VENTURE CAPITAL FIRM PERFORMANCE: THE ROLE OF HUMAN CAPITAL

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ABSTRACT
This paper examines the determinants of the performance of venture capital (VC) firms. Using an extensive hand-collected dataset on European venture capital firms and their partners, we analyze in particular the importance of human capital for the performance of venture capital firms. Specifically, we investigate the impact of concentration of partners’ task-specific human capital (working experience in VC industry), industry-specific human capital (non-VC working experience) and general human capital (education) on the performance of venture capital firms. We find that venture capital firms whose partners mostly have prior working experience in either finance or management are more successful. Furthermore, when the partners are mainly educated in the fields of natural sciences or medical sciences, the venture capital firm performs better as well. After controlling for factors such as (inter alia) the geographic region and the size and age of the venture capital firm, we find that in general a greater amount of (specialized) human capital of the partners at a venture capital firm tends to have a significant positive effect on the performance of that venture capital firm.
INTRODUCTION

The importance of Venture Capital for innovation and economic growth is widely accepted (Bottazzi, Da Rin & Hellmann 2008). Innovative small and medium-sized enterprises (SMEs) are one of the key drivers of economic growth in Europe. However, these SMEs often have trouble raising funds for further growth, since for investors they are not only an investment opportunity with high potential, but also one with high risk; banks often consider such companies to be risky creditors. VC firms can fill this gap by specializing in selectively providing capital for start-up companies. In this way, VC firms are truly one of the main drivers of innovation and growth in the European economies, just like the VC firms in the U.S. played a key role in the success of Silicon Valley (European commission, 1994; Hellmann, 2000; Bygrave & Timmons, 1992).

Consequently, because VC firms are such key players to creating economic growth and innovation, researchers have shown great interest in understanding the factors that contribute to the success of VC firms and their investments. One key question within Private Equity investments research is how the partners of VC firms affect the investment decisions of such firms, and consequently the performance of those firms (Hambrick & Mason, 1984; Botazzi, Da Rin & Hellmann, 2008; Zarutskie, 2008). Interestingly, although, as Zarutskie (2008) notes, a lot of research has been conducted on the influence of human capital on organizational performance in general (Gimeno, et al., 1997; Bertrand & Schoar, 2003; Laursen, Mahnke & Vejrup-Hansen, 2005), there is little research on the role of human capital in the performance of VC firms.

In this paper, we will further examine the role of human capital in the performance of VC firms in particular. We subdivide human capital into the following three categories: task-specific human capital (VC industry working experience), industry-specific human capital (relevant non-VC industry working experience), and general human capital (education). In this research, we investigate the influence of concentration of the venture capitalists’ human capital in a certain field on the ultimate performance of the VC firm. For instance, we wonder whether a VC firm whose partners mainly have a degree in business is more successful than one whose partners mostly have a degree in natural sciences.

The main research question of this paper can be summarized as follows:

*How does the concentration of human capital characteristics of the managing partners of venture capital firms active in the years 1999, 2001, and/or 2003, in specific fields of education or prior working experience, affect the business performance of the VC firm itself as measured by its organizational continuity (whether it was still operational or out of business at the time of data collection (2009/2010))?*
To provide an answer to this problem statement, we construct a number of hypotheses based on prior research conducted on the role of human capital in organizational performance in general. In this paper, we will hypothesize that if venture capitalists have more work experience in the venture capital industry, the venture capital firm will perform better. Furthermore we will hypothesize that concentration of the VC firm’s partners’ human capital in a certain field – be it e.g. in a field of education or prior working experience – has a positive effect on the performance of the VC firm. To test these hypotheses, we made use of a dataset that contains unique hand-collected data on the partners of more than 1300 VC firms from more than 17 countries across Europe for the years 1999, 2001, and 2003. Through statistical analyses with a binary logistic regression model conducted in the statistical programme SPSS, we tested whether the conjectured hypotheses are indeed supported by the empirical evidence.

The results of our empirical analyses indeed support all the before mentioned hypotheses. Firstly, we indeed found that there is a positive effect of having more task-specific human capital on the performance of the firm. However, the effect turned out to be somewhat weaker than expected, but it was still significant. Secondly, we found empirical support for the hypothesis that there is a strongly positive effect of having a higher concentration of industry-specific human capital in management and in finance on the performance of the firm. Lastly, the results of our study indicate that there is a strongly positive relationship between concentration of general human capital in several fields of education – such as business, engineering, medical sciences or natural sciences - and the performance of the venture capital firm.

Importantly, these results can have some interesting and useful practical applications in venture capital firms. These firms can use this information in their recruitment processes; for instance, they could give a preference to applicants with a degree in medical sciences or natural sciences if candidates are equal otherwise. Furthermore, these results also contribute to the fields of both human capital and venture capital research. Our focus on the concentration of human capital in a particular field of education or working experience relative to other fields of education or working experience is new. In this sense, the variables that we constructed for the empirical analyses do indeed shed new light on human capital in organizations by looking at it from a different perspective.

The remainder of this thesis is structured as follows. Chapter 2 gives an overview of the general characteristics of the venture capital industry. Chapter 3 investigates the presence of agency problems in the venture capital industry, as well as ways in which venture capital firms can mitigate these issues. Chapter 4 discusses human capital, particularly in the context of the venture capital industry. Chapter 5 introduces the hypotheses of this study. Chapter 6 discusses the sources of data, the independent, dependent and control variables used in our study, as well as the statistical model (logit model) used in our analysis. Chapter 7 examines the descriptive statistics of the relevant variables in our model, including the correlation between them. Chapter 8 discusses the results of our analysis. Chapter 9 elaborates upon the conclusions drawn from this study, the implications of this study, and its limitations. Finally, chapter 10 provides an overview of the references.
2. VENTURE CAPITAL

2.1: The origins of Venture Capital – the equity gap
Small and medium-sized companies (SMEs) often have great difficulty in raising equity capital or securing long term loans, since they are deemed too risky an investment – a problem which is sometimes also referred to as the equity gap (European commission, 1999; Kusewitt, 1968). In general, Venture Capital firms play a key role in bridging this gap between investors and entrepreneurs looking for funding (Zider, 1998). In fact, it was the equity gap that sparked the first foundation of a VC firm – namely the American Research & Development Corporation (ARD) in late 1940s (Caselli & Gatti, 2004; Kusewitt, 1968). Since then, the Venture Capital industry in the U.S. – and across the globe - has grown at a remarkably rapid pace. For instance, in the U.S. new investments by venture capitalists were estimated to be around $610 million in 1980 and up to $12.5 billion in 1998.

As the Venture Capital industry grew in size and importance, the academic research in this field intensified just as much (Walske & Zacharakis, 2009). As Walske et al. (2009) also notes, research has been conducted on numerous topics, amongst which how Venture Capital firms select the portfolio companies in which they invest (MacMillan, Siegel & Subba Narashima, 1985; Yang, Narayanan & Zahra, 2009), how they negotiate the contracts with their portfolio companies (Kaplan & Strömberg, 2001, 2004; Cumming & Johan, 2009), and how VC firms monitor their portfolio companies (Hochberg, 2004; Kaplan & Strömberg, 2001; Hellmann & Puri, 2000; Gompers, 1995).

In this chapter, I will try to provide a meaningful overview of the existing extensive literature on these research topics within Venture Capital. Firstly, we will examine some general characteristics of the Venture Capital industry and VC firms: where do VC firms get their funds from, what kind of VC firms there are, etc. Then, we will see what causes the previously mentioned equity gap to exist at all. Thus, this chapter will form the foundation for the third chapter, in which we will analyze the role of human capital in the Venture Capital industry; in that chapter we will see how Venture Capitalists manage to bridge the equity gap through the activities of screening, structuring of contracts, monitoring, and mentoring.

2.2: Characteristics of the Venture Capital Industry
The venture capital industry essentially consists of four key players: entrepreneurs in need of funding, investors wanting to obtain a nice return, investment banks who need companies to sell, and the venture capitalists earn money by creating a market for the other three players (Zider, 1998). Figure 2.1 provides an overview of these three players and their role in the Venture Capital industry (Zider, 1998).
A key characteristic of the VC industry is its volatility, or its cyclicality. This characteristic manifests itself in numerous ways. The amount of capital invested in venture capital firms by external parties, the amount of investments the VC firms make in portfolio companies, as well as the performance of VC firms and their portfolio companies all show signs of high cyclicality (Gompers et al., 2008; Gompers and Lerner, 2004). For instance, in the case of the amount of capital invested in VC firms, in times of economic boom too much capital will be invested in the promising opportunities that venture capital offers which causes the supply of funds to reach and excessively high level. On the other hand, in times of economic downturn, investors often overreact in their massive withdrawal of capital from the VC industry. The over-responsiveness of the external financers leads to significant over-and underinvestment in venture capital (Lerner, 2003). It is often argued that the cyclicality of the VC industry is mainly caused by the overreaction by venture capitalists and entrepreneurs to perceived investment opportunities (Gompers et al., 2008; Gupta, 2000).

The European Venture Capital industry is also believed to be a relatively local one; VC firms originating from a certain country invest for the greatest part in portfolio companies from that same country. Nevertheless, there has been some recent research which shows that European Venture Capital markets may be more integrated than previously thought (Botazzi et al., 2004).

2.3: Characteristics of Venture Capital firms
In essence, Venture Capital firms manage the funds of external parties and invest these in promising start-up companies in need of funding (Botazzi & Da Rin, 2002; Gompers & Lerner, 2001). Venture Capital firms obtain these funds mostly from banks, insurance companies, pension funds, corporations, wealthy individuals, and governmental agencies (Botazzi & Da Rin, 2002). Whereas in the U.S. most funds come from institutional investors such as pension funds, in Europe Venture Capitalists are mainly funded by financial institutions, such as banks. Furthermore, governmental funding is very limited in both the U.S. as well as Europe (Botazzi & Da Rin, 2002). The actual venture capitalists are referred to as the general partners, while the investors (i.e. the external funders) are called the limited partners of the VC firm (Sahlman, 1990). The fund of a Venture Capital firm may be drawn from multiple sources and is managed by the venture capitalists who invest it in portfolio...
companies. In order to mitigate any possible agency problems which may occur (since incentives of venture capitalists may diverge from those of the investors), the rewards of the venture capitalists are heavily based on their performance, thus aligning the incentives.

Furthermore, the investments of Venture Capital firms are restricted to private firms, i.e. firms which are not publicly traded on a stock exchange. Moreover, it is typical for Venture Capital firms that they invest with the goal of (short-term) successful exit. Since they are merely financial intermediaries investing other parties’ funds, they need to obtain significant returns on their investments over a limited time horizon. In order to monetize on their illiquid investments, venture capitalists need to turn them into realized return by exiting them (Gompers & Lerner, 2001). Therefore, their focus lies on the ultimate successful divestment (Metrick, 2007). Exiting a portfolio company can be achieved in several ways: through an IPO of the portfolio company, by selling the portfolio company to another investor, or by selling it to a larger company (Metrick, 2007). Typically, the most successful and lucrative type of exit from a portfolio company is through an IPO (Gompers & Lerner, 2001).

Furthermore, Venture Capital firms can be categorized according to their ‘type’. VC firms can be either independent or captive. Captive venture capital funds are funds that are owned partly or completely by parties other than the venture capital professionals themselves. Such captive VC firms could be government-owned, or for instance corporate-, bank-, or insurance firm-affiliated (Cumming, Flemming & Schwienbacher, 2007; Botazzi, Da Rin, Hellmann, 2008). Importantly, as Botazzi et al. (2008) note, independent firms are more profit driven than non-independent firms, and they are free to set their own investment style. On the contrary, captive VC firms such as bank-affiliated VC firms will be influenced to a great extent by their parent companies’ strategic plans and goals. Indeed, several recent studies have shown that non-independent Venture Capital funds tend to act differently than independent ones (Gompers & Lerner, 2000; Hellman, Lindsey & Puri, 2008).

2.4: Asymmetric information & agency theory
As discussed in the first section of this chapter, small and medium-sized companies (SMEs) often have great difficulty in raising equity capital or securing long term loans, since they are deemed too risky an investment – a problem which is often referred to as the equity gap (European commission, 1999; Kusewitt, 1968).

Important questions that now arise are: why is there such an equity gap in the first place? Why is there only limited capital available for promising startups? Firstly, we will investigate the agency problems in the VC industry as a possible explanation for the equity gap. Subsequently, we will see how VC firms in particular overcome these agency problems through the activities of screening, monitoring, mentoring, and the structuring of contracts. The coming sections will lay the foundation for the third chapter, in which we will then see how human capital can positively impact these activities through screening, monitoring, structuring of contracts, and mentoring, and as such also strongly influences the performance of the venture capital fund.
One possible explanation for the equity gap can be found in the well-known agency theory, which is sometimes also referred to as the principal-agent theory. Agency theory deals with problems that arise in agency relationships. An agency relationship is one in which one party (the principal) delegates a specific task to another party (the agent), who then executes this task (Jensen & Meckling, 1976). In such relationships agency problems can arise when the interest, desires or goals of the principal and agent diverge, and the principal is unable to fully check what the agent is doing (Eisenhardt, 1989). Especially when the agent has more and/or different information than the principal, i.e. when there is a situation of information asymmetry, principal-agent problems are likely to arise. Two of the most important and well-known types of principal-agent problems are of course moral hazard and adverse selection, which Akerlof already noticed back in 1970 in the market for lemons (Akerlof, 1970).

Importantly, such problems of asymmetric information between the principal and the agent have a strong presence in the VC-industry (Sahlman, 1990). Firstly, entrepreneurs may have incentives to make investments which have high personal returns for the entrepreneur, but low payoffs for the investors in the company. For instance, an entrepreneur might want to invest in a project that will grant him a great reputation in the academic community, but which has much lower payoffs to the investors than alternative projects. Furthermore, an entrepreneur may have private information on the expected payoff of investments and projects. Consequently, he may choose to continue investing in projects which he knows to have a negative NPV, just for the sake of continuation of the company. For instance, an entrepreneur may choose to go ahead with the product development even though marketing research has shown that there is hardly any demand for that particular product. He may choose to do so just so he can continue the company’s operations, and consequently can keep receiving the benefits of leading such a company (e.g. a high salary) (Gompers & Lerner, 1999, pp. 140-143; Gompers, 1995).

Clearly, when confronted with such ubiquitous agency problems, investors may reconsider their plans to finance startup companies. Consequently, it will become more difficult for SMEs to obtain funding as the supply of such funds is relatively limited. Therefore, the combination of asymmetric information and agency problems in the VC industry can be pointed out as one of the causes of the equity gap. However, as we will discuss in the coming section, VC firms are not completely helpless in face of agency problems.

On a side note, one might wonder why there only exists an equity gap for SMEs and not so much for more mature companies, since agency problems also occur when dealing with such mature companies. In fact, as Jensen & Meckling (1976) state “[The principal-agent problem] exists in all organizations and in all cooperative efforts— at every level of management in firms, in universities, in mutual companies, in cooperatives, in governmental authorities and bureaus, in unions”. This is the case because there is a larger information asymmetry for SMEs between the firm and the investor, which makes the screening and monitoring of these startups more difficult than of mature companies. Consequently, the agency costs when dealing with SMEs are more substantial.
CHAPTER 3: DEALING WITH AGENCY PROBLEMS
In the previous chapter we have seen that agency problems in the VC industry can present a serious problem for VC firms investing in portfolio companies. More often than not, the interests of VC firms (principal) and the entrepreneurs (agent) will diverge. However, venture capitalists can mitigate the agency problems in several ways, namely by screening the portfolio companies before the investment, through the structuring of financial contracts, and by monitoring and mentoring them after the investment (Douma & Schreuder, 2002; Kaplan & Strömberg, 2001). In this chapter we will investigate these agency problem-mitigating activities, and we will see how human capital plays a key role in conducting them successfully.

3.1: Screening of portfolio companies
Firstly, a VC firms will screen potential firms, and select only those with the greatest potential. In the process of screening, the VC firm collects information on a firm before deciding to actually invest in order to filter out the bad, unprofitable companies beforehand (Kaplan & Strömberg, 2001). Venture capitalists must often screen a relatively large number of potential portfolio companies while their staff is limited (Tyebjee & Bruno, 1984). Consequently, potential portfolio companies are often evaluated by looking at a set of standardized characteristics and criteria, such as (amongst others) the market size, competition, strategy, and experience of the management team (Kaplan & Strömberg, 2001). By screening out the outright bad and opportunistic entrepreneurs, VC firms can to a certain extent preempt agency problems. Since VC firms’ funds are limited, and many more firms apply for funding than can possible be provided, venture capitalists can be highly selective in their choice of investments (Tyebjee & Bruno, 1984; Hellmann, 2000).

3.2: Structuring of contracts with portfolio companies
Secondly, after a particular portfolio company has been selected by the VC firm as a potential candidate for investment, the entrepreneur and the venture capitalists must agree on a deal (Hellmann, 2000). VC firms should structure the financial contracts with the entrepreneur and the portfolio company (i.e. the deal) in such a way that there is an alignment of the goals of the agent and principal. Through the distribution of cash flow rights and control rights between the entrepreneur and the investor, the incentives of the entrepreneur can be manipulated in such a way that the entrepreneur is likely to behave in a manner that is optimal for the VC firm (Kaplan & Strömberg, 2001). As such, the agreement between venture capitalist and the entrepreneur establishes the price of the deal as well as the covenants which limit the actions the management of the portfolio company can undertake (Tyebjee & Bruno, 1984).

3.3: Monitoring portfolio companies
Lastly, after the venture capitalists and the portfolio company have mutually agreed upon a deal the VC firm’s work is not finished. In fact, the role of the venture capitalists further expands from that of investors to that of collaborator (Tyebjee & Bruno, 1984). In the post-investment phase, the VC firm can monitor a portfolio company by implementing limits on the agent’s (the portfolio company) unwanted decisions, activities and actions. However, then the VC firm does incur monitoring costs (Jensen & Meckling, 1976; Gompers, 1995). Since
the investor does incur some costs for monitoring the firm in which it invests, the actual level of monitoring lies below the optimal level – which is the continuous monitoring of all the agent’s actions. As such, the actual decisions and actions of the agent will diverge from those required to reach the optimal payoff for the principal (the investor) (Jensen & Meckling, 1976). An example of monitoring in the VC industry could for instance be the auditing of the portfolio company’s books by an external auditor or installing a board of directors by the VC firm (Douma & Schreuder, 2002). Other monitoring costs are for example the opportunity costs of writing a report for both the venture capitalist and entrepreneur (Gompers, 1995). In their empirical study, Hellmann and Puri (2000) find that companies financed by VC-firms are more likely and faster to professionalize, as measured by the adoption of stock option plans, the hiring of outside executives (e.g. CEO). Furthermore, Botazzi et al. (2008) show that investor activism is indeed an important contributor to the ultimate performance of the portfolio company. These pieces of evidence indeed support the theory that VC firms should actively monitor their portfolio companies by e.g. attracting external executives. Consequently, it is not surprising that there is indeed corroborating evidence in research that VC firms put significant effort in monitoring their portfolio companies (Kaplan & Strömberg, 2001).

3.4: Mentoring portfolio companies

Furthermore, next to monitoring, the venture capitalists can also offer valuable advice to the portfolio company in the post-investment phase, an activity which is often referred to as mentoring (Botazzi & Da Rin, 2002). Indeed, empirical evidence shows that venture capitalists see themselves as mentors and advisors (Sapienza et al., 1996). According to research done by Gorman and Sahlman (1989), mentoring is in fact a key determinant of the success of the portfolio company since the entrepreneurs often have a lack of business experience. Clearly, venture capitalists do not only restrain management by monitoring, they also provide the entrepreneurs with their expertise and advice (Botazzi & Da Rin, 2002).

In conclusion, VC firms are confronted with numerous agency problems when dealing with young startup companies. These agency problems make it more risky and less attractive to invest in such companies, and consequently make it more difficult for SMEs to obtain external funds. However, through the screening of potential portfolio companies, the structuring of the contract of the deal so that incentives are aligned, and the by post-investment monitoring and mentoring of the management of portfolio company the agency problems can be mitigated to a great extent. Therefore, it is clear that these four activities of venture capitalists are crucial to the success of their portfolio companies and ultimately to the success of the VC firm itself.
CHAPTER 4: HUMAN CAPITAL

In the previous sections we have seen how VC firms mitigate the agency problems they face. In this section we will investigate the role that human capital plays in the activities of screening, structuring, monitoring and mentoring.

In this context, human capital refers to the partner-characteristics or management-characteristics, which are the characteristics of the partners of the VC firm. These could include variables such as the previous working experience, and the type and level of education of these partners (Bottazzi, Da Rin & Hellmann, 2008; Zarutskie, 2008; Chevalier & Ellison, 1999; Dimov, Shepherd, 2005). Clearly, these management-characteristics basically capture the human capital of the partners working at the VC firm.

4.1: Types of human capital

Although definitions of these two categories within human capital have varied throughout the previous studies on this topic, typically general human capital refers to that set of skills that can be applied to most organizations. On the contrary, specific human capital refers to that set of skills that can only be applied to a specific organization or setting, and/or at a particular time. Specific human capital can in turn be subdivided into task-specific human capital and industry-specific human capital (Zarutskie, 2008).

Firstly, task-specific human capital refers to the human capital that an individual acquires which is specific to the task being performed, instead of being specific to for instance the firm or the industry. In other words, it refers to the idea that you become better at the specific tasks of your job as you gain more experience in performing those tasks (learning-by-doing) (Gibbons & Waldman, 2004). In my dataset, I will measure this task-specific human capital by looking at the number of years the individual has been working in the Venture Capital industry. In their paper, Da Rin, Hellmann and Bottazzi (2005) alternatively refer to this type of human capital as job-specific knowledge.

Secondly, industry-specific human capital refers to the experience in a certain job or industry that enhances an employee’s efficiency and productivity in that work, irrespective of the specific firm at which he is employed (Zarutskie, 2008; Huang, 2003; Gibbons & Waldman, 1999). Alternatively, Neal (1995) describes industry-specific human capital as “skills that are specific to firms in a given industry or sector of the economy”. In other words, these are the set of skills that one learns at his job in one particular company, but that are also useful at similar jobs in other firms in that particular industry. Da Rin, Hellmann, and Bottazzi (2005) alternatively label this type of human capital as generic business knowledge, which they measure by looking at previous working experience.

For the VC industry, industry-specific human capital could for instance refer to the previous work experience of the VC partners in other industries; by working in these other industries, then, they have gained industry-specific human capital because the set of skills they obtained are applicable to the VC industry.
Next to the two types of specific human capital, namely task-specific human capital and industry-specific human capital, there is another important category of human capital, which is **general** human capital.

Basically, general human capital refers to the *education* of an individual. However, within the literature there is some disagreement as to which fields of education should be included into the general human capital. On the one hand, Dimov and Shepherd (2005) argue that only education that is not directly related to the activities of VCFs – such as education in humanities, engineering or natural sciences - should be included in our definition of general human capital. Conversely, they argue that all education that is directly related – such as education in business and/or law – should be considered as specific human capital. On the other hand, Zarutskie (2008) argues that university education in all fields – natural sciences, engineering, business, law, humanities - can be considered as general human capital.

Since previous research has been somewhat ambiguous in the defining of this type of human capital, I choose to follow the suggested categorization of Zarutskie (2008). I prefer this categorization above that of Dimov and Shepherd (2005) because I believe that education in every field is somehow useful when working as a limited partner at a VCF – even fields of education that may seem rather distinct from the VC industry, such as humanities. In fact, Dimov and Shepherd (2005) note this as a limitation of their classification of education in general and specific human capital when they note that: “all education may make some contribution to general human capital” (Dimov and shepherd (2005), p. 7). Furthermore, as Zarutskie (2008) also notes, although education in some fields may be more specific than in other fields, even the more specific education (in e.g. business) is still more general relative to the work experience-based specific human capital. Moreover, Da Rin, Hellmann and Bottazzi (2005) opt for the same categorization of human capital as Zarutskie (2008), although they refer to this type as *formal* knowledge. Therefore, I choose to follow the categorization of Zarutskie (2008).

In summary, we can subdivide the human capital of venture capitalists into three categories: task-specific, industry-specific, and general human capital. Now that we have established a thorough understanding of human capital applied to the venture capital industry, we will see how this human capital plays a role in the earlier described activities of screening, structuring, monitoring and mentoring.

### 4.2: The role of human capital

Firstly, as Hellmann (2000) notes, the process of *screening* requires the venture capitalists to be highly qualified and up-to-date with the most recent developments in the market. Furthermore, the venture capitalist has to evaluate the attractiveness of the opportunity by looking at the strategy, the market size, the technology, the competition, the management team, etc. (Kaplan & Strömberg, 2001). Clearly, VC partners need to be able to completely understand the (proposed) business model, and they need to assess the viability of this business model. Obviously, human capital in the form of *education* (general human capital) as well as *work experience* (task-specific and industry-specific human capital) plays a crucial role in the process of screening.
Secondly, human capital might play a role in the structuring of contracts, but little research has been conducted on this particular topic. However, it does seem logical that more prior working experience in the VC industry gives venture capitalists more experience in the structuring of such contracts. In turn, we can expect them to become better at this – ceteris paribus – as their experience increases. Furthermore, certain types of general human capital (e.g. education in law) are also likely to be beneficial to VC partners’ contract-structuring skills (Dimov & Shepherd, 2005).

Thirdly, human capital is very important in the post-investment activities of monitoring and especially mentoring (Kaplan & Strömberg, 2001). VC partners give valuable advice to their portfolio companies by helping them with – amongst other things – strategic planning, management recruitment, obtaining of additional financing, operational planning and introductions to potential customers and suppliers (Gorman & Sahlman, 1989). In all of these activities, it is clear how knowledge of the business environment – as obtained through relevant prior working experience – will help venture capitalists do a better job. For instance, having worked in business will give a venture capitalist an edge in for instance strategic planning, because he simply is likely to have been involved in strategic planning before. Since VC partners must screen for good entrepreneurs and portfolio companies as well during their work, they may also be better able to assist their portfolio companies in selection competent managers in the post-investment stage (Zarutskie, 2008). Furthermore, we can imagine that basic understanding of relevant academic fields, such as business or engineering, will help VC partners in these activities as well (Zarutskie, 2008). For example, an education in business may help a venture capitalist in understanding operational planning.

However, not only the human capital of a venture capitalists has an impact on these activities of screening, structuring of contracts, monitoring and mentoring – the use of the human capital (i.e. his/her involvement in the portfolio company) also plays an important role. The intensity of involvement differs from venture capitalist to venture capitalist (Teyebjee & Bruno, 1984). In general, the investment styles of VC firms can be divided into two broad types characterized by different levels of involvement: ‘hands-on’, meaning that the VC firms prefers a high level of monitoring, support and control with respect to their portfolio companies, or ‘hands-off’, referring to lower level of monitoring, support and control (Botazzi, Da Rin & Hellmann, 2008). Furthermore, the EVCA, the European Venture Capital Association, noted in a recent report in 2005 that “the degree of activism of Private Equity and Venture Capital investors will vary according to the nature and structure of investments made and the investor should therefore ensure adequate involvement relative to the circumstances of a particular investment”. In other words, the characteristics of the investment (the firm) determined to a great extent the optimal ‘style’ of handling that investment – either with great involvement (hands on) or less involvement (hands off).
CHAPTER 5: HYPOTHESES
In this chapter I will present the hypotheses that I will test in my study; these are based on the theories explored in our literature overview of the previous chapters. They are all related to the greater research question that we posed ourselves in the beginning of this thesis: how does the human capital of partners of venture capital firms affect the business performance of those venture capital firms. The hypotheses are subdivided into three categories: those regarding the task-specific human capital, the industry-specific human capital, and lastly those concerned with the general human capital. These different types of human capital will be related to the dependent variable of venture capital firm performance.

5.1. Task-specific human capital
As mentioned before, task-specific human capital refers to the human capital that an individual acquires which is specific to the task being performed, instead of being specific to for instance the firm or the industry. In other words, it refers to the idea that you become better at the specific tasks of your job as you gain more experience in performing those tasks (learning-by-doing) (Gibbons & Waldman, 2004).

I expect that the more task-specific human capital there is amongst the partners of the VCF, as measured by the number of years that the ‘average’ venture capitalist at a VCF is employed in the VC industry, will have a positive impact on the business performance of that VCF. I expect that more task-specific human capital will simply allow partners to be more efficient at the tasks at their work, and thus increase the performance of the VCF. This leads me to the formulation of my first hypothesis:

**Hypothesis 1:** Venture Capital firms whose partners have on average more task-specific human capital, in the form of a greater average number of years of employment in the VC industry, will have a greater chance to remain in operation (i.e. to remain ‘alive’)

5.2. Industry-specific human capital
As discussed in previous sections, industry-specific human capital refers to the experience in a certain job or industry that enhances an employee’s efficiency and productivity in that work, irrespective of the specific firm at which he is employed (Zarutskie, 2008; Huang, 2003; Gibbons & Waldman, 1999). In other words, these are the set of skills that one learns at his job in one particular company, but that are also useful at similar jobs in other firms in that particular industry.

In the dataset that I will analyze for this study, the possible prior industries in which partners of VC firms have obtained work experience have been divided into four broad categories, namely: finance (banking, insurance), management (management functions in firms that are not finance-related, consulting), entrepreneur (own company), other (anything outside previous categories, including government work, military, researcher (at university), engineer, medical doctor, etc.). The work experience in these different sectors is measured by dummy variables for each subcategory of work experience. I will use the prior working experience of limited VC partners to measure their industry-specific human capital.
In my study, I will focus on these categories of prior working experience in three broad areas, namely finance, management, and entrepreneurship. In particular, I will look at the industry-specific human capital of the venture capitalists at a VCF from a firm-level perspective. In other words, I am not investigating whether one particular VC partner is specialized in e.g. finance (through working experience in the finance industry), in fact, I am interested in finding out whether the VC firm as a whole has specialized in e.g. finance. As such, I will analyze the relative amount of prior working experience of VC partners at a particular firm in each type of working experience as compared to the other possible types. For instance, I will see whether partners at a firm have relatively more experience in the finance industry as compared to having worked as a manager or being self-employed as an entrepreneur.

The question now rises: why will the industry-specific human capital obtained in these three industries or working roles be applicable to or helpful in the VC industry?

Firstly, I expect prior experience in a management function at a firm or in a business-consulting role to grant the VC partners better skills concerning business decisions, business management, and strategic management. I expect that these skills in turn then will help them make better investment decisions, and enable them to provide better business advice to their portfolio companies. Consequently, these skills should – ceteris paribus - lead to a better performance of these portfolio companies, and thus of the VCF (Zarutskie, 2008). Secondly, I predict that prior experience in a finance-related firm, for instance at a bank or insurance company, will also grant the VC partners better skills concerning additional fund raising. Again, these skills should – ceteris paribus - lead to a better overall performance of these portfolio companies, and consequently to a better performance of the VCF (Zarutskie, 2008). Lastly, I expect that previous experience as an entrepreneur also grants the VC partners a set of skills that will help them provide better management advice to their portfolio companies. As before, these skills should – ceteris paribus - lead to a better overall performance of these portfolio companies, and thus of the VCF.

Hypothesis 2: Venture capital firms whose partners have more specialized working experience, in the sense that they are on a firm-level relatively more experienced i) as manager in a non-finance related industry, ii) in the finance industry, and/or iii) as entrepreneur as compared to the two other possible fields of prior working experience, will have a greater chance to remain in operation (i.e. to remain ‘alive’).

5.3. General human capital
Furthermore, as previously mentioned, general human capital refers to the education of an individual. Specifically, I will follow the categorization of Zarutskie (2008), who argues that university education in all fields – natural sciences, engineering, business, law, humanities - can be considered as general human capital.

In the dataset that I will use for this study, the several fields education have been categorized into the following (broad) categories: business (1), engineering (2), natural sciences (3), social sciences (including law) (4), and medical sciences (5). In the dataset the education of the
partners of the VCFs in the several possible fields sectors is measured by dummy variables for each subcategory of education. I will use the graduate education in different fields to measure the general human capital of the partners of the VCFs. As for the prior working experience, I will also look at the general human capital of the venture capitalists at a VCF from a firm-level perspective. As such, I will analyze the relative amount of education of VC partners at a particular firm in each field of education as compared to the other possible fields. For instance, I will see whether partners at a firm are relatively more educated in e.g. engineering as compared to having an education in business, natural sciences, social sciences, or medical sciences.

How could an education in a particular field have a positive influence on the skills of venture capitalists? Firstly, I expect that prior education in the field of business will grant the partners of the VCFs better skills at selecting, screening and advising portfolio companies concerning strategic and operational decisions (Zarutskie, 2008; Dimov and Shepherd, 2005). Consequently, these skills should – ceteris paribus - lead to a better performance of these portfolio companies, and thus of the VCF. Secondly, I predict that prior education in the field of law will give the partners of the VCFs expertise on the structuring of contracts, the legal issues surrounding IPOs of the portfolio companies, etc. (Zarutskie, 2008; Dimov and Shepherd, 2005). As such, prior education in the field of law will – ceteris paribus – lead to a better performance of the VCF. Furthermore, I expect that prior education in the fields of engineering and/or natural sciences will improve on the ability of the partners of the VC firm to select and advise portfolio companies, particularly if these portfolio companies are IT-related, or in any case if these companies are built on a high-technology product or service (Zarutskie, 2008). As a consequence, such prior education should – ceteris paribus – lead to a better performance of the VCF. Lastly, I expect that prior education in the field of medical sciences will grant the partners of the VCF the skill to select and advise portfolio companies, especially if these companies are related to biotechnology, and/or are involved in biological/medical products or services. Therefore, such prior education in medical sciences should – ceteris paribus – lead to a better performance of the VCF.

**Hypothesis 3:** Venture capital firms whose partners are on aggregate more specialized in a particular field of education, in the sense that they have on a firm-level relatively more education at the master’s level in the field of i) business, ii) engineering, iii) natural sciences, iv) social sciences (including law), and/or v) medical sciences as compared to the four other possible fields of education, will have a greater chance to remain in operation (i.e. to remain ‘alive’).
CHAPTER 6: DATA AND METHODOLOGY

6.1. The dataset: sources of the data
As previously mentioned, I will use a dataset that contains hand-collected data on more than 1300 VC firms from more than 17 countries across Europe for the years 1999, 2001, and 2003. The VC firms that are noted in the file are the ones that were active in those years, as measured by having invested in the year 1999, 2001 and/or 2003. The data in this dataset comes from a number of sources.

Firstly, a large part of the data was hand-collected and stems from the website of the VC firms themselves. Often VC firms will have a section listed on their website which contains info on the partners of the VC firm (e.g. a section called ‘team’). Through these websites a lot of valuable and rich information can be gathered directly. Secondly, another major part of the data comes from the EVCA, the European Venture Capital Association. This is an association that stretches across most European countries; VC firms can pay them a fee to become a member of their network. Fortunately, the EVCA publishes an information-book annually containing a large amount of data on its members – ranging from the type of VC firm and the amount of capital under management, to the education and work experience of the partners of these VC firms. As such, this was also a very rich and reliable source of information. Furthermore, data was obtained from commercial databases containing information on VC firms and their management, such as VentureXpert, Amadeus, as well as CapitalIQ. These databases also contained a wealth of information on the education and work experience of the VC firm’s partners. Lastly, data was also obtained through surveying of partners at VC firms for which information was hardly available. These partners were contacted directly via email and/or telephone, and were asked to complete a survey on the VC firm, their education and their work experience. All in all, the resulting dataset is significantly larger than other ones used in previous studies, and is much richer than the commercial databases.

6.2. Specification of Variables

6.2.1. Independent variables
The independent variables described in my three hypotheses can be categorized in two types of variables.

Firstly, the average number of years of employment in the VC industry - which functions as a proxy for the task-specific human capital - can be ratio scaled, in the sense that the ratio of two values of this variable is meaningful. For instance, the knowledge that partner B is employed in the VC industry for twice as long as partner A is meaningful. In the dataset, the year of first entry into the VC industry is noted, but not the total number of years employed in the VC industry. This variable in the dataset is adjusted to the variable YEARS VC INDUSTRY – which measures the total number of years employed in the VC industry – by taking the year under investigation (1999, 2001, or 2003) minus the year of first entry into the VC industry. For instance, if a VC firm that invested in the year 2001 has a partner that first joined the VC industry back in 1989, then a quick calculation (2001-1989) learns us that the value of YEARS VC INDUSTRY is 12 for this partner. The resulting variable YEARS VC
INDUSTRY is a ratio scaled variable that can be easily regressed on the dependent variable. Table 1 gives the definition of this variable.

### Table 6.1: Variable definition

<table>
<thead>
<tr>
<th>Independent variable</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>YEARS VC INDUSTRY</td>
<td>Total number of years employed in the VC industry.</td>
</tr>
</tbody>
</table>

Secondly, the independent variables in the second and third hypotheses cannot be ratio scaled – their ratios are not meaningful. Instead, they are nominally scaled, since their numerical values are chosen arbitrarily. For instance, for the variable of education at the master’s level, a numerical value of 1 is assigned to education in the field of business, whereas a master’s degree in natural sciences is assigned a numerical value of 3. These numbers are arbitrary in the sense that they should not be interpreted as saying that a study in natural sciences is ‘better’ than an education in business (or vice versa) simply because there is a difference in their numerical values. Importantly, nominal variables cannot be inserted into a regression model, since their numerical values are not meaningful. Therefore, I will split up the EDUCATION variable into several dummy variables for each field of education separately, so that e.g. the presence of a master’s in business is represented by a ‘1’, and its absence by a ‘0’. Consequently, regarding the master’s education of partners at VC firms, we used 5 dummy variables – one for each field of education, namely BUSINESS, ENGINEERING, NATURAL SCIENCES, SOCIAL SCIENCES, and MEDICAL SCIENCES.

Since we are interested in the specialization at the firm-level of venture capital partners in a particular field of education, we needed to transform these dummy variables into ‘concentration’ variables, measuring the relative presence of education in a particular field of education in a VC firm. To achieve this, we summed up the relevant dummy variable for each field of education for each partner, and then divided it by all the education dummy variables for all partners summed up. This way we obtained 5 ‘concentration’ variables (one for each field of education), which could take on a value between 0 and 1, with 0 meaning no partner specialized in this field of education, and 1 meaning that all education that partners at the VC firm have consists of a master’s degree in this field of education. Table 6.2 gives an overview of the definitions of these variables. By definition, the sum of these five concentration variables is equal to 1. The variable of SOCIAL SCIENCES_CON will act as a base level, meaning that if the other variables are 0, this variable will take on its maximum value of 1.

### Table 6.2: Variable definition of field of education

<table>
<thead>
<tr>
<th>Independent variable</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>BUSINESS_CON</td>
<td>Variable measuring the degree of concentration of the graduate degrees of the partners at the venture capital firm in the field of business.</td>
</tr>
<tr>
<td>ENGINEERING_CON</td>
<td>Variable measuring the degree of concentration of the graduate degrees of the partners at the venture capital firm in the field of engineering and/or information technology (IT).</td>
</tr>
</tbody>
</table>
NATURAL SCIENCES_CON | Variable measuring the degree of concentration of the graduate degrees of the partners at the venture capital firm in the field of physics, chemistry and/or mathematics (non-applied technical studies).

SOCIAL SCIENCES_CON | Base level: if the other variables summed up take on a value of x, this variable takes on the value of 1-x; variable measuring the degree of concentration of the graduate degrees of the partners at the venture capital firm in the field of law, sociology, psychology and/or humanities.

MEDICAL SCIENCES_CON | Variable measuring the degree of concentration of the graduate degrees of the partners at the venture capital firm in the field of medical studies and/or biology.

Lastly, the variable of previous working experience is already subdivided into several dummy variables in the dataset. These dummy variables are called FINANCE, MANAGEMENT, ENTREPRENEUR, and OTHER. Again, these variables can either take on a value of ‘1’ in case the specific work experience is present or ‘0’ if it is not. A value of ‘0’ in all four dummy variables means that the specific partner had no working experience when he joined the VC firm. Table 6.3 gives an overview of the definitions of these variables.

However, since we want to investigate the specialization at the firm-level of the prior working experience of venture capital partners in a particular industry or sector, we again need to transform these dummy variables into ‘concentration’ variables, measuring the relative presence of prior working experience in a particular industry or sector in the relevant VC firm. To achieve this, we summed up the relevant dummy variable for each field of prior working experience for each partner, and then divided it by all the working experience dummy variables for all partners summed up. This way we obtained 5 ‘concentration’ variables (one for each type of prior working experience), which can take on a value between 0 and 1, with 0 meaning no partner has this type of prior working experience, and 1 meaning that all working experience that partners at the VC firm was gained in this particular industry or sector. Table 6.3 gives an overview of the definitions of these variables. As before, by definition, the sum of these three concentration variables is equal to 1. The variable of ENTREPRENEUR_CON will act as a base level, meaning that if the other variables are 0, this variable will take on its maximum value of 1.

**Table 6.3: Variable definition of previous working experience**

<table>
<thead>
<tr>
<th>Independent variable</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>FINANCE_CON</td>
<td>Variable measuring the degree of concentration of the working experience of the partners at the venture capital firm in the finance sector (banks, insurance companies, other financial institutions, but not in the VC industry).</td>
</tr>
</tbody>
</table>
6.2.2. Dependent variable

The dependent variable of this study is the dummy variable ALIVE, which takes a pivot value of 1 if the VC firm was still operational at the time of the collection of the data, and a value of 0 when it was not operational any longer (either gone bankrupt or acquired by another VC firm). I will use this variable as a proxy for the performance of the VC firms. Naturally, if a VC firm performs badly it will – in an efficient market – lead to either the bankruptcy of that VC firm, or the acquisition of that VC firm by another, more efficient VC firm. Therefore, it provides a very direct measure of the VC firm performance.

Alternatively, the fraction of portfolio companies that exited successfully via an IPO (Initial-Public-Offering) or acquisition out of the total number of portfolio companies under management of the VC firm can be used as a proxy for VC firm performance. This measure is widely used in Private Equity research as a proxy for the business performance of VC firms (Tykvova & Walz, 2004; Sørensen, 2007; Botazzi, Da Rin & Hellmann, 2008). However, my dependent ALIVE variable will grant us a new perspective on VC firm performance, since it gives us a much more direct measure of that performance. Table 6.4 provides the definition of the dependent variable.

<table>
<thead>
<tr>
<th>Table 6.4: Variable definition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dependent variable</strong></td>
</tr>
<tr>
<td>ALIVE</td>
</tr>
</tbody>
</table>

6.2.3. Control variables

As mentioned before, previous research has shown that there are several other variables that may affect the VC firm’s performance (Bottazzi, Da Rin & Hellmann, 2008; Cumming & Dai 2010). For instance, next to the partner characteristics that I am investigating in this study, firm-characteristics can also have an influence on the VC firm performance. As control variables I will use the VC firm type, the size of the VC firm, the country of origin, and time.

Firstly, I will look at the VC firm type. We have identified 4 types of VC firms, namely independent ones, bank-affiliated ones, corporate VC firms, governmental (or municipal) VC firm, and finally other financial intermediary-affiliated ones. These are respectively represented by the 5 dummies INDEPENDENT, BANK-AFFILIATED, CORPORATE,
GOVERNMENTAL, and OTHER FINANCIAL INTERMEDIARY-AFFILIATED, which each can take a value of 1 in case the VC firm in question belongs to this category and 0 if it does not. It is important to control for VC type, because possibly the VC type influences the structure as well as the operation of the VC firm, which naturally in turn could affect its business performance. For instance, there is contradictory evidence in economics literature on the effect of government-ownership on firm performance. While some authors have found results that government-owned firms perform worse than private firms, others have concluded that the opposite is in fact the case (Sun, Tong & Tong, 2002; Nellis, Kikeri & Shirley, 1992). As mentioned before, as Da Rin et al. (2008) note, independent firms are more profit driven than non-independent firms, and they are free to set their own investment style. Alternatively, for instance bank-affiliated VC firms will be influenced to a great extent by their parent companies’ strategic plans and goals. Indeed, several recent studies have shown that non-independent VC firms tend to act differently than independent ones (Gompers & Lerner, 2000; Hellman, Lindsey & Puri, 2008). Therefore, since it is clear that the VC firm types influence the performance of those VC firms, we need to control for this variable. Table 6.5 provides the definition of these control variables.

<table>
<thead>
<tr>
<th>Control variable</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>INDEPENDENT</td>
<td>Equal to 1 if the VC firm is independent.</td>
</tr>
<tr>
<td>BANK-AFFILIATED</td>
<td>Equal to 1 if the VC firm is affiliated to a bank, i.e. if a bank has a majority share in the VC firm.</td>
</tr>
<tr>
<td>CORPORATE</td>
<td>Equal to 1 if the VC firm is a corporate VC firm, i.e. if a corporation has a majority share in the VC firm or if it is a (sub-) division of a larger corporation.</td>
</tr>
<tr>
<td>GOVERNMENTAL</td>
<td>Equal to 1 if the VC firm is a governmental VC firm, i.e. if a government (or municipality) has a majority share in the VC firm.</td>
</tr>
<tr>
<td>OTHER FINANCIAL INTERMEDIARY-AFFILIATED</td>
<td>Equal to 1 if the VC firm is affiliated to another financial intermediary, i.e. if a financial intermediary (non-bank) has a majority share in the VC firm.</td>
</tr>
</tbody>
</table>

Secondly, I will control for the size of the firm. In Private Equity investments literature, it is common to take either the amount of funds under management or the number of partners in the VC firm as a proxy for the firm size (Botazzi et al., 2004; Botazzi, Da Rin & Hellmann, 2008). In my analysis I will focus on the amount of funds under management as a proxy for the firm size, since the number of partners variable has its limitations in my dataset. The number of partners is noted as being 1, 2, 3, 4, 5, or 6 or more. Clearly, the category ‘6 or more’ includes a wide variety of partner numbers – from 6 to maybe as much as 40 partners. Therefore this variable has its limitations as a proxy for firm size. Instead, I will look at the amount of funds under management as a measure of VC firm size. Importantly, the funds under management influence the performance of the VC firm. Venture capital funds that have a greater amount of funds under management will be able to invest more in their portfolio companies, and will also be able to fund more follow-up rounds of investment. However, if a
VC firm has too much funds under management we can in fact expect an adverse effect on the performance, since this may lead to wasteful spending of resources (Zarutskie, 2008). Clearly, the amount of funds under management is an important factor in explaining VC performance, and should therefore be controlled for. Table 6.6 provides the definition of this control variable.

<table>
<thead>
<tr>
<th>Control variable</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>VCAUM</td>
<td>The amount of funds under management by the VC firm in a particular year (1999, 2001 or 2003) measured in millions of Euros.</td>
</tr>
</tbody>
</table>

Thirdly, I will control for the nationality of the firm. As we have seen in chapter 2, the European Venture Capital industry is a relatively local one; VC firms invest mostly in portfolio companies that originate from the same country as the VC firm (Botazzi et al., 2004). Furthermore, the importance of the country of origin on the business performance of a particular firm has been intensely researched and is well established within academic literature (Lee and Yu, 2004; Kogut and Zander, 1993; Kogut and Singh, 1988, Hofstede et al., 1990). Therefore, I have decided to control for the nationality of the VC firms in my analysis. I have decided to group the nationalities according to their geographic region; as such, the nationalities have been divided into the following ‘zones’: Scandinavia, Central Europe, Western Europe, and Southern Europe. In my model I will include a three dummy variables (and one base level – Western Europe), which can take a value of ‘1’ if a VC firm was founded in that region, and a value of ‘0’ otherwise. If all three region dummies take a value of 0, then this means that a particular VC firm originates from Western Europe. It will be interesting to see whether these region-dummies are significant, or, in other words, whether there are any region-specific effects on performance in the VC industry. Table 6.7 provides the definitions of these control variables.

<table>
<thead>
<tr>
<th>Control variable</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>WESTERN EUROPE</td>
<td>Base level; if all other region dummies take a value of 0, the VC firm was founded in the United Kingdom, Ireland, the Netherlands, Luxembourg, or Belgium</td>
</tr>
<tr>
<td>SCANDINAVIA</td>
<td>Equal to 1 if the VC firm was founded in Norway, Sweden, Finland, or Denmark.</td>
</tr>
<tr>
<td>CENTRAL EUROPE</td>
<td>Equal to 1 if the VC firm was founded in Germany, Austria, or Switzerland.</td>
</tr>
<tr>
<td>SOUTHERN EUROPE</td>
<td>Equal to 1 if the VC firm was founded in France, Italy, Spain, Portugal, or Greece</td>
</tr>
</tbody>
</table>

Lastly, I will also control for time – in this case whether the year was ‘1999’, ‘2001’, or ‘2003’. As we have seen in previous chapters, cyclicality is one of the key characteristics of the VC industry. It is very well possible that in a particular year the state of the economy was relatively bad (e.g. a deep recession), whereas in another year it was booming. Obviously,
such macroeconomic effects will most likely have a major impact on individual business performance, especially since the VC firm is so cyclical. Therefore, we have to control for time as well by implementing three time dummies for the three years 1999, 2001, 2003. Both ‘2001’ and ‘2003’ take a value of ‘1’ if the data on the firm pertains to that particular year, and a value of ‘0’ otherwise. If both ‘2001’ and ‘2003’ have a value of 0, the data in that particular row pertains to the year 1999. Table 6.8 provides the definitions of these control variables.

<table>
<thead>
<tr>
<th>Control variable</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1999</td>
<td>Base level; if the variables ‘2001’ and ‘2003’ are both 0, the data on a particular VC firm pertains to the year 1999.</td>
</tr>
<tr>
<td>2001</td>
<td>Equal to 1 if the data on a particular VC firm pertains to the year 2001.</td>
</tr>
<tr>
<td>2003</td>
<td>Equal to 1 if the data on a particular VC firm pertains to the year 2003.</td>
</tr>
</tbody>
</table>

In conclusion, numerous factors outside human capital alone can have major effects on the performance of VC firms. Since we want to gain objective results on the impact of human capital on VC firm performance, we will have to ‘filter out’ the effects of other variables by controlling for them in our model. To this end, we will include control variables for the VC firm type, the size of the firm, its nationality, and for time.

### 6.3: Specification of the model

Since our dependent variable ‘Alive’ is in fact a binary variable, which means that it can take on the value of either 0 or 1, we opt for a logit model. In other words, we will perform a binary logistic regression. The logit model is well suited for the analysis of the influence of continuous and/or categorical independent variables on a binary dependent variable (Nieuwenhuis, 2009). The logit model is based on the following basic assumption:

$$ P( Y = 1 \mid x_1, \ldots, x_k) = \Lambda(w) = \frac{e^w}{1 + e^w} \quad with \quad w = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \ldots + \beta_k x_k $$

And the corollary of the basic assumption:

$$ P( Y = 0 \mid x_1, \ldots, x_k) = 1 - \Lambda(w) = \frac{1}{1 + e^w} \quad with \quad w = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \ldots + \beta_k x_k $$

For the logit model, the odds ratio $P(Y = 1) / P(Y = 0)$ is of special importance. For instance, if the odds ratio is 4, this means that there is an 80% chance that $Y = 1$ and a 20% chance that $Y = 0$. Taking the log of the odds ratio gives us the following equation (Nieuwenhuis, 2009):

$$ \log \left( \frac{P(Y=1)}{P(Y=0)} \right) = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \ldots + \beta_k x_k $$
7. DESCRIPTIVE STATISTICS
In this chapter, I will give a descriptive overview of the dataset. In this way, we will get a ‘feeling’ for the characteristics of the data (and any peculiarities). As mentioned before, the data used here comes from several sources, such as the VC firms’ websites, information books published by the EVCA, and commercial databases such as Amadeus, Capital IQ, and Venture Expert. The analysis of this data has been conducted through use of the statistical analysis programme SPSS.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Sample size</th>
<th>Mean</th>
<th>Standard deviation</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alive</td>
<td>950</td>
<td>0.868</td>
<td>0.338</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Finance_con</td>
<td>950</td>
<td>0.413</td>
<td>0.302</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Management_con</td>
<td>950</td>
<td>0.499</td>
<td>0.287</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Entrepreneur_con</td>
<td>950</td>
<td>0.079</td>
<td>0.149</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Business_con</td>
<td>950</td>
<td>0.648</td>
<td>0.372</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Engineering_con</td>
<td>950</td>
<td>0.122</td>
<td>0.241</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Sciences_con</td>
<td>950</td>
<td>0.039</td>
<td>0.139</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Social_con</td>
<td>950</td>
<td>0.078</td>
<td>0.193</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Medical_con</td>
<td>950</td>
<td>0.067</td>
<td>0.198</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Independent</td>
<td>950</td>
<td>0.712</td>
<td>0.453</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Bank-affiliated</td>
<td>950</td>
<td>0.133</td>
<td>0.339</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Corporate</td>
<td>950</td>
<td>0.067</td>
<td>0.251</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Governmental</td>
<td>950</td>
<td>0.065</td>
<td>0.241</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Other fin.int.-affiliated</td>
<td>950</td>
<td>0.023</td>
<td>0.150</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Amount</td>
<td>950</td>
<td>439.6</td>
<td>1815.15</td>
<td>1</td>
<td>40000</td>
</tr>
<tr>
<td>Amount partner</td>
<td>950</td>
<td>123.9</td>
<td>559.57</td>
<td>0.10</td>
<td>13333.33</td>
</tr>
<tr>
<td>VC age</td>
<td>950</td>
<td>8.93</td>
<td>10.45</td>
<td>0</td>
<td>101</td>
</tr>
</tbody>
</table>

7.1: Dependent variable
The dummy variable ALIVE has a mean value of 0.868 over the dataset, which means that at the time of the collection of the data – which was during the years 2009/2010 – 86.8% of the VC firms that invested in portfolio companies in either 1999, 2001 or 2003 were still alive. Conversely, 13.2% of these firms were considered ‘dead’; in other words, these firms had been acquired or defaulted in the meantime.

7.2: Independent variables
When looking at the prior working experience of venture capitalists, we see that both management and finance backgrounds are most common, with 60.5% and 50.3% of the venture capitalists having such a background. Relatively few VC partners have been self-employed as an entrepreneur – only 11.6 % of the partners have a background as entrepreneur. As for the education at the master’s level, most venture capitalists – 52.2% - have a master’s degree in business, whereas the other types are much less common. Both these distributions of work experience and education over the partners are reasonable, in the sense that we can indeed expect them to have more experience in finance and management on
average, and that as in any business environment we can expect most managers to have a business degree.

7.3: Control variables
Firstly, we can investigate the presence of certain VC types in the European VC industry. Botazzi et al. (2004) noted that one typical characteristic of the European VC industry is that of the domination of bank and corporation-owned VC firms over independent ones. Table 7.1 and table 7.2 (below) show the distribution of VC types over the VC firms. In contrast to the established characteristics, I find that VC firms in Europe appear to be independent firms for the major part (71 %), while bank-affiliated (13 %) and corporate firms (7%) only form a minority of the total. Botazzi et al. (2004) found a similar distribution of the VC types over their sample with a majority of the VC firms being independent. Possibly, the percentage of corporate and bank-owned VC firms is still relatively large compared to e.g. the U.S. VC industry. However, we lack the data to confirm such a hypothesis.

<table>
<thead>
<tr>
<th>VC type</th>
<th>Percentage of total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Independent</td>
<td>71.2</td>
</tr>
<tr>
<td>Bank-affiliated</td>
<td>13.3</td>
</tr>
<tr>
<td>Corporate</td>
<td>6.7</td>
</tr>
<tr>
<td>Governmental</td>
<td>6.5</td>
</tr>
<tr>
<td>Other financial institution-affiliated</td>
<td>2.3</td>
</tr>
</tbody>
</table>

Moreover, another way of looking at the population is by investigating the (average) size of the VC firms. A proxy for firm size can be for instance the amount of funds under management or the number of partners in the VC firm (Botazzi et al., 2004). Firstly, as we can see in table 7.3, the amount of funds under management varies widely from as low as 1 million EUR up to 40000 million EUR (i.e. 40 billion EUR), while the mean amount of funds under management lies at a value of around 440 million EUR.

<table>
<thead>
<tr>
<th>Statistic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average</td>
<td>439.57</td>
</tr>
<tr>
<td>Minimum</td>
<td>1</td>
</tr>
<tr>
<td>Maximum</td>
<td>40000</td>
</tr>
</tbody>
</table>

A second possible proxy for VC firm size can be - as mentioned above - the number of partners per VC firm. Figure 7.2 provides an overview of the distribution of the number of partners at VC firms. As can be seen from the graph, there are no major differences in the distribution of the number of partners. Nevertheless, smaller firms with either two or three partners, as well as larger firms with 6 or more partners are most common in the European VC industry.
Furthermore, when analyzing the (average) age of a VC firm in the European VC industry, one notices that there is a considerable skew in the distribution (see figure 7.3 above). The great number of the VC firms is quite young (<10 years) with the mean age at approximately 9 years (8.94 years), and most VC firms in the European market are less than 20 years old. Importantly, it has often been noted that the European Venture Capital industry is in fact still a young one – it experienced its first boom in the late 1990s (Botazzi et al., 2004). Consequently, this is another sign that our sample describes the population of VC firms well.

Lastly, we can have a look at the distribution of the venture capital firms in our sample over the different countries in Europe which is graphically represented in figure 7.4. As mentioned, the dataset encompasses most of the European countries. Importantly, the distribution of the VC firms seems to be proportional to the size of a country’s market. For instance, countries with an extensive VC market such as the UK, Germany and France are relatively strongly represented in the data, whilst less developed VC markets such as Greece or Italy are represented by fewer VC firms in the dataset. Clearly, this makes sense since smaller markets can be expected to have a smaller amount of VC firms in operation. Therefore, the dataset seems to provide an adequate overview of the European VC industry – no single country seems to be over- or underrepresented in the data.
7.4: Correlation

Table 7.4 shows the correlation coefficients of the dependent variable (Alive) and the independent variables.

<table>
<thead>
<tr>
<th></th>
<th>Alive</th>
<th>VC exp</th>
<th>Fin_con</th>
<th>Man_con</th>
<th>Entrepr._con</th>
<th>Bus_con</th>
<th>Eng_con</th>
<th>Sciences_con</th>
<th>Social_con</th>
<th>Med_con</th>
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</thead>
<tbody>
<tr>
<td>Alive</td>
<td>1</td>
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<td></td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>VC exp</td>
<td>0.146**</td>
<td>1</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fin_con</td>
<td>0.034</td>
<td>0.103**</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Man_con</td>
<td>-0.023</td>
<td>-0.013*</td>
<td>-0.836**</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Entrepr._con</td>
<td>-0.133**</td>
<td>-0.169**</td>
<td>-0.348**</td>
<td>-0.142**</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bus_con</td>
<td>0.039</td>
<td>0.085</td>
<td>0.207**</td>
<td>-0.107**</td>
<td>-0.182**</td>
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</tr>
<tr>
<td>Eng_con</td>
<td>-0.017</td>
<td>-0.051</td>
<td>-0.217**</td>
<td>0.153**</td>
<td>0.140**</td>
<td>-0.470**</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Scien_con</td>
<td>0.033</td>
<td>-0.064*</td>
<td>-0.207**</td>
<td>0.176**</td>
<td>0.044</td>
<td>-0.259**</td>
<td>-0.050</td>
<td>-0.090**</td>
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<td></td>
</tr>
<tr>
<td>Social_con</td>
<td>-0.155**</td>
<td>-0.045</td>
<td>0.113**</td>
<td>-0.136**</td>
<td>-0.024</td>
<td>-0.341**</td>
<td>-0.087**</td>
<td>-0.099**</td>
<td>-0.001</td>
<td>-0.077*</td>
</tr>
<tr>
<td>Med_con</td>
<td>0.034</td>
<td>-0.062</td>
<td>-0.163**</td>
<td>0.095**</td>
<td>0.164**</td>
<td>-0.388**</td>
<td>-0.099**</td>
<td>-0.001</td>
<td>-0.077**</td>
<td>1</td>
</tr>
</tbody>
</table>

*Correlation is significant at the 0.05 level (2-tailed)

**Correlation is significant at the 0.01 level (2-tailed)

The dependent variable has no particularly strong correlation with any of the independent variables.

The dummy variables related to education are nearly all negatively correlated to one another. This seems quite logical, since most people tend to only have one master’s degree in only one particular field of study. Consequently, if a certain venture capitalist has a degree in for instance business, this is highly likely to exclude all other fields of education for this venture capitalist. In other words, having a master’s degree in one field makes it likely that you do not hold a master’s degree from another field of study. This ‘common sense’ is clearly reflected in the data.

The prior working experience dummies also tend to have a relatively strong correlation, quite as expected. Having work experience in the finance sector is negatively related to having work experience as a manager outside the finance industry, as well as to being an entrepreneur. Especially the negative correlation between finance and management is very strong. Apparently, once someone has started a career in a particular industry or sector outside of finance, he will not easily switch to the finance industry and vice versa. Furthermore, there is only a relatively small negative correlation between entrepreneurship and management work experience. Since entrepreneurship gives the entrepreneur valuable management skills (since he has to manage his company), we can indeed expect these two types of prior working experience to be relatively less negatively correlated. It is very well imaginable that an
entrepreneur joins a different firm as a manager to apply these skills after he has e.g. sold his own firm.

As for the control variables (excluded from the correlation table to keep the size manageable), few problems were detected in terms of correlation with other variables. Strangely however, the VC type Independent was very strongly positively correlated (0.957) to the amount under management per partner. Furthermore, the VC type independent was quite strongly correlated to the other four VC types, whilst these four VC types were not highly correlated to one another. Except for the variable VC type ‘independent’, no truly problematic correlations were detected.
8. EMPIRICAL ANALYSIS & RESULTS

8.1: Testing the hypotheses
In this chapter we will conduct the binary logistic regression using the logit model and the variables described in previous sections. Firstly, we will look at the first hypothesis pertaining to the relationship between VC industry experience (task-specific human capital) and the performance of VC firms. Secondly, we will see how the prior relevant work experience (industry-specific human capital) affects the performance of the firms. Then, we will analyze how education (general human capital) impacts this performance. Lastly, we will see how the control variables influence the performance of VC firms.

Models 1 to 6 are all sub-models containing a selection of all variables, to provide insight in the dynamics and characteristics of the variables individually (or per category of variables). Then, in models 7 and 8 we will merge all other models together into a model that encompasses all the relevant variables. As will be discussed in the coming section, in contrast to model 7, model 8 includes an extra interaction term to mitigate some correlation issues. In each model we will insert the control variables mentioned in previous chapters. Table 8.2 provides an overview of the results of the statistical analyses for the models.

8.2: Task-specific human capital
Firstly, we will see how the task-specific human capital of prior VC industry experience, as measured by the number of years that the average venture capitalist at a VC firm is active in the VC industry, impacts the performance of the VC firms as measured by the binary ALIVE variable. Table 8.2 summarizes the results from this regression analysis. As these results show, the amount of prior experience in the VC industry of the partners at a VC firm has a significant (small) positive effect on the performance of that firm. As such, these results corroborate our hypothesis that such task-specific human capital improves the job skills of venture capitalists, and as such the performance of the firm as a whole. However, we do clearly see that task-specific human capital plays only a minor role compared to the other two types of human capital: the coefficient of the variable YEARS VC INDUSTRY is relatively small (0.067).

8.3: Industry-specific human capital
Secondly, we will investigate how industry-specific human capital in the form of prior working experience of the venture capitalists in the finance industry, as a manager (non-finance) or entrepreneur affects the performance of the VC firms as measured by the binary ALIVE variable. Again, table 8.2 summarizes the results from these regression analyses.

In model 7, the two dummy variables for the prior working experience in either the finance industry or as a manager in the non-finance industry are significant and positively related to the performance of the VC firm. Consequently, these initial results suggest that our second hypothesis is also supported by the data. Indeed, when a VC firm has partners that have more specialized (or concentrated) prior working experience (either in the finance industry or as a manager), this will improve the performance of that VC firm. However, the concentration of prior working experience of VC partners in finance and in management are highly negatively
correlated (-0.836), as can be seen in table 7.4. Such a high correlation coefficient could reduce the reliability of the results from model 7. Therefore, we include 3 more models. Model 5 only includes the concentration in management, and leaves out concentration in finance. In contrast, model 6 only includes the concentration in finance, and leaves out concentration in management. Model 8 includes all variables (including both concentration variables) and an interaction variable is added to mitigate the correlation issue.

In model 5, we see that the coefficient of concentration in management has decreased to around zero (-0.042), but this is unreliable since the results is highly insignificant (p-value = 0.91). In model 6 the coefficient for concentration in finance is still positive (though less than in model 7), but is also slightly insignificant (p-value = 0.12). So, individually the coefficients of the prior working experience concentration variables are insignificant. It is probable that since finance_con, management_con, and entrepreneur_con are always 1 if summed up (by definition), excluding two out of these three variables from the model leads to problems with the statistical significance of the third. Therefore, model 8 provides the best way to mitigate the correlation issue by means of including the interaction term between finance_con and management_con; in model 8 both finance_con and management_con are statistically significant.

Nevertheless, as mentioned before, the coefficient for the VC experience is much smaller than those of the prior working experience concentration variables. Clearly, concentration of prior working experience plays a (much) greater role in determining the VC firm performance than the working experience in the VC industry does. Furthermore, in model 8 we see that a concentration of prior working experience in finance is more beneficial (1.586) to the firm than one in management (1.232).

### 8.4: General human capital

Subsequently, we will investigate the impact of the degree of concentration of the education of venture capitalists in a particular field on the performance of the venture capital firms. In the regression analysis we have looked at the relationship between the education concentration dummies (BUSINESS_EDU_CON, ENGINEERING_EDU_CON, SCIENCES_EDU_CON, and MEDICAL_EDU_CON) and the dependent variable. In the model the variable SOCIAL_EDU_CON is omitted, since it will function as the base level. Table 8.2 summarizes the results of this regression analysis.

From the results we can conclude that it holds for all four fields of education that concentration of the master’s degrees of venture capitalists in the relevant field (business, engineering, natural sciences, or medical sciences) improves the ultimate performance of the VC firm. Especially concentration of education in the fields of natural sciences and medical sciences has a strongly positive effect on the performance; this could indicate that VC firms that focus on investments in (bio-) technology (and thus attract venture capitalists with an educational background in natural sciences/medical sciences) are more successful than those investing in other sectors. In any case, the results support our third hypothesis that a higher degree of concentration of the education of venture capitalists in a particular field of study will increase the performance of the VC firm.
In conclusion, in the results from the empirical analyses we have found support for all three of our hypotheses: more task-specific human capital, a higher degree of concentration of industry-specific human capital in a particular field, and a higher degree concentration of general human capital in a particular field leads to a better performance.

8.5: Control variables
Furthermore, we can investigate how the control variables affect the performance of the VC firm, and whether their effects are in line with our expectations. Again, we draw our conclusion from the statistical results summarized in table 8.2.

Firstly, with respect to the geographical region dummies, we can see that all three geographic regions - Southern Europe, Central Europe, and Scandinavia – perform on average better than Western Europe, since all their coefficients a positive. However, this cannot be concluded with certainty, as the coefficients were insignificant.

Secondly, we can note that firms that were active in the years 2001 and 2003 were more likely to still be active (‘alive’) today – as compared to firms that were active in the base year 1999. The dummy for the year 2003 has a relatively more positive coefficient as compared to that of the year 2001. These observations are in line with expectations, since the dot-com bubble - which was strongly present in the VC industry in Europe – reached its height during the year 2000 after which the market largely collapsed. So VC firms that were active in the year 1999 were relatively likely to default between that time and 2001 (and 2003) due to the major collapse of the market.

Furthermore, what is surprising is the coefficient of the variable amount under management per partner. This coefficient is extremely small and significant, which means that there appears to be no relation whatsoever between this variable and the ultimate success of the VC firm.

Lastly, we can have a look at the effect of VC firm types on the performance of the VC firm. The four VC type dummy variables (one was omitted to function as a base level) were extremely insignificant (p-value > 0.99) when included together in the model. Therefore, I decided to only include only the VC type ‘independent’, and thus make the distinction between independent and dependent on a larger entity – e.g. a government, corporation, or larger financial institutions, also called captive VC firms. We can clearly see that independent VC firms perform better on average than captive VC firms; the coefficient of the variable is significant and positive. Indeed, this makes sense since we can expect a captive VC firm to be somewhat inefficient because it often has to adjust its operations to the policies and strategies of the organization on which it is dependent, and consequently cannot always take optimal decisions.
### Table 8.2: Results of empirical analyses

This table provides an overview of the results of the binary logistic regressions we ran on a number of models. The first seven models are sub-models consisting of a selection from all variables. Model 8 is the complete model, which encompasses the other seven models, and includes all variables tested in this study. In each model we have controlled for several variables, which are listed at the bottom half of the upper table. At the bottom of this page we have listed some model characteristics. For each independent variable we report the estimated coefficient and the standard deviation (in parentheses).

Values significant at the 0.01, 0.05 and 0.10 level are respectively identified by *, **, ***.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
<th>Model 4</th>
<th>Model 5</th>
<th>Model 6</th>
<th>Model 7</th>
<th>Model 8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Years VC industry</td>
<td>0.068**</td>
<td>0.068**</td>
<td>0.069**</td>
<td>0.068**</td>
<td>0.064**</td>
<td>0.067**</td>
<td>0.067**</td>
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</tr>
<tr>
<td></td>
<td>(0.028)</td>
<td>(0.028)</td>
<td>(0.029)</td>
<td>(0.029)</td>
<td>(0.029)</td>
<td>(0.029)</td>
<td>(0.029)</td>
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<tr>
<td>Finance_con</td>
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<td>0.560</td>
<td>1.339**</td>
<td>1.586*</td>
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<tr>
<td></td>
<td>(0.524)</td>
<td>(0.527)</td>
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<td>(0.360)</td>
<td>(0.544)</td>
<td>(0.600)</td>
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<td>-0.042</td>
<td>1.027***</td>
<td>1.232**</td>
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<tr>
<td></td>
<td>(0.546)</td>
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<td>(0.363)</td>
<td>(0.554)</td>
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<td>-1.213</td>
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<td>0.623***</td>
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<tr>
<td></td>
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<td>(0.337)</td>
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<td>(0.493)</td>
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<td>1.718**</td>
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<tr>
<td></td>
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<td>(0.871)</td>
<td>(0.868)</td>
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<td>1.176***</td>
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<td>1.344***</td>
<td>1.330***</td>
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<td></td>
<td></td>
<td>(0.638)</td>
<td>(0.649)</td>
<td>(0.650)</td>
<td>(0.644)</td>
<td>(0.645)</td>
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<td>1.003*</td>
<td>0.935*</td>
<td>0.957*</td>
<td>0.880*</td>
<td>0.899*</td>
<td>0.923*</td>
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<td>(0.209)</td>
<td>(0.207)</td>
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<td>Amount per partner</td>
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<td>(0.000)</td>
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</table>

† Base level variable – not included in the models
* Coefficient is significant at the 0.01 level
** Coefficient is significant at the 0.05 level
*** Coefficient is significant at the 0.10 level

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**Model statistics**

<table>
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<tr>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
<th>Model 4</th>
<th>Model 5</th>
<th>Model 6</th>
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9. CONCLUSION, IMPLICATIONS & LIMITATIONS

9.1: Conclusions
In this paper, we have investigated the role of the human capital of venture capitalists in the performance of venture capital firms. Specifically, we looked at three types of human capital: task-specific human capital, industry-specific human capital, and general human capital. For each of these types of human capital we conjectured what their effect on the ultimate performance of the firms would be.

In order to test these hypotheses, we analyzed an extensive data-set containing hand-collected information on the education and prior working experience of partners of venture capital firms across Europe. Furthermore, we collected information on the current operating status of these firms; whether they were still operating (‘alive’) or were out of operation (‘dead’). Through statistical analysis using a binary logistic regression model, we provided empirical evidence that either supported our initial hypotheses or rejected them.

The first hypothesis regarding task-specific human capital was as follows:

Hypothesis 1: Venture Capital firms whose partners have on average more task-specific human capital, in the form of a greater average number of years of employment in the VC industry, will have a greater chance to remain in operation (i.e. to remain ‘alive’).

In our results we found empirical evidence that supported this hypothesis, so we accept the first hypothesis. Indeed, as the positive regression coefficient indicated, there is a positive effect of having more task-specific human capital on the performance of the firm. However, the effect is somewhat weaker than expected, especially when one compares the magnitude of the regression coefficient with those of other variables.

The second hypothesis regarding industry-specific human capital was as follows:

Hypothesis 2: Venture capital firms whose partners have more specialized working experience, in the sense that they are on a firm-level relatively more experienced i) as manager in a non-finance related industry, ii) in the finance industry, and/or iii) as entrepreneur as compared to the two other possible fields of prior working experience, will have a greater chance to remain in operation (i.e. to remain ‘alive’).

In our results we found empirical evidence that supports this hypothesis (as well as its sub-hypotheses), so we accept the second hypothesis. As the strongly positive coefficients of both concentration of industry-specific human capital in management and in finance indicate, there is a strongly positive effect of having more of either type of industry-specific human capital on the performance of the firm (concentration of working experience as an entrepreneur was omitted since it was the base level).
The third hypothesis regarding industry-specific human capital was as follows:

**Hypothesis 3:** Venture capital firms whose partners are on aggregate more specialized in a particular field of education, in the sense that they have on a firm-level relatively more education at the master’s level in the field of i) business, ii) engineering, iii) natural sciences, iv) social sciences (including law), and/or v) medical sciences as compared to the four other possible fields of education, will have a greater chance to remain in operation (i.e. to remain ‘alive’).

In our results we found empirical evidence that supports this hypothesis (as well as its sub-hypotheses), so we accept the third hypothesis. Indeed, the coefficients for all four fields of education-variables included in our model (social sciences was omitted since it was the base level) were strongly positive, indicating a strongly positive relationship between concentration of general human capital in these fields of education and the performance of the venture capital firm.

In summary, in this paper we find that with regard to the venture capitalists at the venture capital firms, task-specific human capital, concentration of industry-specific human capital in either management or finance, as well as concentration of general human capital in either business, engineering, natural sciences, or medical sciences, are important predictors of a good performance of venture capital firms.

### 9.2: Limitations

In the previous chapter we have established whether the empirical evidence corroborates or rejects the earlier posed hypotheses. Nevertheless, there are of course a number of limitations to our study, which could affect the reliability of the conclusions as well as the possibility of generalization of the results of the research.

First of all, there are certain limitations to the geographical scope of the sample, as well as the quality of the data in the sample that we have investigated. We have analyzed venture capital firms in quite a large number of European countries. We cannot be sure that the obtained results hold for regions outside Europe, such as the U.S. or Asia. Furthermore, since the countries in the sample do not include the Eastern European nations, it is questionable that the results are applicable to the Eastern European VC firms as well. Moreover, we are unsure to what extent the sample of VC firms adequately represents the actual population of VC firms in the countries we investigated. In other words, we cannot be sure whether there are any selection-effects present in our sample. Furthermore, there may also be some (minor) problems with the quality of the data in the sample. A large part of the data was collected from e.g. the VC firm’s website – which may render some data-points subjective due to interpretation of the gatherer of the data. However, since most data-points have been double-checked with (amongst others) commercial databases, we believe that the extent of this problem is very limited.

Secondly, there are limitations to the theoretical framework conjectured in this paper. We assumed that the human capital of venture capitalists directly affects the performance of the
VC firm, because it affects the quality of the venture capitalists’ screening, monitoring and mentoring activities. However, there are some papers suggesting that the involvement of the venture capitalist in the portfolio company (e.g. how often a partner interacts with the portfolio company) acts as a mediating variable between human capital characteristics and the actual performance of the VC firm (e.g. Botazzi et al., 2008). Due to the limitations of the data gathered for this dataset - no information was collected on the level of involvement of the partners at the firm – we were unable to take this variable into account. Consequently, an interesting idea for future research could be to conduct an analysis which includes human capital and venture capital performance as well as the possible mediator of partner involvement.

Thirdly, the ‘depth’ of the data was limited. For instance, experience in the finance industry was simplified by a dummy variable. However, such a dummy variable does not distinguish between different quantities of prior experience in finance (e.g. 10 year or 2 years working experience) nor does it differentiate between the types of finance experience (e.g. member of the top management of a bank or an analyst at an insurance firm). Again, it could be interesting to investigate in further research how the length of the working experience in the finance sector of venture capital partners impacts the performance of the VC firm, and whether different types of experience have different influence. The same line of reasoning holds for the previous working experience in the VC industry, which was measured by the number of years that an individual had worked in the industry so far. Again, this proxy does not capture all aspects of the working experience – one could for instance also look at how many IPOs the venture capital partner has been involved in, etc.

Furthermore, the reliability of the dependent variable used – whether the venture capital firm was still operational or not – may have limitations as a proxy for venture capital firm performance. However, an alternative dependent variable such as the fraction of portfolio companies with a successful exit has the same limitation. We used this proxy for the venture capital firm performance because data on for instance the profitability of the venture capital firm – which would certainly be a better proxy for performance – is very tough (if not impossible) to gather for a large number of firms. Venture capital firms tend to be quite secretive about this information, as they do not wish to expose this information to their competitors. Moreover, since they are often not publicly traded on a stock exchange, they do not have to publicize their (quarterly/yearly) results.

Lastly, in this study we could not control for the portfolio company characteristics due to limitations of the dataset we used for the analysis. In further research it could be investigated whether human capital has more/different impact on the VC firm performance if that VC firm invests in portfolio companies with certain characteristics. For instance, such characteristics could include the industry of the portfolio company and whether it is truly a start-up or already quite a mature company.

9.3: Implications
The main implications of this study follow directly from the conclusions as described earlier in this chapter. In fact, from the results regarding the several (sub-) hypotheses conjectured
we can – while keeping in mind the limitations of our study as mentioned in the previous section - construct the ‘ideal’ profile for a venture capital partner at a venture capital firm with regard to the performance of that venture capital firm. The venture capital partner preferably already has some background in finance or as a manager in the non-finance industry. Furthermore, he should have specialized general human capital, such as a degree in natural sciences or medical sciences. Although prior experience in the venture capital industry does have a slightly beneficial effect, this is only minor in comparison to the impact of other factors – in that sense it is not of great importance. As such, the results of our study can be taken into account in the recruitment of new personnel at venture capital firms.
10. REFERENCES


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