Investor Human Capital in Venture Capital Firms: The Effect of Experience and Education on Investment Risk and Investment Performance.

Tim Leenders

Tilburg University
Supervisor: Prof. Marco Da Rin
Second reader: Prof. Frank de Jong
Administration number: 420765
Student number: 2018544

Abstract

This study examines the relationship between human capital of venture capitalists and venture capital firm investment risk and investment performance. Using a hand-collected sample of 226 investments I relate venture capital experience, entrepreneurial experience and education of venture capitalists at the venture capital firm level to the probability of an early stage investment strategy and the probability of a portfolio company going IPO or being acquired. By using LinkedIn as the main data source for information on investors, this study presents evidence on new data in a field where current empirical evidence is inconclusive.

The analysis returned statistically insignificant coefficients (non-findings) for the majority of the hypothesized effects. However, I do find that new ventures backed by venture capital firms with a greater proportion of investors with an educational background in science/engineering or law, are more likely to achieve a successful exit. Additional research is needed.

Key words: *investor human capital, venture capital, investment risk, investment performance, experience, education*

Investor Human Capital in Venture Capital Firms: The Effect of Experience and Education on Investment Risk and Investment Performance.

1. Introduction

Over the past decades venture capital (VC) has proven to be an important factor contributing to disrupting innovation and economic growth. There is a wide disparity in financial results between VC firms (Kaplan & Schoar, 2005). This has posed the question which VC firm characteristics are determinants of VC firm results. Venture capital firms generally provide multiple sources of value such as network and help in setting up strategic partnerships, in addition to financial capital. Because of the nature of the activities of VC firms, the quality of firms seems highly dependent on the investors working for the VC firm. Some venture capitalists (VCs) enter the profession after gaining experience as an entrepreneur, while others have gained experience in other sectors. For example, Marc Andreessen and Ben Horowitz were both successful entrepreneurs before they founded Andreessen Horowitz (a16z), one of the leading venture capital firms in Silicon Valley. Because of the importance of investor characteristics, a new field of research has emerged in the past fifteen years which focuses on identifying how investor human capital factors influence venture capital firms.

Previous research has looked at different dimensions of human capital and its relationship to investment selection (e.g. Dimov et al., 2007; Patzelt et al., 2009), investor involvement (Bottazzi et al., 2008), and investment performance (e.g. Gompers et al., 2005; Zarutskie, 2010). Parhankangas and Hellström (2007) find that investors with industry experience generally accept more risk when setting their preferred investment portfolio, Bottazzi et al. (2008) find that investors with previous experience in business are more actively involved in their portfolio companies, and De Clercq and Dimov (2008) find that industry-specific human capital is positively related to venture performance. However, there is no consensus in academic literature on this topic. Dimov and Shepherd (2005) for example do not find a positive relationship for industry-specific human capital and venture performance. In other words, it is a young topic and additional empirical evidence is necessary.

This study aims to answer two main research questions: (1) What is the relationship between investor human capital and VC firm investment risk? and (2) What is the relationship between investor human capital and VC firm investment performance? Investor human capital is operationalized with three measures following Bottazzi et al., (2008): (1) number of years of

experience as a venture capitalist, (2) whether an investor has previous business experience (measured by previous entrepreneurial experience), and (3) education. Investment risk is operationalized as the investment strategy a VC firm follows, where a seed round investment strategy is deemed most risky and a late stage strategy least risky. Investment performance is measured by whether the venture was a success, in case of an initial public offering (IPO) or acquisition, or failure, when the venture's exit is anything other than IPO or acquisition.

Though these questions have been explored before, empirical evidence is inconclusive. I can provide new evidence by using a hand-collected sample on investor human capital through LinkedIn. Supplemented with deal data from secondary sources such as PitchBook, I am able to add new empirical evidence on the relationships between investor human capital and VC firm investment risk and investment performance. This study focuses on the decision makers in VC firms. For example, associates and analysts are excluded from the sample. Therefore, this study contributes to upper echelon theory, which argues that top managers' backgrounds are a predictor of organizational outcomes (Hambrick & Mason, 1984).

The remainder of the paper is organized as follows: the next section presents an overview of the existing literature on human capital and venture capital. After that, the hypotheses and data are discussed, followed by an explanation of the methodology. Next, the results of the analysis are presented and the final sections consist of limitations, recommendations and a conclusion.

2. Literature review

In this section an overview of the extant literature on human capital and venture capital is presented. First, literature on human capital and the way it influences firm performance and entrepreneurial endeavors will be discussed. Second, an overview of literature on the historic performance of venture capital firms will be presented. Lastly, the recent studies that have been published in the emerging field of investor human capital and venture capital firms are discussed.

2.1 Human capital theory

At the end of the day business decisions are made by humans in the role of manager, investor, entrepreneur, or any other role within an organization. Given the large variety of knowledge and capabilities different people possess, it seems only logical that a business decision, made in a certain situation, is highly dependent on the person responsible for it. This knowledge and

abilities people possess, is more commonly referred to as human capital. Becker (1975) describes human capital as knowledge and abilities gained from training, both on- and off-the-job, and schooling. Coff (2002) defines human capital as the abilities, skills, and knowledge embodied in people.

Human capital theory originated from labor economics, which links returns to training (e.g. through education) to an increase in earnings (De Clercq & Dimov, 2012). Following this, countless researchers have studied the relationship between human capital and firm performance (e.g. Huselid, 1995; Bowen & Ostroff, 2004; Becker & Huselid, 2006; Newbert, 2007), often finding a positive relationship on the individual level as well as on the organizational level. In the last couple of decades researchers have become increasingly convinced that the resource based theory of competitive advantage underlies the differences in firm performance (e.g. Barney, 1991; Peteraf, 1993). The resource based theory formulates that sustained competitive advantage is achieved by the strategic resources a firm possesses. If resources are valuable, rare, inimitable, and not easily substitutable, sustainable competitive advantage can be obtained (Barney, 1991). A special feature about human capital and knowledge of people is that it is often tacit and difficult to put into words, even for those who possess it (Polanyi, 1966). Some researchers even view knowledge embedded in people as the most valuable and most difficult to imitate resource (Kogut & Zander, 1992; Grant, 1996). An example confirming this is that it is hard for firms to assess, copy, or acquire human capital at a competitive cost (Coff, 2002). This theoretic spin-off from the resource based theory is known as the knowledge based view of the firm.

Literature on human capital has historically differentiated between general human capital and specific human capital. General human capital is knowledge and abilities that can be put to use in various situations or at different companies. Specific human capital is defined as experience and education that will enhance the performance of a specific job, task, or activity (Becker, 1975). For example, Gimeno et al. (1997) differentiate between general human capital and human capital specific to the industry in which the company operates. Pennings et al. (1998) find that more firm-specific human capital decreases the likelihood of firm dissolution. Dimov and Shepherd (2005) look at general human capital and specific human capital of the top management. Crook et al. (2011) meta-analyzed 66 studies on the relationship between human capital and firm performance and found a positive relationship. They also distinguished between studies that used measures of general human capital and studies that used measures of

specific human capital. A stronger effect for studies using specific human capital measures was reported.

A large portion of the research on human capital in the field of entrepreneurship has focused on the knowledge, skills, and abilities embodied in the entrepreneurs (as opposed to human capital of the investor) (e.g. Brüderl et al., 1992; Gimeno et al., 1997; Davidsson & Honig, 2003; Rauch et al., 2005). After decades of research it is generally accepted that human capital is positively related to entrepreneurial success, which was confirmed by the results of the meta-analysis carried out by Unger et al. (2011). Entrepreneurship literature reveals a number of mediating effects on this relationship, i.e. how human capital leads to greater entrepreneurial success. First, Shane and Venkataraman (2000) argue that people have asymmetrical information and beliefs, which means they differ in their capability to identify, discover, and exploit entrepreneurial opportunities. This is illustrated by the work of Westhead et al. (2005), who report that entrepreneurs with prior business ownership experience exhibit more entrepreneurial behavior compared to nascent entrepreneurs. Shane (2000) shows that the discovery of entrepreneurial opportunities depends on the prior knowledge embodied in people. In addition, the approach an entrepreneur takes in exploiting a business opportunity is partially determined by (tacit) knowledge. Second, greater industry skill and technical skill (i.e. specific human capital) leads to more specific competencies which in turn lead to greater growth in new ventures (Baum et al., 2001). Third, entrepreneurs' previous experiences and education are determinants of their ability to attract financial capital or other resources (Brush et al., 2001). In addition, ventures with low levels of financial capital and high levels of human capital perform equally as well as ventures with high levels of financial capital and low levels of human capital, indicating that human capital can, at least partially, substitute for limited financial capital, which is a constraint new ventures often face (Chandler & Hanks, 1998). Finally, entrepreneurs with previous managerial experience are more aggressive in future revenue projections and future firm size projections (Cassar, 2006). This is a relevant finding given that growth aspirations are a determinant of achieved growth (Wiklund & Shepherd, 2003).

2.2 Venture capital

The venture capital model has proven to be very effective in start-ups pursuing disruptive technologies. Venture capital facilitates entering new markets by significantly reducing information and opportunity costs for entrepreneurs (Florida & Kenney, 1988). Because venture capital firms tend to cluster together in venture capital hubs such as Silicon Valley and

Massachusetts in the United States and Tel-Aviv in Israel, strong venture capital networks are formed. Because of these networks, venture capital firms do not only assist new firms by providing financial capital, but also by providing the necessary contacts and strategic partnerships for example. These venture capital hubs provide incentives for qualified personnel and entrepreneurs to settle in these areas, which creates a positive feedback loop of new ventures, disruptive innovation, and economic growth (Florida & Kenney, 1988). The aforementioned locations are an excellent example of such a feedback loop in practice. The importance of venture capital to the economy is also highlighted by the fact that well over half of the companies that go public, are backed by venture capital financing before their IPO (Hwang et al., 2005).

Though the venture capital model helps facilitate innovation, venture capital firms as a group have shown difficulties in achieving strong financial results. Harris et al. (2014) report that venture capital firm performance was strong in the early days (until 1999), but in the current century financial returns are lower compared to public markets. However, looking at individual firms, funds or even general partners, there is significant heterogeneity in performance. For example, Kaplan and Schoar (2005) report consistent performance between subsequent funds managed by the same general partner; if a general partner performs above average in one fund, it is likely he will keep this up in subsequent funds as well. These findings raise questions as to what drives venture capital investment performance. A number of reasons could be the cause of heterogeneity in venture capital firm performance. First, Kaplan and Schoar (2005) argue that "proprietary deal flow" may be a factor. What they mean by this is that over performing general partners may have the opportunity to invest in better enterprises, because new ventures want to work with the best general partners, so the over performing general partner can pick the best new ventures. Second, according to Buchner et al. (2017), diversification among investments in new ventures, both in terms of industries and investment stages, provide higher returns. Third, the experience, knowledge and abilities of the investors (i.e. investor human capital) might be very important in explaining venture capital firm performance (e.g. Dimov & Shepherd, 2005; Zarutskie, 2010).

Successful venture capital investments generally require skilled, knowledgeable investors who invest time in picking and helping new ventures grow; the success of VC firms is highly dependent on the investors (Buchner et al., 2017). This makes venture capital an appropriate market to apply human capital theory (De Clercq & Dimov, 2012). That is why over the past

fifteen years literature on (the heterogeneity in) VC firm performance has shifted towards differences between VCs in the skills and knowledge they bring to the table, i.e. investor human capital (e.g. Patzelt et al., 2009; Dimov & De Holan, 2010; Zarutskie, 2010). According to De Clercq and Dimov (2012): 'in the context of a VC firm, human capital represents the knowledge and skills that VC managers bring to the particular investment tasks they set out to perform'. Three stages in the venture capital cycle have been the topic of research, with respect to how investor human capital influences them: (1) pre-investment phase, (2) post-investment phase, (3) investment performance.

The pre-investment phase consists of finding new venture proposals to review, screening them, performing due diligence, negotiating and building a relationship with the entrepreneur, and closing an investment contract (De Clercq & Dimov, 2012). Parhankangas and Hellstrom (2007) find a positive effect between investor experience and risk-taking. More specifically, they find that investor industry experience drives the perception of risk and the amount of risk in the preferred investment portfolio. In addition, they find that experienced investors rely more on risk reduction mechanisms such as monitoring, information seeking, the use of preferred stock, and syndication. Franke et al. (2006) investigate potential biases in the investment allocation of venture capital firms. They present evidence of a similarity bias. More specifically, venture capitalists systematically give a higher evaluation of start-ups whose teams are educated in a field similar to their own and have prior professional experience similar to their own. Patzelt et al. (2009) look at the field of education and type of experience of venture capitalists. They find that venture capital firms are more likely to follow an early-stage investment strategy when their investors have entrepreneurial experience and/or are educated in science/engineering fields. Related to this, Dimov et al. (2007) argue that venture capital firms with more financial expertise are significantly less likely to follow an early-stage investment strategy. Dimov and De Holan (2010) investigate a venture capital firm's decision to enter new industries. They look at the breadth of a firm's human capital (how broad their human capital is) and the depth of a firm's human capital (how deep within a certain industry their experience goes). Their results indicate that venture capital firms in general are unlikely to engage in distant industries, high breadth firms are more likely to enter new industries in a first-round investment stage, high depth firms are more likely to make first-round entries in similar industries and are less likely to enter distant industries in later investment rounds. Patzelt et al. (2009) find that venture capital firms with more education in management (e.g. business administration) are more inclined to diversify their investment portfolios, i.e. invest in different industries. In addition,

they argue that international experience of the investor is a predictor of diversification in terms of the geographic range of investments. Collewaert and Manigart (2016) look at the relationship between human capital of angel investors and pre-money valuations of the start-ups they invest in. Interestingly, they find a positive relationship; higher angel human capital leads to higher valuations. A reason they offer for this is that angels with more human capital can see more value-adding possibilities and can therefore offer a higher valuation.

There is very limited literature on the effect of investor human capital on activities in the post-investment phase. Examples of post-investment activities undertaken by venture capitalists are recruitment of directors, managers, and other essential personnel, assisting in securing subsequent fundraising, and helping companies form strategic alliances (De Clercq & Dimov, 2012). Bottazzi et al. (2008) conducted a study in which they investigated the effect of human capital on investor activism. Their main findings include a positive relationship between venture capitalists with prior business experience and investor activism; more experienced investors are more active in the companies they finance. In addition, they report that more investor activism leads to better exit performance. The reason literature is very limited on this topic is in large part due to data availability. Investor activism cannot be measured through quantifiable variables that are obtainable through a secondary data source. Instead, it can only be obtained through data from the VC firms directly (De Clercq & Dimov, 2012).

Investment performance as an independent variable is often operationalized as a dichotomous variable of either ‘success’, if the venture went public (IPO) or was acquired, or failure, if the venture’s status is anything other than IPO or acquisition (e.g. Bottazzi et al., 2008; Gompers et al., 2005; Sørensen, 2007). Zarutskie (2010) looks at how different dimensions of investor human capital affect investment portfolio performance. She finds that task-specific human capital, measured by the proportion of investors having prior experience as managers at start-ups or as venture capitalists, is positively related to number of exits in a given investment portfolio. So is industry-specific human capital, which is measured by previous work experience in professional science/engineering and management and strategy consulting. General human capital, measured by investors’ education in engineering, science, law, and business, is not a predictor of investment performance. Moreover, VC firms whose investors hold more MBA degrees are more likely to perform worse than average. De Clercq and Dimov (2008) also find that industry-specific human capital is positively related to the performance of portfolio companies. Accordingly, Dimov and De Clercq (2006) find that a higher level of

specialized expertise decreases the failure rate of investment portfolios. However, a study by Dimov and Shepherd (2005) indicates that there is a need for additional research on this topic. They investigated investment performance outcomes: "home runs" (venture went public), and "strikeouts" (venture went bankrupt). They find that general human capital leads to a higher proportion of portfolio companies that underwent an IPO. Surprisingly, they do not find such a relationship for specific human capital. In addition, they do discover that specific human capital is negatively related to the proportions of strikeouts, whereas a positive relationship is found for general human capital. Walske and Zacharakis (2009) look at the human capital of VC firm founders. They argue that previous experience in management, as a consultant, or as a venture capitalist at another firm increases investment performance (proxied by subsequent funds raised), whereas prior experience as an entrepreneur is negatively related to investment performance. Sørensen (2007) finds that new ventures backed by more experienced venture capitalists are more likely to go public. Gompers et al. (2005) report that venture capital firms with greater industry-specific human capital are more likely to increase their investment rate when the market in their industry of expertise is "hot".

Some studies dive deeper into the relationship between human capital and investment performance and explore possible mechanisms enforcing this effect. Organizational learning is one of the suggested explanations (De Clercq and Sapienza, 2005). Parhankangas and Landström (2006) look at how venture capital firms differ in their approaches of helping underperforming new ventures. They find that investors with a greater amount of prior managerial work experience generally support underperforming portfolio companies in more proactive and constructive ways.

3. Data and hypotheses

In this section the different data sources and measures are explained. In addition, based on the theory discussed in the previous section, hypotheses are formulated.

3.1 Dependent variables

The two dependent variables concerning this study are investment performance and investment risk. Investment performance is measured by looking at the exit of ventures backed by VC firms. A dummy variable is created that takes value 1 if the venture has been listed on a public exchange through an initial public offering or has been acquired, 0 otherwise.

VC firm funds follow a stage-based investment strategy. Put another way, venture capital firms decide in advance how they are going to invest a certain fund, e.g. in a portfolio of seed round investments or late stage investments. The investment strategy functions as a proxy for riskiness, with earlier stage investment strategies deemed more risky than later stage investment strategies (e.g. Parhankangas & Hellström, 2007). This study follows this approach by identifying three possible investment strategies: (1) seed round, (2) early stage VC, and (3) later stage VC. The variable is created by aggregating investments at the VC firm level. These values are assigned to one of the investment strategy categories. This process went as follows. If an investment was made in the seed round, it received a score 0, if it was made in the early stages of a venture, it received a score 1, and if it was made in the later stages of a venture, it received a score 2. From this, investments were aggregated by VC firm. For example, a VC firm with two seed round investments and three early stage investments received a score of 0.6 (three times 0 and two times 1). Next, the scores were recoded into one of the three investment strategy categories in the following way. If a score was lower than 0.5 the investment strategy of the VC firm was categorized as seed round strategy, if a score was between 0.5 and 1.49 the investment strategy was categorized as early stage VC strategy, and if a score was 1.5 or higher the investment strategy was categorized as later stage VC strategy. The independent variables are aggregated using the average of the individual investments. For example, if a VC firm is included with two individual investments at two different points in time and it had a score of 0.5 on entrepreneurial experience when the first investment was made and 0.7 when the second investment was made, the VC firm received a score of 0.6 on entrepreneurial experience.

3.2 Human capital variables

Following Bottazzi et al. (2008), I consider two possible ways in which investor human capital can affect venture capital investment selection and performance. First, human capital can be developed by gaining experience as an investor. Second, the knowledge base that investors have gained throughout their professional career as well as through formal education is another kind of human capital that is likely to shape the abilities of venture capitalists. From this, three measures of human capital are created: (1) experience as a venture capitalist, (2) experience as an entrepreneur, and (3) education.

3.2.1 Experience as a VC

There is likely to be at least some extent of on-the-job learning because it is probable that venture capitalists, like all people, get better at what they do with experience. This is measured by the number of years an investor has been active as a venture capitalist. The variable is constructed by taking the average number of years of experience as a venture capitalist of all the investors active at the venture capital firm at the time of the investment. The proposition is that experience improves VCs' abilities to recognize the most promising ventures to invest in. In addition, Patzelt et al. (2009) report that more experience also leads a VC to be more confident in one's own abilities. This, in turn, leads to more willingness to take on risk. Heath and Tversky (1991) find that people are more willing to take risky bets if they are confident in their knowledge on the subject. This suggests the following hypothesis:

H1: VC firms with greater venture capital experience are more likely to follow an early stage investment strategy than VC firms with less venture capital experience.

In the same vein, more experienced VCs should have superior abilities in bringing ventures to successful exits. Zarutskie (2010) finds that first-time VC management teams perform better on average when they have gained previous experience as a venture capitalist at other firms. Wright and Robbie (1998) suggest that VC experience may improve investors' ability to assist the development of the ventures they back because they have gained an improved understanding of the uncertainties and complexities surrounding venture capital investments. A longer track record as a VC improves the network of the investor as well. A VC develops relevant connections on the job, which may be beneficial in setting up strategic partnerships for portfolio companies or might facilitate connecting portfolio companies to the right people (Gupta & Sapienza, 1992). Walske and Zacharakis (2009) show that venture capital experience among venture capital firm founders is a predictor of first fund success. Sørensen (2007) finds that experience as an investor increases the likelihood of IPO of a portfolio company. The discussion above leads to the second hypothesis:

H2: Ventures backed by VC firms with greater venture capital experience are more likely to achieve a positive exit than ventures backed by VC firms with less venture capital experience.

3.2.2 Entrepreneurial experience

The proxy for previous work experience is the proportion of investors who have entrepreneurial experience. The measure is constructed by creating a dummy variable for every investor, which takes the value 1 if the investor was founder or cofounder of a company prior to joining the VC firm or if s/he is the founder or cofounder of the VC firm, 0 otherwise. After that, individual values are turned into a collective measure by proportioning the number of investors within the VC firm who have entrepreneurial experience. Thus, if two out of five investors within a given firm have entrepreneurial experience, the value for this firm on this investment is 0.4.

Especially in the early stages the direction a venture will take is highly dependent on the vision and decisions of the entrepreneur. Because VCs with entrepreneurial experience have experienced "the other side", they might empathize with entrepreneurs. They might recognize themselves when struggling entrepreneurs try to convince them with ambitious business plans. This stems from social identity theory (Tajfel et al., 1971), which states that people (implicitly) identify as part of a social 'group'. These groups can be formed on a wide range of social criteria, for example religion, education level, gender or political party. Entrepreneurship might be such a criterion as well. In the context of VCs with entrepreneurial experience, they might identify as - and feel part of - a social group of ambitious, struggling entrepreneurs. Experiments by Tajfel et al. (1971) also indicate a certain extent of in-group favoritism in people's actions. This would mean that VCs with entrepreneurial experience might be more inclined to help (i.e. invest in) their 'fellow group members', i.e. ambitious, struggling entrepreneurs. Because the image of a struggling entrepreneur fits early stage ventures, this reasoning would suggest that VCs with entrepreneurial experience are more inclined to invest with an early stage strategy.

Moreover, VCs with entrepreneurial experience understand the challenges facing new ventures with regard to product development and market entry, because they have experienced them in a previous life. Especially when their past entrepreneurial endeavors were successful, VCs with entrepreneurial experience might also be more confident in their ability to assist entrepreneurs in overcoming "tough times". Also, Patzelt et al. (2009) point out that investors with entrepreneurial experience may better recognize opportunistic behavior of the entrepreneur than investors without entrepreneurial experience. These potential problems are generally more common when the outcome of the venture is still highly dependent on the entrepreneur. The preceding arguments lead to the following hypothesis:

H3: VC firms with a greater proportion of investors with entrepreneurial experience are more likely to follow an early stage investment strategy than VC firms with a lower proportion of investors with entrepreneurial experience.

Evidence on the effect of VCs' entrepreneurial experience on investment performance is mixed. Dimov and Shepherd (2005) report that entrepreneurial experience does not have a significant effect on the likelihood of IPO of a portfolio company. However, it does slightly decrease the likelihood of bankruptcy. On the other hand, Walske and Zacharakis (2009) find that entrepreneurial experience is a negative predictor of fund performance. There are arguments to be made as to why the relationship is expected to be positive or negative. Former entrepreneurs will have a good understanding of the venture capital process, having experienced it from both sides. Also, former entrepreneurs will have a deep understanding of the industry their entrepreneurial endeavor operated in. This might facilitate paving the way for portfolio companies aiming to break into the same industry. Furthermore, former entrepreneurs have often built a network of other entrepreneurs, suppliers, and partners that might help in for example setting up strategic partnerships or recruiting personnel for their portfolio companies. Following this reasoning, entrepreneurial experience would positively influence investment performance. On the other hand, Walske and Zacharakis (2009) report that limited partners question the ability of investors with entrepreneurial experience to properly manage more than just one company at the same time. Their experience is that former entrepreneurs tend to pick one or two companies out of the portfolio and overly focus on them. Concluding, the direction of the effect of entrepreneurial experience on investment performance could go either way:

H4a: Ventures backed by VC firms with a greater proportion of investors with entrepreneurial experience are more likely to achieve a positive exit than ventures backed by VC firms with a lower proportion of investors with entrepreneurial experience.

H4b: Ventures backed by VC firms with a greater proportion of investors with entrepreneurial experience are less likely to achieve a positive exit than ventures backed by VC firms with a lower proportion of investors with entrepreneurial experience.

3.2.3 Education

In measuring education three categories are distinguished: business education (e.g. finance, economics, business administration, MBA), law education and science/engineering education (e.g. computer science, medicine, electrical engineering). The variables for each of the categories are constructed in the same way the variable for entrepreneurial experience is constructed. An investor could have multiple degrees in different fields. If this is the case, s/he receives a score of 1 in multiple categories. The only requirement is that the investor graduated, i.e. obtained a degree. Thus, a three month minor or exchange program in computer science does not count as science/engineering education if the major is business administration for example.

Business and law education are often classified as specific human capital in the context of venture capital (e.g. Dimov & Shepherd, 2005). The reason for this is that venture capital investing has to do with assessing risk and future potential payoffs of prospect companies. Curricula in business studies include courses, which touch upon this topic. On the contrary, science and engineering education is often classified as general human capital because it does not teach knowledge that is specific to the venture capital context. It does however provide investors with a better perception of technological risks facing certain prospect companies (Patzelt et al., 2009). Some ventures seek venture capital financing when they are still in the phase of exploring an idea, developing a product, or just started market testing. These ventures are not ready to commercialize a product or service just yet. Investing in these ventures would classify as early stage investments. However, other ventures are a few steps further along the road. They have already entered the market with an innovative product or service and the main (financing) problem they are facing, is expanding and scaling the business. Investing in these ventures would classify as later stage investments. It follows that there is more uncertainty surrounding early stage ventures than later stage ventures. Assessing a proper risk-return balance becomes more difficult with uncertainty. Thus, business trained VCs might lean more towards later stage investments because the skills they possess, become more important during the later stages of a new venture. On the other hand, technological risk is more prominent in the earlier stages of a venture. Investors with a background in science or engineering might be more inclined to invest in such ventures, also because they have a better perception of the technological risks and, as a result, might be better able to manage them. They are also more focused on the potential upside and less on the potential loss associated with the investment

(Patzelt et al., 2009). Supporting these thoughts is evidence by Dimov et al. (2007), who find that venture capital firms with more finance expertise are less likely to follow an early stage investment strategy. Patzelt et al. (2009) report that early stage investments are more likely to be made by VC firms with higher proportions of investors with science/engineering education. However, they do not report a negative relationship for business education. The preceding discussion leads to hypotheses five and six:

H5: VC firms with a greater proportion of investors with a degree in business are less likely to follow an early stage investment strategy than VC firms with a lower proportion of investors with a degree in business.

H6: VC firms with a greater proportion of investors with a degree in science/engineering are more likely to follow an early stage investment strategy than VC firms with a lower proportion of investors with a degree in science/engineering.

From the preceding arguments it follows that both general human capital and specific human capital have the potential to contribute to venture capital success. However evidence on the effect of academic background of investors on investment performance is limited and mixed. Dimov and Shepherd (2005) find that a higher proportion of MBA educated investors is negatively related to the proportion of portfolio companies that went bankrupt within a given fund. The same effect holds for venture capital firms with higher proportions of law educated investors. A law education can be specifically beneficial in the venture capital process when it comes to contracting. Remarkably, a higher proportion of science educated investors predicts a higher proportion of portfolio companies going bankrupt within a given fund. However, their results also indicate that a higher proportion of science educated investors predict a higher proportion of portfolio companies going public within a given fund. Interestingly, they do not find such an effect for MBA education or law education. Because each field of education can bring a potential advantage to new ventures for the aforementioned reasons, the final hypotheses are as follows:

H7: Ventures backed by VC firms with a greater proportion of investors with a degree in business are more likely to achieve a positive exit than ventures backed by VC firms with a lower proportion of investors with a degree in business.

H8: Ventures backed by VC firms with a greater proportion of investors with a degree in science/engineering are more likely to achieve a positive exit than ventures backed by VC firms with a lower proportion of investors with a degree in science/engineering.

H9: Ventures backed by VC firms with a greater proportion of investors with a law degree are more likely to achieve a positive exit than ventures backed by VC firms with a lower proportion of investors with a law degree.

3.3 Control variables

Previous research commonly includes control variables such as size and age (e.g. Dimov et al., 2007). Gompers et al. (2005) argues that age of a venture capital firm can serve as a proxy for reputation. Therefore, I included company age as a control variable. No relationship between law education and investment strategy is hypothesized. However, law education is included in the analysis as a control variable.

3.4 Data sources

Data on investments was retrieved from PitchBook, a database site that keeps track of venture capital deals, private equity deals, and M&A deals. Information from this database includes for example the time of investment, the venture capitalists involved, the stage of the venture at the time of the investment, and the current (financing) status of the company. In order to properly assess when a venture capital firm got involved with a company, follow-on investors are excluded from the sample when looking at the investment strategy. Investments included in the dataset were made between 2000 and 2013, allowing the ventures most recently invested in, a time period of five years to exit. This is common in this field of research. Data on investors was obtained mainly from LinkedIn, the world's largest professional social network platform. LinkedIn profiles provide a convenient timeline of an investor's education and the professional activities s/he has undertaken throughout his or her career. This proved to be especially practical when gathering data on investors who were working for a firm at the time an investment was made, but are not working there anymore. Where possible and if needed, data on investors was supplemented with information from venture capital firms' websites. Data on company age was obtained from the website and the PitchBook database. Manually creating the dataset took considerable time and effort, but provides the opportunity to analyze new data. VC firms and

investments from all over the world were included. The final sample consists of 226 investments.

3.5 Research design

The two main questions addressed in this paper are:

(1) What is the relationship between investor human capital and VC firm investment risk?
(2) What is the relationship between investor human capital and VC firm investment performance?

The measures chosen for the dependent variables investment risk (operationalized as investment strategy) and investment performance are either binary variables, in the case of the exit measure (value 1 is "successful", 0 "unsuccessful"), or nominal variables with three levels, in the case of the investment strategy measure (three values: "seed round", "early stage VC", and "later stage VC"). Given the nature of the dependent variables it is appropriate to conduct the analysis using a logit model for the binary dependent variable and a multinomial logit model for the nominal dependent variable with three levels (Wooldridge, 2015). Accordingly, the models take the following specification:

$$Logit\ (P) = \log \frac{P(y = 1)}{1 - (P = 1)} = \beta_0 + \beta_1 H$$

Where $Logit\ (P)$ represents the log odds of the dependent variable taking a certain value, β_0 is an intercept and $\beta_1 H$ represents a vector of human capital variables, comprised of VC experience, entrepreneurial experience and the education variables. For the multinomial logit model, $Logit\ (P)$ represents the log odds of the dependent variable taking a certain value, relative to a base category.

4. Results

4.1 Descriptive statistics and correlations

Table 1 shows the descriptive statistics of the research variables. For experience as a VC and VC firm age the natural logarithm was taken to prevent influential outliers skewing the results. The natural logarithm of average experience as a VC is 1.88 years (standard deviation 0.65), and the average proportion of investors with entrepreneurial experience within a VC firm is 48.8% with a standard deviation of 31.8%. The average proportion of investors with a degree

in business education is 73.2% (std. dev. 25.1%). The average proportion of science/engineering educated investors is 47% (std. dev. 29.6%) and only 6.7% of the investors within a VC firm have obtained a law degree (std. dev. 13.1%). The natural logarithm of average VC firm age is 2.14 years (std. dev. 1.01). 51.8% of investments reached a positive exit. In creating the investment strategy variable, investments were aggregated at the VC firm level. 149 different VC firms were represented in the sample. Approximately 22.15% of the VC firms followed a seed round investment strategy. 68.46% followed an investment strategy predominantly focused on early stage investments. Just 9.4% of VC firms make most of their investments in later stage investment rounds. Table 2 provides the pairwise correlations between the independent variables and control variables. Although there are a few statistically significant correlations, the coefficients are not strong enough to cause concern for multicollinearity. Inspecting the variance inflation factors did not indicate multicollinearity either, following the thresholds defined by Studenmund (2014).

Table 1: Descriptive statistics.

Variable	Obs	Mean	Std.Dev.	Min	Max
Experience VC	223	1.883	.65	0	3.045
Entrepreneurial exp.	225	.488	.318	0	1
Business	224	.732	.251	0	1
Law	224	.067	.131	0	1
Science	224	.47	.296	0	1
VC firm age	218	2.144	1.014	0	4.625
Exit	226	.518	n.a.	0	1
Investment strategy	149				
- *Seed round*	33	22.15%			
- *Early stage VC*	102	68.46%			
- *Later stage VC*	14	9.4%			

Table 2: Pairwise correlations.

Variables	(1)	(2)	(3)	(4)	(5)	(6)
(1) Experience VC	1.00					
(2) Entrepreneurial exp.	-0.11	1.00				
(3) Business	0.17*	0.06	1.00			
(4) Law	0.00	-0.04	-0.05	1.00		
(5) Science	0.07	-0.21*	-0.29*	-0.19*	1.00	
(6) VC firm age	0.61*	-0.40*	0.11	0.05	0.18*	1.00

* shows significance at the .05 level

4.2 Regression results

4.2.1 Investment exit

Table 3 presents the results of a regression where exit is the dependent variable and the human capital measures are the independent variables. VC firm age is included as a control variable. Because the dependent variable is binary (value 1 for successful exit, 0 otherwise) the regression is conducted using a logit model. The resulting coefficients are in log-odds units. This means that the outcome of the prediction equation is $\log\frac{P(y=1)}{1-(P=1)}$, where P is the probability of a successful exit (i.e. $y = 1$). Because that equation is increasing with P, a positive coefficient indicates an increase in the probability of a successful exit. The model validity is increasing with the addition of more independent variables, indicated by the pseudo R-squared value.

Looking at table 3, the coefficient for experience as a venture capitalist is positive in all models. However, the effect is not statistically significant at the 5% level ($p>0.05$). This is contrary to previous empirical evidence by for example Walske and Zacharakis (2009), Sorensen (2007), and Zarutskie (2010), who find a significant positive relationship. Some studies use different measures for investment performance though. Walske and Zacharakis (2009) look at subsequent funds raised while Sorensen (2007) measures exit by whether or not a company went IPO. Zarutskie (2010) looks at the fraction of positive exits within a VC fund. Because of the insignificant coefficient, the null hypothesis of no relationship between experience as a VC and investment performance cannot be rejected. A possible offsetting factor to the arguments underlying hypothesis 2 is offered by the work of Zacharakis and Shepherd (2001). They find evidence that VCs as a group are overconfident, which leads them to overestimate the potential

of new ventures or their ability to bring a venture to a positive exit. Confidence gained with experience might turn into overconfidence and inaccurate decision-making. Concluding, hypothesis 2 is not supported.

Entrepreneurial experience seems to not be a predictor of investment performance. The coefficient is statistically insignificant in all the models in table 3. Furthermore, the sign of the coefficient changes direction with the addition of more independent variables. Previous empirical evidence has not provided a clear relationship either. Dimov and Shepherd (2005) argue that entrepreneurial experience decreases the likelihood of a venture going out of business, but did not find a significant effect for entrepreneurial experience on the fraction of ventures that went IPO. Walske and Zacharakis (2009) found that entrepreneurial experience is a negative predictor for the likelihood of raising future funds. There are arguments to be made as to why the relationship would be either positive or negative. On the one hand, venture capitalists with entrepreneurial experience have seen 'the other side'; they have experienced the problems new ventures face first-hand. On the other hand, venture capitalists with entrepreneurial experience tend to get caught up in one or two ventures, inhibiting their ability to manage an entire portfolio of ventures (according to limited partners, as reported by Walske and Zacharakis (2009)). It is possible that these effects cancel each other out, resulting in no statistically significant effect. Concluding, hypothesis 4a and 4b are not supported.

Turning to the education variables, the results suggest no relationship between the proportion of business educated venture capitalists and the probability of a positive exit. The coefficient for business in table 3 is statistically insignificant. Previous research is inconclusive on this relationship. Zarutskie (2010) finds that a higher fraction of VCs with an MBA degree is negatively related to the fraction of ventures with a positive exit in an investment fund. Dimov and Shepherd (2005) find no effect between the proportion of MBA educated VCs and the fraction of ventures that went IPO. However they did find that a higher fraction of MBA educated investors decreases the fraction of ventures that went out of business. Hence, hypothesis 7 is not supported. Looking at the remaining educational measures, the results support hypotheses 8 and 9. A higher proportion of VCs with education in science/engineering and in law increases the probability of a positive exit. In the same vein, Dimov and Shepherd (2005) find that a higher proportion of science educated investors leads to a higher fraction of ventures going IPO. However, they also find that it is positively related to the fraction of ventures that went out of business. With respect to law education, they report that a higher

fraction of law educated investors decreases the fraction of ventures going out of business. Their results do not indicate a statistically significant relationship between the fraction of law educated investors and the proportion of ventures that went IPO. Zarutskie (2010) finds some support for a positive relationship regarding science and engineering education. She does not report a statistically significant effect for law education.

As a robustness check, I ran another regression using a different measure for the dependent variable. This measure further specifies unsuccessful exits into two categories, bankruptcy/out of business and private. Thus, exit takes value 0 if the venture went bankrupt or out of business, 1 if the venture is still private, and 2 if the venture went IPO or was acquired. Because the dependent variable is nominal with three levels, a multinomial logit is an appropriate model here. Results of this regression are presented in table 4. The base category for the model is IPO or acquisition. Regarding experience as a VC and entrepreneurial experience, the results are robust. The results indicate that an increase in experience does not have a statistically significant effect on the probability of a venture going bankrupt or remaining private, relative to the probability of a venture going IPO or being acquired. The results for the education variables are more interesting. While there is still no significant effect for business education, the way the relationships for science/engineering education and law education identified in table 3 are shaped, becomes clearer. The relative probability of remaining private rather than going IPO or being acquired, is lower for ventures backed by VC firms with a higher fraction of investors with a degree in science/engineering. The results indicate no statistically significant effect for the relative probability of a venture going out of business/bankruptcy rather than going IPO or being acquired. For law education the results are slightly different. The relative probability of going out of business/bankruptcy rather than going IPO or being acquired, is lower for ventures backed by VC firms with a higher fraction of investors with a degree in law education. There is no statistically significant effect for the relative probability of a venture remaining private rather than going IPO or being acquired.

4.2.2 Investment strategy

Table 5 displays the results of a regression analysis where investment strategy is the dependent variable and the human capital measures are the independent variables. VC firm age is included as a control variable. The variables were created by aggregating the observations by VC firm. Because investment strategy is measured as a nominal variable with three levels (seed round,

early stage VC, and later stage VC) the regression is conducted using a multinomial logit model. The resulting coefficients are in log-odds units. This means that the outcome of the prediction equation is $\log \frac{P(y=1)}{1-(P=1)}$, where P is the probability of following a certain investment strategy, relative to a base category (later stage VC in table 5). Because that equation is increasing with P, a positive coefficient indicates an increase in the relative probability. The model validity is increasing with the addition of more independent variables, indicated by the pseudo R-squared value.

The first three models in table 5 present the results using the full sample. A significant number of VC firms are represented by just one investment, which might influence the external validity of the results. Therefore, I dropped those firms and ran the regression again. Models four through six show the results of this regression. All the coefficients in table 5 are statistically insignificant at the 5% level. More experienced venture capitalists are not significantly more likely to follow a seed round strategy or early stage strategy, relative to the probability of following a late stage strategy, than less experienced venture capitalists; hypothesis 1 is not supported. The sign of the coefficient is in the opposite direction, compared to the hypothesis. An explanation could be that more experienced venture capitalists are often successful, tend to manage bigger investment funds, and thus make larger investments. Because ventures generally require more capital in later investment rounds, this would imply that they shift their focus to a later stage investment strategy. This could offset the underlying argument of more risk tolerance for the hypothesized effect. Parhankangas and Hellstrom (2007) report statistically insignificant results as well.

The direction of the effects for entrepreneurial experience are mostly positive, in line with hypothesis 3. However there is no statistical significance, which implies that a higher proportion of investors with entrepreneurial experience has no effect on the relative probability of a VC firm following a seed round strategy or early stage strategy. Patzelt et al. (2009) do find that entrepreneurial experience increases the probability of following an early stage investment strategy. On the other hand, Dimov et al. (2007) do not report a statistically significant effect either. Concluding, hypothesis 3 is not supported.

Looking at the coefficients of the education variables, models three and six in table 5 indicate the direction of effects as hypothesized. For business education a negative coefficient was

hypothesized because business educated investors have obtained more knowledge on markets and entering new markets, which is usually more important in the later stages of a venture. In the same vein, science/engineering educated investors have generally obtained more technical knowledge, which is more beneficial in for example product development. Because this is more important in the early stages of a venture, it was hypothesized that VC firms with more science/engineering educated investors would have an increased relative probability of following a seed round strategy or early stage investment strategy. However, the coefficients are insignificant and therefore no conclusions can be drawn. Hypothesis 5 and 6 are not supported by the results.

Because several scholars (e.g. Gupta & Sapienza, 1992) consider seed round investments part of an early stage investment strategy, I ran another regression where seed round investments were recoded as early stage VC investments. The resulting dependent variable is binary, value 0 for early stage VC and value 1 for later stage VC. Hence, the appropriate model is a logit model. The results of this regression are reported in table 6. The first three models display results on the entire sample, while models four through six show regression results when single-observation VC firms are dropped. Because the table tests the log odds ratio of the probability of the investment strategy being late stage (because value 1 is late stage strategy), a negative coefficient indicates an increase in the probability of an early stage strategy. The measured coefficients are still statistically insignificant. Therefore, the conclusions drawn above regarding hypothesis 1, 3, 5 and 6 are unchanged.

Table 3: Logit regression for exit on investor human capital. This table shows the results of a regression of investment exit on five different investor human capital measures. Exit is the dependent variable. The independent variables are the natural logarithm of the number of years of experience as a venture capitalist investors within a VC firm have on average, the proportion of investors with entrepreneurial experience within a VC firm and the proportion of investors with a degree in business, science/engineering, or law. The natural logarithm of VC firm age is included as a control variable. The final column, model 5, shows the regression with all independent variables and control variable included. The bottom of the table shows the number of observations and an indicator for the goodness of fit of the model (Pseudo R^2). T-statistics are shown in parentheses.

	(1)	(2)	(3)	(4)	(5)
Experience VC	0.271	0.264	0.278	0.264	0.334
	(1.29)	(1.26)	(1.27)	(1.20)	(1.16)
Entrepreneurial exp.		-0.119	0.0183	0.118	-0.126
		(-0.28)	(0.04)	(0.26)	(-0.25)
Business			-0.227	-0.0501	0.0308
			(-0.39)	(-0.08)	(0.05)
Science			0.988*	1.318*	1.366*
			(1.97)	(2.48)	(2.52)
Law				2.810*	2.917*
				(2.34)	(2.41)
VC firm age					-0.0943
					(-0.48)
Constant	-0.447	-0.377	-0.781	-1.276	-1.192
	(-1.07)	(-0.78)	(-1.14)	(-1.74)	(-1.57)
Observations	223	223	222	222	217
Pseudo R^2	0.005	0.006	0.023	0.043	0.046

t statistics in parentheses, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 4: Multinomial logit regression for exit on investor human capital using an alternative exit measure. The first part of the table shows results on exit taking value 0, i.e. the venture went out of business. The second part of the table displays the results on exit taking value 1, i.e. the venture remained private. The exit category for success, i.e. exit taking value 2, is the base category. The independent variables are the natural logarithm of the number of years of experience as a venture capitalist investors within a VC firm have on average, the proportion of investors with entrepreneurial experience within a VC firm and the proportion of investors with a degree in business, science/engineering, or law. The natural logarithm of VC firm age is included as a control variable. The final column, model 5, shows the regression with all independent variables and control variable included. The bottom of the table shows the number of observations and an indicator for the goodness of fit of the model (Pseudo R^2). T-statistics are shown in parentheses.

	(1)	(2)	(3)	(4)	(5)
Out of business					
Experience VC	-0.226	-0.266	-0.294	-0.238	-0.116
	(-0.68)	(-0.77)	(-0.83)	(-0.67)	(-0.25)
Entrepreneurial exp.		-0.825	-0.887	-1.080	-1.046
		(-1.16)	(-1.22)	(-1.48)	(-1.33)
Business			0.325	0.0316	0.0962
			(0.34)	(0.03)	(0.10)
Science			-0.511	-0.989	-0.859
			(-0.63)	(-1.20)	(-1.04)
Law				-6.447*	-6.013*
				(-2.09)	(-1.99)
VC firm age					-0.179
					(-0.59)
Constant	-1.059	-0.622	-0.514	0.229	0.224
	(-1.62)	(-0.82)	(-0.47)	(0.21)	(0.20)

Private					
Experience VC	-0.285	-0.257	-0.267	-0.258	-0.402
	(-1.27)	(-1.15)	(-1.15)	(-1.10)	(-1.30)
Entrepreneurial exp.		0.409	0.251	0.163	0.522
		(0.88)	(0.53)	(0.34)	(0.94)
Business			0.207	0.0673	-0.0555
			(0.33)	(0.10)	(-0.08)
Science			-1.134*	-1.416*	-1.543**
			(-2.10)	(-2.49)	(-2.64)
Law				-2.185	-2.388
				(-1.81)	(-1.95)
VC firm age					0.206
					(0.95)
Constant	0.197	-0.0586	0.424	0.840	0.679
	(0.44)	(-0.11)	(0.57)	(1.07)	(0.82)
Observations	223	223	222	222	217
Pseudo R^2	0.004	0.011	0.025	0.045	0.050

t statistics in parentheses, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 5: Multinomial logit for investment strategy on investor human capital. The first part of the table shows results on seed round investments as an investment strategy. The second part of the table displays the results on early stage VC investments as an investment strategy. Later stage VC investments as an investment strategy is the base category. The independent variables are the natural logarithm of the number of years of experience as a venture capitalist investors within a VC firm have on average, the proportion of investors with entrepreneurial experience within a VC firm and the proportion of investors with a degree in business and science/engineering. The natural logarithm of VC firm age and the proportion of investors with a law degree are included as control variables. The first three models show results on the entire sample. Models four through six show regression results when VC firms with only one observation are excluded. The bottom of the table shows the number of observations and an indicator for the goodness of fit of the model (Pseudo R^2). T-statistics are shown in parentheses.

	(1)	(2)	(3)	(4)	(5)	(6)
Seed round						
Experience VC	-0.684	-0.766	-0.711	-1.689	-1.280	-2.777
	(-1.19)	(-1.28)	(-1.12)	(-0.86)	(-0.58)	(-1.05)
Entrepreneurial exp.		0.820	1.012		-1.334	-1.440
		(0.73)	(0.88)		(-0.40)	(-0.37)
Business			-1.366			-0.109
			(-0.89)			(-0.02)
Science			0.810			1.075
			(0.68)			(0.21)
Law			2.266			-1.238
			(0.61)			(-0.12)
VC firm age	0.255	0.384	0.366	-0.925	-1.206	-1.650
	(0.65)	(0.90)	(0.81)	(-0.88)	(-0.94)	(-1.14)
Constant	1.588	1.088	1.614	5.498	5.905	9.958
	(1.70)	(0.94)	(0.98)	(1.49)	(1.50)	(1.33)

Early stage VC						
Experience VC	-0.364	-0.455	-0.308	-0.660	-0.833	-2.090
	(-0.70)	(-0.83)	(-0.52)	(-0.41)	(-0.47)	(-0.92)
Entrepreneurial exp.		0.876	1.117		0.680	3.217
		(0.86)	(1.05)		(0.24)	(0.96)
Business			-1.626			-0.544
			(-1.13)			(-0.09)
Science			1.869			6.877
			(1.68)			(1.58)
Law			4.437			7.788
			(1.29)			(0.92)
VC firm age	0.616	0.756*	0.635	-0.597	-0.464	-0.653
	(1.78)	(1.99)	(1.56)	(-0.83)	(-0.51)	(-0.63)
Constant	1.532	0.997	1.073	5.155	4.889	4.600
	(1.71)	(0.92)	(0.68)	(1.47)	(1.32)	(0.67)
Observations	142	142	141	47	47	47
Pseudo R^2	0.038	0.042	0.087	0.099	0.120	0.321

t statistics in parentheses, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 6: Logit regression for investment strategy on investor human capital. This table displays results of a regression of investment strategy on four investor human capital variables. Investment strategy takes value 0 for an early stage VC strategy and value 1 for a late stage VC strategy. The independent variables are the natural logarithm of the number of years of experience as a venture capitalist investors within a VC firm have on average, the proportion of investors with entrepreneurial experience within a VC firm and the proportion of investors with a degree in business or science/engineering. The natural logarithm of VC firm age and the proportion of investors with a law degree are included as control variables. The first three models show results on the entire sample. Models four through six show regression results when VC firms with only one observation are excluded. The bottom of the table shows the number of observations and an indicator for the goodness of fit of the model (Pseudo R^2). T-statistics are shown in parentheses.

	(1)	(2)	(3)	(4)	(5)	(6)
Experience VC	0.558	0.617	0.580	0.885	0.778	1.231
	(1.16)	(1.24)	(1.07)	(0.79)	(0.60)	(0.76)
Entrepreneurial exp.		-0.633	-0.813		0.340	-0.653
		(-0.66)	(-0.82)		(0.15)	(-0.27)
Business			0.771			-3.720
			(0.62)			(-1.07)
Science			-1.673			-6.085
			(-1.61)			(-1.81)
Law			-4.178			-7.678
			(-1.23)			(-1.06)
VC firm age	-0.695*	-0.794*	-0.697	-0.295	-0.211	0.182
	(-2.10)	(-2.19)	(-1.80)	(-0.47)	(-0.25)	(0.20)
Constant	-1.976*	-1.575	-1.296	-3.221	-3.361	0.616
	(-2.43)	(-1.57)	(-0.96)	(-1.62)	(-1.52)	(0.19)
Observations	142	142	141	47	47	47
Pseudo R^2	0.048	0.053	0.116	0.020	0.021	0.185

t statistics in parentheses, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

5. Limitations and recommendations

5.1 Limitations

Like all studies, this paper has some limitations. The most relevant ones are the limitations regarding the data. The sample size in this study is limited. While other studies obtain their data from venture capital firms directly and are able to look at complete investment portfolios, this study investigates individual investments. This is especially limiting when testing the investment strategy of VC firms, indicated by the fact that only 47 VC firms were included in the sample with more than one investment. The small sample size might explain the statistical insignificance of the coefficients in the regression results and the relatively low pseudo R-squared. Because this is a master thesis, time constraints were a critical factor in the sample size. Hand-collecting the current sample already took significant time and effort. I was simply constrained by deadlines to gather a larger sample.

Though LinkedIn provides an opportunity for an uninvestigated online database, it comes with some concerns. Investors create their own profile and can post experiences and academic achievements without references. Also, LinkedIn profiles are often incomplete. It was not uncommon for investors to have "CV gaps" on their personal page, especially if the particular investor started his career several decades ago, well before the internet. In addition, when collecting data on entrepreneurial experiences there is a potential success bias because investors might be tempted to not post unsuccessful entrepreneurial undertakings.

Though investors were only assigned an educational degree when they graduated in a particular field, this paper did not differentiate in the level of education. It is likely that an investor with an MBA degree from an Ivy League university has obtained a more advanced level of knowledge than an investor with an economics degree from a community college. In the same vein, entrepreneurial experience might be more valuable when the venture they (co)founded received venture capital funding.

Lastly, I did not control for reverse causality when it comes to the investment strategy followed by VC firms. It is a realistic possibility that VC firms hire investors which best suit their investment strategy, instead of the investors determining the investment strategy.

5.2 Recommendations

Some recommendations for future research emerge from this study. First, it would be interesting to investigate some moderating effects on the relationships between investor human capital and investment strategy and investment performance. Previous research suggested other factors causing heterogeneous VC firm performance, such as deal flow (Kaplan and Schoar, 2005) and industry diversification (Buchner et al., 2017). Investigating how deal flow affects the relationship between investor human capital and investment strategy, or how industry diversification affects the relationship between experience as a VC and investment performance would be interesting topics for example. Further investigating the effects for education by controlling for reputation of the educational institution for example, would add be a relevant addition to current literature as well.

Second, results of this study highlight the need for future research in the field of human capital and venture capital. With the recent invention and rise in the use of LinkedIn, a new global database on investor human capital is readily available. Replicating this analysis for a larger sample might yield interesting, statistically significant effects that could contribute to establishing consensus on the relationships investigated in this study.

6. Conclusion

This paper adds empirical evidence on the relationship between investor human capital and venture capital by addressing two research questions:

(1) What is the relationship between investor human capital and VC firm investment risk?
(2) What is the relationship between investor human capital and VC firm investment performance?

In order to answer these questions I investigated the relationship of five human capital variables on investment risk and investment performance. The analysis largely resulted in non-findings, though it should be noted that statistical insignificance is not uncommon in this field of research (see interpretation of the results above for examples) or in upper echelon theory (e.g. West and Schwenk, 1996). However, the results do indicate a positive relationship between the proportion of investors with a degree in science/engineering or law and the probability of a successful exit. In the context of the venture capital model, investors with a degree in science/engineering might

be better able to deal with technological risk. A law degree might be beneficial in contracting, for example when creating term sheets.

Some practical implications emerge from this study as well. From the VC firm perspective, investors with an education in science/engineering or law enhance investment performance. This should be considered when attracting venture capitalists to work for the firm. Also, VC experience seems to have no effect on investment performance. VC firms might benefit from investigating ways they can improve or stimulate on-the-job learning. From the perspective of a new venture, taking on VC firms with a higher proportion of science/engineering educated investors or investors with a law degree seems to enhance the probability of a successful exit. However, it should be noted that on an individual basis, the investor human capital a new venture requires, is probably highly dependent on other factors, such as the industry it is trying to enter and complementarity to the human capital it already possesses. Lastly, results from this study indicate that for new ventures it is beneficial to not just consider the knowledge and expertise of the individual investor, but also collective human capital at the VC firm level.

References

1. Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of Management*, *17*(1), 99-120.
2. Barney, J., Wright, M., & Ketchen Jr, D. J. (2001). The resource-based view of the firm: Ten years after 1991. *Journal of Management*, *27*(6), 625-641.
3. Baum, J. R., Locke, E. A., & Smith, K. G. (2001). A multidimensional model of venture growth. *Academy of Management Journal*, *44*(2), 292-303.
4. Becker, G. S. (1975). Investment in human capital: Effects on earnings. In *Human Capital: A Theoretical and Empirical Analysis, with Special Reference to Education, Second Edition* (pp. 13-44). NBER.
5. Becker, B. E., & Huselid, M. A. (2006). Strategic human resources management: Where do we go from here?. *Journal of Management*, *32*(6), 898-925.
6. Bottazzi, L., Da Rin, M., & Hellmann, T. (2008). Who are the active investors?: Evidence from venture capital. *Journal of Financial Economics*, *89*(3), 488-512.
7. Bowen, D. E., & Ostroff, C. (2004). Understanding HRM–firm performance linkages: The role of the "strength" of the HRM system. *Academy of Management Review*, *29*(2), 203-221.
8. Brüderl, J., Preisendörfer, P., & Ziegler, R. (1992). Survival chances of newly founded business organizations. *American Sociological Review*, 227-242.
9. Brush, C. G., Greene, P. G., & Hart, M. M. (2001). From initial idea to unique advantage: The entrepreneurial challenge of constructing a resource base. *Academy of Management Perspectives*, *15*(1), 64-78.
10. Buchner, A., Mohamed, A., & Schwienbacher, A. (2017). Diversification, risk, and returns in venture capital. *Journal of Business Venturing*, *32*(5), 519-535.
11. Cassar, G. (2006). Entrepreneur opportunity costs and intended venture growth. *Journal of Business Venturing*, *21*(5), 610-632.
12. Chandler, G. N., & Hanks, S. H. (1998). An examination of the substitutability of founders human and financial capital in emerging business ventures. *Journal of Business Venturing*, *13*(5), 353-369.
13. Coff, R. W. (2002). Human capital, shared expertise, and the likelihood of impasse in corporate acquisitions. *Journal of Management*, *28*(1), 107-128.
14. Collewaert, V., & Manigart, S. (2016). Valuation of angel-backed companies: The role of investor human capital. *Journal of Small Business Management*, *54*(1), 356-372.

15. Crook, T. R., Todd, S. Y., Combs, J. G., Woehr, D. J., & Ketchen Jr, D. J. (2011). Does human capital matter? A meta-analysis of the relationship between human capital and firm performance. *Journal of applied psychology*, *96*(3), 443-456.
16. Davidsson, P., & Honig, B. (2003). The role of social and human capital among nascent entrepreneurs. *Journal of Business Venturing*, *18*(3), 301-331.
17. De Clercq, D., & Dimov, D. (2008). Internal knowledge development and external knowledge access in venture capital investment performance. *Journal of Management Studies*, *45*(3), 585-612.
18. De Clercq, D., & Dimov, D. (2012). Venture capital firms: a human capital perspective. In *Handbook of Research on Venture Capital: Volume 2* (101-123). Edward Elgar.
19. De Clercq, D., & Sapienza, H. J. (2005). When do venture capital firms learn from their portfolio companies?. *Entrepreneurship Theory and Practice*, *29*(4), 517-535.
20. Dimov, D., & De Clercq, D. (2006). Venture capital investment strategy and portfolio failure rate: A longitudinal study. *Entrepreneurship Theory and Practice*, *30*(2), 207-223.
21. Dimov, D., & de Holan, M. P. (2010). Firm experience and market entry by venture capital firms (1962–2004). *Journal of Management Studies*, *47*(1), 130-161.
22. Dimov, D. P., & Shepherd, D. A. (2005). Human capital theory and venture capital firms: Exploring “home runs” and “strike outs”. *Journal of Business Venturing*, *20*(1), 1-21.
23. Dimov, D., Shepherd, D. A., & Sutcliffe, K. M. (2007). Requisite expertise, firm reputation, and status in venture capital investment allocation decisions. *Journal of Business Venturing*, *22*(4), 481-502.
24. Florida, R. L., & Kenney, M. (1988). Venture capital, high technology and regional development. *Regional Studies*, *22*(1), 33-48.
25. Franke, N., Gruber, M., Harhoff, D., & Henkel, J. (2006). What you are is what you like—similarity biases in venture capitalists' evaluations of start-up teams. *Journal of Business Venturing*, *21*(6), 802-826.
26. Gimeno, J., Folta, T. B., Cooper, A. C., & Woo, C. Y. (1997). Survival of the fittest? Entrepreneurial human capital and the persistence of underperforming firms. *Administrative Science Quarterly*, 750-783.

27. Gompers, P., Kovner, A., Lerner, J., & Scharfstein, D. (2005). Venture capital investment cycles: The role of experience and specialization. *Journal of Financial Economics, forthcoming*.
28. Grant, R. M. (1996). Toward a knowledge-based theory of the firm. *Strategic Management Journal*, *17*(S2), 109-122.
29. Gupta, A. K., & Sapienza, H. J. (1992). Determinants of venture capital firms' preferences regarding the industry diversity and geographic scope of their investments. *Journal of Business Venturing*, *7*(5), 347-362.
30. Hambrick, D. C., & Mason, P. A. (1984). Upper echelons: The organization as a reflection of its top managers. *Academy of Management Review*, *9*(2), 193-206.
31. Harris, R.S., Jenkinson, T., & Kaplan, S.N. (2014). Private equity performance: What do we know? *Journal of Finance, 69*(5), 1851-1882.
32. Heath, C., & Tversky, A. (1991). Preference and belief: Ambiguity and competence in choice under uncertainty. *Journal of Risk and Uncertainty*, *4*(1), 5-28.
33. Huselid, M. A. (1995). The impact of human resource management practices on turnover, productivity, and corporate financial performance. *Academy of Management Journal*, *38*(3), 635-672.
34. Hwang, M., Quigley, J. M., & Woodward, S. E. (2005). An index for venture capital, 1987-2003. *Contributions in Economic Analysis & Policy*, *4*(1).
35. Kaplan, S. N., & Schoar, A. (2005). Private equity performance: Returns, persistence, and capital flows. The Journal of Finance, 60(4), 1791-1823.
36. Kogut, B., & Zander, U. (1992). Knowledge of the firm, combinative capabilities, and the replication of technology. *Organization Science*, *3*(3), 383-397.
37. Newbert, S. L. (2007). Empirical research on the resource-based view of the firm: An assessment and suggestions for future research. *Strategic Management Journal*, *28*(2), 121-146.
38. Parhankangas, A., & Hellström, T. (2007). How experience and perceptions shape risky behaviour: Evidence from the venture capital industry. *Venture Capital*, *9*(3), 183-205.
39. Parhankangas, A., & Landström, H. (2006). How venture capitalists respond to unmet expectations: The role of social environment. *Journal of Business Venturing*, *21*(6), 773-801.

40. Patzelt, H., zu Knyphausen-Aufseß, D., & Fischer, H. T. (2009). Upper echelons and portfolio strategies of venture capital firms. *Journal of Business Venturing*, *24*(6), 558-572.
41. Pennings, J. M., Lee, K., & Witteloostuijn, A. V. (1998). Human capital, social capital, and firm dissolution. *Academy of Management Journal*, *41*(4), 425-440.
42. Peteraf, M. A. (1993). The cornerstones of competitive advantage: A resource-based view. *Strategic Management Journal*, *14*(3), 179-191.
43. Polanyi, M. (1966). The logic of tacit inference. *Philosophy*, *41*(155), 1-18.
44. Rauch, A., Frese, M., & Utsch, A. (2005). Effects of human capital and long–term human resources development and utilization on employment growth of small–scale businesses: A causal analysis. *Entrepreneurship Theory and Practice*, *29*(6), 681-698.
45. Shane, S. (2000). Prior knowledge and the discovery of entrepreneurial opportunities. *Organization Science*, *11*(4), 448-469.
46. Shane, S., & Venkataraman, S. (2000). The promise of entrepreneurship as a field of research. *Academy of Management Review*, *25*(1), 217-226.
47. Sørensen, M. (2007). How smart is smart money? A two-sided matching model of venture capital. *The Journal of Finance*, *62*(6), 2725-2762.
48. Studenmund, A. H. (2016). Using econometrics: A practical guide. *Pearson.*
49. Tajfel, H., Billig, M. G., Bundy, R. P., & Flament, C. (1971). Social categorization and intergroup behavior. *European Journal of Social Psychology*, *1*(2), 149-178.
50. Unger, J. M., Rauch, A., Frese, M., & Rosenbusch, N. (2011). Human capital and entrepreneurial success: A meta-analytical review. *Journal of Business Venturing*, *26*(3), 341-358.
51. Walske, J. M., & Zacharakis, A. (2009). Genetically engineered: Why some venture capital firms are more successful than others. *Entrepreneurship Theory and Practice*, *33*(1), 297-318.
52. West Jr, C. T., & Schwenk, C. R. (1996). Top management team strategic consensus, demographic homogeneity and firm performance: A report of resounding nonfindings. *Strategic Management Journal*, *17*(7), 571-576.
53. Westhead, P., Ucbasaran, D., & Wright, M. (2005). Decisions, actions, and performance: Do novice, serial, and portfolio entrepreneurs differ? *Journal of Small Business Management*, *43*(4), 393-417.

54. Wiklund, J., & Shepherd, D. (2003). Aspiring for, and achieving growth: The moderating role of resources and opportunities. *Journal of Management Studies*, *40*(8), 1919-1941.
55. Wooldridge, J. M. (2015). Introductory econometrics: A modern approach. *Nelson Education.*
56. Wright M. & Robbie K. (1998). Venture capital and private equity: A review and synthesis. *Journal of Business Finance & Accounting, 25*(5), 521-570.
57. Zacharakis, A. L., & Shepherd, D. A. (2001). The nature of information and overconfidence on venture capitalists' decision making. *Journal of Business Venturing*, *16*(4), 311-332.
58. Zarutskie, R. (2010). The role of top management team human capital in venture capital markets: Evidence from first-time funds. *Journal of Business Venturing*, *25*(1), 155-172.