

Venture capital and the financial crisis

*A comparison of the effects of the financial crisis on the venture capital industry in the
United States and Europe*

M.A.L.M. Breukers BSc

Erasmus University Rotterdam

Supervisor: Ph.D. A.G. De Vries

Name: Michel Arthur Leon Marie Breukers

Student No.: 363223

Phone: 06-10575981

E-mail: m.breukers@student.es.nl

Abstract

Venture capital investment has developed throughout the years as an important financial intermediary for start-up firms. Notwithstanding its fundamental role, the effects of an economic crisis on venture capital have not been widely explored within contemporary scientific research. The primary focus of this research is to analyze the effects of the financial crisis on the level of syndication and the investments of independent, institutional, public, corporate and financial venture capital firms. In addition, differences in the effects of the financial crisis between the United States and European venture capital industries are explored.

The results show that the level of syndication decreases due to the financial crisis in both the United States and Europe. Furthermore, during the crisis, the level of syndication tends to be higher in the European venture capital industry. Although institutional and financial venture capital firms rely more on the IPO market, the results indicate that they are affected less by the crisis. When comparing the effects of the financial crisis between the United States and European venture capital firms, this research shows that the United States venture capital industry saw more negative effects from the financial crisis.

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1. Introduction

Innovative start-up firms are an important determinant of the economic growth within a country. Despite its importance, these start-up firms perceive difficulties gaining the necessary financial assets to develop and implement new technologies or business ideas (Zider, 1998). This shortage of capital is caused by their limited access into the broad network of financial institutions. For example, the inherent risks accompanied with start-ups, due to the absence of tangible assets, are generally not accepted by banks and insurance companies (Bottazzi & Da Rin, 2002). Additionally, the premature development stage of these firms makes the stock and equity market inaccessible (Block et al., 2009). Eventually, this “financial gap” gave rise to the development of venture capitalism as an important intermediary in financial markets (Gompers & Lerner, 2001).

Venture capital firms invest in high risk entrepreneurial start-up firms as a means to obtain a potentially high rate of return. These start-ups are either in their seed, early, later or expansion stages of development and are provided with equity, debt or other hybrid forms of financing by venture capital firms (Amit et al., 1998). While the economic contributions of venture capital is still underexplored, scientists believe that venture capitalism plays a essential role in allocating the necessary financial assets to start-up firms and thereby transferring innovation to markets (Bottazzi & Da Rin, 2002). Research done by Kortum & Lerner (2004) suggests that an increase in venture capital leads for the United States alone to an industrial innovation of 10 percent. Venture capital thus stimulates innovation and fosters economic growth (Gompers & Lerner, 2001).

Over the last few decades the venture capital industry has grown significantly across the world. The period before the burst of the internet bubble was characterized by a significant growth of venture capital fundraising and the accessibility of investments. As a result, the American venture capital industry rose from a minor 3 billion in the beginning of the 1990s to over 70 billion in 1999 (Gompers & Lerner, 2001). Whereas, the European venture capital industry grew in the same period from 1.5 billion dollar to 48 billion dollars (McGlue, 2002). This excessive growth spur was caused by the extremely positive economic climate in the last decade of the 20th century.

Through the years, researchers investigated the high cyclic relation between the economic climate and the venture capital industry. The primary factor with respect to this relation is the

liquidity risk of investments (McKenzie & Janeway, 2011). Venture capitalists base investment decisions for a large part on the level of liquidity risk. Liquidity risk occurs when venture capital firms are not able to effectively exit investments (Cumming et al., 2005). Research done by Giot & Schwienbacher (2007) and Cumming et al (2005) state that IPO`s are most commonly used by venture capitalists as exit transactions. Therefore, with liquidity conditions is meant the level of risk associated with IPO`s as an exit transaction for investments.

The attractiveness of IPO`s in the equity market and thus the level of liquidity risk of venture capital investments, is closely related to the economic climate. This because a positive economic climate leads to a higher attractiveness of IPO`s and therefore results in lower liquidity risks for venture capitalists as the probability of an effective exit transaction, with respect to their investment, increases. (McKenzie & Janeway, 2011). These lower liquidity risks resulted in the subsequent extraordinary increase of the venture capital industry in the 1990s. This dependence of venture capitalists on the attractiveness of IPO`s, as a means to effectively exit an investment (liquidity risk), explicates the high cyclic relation of the venture capital industry with respect to the economic climate.

The years before the financial crisis were characterized by strong economic performance throughout the world. Western economies experienced a significant period of stable economic growth, low inflation and expansion of international capital flows and trade (Obstfeld & Rogoff, 2009). However, a combination of macro and microeconomic processes, from which some find origin decades before, led to an incredible decline of the global economy. This financial crisis caused, as we nowadays know, the failure of many well-known financial institutions as well as a decline in international trade of 12 percent (Guaranteed to fail, 2011). As the crisis had a significant effect on the economic climate, the venture capital industry would not stay unaffected (Block et al., 2011). Significant decreases in the venture capital industry, including changes in investment features, occurred. Interestingly, these effects of the crisis on the venture capital industry differ between the United States and Europe.

The venture capital industry of the United States originated in 1946. After decades of progressive development the United States venture capital industry has now entered its maturity stage, this in contrast to the European venture capital industry. The European venture capital industry started to develop, at a slow paste, in the 1980s. Nowadays, the European venture capital industry is thus still developing and more infantile compared to their United

States counterpart. Explanations for this sluggish growth of the European venture capital industry are existing, yet extensive. In general, it can be said that the European venture capital industry is lagging behind as the European Community, although often viewed by the United States as a relatively homogeneous entity, is in fact far from total economic and cultural integration (Economist, 2010).

This research tries to explore the effects and subsequent differences of the financial crisis on the United States and European venture capital industry. To that the following question is formulated:

- ***How does the financial crisis effect the venture capital industry in the United States and Europe?***

By obtaining an answer to this research question information, about the effects and subsequent differences of the financial crisis with respect to the United States and European venture capital industry, is collected. This information is of use to venture capitalists as it explores the level of influence a change in the economic climate (outbreak financial crisis) has on the venture capital industry.

As stated before, the venture capital industry is an important determinant of innovation and thus the economic climate (Gompers & Lerner, 2001). Acquiring substantive evidence about the effects of an economic crisis on venture capitalism is therefore of particular interest for multiple actors. Yet, the number of scientific papers covering this topic is limited. This research therefore aims to fill a portion of this scientific gap with respect to venture capitalism.

Investigating the effects of the financial crisis on the entire venture capital industry would be too broad of a scope. Therefore, this research focuses on the financial crisis in relation with specific aspects of the venture capital industry that have not been investigated by a plurality of researchers. These specific aspects explored are the syndicate size and the different types of venture capital firms active within the venture capital industry.

The coordination of investment by two or more participants is called syndication (Lerner, 1994). Research indicates that venture capital firms syndicate as a means to reduce risk, to share knowledge and proliferate networks. Subsequently, according to common theoretical reasoning, in times of an economic crisis, when risks increase and accurate knowledge and a

large network becomes more essential, the syndicate size is expected to increase. However, research done by Giot & Schwiendbacher (2007) and Cumming et al. (2005) indicate that there is a strong negative relation between the state of the economy and the level of syndication. This contradiction between theory and practice, and the contributions to this stream of literature by providing more scientific evidence, are the rationale for this research to further explore this subject.

The primary purpose of venture capital actors is to invest in high risk start-up firms. As said before, the venture capital industry tries to fill the “financial gap” as a result of market imperfections (Amit et al., 1998). The venture capital industry consists of a large amount of these venture capital actors, each related to a particular type of field, which invest in these entrepreneurial start-ups. This research categorizes these venture capital actors into five distinct types of venture capital firms. These five types are: independent, institutional, public, corporate and financial venture capital firms. The effects of the financial crisis on the investments of these types of venture capital firms have not been explored within the contemporary science. Notwithstanding, the fundamental role these venture capital firms play in the chain of financial intermediation. This research thus tries to provide scientific insights with respect to this aspect of venture capitalism and its relation on the state of the economic climate.

As mentioned earlier, the United States and European venture industry differs in both size and characteristics. It is therefore not improbable that the crisis has distinctive effects on both industries. As an extra dimension to this research, the effects of the crisis on syndicate size and the investments of the types of venture capital firms are compared between the United States and European venture capital industry. By including this additional dimension better insights, in both industries and the events that affect them, are obtained.

The results obtained in this research indicate that the syndicate size decreases during the financial crisis. In addition, this decrease is smaller for the European venture capital industry. With respect to the investments of the types of venture capital firms, the results show no significant stronger effect of the crisis on institutional and financial venture capital firms. Furthermore, the effects of the financial crisis were more severe on the investments of the venture capital firms active in the United States venture capital industry.

1.1 Outline of this research

The paper is structured as follows. Section 2, 3, 4, 5, 6 provide the theoretical framework for this research. First, chapter 2 presents an overview of venture capitalism. This part discusses the origin and development of the venture capital industry of the United States and Europe, and discusses their differences. Chapter 3 provides insights in the causes and effects of the financial crisis. Chapter 4 provides information on more specific aspects of venture capital. Within this chapter the venture capital stages of investment and syndication are explained. In addition, the different types of venture capital firms, the determinants of venture capital fundraising and the importance of the exit markets are described. The 5th chapter defines the effects of the financial crisis on the venture capital industry. In addition, this chapter explains the causes of the effects of the financial crisis on the venture capital industry. In chapter 6 the hypotheses, with respect syndicate size and the types of venture capital firms, are introduced. Chapter 7 gives a brief elaboration of the research data. This chapter describes the data, period of analysis, main and control variables. In addition, descriptive statistics of the used variables are presented. This chapter also explains the used methodology in this research. Finally, chapter 8 presents the results and provides answers to the formulated hypotheses. Chapter 9 discusses this research and explains its contribution to venture capital. Furthermore, it presents numerous limitations and suggestions for future research. The 10th chapter will display the list of theoretical references.

2. Venture capital

This section presents an overview of the venture capital industry in the United States and Europe. First, it discusses the origin and development of both venture capital industries. In addition, the differences between these industries are described.

2.1 The origin of the United States venture capital industry

Venture capital is a relatively young addition to the sources of financial intermediation. The first venture capital firm was established in 1946 in the United States and made high risk investments in innovative companies that focused on developing technology with respect to the Second World War (Jeng & Wells, 2000).

Through the decades the United States venture capital firms were structured in a wide range of organizational designs. Yet, three distinct types of organizational designs were most

commonly used. The first venture capital firm was structured as a publicly traded closed-end fund. Unfortunately, this structure has some significant drawbacks (regulatory provisions) that became clear in the earlier stage of the American venture capital industry. Despite these imperfections, the publicly traded closed-end funds have seen a minor revival in the American industry from the 1990s and onwards (Gompers & Lerner, 2001). Their renewed appeal was caused by two factors. First, there's the desire of individual investors to put some of their money in venture capital. And second, the inaccessibility of these individual investors to the traditional venture capital funds (Gompers & Lerner, 2001). Nowadays, the venture capital industry is mostly dominated by limited partnerships. Through the decades, these limited partnerships obtained more freedom with respect to their investment decision as they were exempt from extensive security regulations. However, the fundraising conditions were much more restricted compared to closed-end funds. The third commonly used structure was the Small Business Investment Company. These SBIC's replaced for a brief period in the 1980s the limited partnership as the dominant organizational form. Nowadays, their share in the venture capital industry is minimal (Gompers & Lerner, 2001).

After two decades, the venture capital industry started to increase due to regulation adjustments. In 1979, the government regulation called the Employment Retirement Income Stabilization Act was enacted to create a more efficient organizational design. This allowed a broader range of investors (for example: pension funds) to finance venture capital firms (Bottazzi & Da Rin, 2002).

In the 80s and the beginning of the 90s, venture capital firms witnessed both profitable and challenging times (Giot & Schwienbacher, 2006). During these years, venture capitalists backed many successful companies including Apple, Microsoft and Starbucks. However, at the same time commitments to the venture capital industry were unevenly dispersed. Through a decline in investment returns, as a result of overinvestment and entry of inexperienced venture capitalists, fundraising declined from 1987 until 1991 (Gompers & Lerner, 2001).

The decline came to a hold in the mid 1990s. This reversal was caused by an advancement of the exit markets and in particular the positive climate of the initial public offerings market (IPO) (Black & Gilson, 1998). In addition, this increase in investment returns, due to a higher level of liquidity of investments, changed the view organizations had about the venture capital industry in the United States. As a result, investment portfolios in venture capital firms grew considerably from that period onward. Besides, organizations started to reflect on their strategy with respect to managing the innovation process. They questioned if outside venture capital might be a superior alternative to an internal, centralized R&D (Gompers & Lerner,

2001). A further intensification of companies in venture capital was led by the growing acceptance of collaboration with independent venture capital firms. In addition, the growing dispersion of investment opportunities and the understanding of its immediate implications also triggered an increase in venture capitalism by corporations. At the end of the 1990s relationships with corporations improved further as they were increasingly more willing to consider collaborating with venture capital investors. Not only with respect to financial assets but even acting as limited partners (Kortum & Lerner, 2004).

Around the end of the 1990s, about 60 percent of the acquired capital by American venture capital funds was invested in information technology industries and more than one third of that capital went to the California region (Gompers & Lerner, 2001). This concentration of venture capital funds in high technology firms, primarily in the region of California, has been a consistent feature through the decades.

The beginning of 2000 was characterized by the burst of the internet bubble. Due to the fact that the venture capital industry is closely linked to the general economic climate and stock market indexes (IPO`s) the venture capital industry was hit hard by the subsequent recession (De Vries & Block, 2011). The total amount invested by United States venture capital firms declined by 42% in the beginning of 2001. When the economy started to recover, venture capital investment had decreased a total 85% since the burst of the dot.com bubble (OECD, 2009). Although the economy started to grow again in 2003, equal heights in the American venture capital industry, as before the burst of the internet bubble, were never reached.

2.2 The origin of the European venture capital industry

The European venture capital industry started developing decades later than their American counterpart. The first notion of European venture capitalism was in the beginning of the 1980s in the United Kingdom (Roure et al., 1990). The reason that venture capitalism did not reach Europe until the late 1970s is a direct consequence of the Second World War.

The years after the great devastations of the Second World War were marked as the recovery years in Europe. This period was characterized by the absence of entrepreneurial strength and thereby led by governments, large industries and centralized labour unions. The absence of entrepreneurial strength was furthermore caused by cartelized and centralized markets, strong cooperative relations between government and commercial organizations and unbreakable boundaries with respect to social classes (Tyebjee & Vickery, 1988).

Before the introduction of the European venture capital market, European investors invested in American venture capital firms. After a while they established their own limited partnerships and corporate alliances with their American counterpart (Schilit, 1992). However, the European venture capital industry was still characterized by low entrepreneurial risk taking. This, because at that time the European venture capital market was largely dominated by governments, large financial and institutional organizations. Therefore, in that period lifetime employment seemed more valuable than entrepreneurship (Economist, 2010).

When venture capital was introduced in Europe it played a minor role as an intermediary in the financial markets. In the beginning of the 1980s the amount invested by venture capital firms in Europe was eight times smaller as in America (Roure et al., 1990). Even when taking into consideration that this percentage is adjusted with respect to the size of the economy.

However, after a few years their level of entrepreneurship, and therefore the importance and influence of venture capital, changed as a result of adjustments administered in the industry. These adjustments, made in the beginning of the 1990s, included industries growth prospects, trends in competition, investment returns, general business climate as well as the introduction of the European Market in 1992 (Roure et al., 1990). The introduction of the European Market had as a result that investors also started to focus on later and expansion stage investments as it increased the number of possible exit transactions. In addition to the aforementioned adjustments, political policies were implemented in order to stimulate the availability of venture capital. The European governments adopted two types of incentives, namely fiscal advantages and loss guarantees (Tyebjee & Vickery, 1988).

These adjustments led to a series of positive effects. The European venture capital industry grew significantly from 1.5 billion dollar to 48 billion dollars at the end of the 1990s (McGlue, 2002). However, not every individual European venture capital industry grew at the same rate. The United Kingdom and the Netherlands were frontrunners with respect to the development of their venture capital industry. From early on, the United Kingdom experienced a venture capital boom. Investment had grown rapidly through the years. As a fraction of their domestic product, venture capital investment had grown nearly five times that of its closest follower. The venture capital industry in the Netherlands also showed a significant growth at start. At the end of the 1990s their venture capital industry entered the maturity stage. The southern countries, like Italy and Spain, started developing in a faster pace after a relatively slow start. At the same time, France and Belgium were characterized by high growth (Roure et al., 1990). In the early 2000 they reached a level of investment activity matching that of the United States. Despite the overall growth of the European

venture capital industry, Germany was falling behind. At the beginning of 2000, Germany still remained at an introduction state. Their activity level, relative to the domestic product, is by far the lowest of the group.

This wide range of differences between European countries could be related to the fact that the European Community, although often viewed by Americans as a relatively homogeneous entity, is in fact far from total economic integration (Economist, 2010). Large differences between technologies, taxes, and economic policies of the member countries, in addition to the cultural and linguistic diversity, restricted individual countries, as well as the entire European venture capital industry, from developing at an equal pace compared to their American counterpart (Colombo, 2011).

After a strong period of development and growth, the entire European venture capital industry was negatively affected by the burst of the internet bubble in the year 2000 (McGlue, 2002). The European venture capital industry was hit even harder compared to the United States due to a much weaker established base. The total amount of venture capital investments declined with 37.75% (OECD, 2002). After the dot.com crisis in 2003, the European venture capital industry entered challenging times due to fast subsequent crises like the credit and government debt crisis.

2.3 United States versus Europe

American venture capital firms are an accepted and important form of financial intermediation. Research indicates that they account for 10% of the total amount of industrial innovation (Kortum & Lerner, 2004), whereas the role and impact of venture capital in Europe is currently the subject of a major policy debate (Colombo, 2011). These discrepancies between the American and European venture capital industry exist as they are influenced and shaped by different factors.

As described earlier, the American venture capital industry has seen excessive growth in the 1990s. At the end of the 1990s the venture capital industry in America had increased by a factor 80, reaching levels of investment of 70 billion dollars compared to 3 billion dollars in 1990 (Gompers & Lerner, 2001), whereas the European industry grew in the same period to 48 billion dollars (McGlue, 2002). A large portion of the European growth was as a result of the opening of the European Market in 1992. This development led to a higher liquidity level of investments, especially for technology firms. Interestingly, while the total amount invested in the European venture capital industry is lower; the range of companies that receive

financial support is nearly twice as large compared to the United States. In addition, European venture capital firms invest an increasing share in early stage investment. From 1999 and onwards the amount invested in early stage investment was even larger in Europe than in the United States. Still, the majority of the venture capital firms, in America and Europe, are invested in later and expansion stage investment. In addition, both industries have a comparable level of collaboration between venture capital firms with respects to investments and invest foremost in high technology firms (Bottazzi & Da Rin, 2002).

Although there is some conformity between these two industries, the number of discrepancies is even larger. Research done by Colombo (2011) states that Europe`s diversity is the most important reason for the slow development of the European venture capital industry. This large divergence between cultures and languages has not been beneficial for the development of the venture capital industry. On the contrary, it resulted in a clash between European venture capital firms. In addition, the stagnant growth rate of the European economy and particularly the technological businesses in the beginning of 1990 did not benefit the development process.

The acceleration of the European venture capital growth rate started at the end of the 1990s. This growth spur was set in motion by received knowledge of venture capitalists to exploit the cultural difference of Europe (Economist, 2010). By applying this knowledge, Europeans became more suitable to work in a cultural shattered environment. The stronger focus on internationalization of venture capital investments and the peculiarity of cross border investments proved to be essential for a steady development and an increase in the mobility of the European venture capital industry.

However, the question arises what caused these discrepancies to occur. Why did the American venture capital industry enter the maturity stage years ago while Europe still searches for stability and constant investments patterns (Bottazzi & Da Rin, 2002)? This delayed development of the European venture capital industry is caused by the following factors:

- The first factor of influence is the difference in *mentality and skills* between Americans and Europeans (Colombo, 2011). Although creative and talented people can be found all over the world their mindset is of particular importance with respect to entrepreneurship. Whereas American entrepreneurs are focused on making profit

and increasing value, Europeans are more concentrated on delivering high quality products. This adjusted capitalistic view results in less risk taking and a lower degree of greediness (Economist, 2010).

Venture capitalists can be characterized as a very heterogeneous group, in terms of skills, governance structures, objectives and investment horizon (Economist, 2010). Not every investor obtains the right set of skills necessary to both start and manage new businesses (Jeng & Wells, 2000). Europe lacks strong executives with the skills (and experience) to turn a seed and start-up firms into successful global organizations.

- The second factor is opposed *regulations* by European governments. Starting your own firm in Europe carries a lot of risks and low rates of return. With respect to income, obtaining a fixed salary is more beneficial than acquiring investment returns as shares or options. This due to the high level of opposed taxes (Economist, 2010).

Besides that, the labour market rigidities, formed through regulations, are a disadvantage. Research done by Sahlman (1990) indicates that these rigidities form a large barrier to the success of venture capital. The strict labour laws make it difficult for start-up firms to hire and fire employees. This, as firms have to pay large benefits to employees plus high compulsory severance payments in case of departure. In addition, seniority laws prevent start-up firms from maintaining younger employees with a fresher set of skills (Jeng & Wells, 2000).

- The *different types of venture capital actors* are the third factor. Although research done by Gompers & Lerner (2001) indicates that each venture capital actor tries to fill the “financial gap”, as a results of market imperfections, different types of venture capital actors can be identified . The venture capital industry in the United States consists primarily of organizations and institutions. In addition, these venture capital actors, with affiliation in technology, raise a large amount of their funds from university endowments. However, the dependence on these types of venture capital actors, within the European venture capital industry, and their venture capital firms, is more than 10 times smaller (Economist, 2010). Other big venture capital actors in the United States are pension funds and insurance companies. These actors, combined with university endowments, are present in almost two thirds of the entire venture capital industry while this is only one third in Europe. Since the American venture capital industry is in a more mature stage, with a lower reliance on different types of

venture capital actors, their industry is less affected by changes in the investment environment. Whereas the European venture capital industry, dependent on a large group of different venture capital actors, is relatively unstable (Bottazzi & Da Rin, 2002).

An important venture capital actor for the European venture capital industry is the European investment fund (McGlue, 2002). This fund is owned by the European investments bank and the European Union. The primary function of this government fund is to place capital with primarily European venture capital firms (Colombo, 2011). However, the governmental influence accompanied with this public funding tends to distort the venture capital industry. As O`Shea (1996) points out, interference by governments may hinder the development of a private venture capital industry. Besides, their actions are influenced by political views and preferences.

- The last factor of influence is the state of the *IPO market*. Every investor wants a wide range of opportunities which enable them to effectively liquidate their investment. The level of liquidity risk is of particular relevance for investors as it determinates for a large part the value of set investment (McKenzie & Janeway, 2011). While there are many mechanism available to liquidate investments, initial public offerings (IPO`s) are the most attractive. This, as the investor can maintain control. In addition, the financial benefits are more significant compared to other options (Bottazzi & Da Rin, 2002). The European venture capital industry is characterized by an absence of effective exit options. Where the United States has access to the world largest technology stock market, the Nasdaq exchange, Europe lacks a proper technology stock market. And without a suitable exit strategy, liquidity risk increases which negatively effects the growth of the venture capital industry.

3. The financial crisis

The third chapter will explain the period of analysis of this research: the financial crisis. This chapter starts with an overview of the effects of the financial crisis. The second paragraph will explain the specific causes that led to this crisis.

3.1 An overview of the financial crisis

The period before the financial crisis was characterized by strong economic performance throughout the world. Western economies experienced years of stable economic growth, low inflation and expansion of international financial flows and trade (Obstfeld & Rogoff, 2009). However, between the fall of 2008 and the winter of 2009 the world economy and financial markets plummeted. As a direct result of the financial crisis, stock markets lost between a third and half of its value. In addition, the crisis contributed to the failure of many well-known financial institutions, triggered a decline in international trade of 12% and for the first time in decades contracted the size of the global economy (Guaranteed to fail, 2011).

The dot.com crisis at the end of the 1990s had, compared to the financial crisis, a moderate affect on the real economy as the securities were held mainly by individual households. However, the financial crisis led to heavy losses, suffered by many financial institutions, which created widespread problems of liquidity and solvability (Balancing the banks, 2010). In addition, the financial crisis, (hereafter crisis) can officially be stated as a banking crisis as it affected the money stock and therefore the real economy (Lastra & Wood, 2010).

The crisis first surfaced in August 2007. At that time the European Central Bank had to intervene for the first time in the interbank market due to the abrupt sale of assets at fire-sale prices (Balancing the banks, 2010). These interbank market problems were caused by the bankruptcy of Bear Stearns` in-house hedge fund (Block et al., 2011). Subsequently, in September 2007 the Bank of England announced that they would financially support the investment bank Northern Rock. The national bank undertook this action to calm down the markets as costumers were panicking. However, the opposite occurred as costumers saw this intervention as a sign of solvability problems (Balancing the banks, 2010).

In the summer of 2008 the problems of investment banks, insurance companies and government sponsored enterprises deepened. Through the failure of Bear Stearns it became clearer that individual financial firms were interconnected with the entire financial system. This so-called counterpart risk imposes losses on other institutions and therefore creates a ripple effect throughout the system (Guaranteed to fail, 2011). The two largest mortgage providers in the United States, Fannie Mae and Freddie Mac (with in total 4.000 billion on their balance sheets), were the first two to fail, as a result of this counterpart risk, and were placed under government conservatorship. This action, by most seen as the largest governmental intervention in the private markets in decades, was necessary as about 50% of

their debt was owned by banks coping with liquidity problems themselves (Guaranteed to fail, 2011).

On September 14th the financial crisis reached its height when the investment bank Lehman Brothers had to declare bankruptcy caused by immediate liquidity problems. Bad judgements about the counter risk imposed with the failure of Lehman Brothers (a total of 613 million dollars in debt) led to the largest crisis since the great depression. In a period of two months, five of America`s biggest investment banks went either bankrupt or merged with commercial banks and the biggest insurance company in the world was nationalized (Balancing the banks, 2010). In addition, a ripple effect occurred throughout the world as more international financial institutions were effected and lost a significant amount of their value or declared bankruptcy. Since all these financial firms could not repay their outstanding debts, the credit markets froze, commerce plummeted and economies fell into the largest recession since decades (Block et al., 2011).

3.2 Causes of the financial crisis

Recent economic literature focuses on the causes of this crisis. Research done by Orłowski (2008) indicates that the crisis stemmed from an idiosyncratic combination of macro and microeconomic processes.

The first macroeconomic factor was the international savings glut. At the end of the 1990s the macroeconomic imbalances in the world drastically changed. In these years the economic activity in China, Japan and oil producing countries grew significantly. This large growth resulted in high current account surpluses (Obstfeld & Rogoff, 2009). Because the investors in these growth countries were unable to find sufficient amounts of valuable domestic investments they started looking across national borders. This, and the large volume of securities in the United States, resulted in significant amounts of investments on American soil (Balancing the banks, 2010). Although allocating current account surpluses in foreign debt instruments is not unusual, large and persistent investments could generate economic imbalances (Lastra & Wood, 2010). The situation, when more money is invested in debt instruments in relation to domestic investments is called; international savings glut.

The second macroeconomic factor was the housing bubble in the United States and the subsequent subprime crisis. A large part of the before mentioned excess supply of capital entering the United States sought investments in real estate. This factor, among low federal interest rates for years, larger margin profits for banks and high financial incentives for financial institutions selling mortgages, resulted in a strong increase in the housing prices

though the years (Block et al., 2009). An additional effect was the strong increase of mortgages provided to lenders with low credit ratings (so-called subprime mortgages). As the housing market and its prices kept growing, the perceived risks of these subprime loans were low. However, small changes in before mentioned factors would have immediate and significant effects on these mortgages. This became clear when the federal interest rates started to increase in 2004 and the housing prices started to level out in 2006 (Orlowski, 2008). These developments caused severe liquidity problems and resulted in an increasing amount of home owners that had to default. Hence, the financial institutions owning these mortgages had to adjust their balance sheet. In turn, this affected their solvability level (Orlowski, 2008).

As mentioned before, some microeconomic institutional factors were also of influence. First, besides the increasing inflow of foreign cash, the loosening government regulation concerning capital, led to an increase in secularisation and development of new structured financial products (Block et al., 2009). Subprime mortgages were pooled and bundled into new financial products and sold to investors. These products, called collateralized debt structures; in particular collateralized debt obligation (CDOs) and mortgage-backed securities (MBS), were presented with the highest possible rating and sold as “safe” products (Triple A status). While the basics of these collateralized debt structures, high risk/subprime mortgages, did not change. Another new financial product was the credit default swap (CDS). This financial product protected holders of debt structures against possible default risks. AIG, the biggest insurance company in the world, was the largest owner of these CDS`s. Eventually, these billions of dollars of debt obligations outstanding through CDS`s was the sole factor responsible for its destruction (Cordon, 2009).

The primary problems with these new financial products were their inadequate and incorrect risk accession and the lack of government regulation. Therefore, the last microeconomic factors of influence are the credit rating agencies and government regulations. Credit rating agencies and governments are supposed to protect the investor. However, this was not always the case. For example, credit rating agencies showed issuers of new financial products how to acquire the highest safety rating even if the real risk for investors was considerably higher (Balancing the banks, 2010). In addition, the government created, by deregulating the financial sector, an uncontrolled and unregulated environment where these high risk and unreliable collateralized debt product could exist and flourish.

To conclude, the microeconomic factors of influence with respect to the causes of the crisis are the rapid growth of secularisation of debt, the development of new structured financial products and inadequate financial supervisory and regulatory frameworks (Orlowski, 2008).

4. Aspects of venture capital

This section focuses on more specific aspects of venture capital. First, the different investment stages of interest for venture capitalists are explained. Then, the meaning of syndication, its benefits as well as its issues for venture capital firms are described. The next paragraph focuses on the types of venture capital firms and their differences. The last two paragraphs focus venture capital fundraising and the importance of the exit markets. These aspects are described as they are important with respect to the designed hypotheses explained later in this research.

4.1 Investment stages of interest for venture capitalists

Each investment has a different set of features which venture capitalists carefully weigh in before they commit to invest in a particular venture. The risk and uncertainty accompanied with these features are strong incentives for venture capital firms to control and monitor their investments. An effective mechanism for controlling and monitoring investments is staged capital infusion (Sahlman, 1990). The advantages of staged capital infusion are that the owner and manager cannot handle without approval of the venture capitalist. Eventually this will reduce losses from bad decision making. Stage investment therefore increases the ability to monitor investments and gather information, while maintaining the option to effectively exit investments (Guidici & Paleari, 2000). In addition, each time when funding rounds come to an end and new capital infusion is needed, contracts need to be renegotiated. This provides venture capital firms with the opportunity to re-analyse their optimal strategy of funding. Research done by Bottazzi & Da Rin (2002), Jeng & Wells (2000), and Gompers (1995) state that staged capital infusion can be divided in early stage (sub-stages: seed and start-up) and late stage (sub-stages: later and expansion) investment.

Seed staged investment is a small investment commitment that provides the investor with the opportunity to inspect the operational and economic viability (Jeng & Wells, 2000). The financial assets inserted are used for initial product research and development. The second sub-stage of early stage investments is start-up investment. Firms, whose business designs or

technologies have been proven viable, are eligible for this investment stage. At this point, the financial assets are used for operational purposes (production and marketing development) as well as employee expansion. Important for this start-up stage is the fact that the companies still operate at a loss. In addition, both seed and start-up stage investments are hard to analyse (operational and economical viability) due to their short current life span (Bottazzi & Da Rin, 2002). In addition, both sub stages are negatively impacted by labour market rigidities (Jeng & Wells, 2000). However, despite these uncertainties and informational asymmetries, venture capitalists concentrate a significant part of their investments on seed and start-up stage investments.

Late stage investment can be divided in the sub stages, later and expansion stage investment. When the tangibility of assets increase, firms become eligible for later stage investment. This, as the higher degree of tangibility increases the liquidity of investments and therefore lowers associated agency costs. In addition, as the need to monitor management declines, the duration of investments could increase. This same effect occurs when the asset specificity of investment decreases (Gompers, 1995).

Firms receiving expansion stage investments have an established product that needs additional financial assets to expand its manufacturing and distribution capacity (Bottazzi & Da Rin, 2002). Besides, a share of the assigned capital is allocated to the R&D division. In addition, the venture capital firm provides the start-up firm with help regarding the marketing of products and establishing long term client and supplier relations. Furthermore, expansion stage investment has another significant purpose. This purpose is helping firms to become a market leader and exploring the right exit transaction.

4.2 Syndication

The coordination of investment by two or more participants is called syndication (Lerner, 1994). It was first used in 1870 in the United States as a means to reduce risk through diversification. This particular method of syndication was applied on the purchase and inventory of goods and the sales of securities (Ooghe et al., 1991). Nowadays it is used in a wide range of industries, including venture capital. The growing use of syndication within the venture capital industry is fostered by the low degree of regulations from the Securities and Exchange Committee (Ooghe et al., 1991). Research indicates that the growth in syndicate size is related to the state of the industry. However, the level of syndication within the venture capital industry with respect to the types of venture capital firms, differ (Hege et al., 2003).

Firms benefit from syndication. The reasons why venture capitalists syndicate can be divided into three categories. These categories are: risk reduction, proliferation of networks and knowledge sharing. The explicit reasons will be thoroughly described below.

4.2.1 Risk reduction

Syndication of venture capital investments occurs on a national and international level. Regardless of the nature of syndication, an immediate result is the growth in the number of investment deals. Where venture capital firms previously could only invest in a small number of start-ups, they now have the possibility to divide their financial assets across more investments opportunities. Through this diversification of investments the degree of risk, with respect to their total investment portfolio, decreases (Zider, 1998). So, this reduction of the invested amount per start-up fosters the optimisation of the portfolio of venture capital firms (De Vries & Block, 2011). Besides, due to a higher syndicate size, the uncertainty (risk) regarding the selection process of new investments decreases as investment decisions are communicated across multiple venture capital firms (Lerner 1994). Therefore, the risk of making a wrong investment decision declines.

Another assessment of risk is the liquidity of investments. Venture capital firms which syndicate obtain a higher level of liquidity with respect to their investments. Venture capitalists provide firms with financial support for a minimum of 5 and a maximum of 10 years time. So, before invested capital is liquid again, through an exit transaction, a significant amount of years passes (De Vries & Block, 2011). Therefore, by dividing capital over more investments with different stages of maturity, the level of liquidity increases. Although, this argument implicates that venture capital firms must focus on all investment stages to obtain this higher level of liquidity. This is however not common as venture capital firms tend to focus on a particular type of investment stage (paragraph 4.1). In addition, research done by Ooghe et al. (1991) and Cumming et al. (2005) indicates that syndication increases the affectability of exiting an investment. Thus, syndication leads by means of diversification to risk reduction and an increase in the liquidity of investments.

4.2.2. Proliferation of networks

Besides the reduction in risk, syndication has a positive effect on the proliferation of networks between venture capital firms. When firms cooperate regarding investments, a broader network of connections becomes available. These connections between venture

capital firms make cooperation easier and thus lower the cost of information. Besides, the increasing cooperation between firms will lead to a higher degree of familiarity and trust (De Vries & Block, 2011). This will increase the number of offered investments opportunities. Therefore, a better relationship between venture capital firms ensures a sufficient deal flow in the future, as this partaking in investment opportunities in collaboration with other firms, will have reciprocity as a result. A higher degree of familiarity and trust will also ease the search for partner firms regarding investments (Hege et al, 2003). Besides providing help in the pre-selection phase, syndication can create and add value by sharing managerial experiences and industry specific knowledge (Amit et al., 1998).

4.2.3 Knowledge sharing.

As venture capital firms claim that generated information and services provided are as important as their financial support, the importance of collaboration between venture capital firms increases. This as it is a mean to increase available knowledge and therefore offered services (Gompers, 1995). The aspect of knowledge sharing is thus an important reason for syndication. In time, this transfer of managerial and industry specific knowledge will result in a higher value creation (Amit et al., 1998). In addition, collaboration between venture capital firms can provide additional information and expertise with regard to the due diligence process. This will help improving the quality of investment decisions (Lerner, 1994). Besides, a syndicate partner can provide assistance in the area of investment selection (Ooghe et al., 1991). Without syndication, a firm's decision to invest is based on their own research and observations. With syndication the viability of the project is evaluated by more venture capital firms. Thus, knowledge and expertise within venture capital firms become available for others (Lerner, 1994). Besides, by promoting direct knowledge sharing, syndication reduces problems with respect to information asymmetries (Amit et al., 1998). In addition, venture capital firms can expect an increased performance through greater complementarities of skills between syndication partners (Cumming et al., 2005).

4.2.4 Issues of syndication

While syndication has a lot of positive contributions to the venture capital industry, a small range of issues arise when venture capital firms syndicate. One of these issues that occurs is the higher costs of coordination which in turn results in considerably higher transaction costs concerning the investment (De Vries & Block, 2011). Another issue that

arises is free-riding behaviour. This behaviour surfaces when venture capital partners ride on the actions and knowledge of others, without adding significant contributions themselves (Shefrin, 2007). In addition, conflicts of interest and information asymmetries between syndicate partners may arise. Agency conflicts occur when venture capital firms have conflicting investment objectives and time horizons (Fried & Hisrich, 1992). The costs associated with agency conflicts are influenced by the degree of tangibility, growth options and the asset specificity of investments (Gompers, 1995). It is therefore important for every venture capital firm to be aware of the trade-off between the benefits and possible issues of syndication. Yet, some issues will always exist in a small degree.

4.3 Types of venture capital firms

The primary purpose of venture capital firms is to fill the “gap” in financial intermediation by investing in high risk start-up firms. This as the investment might potentially lead to a high rate of return (Amit et al., 1998). In the late 1990s the number of investments rose sharply as the amount of venture capital firms and their funds increased. However, the economic viability of these new investments was rather low. This had as a result that a large amount of venture capital was given to average business plans and technologies with no substantive revenue generating possibilities (Berniker, 2001). Eventually, this led to the development that too much money was chasing bad investments opportunities. However, the following dot.com crisis in the beginning of 2000 purified the industry of bad investment opportunities and the abundance of venture capital firms and capital. Nowadays, the number of investments and venture capital firms are more in balance.

However, from who do these start-up firms receive venture capital. These start-up firms receive money from a wide range of venture capital actor whereas each is related to a particular type of field. By examining previous research, these venture capital actors, in relation to their specific fields, are bundled in this research into five distinct types of categories. Although contemporary science states that the name “venture capital firm” is specifically related to private equity firms, this research, in term of simplicity, labels all five types of distinct categories as different venture capital firms.

4.3.1 Independent venture capital firms

Independent venture capital firms consist foremost out of limited partnerships. Through the legal structures of a limited partnership, capital and knowledge of individuals are combined. These partnerships consist of individuals with a low aversion towards risk (Colombo, 2011). This low risk aversion results in affiliation for seed and start-up investment stages (Mayer et al., 2005). Other characteristics of these actors are shorter duration of investment and lower domestic investment. Furthermore, the availability of capital is not often an issue for independent venture capitalists (Leleux & Surlemont, 2001).

An actor of independent venture capital firms that deserves a special notion is the business angel. Business angels are individual investors who provide early stage firms with the necessary financial assets (Bottazzi & Da Rin, 2002). Although these actors are important, their scope is limited by the wealth of these “angels” (Gompers, 1995). The firms, in which these business angels invest, are largely based on personal relationships. In addition to capital, these individuals also provide start-up firms with knowledge of the industry and legal or organizational support (Gompers, 1995).

4.3.2 Institutional venture capital firms

Pension funds and insurance companies are the prime actors of institutional venture capital firms (Bottazzi & Da Rin, 2002). An important feature of these actors is that they have low liquidity requirements. They therefore could prefer high risk investments (Mayer et al., 2005). However, institutional venture capital firms do not particularly focus on high risk, early stage investment. On the contrary, for institutional venture capital firms mature industries are of higher importance compared to a young industry.

4.3.3 Public venture capital firms

The public venture capital firms consist of the venture capital actors; government, university endowments, foundations and other non-financial firms. These public venture capital firms concentrate more of their investment on high risk, early stage, firms (Jenkins, 1989). Additional goals of these public venture capital firms include non-financial items as politics and employment (Leleux & Surlemont, 2001). Compared to other, research indicates that public venture capital firms have a higher propensity of investment in local firms and investment duration. However, they experience difficulties with respect to the availability of

capital. Furthermore, they focus on a broader range of investments and thereby benefit from diversification across industries and technologies. (Leleux & Surlemont, 2001).

4.3.4 Corporate venture capital firms

This category of venture capital firms is best associated with business corporations. Corporate venture capital firms are viewed as an “average venture capital firm” with respect to their investment characteristics (age and size) (Colombo, 2011). In addition, corporate backed firms primarily focus on early stage investment and have a low level of syndication. Their entire strategy is based on finding viable, seed and start-up, investment opportunities in the technology industry (Mayer et al., 2005). However, research done by Jeng & Wells (2000) suggests that this strategy only had limited success in the past.

4.3.5 Financial venture capital firms

Financial venture capital firms consist foremost of the actors; banks and other financial corporations. Typical for these types of firms is their wide range of investments in both local and established larger companies. Banks have the social responsibility to support starting firms but also the objective to strengthen their relationship with established, older companies (Colombo, 2011). However, their actions contradict this statement, as financial venture capitalists are mostly focused on later stage investments (Mayer et al, 2005). Their investment strategy is characterized by low risk with high affiliation to domestic syndication. This due to their high immediate liquidity needs.

4.4 Venture capital fundraising

As explained in an earlier paragraph, start-up firms receive financial support from the different types of venture capital firms, when obtaining capital through other forms of financial intermediation is impeded. However, these venture capital firms are, with respect to their capital, in turn dependent on one or multiple venture capital actor with respect to fundraising. Combining information collected by Klein (2011) and Gompers & Lerner (2001) this research states that the amount acquired through fundraising from these actors is influenced by seven determinants.

First, venture capital fundraising is affected by the state of the economy. The willingness of investors to provide venture capital firms with capital is related to the expected return of investments. A higher rate of return results in a higher willingness of investors to supply

venture capital. Thus, in times of economic growth, when investments generate higher rates of return, the willingness of investors to fund venture capital firms is higher (Gompers & Lerner, 2001). Therefore the statement is made that the state of the economy affects the level of fundraising of venture capital firms.

Second, the level of fundraising is determined by the level of investment liquidity (Giot & Schwienbacher, 2007; Cumming et al., 2005). The ability to effectively exit investments is related to the attractiveness of the exit markets (IPO's). In times of a positive economic climate the demand for IPO's is higher and therefore the liquidity risk, with respect to investments, lower. So, due to this high IPO attractiveness, venture capital firms can more effectively exit investments and thus raise higher amounts of funds.

Capital gains tax rates are also of influence on fundraising. High capital tax rates, imposed by governments, will diminish the acquired return of investors (Economist, 2010). As a result, investing in venture capital firms becomes less profitable what affects the level of funds raised.

In addition, the labour market conditions are of particular interest to the level of fundraising as these market rigidities form a large barrier with respect to venture capital investments (Sahlman, 1990). Strict labour laws will lead to inflexibility of workers as protection mechanisms constrain companies to fire employees. Besides, high severance payments make changing the workforce difficult. This will affect the rates of return and therefore the amount of funds raised.

The fifth determinant on the level of fundraising is the transparency of investments. Transparency is important for every investor as it provides them with the means to obtain the right and detailed information about uncertainties, risks and opportunities. The quality of reporting standards are therefore important to investors. Therefore, high reporting standards have a positive influence on the level of fundraising as it creates transparency (Klein, 2011).

Governmental activities and social programs shape the venture capital industry. Their interference in the venture capital industry influences the market conditions. Eventually, these actions may hinder the venture capital market and thus making fundraising more difficult (Klein, 2011).

The last determinant of influence is the performance and reputation of a venture capital firm. Venture capital firms with acknowledged reputation perceive fewer difficulties in obtaining funds (Gompers & Lerner, 2001). Primarily established and larger venture capital firms have thus a higher chance to collect enough capital.

4.5 Venture capital and exit markets

The assessment of possible exit options is important for venture capitalist with regard to their choices of investment (Giot & Schwienbacher, 2007). Venture capitalists provide start-up firms with the necessary financial assets to develop and implement new technologies and business designs. However, these start-ups lack the cash flow to pay interest, debt or dividends on given capital. Therefore, the entire return venture capitalists gain is through exit transactions (Cumming et al., 2005).

There are three types of exit transactions venture capitalist can choose. These are; trade sales, liquidations and Initial Public Offerings (IPO`s) (Giot & Schwienbacher, 2007; Black & Gilson, 1998). The most common exit transaction of venture capitalists is an IPO. This, as it normally provides venture capital firms with the highest return and reputational benefits. Yet, every exit transaction copes with a certain degree of liquidity risk. Liquidity risk occurs when a venture capital firm is not able to effectively exit an investment and is therefore being forced to hold current investments or sell their shares with a loss (Cumming et al., 2005). The level of liquidity risk is important for venture capitalist as they adjust investment decisions among other things to the current liquidity conditions (McKenzie & Janeway, 2011).

As mentioned earlier, IPO`s are most commonly used by venture capitalists as exit transactions (Giot & Schwienbacher, 2007; Cumming et al., 2005). This research therefore states that liquidity risk refers to IPO exit risk. The risk associated with an IPO as an exit strategy is related to the economic climate (McKenzie & Janeway, 2011). In times of a positive economic climate the attractiveness of IPO`s is high, which makes it easier for venture capitalists to exit their investment. The IPO exit risk (or liquidity risk) is therefore low. In addition, when the economic climate weakens the opposite occurs. The IPO exit risk increases as the attractiveness of IPOs by investors decline. Therefore, a change in the economic climate effects the attractiveness of IPO`s and thus alters perceived IPO exit risk.

5. Venture capital and the financial crisis

5.1 Effects of the crisis on venture capital

As the financial crisis deepened, its effect on the venture capital industry became apparent. Research done by Block et al (2011) suggests that the crisis led to a decrease in the total number and the amount invested per funding round. Although this decrease was considerable in all industries where venture capital is active, the communication industry was

hit the hardest. Its number of venture capital investments decreased more than 80 percent (OECD, 2009).

In addition, the decrease was the strongest with respect to early stage investments. Early stage stages investment dramatically increased by approximately 56 percent (OECD, 2009). While the crisis affected both the American and European venture capital industry, its effects have been more severe in the United States. Their total amount of venture capital investments declined 60%, in the first quarter of 2009. Although venture capital backed firms experience no sales growth in 2008, their performance was better than non venture capital backed firms (Colombo, 2011).

5.2 Causes of the effects of the crisis on venture capital

As explained above, the venture capital industry was negatively influenced by the financial crisis. Yet, which features of the venture capital industry were affected by the crisis and thus caused this decline. The theoretical framework indicates that the development of venture capital industry, within a country, is dependent on both the investment behaviour of the venture capitalists as well as the level of fundraising of investors in venture capital firms. Unfortunately, the financial crisis affected both determinants of the state of the venture capital industry.

The crisis negatively affected the investment behaviour of venture capitalists as it worsened the IPO conditions. Due to the crisis, the attractiveness of IPO's decreases what led to a higher liquidity risk of investment. Subsequently, this higher liquidity risk results in fewer investments of venture capital firms (McKenzie & Janeway, 2011). The shift in investment stages, due to the crisis, is related to the risk associated with early stage start-up firms (higher uncertainty and intangible assets (Bottazzi & Da Rin, 2002).

With respect to the level of funds raised by venture capital firms the crisis affected four of its seven determinants. First, the expected return of investments as economic prospers times generate higher rates of return (Gompers & Lerner, 2001). Second, as the exit conditions worsened, the liquidity risk increased. The level of liquidity risk does not only effect the behaviour of the venture capital firms as well as the investors providing these firms with capital. This higher liquidity risk changes the willingness of investors to provide capital to venture capital firms as they cannot effectively exit their investments (Giot & Schwienbacher, 2007; Cumming et al., 2005).

As the economy, and thus the incoming orders, declines the workforce of the start-up firms has to be reduced. This will result in high severance payments and therefore lower rates of return (Klein, 2011).

At the start of the crisis it became clear that the level of counter risk imposed within the financial sector was large. This means that all financial firms are interconnected with each other. As nobody exactly understood the relation underlying these firms the level of transparency declined. For investors transparency, obtaining the right and detailed information about uncertainties and risks, is important. As the level of transparency declined, so did the number of investments in venture capital firms (Klein, 2011).

6. Research hypotheses

6.1 Syndication

Syndication is a commonly used method in venture capitalism. The ability to reduce risk, the proliferation of a network within the industry and the creation of a platform for transferring specific knowledge and assets are important reasons why venture capitalists syndicate (De Vries & Block, 2011).

An important factor with respect to the syndicate size is the liquidity risk of an investment, as venture capitalist adjusts their investment decisions according to the current liquidity conditions. As explained before, with liquidity risk is meant the ability to effectively exit investments through an IPO (Cumming et al., 2005). Consequently, the state of the IPO market thereby provides information about the liquidity risk. Meanwhile, the IPO market is strongly related to the state of the economy (McKenzie & Janeway, 2011). Therefore, a change in the economic climate affects the IPO market and thus alters the liquidity risk.

Research done by Giot & Schwienbacher (2007), De Vries & Block (2011) and Cumming et al. (2005) states that a strong IPO market (therefore low liquidity risk) results in an incentive to syndicate. Their research shows a strong negative relation between the liquidity of exit markets and the size of the level of syndication. Venture capitalists thus syndicate more in times when liquidity risk is low as they can liquidate their investments more easily.

In addition, they provide complementary evidence that shows that venture capital firms start focusing on their primary investments in times of high liquidity risk. Research by De Vries & Block (2011) and Gompers & Lerner (2001) confirms that venture capital firms syndicate more during times of low liquidity risk while focussing on existing relationship in times of an economic crisis (high liquidity risk). This, as the increased risk and uncertainty

must be closely monitored by venture capital firms. High liquidity risk therefore affects the degree of syndication as firms are adjusting their existing portfolio to eliminate possible investment risks (Cumming et al., 2005). In addition, a shake-out within the industry will occur due to the hardened economic climate and eventually will influence the number of suitable syndicate partners (Greene, et al, 2001). Therefore, engagement in new investments with new syndicate partners is low (Mason, 2009).

Cumming et al (2005) and Giot & Schwienbacher (2007) also indicate a difference in the liquidity of exit markets between Europe and the United States. They argue that exit markets in Europe are less liquid and developed compared to the United States. This discrepancy could be explained by the differences between European countries. Whereas the United States is a more unified and homogenous market the European Union is still influenced by cultural, fiscal and economical differences. This will influence the development of the venture capital industry (Economist, 2010).

To summarise, we argue that the level of syndication decreases during the financial crisis as the level of liquidity risk increases, and it thus becomes more difficult for venture capital firms to exit investments. In addition, the syndicate size decreases because the financial crisis leads to a shift in focus of venture capitalists (core investments) (Gompers & Lerner, 2001; Mason, 2009). In addition, subsequent shake-out hardens the search for suitable syndicate partners (Green, 2004). With this information the following hypothesis can be formulated:

Hypothesis 1a: *The syndicate size within the venture capital industry decreases in times of the financial crisis in relation to non-economic crises times.*

There are differences in the liquidity of the exit markets between the United States and Europe. Exit markets in Europe are less liquid and developed compared to the United States (Cumming et al, 2005; Giot & Schwienbacher, 2007). This lower level of liquidity has, as explained before, a strong negative relation on the syndicate size as venture capitalist cannot exit investment easy. In addition, differences between the homogeneity of both industries, with respect to cultural, fiscal and economic discrepancies, are of influence on the development of the American and European venture capital industry and its level of syndication (Economist, 2010). Due to these variations between both industries this research proposes the statement that the syndicate sizes of the American and European venture capital

market might be affected differently by the financial crisis. The hypothesis formulated this statement is:

Hypothesis 1b: *The changes in syndicate size, due to the financial crisis, are greater for the European venture capital industry compared to the United States venture capital market.*

6.2 Venture capital firms

Innovative start-up firms receive venture capital from different types of venture capital firms. As these venture capital firms fill the financing gap left by other financial institutions, they are a significant hub in the entire world economy. As mentioned before, research suggests that the wide range of venture capital actors active in the industry can be classified into five types of venture capital firms. Consequently, as each type of venture capital firm consists of multiple actors, it is affected differently by determinants of the venture capital industry and the entire economy (Jeng & Wells, 2000).

The five kinds of venture capital firms described in the theoretical framework are:

- Independent venture capital firms
- Institutional venture capital firms
- Public venture capital firms
- Corporate venture capital firms
- Financial venture capital firms

The risk aversion of the independent, public and corporate venture capital firms results in a high affiliation for early stage (seed and start-up) investment (Mayer et al., 2005; Jenkins, 1989; Colombo, 2011), while the institutional and financial venture capital firms focus more on low risk, later stage (late and expansion) investment (Mayer et al., 2005).

Because these types of firms focus on later stage investments, the state of the IPO market is of particular interest. Where the state of the IPO market is of less influence on early stage investments, it is a significant determinant for later stage investments. Since start-up firms receiving later stage investment will utilize exit markets in an earlier stadium, the state of the IPO market is an important determinant of its attractiveness (Jeng & Wells, 2000). And because a change in the economic climate has an immediate effect on the state of the IPO

market it therefore influences the value of the investment and liquidity risk (McKenzie & Janeway, 2011; Shefrin, 2007). Research done by Block and Sandner (2009) confirms this statement. They state that there is a strong negative effect on the amount of funds raised in later stage funding due to the financial crisis.

Thus, due to the crisis, the attractiveness of IPO's (hence a higher liquidity risk) decreases what in turn effects the market for later stage investments. Therefore, as institutional and financial venture capital firms primarily provide capital to firms in a late stage, they are more vulnerable to any decrease in demand. With this information this research proposes the following hypothesis:

Hypothesis 2a: *The financial crisis will have a stronger negative effect on the investments of institutional and financial venture capital firms in relation to independent, public and corporate venture capital firms.*

However, not every venture capital industry is equal. Distributions within an industry, with respect to their reliance on types of venture capital actors and firms, could differ. An economic crisis could therefore have a different affect across industries (Bottazzi & Da Rin, 2002).

Research indicates that the American and European venture capital industries have significant structural differences with respect to reliance on types of venture capital firms. Where pension funds (institutional venture capital firms) are the largest contributor in the American venture capital market, the dependence in this type of firm is lower in Europe (Black & Gilson, 1998; McGlue, 2002). Even today, their share in financing the American venture capital industry keeps growing. This stability is a sign of the maturity of the American market as they do not heavily depend on "other" types of venture capital firms (Bottazzi & Da Rin, 2002).

The European venture capital industry consists for a larger part of financial venture capital firms (banks) (Mayer et. al, 2005). Researchers do not expect this to change as even the institutional venture capital firms (pension funds) will likely be controlled by banks the coming decades (Bottazzi & Da Rin, 2002).

Public venture capital firms are primarily non-existent in the United States. Although this type of venture capital firm actually exists in America (SBIC's), it's not considered as a venture capital firm (Bottazzi & Da Rin, 2002). Public venture capital firms became of more

significance in Europe after the introduction of the European investment fund in 1994. Since the mid-2000s both the European Investment Bank and European Commission gave the investment fund permission to invest on their behalf. From then on, the European Union became a specialist provider of funding regarding the technology sector (McGlue, 2002).

The independent and corporate venture capital firms are also important in Europe. With respect to corporate venture capital firms the amount has doubled in the second half of the 1990s (Bottazzi & Da Rin, 2002). Yet, Europe's reliance on a wide range of different types of venture capital firms, show that the venture capital market has not yet entered the maturity stage. Between European countries structural differences exist with respect to the venture capital industry. However, this research will not emphasize them. The European venture capital market is seen as one market (Leleux & Surlemont, 2001).

Hypothesis 2a suggests that investments by institutional and financial venture capital firms will decline more due to the financial crisis. Therefore, this subsequent hypothesis suggests that the financial crisis had a stronger negative effect on the American venture capital industry compared to the European venture capital industry, as their dependence on the types of venture capital firms are dissimilar. Therefore, the effect of the financial crisis might also differ. As stated before, the American venture capital industry depends heavily on investments of institutional venture capital firms. About 60% of their market is financed by institutional venture capital firms (pension funds) (Bottazzi & Da Rin, 2002). Therefore, a decrease in investments made by institutional venture capital firms will have a strong effect on the American venture capital market. Meanwhile, Europe is more dependent on a wide range of venture capital firms. A decrease in investments made by one particular firm therefore has a smaller effect on the entire venture capital market. With this information the last hypothesis can be formulated:

Hypothesis 2b: *As the financial crisis has a stronger negative effect on the investments of institutional and financial venture capital firms, the United States venture capital industry is more negatively affected, compared to Europe, by the financial crisis as its dependency on these types of venture capital firms is larger.*

7. Research data

7.1 Data description

As described before, the focus of this research is the relation between the venture capital industry and the financial crisis. Regarding this subject four hypotheses are formulated. These hypotheses focus on syndicate size and the different types of venture capital firms active within the industry. The effects of the financial crisis are investigated on both the venture capital industry as a whole as well as the variances between the United States and European industries. To test whether the derived hypotheses are valid, the Thompson Venture Economics database, provided by Thompson Economics, is used for statistical analysis. This proprietary database, also known as VentureXpert, contains aggregate data information on cash flows on a fund level; self estimated residual values and calculated rates of return. The data is acquired from a large number of international venture capital firms (7.000 funds and 23.000 portfolio companies) that voluntarily provide this information on a quarterly basis (McKenzie & Janeway, 2011). Thus, the VentureXpert database offers extensive coverage about the venture capital industry from 1969 until present day. Therefore, by means of quantitative analysis, the information available in this database will be used in order to understand the effect of the financial crisis on venture capital.

7.2 Period of analysis

This research focuses purely on the effects of the financial crisis. As explained before, the crisis started to ascend in the summer of 2007 and reached its heights on September 14th 2008 with the bankruptcy of Lehman Brothers. The fall of this investment bank resulted in a worldwide financial systems crash caused by unforeseen high level of counter risk. Due to the significance of this event, the official start of the financial crisis in this research will be linked to this particular date. The entire period of analysis will be from September 14th 2006 until September 14th 2010. By including two years before the start of the financial crisis a sufficient base is created to which results can be compared. In addition, effects of the financial crisis on the venture capital industry cannot be noticed immediately. Therefore, this research will include two years after the fall of Lehman Brothers into the analysis.

7.3 Sample construction

The data used in this research is obtained from the VentureXpert database. Yet, before analysis the selected data is considerably reduced. First, a selection is made between the countries analysed. This research focuses on the United States and European venture capital industry. With respect to the European venture capital industry, only countries which are member of the European Monetary Union (EMU) are included. Furthermore, the United Kingdom, although not a member of the EMU, is added to the dataset as it is highly interconnected, on a political and economical base, with EMU countries. In addition, the United Kingdom venture capital industry is with respect to the entire European Union too large to ignore. Therefore, when referred in this research to the “European venture capital industry” all EMU countries and the United Kingdom are implicated. All other countries, not within the United States or European venture capital industry are excluded from the dataset.

After fitting the data with respect to the countries of analyses and the period of analysis, the used variables are analyzed for missing values. Three variables contain missing values. These variables, age of start-up firms receiving venture capital, age of venture capital firms and the amount invested per round, are adjusted. Their missing values are removed from the dataset. In addition, all variables, in which applicable, are adjusted with respect to their mean in relation to the identification round. This is done as the entire analyses takes place on a funding round level.

After creating a dataset containing the right period of analysis, the venture capital industries of interest, a set of variables without missing values and if applicable on funding round level and converted to its mean, the residual data is cleaned from investments that are included twice. These duplicates are removed.

Before implementing the adjustments described in this paragraph the number of observations included in this dataset was 75.428 funding rounds (period: 14-09-2006/14-09-2010). After selecting only the industries of interest the funding rounds declined to 33.815. Eventually, after deleting duplicate round and adjusting from missing values the number of funding rounds in this dataset consists of 14.959. Hence, the dataset used for analysis in this research, contains 14.959 funding rounds.

7.4 Main variables

This research has two main dependent and independent variables (table 2). With respect to hypotheses 1a and 1b, the main dependent variable of interest is the level of *syndication*

(*syndicate size*). This variable calculates the syndicate size in the venture capital industry based on the number of venture capital firms investing in a round. With respect to the second hypotheses (2a and 2b) the dependent variable is venture capital actor. This variable, divided into 16 categories, provides information about the types of venture capital firms active in the venture capital industry. With respect to this research these 16 categories are pooled into the five primary venture capital firms described in the theoretical framework (Table 1). These five types of venture capital firms (independent, institutional, public, corporate and financial) are dummy variables where the value 1 indicates that the investment is done by a particular type of venture capital firm. Table 1 shows the classification of the 16 venture capital actors into these five types of venture capital firms.

Table 1: Categorization venture capital actors

<i>Independent venture capital firms</i>	<ul style="list-style-type: none"> • Angel Groups • Individuals • Other • Private equity advisor or fund of funds • Private equity firm
<i>Institutional venture capital firms</i>	<ul style="list-style-type: none"> • Endowment, foundation or pension fund • Insurance firm Affiliate
<i>Public venture capital firms</i>	<ul style="list-style-type: none"> • Government affiliated program • Incubator/development program • Investment management firm • SBIC • University program
<i>Corporate venture capital firms</i>	<ul style="list-style-type: none"> • Corporate PE/Venture • Service Provider
<i>Financial venture capital firms</i>	<ul style="list-style-type: none"> • Bank affiliated • Investment management firm

Notes: This table presents the classification of the 16 venture capital actors into the 5 types of venture capital firms (The classification of the variable VC actor type is based on the theoretical framework, paragraph 4.3).

The main independent variables are the binary dummy variables *crisis period* and *start-up region* (table 2). The dummy variable *crisis period* is crucial for this research as it indicates the period of analysis (financial crisis). This variable is adjusted to include only data important for this research (paragraph 7.2), where the value 1 indicates observations after the start of the financial crisis. The second important independent variable is the region of the start-up firm. This independent dummy variable is an indicator of the location of the start-up. During the sample construction, the possible location of the start-ups, used for analysis, is reduced to only the United States and Europe. This independent dummy variable is therefore a

means to compare these two industries, where value 1 indicates only start-ups from the European venture capital industry (non-US).

This research tempts to investigate the effects of the crisis between the United States and European venture capital market. These possible differences are explored by the use of the interaction variable crisis period and start-up region. When added to the analysis, this interaction variable indicates of there are significant differences, between both industries, on the dependent variables as a result of the crisis.

7.5 Control variables

With respect to the entire model a number of variables are added to control for influences on the dependent variables, other than the independent variables crisis period and start-up region. These control variables are; venture capital experience, age of start-up firms receiving venture capital, age of venture capital firms, amount invested per round, stages of venture capital investment, round number and industry region (table 2). The variables *venture capital experience*, *age of start-up firms*, *age of venture capital firms* and *amount invested per round* are formulated as a logarithm as they are not normally distributed. In addition, these variables are adjusted to funding round levels. The variable with respect to investment stages is categorized into four binary dummy variables. Each dummy variable indicates a different investment stage. These investment stages are: *seed*, *early*, *later* and *expansion stage*. Further, the control variable *round number* is included. The last control variable is the *industry region* of venture capital firms. This control variable is in the regressions constructed into ten dummy variables each indicating a different industry focus.

Table 2: Definitions of variables

Variables	Description
<i>Dependent variables:</i>	
Syndicate size	The number of venture capital actors that collaborate with respect to a particular investment
Independent VC firms	Dummy variable which indicates whether independent venture capital firms are active in a funding round
Institutional VC firms	Dummy variable which indicates whether institutional venture capital firms are active in a funding round
Public VC firms	Dummy variable which indicates whether public venture capital firms are active in a funding round
Corporate VC firms	Dummy variable which indicates whether corporate venture capital firms are active in a funding round
Financial VC firms	Dummy variable which indicates whether financial venture capital firms are active in a funding round
<i>Independent variables:</i>	
Crisis period	Dummy variable indicating whether an investment takes place before or after the start of the financial crisis
Start-up region	Dummy variable which indicates whether the start-up firms is located in the United States or Europe
Crisis*start-up region	Interaction variable, combination of crisis period and start-up region
<i>Control variables:</i>	
VC experience	The level of experience of venture capital firms conducted by the number of investments
VC firm age	The age of the venture capital firm in years
Start-up firm age	The age of the start-up firm in years
Round amount	The amount invested by venture capital firms in start-ups per funding round
Round number	The number of times that a start-up firms received venture capital funding
Seed stage investment	Dummy variable: indicating whether a venture capital firms invests in seed stage investments
Early stage investment	Dummy variable: indicating whether a venture capital firms invests in early stage investments
Later stage investment	Dummy variable: indicating whether a venture capital firms invests in later stage investments
Expansion stage investment	Dummy variable: indicating whether a venture capital firms invests in expansion stage investments
Start-up industry	Dummy variable: indicating the 10 industry categories of the start-up firm

Notes: All variables are generated at a funding round level.

7.6 Descriptive statistics

A first look at the statistics in table 3 shows that the variables: age of venture capital firms, the age of start-up firms, round number and amount invested per round are right skewed. In addition, the dependent variable syndicate size is left skewed. Furthermore, all variables contain 14.959 observations and after adjustment (see paragraph 7.3) no missing values.

Table 3: Descriptive statistics: dependent, independent and control variables.

Variables	Observations	Missings	Mean	Standard deviation	Minimum	Maximum
<i>Dependent variables:</i>						
Syndicate size	14959	0	2.547697	1.856205	1	59
Independent VC firms	14959	0	0.9336186	0.248956	0	1
Institutional VC firms	14959	0	0.0131693	0.1140034	0	1
Public VC firms	14959	0	0.0948593	0.2930303	0	1
Corporate VC firms	14959	0	0.1643826	0.3706348	0	1
Financial VC firms	14959	0	0.1211979	0.3263671	0	1
<i>Independent variables:</i>						
Crisis period	14959	0	0.4383983	0.4962073	0	1
Start-up region	14959	0	0.1530851	0.3600815	0	1
<i>Control variables:</i>						
VC experience	14959	0	5.529529	1.9954535	0	10.82327
VC firm age	14959	0	8.563287	0.6667434	2.995732	10.57977
Start-up firm age	14959	0	7.358325	1.034796	0	10.54946
Round amount	14959	0	1.675419	1.081095	0	8.594154
Round number	14959	0	3.540076	2.757476	1	22
Seed stage	14959	0	0.0882412	0.2936548	0	1
Early stage	14959	0	0.2396551	0.4268872	0	1
Later stage	14959	0	0.3032957	0.4596972	0	1
Expansion stage	14959	0	0.3038305	0.4599257	0	1
Start-up industry 1	14959	0	0.1095661	0.3123587	0	1
Start-up industry 2	14959	0	0.0697908	0.2548026	0	1
Start-up industry 3	14959	0	0.036834	0.1883604	0	1
Start-up industry 4	14959	0	0.2050271	0.4037349	0	1
Start-up industry 5	14959	0	0.0369009	0.1885247	0	1
Start-up industry 6	14959	0	0.0707935	0.2564882	0	1
Start-up industry 7	14959	0	0.1931947	0.3948176	0	1
Start-up industry 8	14959	0	0.1396484	0.3466334	0	1
Start-up industry 9	14959	0	0.0628384	0.2426802	0	1
Start-up industry 10	14959	0	0.0754061	0.2640543	0	1

Notes: This table presents the main statistics of all the variables used in this research.

A first look at the correlation matrix in table 4 shows interesting correlations between multiple variables. First, with respect to the main dependent variable syndicate size the matrix indicates, for the variables crisis period and start-up region, a negative correlation with syndicate size (-0.0800, -0.0966). This might indicate that there is indeed a negative relation between the financial crisis and the syndicate size. In addition, the negative correlation of start-up region could imply that there is indeed a difference on the effect of syndicate size, between venture capital industries. Furthermore, regarding the different investment stages, syndicate size has the highest correlation with later stage investment (0.1815). Interestingly, seed and early stage show a, although minor, negative correlation with syndicate size. This

seems to contradict with the described theory as it indicates that firms, investing in seed and early stage investments, would syndicate as it reduces risk, fosters knowledge sharing and the proliferation of networks. At last, with respect to the syndicate size, the correlation matrix indicates a high correlation with the invested amount per round.

Also the other main dependent variable, types of venture capital firms, shows in relation to some variables interesting results. First, the correlation matrix (table 4) indicates that corporate and financial venture capital firms correlate the highest with respect to syndicate size (0.3879, 0.2767). Whereas the correlation between public venture capital firms and syndicate size is the smallest with a correlation of 0.1411. The high positive correlation between corporate venture capital firms and syndicate size contradicts with previous research. However, the literature indicates that the previous strategy of corporate venture capital firms had no significant results. This high correlation could therefore indicate a shift in their strategy. In addition, the literature states that independent venture capital firms invest foremost in seed and early stage investment firms. Yet, the correlation matrix shows a negative correlation with respect to these investments (-0.0269, -0.0069). This is similar to corporate venture capital firms (-0.0222, -0.0437). The negative correlation of corporate venture capital firms with early stage investment also contradicts regarding previous research. The same reasoning as explained above is applicable here. With respect to the variable crisis period, only the public venture capital firms show a, although minor) positive correlation (0,020). Furthermore, independent and corporate venture capital firms show a negative correlation with respect to start-up region (-0.1275, -0.0413).

The highest correlation can be found between the variables venture capital experience and venture capital age (0.7140). This positive correlation is not surprising as the age of a venture capital firms is an important determinant for the number of investments made and thus the acquired experience of the venture capital industry.

Table 4: Correlation matrix of dependent, independent and control variables.

	syndicate size	Independent VC firms	Institutional VC firms	Public VC firms	Corporate VC firms	Financial VC firms	Start-up region	Crisis period	Crisis period*start-up region	VC experience	VC firm age	Start-up firm age	Round number	Round amount	Seed stage	Early stage	Later stage
Independent VC firms	0.1998																
Institutional VC firms	0.1628	-0.0422															
Public VC firms	0.1411	-0.3352	0.0146														
Corporate VC firms	0.3879	-0.0795	0.0469	0.0300													
Financial VC firms	0.2767	-0.1972	0.0415	0.2188	0.0597												
Start-up region	-0.0966	-0.1275	0.0339	0.0841	-0.0413	0.1686											
Crisis period	-0.0800	-0.0345	-0.0111	0.0197	-0.0418	-0.0115	0.0513										
Crisis period*start-up region	-0.0654	-0.0964	0.0287	0.0746	-0.0187	0.1163	0.6759	0.3252									
VC experience	0.0231	0.1655	-0.0230	-0.1375	0.0137	-0.1277	-0.0992	0.0355	-0.0862								
VC firm age	0.0209	0.0619	0.0004	-0.0664	0.0258	-0.0027	-0.0303	0.0554	-0.0306	0.7140							
Start-up firm age	0.0569	-0.0291	0.0237	0.0024	0.0319	0.1090	0.0736	0.0785	0.0588	-0.0168	0.0819						
Round number	0.2405	0.1124	0.0414	-0.0333	0.0949	0.0520	-0.1356	0.0425	-0.1265	0.0939	0.1211	0.4017					
Round amount	0.2939	0.0012	0.0548	-0.0239	0.1489	0.1258	-0.0362	-0.0427	-0.0394	0.0537	0.0939	0.1163	0.0868				
Seed stage	-0.0561	-0.0269	-0.0049	0.0320	-0.0222	-0.0556	-0.0105	-0.0226	-0.0326	-0.0055	-0.0442	-0.4092	-0.2273	-0.0974			
Early stage	-0.0784	-0.0069	-0.0209	0.0171	-0.0437	-0.0746	-0.0186	0.0522	0.0068	0.0018	-0.0677	-0.3831	-0.3184	-0.1298	-0.1697		
Later stage	0.1815	0.0498	0.0284	0.0167	0.0715	0.1008	-0.0915	-0.0108	-0.0417	-0.0129	0.0497	0.4441	0.4494	0.0333	-0.2012	-0.3677	
Expansion stage	0.0113	0.0144	0.0027	-0.0154	-0.0106	0.0174	0.1010	-0.0166	0.0560	0.0006	0.0199	0.0654	-0.0272	0.0273	-0.1989	-0.3668	-0.4280

Notes: Correlation matrix of dependent, independent and control variables. Variable start-up region excluded from correlation matrix due to its minor importance with respect to this research.

7.7 Methodology

To test the validity of the hypotheses, different models of the dependent variables syndicate size and types of venture capital firms, are created. A Shapiro Wilk test is executed to test if the data is normally distributed and confirms this statement (Multivariate Data Analysis: A global perspective, 2010, p. 73). Furthermore, all models in this research are reported as robust standard errors as White`s test indicates that the variables show signs of heteroskedasticity (Principles of Econometrics, 2008, p. 215). With respect to multi collinearity, VIF tests are performed on the OLS regression. These VIF tests are performed on all models used in this research to make sure the results are robust. These tests indicate that only the variables, with respect to the investment stages, show signs of multi collinearity (Multivariate Data Analysis: A global perspective, 2010, p. 161). Therefore, the variable early stage is omitted from the regression.

The first main dependent variable is syndicate size. As this variable is a count variable, the use of ordinary count models, poisson or negative binomial models, is appropriate (Principles of Econometrics, 2008, p. 437). With respect to this research the poisson model is preferred as there are no significant signs of over dispersion. This is concluded as the variance of the dependent variable syndicate size is approximately equal to its mean (Multivariate Data Analysis: A global perspective, 2010, p. 74). In addition, multiple goodness of fit tests, confirms the use of the Poisson model. As the data includes not a large amount of zero`s, generating zero inflated Poisson models is not necessary. Furthermore, to increase the interpretability all the results of the poisson models are reported as incidence-rate ratios.

To test whether the second hypotheses (2a, 2b) are valid this research uses a binary logistic model for its dependent variables; independent, institutional, public, corporate and financial venture capital firms. A logit model is used as the five dependent variables are binary dummy variables taking values of either 0 or 1 (Principles of Econometrics, 2008, p. 425). To increase the interpretability of the logit models all the results are reported as odds ratio`s.

8. Regression results

After describing the research data, descriptive statistics and methodology in chapter 6 and 7, the main results, conducted from the regression analysis, will be interpreted. Table 5 shows the regression results with syndicate size as the main dependent variable. It explains whether

the syndicate size of firms is negatively affected by the crisis and its difference between the two industries. Table 6 tests if institutional and financial venture capital funds are more negatively affected by the crisis compared to other funds. In addition, this table shows whether the United States` venture capital industry is affected more negatively by the financial crisis. This, as their industry is more dependent on the types of venture capital firms, for which this research predicts that they will be more negatively affected by the crisis.

8.1 Syndicate size

Presented in table 5 are three different models generated for the analysis of the syndicate size of venture capital firms. All the results are reported as incidence-rate ratio`s and have robust standard errors. The first model includes the regular control variables plus the independent variable start-up region. This model focuses on the level of syndication across the two industries. In the second model the independent dummy variable crisis period is included. This model shows whether the level of syndication decreases in times of the financial crisis. The last model adds the interaction variable crisis period and start-up region. This interaction variable combines the effects of these two independent variables and test whether they significantly modify each other. Thus, it therefore indicates whether the syndicate size of European venture capital firms is affected more by the financial crisis compared to the United States venture capital market. In addition, when analysing the results, all control variables are held constant.

The independent variable start-up region is significant in all models, presented in table 5, at a 1% level. The first model indicates that the European venture capital industry is expected to have approximately a 12% lower level of syndicate size (0.8797706) compared to the United States. Even by including the dummy variable crisis period within the model, the variable start-up region shows minor changes.

The dummy variable crisis period is also significant at a 1% rate in all models. The results indicate that the period after the fall of Lehman Brothers is expected to negatively affect the syndicate size by 8 percent (0.9185861) compared to the period before the crisis. Thus the financial crisis affects the syndicate size of venture capital firms.

When looking at the third and final model in table 5, the interaction variable crisis period*start-up region indicates that the effect of the financial crisis on the level of

syndication is greater for the United States as for the European venture capital industry. The syndicate size of the European venture capital industry is expected to be, even in times of the financial crisis, larger at a rate of 12 percent compared to the United States (1.120043).

With respect to the different venture capital firms and their level of syndication, the results in the models indicate that all venture capital firms have a positive and significant relation. Thus, all venture capital firms syndicate. Independent venture capital firms tend to syndicate on average 163% more of their investments, compared to other types of venture capital firms. Corporate venture capital firms tend to syndicate the least (27%). Other variables do not deviate significantly between models and show no peculiar results. The Pseudo R² of the three models indicates that the level of improvement over the intercept model, by including more variables, did not alter significantly. In addition, the low values of the pseudo R² indicate that the presented models are a better fit than the intercept model.

8.1.1 Hypothesis 1a

The second model indicates highly significant results, that the financial crisis negatively affects the level of syndication of venture capital firms. The syndicate size within the venture capital industry decreases by 8.125 percent. The first formulated hypothesis is valid.

8.1.2 Hypothesis 1b

In addition, the results suggest that the effects of the financial crisis on syndication are smaller for European venture capital firms. This difference of effects, between the United States and European venture capital industry, is 12 percent. Thus, the level of syndication within the European venture capital industry, in times of the financial crisis tends to be higher compared to the United States venture capital industry. Thus, the second hypothesis is supported by the obtained results.

Table 5: Poisson regressions: syndication

Explanatory variables	Poisson Regression. Dependent Variable Syndicate Size		
	(1)	(2)	(3)
Start-up region	0.8797706*** (0.0151096)	0.8852198*** (0.0153488)	0.8394551*** (0.0265286)
Crisis		0.9185861*** (0.0088043)	0.9045721*** (0.0092086)
Crisis*start-up region			1.120043*** (0.0428676)
VC experience	1.057027*** (0.003668)	1.056885*** (0.0036591)	1.057049*** (0.0036641)
VC firm age	0.9289803*** (0.0091501)	0.9331187*** (0.009205)	0.933592*** (0.0091868)
Start-up firm age	0.9457273*** (0.0057073)	0.9507203*** (0.0057739)	0.9512674*** (0.0057546)
Round amount	1.138361*** (0.0053)	1.136374*** (0.0052707)	1.136608*** (0.0052791)
Round number	1.023879*** (0.0022641)	1.02517*** (0.0022599)	1.025853*** (0.0023475)
Independent VC firms	2.650109*** (0.0537233)	2.637646*** (0.0534024)	2.636882*** (0.0534947)
Institutional VC firms	1.55447*** (0.0518661)	1.549003*** (0.0512187)	1.545876*** (0.0510929)
Public VC firms	1.35038*** (0.0253729)	1.357855*** (0.0253376)	1.35674*** (0.025594)
Corporate VC firms	1.273281*** (0.0077897)	1.270731*** (0.0077035)	1.269659*** (0.007841)
Financial VC firms	1.479942*** (0.0210362)	1.474028*** (0.020765)	1.474389*** (0.0207489)
Start-up industry	Embedded in regression	Yes	Yes
VC investment stages	Embedded in regression	Yes	Yes
Number of observations	14.961	14.961	14.961
Loglikelihood	-25.958,242	25.922,482	-25.915,117
Pseudo R2	0.1512	0.1529	0.1531

Notes: Models 1, 2 and 3 represent poisson models. The dependent variable is the syndicate size of venture capital firms. All models are reported as incidence rate ratio's and robust standard error's. The first model excludes the variables crisis period and crisis-period*start-up region. The second model represents both start-up region and crisis period. The third model includes all the variables. The control variables start-up industry and venture capital investment stages are, although not presented in the model, included in the regressions.

8.2 Types of venture capital firms

Presented in table 6 are the five different types of venture capital firms, used as dependent variables in binary logistic regressions. As explained before, all the results are reported as odds ratios (higher interpretability) and robust standard errors (heterogeneity). The table shows two analyses for each dependent dummy variable.

The first model includes the regular control variables, the independent variable start-up region and the independent dummy variable crisis period. This model thus indicates the effects of the financial crisis on the level of investments by a particular venture capital firm.

The second model adds the interaction variable crisis period and start-up region. This model focuses on the impact the financial crisis of these distinct types of venture capital firms, with respect to the start-up region. This interaction variable thus indicates whether the investments of a particular type of venture capital firms, in the European venture capital industry, is affected more by the financial crisis compared to the United States venture capital industry.

When looking at the first models in table 6, with respect to all the different types of venture capital firms, the independent variable start-up region is significant in all models at a 5% or in most cases a 1% level. The results indicate that the odds for start-up firms in the European venture capital industry, of receiving venture capital from independent, public and financial venture capital firms is 2.219, 1.577 and 3.236 times larger than the odds that start-up firms in United States venture capital industry receive capital from these particular types of firms. When looking at the crisis period variable the model shows that the dependent variable institutional venture capital firms has no significant effect with respect to the crisis. The other types of venture capital firms are significant at a 5% and foremost a 1% level. The first model shows a positive effect on the investment by public venture capital firms. This means that, in times of the financial crisis, the odds that start-up firms are financed by public venture capital firms, increases (1.145443). Yet, the other venture capital firms show a decrease in the chance that they invest in firms during the financial crisis (0.790062, 0.8319873 and 0.8756678).

For the second model in table 6 the interaction variable is included. The interaction variable explores if the effects of the financial crisis on the investments by these particular types of firms, alter between different start-up regions. The interaction variable is only significant for the dependent variables institutional and corporate venture capital firms. Only within these models are the variables crisis period and start-up region, with respect to the

dependent variables, significantly modified by each other. The interaction variables of the institutional and corporate venture capital firms are respectively significant at a 5% and 1% level. The odds rates of these variables are 2.050111 and 1.771087. These results indicate the chance that the effects of the crisis, on the investments by these two types of venture capital firms, in the European industry, are lower. Thus, the odds rates show that these types of venture capital firms, in the United States venture capital market, are 2.05 and 1.77 times as negatively affected by the financial crisis compared to Europe. The investments of institutional and corporate venture capital firms in Europe, in times of the financial crisis, are higher compared to the United States.

The results with respect to the control variables show that the age of start-up firms has only a significant effect on independent venture capital firms. Meanwhile, the amount invested per round and the round number has a significant effect for all the types of venture capital firms except independent venture capital firms. All models fit the data and Pseudo R² for each of the two generated models indicates that the level of improvement over the intercept model, by including the interaction variable, did not alter significantly.

8.2.1 Hypothesis 2a

The third hypothesis suggested that the crisis will have a stronger negative effect on the investments of institutional and financial venture capital firms in relation to independent, public and corporate venture capital firms. The obtained results indicate that this hypothesis is not supported as it shows no significant effect of the crisis on institutional venture capital firms and financial venture capital firms are not more negatively affected compared to other venture capital firms.

8.2.2 Hypothesis 2b

The last formulated hypothesis proposes that, as the financial crisis has a stronger negative effect on the investments of institutional and financial venture capital firms, the American venture capital industry is more negatively affected as it is more dependent on these types of venture capital firms. The obtained results indicate that the second hypothesis is valid. The validity of the hypothesis is in contrast with the results found with respect to hypothesis 2a which indicates that institutional and financial venture capital firms are not more negatively affected by the financial crisis. Yet, the significant results for institutional and corporate

venture capital firms indicate that the effects of the crisis, for the United States venture capital industry, are greater. The odds rates show that institutional and corporate venture capital firms, in the United States venture capital industry, are 2.05 and 1.77 times as negatively affected by the financial crisis compared to Europe. Thus, the investments of institutional and corporate venture capital firms in Europe, in times of the financial crisis, are higher compared to the United States.

Table 6: Logit regressions: Types of venture capital firms

Binary logistic regression. Dependent variables: five types of venture capital firms										
	Independent VC firms		Institutional VC firms		Public VC firms		Corporate VC firms		Financial VC firms	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Start-up region	0,568891*** (0,0480932)	0,5042377*** (0,574742)	2,219409*** (0,3989314)	1,610591** (0,3873596)	1,577051*** (0,116811)	1,443644*** (0,1464513)	0,8507562** (0,0601769)	0,6479289*** (0,0645512)	3,236667*** (0,2087427)	2,956784*** (0,2545965)
Crisis period	0,7900625*** (0,05514)	0,7372391*** (0,0604006)	0,8204763 (0,122656)	0,6745256** (0,1209881)	1,145443*** (0,0668121)	1,100396 (0,0732694)	0,8319873*** (0,038967)	0,7706962*** (0,0391375)	0,8756678** (0,0475507)	0,8293244*** (0,0525477)
Crisis*start-up region		1,265611 (0,1950603)		2,050111** (0,7009362)		1,189998 (0,1652979)		1,771087*** (0,245853)		1,21669 (0,1518361)
VC experience	1,483386*** (0,0478142)	1,481837*** (0,0476566)	0,8173706*** (0,0387667)	0,8176703*** (0,0392975)	0,7389656*** (0,0152156)	0,7385148*** (0,0152131)	1,110626*** (0,020643)	1,113061*** (0,0208308)	0,7002417*** (0,0129831)	0,6998661*** (0,0130016)
VC firm age	0,63764*** (0,0530622)	0,633005*** (0,0530223)	1,371459** (0,2106323)	1,381283** (0,2150189)	1,317177*** (0,0755488)	1,318343*** (0,0757147)	0,6548043*** (0,0329095)	0,6537292*** (0,0331089)	1,856812*** (0,0975391)	1,861645*** (0,0980798)
Start-up firm age	0,7733702*** (0,0334649)	0,7742265*** (0,0334781)	0,9629767 (0,0862993)	0,9634181 (0,0867355)	0,9436014* (0,0314422)	0,9441788* (0,0314802)	0,9590085 (0,027731)	0,9610982 (0,0278153)	1,048205 (0,0364357)	1,049003 (0,0364702)
Round amount	0,960437 (0,0353279)	0,9602781 (0,0352603)	1,492261*** (0,0874797)	1,493448*** (0,0879315)	0,9310292** (0,026098)	0,9308315** (0,0261226)	1,419922*** (0,0294123)	1,420569*** (0,029538)	1,434042*** (0,0347833)	1,434376*** (0,0348543)
Round number	1,20861 (0,028716)	1,211993*** (0,0289211)	1,094923*** (0,0225215)	1,101565*** (0,0227333)	0,9573715*** (0,0124828)	0,9589026*** (0,0125444)	1,049978*** (0,0091302)	1,053593*** (0,0092366)	1,027771*** (0,013874)	1,029601*** (0,0104447)
Start-up industry	Embedded in regression	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
VC investment stage	Embedded in regression	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	14.959	14.959	14.959	14.959	14.959	14.959	14.959	14.959	14.959	14.959
Log likelihood	-3.222,7474	-3.221,5401	-985,05969	-982,81511	-4.380,2429	-4.379,4501	-6.307,4018	-6.298,9121	-4.887,2545	-4.885,9479
Pseudo R²	0,1177	0,1180	0,0607	0,0628	0,0664	0,0666	0,0564	0,0577	0,1153	0,1156

Notes: Models 1 and 2 represent logit models. The dependent variables are the distinct types of venture capital firms. All models are reported as odds ratio's and robust standard error's. The interaction variable crisis period*start-up region is excluded from model 1 with respect to every regression. The control variables start-up industry and venture capital investment stages are, although not presented in the model, included in the regressions.

9. Discussion

This final chapter will discuss the obtained results of this research. After providing a critical reflection with respect to the results, the contributions of this research to venture capitalism are explored. In addition, important limitations, with respect to this research, and suggestions for future research are presented. This chapter will end with a short conclusion regarding the entire research.

9.1 Summary of the results

The obtained results indicate that the level of syndication decreases due to the financial crisis, in both the United States and European venture capital industry. However, the effect of the financial crisis, on syndicate size, differs across industries. The results show that the effects of the crisis on syndicate size are smaller in the European venture capital industry compared to the United States.

Furthermore, this research suggests that the investments of institutional and financial venture capital firms are not more negatively affected by the crisis compared to other types of venture capital firms. In addition, the obtained results confirm that the United States venture capital industry, with respect to investments of the types of venture capital firms, is more negatively affected by the financial crisis as their European counterpart.

9.2 Discussion of the results

The results confirm the rationale that venture capital firms attach higher value to the liquidity risk of their investments, with respect to syndication decisions, than the reduction of risk, increased knowledge sharing between venture capital firms and the proliferation of networks (De Vries & Block, 2011; Ooghe et al., 1991; Cumming et al., 2005). Thus, this research therefore supports previous research done by Giot & Schwienbacher (2007) and Cumming et al. (2005) which indicates that syndication is only attractive for venture capital firms in times of a positive economic climate (low liquidity risk) as venture capital firms can more easily exit syndicate investments. In addition, venture capital firms may have shifted their focus to their core investments as the increased risk and uncertainty must be closely monitored (Cumming et al., 2005). Furthermore, a possible shake-out that occurred due to the crisis, might have led to less suitable syndicate partners (Green, 2004; Mason, 2009).

The outcome that the effect of the crisis on syndication is stronger on the United States venture capital industry contradicts with the rationale based on the formulated theoretical framework. This research suggested that, as the European venture capital exit markets are less developed and liquid compared to the United States, their lower level of liquidity will result in a higher vulnerability with respect to sudden changes in the economic climate and thus the level of syndication during the financial crisis (Cumming et al, 2005; Giot & Schwienbacher, 2007). In addition, it was expected that, during the crisis, the economical, cultural and political differences between European countries would be an important determinant with respect to the syndicate size. While the United States is viewed as a homogenous market, the European Union is still far from total integration (Economist, 2010). Therefore, the relative higher transaction costs, during the financial crisis, for syndicates were expected to have led to a lower syndicate size for the European venture capital industry (De Vries & Block, 2011). However, the obtained results indicate otherwise.

The statement that investments by institutional and financial venture capital firms are more vulnerable with respect to a change in the economic climate, is invalid. Even though they utilize the exit markets in the nearer future (higher ratio later stage investments), they seem less affected by a change in the liquidity of exit markets (IPO`s) (De Vries & Block, 2011).

In addition, although the formulated theory, that the American venture capital industry was hit harder by the financial crisis, was supported by the results, the proposed rationale behind this was incorrect. The theory was based on the rationale that, as the investments by institutional and financial venture capital firms were hit harder, and the dependency of the United States venture capital industry on these types of firms was higher; their industry would be hit harder by the financial crisis (Bottazzi & Da Rin, 2002). However, the obtained results could not confirm that the investments by institutional and financial venture capital firms were more negatively affected. But, the results did indicate that the United States venture capital industry, with respect to the investments of the types of venture capital firms, was more negatively affected by the financial crisis.

9.3 Scientific contribution

Preliminary research done by Cumming et al. (2005), De Vries & Block (2009) and Giot & Schwienbacher (2007) indicate that there is a strong negative relation between the state of the economy and the level of syndication. This contradicts with the common theoretical reasoning

that, in times of an economic crisis, when risks increase and accurate knowledge and a large network become more essential, the syndicate size is expected to increase.

The obtained results indicate that the financial crisis indeed had a negative effect on the level of syndication. It thus confirms the opposed contradiction between theory and practice and contributes to this stream of literature by providing more scientific evidence with respect to the negative effects of the state of the economy on the level syndication.

Furthermore, by analysing both the United States and European venture capital industry separately, region specific information is obtained with respect to the influence and magnitude of the financial crisis on their level of syndication. It therefore contributes to the stream venture capital literature as it provides a better insight with respect to the differences between these venture capital industries.

In addition, this research tried to provide scientific insights with respect to the effects of the financial crisis on the investments of the different types of venture capital firms. This, as these effects have not yet been explored within contemporary scientific research. The obtained results in this research thus contribute to the development of a better scientific insight with respect to this field of venture capital. In addition, by analysing the relation between the financial crisis and the investments of these types of venture capital firms, valuable information is provided with respect to its implications for start-up firms for the entire venture capital industry as well as the United States and European venture capital industry on an individual level.

9.4 Suggestions for future research and limitations

This research analyses the effects of the financial crisis on venture capital, specifically the syndicate size and the investments of the distinct types of venture capital firms. The results indicate that the level of syndication tends to be lower in the United States venture capital industry in times of the financial crisis. Future research might take a closer look at what caused this effect to be larger for the United States compared to Europe.

In addition, the formulated hypothesis, that investments by independent and financial venture capital firms are more vulnerable with respect to the effects of the financial crisis, was not supported by the obtained results. This invalidity of the hypothesis contradicts with the theoretical framework, which suggest that as these venture capital firms utilize the exit markets in the nearer future (higher ratio later stage investments), they are more affected by a

change in the liquidity of exit markets (IPO`s) (De Vries & Block, 2011). Future research could elaborate this contradiction between theory and practice and try to provide a valid explanation for this result.

In addition, the obtained results indicate that in times of the financial crisis all types of venture capital firms, except public venture capital firms, decrease their investments. This result could indicate that governments try to fill the financing gap in venture capital, due to a change in the investments of other types of venture capital firms, as an immediate result of the financial crisis. This development could be interesting to further explore.

At last, the correlation matrix indicated that corporate venture capital firms have a negative correlation with respect to seed and early stage investment. As this contradicts with previous research it would be interesting to investigate whether corporate venture capital firms have experienced a strategy shift with respect to the stages of investment.

With respect to this research, numerous limitations can be conducted. First, this research categorized a set of venture capital actors into five types of venture capital firms. Yet, these actors might have some overlay with multiple types of venture capital firms. So, the results with respect to the investments by venture capital firms could show minor changes when venture capital actors are categorized differently. Second, this research compares all results between the United States and European venture capital industry. The European venture capital industry consists, in this research, of EMU member countries and the United Kingdom. The inclusion of the United Kingdom or the exclusion of other European Union countries could provide different results. Third, the number of control variables added to the regression models are minor compared to the available number of control variables.

9.5 Conclusion

The purpose of this research was to explore the effects of the financial crisis on venture capital and subsequent differences between the United States and European venture capital industry. This primarily on two aspects: the syndicate size and the investments of the different types of venture capital firms. Before analysing the data a theoretical framework was created which explained all the important aspects and determinants of venture capital. By use of poisson and logit regression models the results were obtained. The first model indicated that the financial crisis negatively affected the level of syndication. Hence, the number of syndicate partners declined in both industries. In addition, this effect was smaller for the

European venture capital industry compared to the United States. The second model investigated whether the investments of the five distinct types of venture capital firms were affected by the financial crisis and whether this differs between the United States and Europe. Although the results indicates that some of these types of venture capital firms were influenced by the financial crisis, the results did not confirm the expectation that investments by institutional and financial venture capital firms were more negatively affected. Meanwhile, the assumption that the United States venture capital industry, with respect to the investments of venture capital firms, was affected more negatively by the financial crisis was supported by the results.

Thus, this research can conclude that the financial crisis influences venture capital as it decreases the syndicate size and effects the investments of venture capital firms.

10 References

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