contestable niches. The argument was taken over and further developed by management practitioners such as Moore (1991), who argued that focusing on a specific market segment or niche market is critical

to market and sell new high tech products and argue that once the potential of the product/technology is demonstrated in a smaller market segment, the firm can use these first customers as a reference to go after larger, broader market experience.

6.2.3 The economic view

Studies of growth in economics have a long history, at least going back to Kapteyn's (1903) statements that growth is proportional to size and the factor of proportionality is random. In 1931, Gibrat argued that the size distribution of firms should be lognormal because of Kapteyn's growth process, better known as Gibrat's law. An extensive literature has tested Gibrat's law with mixed success (see Hannan and Ranger-Moore (1990) for an overview). As argued by Evans (1987), studies based on data for the late 1940s and 1950s typically find a positive relationship between size and growth (in other words, large organizations grow more than small ones), while studies based on data after the sixties typically show a negative relationship between size and growth. The main conclusion from this stream might be that there is probably no relation between founding size and growth to be hypothesized.

In this chapter, we analyse how venture capitalists intervene in the growth function of individual companies. Can we, based upon the theoretical insights as formulated above, explain differences in the growth of portfolio companies based upon the different selection criteria which VCs use and the different roles they play? And, do fund characteristics play a role in this?

In the next section we develop a hypothetical framework which links the selection behaviour and follow up intensity of VC funds to the growth of their portfolio companies, using the aforementioned theories as a guidance.

6.3 Model development

In this section we develop our model about how differences in VC selection and follow-up behaviour may affect investee growth.

6.3.1 Measuring growth

In this research, we focus on one specific growth measure, namely employee growth. Delmar et al. (2003) argue that there is no best way of measuring high tech venture growth. Several scholars argue that traditional accounting-based indicators of profitability are inappropriate for early stage RBSUs (e.g. Lee et al., 2001). Delmar et al. (2003) for instance indicate that assets and employment will grow before any sales will occur. Therefore, resource-based view scholars value employment and assets based measures as a highly suitable indicator of firm growth (Penrose, 1959; Kogut and Zander, 1992). Researchers studying the liability of newness have emphasized the importance for early stage high tech companies of reaching critical mass as soon as possible in order to bridge this liability (Oakey, 1995; Storey and Tether, 1998). Besides, policy makers are especially interested in identifying firms that contribute most to job creation. The focus on employee growth makes this research particularly interesting to VCs as researchers have provided evidence on a positive association between employee growth and value creation over successive rounds of financing (Davila et al., 2003).

6.3.2 Selection behaviour and employee growth

The venture capital literature gives a number of indications why venture capital might be a resource which addresses the market failure gap as described by Wernerfelt (1984) and becomes thus a competitive advantage. Amit et al. (1998) state that VCs exactly emerge because they develop specialized abilities in selecting and monitoring entrepreneurial projects, which decrease the chance of encountering adverse selection and moral hazard problems caused by information asymmetries. First, before making an investment, VCs carefully scrutinize the founders and their business concepts (Fried and Hisrich, 1994). Besides, VCs are expected to select those start-ups that have potential to obtain high growth and a management pursuing high growth (Zacharakis and Meyer, 1998; 2000). Thus, if a company succeeds in getting VC-money, this is also an indication of its growth potential, which might be difficult to observe from the outside. Previous research on the impact of VCs on the performance of firms usually took this point of departure, but did not come to a consensus (Schoonhoven et al. 1990; Hellman and Puri, 2000). This might be because VC involvement was introduced as a dummy variable, overlooking the

differences between VC funds. In line with this, Heirman and Clarysse (2005) find that there is a minimum critical amount of VC money a firm needs to be able to collect before a positive relation with growth is found.

Because investment managers do not have a fully transparent view on the incentives and competencies of the agents they invest in (Cyert and March, 1963; Newell and Simon, 1972; Simon 1955), they will use proxies to base their investment decision on. These proxies have been described as selection criteria in the venture capital literature. In the VC practice, these selection criteria have been built up through experiential learning, not through any theoretical guidance. However, one would expect that those VCs which invest in those deals using selection criteria which are similar to the ones that have been found in the theoretical literature as determinants of growth will also be able to attract the companies with the highest growth potential.

First, a number of studies show that some VCs emphasize the human capital or the entrepreneurial team as an important decision factor (Tyebjee and Bruno, 1984; MacMillan et al., 1985; 1987). Human capital includes the perceived management ability. This is usually measured by proxies such as the management experience and perseverance of the entrepreneur, the contact that the investment managers has with the entrepreneur (Shepherd and Zacharakis, 1998) and the heterogeneity of the entrepreneurial team (Shepherd and Zacharakis, 1998; Tyebjee and Bruno, 1984; MacMillan et al., 1985; 1987; Keeley and Roure, 1989). Among a group of European early stage high tech investors, we identified a group of investors which were called the people investors that were mainly building their investment decision on the team characteristics and the characteristics of the lead entrepreneur (see chapter 4). A second group of VCs emphasize the product/market environment in which the venture starts up as one of the major decision factors. This environment includes the characteristics of the market/industry, environmental threats to the business, the level of competition and the degree of product differentiation (Hisrich and Jankowitz, 1990; Tyebjee and Bruno, 1984; Meyer et al., 1993; Hutt and Thomas, 1985; Kahn, 1987; Muzyka et al., 1996). A third group, which was identified in chapter 4 and which seems to be specific to early

stage high tech VCs, is the group of technology investors. These investors put the uniqueness and protectability of the technology on top of their list of selection criteria.

In what follows, we build hypotheses on the link between selection behaviour of VCs and employee growth of their portfolio companies.

6.3.2.1 Human capital

Theoretical backing for the hypotheses on the link between human capital selection criteria and portfolio company growth is found in the resource-based view of the firm.

Researchers in the resource-based view of the firm report that the entrepreneur's skills and experience are positively related to new firm success (Roberts, 1991; Cooper et al., 1994). Heirman and Clarysse (2005) found that the commercial experience of the founding team highly contributed to company performance, and research by Gorman and Sahlman (1989) has shown that weak operating business senior management is a dominant cause of failure.

Human capital investors mainly look at two factors in order to make their decision. These are 1) the entrepreneurial team and 2) the lead entrepreneur. These investors believe that the experience and network of the team of entrepreneurs and the leadership potential of the lead entrepreneur will, above all, affect the company's performance. They believe that changing a team after investment takes too much time and makes them loose market share to competitors in the meanwhile. The same goes for the lead entrepreneur: these investors believe that the lead entrepreneur will be able to manage the team. They look for someone who has the potential of leading a high tech venture, which is an extremely demanding job due to the uncertain environment these ventures are confronted with. Therefore, they look at whether there is a lead entrepreneur who has the ability of leading a team thanks to his leadership skills and ability of perseverance. This lead entrepreneur should, apart from his leadership potential and ability of perseverance, understand that changes in the management team may be necessary, and that even his own position in the company may come under pressure as the company grows.

Therefore, we offer the following hypothesis:

H1: There is a positive relationship between a VC emphasis on the experience and completeness of the venture team as a selection criterion and the growth of the portfolio company.

Beside a complementary team, the new venture may also need a strong entrepreneur who will, at least during the first years, be able to build the team and to manage the company. This person should understand the challenges the venture will be facing and be willing to let the company grow, even if this requires attracting new or other team members, and even putting his own position in question at times. Research has confirmed the importance of the lead entrepreneur. Murray (1996) for instance stresses in his analysis of six European case studies of successfully exited, venture capital-financed NTBFs the importance of the track records and competence of the founders.

Therefore, we offer the following hypothesis:

H2: There will be a positive relationship between a VC emphasis on the lead entrepreneur's abilities as a selection criterion and the growth of the portfolio company.

6.3.2.2 Market

We build our hypotheses on market selection criteria based on the theoretical backing provided by the Porterian or market view elaborated above. Below, we elaborate hypotheses on market growth and niche markets.

There are a number of reasons why some VCs are attaching the most importance to the expected market growth. First, research confirms (e.g. Finley et al., 1994) that the firm workforce growth rate is positively correlated to growth of the targeted market. Second, VCs indicate that they are mainly interested in investing in businesses that target fast growing markets as these companies will be providing more interesting exit routes to them. They argue that it are mainly these portfolio companies that are likely to be

successfully exited, either through IPO or trade sale. In case of a new technology, IPOs are only likely to be realised if the company that is preparing the IPO is playing on a high growth market. This makes them interesting to both individual and institutional investors, who are willing to take the perceived higher risk attached to high tech as long as markets targeted look more promising than for traditional businesses. Beside the exit route through IPO, also trade sales are more likely to be realized for ventures operating on high growth markets, as this high growth potential makes them extremely interesting to larger, established companies that have waited to jump on the bandwagon, and are seizing the opportunity by buying the company that built an established position in the emerging market. Therefore, these investors, focusing on market growth, believe that companies targeting high growing markets will grow faster than those that do not, and will provide more interesting exit routes to them. This is confirmed by Murray's (1996) research on successfully exited ventures indicating that they were all playing on high growth markets.

Therefore, we offer the following hypothesis:

H3: There will be a positive relationship between a VC emphasis on the expected market growth as a selection criterion and the growth of the portfolio company.

Beside this high growth market argument put forward by VCs emphasizing market criteria, some VCs stress the fact that the market targeted is a specific market segment or a niche market. They believe that this focus is necessary in order to sell new high tech products and argue that once the potential of the product or technology is demonstrated in a smaller market segment, the firm can use these first customers as a reference to go to larger, broader markets. This is also found by Moore (1991). If new ventures target niche markets they may be able to grow faster, as they face less competition from established players. Focusing on niche markets has another advantage: as niche markets are specialised markets with a small number of players, new ventures may be able to faster acquire a position in the market, and may not have to compete against large established companies. At the same time, the fact that they are targeting niche markets, which larger companies find hard to target given their focus on mainstream markets and their large

overhead structure, makes them interesting take-over targets to established companies, and may explain why some VCs emphasis this criterion during the selection phase.

Therefore, we offer the following hypothesis:

H4: There will be a positive relationship between a VC emphasis on niche market as a selection criterion and the growth of the portfolio company.

6.3.2.3 Product/technology

In order to build these hypotheses, we built on the insights provided in the resource-based view of the firm, which gives a number of indications on how protectability of technology and platform technology can affect company performance.

Companies that have protected technologies and products may be growing faster than those that do not. The protection of their technology gives them a head start compared to competitors that may find it difficult to put products on the market that do not violate the patent. Even though the protection may be limited in time, it gives the company that owns it the chance of expanding its market share and growing faster than its competitors. It gives companies the opportunity to diversify with respect to commercialisation paths, allowing them to grow faster, and to differentiate themselves. Venture capitalists interviewed, that were emphasizing this protection, indicated another reason why protection of technology is important: it allows to make changes to the team that are necessary in order to increase professionalisation, without loosing knowledge to competitors (which may for instance occur if team member take the company's knowledge with them when leaving the company). Both venture capital and entrepreneurship emphasize the importance of having protectable technologies: Lee et al. (2001) found the protectability of the technological innovation to positively impact company growth. In venture capital literature, MacMillan et al. (1987) indicated that VCs link lack of protection for the product to unsuccessful ventures. Murray et al. (1996) indicate that for each of the six successfully exited ventures studied, patent protection was important.

Therefore, we offer the following hypothesis:

H5: There will be a positive relationship between a VC emphasis on the protectability of the technology as a selection criteria and the growth of the portfolio company.

Interviews indicate that European VCs have shifted over the previous years from investing in platform technologies to non-platform technologies. Platform technologies are broad technologies with lots of different applications. VCs indicated that platform technologies have both advantages and disadvantages. The advantage is that there are multiple possibilities if one application fails to live up to the expectations. The disadvantage, which was found by some VCs to be more important than this advantage, is that there is no real focus during development and commercialisation. Small high tech ventures only have limited resources and in case of a platform technology approach, resources are split over several projects, causing a longer period before technological finalisation and commercialisation. The risk of platform technologies may be that entrepreneurs keep on developing several applications without really coming to commercialisation of any of them. Researchers (e.g. Murray, 1996) indicate that a danger with new technologically sophisticated products is that their inventors never stop improving them, which is often described as the entrepreneurs being in love with the elegance and novelty of the technology itself rather than its ability to make money. This may be extremely problematic in case of a platform technology that involves the development of different applications.

Therefore, we offer the following hypothesis:

H6: There will be a negative relationship between a VC emphasis on the platform technology as a selection criteria and the growth of the portfolio company

6.3.3 Follow-up behaviour and employee growth

We again find theoretical backing in the resource based view of the firm, indicating that venture capital is smart money provided to the company. VCs play an active role in their portfolio companies and are involved in monitoring and value-adding activities (Sapienza et al., 1996; Fried et al., 1998; Hellman and Puri, 2000; Schefczyk and Gerpott, 2001; Gompers, 1995; MacMillan et al., 1989). The rationale for the active role with respect to monitoring lies in information asymmetries between VC and entrepreneur that might give rise to agency conflicts that drive VCs to monitor their portfolio companies. Agency theory suggests that equity finance provides entrepreneurs with incentives to engage in activities from which they benefit disproportionately (Gompers, 1995). Another reason for this post-investment involvement lies in the belief by VCs that they can add value to the ventures invested in and thus improve outcomes of their investments (Sapienza, 1992, 1996; Fried et al., 1998; Hellman and Puri, 2000; Schefczyk and Gerpott, 2001). Sapienza (1992) and Sapienza and Timmons (1989) detected positive correlations between VC management support intensities and portfolio company performance. Schefczyk (2001) found intensifying co-operation between VCs and portfolio companies to coincide with above average success of portfolio companies.

There are a number of indications of how intensity of follow-up behaviour could link to portfolio company growth. First, venture capitalists have the same objective when following up on portfolio companies from a monitoring or from a value-adding point of view: making sure that the value of the venture increases, either by making sure that the entrepreneurs does not take actions that decrease the company's value (monitoring) or by taking actions that are expected to contribute the company's value (value-adding). In this reasoning, the intensity of follow-up behaviour is expected to positively correlate to portfolio company growth.
Therefore, we offer the following hypothesis:

H7: There will be a positive relationship between a VC's intensity of follow-up behaviour and the growth of the portfolio company.

6.4 Methodology

In order to test these hypotheses, we needed 1) information on the VC fund that invested in the portfolio company, the investment manager involved in selection and follow-up, and the timing of the investment, 2) information on the starting resource configurations of the portfolio companies that were shown by other researchers to influence company growth, and to act as a buffer against liabilities of newness and smallness (Cooper et al., 1994), and the financial resources obtained over the companies lifetime and 3) information on employee growth of portfolio companies.

6.4.1 VC level information

Again, we use the sample of 68 European VCs, described in 3.2 as a starting point.
In order to get insight into the selection behaviour of these VCs, a conjoint methodology was used. We refer to chapter 4 for further information on the methodology used. In short, we presented the VCs in our sample with a number of fictive business cases that differed on attributes that were based on four main categories of selection criteria: team, market, product and finance. In total, twelve different attributes were included: team, entrepreneur, contact with the entrepreneur, uniqueness of the product, protection of the product, market acceptance, platform technology, location, size and growth of the targeted market, time to break-even and return on investment. In line with the conjoint analysis philosophy, and consistent with Muzyka et al. (1996), potential events were matched to the different attributes (see Table 8). A fractional factorial design using Addelman's basic plans (Addelman, 1962) for designing an orthogonal main effects plan was chosen, resulting in 27 business proposals that were presented to the respondents (investment managers).

These 27 proposals were printed on 'cards' used during the interviews. Investment managers were asked to judge the proposals on a five-point Likert scale (1= bad investment opportunity, I would certainly not invest; 5= major investment opportunity, large chance of investing). From these scores, conjoint analysis derived utility scores for each attribute, indicating how important each characteristic is to the respondent's overall preference of a product. Descriptives on the utility scores used are provided in Table 20.

With respect to follow-up behaviour, investment managers were asked to estimate the average number of days spent per month per portfolio company. We will use this estimation as a measure for the intensity of follow-up behaviour by the VC.
During the interviews also information about the VC fund characteristics, such as capital managed, fund age, geographical investment scope etc. was collected.

6.4.2 Portfolio company level information

Mid 2004, all of the interviewed investment managers were asked to provide us with a list of portfolio companies. We asked them only to include those companies for which they had been involved in the selection phase, and that were currently being followed up by them. We received responses from 37 of the 68 interviewed VCs.
This resulted in a database of 172 high tech firms that had been financed by 5 Dutch, 4 British, 5 German, 4 French, 7 Belgian, 7 Swedish and 4 Finnish VC funds. Those firms that had only been in the VC's portfolio since 2003 or later were excluded from the analysis, resulting in a database of 140 firms.
Information on the starting resource configurations of the portfolio companies was collected during telephone interviews during the second half of 2004. 107 founders of portfolio companies were interviewed concerning the starting configurations (such as founding team, commercial experience of the founders), the activities of the company and the evolution of the company's financial resources over its lifetime.

6.4.3 Employee growth information

In order to collect information on portfolio company growth, we relied in first instance on a European database of annual accounts of companies, called Amadeus. The Amadeus' data were supplemented by information retrieved from national databases, including Fame (UK), Belfirst (Belgium), REACH (The Netherlands) and Hoppenstedt Firmendatenbank (Germany). Data was checked and supplemented with data obtained during telephone interviews with the founders.
This resulted in a unique dataset of 99 firms for which both annual account, starting resource information, and information on the VC investing were available. These 99 firms had received financing from 32 different European VCs. 5 companies were based in

the Netherlands, 14 in the UK, 11 in Germany, 8 in France, 25 in Belgium, 19 in Sweden, 12 in Finland, and 5 in other European countries, Israel or the US.

To judge whether the final subsample (32 VCs) used in this study could be used to make inferences about the whole sample (68 VCs), t tests and chi-square tests were performed on all VC variables, being variables on selection behaviour, follow-up behaviour, and fund characteristics. Differences were insignificant for selection behaviour and fund characteristics (such as fund size). With respect to follow-up behaviour however, the subsample showed a higher involvement than the remaining VCs, which we will take into account during the analyses.

In order to study the effect of VC behaviour and VC characteristics on company growth, we used OLS regression analysis. The variables used in this analysis are explained below.

6.5 Variables

6.5.1 Dependent variable: portfolio company employee growth

Information from annual accounts was transformed to yearly absolute post-investment growth measures. The growth measure studied in this chapter is yearly absolute post-investment employee growth, calculated as

$$\left(FTE_t - FTE_{i-1}\right)/(t-i-1)$$

Where FTE_t is the number of employees at the end of the last available year (t) (2002 or 2003) and FTE_{i-1} is the number of employees at the end of the last year before investment (i-1) by the VC. Given that the companies studied had received investment during their early stage of development and that the timeframe between investment and the last available FTE measure is relatively short (on average 3 years), the growth studied here should not be confused with sustainable growth. However, researchers indicate the importance for high tech ventures to obtain this early growth in order to bridge the liability of newness and smallness, and in order to obtain sustainable growth.

6.5.2 Independent variables: selection behaviour

The utility scores, derived from the conjoint analysis described above for team, market and product/technology characteristics were used as measures with respect to selection behaviour.

6.5.3 Independent variable: follow-up behaviour

We use the average days spent per month per portfolio company as a measure for the intensity of follow-up behaviour by the VC. The advantage of taking an average measure is that it relates to the overall degree of involvement by the VC, while involvement measures by portfolio company may be biased by specific events, and be highly biased by the interview moment.

6.5.4 Independent variables: controls

6.5.4.1 Total capital raised

We control for the total capital that was raised by the portfolio company over its lifetime, given that the resource-based view of the firm considers finance to be a resource enhancing company growth. Lee et al. (2001) found the total amount of capital invested to be positively associated with company growth.

6.5.4.2 Founding conditions

First, we control for the commercial experience of the founding team, measured by the number of founders that had commercial experience in the sector of the portfolio company upon foundation, which were found by other researchers (Cooper et al., 1994; Murray, 1996) to influence company growth. Second, we control for the size of the founding team, measured by the number of founders, that was found by Feeser and Willard (1990) and Cooper and Bruno (1977) to impact company growth.

6.5.4.3 Industry sector

Delmar et al. (2003) indicate that the growth rates of individual companies are dependent on the growth rates of the industry. Therefore, consistent with Bollingtoft et al. (2003), we create two dummy variables, controlling for sector of the portfolio company. If the portfolio company is active in biotech the biotech dummy variable takes value 1, 0

otherwise. It the portfolio company is active in ICT the ICT dummy variable takes value 1, 0 otherwise.

6.5.4.4 VC size and age

We controlled for the size and age of the VCs that invested in the portfolio companies. The rationale behind this is that younger and/or smaller VCs may exhibit differences in selection behaviour (Engel, 2004) or follow-up behaviour (Elango et al., 1995; Engel, 2004). The VC fund size is measured as the amount of capital managed by the VC fund, and available for direct investments, in million Euros. Information on VC fund size and age was obtained from VC websites and checked during face-to-face interviews with investment managers.

6.5.4.5 VC attributes

Based on the economic view, elaborated above, we also controlled for the size of the company at the time of VC investment (calculated as the number of FTEs before investment), the year of the investment since founding and the timeframe between the investment year and the year of the last available FTE measure.

6.6 Results

6.6.1 Results: Full sample

The correlations and descriptive statistics for all variables are presented in Table 20.

Table 20: Descriptive statistics and correlations (full model): growth analysis

	Mean	S.D.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. Absolute yearly FTE growth	4.91	7.07	1															
2. Utility of experienced, compl team	.30	.18	-.19	1														
3. Utility of lead entrepreneur	.49	.35	-.19	.28	1													
4. Utility of high growth market	.24	.15	.28	.04	-.22	1												
5. Utility of niche market	.03	.17	.15	-.01	-.02	.14	1											
6. Utility of protectability	.23	.31	.35	-.38	-.32	-.03	.14	1										
7. Utility of platform	.11	.15	-.42	.08	-.14	-.25	-.10	.18	1									
8. Average time spent (days per month)	3.99	4.26	-.10	.00	.12	.08	.54	.00	.08	1								
9. Log VC Fund size	4.07	1.73	.64	-.02	-.14	.16	-.12	.19	-.58	-.43	1							
10. Log VC Fund age	1.88	.89	.50	-.05	-.04	.04	.06	.36	-.15	-.02	.39	1						
11. Size of the founding team (number of found)	3.03	1.49	.16	-.20	-.20	.07	.00	.26	-.09	-.08	.15	-.04	1					
12. Commercial experience founding team (number of founders)	1.26	1.18	.24	-.06	-.19	.12	.16	.04	-.13	.04	.19	.12	.26	1				
13. Amount of capital raised (million of Euros)	13.79	24.88	.48	-.17	-.18	.09	.03	.28	-.26	.07	.37	.44	.17	.11	1			
14. Pre-investment size (number of FTEs)	10.00	14.20	.31	-.11	-.24	.12	-.11	-.03	-.25	-.05	.43	.08	.07	.13	.35	1		
15. Investment = Xth year after founding	3.34	2.88	-.06	.12	.06	-.01	-.08	-.14	-.11	-.07	.04	.03	-.33	-.09	.00	.30	1	
16. Timeframe between investment and now (number of years)	2.92	1.77	.20	-.02	-.14	.28	.08	.05	-.09	.16	.10	.36	.21	.28	.09	-.10	-.17	1

Pearson correlations for continuous variables; * correlations < or > .25 are significant at P<.05

Correlations were found to be significantly positive between the dependent variable (absolute yearly FTE growth) and the utility of high growth markets in the screening process. Other factors that correlated significantly positive to the dependent variable were: fund size and fund age, the amount of capital raised by the venture and the size of the company before investment by the VC. One factor was found to correlate significantly negative to FTE growth: the utility attached to platform technologies during the screening process.

Collinearity diagnostics showed that all variance inflation values were below 3.0, suggesting that multicollinearity was not an issue (Hair et al., 1998). We used OLS regression analysis in order to test the hypotheses elaborated earlier. We conducted several diagnostic tests to ensure the data did not violate the assumptions of normality, linearity, and homoscedasticity necessary for OLS regression estimation. Distribution for two independent variables, namely fund size and fund age were found to be skewed and these variables were transformed by taking the logarithms. Residuals were tested for independence, normality and constant variance. All necessary conditions were met.

The regression results are presented in Table 21.

Table 21: Regression analysis (growth analysis)

	Base model	Base model + selection criteria	Base model + follow-up behaviour	Full sample	Limited sample
Importance of selection criteria					
Utility of experienced, compl team		-.119		-.122	-.062
Utility of lead entrepreneur		.027		.040	-.013
Utility of high growth market		.163**		.167**	.298***
Utility of niche market		.113		.138	.336**
Utility of protectability		.164		.169[12]	-.018
Utility of platform technology		-.049		-.040	.060
Intensity of follow-up behaviour					
Average time spent per portfolio cy			.099	-.054	-.006
Control variables					
Size of the founding team	.000	-.040	.011	-.045	-.115
Commercial experience founding team	.073	.045	.069	.044	.077
Amount of capital raised	.196**	.164*	.169*	.176*	.118
Biotech	.058	-.02	.072	-.02	-.038
ICT	.093	.104	.083	.112	.212*
Pre-investment size	.032	.043	.017	.054	-.095
Xth year after founding	-.066	-.057	-.056	-.060	.070
Timeframe between investment and now	.020	-.018	.004	-.008	-.095
Log Fund size	.452****	.419***	.512****	.397***	.307**
Log Fund age	.220**	.193**	.214**	.191**	-.069
Constant	-7.997***	-6.946**	-9.400***	-6.565*	-.328
Model					
F statistic	10.200****	8.240****	9.494****	7.700****	3.051****
R^2	.54	.62	.54	.62	.42
Adjusted R^2	.48	.54	.49	.54	.28

Levels of significance: *=.10; **=.05; ***=.01; ****=.001; n=99 (91 for limited sample)

[12] The utility of protectability was significant (.10 level) in the fixed effects model that was run in order to correct for independency between observations of the same VC

6.6.1.1 The importance of market focus during the selection process

The full model had significantly positive coefficients for the emphasis that VCs put on the growth potential of the targeted market during the selection process, the amount of capital raised, fund size and fund age.

Therefore, we conclude that **no support** was found for **H1**: the experience and complementarity of the team was not found to significantly affect growth of portfolio companies. **No support** was found for **H2**: VCs that emphasize potential of the lead entrepreneur during the selection process do not tend to have faster growing portfolio companies. Focusing during the investment decision on the human capital factors therefore was not found to lead to having portfolio companies that are attaining higher growth, despite the emphasis that was put by resource-based view scholars on these human capital factors. The reason for this may lie in the fact that companies that start off with complementary teams and strong human capital factors may be to static. It may a good thing to have team changes now and then, especially in the early stage of a venture where there are different milestones to be taken that require different skills. There is no use of having a high level business developer in the company at the moment that the technology is still in a development phase. The company may be doing fine with the founder/inventor as a CEO during this phase, but may need another CEO profile at the time of commercialisation. Therefore, team changes are not necessarily bad for the company and sticking to the original founding team, because it is complementary may be paralysing the company. Also Hellman and Puri (2000) found that executive turnover in a company is necessary for new ventures, leads to a higher degree of professionalisation and connected to it company growth.

We find **support for H3**: VCs that emphasize the growth potential of the targeted market in the business proposal, have faster growing companies in their portfolio. **No support** was found for **H4**: VCs that prefer to invest in niche markets do not have portfolio companies that exhibit higher growth.

No support was found for **H5** and **H6**: emphasis during the selection process on the protectability of the technology and on platform technologies does not seem to have an impact on portfolio company growth.

No support was found for **H7**: no clear relationship between the intensity of follow-up behaviour by the VC and company employee growth was found. This is consistent with the findings of Macmillan et al. (1989) who found that there was no significant difference in operating business performance between different levels of involvement (identified as limited, moderate and high). There may be several explanations for this. First, we only studied companies that were still in the VC's portfolio. It may be that it takes longer before impact of VC's involvement becomes visible, or it may even take until exit before results of efforts put into follow-up of portfolio companies become clear, with VC that have been more involved with their portfolio companies having larger chances of realizing the appropriate exit for the company. Second, it may be that the involvement level of the VC increases in case portfolio companies are doing worse, consistent with Fredriksen et al. (1997), finding that VCs are 'firefighters' that allocate their scarce time to portfolio companies with problems. In this case, it is employee growth that is likely to impact the involvement level, and not vise-versa. Finally, as mentioned earlier, the group of VCs in our sample showed above average involvement in their portfolio companies, which may be the reason for no significant results with respect to follow-up coming through.

This seems to suggest that it are only those VCs that put emphasis during the screening process on the growth potential of the targeted market are selecting the best deals with the largest growth potential. Other factors, such as the emphasis put on other screening criteria, or the time spent during the follow-up phase do not seem to have explanatory power for growth of portfolio companies.

However, further analysis of the results shows that, interestingly, the control variables that linked to the VC's fund size and age were significantly positive, just as the amount of capital that the company had raised over its lifetime. This finding called for further analysis.

6.6.1.2 The link between VC fund size and portfolio company growth

There are a number of reasons why larger VCs may have faster growing companies in their portfolio.

According to Davila et al. (2003), VC funding events are important signals about the quality of the new venture, diminishing uncertainty for employees, and increasing credibility, and thus enhancing the likelihood of new employees joining the company. Megginson and Weiss (1991) indicate that the reputation of some long-existing VC companies is second to none, and their presence in the capital structure sends a strong positive signal to other investors and stakeholders. Stuart et al. (1999) found that privately held biotech firms with, amongst others, organizational equity investors went to IPO faster and earned greater valuations at IPO than firms that lack such connections. The extent to which there is an effect of reputation may be determined by the size of the VC fund. Smaller and younger VCs may however enhance no or a less pronounced reputation effect towards company stakeholders, and may therefore have a smaller impact on the portfolio company growth.

The signaling or reputation effect is an **effect** of attracting large funds in the capital of a new venture on portfolio company growth. However, in this context, it is hard to distinguish between cause and effect. There may be other mechanisms at work than a signaling effect towards employees only. VC's fund size, age, and connected to it, its reputation may have a signaling effect to other VCs. These VCs can then prefer to syndicate with this reputated VC, given its financial capacity and its reputation. Or it may be that entrepreneurs with high growth potential business proposals try to get funding from large VCs first, before stepping to their smaller counterparts. In this case, the fund size **causes** having portfolio companies that grow faster: larger VCs simply attract the better (faster growing) deals, which come directly to them, or are suggested to them by syndication partners, because of their financial capacity and their reputation. In this case, larger funds get the first choice to pick the deals with high growth potential, and smaller funds may be presented deals that were previously turned down by larger funds.

Some may argue that smaller funds prefer to invest in projects that are not expected to grow exponentially, but that will be break-even in short term and not be burning huge amounts of cash. Given their limited funds, they are more dependent on other financiers in subsequent rounds of financing. In this case, small funds may avoid subsequent rounds of financing, during which they may be put in a parlous financial position, making the pricing of equity to the follow-on co-investors potentially difficult, and causing dilution of the initial investment (Murray, 1999). Therefore, smaller VCs may be inclined to invest in companies that are less likely to grow in number of employees, in order to reduce the cash burn from salary costs. Our results show that this is not likely, and that, after taking into account the selection focus of VCs, smaller VCs tend to have slower growing companies in portfolio. Research by Gompers (1996) indeed shows that young and thus, small, VCs have incentives to grandstand, i.e. to take actions that signal their ability to potential investors. These VCs were even found to bring companies public earlier than old venture capital firms in order to establish a reputation and successfully raise capital for new funds. Therefore, given that previous research found that past performance influences fundraising ability (Lakonishok et al., 1991; Patel et al., 1991), small VCs have a large incentive to invest in those companies that are likely to grow fast and can be brought public in an IPO. This is shown to be the most effective way of signaling ability or the value of portfolio companies to potential fund investors, increasing the chances of raising a new fund within a short, predetermined time, and their chances of surviving as a fund in the longer run. Therefore, also small funds have an incentive to pick the business proposals with high growth potential from their deal flow. However, our research shows that they end up with a portfolio of slower growing companies. This finding may have implications for the survival chances of these small funds.

Further analysis of the sample indicates that larger VC funds may indeed be attracting the better deals. Further examination of the data showed that 7 of the 10 top-growing portfolio companies in our sample had been invested in by one VC. This VC is managing 3 billion Euro for direct investments, and was established in 1959. Both its size and age were found to be an exceptional to our sample. Further analysis of the portfolio

companies of this VC showed that the VC was rarely lead investor in these companies and rarely had a board seat. The investor had always been part of large syndicates, often with the same syndication partners, and often in a first round. Besides, the portfolio companies of this VC had raised considerable amounts of financing over their lifetime: they on average had raised 60 million Euro, which is extremely high compared to the remainder of the sample that had on average raised 9 million Euro. It seemed that this VC had been picking up high growing deals from the market, and moreover, often had these deals presented by other VCs, mainly large funds. The growth that most of the portfolio companies of this VC had been making could not only be attributed to organic growth: some of them had acquired other companies on the international market, or had acquired technologies in other countries. Part of their growth can therefore be attributed to acquisitive growth.

Given that this VC was an exception to our sample, we excluded its portfolio companies from further analysis.

Stage 2 of the analysis involved re-estimating the model on the sample when the cases had been removed. We report on the results in the next section.

6.6.2 Results: limited sample

The results of the limited sample are presented in Table 21. As in the full model, we find significant results for the emphasis put on the high growth criterion in the business proposal (H3) and the VC fund size variable. No significant coefficients were found for the amount of capital raised by the companies and the VC fund age variable. The importance attached by the VC to the fact that the targeted market is a niche market was found to be significantly affecting portfolio company growth (in a positive way).

Therefore, we conclude that in the limited model, we find **support for H4**. Therefore, we can conclude that for the limited sample of VCs, the focus on market criteria, such as market growth and niche markets, affects the growth of portfolio companies. Interestingly, no significant result was obtained anymore for the amount of finance raised by the company, which was the case in the full model. This may indicate that for mega funds, of which the exceptional VC is one, the size of the market does not matter, as long

as it is a fast growing one. This is linked to the fact that they have deep pockets and can provide the portfolio company with huge amounts of capital, which is the case for the exceptional VC portfolio companies. This comfortable cash position does not require these new ventures to focus on a niche market. They do not need to secure a market position in a niche market first before expanding to broader, larger markets, as Moore (1991) suggested to be the most appropriate growth path for new ventures. The large amounts of finance that the VC provides allow to follow an acquisitive growth path, and allow to acquire companies or technology that has been established in the market earlier, even if this market is a mainstream one.

6.7 Conclusions

Using a unique, hand-collected dataset, we analyzed how venture capital can impact portfolio company growth. So far, in entrepreneurship literature, venture capital has been included as a dummy variable. Venture capital literature however indicates that VCs exhibit heterogeneity both in selection and follow-up behaviour. These differences may explain why entrepreneurship researchers have obtained no consensus on the role of venture capital and have found differences in the growth pattern of VC-backed companies and have even found non VC-backed companies to outperform VC-backed ones. Therefore, building on previous research, we united both selection and follow-up behaviour of VCs to explain how differences in VC behaviour may affect portfolio company growth. Our research shows that both the VC's selection behaviour and the VC's fund size are explanatory for portfolio company growth.

We find that VCs that focus on the potential growth of the targeted market in the business plan have portfolio companies that obtain higher growth. Also VCs that target niche markets tend to select those portfolio companies that grow faster, unless megafunds are investing. These megafunds provide large amounts of finance so that the portfolio company can pursue an acquisitive growth strategy, and may target a mainstream market.

We do not find the time that VCs spend during the post-investment follow-up phase to affect portfolio company growth.

We find the size of the VC investing to be positively correlated to portfolio company growth. The analysis shows that, besides the possibility that a signaling effect occurs, some other factors are at play.

First, VC firms looking for syndication partners may first approach larger, reputated funds, and these larger funds may then get the first opportunity to invest in potentially high growing companies. Second, entrepreneurs with high growth business proposals may first approach larger funds, causing smaller funds to get business proposals that were already rejected by these larger funds, and thus getting worse deal flow. This finding raises questions on the survival chances of smaller funds, given that additional fund raising is only expected to be successful if a considerable track record, mainly based on successful IPOs, can be shown.

These research results are interesting to a number of parties.

First, our results are interesting to policy makers, who are worried about increasing employment rates, and are therefore interested in factors that can affect employment growth. These results fit into the plea for increasing the financial capacity of European funds (as suggested by Bottazzi and Da Rin, 2002). Indeed, larger funds seem to have portfolio companies that are growing faster. It may however not be the best strategy to only increase the financial capacity of funds, for instance by setting up public/private partnerships. As Martin et al. (2002) indicate, larger funds invest larger amounts of money in one portfolio company, and avoid investing small amounts of money in seed stages, in contrast to the US. This is also the case in our sample of VC funds, where large funds are significantly less involved in seed investing than smaller funds (Mann Whitney U test significant at $P<0.001$ level). So if policy measures only aim at increasing the financial capacities of funds, this may result in an enlargement of the equity gap, with less new ventures being started up. Therefore, policy measures should focus on increasing the financial capacity of funds, but meanwhile also increase the part of fund capital dedicated to seed investments, or diminishing the risk incurred from seed investing, for instance through guarantee mechanisms or risk-sharing mechanisms. The first is for instance the case with the European Community scheme, I-TEC, providing public funds for the co-financing of existing or new VC funds which are prepared to

devote at least 25% of their funds to early stage investment in technologically innovative SMEs over the next three years. Also the European Investment Fund transformed over the last years into a major investor in venture capital funds, without neglecting seed capital investments (f.i. the seed capital action, providing finance for recruiting additional investment managers who specifically focus on seed investing). However, still quite a lot of initiatives were set up recently in the EU member states that were mainly focusing on increasing the financial capacity of funds (such as the Danish Growth Fund, the French "Fonds de Promotion pour le Capital Risque", the UK regional venture capital funds, the 6th Swedish Pension Fund and the Belgian Arkimedes Fund).

Second, the results of the current study are interesting to entrepreneurs as they are concerned about the growth path of their company, and interested in the drivers of this growth.

Third, venture capitalists can learn from the mechanisms behind venture capital and portfolio company growth, and more specifically from the impact of their selection and follow-up processes on company growth. This research shows that those VCs that invest in business proposals targeting high growth markets are expected to have high growth portfolio companies. Smaller funds should be aware of the impact of investing in slow growing companies on their survival chances in the longer run.

6.8 References

Acs Z.J., Audretsch D.B. (1990). Innovation and Small Firms. Cambridge, MA: MIT Press.

Addelman S. (1962). Orthogonal Main-Effect Plans for Asymmetrical Factorial Experiments. *Technometrics*. 4(1): 21-46.

Amit R., Brander J., Zott C. (1998). Why do venture capital firms exist? Theory and Canadian evidence. Journal of Business Venturing. 13: 441-466.

Autio E., Yli-Renko H. (1998). New, technology-based firms in small open economies. An analysis based on the Finnish experience. *Research Policy*. 26: 973-987.

Bain J.S. (1962). Barriers to New Competition. Cambridge, MA: Harvard University Press.

Barney J.B. (1991). Firm resources and sustained competitive advantage. *Journal of Management*. 17(1): 99-120.

Barron D.N., West E., Hannan M.T. (1994). A Time to Grow and a Time to Die: Growth and Mortality of Credit Unions in New York City, 1914-1990. American Journal of Sociology. 100(2): 381-421.

Baum J.A.C. and Silverman B.S. (2004). Picking winners or building them? Alliance, intellectual and human capital as selection criteria in venture financing and performance of biotechnology start-ups. *Journal of Business Venturing*. Vol. 19, iss. 3. p. 411.

Baumol W.J., Panzar J.C., Willig R.D. (1983) Contestable Markets: An Uprising in the Theory of Industry Structure: Reply. *American Economic Review*. 73(3): 491-497.

Bollingtoft A., Ulhoi J.P., Madsen H., Neergaard H. (2003). The effect of financial factors on the performance of new venture companies in high tech and knowledge-intensive industries: an empirical study in Denmark. *International Journal of Management*. 20(4): 535-547.

Bottazzi L., Da Rin M. (2002). Venture capital in Europe and the financing of innovative companies. *Economic Policy* 34, 231-269.

Clarysse B., Knockaert M., Lockett A. (2005). Selection behaviour of early stage high technology investors. A pan-European study. Working Paper Series Universiteit Gent and Vlerick Leuven Gent Management School.

Cohen W.M., Levin R.C. (1988). Empirical Studies of Innovation and Market Structure. In Schmalensee, R. and R.D. Willig (eds). Handbook of Industrial Organization. Vol. II, chapter 18: 1060-1107.

Cooper A.C., Gimeno-Gascon F.J., Woo C.Y. (1994). Initial human and financial capital as predictors of new venture performance. *Journal of Business Venturing*. 9: 371-395.

Cooper A.C., Bruno A.V. (1977). Success among high-technology firms. *Business Horizons*. April. p. 16-22.

Cyert R.M., March J.G. (1963). A behavior theory of the firm. Englewood Cliffs, New York: Prentice Hall.

Davila A., Foster G., Gupta M. (2003). Venture capital financing and the growth of startup firms. *Journal of Business Venturing.* 18:689-708.

Delmar F., Davidsson P., Gartner W.B. (2003). Arriving at the High-Growth Firm. *Journal of Business Venturing*. 18: 189-216.

Dittmann I., Maug E., Kemper J. (2004). How fundamental are fundamental values? Valuation methods and their impact on the performance of German Venture Capitalists. *European Financial Management*. 10(4): 609-638.

Elango B., Fried V.H., Hisrich R.D., Poloncjek, A. (1995). How Venture Capital Firms Differ. *Journal of Business Venturing* 10: 157-179.

Engel D. (2004). The performance of venture-backed firms: the effect of venture capital company characteristics. *Industry and Innovation.* 11(3): 249-263.

Evans D.S. (1987). The Relationship between Firm Growth, Size and Age: Estimates for 100 Manufacturing Industries. *Journal of Industrial Economy*. 35(4): 567-581.

Feeser H.R., Willard G.E. (1990). Founding strategy and performance: a comparison of high and low growth high tech firms. *Strategic Management Journal*. 11: 87-98.

Finley L., Buntzman G.F. (1994). What does affect company performance? *Arkansas Business and Economic Review*. 27(2): 1-15.

Fredriksen O., Olofsson C., Wahlbin C. (1997). Are venture capitalists firefighters? A study of the influence and impact of venture capital firms. *Technovation*. 17(9): 503-511.

Freeman C. (1983). The economics of industrial innovation. Cambridge, MA: MIT Press.

Fried V., Hisrich R. (1994). Toward a model of venture capital investment decision making. *Financial Management*. 23(3): 28-37.

Fried V.H., Bruton G.D., Hisrich R.D. (1998). Strategy and the board of directors in venture capital-backed firms. *Journal of Business Venturing*; 13(6): 493-504.

Gompers P.A. (1995). Optimal Investment, Monitoring, and the Staging of Venture Capital. *Journal of Finance*. 50(5): 1461-1489.

Gompers P.A. (1996). Grandstanding in the venture capital industry. *Journal of Financial Economics*. 42: 133-156.

Gorman M., Sahlman W.A. (1989). What do venture capitalists do? *Journal of Business Venturing*. 4: 231-248.

Hair J.F., Anderson R.E., Tathum R.L., Black W.C. (1998). Multivariate data analysis with readings. MacMillan, New York.

Hall, J., Hofer, C.W. (1993). Venture Capitalists' Decision Criteria in New Venture Evaluation. *Journal of Business Venturing*. 8: 25-42.

Hannan M.T., Ranger-Moore J. (1990). The Ecology of Organizational Size Distributions: A Microsimulation Approcah. Journal Of Mathematical Sociology. 94: 65-89.

Hannan M.T., Ranger-Moore J., Banaszak-Holl J. (1990). Competition and the Evolution of Organizational Size Distributions. In: Organizational Evolution: New Directions (J. Singh, ed). 247-268. Sage, Newbury Park, CA.

Hellmann T., Puri M. (2000). The interaction between product market and financing strategy: the role of venture capital. *The Review of Financial Studies*. 13(4): 959-984.

Hellmann T., Puri M. (2002). Venture capital and the professionalization of start-up firms: Empirical evidence. *The Journal of Finance*. 57(1); 169-198.

Heirman A., Clarysse B. (2005). The initial resources and market strategy to create high growth firms. Forthcoming in: *Academy of Management Best Paper Proceedings*, 2005.

Hisrich, R.D. and Jankowitz, A.D. (1990). Intuition in venture capital decisions: an exploratory study using a new technique. *Journal of Business Venturing*. 5: 49-62.

Hutt, R.W. and Thomas, B. (1985). Venture capital in Arizona. *Frontiers of Entrepreneurship Research*. 155-169.

Jovanovich B. (1982). Selection and the Evolution of Industry. *Econometrica*. 50(3): 649-670.

Kahn, A.M. (1987). Assessing venture capital investments with noncompensatory behavioural decision models. *Journal of Business Venturing*. 2: 193-205.

Kamien M.IK, Schwartz N.L. (1982). Market Structure and Innovation. Cambridge: Cambridge University Press.

Kapteyn J. (1903). Skew Frequency Curves in Biology and Statistics. Astronomical Laboratory. Groningen: Noordhof.

Keeble D.E. (1989). High-technology industry and regional development in Britain: the case of the Cambridge phenomenon. *Environment and Planning*. 7: 153-172.

Keeley, R.H. and Roure, J.B. (1989). Determinants of new venture success before 1982 and after a preliminary look at two eras. *Frontiers of Entrepreneurship Research*. 274-287.

Kogut B. and Zander U. (1992). Knowledge of the Firm, Combinative Capabilities, and the Replication of Technology. Organization Science. 3 (3): 383-397.

Kortum S., Lerner J. (2000). Assessing the contribution of venture capital to innovation. *The Rand Journal of Economics*. 31(4): 674-693.

Lakonishok J., Shleifer A., Thaler R., Viskny R. (1991). Window dressing by pension fund managers. *American Economic Review*. 81: 227-231.

Lee C., Lee K., Pennings J.M. (2001). Internal capacilities, external networks, and performance: a study on technology-based ventures. *Strategic Management Journal*. 22: 615-640.

MacMillan, I.C., Siegel, R. and Subbanarashima, P.N. (1985). Criteria used by venture capitalists to evaluate new venture proposals. *Journal of Business Venturing*. 1: 119-128.

MacMillan, I.C., Zemann, L. and Subbanarashima, P.N. (1987). Criteria distinguishing successful from unsuccessful ventures in the venture screening process', *Journal of Business Venturing*. 2: 123-137.

MacMillan I., Kulow D., Khoylian R. (1989). Venture capitalists involvement in their investments: extent and performance. *Journal of Business Venturing*. 4: 27-47.

Martin R., Sunley P., Turner D. (2002). Taking risks in regions: the geographical anatomy of Europe's emerging venture capital market. *Journal of Economic Geography*. 2(2): 121

McCann J.E. (1991). Patterns of growth, competitive technology, and financial strategies in young ventures. *Journal of Business Venturing*. 6: 189-208.

Megginson W.L., Weiss K.A. (1991). Venture Capitalist Certification in Initial Public Offerings. The Journal of Finance. XLVI(3): 879-903.

Meyer, G.D., Zacharakis, A.L. and De Castro, J. (1993). A post-mortem of new venture failure: an attribution theory perspective. *Frontiers of Entrepreneurship Research*. 256-269.

Moore G.A. (1991). Marketing and Selling High-Tech Products to Mainstream Customers. Crossing the Chasm. HarperBusiness. New York.

Murray G. (1996). A synthesis of six exploratory, European case studies of successfully exited, venture capital-financed, new technology-based firms. *Entrepreneurship Theory and Practice*, summer, 41-60.

Murray G. (1999). Early-stage venture capital funds, scale economies and public support. *Venture capital*. 1(4): 351-384.

Mustar P. (1997). Spin-off enterprises. How French academics create hi-tech companies: the conditions for success and failure. *Science and Public Policy*. 24: 37-43.

Muzyka, D., Birley, S., Leleux, B. (1996). Trade-offs in the investment decisions of European Venture Capitalists, *Journal of Business Venturing*, 11: 273-287.

Newell A., Simon H.A. (1972). Human problem solving. Englewood Cliffs, New York. Prentice-Hall.

Oakey R.O., Rothwell R., Cooper S. (1988). Management of innovation in small firms. London: Francis Pinter.

Oakey R. (1995). High Technology New Firms: Variable Barriers to Growth. Paul Chapman Publishing Ltd. London.

Patel J., Zechkhauser R., Hendricks D. (1991). The rationality struggle, illustrations from financial markets. *American Economic Review*. 81: 232-236.

Penrose E.T. (1959). The theory of the growth of the firm. New York: Wiley.

Porter M. (1980). Competitive Advantage. The Free Press.

Ruhnka J.C., Feldman H.D., Dean T.J. (1992). The 'Living Dead' Phenomenon in Venture Capital Investments. *Journal of Business Venturing*. 7(2): 137-156.

Roberts E.B. (1991). Entrepreneurs in high technology. Lessons from MIT and beyond. Oxford University Press. New York.

Rothwell R., Zegveld W. (1982). Industrial innovation and small and medium sized firms. London: Francis Pinter.

Sapienza H.J., Timmons J.A. (1989). The roles of venture capitalists in new ventures: what determines their importance? *Academy of Management Best Paper Proceedings*. 74-78.

Sapienza H.J. (1992). When do venture capitalists add value? *Journal of Business Venturing*. 7: 9-27.

Sapienza H.J., Amason A.C., Manigart S. (1994). The level and nature of venture capitalist involvement in their portfolio companies: a study of three European countries. *Managerial Finance*. 20 (1): 3-17.

Sapienza H.J., Manigart S., Vermeir W. (1995). A comparison of venture capitalist governance and value-added in the U.S. and Western Europe. *Academy of Management Journal*. 105-109.

Sapienza H.J., Manigart S., Vermeir W. (1996). Venture capitalist governance and value added in four countries. *Journal of Business Venturing*. 11: 439-469.

Schefczyk M. (2001). Determinants of success of German Venture Capital Investments. *Interfaces*. 31: 43-61.

Schefczyk M., Gerpott T.J. (2001). Management support for portfolio companies of venture capital firms: an empirical study of German venture capital investments. *British Journal of Management*. 12: 201-216.

Schoonhoven C.B., Eisenhardt K.M., Lyman K. (1990). Speeding Products to Market: Waiting Time to First Product Introduction in New Firms. *Administrative Science Quarterly*. 35: 177-207.

Shane S., Stuart T. (2002). Organizational Endowments and the Performance of University Start-ups. *Management Science*. 48(1): 154-161.

Shepherd D.A., Zacharakis A. (1999). Conjoint analysis: a new methodological approach for researching the decision policies of venture capitalists, *Venture Capital*, 1 (3): 197 – 217.

Simon H.A. (1955). A behavioral model of rational choice. *Quarterly Journal of Economics*. 69: 99-118.

Storey D.J., Tether B.S. (1998). Public policy measures to support new technology-based firms in the European Union. *Research Policy*. 26: 1037-1057.

Stuart T.E., Hoang H., Hybels R.C. (1999). Interorganizational Endorsements and the Performance of Entrepreneurial Ventures. *Administrative Science Quarterly*. 44: 315-349.

Teece D.J., Pisano G., Shuen A. (1997). Dynamic capabilities and strategic management. Strategic Management Journal. 18(7): 509-530.

Tyebjee T.T., Bruno A.V. (1984). A model of VC investment activity. *Management Science*. 30: 1051-1066.

Utterback J.M., Meyer M., Roberts E., Reitberger G. (1988). Technology and Industrial Innovation in Sweden: A Study of Technology-Based Firms formed between 1965 and 1980. *Research Policy*. 17: 15-26.

Van den Berghe L., Levrau A. (2002). The role of the venture capitalist as monitor of the company: a corporate governance perspective. *Corporate Governance-An International Review*. 10 (3): 124-136.

Welbourne T.M., Andrews A.O. (1996). Predicting the Performance of Initial Public Offerings: Should Human Resource Management be in the Equation? *Academy of Management Journal*. 39(4): 891-920.

Wernerfelt B. (1984). A Resource-based View of the Firm. Strategic Management Journal. 5(2): 171-181.

Zacharakis A.L., Meyer G.D. (1995). The venture capitalist decision: understanding process versus outcome. *Frontiers of Entrepreneurship Research*. 465-478.

Zacharakis A.L., Meyer G.D. (1998). A lack of insight: do venture capitalists really understand their own decision process? *Journal of Business Venturing*. 13: 57-76.

Zacharakis A.L., Meyer G.D. (2000). The potential of actuarial decision models: can they improve the venture capital investment decision? *Journal of Business Venturing*. 15: 323-346.

7 Conclusions, implications and directions for further research

As Murray (1999) notes, the European venture capital industry is basically a development capital industry. Compared to the US, only a limited proportion of venture capital investments is directed towards early stage high tech investments. However, given that little financing alternatives exist for high tech ventures in their early phase of existence, it is an important way of financing for these companies.

This study aimed at understanding how early stage high tech investors select their investments, follow-up on them, and how they can affect portfolio company growth. Besides, it aimed at understanding what drives selection and follow-up behaviour of these investors.

In this concluding chapter, we first provide an overview of the main findings and conclusions of this study. Second, we discuss the implications for science and practice. And last, we give an overview of limitations of the study and give directions for further research.

7.1 Main findings and conclusions

First, we analysed selection behaviour of early stage high tech investors (chapter 4) and examined whether or not these VCs exhibit heterogeneity in their selection behaviour. Using a conjoint methodology and hierarchical cluster analysis, we found that VCs do exhibit substantial **heterogeneity in investment selection behaviour**. We found one group of investors that focuses on technology (which we called “technology investors), a group of investors that emphasizes the financial aspects in the business plan (called “financial investors”) and a group of investors putting people characteristics on top of their list of selection criteria (called “people investors”). Technology investors make the most balanced due diligence, but emphasize the extent to which the technology can be protected and the contact they have with the lead entrepreneur. Financial investors put emphasis on the financial characteristics of the business proposals. Also people investors

find these financial criteria quite important, but emphasize the team and leadership potential of the founders.

We find a category of investors, which is quite different from the ones found in previous studies: the technology investors. Even though these investors make a balanced due-diligence, they emphasize factors such as protectability and uniqueness of the technology. Using a multinomial regression model, we then examined the **drivers of these differences**, being the origin of funds, the human capital of the investment manager, and the sectoral focus. We mainly found significant differences between technology and people investors.

We found that the technology investors make significantly more use of **public money** than the other groups of investors. Given that these investors focus the most on the technological strength of a business plan, it looks as if this money is targeted towards technological renewal and stimulation of economic growth.

With respect to human capital, no significant differences were found between groups of investors concerning educational background. We found that people investors had more **experience** in financial functions and had more often built experience working at other VC funds. Technology investors had more academic experience (and obtained a Ph. D. before joining VC industry) compared to people investors. Given that no differences with respect to experience were found between the other categories, we concluded that investment managers, who had worked at previous funds or in a banking environment, tend to find people characteristics most important. Technology investors were found to excessively recruit academics as investment managers.

Also the **sectoral focus** of the fund mattered. On the one hand, the percentage of technology investors investing in biotech was found to be significantly higher than within the group of people investors. On the other hand, people investors were much more involved in investing in industrial automation than their colleagues in the other categories.

Second, we analysed the **follow-up behaviour** of early stage high tech investors (chapter 5). Besides, we examined the neglected but important issue concerning the relationship between the human capital and fund characteristics of VCs and post-investment follow-up behaviour. We examined the nature of post-investment activities.

We looked at the types of activities that are carried out during the follow-up phase, which we split up in monitoring and value-adding activities. We looked at whether fund or human capital characteristics could explain the involvement in these types of activities.
Monitoring is seen by VCs as a necessary investment to avoid bankruptcy or excessively high cash losses. As such it is an institutionalized professional feature of the VC industry adopted by each VC. This is confirmed by this research, finding that neither human capital variables nor fund characteristics seem to be important determinants of the degree to which the investment manager is involved in **monitoring activities**.

VCs are involved in value-adding activities in order to improve outcomes of their investments. We did find fund and human capital characteristics to impact the involvement in value-adding activities. Investment managers working at **captive funds** (public funds and private equity arms of banks) seemed to be much **less involved in value-adding activities**. This is especially surprising for the public funds, which are investing in seed phases and in incomplete teams of entrepreneurs possessing a strong, proprietary technology. Since resources are scarce at this stage, one would expect high and time intensive involvement by the VC in these companies, which does not seem to be the case. Investment managers that are managing **higher diversified portfolios** and work at highly diversifying funds are **less involved** in this kind of activities. This is not counter-intuitive since it is difficult for investment managers, or even funds, to keep track of strategic information and build a network in different sectors and industries. The greater the diversification, the less likely it is there will be spill-overs between portfolio companies managed by the same investment manager. With respect to experience of the investment managers, we found that a higher level of **consulting experience** leads to a **higher involvement** in value-adding activities. Also investment managers that were

entrepreneurs themselves before joining VC industry seem to be more involved in these activities.

Finally, we analysed how venture capital could affect **portfolio company performance**, and more specifically, portfolio company employee growth. In this study, presented in chapter 6, we united these factors that are likely to influence growth of VC-backed companies, being selection and follow-up behaviour. We found that some selection criteria, especially **market selection criteria**, have a **positive impact** on portfolio company performance. VCs that stress market criteria, such as niche markets and high growth markets, in their selection procedure, tend to have higher growing companies in their portfolio. We did **not** find the **amount of time the VC spends** per portfolio company to affect company employee growth. This may be caused by the fact that we studied companies that were still in the VC's portfolio. It may simply take longer before impact of VC's involvement becomes clear, or it may even take until exit. Second, it may be that the involvement level of the VC increases in case portfolio companies perform worse. In this case, it is employee growth that is likely to impact the involvement level, and not vise-versa. We found **VC fund size** to significantly impact portfolio company growth. The results show that portfolio companies of larger funds obtain higher growth compared to portfolio companies of smaller funds. It may be that larger funds enhance a larger signaling effect towards potential employees, by which portfolio companies find it easier to grow.

There may however be other factors at play beside this signaling effect. It may be that larger VCs simply attract the deals with higher growth potential, which come directly to them, or are suggested to them by syndication partners, because of their financial capacity and reputation. In this case, larger funds get the first choice to pick the deals with high growth potential, and smaller funds may be presented deals that were previously turned down by larger funds.

This finding however has serious implications for the survival chances of these smaller funds, that have, even more than large funds, incentives to invest in large companies that

can be brought public in an IPO. Indeed, through successful exits, smaller funds can signal their ability to potential investors and increase their chances of raising new funds. Therefore, small funds applying a strategy of investing in slower growing companies may be jeopardizing their own future.

7.2 Implications

First, we discuss implications for management science. Second, we provide an overview of implications for practitioners, being venture capitalists, entrepreneurs and policy makers.

7.2.1 Implications for management science

This research makes a number of contributions to management science.

First, most research has treated VCs as a homogenous group of investors, and little research has focused on early stage high tech investing only. This is surprising, given that previous research has shown that early stage investing is different from late stage investing, and that high tech investing is different from non-tech investing (e.g. Lockett et al., 2002). Besides, most VC research has been carried out in the US. This lack of European research is caused by the fact that, in comparison to the US, little data on European venture capital is publicly available. This may be due to the fact that the European venture capital has emerged only quite recently in comparison to the US. Therefore, this research analysis early stage high tech venture capital in Europe, fills a gap in existing VC literature. This research especially provides insight into how early stage, high tech investors, who are confronted with a considerable degree of information asymmetries, try to limit costs and problems that arise from these asymmetries by selection and follow-up behaviour and contributes to agency theory.

Second, this research contributes to management science by shedding light on how this specific group of early stage high tech investors select their investments. In order to do so, we used a novel methodology which combines the advantages of the post hoc studies and the real time studies, that have been extensively put forward in venture capital literature. The use of conjoint methodology allowed us to both capture the hierarchy of

selection criteria used by VCs and the reasoning of the investment manager during the selection process. This research is particularly interesting to management science, as it sheds light on the determinants of selection behaviour, which has only been fragmentarily discussed in venture capital literature.

Third, this research tackles a major omission in venture capital literature with respect to post-investment follow-up behaviour. Little research has been carried out focusing on the human capital of VC investment executives and the characteristics of VC funds as determinants of post-investment follow-up behaviour.

Fourth, this research fills a gap in growth literature and venture capital literature by uniting selection, follow-up and other VC factors and studying impact on employee growth. So far, growth literature has mainly studied the effect of venture capital on company growth, focusing on differences between samples of venture capital-backed and non-venture capital-backed companies, and including VC as a dummy variable. The analysis of selection and follow-up behaviour however indicated that venture capitalists exhibit large heterogeneity in this behaviour, and these differences are unlikely to be captured using a dummy variable. Therefore, this research studying which VC factors are likely to affect portfolio company growth is of high interest to entrepreneurship researchers.

7.2.2 Implications for practitioners

7.2.2.1 Venture capitalists

On the one hand, venture capitalists can learn from this research how other VCs select and follow up on their investments, how they differ from other VCs, and what is driving these differences. It is particularly interesting to them to know which VCs they will be competing with on specific deals, or which VCs could be potential syndication partners, given their similar selection pattern. Besides, this research has important implications for the recruitment policy of VCs. Both research on selection behaviour and follow-up behaviour showed that previous experience of the investment manager impact behaviour. We found a higher representation of investment managers with academic experience

within the group of “technology investors” and we found that investment managers with a higher degree of financial experience or who had worked at other VC funds to belong to the group of “people investors”. With respect to follow-up behaviour, our findings indicate that the investment manager’s prior experience determines to a large extent his/her management style once he/she enters into the VC world. Investment managers with a consulting background for instance spend the least time per portfolio company, but are significantly more involved in value-adding activities. This means that they manage the portfolio companies in a time efficient way. Investment managers with a financial background spend more time in their portfolio companies than those with a consulting background, but are significantly less involved in value-adding activities.

On the other hand, it is extremely interesting to VCs to understand how their behaviour or characteristics are affecting portfolio company growth, given that growth was found to be positively correlated to company value (Davila et al., 2003). Even though there is no direct link between portfolio company performance and venture capitalist performance (which is mainly determined by the number and quality of exits), it seems reasonable that the higher the value created, the higher the likelihood of obtaining a successful exit. Our research showed that there was some impact of selection criteria. Those VCs emphasizing high growing markets and niche markets during the selection process tend to have companies in their portfolio that grow faster. We found no indications that the time VCs spend with their portfolio companies affects portfolio company growth. We did find that the size of the VC fund affected portfolio company growth, for a number of reasons (see above, 7.1). This result has a major implication for smaller funds that should be aware of the impact of investing in slow growing companies on their survival chances in the longer run.

7.2.2.2 High tech entrepreneurs

On the one hand, a better knowledge on selection and follow-up behaviour of VCs is important to high tech entrepreneurs. What makes this research particularly interesting to them is that it focuses on a subset of the European VC industry and focuses on those investors they will call upon when looking for finance for their early stage high tech

projects. It may help entrepreneurs to select the most appropriate investor for the business proposal, and increase his or her chances of finding finance for the company. This research shows that not all early stage high tech investors are the same. An entrepreneur who is lacking an experienced team but who possesses a strong, proprietary technology may still have chances of finding finance, especially with public funds. This research also shows that not all VCs are involved in value-adding activities to the same extent. This has important implications for entrepreneurs looking for "smart money". If an entrepreneurial team is confident that it does not require advice or detailed value adding assistance from a VC investor, it may seek for finance with a public or captive fund. Alternatively, when it does need advice, it may be better to seek investment with an independent, specialist VC firm.

On the other hand, it is particularly interesting to entrepreneurs to understand how venture capital could affect company growth. Our research (chapter 6) showed that large funds have portfolio companies that obtain a higher degree of employee growth. There are a number of reasons for this. First, finding finance with these larger funds enlarges the credibility of the venture through an enlarged signaling effect, and is enhancing company growth. Second, larger funds get the first chance to pick the business proposals that are expected to obtain higher growth. This again shows the entrepreneur that it is important to select the right investor, just as the results on selection and follow-up behaviour showed. Entrepreneurs that are starting up a business in slower growing markets and that needs small amounts of finance in order to bridge the first phase, may have higher chances of finding finance with smaller funds.

Above all, this research shows how important it is to the entrepreneur to select the appropriate investor for his business proposal. Before approaching a financial party, the entrepreneur should do its own 'due diligence' and perfectly understand his/her own weaknesses and strengths and that of the entrepreneurial team, the technology, financial perspectives etc. This will enable him to select those investors that may be interested in the business proposal, and that have the same growth perspectives for the company as

he/she has. But it will also enable him to select those investors that may be complementary and that can add value to the company.
However, entrepreneurs may not be best placed to make this due diligence or to identify their needs so that intermediaries may have an important role to play in identifying the most appropriate VC partner. This suggests that entrepreneurs and their advisors may need to devote considerable effort in making their investees 'ready' to receive the kind of VC support they need rather than attempting to approach VCs too soon.

7.2.2.3 Policy makers

On the one hand, this research sheds light on the use of public money for financing of early stage high tech companies through venture capital, making it an interesting benchmarking instrument for policy makers. On the other hand, it sheds light on how venture capital affects portfolio company growth, and how policy makers could intervene in order to create higher growth.

We find most public money invested in the funds of the technology investors, stressing the technological strength of a business plan. This means that public money is used for technological renewal and stimulation of economic growth. These technology investors were found to be highly involved in biotech investing, and less in ICT. As these investors are active in a very early stage more frequent than the other groups of investors identified and often provide seed financing, it is acceptable that they are helping to overcome the market failure high tech entrepreneurs are confronted with (often referred to as "equity gap"). This public money is managed by investment managers that have a profile which is not common in the VC industry. Quite a lot of these investment managers have academic experience, and little of them have prior experience within other funds. They seem to be relatively new in the VC business.

With respect to follow-up behaviour, we find that public funds are less intensively involved in value-adding activities for their portfolio companies. This is surprising, given that these funds typically invest in the seed stage, where private investors are reluctant to invest because of the high degree of risk and uncertainty. The study of selection

behaviour exactly showed that it is these publicly funded VCs that invest in ventures that are created by incomplete teams of entrepreneurs, without initial customer contracts, but with a strong proprietary technology. Especially for these companies, one would expect a higher involvement by the VC, offering coaching to the company.

There may be several reasons for this post-investment behaviour of public funds. First, they invest relatively small amounts of money in very different technologies. Moreover, they tend to invest in a larger number of companies than the private funds. The diversification focus of these funds does not allow investment managers to develop skills, nor a complementary network. In addition, these funds tend to be smaller in size and thus smaller in the amount of management fee they can spend. This can result in the attraction of investment managers that are both less experienced, which is shown in our research on selection criteria, indicating that these investment managers in the group of ”technology investors” have less experience in other funds, and more often come out of the academic world. Besides, investment managers at public funds are part of a smaller team of investment managers for a larger and more diversified portfolio of companies.
Finally, this research shows that some of the public-private partnerships that have been set up in order to bridge the equity gap for high tech start-ups and academic spin-outs may not be reaching their goal. In some cases the partners in these funds are private equity arms of large financial institutions. Even if the fund is mainly public, often investment managers from these private equity arms manage the entire fund. The drawback is that it is precisely those VC funds and their investment managers who have the least experience with a hands-on approach in their portfolio companies. As a result they engage less in value- adding activities.

Policy makers should reflect about new ways to manage public funds so that even a small fund can afford a large and experienced team to coach its portfolio companies intensively. We believe there are a number of possible ways in which public funds could match their goal to invest in a large number of companies and intensively coach their portfolio companies. First, public funds could use a different mechanism to pay their investment managers than the private funds (which usually reserve a percentage of the

fund capital for management fees), by providing finance for investment management from public sources directly, and independent of the fund size. By doing so, the number of investment managers compared to the number of investments made could increase drastically. Besides, this will enable smaller public funds to attract people that can act as coaches to the investees, with incentive systems that are comparable to the private VC industry. Second, public funds could increasingly syndicate their investments with private VCs.

Chapter 6, looking at how VC behaviour and characteristics could impact company employee growth is particularly interesting to policy makers, who are concerned about increasing employment rates, and therefore interested in factors that could affect employment growth. One of the most interesting results from this research is the link between VC fund size and company employee growth: larger funds tend to have companies that grow faster in their portfolio. This results fit into the plea for increasing the financial capacity of European funds. However, governments should take care not only to pay attention to this increase of financial capacity. Research by for instance Martin et al. (2002) indicate that larger funds invest larger amounts of money in one portfolio company, but avoid investing small amounts of money in seed stages. If policy measures only aim at increasing the financial capacity of funds, this may result in an enlargement of the equity gap, with less new ventures being started up. Therefore, policy measures should, next to increasing the financial capacity of funds, increase the part of the fund that is dedicated to seed investments, or diminish the risk that is incurred from seed investing. Governments could do this by installing guarantee or risk-sharing mechanisms.

7.3 Limitations and directions for further research

This study attempted to provide insight into the selection and follow-up behaviour of VCs and how this behaviour could affect employee growth of portfolio companies. However, it has a number of limitations.

One of the limitations of this study is that, even though a high proportion of early stage high tech funds active in the selected regions were interviewed, only one investment manager per fund was interviewed. Interviews with several investment managers would indicate whether all investment managers in the fund use similar selection criteria in the selection process (differences may of course occur, as the results show, if investment managers specialise in one industry in, for instance, a diversified fund). It would also show whether investment managers within one fund are involved in value-adding and monitoring activities to the same extent. Collecting information on both selection and follow-up behaviour at fund level would provide more insight into which proportion of the investment manager's behaviour is determined by his own human capital and how much is determined by the fund characteristics. Fund strategy may indeed impact the individual's behaviour, as a fund may impose specific selection or follow-up behaviour. Besides, collecting information on the portfolio companies managed by other investment managers may reinforce the data set, and provide additional insight into how the size of funds may impact portfolio company growth.

A second limitation is that in this study only employee growth was considered. It would be interesting to consider other measures such as total asset growth, sales growth, cash flow growth and profit growth. These measures should however be studied with cautiousness given that this information is only limitedly available from neutral sources (national databases) that were used in this research. Therefore, we would have to rely on the limitedly available information, double-checked and added with information from interviews with CEOs. Including these measures would give an additional insight into the performance of these companies. Besides, following up on the portfolio companies will enable us to provide an insight into the survival chances of these companies, and how VC characteristics or behaviour have been affecting these survival chances. A longitudinal research design would then have to be employed. Following up on these portfolio companies would also provide insight into the success of selection and follow-up procedures used by VCs. Within five years, more information will become available, such as whether the company is still alive or not, whether the VC has exited the portfolio company (and if yes, what the exit route was). Besides, we could contact the VCs again and ask them for the rates of return realised on the investment. After exit, this is objective

information which could be provided by the investment manager, or if he has left, anyone else in the fund. The attempt to include the estimated rates of return in the current analysis proved unsuccessful given that most of the investment managers found it difficult to make this estimation and would have been largely biased as Dittman et al. (2004) indicate.

A third limitation is that this research is a snapshot of one moment in time. Selection and follow-up behaviour of VCs may vary in time. With the crisis in the ICT sector in 2000, VCs may have turned to less risky investments, with well established management teams, protected technology and less uncertain markets compared to the investments they made before. Following up on the changes in selection and follow-up behaviour of investment managers would be interesting. However, as we experienced during the additional phase of this research, where we asked investment managers to provide us with their portfolio companies, the VC industry is an industry with a high personnel turnover. The more investment managers leave their original fund, the less useful it will be to do this follow-up and comparison.

A fourth limitation is that the point of departure is the venture capitalist. Therefore, the early stage high tech companies studied are all VC-backed. This rules out the possibility of comparing the results obtained in chapter 6 to non-VC backed companies. In that chapter, we pointed out that larger VC funds had portfolio companies that grew faster in employees. However, we have no indication of whether the companies that were financially backed by smaller funds still grew faster than non-VC-backed ones. Supplementing the data set with non-VC-backed companies, for instance by using a matched pair methodology, could provide more insight into this.

Fifth, the analyses in chapter 6 showed how VC fund size affected portfolio company growth. It would be interesting to extend the dataset of portfolio companies with portfolio companies of other investment managers, and other VC funds.

Sixth, with respect to follow-up behaviour, only the average involvement in monitoring and value-adding involvement was measured. It seems natural that the involvement in the portfolio company will be highly dependent on the characteristics of the portfolio, such as age, performance, experience of the founders, agency risk etc. It may be that investment managers spend most of their time with the ‘stars’ in the portfolio, and spend the least

time with other investments. Or it may be that they spend the most time with portfolio companies that are not performing well, called the firefighting role of the venture capitalist by Fredriksen et al. (1997). It was however not the target of this study to identify with which kind of portfolio companies VCs are most involved, but to provide insight into whether the VC fund characteristics and the human capital characteristics of the investment manager could affect follow-up behaviour. It would however be interesting to supplement the portfolio company information with information on the involvement of the investment manager for a specific portfolio company. Adding this information, in contrast to the average time spent indicators used now, may provide additional insights for the analyses in chapter 6 on employee growth.

Seventh, the study on selection criteria focuses on the selection process on specific deals and does specifically look at the overall investment strategy of the VC fund (as discussed by for instance De Clercq et al., 2001).

Eight, syndication is not taken into account in this study. However, quite a lot of VCs engage in syndication for a number of reasons. They may for instance engage in syndication as there may be an advantage to having more than one venture capitalist evaluate a project (Brander et al., 2002). Syndication may however also impact the follow-up after investment carried out by the VC. From a lead venture capitalist's point of view, the benefit of seeking syndication is that the value of the project rises if other VCs become involved, as they have different skills and information (Brander et al., 2002). Therefore, the fact of whether a VC syndicates or not may highly impact the involvement in the portfolio companies. This syndication perspective will be taken into account during further research on the portfolio companies.

Some of these limitations also lead to interesting indications for further research.

First, it would be interesting to follow up on these venture capital funds and their portfolio companies in the future. Following up on the VC funds will indicate whether they will manage to survive and how successful their exit routes (IPO, trade sale, write-off) are, and will show whether portfolio company growth studied translated through in value for the VC. In the longer run, objective figures on returns on funds will become

available, whereas performance estimates by VCs now would be largely biased as Dittman et al. (2004) indicate. It will also show whether smaller funds investing in low growing companies indeed experienced difficulties to survive, as this research suggests. It will however also shed light on what factors (selection behaviour, follow-up behaviour, fund and human capital characteristics) are determining VC performance. In order to do so, a longitudinal research design will have to be set up, that allows to follow up on funds on the one hand, and that will allow to collect additional information on fund level on the other hand.

Second, it would be interesting to follow up on the portfolio companies, and to study them in more detail. Further research on portfolio companies will indicate whether the employee growth studied in this research also results in sustainable growth, and whether portfolio companies will still survive in the longer run. In order to further study the impact of venture capital, in depth interviews should be carried out with these portfolio companies, that will shed light on the development of the company and the role of venture capital.

Third, it would be interesting to extend this research to other regions, such as the US, and to investigate differences that exist between regions with respect to selection, follow-up behaviour and fund characteristics. A comparative study with the US may indicate why European innovative small and medium companies find it more difficult to get started and grow. The dominant view is that this is due to the nature of capital markets and the problems of raising finance for small risky businesses (Martin et al., 2002). However, even though some explanations for these differences exist (see 2.3.1), a systematic approach and research into differences may indicate how and when venture capital in itself could positively impact high tech venture growth.

7.4 References

Brander J.A., Amit R., Antweiler W. (2002). Venture-capital syndication: improved venture selection vs. the value-added hypothesis. *Journal of Economics and Management Strategy*. 11(3): 423-452.

Davila A., Foster G., Gupta M. (2003). Venture capital financing and the growth of startup firms. *Journal of Business Venturing.* 18:689-708.

Dittmann I., Maug E., Kemper J. (2004). How fundamental are fundamental values? Valuation methods and their impact on the performance of German Venture Capitalists. *European Financial Management*. 10(4): 609-638.

Fredriksen O., Olofsson C., Wahlbin C. (1997). Are venture capitalists firefighters? A study of the influence and impact of venture capital firms. *Technovation*. 17(9): 503-511.

Lockett A., Murray, G., Wright, M. (2002). Do UK venture capitalists still have a bias against investment in new technology firms. *Research Policy.* 31: 1009-1030.

Martin R., Sunley P., Turner D. (2002). Taking risks in regions: the geographical anatomy of Europe's emerging venture capital market. *Journal of Economic Geography*. 2(2): 121.

Murray G. (1999). Early stage venture capital funds, scale economies and public support. *Venture capital*. 1(4) : 351-384.

Rosenstein J., Bruno A.V., Bygrave W.D., Taylor N.T. (1993). The CEO, venture capitalists, and the board. *Journal of Business Venturing*. 8(2): 99-114.

Sapienza H.J., Gupta A.K. (1994). The impact of agency risks and task uncertainty on venture capitalist-CEO interaction. *Academy of Management Journal*. 37(5): 1618-1632.

8 Appendices

8.1 List of interviewed VCs

Elderstreet – UK

UCF Cambridge – UK

UCF London (Sussex Place Ventures)- UK

Quester – UK

The Summit Group – UK

ET Capital – UK

Prelude Ventures – UK

Value Added Partners – UK

Frontiers Capital – UK

Abingworth – UK

BancBoston Capital – UK

GIMV – Belgium

Capricorn Venture Partners – Belgium

Software Holding and Finance – Belgium

Partners@Venture – Belgium

IT-Partners – Belgium

LRM – Belgium

Rendex – Belgium

Fagus Fund – Belgium

Danske Venture Partners – Finland

3i Finland – Finland

Helmet Capital – Finland

Eqvitec Partners – Finland

Sitra – Finland

Biofund Management – Finland

Nexit Ventures – Finland

Ecart Invest – the Netherlands

NIB Capital – the Netherlands

ABN AMRO – the Netherlands

Life Science Partners – the Netherlands

Holland Venture – the Netherlands

Gelderse Ontwikkelingsmaatschappij – the Netherlands

Technostarters – the Netherlands

Innofonds Twente – the Netherlands

Gilde IT Fund – the Netherlands

Nesbic – the Netherlands

Galileo Partners – France

OTC Asset Management – France

3i Gestion – France

Credit Lyonnais Private Equity – France

Sofinnova Partners – France

Bio-Am – France

Atlas Venture – France

Seeft Management – France

Odyssee Venture – France

Part'com – France

Polytechnos – Germany

TVM – Germany

Atlas Venture – Germany

VCI Technoinvest – Germany

BEGES Beteilungsgesellschaft – Germany

Global Life Science Venture – Germany

Wellington Partners – Germany

Bayernkapital – Germany

BIO-M – Germany

Apax Partners – Germany

Affarstratagerna – Sweden

ACR Capital – Sweden

Brainheart – Sweden

CAPMAN – Sweden

Foretagsbyggarna – Sweden

IT Provider – Sweden

Industrifonden – Sweden

Linkmed – Sweden

Ledstiernan – Sweden

Northzone Ventures – Sweden

Startup Factory – Sweden