The Effect of the Financial Crisis on Venture Capital-backed Firms

An Empirical Study on the VC Industry's Function and its Investees

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Abstract

The aim of this thesis is to empirically determine the effects of the Financial Crisis on the Venture Capital (VC) industry and its investees. The function of VC firms is assessed by discussing the 'Coach versus Scout' debate, and linked to potential selection effects urged by the crisis. The main results, which stem from a variety of regression methods applied to multiple datasets, indicate a clear negative impact of the crisis on VC activity in the United States. I argue that VC firms retreat to their core function, being critical scouting and focused coaching, which results in a smaller selection of firms receiving funding. An extended firm level analysis highlights the success of the core functions of VC, as critically scouted firms show to be eligible for the most common successful exit mechanism used by VCs, being an IPO, after more focused coaching is allowed. Ultimately, concerns are raised about the lasting effects of the crisis on a country's innovative capacity due to fewer innovative firms having access to smart capital financing needed to fill the early stage funding gap.

JEL Classifications: G24, L25, O30
Keywords: Venture Capital, Financial Crisis, Selection Effects, Startup Financing

Master thesis – Economics and Business: Entrepreneurship & Strategy Economics
ERASMUS UNIVERSITY ROTTERDAM
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August 2016

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1. Introduction

Given the growing concerns about innovation as an instrument for economic growth, venture capital (VC) financing is gaining importance for new technology startups as well as for the economic system. Despite extensive research on the investment behavior of VC firms, the connection to its surrounding economic context has not been studied thoroughly. Previous empirical literature shows that VC activities severely slowed down due to the Financial Crisis (2008-2009), which raises the concern about a 'funding gap' for innovative ventures (Block & Sandner (2009); Mason (2009)). This thesis answers the call for further research on VC and its temporal context by assessing the effect of the Financial Crisis (hereafter: crisis) on the VC industry and its investees.

The early findings of Block and Sandner (2009) on United States based internet startups, indicate that the crisis resulted in lower VC activity. This is worrisome, because the VC industry is a vital source for startups in innovative industries looking to fill the early-stage funding gap (Block & Sandner, 2009, p. 296). Bergemann and Hege (1998, p. 704) underline the industry's importance and state that VC is the main financing mode for projects where 'learning' and 'innovation' are important. As innovation has become an urgent concern for an increasing number of firms and significantly affects long-term economic growth (Holmstrom (1989); Branscomb & Auerswald (2002)), the importance of VC activity should not be underestimated.

Even though research has shown that startups with VC-backed funding are more successful than comparable ventures without this smart capital financing, there is little insight into the ways in which VCs impact the selection process of startups (Baum & Silverman, 2004, pp. 412-413). Baum and Silverman (2004) address this gap in the literature and investigate whether winners are picked or built, the so-called 'Coach versus Scout' debate assessing the function of VCs. Whereas the scout function describes the ability of VCs to identify particularly promising startups, the coach function describes a VC's ability to help these firms realize their full potential (p. 412). The findings of Baum and Silverman (2004) indicate a balanced stance in the debate, as they find support for the belief in VC expertise up to a certain point.

The still limited research on both the temporal context of VCs and the effects on its investees has, to the best of my knowledge, not been explored altogether. In this thesis I assess the function of VCs and link it to potential selection effects in times of crisis. Ultimately,

the objective of this research is to empirically determine the effects of the crisis on the VC industry and its investees. Hence, the following research question is formulated:

Concerning the effects of the Financial Crisis, to what extent does the macroeconomic context in which Venture Capitalists invest impact their investees?

In order to answer the research question, this thesis moves from an industry broad perspective to a narrow firm level analysis. The dataset used for the first part of this research is Thomson Reuter's VentureXpert database. This is the largest available VC database and is widely used in the VC literature (Block, De Vries, & Sandner, 2010, p. 199). Through both univariate and multivariate regression analysis I seek to determine the impact of the crisis on the VC industry as a whole. Thereafter, the VentureXpert sample is combined with both Orbis and Compustat data in order to obtain VC-backed firm level data. Potential selection effects of VCs are analyzed by looking at the likelihood of crisis and non-crisis funded firms to go public. An IPO is the most commonly used successful exit strategy by VCs and is telling about the performance of VC's investees in a difficult temporal context (Brander, Amit, & Antweiler, 2002, p. 437; Black & Gilson, 1998). Furthermore, I seek to determine whether firms scouted during the crisis differ from the ordinary in long term performance, as this may also indicate the benefits of focused coaching. All in all, a variety of empirical models are applied, ranging from a binary choice model to panel data regressions, in order to assess the different hypotheses concerning the effects of the crisis on the VC industry and its investees.

Summarizing the main results, the empirical analysis shows that the Financial Crisis has a negative impact on VC activity in the United States. Both the volume of VC funding and the number of funding rounds is lower during the crisis. However, these effects appear to be more significant for first round funding as compared to follow-up investments. In addition, it is found that firms that were selected for VC funds during the crisis are more likely to go public than firms that did not receive funding during the crisis. Yet, these selected firms, once public, are not significantly outperforming VC-backed public firms that did not receive VC funding during the crisis. I conclude that the retreat of VCs to their core function, being critical scouting and coaching, results in a smaller selection of firms receiving funding. I find that despite the difficult economic context these critically scouted firms show to be eligible for the most commonly used successful VC exit mechanism, being an IPO, after more focused coaching is allowed. Ultimately, the success of the core functions of VC firms is highlighted, which also

raises concerns about a country's innovative capacity as fewer innovative firms have access to smart capital financing in times of crisis. In contrast to the inefficient policy of providing public funds to fill the early stage funding gap, I argue that legal reforms may be needed as the country's regulatory framework is found to be crucial to VC activity (Armour & Cumming, 2006; Kortum & Lerner, 2000).

The structure of this thesis is as follows. Chapter 2 provides an overview of the various aspects of the VC industry, which are essential in understanding the terminology used in the remainder of this research. Chapter 3 discusses the link between the VC industry and its temporal context, with a focus on the financial crisis, and concludes with the hypotheses underlying the empirical section. Chapter 4 discusses the data and methodology used to test the set hypotheses, and Chapter 5 presents and discusses the corresponding results. Lastly, Chapter 6 concludes by assessing the implications of this research, discusses the limitations, and ultimately provides directions for further research.

2. The Venture Capital Industry

This chapter serves as an overview of the various aspects of VC firms in their role as mediators between investors and investees, which I deem necessary in understanding the terminology used in the remainder of this thesis. First, VC is defined and its importance is highlighted. Yet, to truly understand the VC industry, it is key that one understands the 'venture cycle'. This cycle starts with VCs raising funds; continues as the most promising investment opportunities are scouted; proceeds through the financing and coaching of selected startups and ends with market exit strategies that result in capital returns to investors (Gompers & Lerner, 2001, p. 152). All aspects of the cycle are interrelated and are discussed in succession.

2.1 Introduction to the Venture Capital Industry

The VC industry lacks a commonly accepted definition, but can be described by four characteristics identified by Brander, Amit and Antweiler (2002, pp. 428-429). The first three characteristics are emphasized in the following definition given by Schilit (1991, p. 34): "venture capital can be thought of as *financing for privately held companies*, generally *in the form of equity* and/or long term convertible debt… The venture capitalist, like the banker, serves as *an intermediary* between the investors… and the entrepreneurs." The final key characteristic is highlighted by the following statement from Kunze (1990): "The combination of equity participation *plus active involvement in the development of the company* is what distinguishes venture capital from all other investment vehicles." The aforementioned characteristics of the VC industry make it to be a vital source for startups in innovative industries looking to fill the early-stage funding gap (Block & Sandner, 2009, p. 296). Bergemann and Hege (1998, p. 704) underline the industry's importance and state that VC is the main financing mode for projects where 'learning' and 'innovation' are important. As innovation has become an urgent concern for an increasing number of firms and significantly affects long-term economic growth (Holmstrom, 1989; Branscomb & Auerswald, 2002), the importance of VC activity cannot be underestimated.

2.2 The Fundraising Process

As stated, the VC industry can best be understood by learning about the venture cycle. The first chain in this cycle concerns the fundraising of VCs, who are dependent on investors willing

to take calculated risks. Gompers and Lerner (2004, p. 23) argue that the structure of the funds obtained have long-term implications for VCs' investment behavior. Most VC targeted firms and buyout funds are anticipated to dissolve after ten to twelve years, which is labeled as being 'self-liquidating'. This mechanism forces VCs to write off underperforming ventures in their portfolios. However, this puts pressure on promising firms that have yet to reach their full potential. In particular, young private equity firms are known to rush young ventures into going public, as this reflects positively on the VC's track record. This strategy is called 'grandstanding' and may harm companies, which are not ready for their Initial Public Offering (IPO).

The findings of Gompers and Lerner (2004, pp. 33-63) emphasize the critical importance of the demand for VC in the fundraising process. Several macroeconomic factors are found to affect VC activity; a lower capital gains tax rate as well as higher GDP growth and R&D spending all positively influence the amount of VC raised. VC characteristics are also argued to play a significant role. The ability of VCs to raise new capital is dependent on the performance of its funds. Not only venture reputation in terms of age and size increases the likelihood of raising funds, but also the venture's possession of significant equity stakes in companies that have gone public in recent times. Successfully guiding ventures in the process of going public is logically dependent on the state of the IPO exit market. Empirical literature supports the view that VCs adjust their strategies to the liquidity state of these markets (see, e.g. Cumming et al. (2005) or Giot & Schwienbacher (2007)).

In addition to macroeconomic determinants and VC characteristics, policy changes have historically affected the fundraising process. A noteworthy example is the amendment of the Employee Retirement Income Security Act (ERISA) in the United States in 1979. This act restricted investments of pension funds in high-risk asset classes such as VC. After discontinuing the set limitations to pension fund's investment options, there was a clear spike in funds raised by VC firms (Kortum & Lerner, 2000, pp. 676-677).

All in all, the vitality of the VC industry is dependent on macroeconomic factors, venture characteristics, and enabling government policy. Furthermore, it is important to note that the structure of the funds obtained influences the long-term investment behavior of VCs.

2.3 The Selection Process of Investment Opportunities

After having raised sufficient funds, the decision to invest time, capital and other resources in an upcoming firm proves a delicate valuation challenge. Young companies are confronted by many obstacles, as they usually have no working relationships with customers and suppliers, lack employee commitment and knowledge of their environment (Baum & Silverman, 2004, p. 415). Moreover, the 'hype' surrounding certain innovative technology may disappear, and a sustained period of poor performance is often insurmountable for the often still small startups (Aldrich & Auster, 1986) . These aspects in combination with the short-track records on which these companies can be judged, make their value highly uncertain and the selection process difficult.

2.3.1 The Scout Function

Consequently to the difficulty of startup valuation, VCs carefully assess signals of a startup's quality and prospects (Hall & Hofer, 1993). This results in the typical view that VC investment is the most critical form of capital, while consistent with the classic economic signaling literature (Baum & Silverman, 2004, p. 415). The ability to identify particularly promising startups and selecting them as investees is what I term 'scouting' in this research. A widely believed misconception is that VCs scout solely for outstanding people with brilliant ideas. As argued by Zider (1998, p. 133): "The reality is that they invest in good industries". VCs target industries with a high probability of success for inside companies, where the timing of investment is crucial (Shepherd, Ettenson, & Crouch, 2000). The majority of VC investment takes place in the adolescent phase of a firm's life cycle, where accelerated growth is essential and winners and losers perform alike (Zider, 1998, p. 134).

The importance of the industry is paramount in selecting investment opportunities, but it does not take away from the importance of VC characteristics. Baum and Silverman (2004) argue that there are three broad types of signals that may affect VC's assessments of startups: alliance-, intellectual-, and human capital. A startup's alliance capital signals both access to resources and knowledge critical to early performance as well as the positive evaluation from other related actors (p. 416). Furthermore, intellectual claims (i.e. patents and patents pending) and human capital are an early signal of a startup's future potential, therefore, they increase the likelihood that VC financing is obtained (pp. 416-417).

Lastly, the geographical area in which a startup is located plays a significant role. As stated by Hellmann (2000, p. 287): “many VC funds do not invest in companies that are more than two hours away by car”. Thus, complementary to the external signal of industry performance, startups are scouted for their geographical proximity and capital in terms of alliances, intellect and talent.

2.4 Smart Capital Financing

After successfully scouting high potential startups, VCs will proceed to actually invest. Wang and Zhou (2004) characterize VC financing mainly by staging the commitment of capital and preserving the option to abandon the project. Zider (1998, p. 134) underlines the logic of the deal, where VCs protect their investments in case of failure. An important addition of the author is that investors also make sure to have a favorable position when the investee proves to be a winner. This subsection focusses on the process of smart capital financing by first discussing the staging of investment and then introducing the concept of syndication. Lastly, the coach function of VCs will be explained by discussing smart capital financing in depth; the provision of advice, network- and management support.

2.4.1 The Staging of Investment

As introduced, preserving the option to abandon projects is valuable to VCs, as it helps deal with the high uncertainty surrounding innovative firms. A common instrument used to maintain control is investment staging (Hellmann, 2000). In general, the literature distinguishes five stages in the financing process (Brander, Amit, & Antweiler, 2002, pp. 428-429). First, *seed investment* may occur before a company exists and forms the earliest stage of investment. Second, investments made after a company is founded but before sales occur are part of the *startup investment* stage. Third, the period where sales occur but are not yet a major source of finance for ongoing operations, corresponds to the *early growth phase*. Moreover, the fourth stage is referred to as *later-stage* financing, and the final investment stage typically focuses on *turnaround investments* and *leveraged buyouts* for mature privately held companies. Note that the time horizon and the number of investment rounds of each stage may vary. Moreover, every stage requires different expertise of the VC and carries different risk with accompanying monitoring requirements.

2.4.2 Syndication

In addition to the staging of investment, VCs make use of syndication to protect themselves from risk (Zider, 1998, p. 135). Syndication refers to the coordination of investment by multiple actors. As discussed by De Vries and Block (2011, pp. 196-197) the literature highlights three main reasons for syndication, which result from a financial-, networking-, and resource-based perspective.

Firstly, from a financial perspective syndication may be used to diversify the portfolio. VCs are able to finance more startups when investment is split amongst multiple participants. This type of portfolio diversification limits a VCs exposure to risk. Furthermore, the non-liquid nature of VC investments may be a financial motive for syndication. Before maturity of the intended life cycle of a VC fund is reached, the investment is hard to reclaim. Hence, VCs may prefer more flexibility in terms of liquidity by spreading investments over several ventures. Secondly, the networking perspective favors syndication due to status and future deal flow. The VC industry is known for its reciprocity in terms of investment involvement, resulting in future deal flow. Through inviting other VCs to participate in syndication, a venture may expect future invitations from the co-investor. Moreover, VCs may show particularly skillful to syndication partners. This will reflect positively on their status and further increase their future deal flow. Thirdly, from the resource-based perspective, knowledge sharing is a key reason for syndication. As discussed, the industry in which a startup is active is a determining factor for the scouting function of VCs. Industry specific knowledge and other assets may be shared by syndication partners to stimulate performance of specific investments (De Vries & Block, 2011, pp. 196-197).

The aforementioned perspectives highlight the advantages of syndication, but the disadvantages also require discussion. The coordination of investments by VCs create additional transaction costs and may lead to agency problems. Due to the engaged nature of VCs, this type of funding is effective in dealing with innovative ventures associated with intangible assets and dynamic environments. Still, both these factors raise the likelihood of agency problems, in particular, asymmetric information and moral hazard (Hall & Lerner, 2010). Through syndication these problems are more extensive as there are more investors involved. In a one dimensional setting VCs monitor their investment by actively participating in decision making processes through, for example, taking seat in the board of directors of an

investee (Cumming & Johan, 2007). Even though, monitoring co-investors in a syndicate may prove more difficult, it should not be neglected when looking to safely apply syndication[2].

2.4.3 The Coach Function

It is evident that the VC industry is based on taking calculated risks in order to profit from investments in innovation. The need from innovative startups for VC financing surpasses the basic need for funding, because these young firms may also require advice-, network- and management support. This need is highlighted by Zider (1998, p. 139):

"The person who starts the business is seldom the person who can grow it, and that person in seldom the one who can lead a much larger company. Thus, it is unlikely that the founder will be the same person who takes the company public."

Startups often lack the knowledge and assets to develop their company into a successful public enterprise, which makes smart capital an attractive option. Whereas the scout function describes the ability of VCs to identify particularly promising startups, the coach function describes the ability of VCs to help investees realize their full potential (Baum & Silverman, 2004, p. 412).

The prominent literature on VC coaching focuses on Silicon Valley based startups. The empirical findings of Hellmann and Puri (2002) suggest that the role of VCs surpasses that of traditional intermediaries. The authors find that VCs influence developments at the top as well as further down the organization. For example, they find that VCs may recruit outsider CEOs to replace the original founders. Moreover, the introduction of stock option plans, the formulation of human resource policies, and the hiring of sales- and marketing vice presidents are linked to VC activity (pp. 169-172).

A theoretical study by Hellmann (2000) on the coaches of Silicon Valley highlights the statement that most VCs play a larger role than solely providing funds. Their business expertise may prove critical in the development of startups. Firstly, VCs often adopt the advisory role by providing mentoring and guidance to set an effective overall company strategy. Secondly, network support can be granted to forge strategic alliances between firms. The most prominent VCs are especially likely to leverage their networks for this purpose and

[2] The literature on agency problems in VC activity is extensive. For this research, it suffices to state that both empirical- and theoretical studies suggest that VCs use the closely interrelated concepts of contracting, screening and monitoring to mitigate principal-agent conflicts. For a discussion, see Kaplan and Stromberg (2001).

may connect different startups from their own portfolios. Furthermore, network support may be provided in the form of financial and legal support. VCs often have close connections with investment bankers that could be willing to provide later stage funding. Similarly, connections with specialized law-, accounting- and consulting firms can be valuable assets to startups. Thirdly, management support is the final and key example of coaching. Not only do VCs play an active role in attracting top talent into startups, they often intervene in the top management. Despite it being a controversial issue, Hellmann and Puri (2002) find that most VC-backed companies have their founder replaced by a different CEO. This illustrates the control that coaching VCs like to exert as well as the need of startups for experienced leadership, which is exemplified by the aforementioned quote of Zider (1998). Lastly, in addition to VC's advice-, network- and management support, their sheer involvement may already benefit a startup. Megginson and Weiss (1991) argue that the highly respected ability of VCs to scout particularly promising firms, provides startups with a beneficial certification that opens doors to other resources.

An important final note on the coaching function of VCs is that not all investors play an equally active role in supporting their investees. Moreover, VCs tend to have different backgrounds, with the main expertise often being either technological, financial or managerial. Hence, the intensity and area of coaching may vary significantly among firms (Hellmann, 2000).

2.5 The Exit Strategies of Venture Capitalists

The final chain in the venture cycle concerns the exit strategies of VCs. As discussed this factor also influences the fundraising ability of ventures and thus completes the circle. Traditionally there are three types of exit strategies available to VCs: trade sales, IPO's and liquidations (Giot & Schwienbacher, 2007). Following the characterization of Brander et al. (2002, p. 437) I distinguish between several forms of these types of exit strategies.

For successful ventures trade sales and IPO's are appropriate types of exit. One possibility is that venture shares are sold to insiders in a management buyout (MBO). VCs may also sell their shares to a third party in order to exit through a private third-party acquisition. In addition, the VC's holding can be sold to a third party in a private sale, but not as part of a third-party acquisition. This final form of a trade sale is called a secondary sale. The most

common type of successful VC market exit is through an IPO, which generally reflects positively on the venture's reputation and reaps the highest return. For more unsuccessful ventures, it can occur that the investment is simply written off by the VC. As discussed, this liquidation mechanism serves to dispose of underperforming portfolio investments after a certain period (Brander, Amit, & Antweiler, 2002, p. 437).

Final, as a concluding remark on the venture cycle, it is important to note that the process renews itself when VC firms raise additional funds and seek new or follow-up investments.

3. The Financial Crisis

Whereas the previous chapter provided an essential overview of the most important aspects of VC, this chapter goes more in depth by linking VC activity to its temporal context. First of all, the impact of the Financial Crisis of 2008-2009 (henceforward: crisis) on the VC industry is discussed. Thereafter, the effect of the crisis on VC-backed firms is discussed. In due course, this results in the hypotheses underlying the empirics of this research.

3.1 The Effect of the Financial Crisis on the VC Industry

The crisis became apparent on September 15 2008, after the announcement of Lehman Brothers' bankruptcy. Shortly after, the credit rating of the important insurance firm American International Group (AIG) was downgraded due to a liquidity crisis. Consequently, financial markets panicked and the snowball effect affected financial institutions all over the world[3]. As stock prices were plummeting, a recession was imminent and only governmental funds were able to save key institutions from bankruptcy (Block & Sandner, 2009, p. 295). Ultimately, this resulted in a crisis commonly regarded the most severe one since the Great Depression.

The entanglement of the VC industry with the general economic climate raises concerns about adverse effects of the crisis on both the VC industry and innovative startups. Block and Sandner (2009) are the first ones to empirically study the impact of the crisis on VC activity. The authors propose several argument as to why the impact is likely to be negative and severe. Their arguments focus on several stages of the venture cycle. As discussed, the fundraising ability of the VC industry is largely dependent on macroeconomic factors. The impact of the crisis on large institutional investors raised the need for governmental help (e.g., AIG, ABN Ambro) and even led to bankruptcy (e.g., Lehman Brothers). These institutions are typical investors in the VC industry and their hardship harms the first chain of the venture cycle: the fundraising process of VCs (Block, De Vries, & Sandner, 2010). The macroeconomic situation also negatively affected the IPO market[4]. This does not only add to the difficulty of raising funds by VCs, but also limits the commonly used successful exit strategy of taking firms public (Black & Gilson, 1998). Moreover, Block et al. (2010) argue that the exit strategy of VCs is further affected by a decrease in valuation of VC-backed startups. The deep recession caused

[3] See Orlowski (2008) for an in-depth discussion on the distinctive stages of the global financial crisis.
[4] See Ritter (2008) for an overview of the IPO market developments up to the Financial Crisis.

by the crisis makes it difficult for startups to generate sufficient revenues. This slows their growth and consequently enterprise value, resulting in both a lower likelihood of successful exit by VCs and lower returns on public equity markets.

As stated, Block and Sandner (2009) were the first ones to empirically study the impact of the crisis on VC. The authors have contributed to this field of research by publishing several empirical papers discussing different aspects of VC. Their research is at the core of this thesis and forms a building block for the later discussed empirics. In order to assess potential differences between crisis-funded firms and firms that were VC-backed in more prosperous economic times, it is essential to first get a broader perspective on the impact of the crisis on the VC industry. Following up on the arguments discussed in the previous paragraph, Block and Sandner (2009) find that the financial crisis results in a significant decrease of the amount of VC funds raised by startups in later funding rounds. In a later publication, Block et al. (2010) show that the crisis also resulted in a decrease in the number of initial funding rounds, which was especially significant for the United States. The hypotheses for the industry level analysis of this research are similar to those tested by the aforementioned publications and are used to set the stage for the effect of the crisis on VC-backed firms.

Overall, the crisis is expected to harm the venture cycle from start to finish, mainly affecting the fundraising ability and exit strategies of VCs, resulting in a slowing down of VC activity:

H1a: *The number of VC funding rounds is lower during the Financial Crisis.*

H1b*: The volume of VC funding is lower during the Financial Crisis.*

In addition, these hypothesized effects of the crisis are likely to differ between first- and later funding rounds. This expectation follows from the distinctive associated startup stages of first- and later round funding, which is explained by De Vries and Block (2011, pp. 198-199) and brings us back to the staging of investment typical to smart capital financing. First round funding often targets startups in an early development stage, where exit mechanisms of VCs are not pursued in the short-run. In contrast, later round funding is associated with startups in a later development stage and a shorter time horizon to VC exit. In crisis times, these investments carry more risk, because the IPO market is in an unhealthy state. Therefore, the

temporal context is likely to affect VC activity differently when it concerns different stages of funding.

3.2 The Effect of the Financial Crisis on VC-backed Firms

Having a grasp on the effect of the crisis on the VC industry allows for more in-depth research on the consequences for VC-backed firms. The effect of the crisis on the VC industry is hypothesized to decrease VC activity, mainly due to more uncertainty surrounding fundraising and exiting strategies of VCs. Logically, these developments will have consequences for the recipients of VC. Block and Sandner (2009) raise several questions about the impact of the crisis on VC's investees. The authors suggest further research on "how startups receiving funding during the financial crisis differ from startups that had received funding before the financial crisis" (p. 308). The expected reduction in both the number of funding rounds and volume of VC funding during the crisis most likely affects the selection procedure of VCs. As suggested by Block and Sandner (2009), there may be a selection effect, where only the more promising firms receive funding. In order to assess potential selection effects, a discussion on the VC's function is essential. This touches upon the scout- and coach function of VCs, which were introduced in subsections 2.3.1 and 2.4.3 respectively. This section will first address the VC's function by covering the coach versus scout debate. Thereafter, the final hypotheses concerning potential selection effects and their impact on VC's investees are formulated.

3.2.1 The VC's Function: The Coach versus Scout Debate

The old coach versus scout debate traces back to Kanter (1989). The author refers to the active role of a coach as someone who helps refine ideas and promotes them to top management and potential investors. The scout role describes the receiver and allocator of new ideas that has access to corporate money. Since then, this role divide has taken various forms in the literature on radical innovation (see, e.g. Leifer et al. (2001, pp. 105-106)). Eventually, Baum and Silverman (2004) used the analogy in order to describe the function of VC. In this research, I build on their definitions and define the scout function as the ability of VCs to identify particularly promising startups, whereas the coach function describes a VC's ability to help these firms realize their full potential.

Supporters of the VC's scout function attribute the success of VC-backed firms to the ability of VCs to identify high potentials pre-investment (Shepherd, Ettenson, & Crouch, 2000; Chan, 1983). The widely respected scouting ability was argued to be the main contributor to further resources for VC-backed startups (Megginson & Weiss, 1991). Prior to the publication of Baum and Silverman (2004) most research assumed VCs to be specialists in scouting. Therefore, the possible impact of the coaching function is likely to have been overlooked. More recently, the conception that the signaling of expert support by VCs leads to additional resources has gained popularity. This stream of research highlights the coach function of VCs and does not emphasize the ability to pick winners, but the ability to build winners (Hellmann, 2000; Hellmann & Puri, 2002). In spirit of the described debate, Baum and Silverman (2004, p. 414) were the first ones to raise the question: "Which of these roles dominates?" The authors research on biotechnology startups results in a balanced stance as they find support for the belief in VC expertise, but only to a certain point. In addition, research conducted by Colombo and Grilli (2010; 2009) contributes to the issue of building versus selecting winners. By an empirical assessment of Italian new technology-based firms the authors conclude that coaching is the main function performed by VC investors, where the key advantage for VC-backed startups resides in the access to external resources and the establishment of new alliances. Further research by Bertoni, Colombo and Grilli (2011) contributes to the debate by isolating the treatment effect of VC investment from the selection effect. The authors conclude that the coaching aspect of VC investments has a large positive effect on employment and sales growth of startups.

Overall, the debate on the function of VC has yet to be settled. The empirical- and theoretical literature provided by proponents of both sides of the coach versus scout debate is compelling. Therefore, I conclude that it is likely that the truth resides in a more balanced view, as proposed by Baum and Silverman (2004).

3.2.2 The Effect of the VC's Function on Investees during the Financial Crisis

It is evident that the VC industry is highly entangled with the general economic climate; therefore, the crisis is hypothesized to reduce both the number of funding rounds as well as the volume of VC investments. In order for the VC industry to remain relevant in a challenging economic context, firms are expected to prioritize their engagement with core projects (De Vries & Block, 2011, pp. 208-210). This retreat to the core function of VC is likely to impact

firms seeking investment and may lead to selection effects. As argued by Block et al. (2010) stricter investment criteria are the most likely cause for lower VC activity in first funding rounds. The combination of lower fundraising and worse exit markets leads VCs to be more critical in their investment decisions. Consequently, their investment behavior is more risk averse and the selection of investees more critical. Thus, the core scouting function of VCs may result in stricter selection effects targeting low-risk winners during the crisis. In addition, De Vries and Block (2011) find that syndication decreases during a crisis, which leads to lower levels of risk sharing. The authors argue that VC's are likely to 'retreat' to their existing investments (p. 210). I expect this focus to result in more intense coaching of both the existing- and the few new portfolio investments. All in all, it is likely that the scout function leads to stricter selection effects, where only truly high potential firms receive VC funds. Moreover, the retreat to existing investments and tempered growth of VC's portfolios allows for more focused coaching. These two aspects raise the expectation that firms receiving VC funds during the crisis have the potential to outperform firms that received VC funds in more prosperous economic times.

In order to assess the validity of this train of thought, one has to look at the performance of VC's investees. Despite the unhealthy state of the IPO market during the crisis, taking a firm public remains the most common successful exit strategy used by VCs (Black & Gilson, 1998; Brander, Amit, & Antweiler, 2002). Thus, I expect firms that were scouted during the crisis to be more likely to go public than firms that did not receive VC funding in these critical times. As Cumming, Fleming and Schwienbacher (2005) show that when exit markets are illiquid VC investors focus more on early-stage projects, this expectation does take time to unfold. Ultimately, this results in the following hypothesis:

H2: *Firms selected for VC funding during the Financial Crisis are more likely to go public than firms that did not receive VC funding during the crisis.*

While hypothesis **H2** assesses the core of VC-backed firm performance in a difficult economic context, it may be caused by grandstanding. Therefore, more long term assessment of firm performance is required. Moreover, a longer term assessment may tell more about the impact of a more focused coaching role on VC's investees. Firms are likely to have to reassess their business plan to survive in a period of economic crisis. The coaching function is about

helping firms reach their full potential and in combination with the more critical scouting during the crisis, this is expected to result in higher long term firm performance:

***H3**: Firms selected for VC funding during the Financial Crisis, which went public, outperform VC-backed public firms that received VC funding outside the crisis.*

4. Data and Methodology

This chapter discusses the identification strategy used to conclude upon the hypotheses set in the previous chapter. In order to answer the research question, this thesis moves from an industry broad perspective to a narrow firm level analysis. This approach results in two distinct sections concerning data and methodology. In terms of structure this chapter follows the buildup of the hypotheses and is split between the effect of the crisis on- the VC industry, and VC-backed firms.

4.1 VC Industry Analysis

The dataset used for the first part of this research is obtained from the Thomson Reuter's VentureXpert database. This is the largest available VC database and is widely used in the VC literature (Block, De Vries, & Sandner, 2010, p. 199). Because of these characteristics, I decide not to use the alternative option, being the CrunchBase database used by Block and Sandner (2009), who lay the foundation for the methodology of this part of the research. The data obtained from the VentureXpert database covers all VC equity investment rounds in the United States over a 10-year period: January 1st 2006 till December 31st 2015. The regional restriction of focusing on United States based startups is implemented, because it keeps exogenous factors that impact VC activities (i.e. bankruptcy laws and tax policies (Armour & Cumming, 2006)) constant. Moreover, the duration and impact of the crisis is better captured when focusing on the US, whereas, for example, in Europe these factors vary widely between countries. Also, Block et al. (2010) find the strongest effects of the crisis in the United States, making it a particularly interesting case. **Table 1** shows the construction of the sample, which results in 22658 funding rounds and 6751 VC-backed firms.

>Insert Table 1<

Concerning the regression analysis, the explained variable is the amount of VC funds raised by a startup in a funding round (*Raised Amount*). The main explanatory variable is a dummy

variable that indicates the Financial Crisis (*Financial Crisis*). This variable runs from the month in which the bank Lehman Brothers went bankrupt, September 2008, until the month in which the United States started recovering from its recession, September 2009[5]. In total 1982 funding rounds in the sample took place during this crisis period. Furthermore, three other explanatory variables are of particular interest. Firstly, a dummy variable is included that distinguishes between first- and later funding rounds (*Later Round*). Secondly, a dummy variable is included that indicates whether a certain funding round was initiated by a single VC investor or a syndicate (*Syndicate*). Thirdly, the age of the firm in years at the time of funding is included (*Firm Age*). Lastly, control dummies for the startup stage and sector are included[6]. **Table 2** shows a summary of the variables used and **Table 3** the descriptive statistics and correlations.

>Insert Table 2 & 3<

The identification strategy is to first seek to obtain an overview on both hypotheses **H1a** and **H1b**, before addressing them individually. The overall effect of the Financial Crisis on the VC industry is obtained by graphically showing the evolution of VC activity over the full duration of the sample. The total VC investment volume as well as the number of funding rounds obtained by firms are pooled per month.

Hypothesis **H1a** is evaluated by univariate analysis, which assesses the difference in the number of funding rounds during and outside of the crisis. Both the mean and median number of funding rounds are stated for both periods, and a test of equality of means (t-test) and a Wilcoxon rank-sum test of equality of medians is conducted. As the time sample covers a significant period after the crisis, it may bias the differences observed for the relatively short crisis period. Therefore, the univariate analysis is also conducted for a restricted sample covering the crisis period and one year prior. This will highlight a possible (expected) break in the trend of VC activity caused by the crisis. As discussed in section 3.1, a difference in the effect of the crisis between first- and later round financing is likely. Therefore, both the

[5] This period aligns with the empirical research conducted by both Block et al. (2010) and De Vries & Block (2011).

[6] The startup stage division follows from the distinctions made within the VentureXpert database, see section 2.4.1 of this thesis for a discussion on the staging of investment. The sector division follows the major groups division of the standard industrial classification (SIC – siccode.com).

complete- and restricted sample assess the effect of the crisis on both first- and later round funding separately.

Hypothesis **H1b** is evaluated by the estimation of multiple regression models: Ordinary Least Squares (OLS) and Quantile Regression (QR). The applied basic OLS estimation is captured by the following equation:

$$y_i = \beta_1 + \beta_2 x_{i2} + \cdots + \beta_k x_{ik} + e_i$$

Where *y* is the explained variable, β_1 is the constant, β_2 until β_k are the parameters for the explanatory variables x_i, and e_i is the error term (Carter Hill, Griffiths, & Lim, 2012). As outliers may bias the OLS model, an additional QR model is applied. I estimate a quantile regression on the median of the explained variable, which is more robust to outliers than the mean estimated in the OLS regression (Koenker & Hallock, 2001).

As stated, the explained variable is the amount of VC funds raised by a startup in a funding round (*Raised Amount*). In order to normalize the distribution of this variable the natural logarithm is used. This same logic also applies to the explanatory variable: *Firm Age*. Even though the correlation table indicates no multicollinearity problems, a Variance Inflation Factor (VIF) test is conducted. The low VIFs confirm that the estimations do not appear to suffer from multicollinearity problems. Moreover, in order to deal with possible heteroscedasticity, the standard errors are robust and clustered by firms. Again, all tests are conducted on both the complete- and restricted sample. In addition, both samples are also split between first- and later round funding, for the same reasons as discussed earlier.

4.2 VC-backed Firms Analysis

The dataset used for the second part of this research flows from the VentureXpert sample used for the VC industry analysis. As stated, this sample consists of 6751 firms that received VC funding between January 2006 and December 2015 in the United States. First of all, the sample and methodology used for hypothesis **H2** is discussed. The use of the batch search function in the Orbis database allowed for the obtainment of the Ticker code of 4484 firms, which includes both listed and unlisted firms[7]. In order to equalize the lifespan of the sampled

[7] The VentureXpert database only provides company names and no other identification codes, therefore, the Orbis database was used in order to obtain the Ticker code needed to obtain detailed firm level data.

firms, the firms that did not receive first round VC funding during the 10-year time frame were dropped from the sample. Ultimately, this results in 3371 firms used for the testing of Hypothesis **H2**. **Table 4** shows the construction of the sample and **Table 5** the descriptive statistics and correlations. Based on the correlation table it is save to conclude that there are no problems with multicollinearity.

>Insert Table 4 & 5<

Hypothesis **H2**, concerning the probability of VC-backed firms going public, is evaluated by a binary choice Logit model. The basic Logit model is captured by the following equation:

$$Pr(y = 1|x_1, x_k) = \frac{\exp(\beta_0 + \beta_1 x_1 + \beta_k x_k)}{1 + \exp(\beta_0 + \beta_1 x_1 + \beta_k x_k)}$$

Where *y* is the explained variable, β_0 is the constant, β_1 until β_k are the parameters for the explanatory variables x_k (Carter Hill, Griffiths, & Lim, 2012). More specifically, the explained variable is a dummy variable that takes value 1 if a firm went through an IPO (*dPublic*). As to be expected, there is a significant period between receiving first round VC funding and actually going public, hence, the earliest IPO in the sample dates from 2010. The main explanatory variable is a dummy variable that takes value 1 if a firm received VC funding, either first- or later round, during the crisis (*VC Raised Crisis*). The other explanatory variables of interest are the total amount raised in first- and later round funding; *Total First Round VC*, and *Total Later Round VC* respectively. In order to normalize the distribution of the last two mentioned variables, the natural logarithm is used. Moreover, sector dummy variables and the natural logarithm of the firm age in years at the first VC round are included as a means of control.

After having concluded upon the effect of VC investment on the probability of an investee to go public, it is of interest to look at the long-term performance of VC-backed public firms for hypothesis **H3**. The use of the Ticker codes obtained from the Orbis database allowed the obtainment of comparative performance data from the Compustat database for 134 active public firms. The construction of the company financials sample is shown in **Table 4** and is the basis for a panel data estimation captured by the following equation:

$$y_{it} = \beta_{1i} + \beta_2 x_{1it} + \beta_k x_{kit} + e_{it}$$

Where y_{it} is the explained variable, β_{1i} is the constant, β_2 until β_k are the parameters for the explanatory variables x_{it}, and e_i is the error term. Subscripts *i* and t denote the panel ID variable (Firms) and the time variable (Quarters) respectively. As the between variation is of interest, the panel model is applied as a Random Effects (RE) Model (Carter Hill, Griffiths, & Lim, 2012):

$$\beta_{it} = \bar{\beta}_1 + u_i$$

More specifically, the RE Model estimates an unbalanced panel dataset of public firms over a period of 40 quarters between the year 2006 and 2015. Hypothesis **H3** is evaluated by the use of two different explained variables: Return on Assets (ROA) and Return on Equity (ROE)[8]. These are commonly used indicators of operating performance, which allow for the comparison of firms (see, e.g. Hart & Ahuja (1996)). The comparative performance indicators are constructed according to the Compustat Data Definitions provided by the ISS Governance Services:

$$ROA = \frac{Income\ Before\ Extraordinary\ Items\ (Available\ for\ Common)}{Total\ Assets}$$

$$ROE = \frac{Income\ Before\ Extraordinary\ Items\ (Available\ for\ Common)}{Common\ Equity\ as\ Reported}$$

where the *Income Before Extraordinary Items (Available for Common)* is defined as income before extraordinary items and discontinued operations minus preferred dividend requirements, but before adding savings due to common stock equivalents; the *Total Assets* is defined as the sum of current assets, net property, plant, and equipment, and other noncurrent assets; and *Common Equity as Reported* is defined as the common shareholders' interest in the company[9].

In addition, again the explanatory variables *Total First Round VC Raised* and *Total Later Round VC Raised* are included, which are log transformed for normality. Moreover, time (quarterly) fixed effects are included in all models, and both sector- and region fixed effects

[8] Additional comparative performance indicators are added to the model as explained variables for robustness reasons, the methodology and results for these models are presented in Appendix B.

[9] The construction of both explained variables follows from the Compustat Data Definitions provided by the ISS Governance Services, which is available here:
https://www.issgovernance.com/file/files/CompanyFinancials_DataDefinitions.pdf

are included as controls[10]. Final, the correlations show no signs of problematic multicollinearity, and in both the Logit and the RE model robust standard errors are applied to deal with possible heteroscedasticity.

[10] The sector division follows the major groups division of the standard industrial classification (SIC - siccode.com). The state division over economic regions follows from the Bureau of Economic Analysis (BEA - http://www.bea.gov/regional/docs/regions.cfm) and is shown in Appendix A.

5. Results

As described in the previous chapter, a variety of tests are performed to conclude upon the set hypotheses. In this chapter, the corresponding results are presented. Firstly, the outcomes of the tests concerning the effects of the crisis on the VC industry are presented. Secondly, the results of the firm level analysis are presented, which show the effects of the crisis on VC-backed firms. Lastly, the results are summarized and discussed.

5.1 Results VC Industry Analysis

Figure 1 shows the development of VC activity in the United States from January 2006 to December 2015 based on the complete aggregated data sample. From the figure, one can observe the trend that both the number of funding rounds- and the total amount of VC investments per month decreased during the crisis. The period before the crisis shows a steady upward trend in VC activity, both in terms of investment volume and number of funding rounds. After the crisis total VC investment appears to be on the rise, whereas the number of funding rounds are following an inverted U-shape trend with its peak in late 2013.

>Insert Figure 1<

Table 6 shows results of the univariate analysis, which concerns the development of the number of funding rounds in the United States during and outside of the crisis.

>Insert Table 6<

From the table a significant lower number of funding rounds during the crisis relative to the period outside of the crisis is observed. This result holds both for the complete 10-year sample (-30.41% and -35.88% mean difference in number of crisis first- and later funding rounds respectively) and for the restricted sample (-58.09% and -8.18% mean difference in number of crisis first- and later funding rounds respectively), which covers the crisis period and one year prior. There is a significant decrease in both the number of first- and later funding rounds in both samples. Compared to the complete sample, the decrease in first round funding during the crisis is more striking for the restricted sample, and the decrease in later round funding during the crisis is less striking for the restricted sample. These results are supported by both a straightforward t-test that compares the difference in mean between the two periods, and the Wilcoxon rank-sum test that compares the difference in median between

the two periods. Overall, from **Table 6** I conclude that hypothesis **H1a** is confirmed; the number of VC funding rounds is lower during the Financial Crisis for both first- and later round funding.

>Insert Table 7<

Moving on to the regression results for the raised amount of VC investment in the United States, **Table 7** presents the results for the complete sample. Models 1 and 2 find that the main explanatory variable *Financial Crisis* is associated with a lower raised amount of VC investment for firms during the crisis compared to outside the crisis, this is significant at the 1% level for the OLS regression and at the 5% for the Quantile regression. During the crisis, the mean amount of funds raised in a funding round decreased by 6.8% (e.g. Model 1: $\beta = -0.068$, $p < 0.01$), whereas the median amount of funds raised decreased by 5.4% (e.g. Model 2: $\beta = -0.054$, $p < 0.05$). Moreover, Models 1 and 2 estimate significant positive effects at the 1% level for the remaining three explanatory variables of interest. Firstly, in later funding rounds a significant higher amount of VC funds is raised, compared to first round funding, ceteris paribus (e.g. Model 2: $\beta = 0.195$, $p < 0.01$). Secondly, firms funded by a syndicate are associated with a significant higher amount raised, compared to funding rounds with a single investor, ceteris paribus (e.g. Model 2: $\beta = 0.891$, $p < 0.01$). Thirdly, firms that are older at a funding round raise significant higher amounts of VC funding, ceteris paribus (e.g. Model 2: $\beta = 0.146$, $p < 0.01$). Furthermore, the startup stage shows to have a significant impact on the raised amount by firms. In general, the further a startup is in terms of development, the higher the amount of VC raised in a funding round. In terms of sectoral effects, it is observed that the Finance, Insurance & Real Estate sector raise a significant higher amount of VC funding, and the Services sector a significant lower amount of VC funding, compared to the Transportation & Public Utilities sector. **Table 7** also presents the robustness checks in terms of funding rounds. Models 3 and 4 show no significant relationship between the Financial Crisis and the raised amount of first round VC investments (e.g. Model 4: $\beta = 0.037$, $p > 0.1$). In contrast, Models 5 and 6 show that the Financial Crisis is associated with a lower raised amount of later round VC investments for firms compared to non-crisis times, this is significant at the 1% level for both regression methods (e.g. Model 6: $\beta = -0.084$, $p < 0.01$). The conclusions on the other explanatory variables remain similar.

As the complete sample may lead to biased results, it is important to also look at the results from the restricted sample that covers the crisis period and one year prior.

>Insert Table 8<

Table 8 presents the results for the restricted sample. Models 1 and 2 show that the main explanatory dummy variable Financial Crisis is associated with a lower raised amount of VC investment for firms compared to non-crisis times, this is significant at the 1% level for both regression models. During the crisis, the mean amount of funds raised in a funding round decreased by 8.6% (e.g. Model 1: $\beta = -0.086$, $p < 0.01$), whereas the median amount of funds raised decreased by 12.3% (e.g. Model 2: $\beta = -0.123$, $p < 0.01$). Moreover, the only other explanatory variable that has significant results is the syndicate dummy variable, which is positively significant at the 1% level. Funding by a syndicate results in a significant higher amount of VC funds raised, compared to funding rounds with a single investor, ceteris paribus (e.g. Model 2: $\beta = 0.967$, $p < 0.01$). Furthermore, for the Startup Stage variables the findings are similar to those of the complete sample. In general, the further a startup is in terms of development, the higher the amount of VC raised in a funding round. In terms of sectoral effects there are no longer striking significant findings. **Table 8** also presents the results when the sample is split in first- and later funding rounds. In contrast to the earlier discussed results of the complete sample, now Models 3 and 4 show that the Financial Crisis has a significant negative effect on the raised amount of first round VC investments (e.g. Model 4: $\beta = -0.146$, $p < 0.05$). Moreover, for later round funding the results are less striking as Model 5 shows a significant negative effect at the 5% level and Model 6 no significant results. The conclusions on the other explanatory variables, as well as the startup stage and sector variables remain similar to those of Models 1 and 2 of the restricted sample.

Overall, I observe that the financial crisis leads to a lower volume of VC funding, where depending on the comparison period there is a difference in the results when comparing first- and later funding rounds. As the restricted sample is less prone to biases, I argue that this conclusion is particularly valid for first round funding. Thus, I conclude that the results confirm hypothesis **H1b**; the volume of VC funding is lower during the Financial Crisis. However, it is important to note that this effect is more significant for first round funding as compared to later round funding. As a final remark, the explanatory power of the models is acceptable (e.g.

R^2 = 0.15 in Model 1 and the Pseudo R^2 = 0.10 in Model 2 of the complete sample, and higher for the restricted sample).

5.2 Results VC-backed Firms Analysis

Table 9 presents the result concerning the probability of going public by VC-backed firms, which is used to conclude upon hypothesis **H2**.

>Insert Table 9<

First of all, the findings in Models 1 and 2 are extremely similar, with no major differences in signs or magnitude. Therefore, discussing both would be superfluous and I will discuss the results of Model 2 as it has a slightly better fit according to the Bayesian- and Aikaike Information Criterion. The results show that the odds of firms that received VC funding during the crisis to go public are 38.1% higher than the odds of firms that did not receive VC funding during the crisis, ceteris paribus. This finding is significant at the 10% level. Furthermore, firms that raised higher amounts of total first round VC funding are more likely to go public, this is significant at the 1% level. In addition, firms that raised higher amounts of total later round VC funding are more likely to go public, which is also significant at the 1% level. Moreover, firms active in the Mining & Construction-, and Manufacturing sector are significantly more likely to go public than firms active in the Transportation & Public Utilities sector, ceteris paribus. These findings are significant at the 5% level. No significant relationship is found between the firm age at the first VC round and the probability of going public. Lastly, the explanatory power of the Logit models is acceptable (e.g. Pseudo R^2 = 0.105 in Model 1 & Pseudo R^2 = 0.129 in Model 2). Overall, I observe that firms selected for VC funding during the crisis are more likely to go public than firms that did not receive VC funding during the crisis. Hence, hypothesis **H2** is confirmed.

>Insert Table 10<

Secondly, **Table 10** presents the results concerning the performance of public firms. As the Sector- and Region fixed effects are not jointly significant at the 10% level, the results of Models 2 and 4 are not be concluded upon. For Model 1 the results do not show a significant relationship between a firm receiving VC funds during the crisis, as compared to a firm not receiving VC funds during the crisis, and the return on assets. Also, for the remaining explanatory variables there are no statistically significant findings. Furthermore, Model 3 does

not find a significant relationship between a firm receiving VC funds during the crisis, as compared to a firm not receiving VC funds during the crisis, and the return on equity. Model 3 does show a negative relationship between receiving higher total later round VC funding and the return on equity, which is significant at the 5% level. Lastly, it is important to note that the explanatory power of the models is fairly low (e.g. Overall $R^2 = 0.042$ in Model 1 & Overall $R^2 = 0.019$ in Model 3). Finally, as no significant relationships are found between firms that are VC funded during the crisis and a higher return on assets or equity, I conclude that hypothesis **H3** cannot be confirmed. For robustness reasons, the model is also tested using less common comparative performance indicators, the Return on Sales (ROS) and Return on Investment (ROI), for which the results are presented in **Appendix B**. Only a weakly significant ($p < 0.1$) positive relationship is found between a firm receiving VC funds during the crisis and its return on sales. However, as the finding is only weakly significant and the explaining power of the model low (e.g. Overall $R^2 = 0.026$ in Model 1), there is no reason to change the conclusions surrounding hypothesis **H3**.

5.3 Discussion of the Results

Summarizing the main results, the empirical analysis shows that the Financial Crisis has a negative impact on VC activity in the United States. Even though the VC industry did not come to an abrupt halt, a clear decline in both the volume of VC funding and the number of funding rounds during the crisis is observed. However, these effects appear to be more significant for first round funding as compared to later round investments. Moreover, it is found that firms that were scouted for VC funds during the crisis are more likely to go public than firms that did not receive funding during the crisis. Yet, no evidence is found that these scouted firms, once public, outperform VC-backed public firms that did not receive VC funds during the crisis.

The results show that the VC industry is clearly hit by the crisis. The finding that both the number of funding rounds and the volume of VC investments is lower in this harsh economic context complements the findings of Block and Sandner (2009) and Block et al. (2010). In contrast to the early findings of Block and Sandner (2009) on United States based internet startups, my results indicate that the largest impact of the crisis is on first round funding. This partly supports the findings of Block et al. (2010), who also observe the strongest decrease in the number of funding rounds to concern first round funding. Yet, the authors highlight the strongest decrease in investment volume to occur in later funding rounds. As their empirical

analysis is completely univariate, I state that the multivariate analysis conducted in this thesis may proof more robust.

The main argument for the decline in VC activity during the crisis proposed by Block et al. (2010) concerns stricter investment criteria by VC firms. In addition, De Vries and Block (2011) argue that VC firms are expected to prioritize their engagement with core projects during the crisis. Elaborating on these arguments, I reason that the selection effects are a result of VC firms retreating to their core scouting function in a harsh economic context. As the growth prospects of startups, and the fundraising ability- and exit strategies of VCs are more uncertain, VC firms become more critical and postpone investments. This is a straightforward strategy in dealing with the high levels of uncertainty surrounding both VCs their investors and investees during the crisis. The pursued reduction of risk exposure also explains why, in general, syndicates are associated with higher investment volumes. VCs are more willing to commit when multiple investors collaborate, as it diversifies their portfolio and spreads the risk. Essentially, VCs retreat to their core functions when they are confronted with the choice to partly write off investments or to commit in a difficult economic context. The observed lower number of later funding rounds indicates the postponement or termination of struggling portfolio investments. Still, the amount of funds raised in the lower number of later funding rounds is not significantly lower. Moreover, investments in later startup stages carry higher amounts of funds than early stage investments. This is unexpected, as the illiquidity of the IPO market is expected to result in a focus of VC firms on early-stage projects (Cumming, Fleming, & Schwienbacher, 2005). A possible explanation for this observation is that the return to the core function of VCs is not limited to stricter scouting, but also leads to more focused coaching. Despite the unhealthy state of the IPO market, VC firms remain hesitant to write off portfolio investments. Moreover, the lowered fundraising ability raises the need for alternative methods of money generation in order to secure the VC's future. Postponing exit mechanisms may be an attractive option to limit uncertainty, but cannot be the encompassing answer to survival. It is likely that VCs are strictly scouting firms for follow-up investments to maximize returns on previous commitments. For this internal scouting to be successful, efficient coaching of these firms is required, as they are forced to adapt to the new economic context. The fall in the number of VC funds is likely to allow for more focused coaching, which could explain the stability of the volume of later round investments. In a nutshell, VCs critically scout

high potential firms which they have previously committed to, and coach them to obtain the maximal return in a difficult economic context, resulting in the need for later round investments to assure the best possible exit mechanism.

In conclusion, I argue that the lower VC activity in first funding rounds, both in terms of number and volume of investments, is most likely to be due to stricter scouting. This retreat to the core function of scouting is a result of the lower fundraising ability of VCs and the illiquidity of exit markets caused by the difficult temporal context. Moreover, the lower number of follow-up investments may be explained by VC firms seeking to limit risk exposure during the crisis, resulting in the postponement or even writing-off of portfolio investments. Yet, the fairly stable volume of follow-up investments points to VC's willingness to maximize returns on previous commitments. In order to survive, the generation of funds is key. I argue that effective (internal) scouting combined with focused coaching are the main reasons explaining the results, and that these core functions are likely to be the VC's best option to raise funds while their investors are struggling.

Furthermore, the findings for the firm level analysis support the argument that VCs retreat to their core functions during the crisis. The results show that firms selected for VC funds during the crisis are more likely to go public than firms that did not make the cut. Again, despite the unhealthy state of the IPO market, taking a firm public remains the most common successful exit mechanism used by VCs (Black & Gilson, 1998; Brander, Amit, & Antweiler, 2002). The success of crisis-selected firms is not merely an indication of successful scouting, but also a sign of efficient coaching to help these firms reach their potential in times of high uncertainty. This conclusion supports the balanced stance of Baum and Silverman (2004) in the coach versus scout debate, indicating the importance of both VC functions. As a final remark, the results concerning the long term performance of crisis-selected firms do not allow for further conclusions on the coach function of VCs. These firms do not appear to outperform public firms that received VC funds outside of the crisis. Still, as there is also no evidence for underperformance of these firms on the stock market, the earlier conclusions cannot be nullified by potential grandstanding of VC firms.

6. Conclusions

The empirics in this thesis highlight a significant decrease in VC activity caused by the Financial Crisis. The implications for the evolution of innovative industries are worrisome, as VC funds are the main financing mode for innovative projects (Bergemann & Hege, 1998). A country's innovative capacity is likely to be negatively affected by startups unable to fill the early-stage funding gap (Block & Sandner, 2009). As argued by Block et al. (2010), governments may look to liberalize bankruptcy laws, reevaluate tax policy, and legalize the investment of pension funds in VC. These legal reforms could soften the impact of the crisis on the VC market, as the country's regulatory framework is found to be crucial to VC activity (Armour & Cumming, 2006; Kortum & Lerner, 2000). In addition, it may seem straightforward to use public funds to fill the early-stage funding gap, however, this solution may be counterproductive in the long-run as Cumming and MacIntosh (2006) highlight problematic crowding-out effects.

Naturally, the implications for the VC industry affect innovative firms in multiple ways. Early stage startups seeking initial funding may face a discount in valuation or may even be completely unable to attract VC funding. The aim of this thesis is to determine to what extent the macroeconomic context in which VCs invest impacts their investees, while considering the effects of the crisis. The results indicate a retreat of VCs to their core function of critical scouting and focused coaching, resulting in a stricter selection of both initial and follow-up investments. Hence, in order to still attract VC funds, it is key for entrepreneurs to adapt their business plans to the changing economic context. Just as the strategy of VCs to postpone investments, innovative firms may need to postpone raising (suboptimal) VC funding due to their lower valuation in times of crisis. Furthermore, entrepreneurs might have to turn to alternative types of funding, such as crowdfunding or business angels (Block, De Vries, & Sandner, 2010). Concluding upon the aim of this thesis, the retreat of VCs to their core function results in a smaller selection of firms receiving funding. I find that despite the difficult economic context these critically scouted firms show to be eligible for the most common successful VC exit mechanism after being coached successfully. At last, this highlights the success of the core function of VC firms, but also raises concern about a country's innovative capacity as fewer innovative firms have access to smart capital financing in times of crisis.

6.1 Limitations and Directions for Further Research

The results that were discussed in this thesis should be approached with some caution, mainly due to limitations surrounding the data. First of all, the VentureXpert database does not provide global identifier codes, but solely the name of the company receiving VC. Despite careful manipulation of this crude identifier, the outcome from the Orbis batch search on company name may contain errors. These matching problems also limited the possibility of including additional variables of interest, which, for example, did not allow to distinguish between different types of venture capital firms (e.g., Specialized Venture Capital firms vs. Corporate Venture Capital firms). Moreover, I was only able to obtain firm level data for active public firms. Hence, my research suffers from the common sample selection problem of overrepresenting successful firms. For non-public firms I was unable to obtain sufficient data and even for the public firms the sample is rather limited. Also, because both the sector- and region variables turned out to be jointly insignificant, the controls used for the firm level analysis are rather limited. Lastly, despite the careful choice for focusing on the United States VC industry, the effect of the crisis on VCs and its investees in other regions may be fairly different.

The limitations regarding available data do provide for good starting points for further research. Whereas the effect of the crisis on the VC industry has been explored, empirical research on the VC's function in combination with their investees performance in this temporal context is, to the best of my knowledge, completely new. More extensive firm level data could tell more about the coach- and scout function of VCs during the crisis. For example, is there a shift from being more scout (coach) focused to being more coach (scout) focused in a changing economic context? Moreover, are there differences in the success of both VC firms and their investees when the strategy of the VC leans more to either picking- or building winners? Disentangling the selection- from treatment effects requires extensive firm level data, but covers a field of research that has not been explored in combination with the temporal context of VC. I believe, that there is much to be gained in this field of research as it touches upon the core function of the vibrant VC industry as well as the drivers and needs behind innovative startups. Ultimately, these factors are likely to influence the real economy through stimulating a country's innovative capacity, which is a relationship that also allows for further research.

Acknowledgement

I would like to greatly thank my thesis supervisor Dr. Spyridon Stavropoulos for providing very useful advice throughout the process as well as his pleasant guidance and responsiveness.

References

Aldrich, H., & Auster, E. (1986). Even dwarfs started small: liabilities of age and size and their strategic implications. *Research in Organizational Behavior, 8*, 165-198.

Armour, J., & Cumming, D. (2006). The Legislative Road to Silicon Valley. *Oxford Economic Papers, 58*, 596-635.

Baum, J., & Silverman, B. (2004). Picking winners or building them? Alliance, intellectual, and human capital as selection criteria in venture financing and performance of biotechnology startups. *Journal of Business Venturing, 19*, 411-436.

Bergemann, D., & Hege, U. (1998). Venture capital financing, moral hazard, and learning. *Journal of Banking & Finance, 22*(6), 703-735.

Bertoni, F., Colombo, M., & Grilli, L. (2011). Venture capital financing and the growth of high-tech start-ups: Disentangling treatment from selection effects. *Research Policy, 40*, 1028-1043.

Black, B., & Gilson, R. (1998). Venture capital and the structure of capital markets: banks versus stock markets. *Journal of Financial Economics, 47*, 243-277.

Block, J., & Sandner, P. (2009). What is the effect of the financial crisis on venture capital financing? Empirical evidence from US Internet start-ups. *Venture Capital*, 195-309.

Block, J., De Vries, G., & Sandner, P. (2010). Venture Capital and the Financial Crisis: An Empirical Study Across Industries and Countries. In *The Oxford Handbook of Venture Capital* (pp. 37-61). Oxford University Press.

Brander, J., Amit, R., & Antweiler, W. (2002). Venture-Capital Syndication: Improved Venture Selection vs. the Value Added Hypothesis. *Journal of Economics & Management Strategy, 11*(3), 423-452.

Branscomb, L., & Auerswald, P. (2002). *Between Invention and Innovation: An Analysis of Funding for Early-Stage Technology Development.* Gaithersburg: NIST GCR 02-841.

Carter Hill, R., Griffiths, W., & Lim, G. (2012). *Principles of Econometrics* (4th ed.). Asia: Wiley.

Chan, Y. (1983). On the Positive Role of Financial Intermediation in Allocation of Venture Capital in a Market with Imperfect Information. *The Journal of Finance, 38*(5), 1543-1568.

Colombo, M., & Grilli, L. (2009). A capital partnership: how human and venture capital affect the growth of high-tech start-ups. *Strategic Change*(18), 231-239.

Colombo, M., & Grilli, L. (2010). On growth drivers of high-tech start-ups: Exploring the role of founders' human capital and venture capital. *Journal of Busines Venturing*(25), 610-626.

Cumming, D., & Johan, S. (2007). Advice and monitoring in venture finance. *Financial Markets and Portfolio Management, 21*(1), 3-43.

Cumming, D., & MacIntosh, J. (2006). Crowding Out Private Equity: Canadian Evidence. *Journal of Business Venturing*(21), 569-609.

Cumming, D., Fleming, G., & Schwienbacher, A. (2005). Liquidity Risk and Venture Capital Finance. *Financial Management, 34*(4), 77-105.

De Vries, G., & Block, J. (2011). Venture capital syndication in times of economic crisis. *Venture Capital, 13*(3), 195-213.

Giot, P., & Schwienbacher, A. (2007). IPOs, trade sales and liquidations: Modelling venture capital exits using survival analysis. *Journal of Banking & Finance*, 679-702.

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

Gompers, P., & Lerner, J. (2004). *The Venture Capital Cycle.* Cambridge: The MIT Press.

Hall, B., & Lerner, J. (2010). The financing of R&D and innovation. *Handbook in Economics, 1*, 610-635.

Hall, J., & Hofer, C. (1993). Venture capitalists' decision criteria in new venture evaluation. *Journal of Business Venturing, 8*(1), 25-42.

Hart, S., & Ahuja, G. (1996). Business Strategy and Environment. *Does it pay to be green? An empirical examination of the relationship between emission reduction and firm performance, 5*, 30-37.

Hellmann, T. (2000). Venture Capitalists: The Coaches of Silicon Valley. *The Silicon Valley Edge*, 276-294.

Hellmann, T., & Puri, M. (2002). Venture Capital and the Professionalization of Start-Up Firms: Empirical Evidence. *The Journal of Finance, 57*(1), 196-197.

Hochberg, Y., Ljungqvist, A., & Lu, Y. (2007). Whom You Know Matters: Venture Capital Networks and Investment Performance. *The Journal of Finance, 62*(1), 251-301.

Holmstrom, B. (1989). Agency Costs and Innovation. *Journal of Economic Behavior and Organization*, 305-327.

Kanter, R. (1989). *When Giants Learn to Dance.* New York: Simon & Schuster.

Kaplan, S., & Stromberg, P. (2001). Venture Capitalists As Principals: Contracting, Screening, and Monitoring. *American Economic Review, 91*, 426-430.

Koenker, R., & Hallock, K. (2001). Quantile Regression. *Journal of Economic Perspectives, 15*(4), 143-156.

Kortum, S., & Lerner, J. (2000). Assessing the Contribution of Venture Capital to Innovation. *The RAND Journal of Economics, 31*(4), 674-692.

Kunze, R. (1990). *Nothing Ventured: The Perils and Payoffs of the Great American Venture Capital Game.* New York: HarperCollins.

Leifer, R., O'Connor, G., & Rice, M. (2001). Implementing radical innovation in mature firms: The role of hubs. *Academy of Management Executive, 15*(3), 102-113.

Mason, C. (2009). Venture capital in crisis? *Venture Capital, 11*(4), 279-285.

Megginson, W., & Weiss, K. (1991). Venture Capitalist Certification in Initial Public Offerings. *The Journal of Finance, 46*(3), 879-903.

Orlowski, L. (2008). Stages of the 2007/2008 Global Financial Crisis: Is There a Wandering Asset-Price Bubble? *Economics E-Journal*(No. 2008-43).

Ritter, J. (2008, December 9). *Some Factoids About the 2008 IPO Market*. Retrieved July 20, 2016, from http://www1.american.edu/academic.depts/ksb/finance_realestate/rhauswald/fin673/673mat/Ritter%20(2008),%20Some%20Factoids%20About%20the%202008%20IPO%20Market.pdf

Schilit, W. (1991). *Dream Makers and Deal Breakers: Inside the Venture Capital Industry.* Englewood Cliffs, New Jersey: Prentice Hall Trade.

Shepherd, D., Ettenson, R., & Crouch, A. (2000). New Venture Strategy and Profitability: A Venture Capitalist's Assessment. *Journal of Business Venturing, 15*, 449-467.

Wang, S., & Zhou, H. (2004). Staged financing in venture capital: moral hazard and risks. *Journal of Corporate Finance, 10*, 131-155.

Zider, B. (1998). 1998. *Harvard Business Review, 76*(6), 131-139.

Tables and Figures

Table 1: Construction of the VentureXpert Sample for VC Industry Analysis.

Total # of U.S. funding rounds in the period January 2006 – December 2015	33731 obs.
- Firm Name is a missing value	43 obs.
- Raised Amount of funds is not disclosed	6106 obs.
- SIC-Code is a missing value	62 obs.
- Firm Age is a missing value	4804 obs.
- Duplicate observations	58 obs.
Final Sample (6751 unique firms)	22658 obs.

Table 2: Variable Description.

Variable name	Description
Raised Amount	VC funds raised in funding round (mln. USD)
Financial Crisis	Dummy variable, 1 if funding occurred between September 2008 and September 2009
Later Round	Dummy variable, 1 if second or later funding round
Syndicate	Dummy variable, 1 if multiple VC investors participate in funding round
Firm Age in Years	Age of firm at funding round in years
Startup Stage	Five dummy variables indicating the stage of the startup at a particular funding round: Seed-, Early-, Later-, Expansion-, or Other Stage[11]
Sector	Seven dummy variables indicating the industry sector in which the startup is active: Mining & Construction; Manufacturing; Wholesale Trade & Retail Trade; Finance, Insurance & Real Estate; Public Administration; Services; and Transportation & Public Utilities

Table 3: Descriptive Statistics and Correlation Table.

	N = 22658	mean	s.d.	min	max	1	2	3	4	5	VIF
1	Raised Amount (ln)	1.818	1.105	0.010	8.079	1					
2	Financial Crisis (d)	0.088	0.283	0	1	-0.02	1				1.00
3	Later Round (d)	0.774	0.419	0	1	0.16	0.01	1			1.23
4	Syndicate (d)	0.767	0.423	0	1	0.30	-0.01	0.05	1		1.00
5	Firm Age in Years (ln)	1.587	0.730	0	4.836	0.18	-0.03	0.43	0.02	1	1.23

Table 3 Notes: Variable 1 is the natural logarithm (ln) of the Raised Amount of VC in million USD. Variable 2, 3 and 4 are dummy variables. Variable 5 is the natural logarithm of the Firm Age in years at a specific funding round. N = number of observations, s.d. = standard deviation, and VIF = Variance Inflation Factor.

[11] The dummy variable *Other Stage* includes startup stages such as: 'Private Investment in Public Equity (PIPE) ', 'Recap or Turnaround', 'Secondary Purchase', 'Secondary Buyout', 'Leveraged Buyout', 'Acquisition', 'Bridge Loan', 'Open Market Purchase', and 'Other'.

Table 4: Construction of the Sample for the Firm Level Analysis.

Final # of Firms from **VentureXpert database**	6751 firms
- Ticker Code (incl. "Unlisted") unobtainable from **Orbis database**	2267 firms
- Did not receive First Round VC funding between January 2006 and December 2015	1110 firms
Final Sample (Hypothesis 2)	3371 firms
↳ Consisting of # of:	
- Public firms	167 firms
- VC-backed firms during crisis	745 firms
- Public- & VC-backed firms during crisis	60 firms
Final # of Public Firms from **Orbis database**	167 firms
- No matching or available data from **Compustat database**	33 firms
Final Sample (Hypothesis 3)	134 firms
↳ Consisting of # of:	
- VC-backed firms during crisis	52 firms
- VC-backed firms outside crisis	82 firms

Table 5: Descriptive Statistics and Correlation Table for Firm IPO Probability.

	N = 3371	**mean**	**s.d.**	**min**	**max**	**1**	**2**	**3**	**4**	**5**
1	Public Firm (d)	0.050	0.217	0	1	1				
2	VC Raised Crisis (d)	0.221	0.415	0	1	0.076	1			
3	Total First Round VC (ln)	14.815	1.431	9.210	20.618	0.144	0.026	1		
4	Total Later Round VC (ln)	12.775	6.995	0	22.500	0.118	0.233	0.076	1	
5	Firm Age in Years at First VC Round (ln)	0.995	0.766	0	4.317	-0.011	-0.084	0.221	-0.205	1

Table 5 Notes: Variable 1 and 2 are dummy variables. Variable 3, 4 and 5 are natural logarithms (ln) of the Total First Round VC, Total Later Round VC, and Firm Age in Years at First VC Round, respectively. N = number of observations, s.d. = standard deviation.

Table 6: Development of the Number of U.S. VC Funding Rounds During and Outside of the Crisis.

		Outside Crisis			During Crisis			Change in # of funding rounds	
Sample	**Funding Stage**	**N**	**Mean**	**Median**	**N**	**Mean**	**Median**	**Mean difference**	**Median difference (Z-value)**
Complete	First Round	4694	48.20	48	433	36.96	37	-30.41%***	15.82***
	Later Round	15982	163.79	167	1549	120.54	118	-35.88%***	44.03***
Restricted	First Round	686	58.43	57	433	36.96	37	-58.09%***	22.98***
	Later Round	1535	130.40	130	1549	120.54	118	-8.18***	14.24***

*Table 6 Notes: ***p<0.01, **p<0.05, *p<0.1. N = Number of funding rounds. The Crisis period runs from September 2008 till September 2009. For the Complete Sample the Outside Crisis period covers the remaining months between January 2006 and December 2015. For the Restricted Sample the Outside Crisis period covers the 12 months leading up to the crisis. The significance of the difference in mean is tested by a two sided t-test (p-value). The difference in median is tested by a Wilcoxon rank-sum test (Z-value), which is also known as the Mann-Whitney two sample test.*

Table 7: VC Investment in the U.S. from January 2006 till December 2015.

Complete Sample	(1) OLS	(2) QR	(3) FR OLS	(4) FR QR	(5) LR OLS	(6) LR QR
Financial Crisis (dummy)	-0.068***	-0.054**	0.016	0.037	-0.098***	-0.084***
	(0.023)	(0.027)	(0.045)	(0.076)	(0.027)	(0.028)
Later Round (dummy)	0.166***	0.195***				
	(0.018)	(0.022)				
Syndicate (dummy)	0.759***	0.891***	0.465***	0.468***	0.861***	1.065***
	(0.019)	(0.020)	(0.027)	(0.035)	(0.023)	(0.023)
Firm Age in Years (ln)	0.129***	0.146***	0.156***	0.223***	0.106***	0.090***
	(0.021)	(0.018)	(0.025)	(0.028)	(0.027)	(0.023)
Startup Stage: Early	0.115***	0.122***	0.041	0.028	0.212***	0.212***
	(0.028)	(0.030)	(0.032)	(0.043)	(0.046)	(0.058)
Startup Stage: Later	0.323***	0.345***	0.468***	0.453***	0.391***	0.442***
	(0.047)	(0.046)	(0.076)	(0.094)	(0.062)	(0.068)
Startup Stage: Expansion	0.438***	0.469***	0.442***	0.447***	0.497***	0.532***
	(0.038)	(0.036)	(0.053)	(0.060)	(0.053)	(0.060)
Startup Stage: Other	-0.033	-0.312***	0.203**	-0.318***	0.018	-0.198***
	(0.055)	(0.053)	(0.102)	(0.120)	(0.069)	(0.073)
Sector: Mining & Construction	-0.052	-0.091	0.068	0.102	-0.078	-0.107
	(0.185)	(0.109)	(0.232)	(0.448)	(0.200)	(0.173)
Sector: Manufacturing	-0.034	0.004	-0.034	-0.031	-0.034	-0.000
	(0.070)	(0.057)	(0.085)	(0.131)	(0.080)	(0.063)
Sector: Wholesale Trade & Retail Trade	-0.005	-0.077	-0.248**	-0.345**	0.065	0.012
	(0.091)	(0.076)	(0.101)	(0.152)	(0.107)	(0.097)
Sector: Finance, Insurance & Real Estate	0.261**	0.302***	0.276**	0.239	0.249*	0.294***
	(0.112)	(0.084)	(0.136)	(0.149)	(0.134)	(0.108)
Sector: Services	-0.157**	-0.187***	-0.256***	-0.317**	-0.136*	-0.181***
	(0.069)	(0.056)	(0.082)	(0.127)	(0.079)	(0.061)
Sector: Public Administration	0.154	0.088	0.409	-0.165	0.097	0.047
	(0.309)	(0.121)	(0.375)	(0.128)	(0.364)	(0.255)
Constant	0.773***	0.569***	1.045***	0.948***	0.820***	0.639***
	(0.072)	(0.062)	(0.085)	(0.133)	(0.092)	(0.085)
Observations	22,658	22,658	5,129	5,129	17,529	17,529
R-squared	0.154		0.143		0.137	
Pseudo R-squared		0.103		0.089		0.098

*Table 7 Notes: Robust standard errors in parentheses, ***p<0.01, **p<0.05, *p<0.1. The complete sample is taken into account, with the Financial Crisis running from September 2008 till September 2009. The explained variable is the natural logarithm of the raised amount in a funding round per company per month in million USD. Model 1, 3 and 5 are Ordinary Least Squared regression estimates. Model 2, 4 and 6 are Quantile Regression estimates. Model 1 and 2 cover the entire sample. Model 3 and 4 only look at first round (FR) funding, whereas model 5 and 6 only take later round (LR) funding into account. In all models the Startup Stage dummy Seed Stage, and the Sector dummy Transportation & Public Utilities are the reference categories. An F-test of the joint significance of both the Startup Stage and Sector variables is significant in all models (p<0.001).*

Table 8: VC investment in the U.S. from September 2007 till September 2009.

Restricted Sample	(1) OLS	(2) QR	(3) FR OLS	(4) FR QR	(5) LR OLS	(6) LR QR
Financial Crisis (dummy)	-0.086***	-0.123***	-0.105*	-0.146**	-0.068**	-0.072
	(0.029)	(0.036)	(0.054)	(0.070)	(0.034)	(0.044)
Later Round (dummy)	-0.008	0.026				
	(0.037)	(0.043)				
Syndicate (dummy)	0.782***	0.967***	0.581***	0.693***	0.894***	1.099***
	(0.038)	(0.043)	(0.054)	(0.074)	(0.049)	(0.049)
Firm Age in Years (ln)	0.038	0.014	0.066	0.107*	0.009	-0.000
	(0.032)	(0.035)	(0.048)	(0.059)	(0.041)	(0.047)
Startup Stage: Early	0.195***	0.241***	0.125**	0.146*	0.236***	0.292***
	(0.050)	(0.064)	(0.062)	(0.088)	(0.079)	(0.093)
Startup Stage: Later	0.528***	0.638***	0.594***	0.738***	0.541***	0.624***
	(0.074)	(0.090)	(0.144)	(0.158)	(0.098)	(0.113)
Startup Stage: Expansion	0.585***	0.620***	0.592***	0.497***	0.592***	0.626***
	(0.064)	(0.075)	(0.101)	(0.127)	(0.088)	(0.097)
Startup Stage: Other	0.257**	-0.052	0.634**	0.708	0.235*	-0.030
	(0.115)	(0.162)	(0.287)	(0.692)	(0.135)	(0.175)
Sector: Mining & Construction	0.281	0.366	0.857*	0.755	0.100	0.284
	(0.318)	(0.246)	(0.484)	(0.649)	(0.371)	(0.371)
Sector: Manufacturing	0.122	0.214*	0.124	0.019	0.124	0.191
	(0.091)	(0.116)	(0.175)	(0.217)	(0.099)	(0.122)
Sector: Wholesale Trade & Retail Trade	-0.089	-0.118	-0.136	-0.238	-0.051	-0.072
	(0.136)	(0.193)	(0.229)	(0.298)	(0.158)	(0.233)
Sector: Finance, Insurance & Real Estate	0.172	0.338*	0.550**	0.476	-0.008	0.161
	(0.172)	(0.194)	(0.271)	(0.363)	(0.211)	(0.188)
Sector: Services	-0.142	-0.062	-0.135	-0.204	-0.138	-0.038
	(0.089)	(0.113)	(0.170)	(0.206)	(0.096)	(0.119)
Sector: Public Administration	0.162	0.129	Omitted	Omitted	0.229	0.133
	(0.306)	(0.136)			(0.306)	(0.155)
Constant	0.850***	0.601***	0.965***	0.897***	0.772***	0.511***
	(0.100)	(0.128)	(0.174)	(0.221)	(0.127)	(0.152)
Observations	4,203	4,203	1,119	1,119	3,084	3,084
R-squared	0.187		0.202		0.170	
Pseudo R-squared		0.117		0.113		0.116

*Table 8 Notes: Robust standard errors in parentheses, ***p<0.01, **p<0.05, *p<0.1. The sample is restricted to the Financial Crisis (September 2008-September 2009) and one year prior. The explained variable is the natural logarithm of the raised amount in a funding round per company per month in million USD. Model 1, 3 and 5 are Ordinary Least Squared regression estimates. Model 2, 4 and 6 are Quantile Regression estimates. Model 1 and 2 cover the entire restricted sample. Model 3 and 4 only look at first round (FR) funding, whereas model 5 and 6 only take later round (LR) funding into account. In all models the Startup Stage dummy Seed Stage, and the Sector dummy Transportation & Public Utilities are the reference categories. An F-test of the joint significance of both Startup Stage and Sector variables is significant in all models (p<0.001).*

Table 9: Probability of going Public by VC-backed Firms.

Logit Model	(1)		(2)	
	Coef.	OR	Coef.	OR
VC-backed Crisis (d)	0.404**	1.498**	0.323*	1.381*
	(0.173)	(0.260)	(0.177)	(0.245)
Total First Round VC Raised (ln)	0.544***	1.723***	0.521***	1.684***
	(0.085)	(0.147)	(0.088)	(0.149)
Total Later Round VC Raised (ln)	0.112***	1.118***	0.106***	1.112***
	(0.031)	(0.034)	(0.030)	(0.034)
Firm Age at First VC Round (ln)	-0.095	0.909	-0.092	0.912
	(0.124)	(0.113)	(0.124)	(0.113)
Sector: Mining & Construction			2.687**	14.689**
			(1.266)	(18.592)
Sector: Manufacturing			2.350**	10.490**
			(1.034)	(10.844)
Sector: Wholesale Trade & Retail Trade			1.767	5.854
			(1.127)	(6.599)
Sector: Finance, Insurance & Real Estate			Omitted	Omitted
Sector: Services			1.550	4.712
			(1.037)	(4.888)
Sector: Public Administration			Omitted	Omitted
Constant	-12.944***	0.000***	-14.294***	0.000***
	(1.274)	(0.000)	(1.801)	(0.000)
Observations	3,371		3,326	
Pseudo R-squared	0.105		0.129	
AIC	1199.47		1171.507	
BIC	1230.47		1226.493	

*Table 9 Notes: Robust standard errors in parentheses, ***p<0.01, **p<0.05, *p<0.1. The explained variable is the dummy variable that takes value 1 if a firms goes public. Both Model (1) and (2) represent logit models, and report both the coefficients (Coef.) and the odds ratio's (OR). Model (2) includes the Sector dummy variables, where the Sector dummy Transportation & Public Utilities is the reference category. An F-test of the joint significance of the Sector variables is significant in Model (2) (p<0.001).*

Table 10: Performance of VC-backed Public Firms.

Random Effects – Explained variable:	(1) ROA	(2) ROA	(3) ROE	(4) ROE
VC-backed Crisis (d)	0.090	0.124*	0.150	0.156
	(0.056)	(0.075)	(0.214)	(0.237)
Total First Round VC Raised (ln)	0.086	0.116	-0.008	-0.003
	(0.061)	(0.079)	(0.080)	(0.075)
Total Later Round VC Raised (ln)	0.083	0.082	-0.035**	-0.047***
	(0.069)	(0.064)	(0.016)	(0.018)
Constant	-2.973	-3.430	0.194	0.474
	(1.870)	(2.116)	(1.380)	(1.256)
Observations	1,496	1,496	1,496	1,496
Number of ID	134	134	134	134
Quarterly FE	YES	YES	YES	YES
Sector FE		YES		YES
Region FE		YES		YES
Overall R-squared	0.042	0.048	0.019	0.023

*Table 10 Notes: Robust standard errors in parentheses, ***p<0.01, **p<0.05, *p<0.1. The explained variable in Model (1) and (2) is Return on Assets, and in Model (3) and (4) Return on Equity. All models are estimated by a Random-Effects model with Quarterly Fixed-Effects. Models (2) and (4) include Sector- and Region Fixed-Effects, an F-test of the joint significance of both these control groups is insignificant in both models (p>0.1).*

Figure 1: VC activity in the U.S. from January 2006 till December 2015.

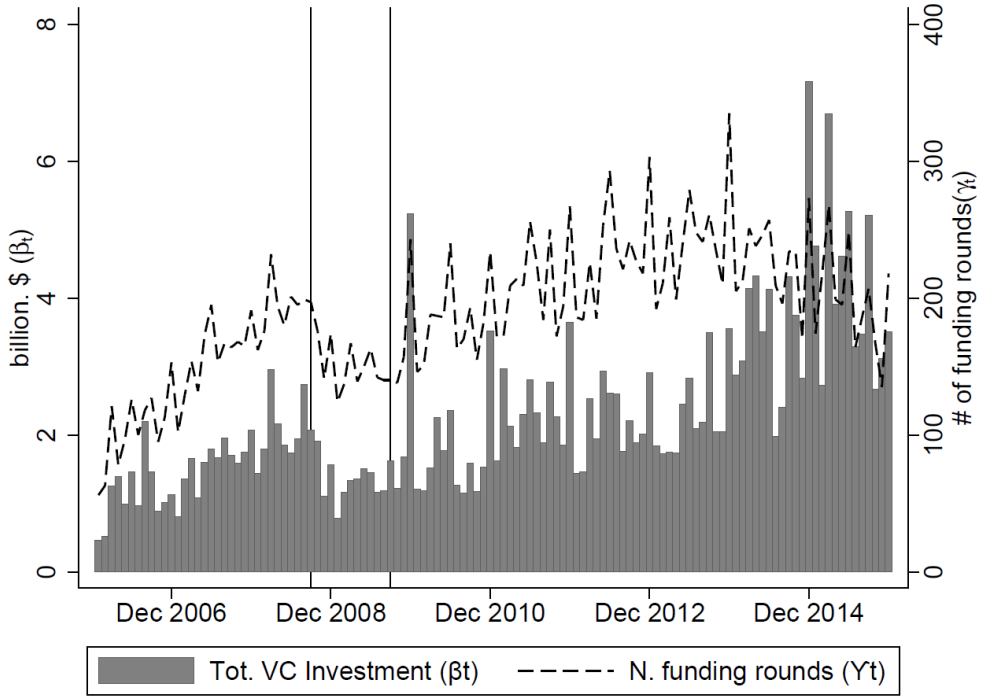

Figure 1 Notes: This figure is based on the complete aggregated monthly data derived from the VentureXpert database. The vertical lines represent the Financial Crisis, which lasted from September 2008 till September 2009.

Appendices

Appendix A: State Division over Economic Regions.

Economic Region	States
New England	Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont
Mideast	Delaware, District of Columbia, Maryland, New Jersey, New York, and Pennsylvania
Great Lakes	Illinois, Indiana, Michigan, Ohio, and Wisconsin
Plains	Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, and South Dakota
Southeast	Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Virginia, and West Virginia
Southwest	Colorado, Idaho, Montana, Utah, and Wyoming
Far West	Alaska, California, Hawaii, Nevada, Oregon, and Washington

Source: Bureau of Economic Analysis (http://www.bea.gov/regional/docs/regions.cfm)

Appendix B: Performance of VC-backed Public Firms – Additional Indicators.

Random Effects – Explained variable:	(1) ROS	(2) ROS	(3) ROI	(4) ROI
VC-backed Crisis (d)	0.534*	0.704**	0.032	-0.043
	(0.292)	(0.320)	(0.353)	(0.414)
Total First Round VC Raised (ln)	0.048	0.029	0.087	0.098
	(0.103)	(0.093)	(0.093)	(0.094)
Total Later Round VC Raised (ln)	0.012	0.019	0.008	-0.001
	(0.028)	(0.030)	(0.021)	(0.019)
Constant	-1.438	-1.423	-1.841	-1.781
	(1.944)	(1.780)	(1.606)	(1.626)
Observations	1,338	1,338	1,485	1,485
Number of ID	102	102	134	134
Quarterly FE	YES	YES	YES	YES
Sector FE		YES		YES
Region FE		YES		YES
Overall R-squared	0.026	0.034	0.009	0.016

*Appendix B Notes: Robust standard errors in parentheses, ***p<0.01, **p<0.05, *p<0.1. The explained variable in Model (1) and (2) is Return on Sales, and in Model (3) and (4) Return on Investment. All models are estimated by a Random-Effects model with Quarterly Fixed-Effects. Models (2) and (4) include Sector- and Region Fixed-Effects, an F-test of the joint significance of both these control groups is insignificant in both models (p>0.1). The explained variable construction is as follows:*

$$ROS = \frac{Net\ Income\ (Before\ Interest\ and\ Tax)}{Net\ Sales}$$

$$ROI = \frac{Income\ Before\ Extraordinary\ Items\ (Available\ for\ Common)}{Total\ Invested\ Capital}$$

where *Net Income (Before Interest and Tax)* is operating and non-operating income before taxes and minority interest; the *Income Before Extraordinary Items (Available for Common)* is defined as income before extraordinary items and discontinued operations minus preferred dividend requirements, but before adding savings due to common stock equivalents; and *Total Invested Capital* is the sum of the following items: Total Long-Term Debt, Preferred Stock, Minority Interest, and Total Common Equity [12].

[12] The construction of both explained variables follows from the Compustat Data Definitions provided by the ISS Governance Services, which is available here:
https://www.issgovernance.com/file/files/CompanyFinancials_DataDefinitions.pdf