HELSINKI SCHOOL OF ECONOMICS AND BUSINESS ADMINISTRATION
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IPO LOCKUP EXPIRATIONS: MORE EVIDENCE ON VENTURE CAPITALISTS' INVOLVEMENT

Master's Thesis in Finance
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SUMMARY

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Aim of the study

The aim of the study was to examine further the relationship between the IPO share lockup and venture capital financing. The theoretical part of the study covers previous studies on lockups and explanations for the negative abnormal return, as well as, information on both IPOs in general and venture capital. In the empirical part the abnormal return and the abnormal volume around the expiration are calculated for venture-backed companies. Regressions are run in order to examine the effects of venture capital related independent variables and to study which of them are the most significant in creating abnormal return and abnormal volume.

Sources

The sample consisted of 1864 venture-backed companies that had their IPO lockup expired during 1986-2000. The companies were listed either in the NYSE, the Nasdaq or the AMEX. The expiration dates and the venture fund data were obtained from the SDC database using the VentureXpert data on IPOs. The daily stock return data and the volume data were collected from the CRSP cd-rom.

Research methodology

Standard event study methodology was applied to measure the cumulative abnormal returns. Abnormal volume was calculated by comparing trading volume around the event to its previous levels. Parametric t-test and non-parametric Wilcoxon signed rank test were used to examine statistical significance. Ordinary least squares regressions were run to see the effects of different variables.

Results

The study gave more insight on venture capitalists' involvement in creating abnormal negative returns at lockup expiration. The drift in the share prices starts five days before the expiration date. On the expiration day the prices fall 1.5 percent on average. When a five-day time period (-2, +2) is examined the results show a return of –2.8 percent. No recovery occurred during the next hundred days. On the expiration day and on day +1 volume increases by 80 percent. Thereafter the average decreases to the levels of +40 percent. Regression analyses showed that higher number of venture capitalists involved caused greater negative return. Long investing periods, large fund sizes and high standard deviation of post-IPO price performance were also statistically significant contributing in greater negative return. The most significant variables for abnormal volume were post-IPO price performance, lockup length, IPO size, number of venture capitalists and fund size.

Keywords

initial public offering, lockup, venture capital, share distribution

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Tutkimuksen tavoitteet

Tutkielman tavoite oli saada selvyyttä listautumisantien lockup –myyntirajoitteen päättymispäivien osakekurssilaskujen ja pääomasijoittajien käyttäytymisen välisestä yhteydestä. Tutkielman teoreettinen osa kattaa edelliset tutkimukset aiheesta sekä myös perustiedot listautumisanneista ja pääomasijoittamisesta. Myös teoriat miksi osakekurssit laskevat kyseisinä päivinä käydään läpi. Empiirisessä osassa tarkastellaan epänormaaleja kurssi- ja volyymireaktioita. Regressioanalyysilla selvitetään miten erilaiset pääomasijoittamiseen liittyvät muuttujat vaikuttavat sekä kursseihin että volyymeihin, ja mitkä näistä muuttujista ovat merkittäviä.

Lähdeaineisto

Aineisto koostui 1864 yrityksestä, jotka olivat saaneet pääomasijoittajilta rahoitusta, ja joiden listautumisannin lockup –myyntirajoite päättyi vuosien 1986 ja 2000 välillä. Yritykset olivat listattuina joko New York Stock Exchangessa, Nasdaqissa tai American Stock Exchangessa. Myyntirajoitteen päättymispäivät sekä muu pääomasijoittamiseen liittyvä muuttuja-data saatiin SDC tietokannan VentureXpert osiosta. Osakekursseihin ja volyymeihin liittyvä data saatiin CRSP cd-romista.

Tutkimustapa

Event study –tapahtumatutkimusta käytettiin laskettaessa kumulatiivisia epänormaaleja tuottoja. Epänormaalit volyymit laskettiin vertaamalla myyntirajoitteen päättymispäivän volyymeja saman osakkeen aikaisempiin volyymeihin. Tilastollista merkittävyyttä tutkittiin parametrisella t-testillä ja ei-parametrisella Wilcoxon signed rank –testillä. Eri muuttujien vaikutukset kursseihin ja volyymeihin selvitettiin pienimmän neliösumman regressioanalyysillä.

Tulokset

Tutkimus vahvistaa selkeästi, että pääomasijoittajilla on merkittävä vaikutus myyntirajoitteen päättymispäivien negatiivisille tuotoille. Osakekurssit alkavat laskea viisi päivää ennen päättymispäivää. Itse päättymispäivänä kurssit laskevat keskimäärin 1.5%. Viiden päivän (-2, +2) tuottoja tarkasteltaessa laskua kertyi 2.8%. Osakekurssit eivät palaudu aikaisemmille tasoilleen seuraavan sadan päivän aikana. Volyymit sen sijaan ovat myyntirajoitteen päättymispäivänä ja sitä seuraavana päivänä 80% normaalia suuremmat. Tämän jälkeen volyymit laskeutuvat 40% aikaisempia korkeammille tasoille. Regressioanalyysi osoitti, että sijoittajien määrän kasvaessa myös negatiiviset tuotot kasvoivat. Myös pitkät sijoittamisajat, suuri rahaston koko sekä kurssikehityksen suuri keskihajonta kasvattivat negatiivisia tuottoja. Tilastollisesti merkittävimmät muuttujat volyymien kohdalla olivat osakkeen kurssikehitys, myyntirajoitteen pituus, annin koko sekä sijoittajien lukumäärä.

Avainsanat

listautumisanti, lockup, pääomasijoittaminen, osakkeiden siirto

TABLE OF CONTENTS

LIST OF TABLES:

LIST OF FIGURES:

1. Introduction

Venture capital (VC) financing and initial public offerings (IPOs) are more and more associated with each other. In the last ten years almost a half of the companies that have gone public in the New York Stock Exchange (NYSE), American Stock Exchange (AMEX) and NASDAQ have used VC financing (Field & Hanka, 2001). Venture capitalists are normally active investors in the companies they finance. They monitor the company very closely, provide advice and use their connections to help the company to grow. But eventually venture capitalists want to liquidate their ownership, and one of the ways to do it is to take the company public. As venture capitalists are insiders, they are forced to undertake a lockup agreement with the investment banker underwriting the offering. In the agreement they promise to refrain from selling their shares for several months. Although insiders hold most of their shares after the expiration of the lockup, it has been proven in recent studies that insiders do sell part of their shares at the expiration.

IPO lockup is a fairly new subject to academic literature. However there have been quite a few studies done about the topic. The growing interest towards lockups in recent years can be explained with the stock hype in the late 1990's and therefore general acknowledgement towards the lockup. As the price of the share has skyrocketed at the IPO, people have started to notice the small bump in the price at the lockup expiration day as the insiders cash in their investments. This possibility is mentioned in many of the prospectuses as a warning (Field & Hanka, 2001). Also the fact that now Thompson Financial Services has provided the lockup expiration dates etc. from NYSE, AMEX and NASDAQ in their SDC database, the lockup expiration research has now become considerably easier.

The insiders normally own a significant portion of the company after the offering, in some cases over 90 percent. The lockup agreement is made to reassure the market that the key employees will have an economic interest with the company at least for a few months and that they will not be able to cash out immediately after the IPO. It also helps the underwriter to support the price of the share if needed, because there will not be a sudden increase in the supply of shares. So the lockup agreement should make the IPO more attractive for the public, and the likelihood of its success should increase. 180 Days has become more or less the market standard for the length of the lockup period. The agreement covers most of the shares that are not sold in the IPO. As companies that have just gone through an IPO and are new to the market, there can be information asymmetries between the two sides, and as the lockup expiration date represents the first possibility for the insiders to sell, then the market can infer private information from insiders' activity.

Most of the studies concerning the lockups i.e. Field & Hanka (2001), Bradley et al. (1999), and Brav & Gompers (2003) have studied the phenomenon itself and in the process they also have compared companies that have VC financing and companies that do not. They all came the same conclusion that share prices do fall on the day of the expiration. The phenomenon also effects the days before and after the expiration. The share price already starts to fall few before the expiration, and after the expiration the share price does not bounce back to its original levels. When analyzing the venture capitalists, they discovered that companies that have VC financing experience greater negative abnormal return on the expiration day than companies that do not have VC financing. As the amount of shares locked up often exceeds the amount of shares that are in the market, which makes a large sudden increase in the supply of shares possible, abnormal volume at the expiration has also been studied. Positive abnormal volume has been seen to be associated with negative abnormal return.

The previous studies have found support for some hypotheses that might explain the abnormal return, but no complete explanation. Downward sloping demand curves theory has been investigated in three studies, and there is some support for it. Other explanations for the phenomenon that had support were unanticipated insider sales prior to unlock day (Field & Hanka, 2001) and larger-than-expected insider sales at the expiration (Brav & Gompers, 2003 and Ofek & Richardson, 2000). Bradley et al. (2000) studied only explanatory variables and found that the venture capital-dummy was the most significant factor for both the abnormal return and for the abnormal volume in the regressions. Both Field & Hanka and Brav & Gompers had similar results.

1.2. The motivation and the aim of the study

As an explanatory variable VC has been seen as the main influence for the phenomenon, the purpose of this paper is to study further the relationship between the lockup and VC financing. Both the abnormal return and the abnormal volume will be examined with a sample that only consists on VC-backed companies in the American stock market. The effects of different VC characteristics will be main focus. However, as a normal measure, few other characteristics that have been seen significant in the previous studies are also again examined in order to see are the VC characteristics more dominant. The characteristics used are the ones available from the SDC database in order to keep the sample size as large as possible. The expected reactions of the VC characteristics are not based on any previous studies, as the author was not able to find a study that would have covered them. With the exception of the age of the fund, and it has been proven that there is a positive correlation between the success and the age of the fund. In addition to the VC research, as the samples of the previous studies end to the year 1998, this paper also covers the latter stock hype years, which can seen interesting from the common lockup research point-of-view.

The theoretical framework of the study is split into two different sections. First, the IPO process and the reason for the lockup and its common features are covered in detail. The previous studies on the subject are presented and the explanations they offer for the abnormal return and the abnormal volume are presented. In the second part, VC financing is covered: how they operate, what are their intentions, the rules and regulations and their role in the IPO process. As the share distributions of the venture capitalists are quite possibly one of the most significant reasons for VC associated negative abnormal return at the expiration, it is examined is more detail.

The data, which is presented next, features over 1800 venture financed companies from the North American stock exchanges between the years 1988 and 2000. The methodology for the study is also in the same chapter and it covers the equations used as well the issues that have to considered when using daily stock return data and implementing them to an event study. The hypotheses chapter presents the expected results for the independent variables that are used in the linear regression. The results chapter shows whether abnormal return or abnormal volume appears in the whole sample or in the smaller subsamples created. The results from the linear regression made for both the abnormal return and abnormal volume will show what are the independent variables that effect these dependent variables the most. Conclusions and suggestions for further research ends the study.

1.3. Summary of the results

This study clearly strengthens the results of the previous studies on venture capitalists involvement in creating negative abnormal returns at the lockup expiration. The drift in the share prices starts five days before the expiration date as the market prepares for the event. But still, on the expiration day, the prices fall the 1.5 percent on average. On day +1 the market has stabilized and there is no statistically significant movement. Within the five-day period (two days before and after) the average return is -2.8 percent. The share price movements were followed for a hundred days following the event and no recovery occurred during that time. The regression analysis showed that statistically significant variables in creating greater negative return were the number of venture capitalists involved in the IPO, the length of investing period, the fund size and the standard deviation of post-IPO price performance. As for the abnormal volume, the averages start to rise approximately four days before the expiration. On the expiration day the average volume increases by over 80 percent and similar volumes are also experienced on day +1. Thereafter the average decreases to the levels of +40 percent. Within the following hundred days the average slowly climbs to an average of +50 percent above the pre-lockup average. The most significant variables for abnormal volume were post-IPO price performance, lockup length, IPO size, the number of venture capitalists and fund size. As covered in the theoretical part, the venture capitalists distribute their shares at the expiration making possible for the limited partners of the venture capital fund to liquidate their assets. As the market has started to pay more attention to the lockup expiration dates, it also should pay more attention to the companies' owners when preparing for the lockup expiration. Especially the number of venture capitalists and for how long has the company received venture capital should be closely monitored.

2. The IPO process

When a company decides to go public, first they choose the book manager and the co-managers. The investment bank, which is chosen to be the lead manager and underwriter, invites other underwriters into the underwriting syndicate. The syndicate assists the lead underwriter in the sale of the shares to the public. The role of the lead underwriter can be crucial to the success of the offering process. Krigman, Shaw, and Womack (2001) report survey evidence that issuers cite analyst coverage as the most important factor when choosing an underwriter. Also the reputation of the underwriter marks as an another important factor; the underwriter has to have a good reputation of producing successful IPOs, and most importantly they are from the same industry as the company going public. This also often suggests that the underwriter has excellent quality research in that specific industry. As the investors also know the quality of the research, it is the more likely that the underwriter with its syndicate succeeds in persuading investors to invest in the particular IPO.

Next the underwriter drafts a letter of intent, which protects the underwriter against any uncovered expenses if the offer is withdrawn and it contains a commitment by the issuing company to grant a 15 percent overallotment option to the underwriter. The letter also specifies the gross spread, the underwriters fee, which usually is seven percent. The gross spread consists of management fee, underwriting fee and selling concession, and in which the latter makes more than a half of the total fee. (Chen & Ritter, 2000)

After the certification of the underwriter's and the issuer's agreement, the underwriter starts to help the company to be ready for the IPO; choosing the right moment for the offering and advising them on the proper structure of financial statements. The issuer and the underwriter are also obligated to draft a registration statement for filing with the Securities and Exchange Commission (SEC), which ensures that the public has adequate and reliable information regarding securities that are offered for sale. The securities act of 1933 makes it illegal to offer or sell securities to the public unless they first have been registered. Later the statement transforms into the preliminary offering prospectus (i.e. red herring), which is of the primary tools when marketing the issue. The prospectus is sent to the sales people and to the institutional investors as well as used on the "road-show".

On the road-show the underwriter and the senior management of the issuing company make presentations to the institutional or other significant investors about company and its strategy in the market. If the investors are convinced that the company is worth investing in, they are asked how many shares are their possibly willing to take and at what price. All the information about the demand on the road-show goes to the order book, which in the end represents a hypothetical demand curve for the company's stock. A typical road-show lasts from three to four weeks, with two or more meetings per day. However, regardless of the source of indication of interest, at this stage, no shares can be officially sold, so any orders submitted are not legally binding.

After the road-show is over and the registration statement has the SEC approval, the underwriter files an acceleration request to the SEC that they would accelerate the effective date of the registration statement. On the day before the effective date, the management of the issuing company and the lead underwriter decide the final price or the final price-range and the number of shares to be sold. The order book used on the road-show is used to help the analysts to make the decision. The following week after the price or price-range was decided, orders are taken in.

On the day prior to the issuance day after the market closes the final decision about whether the offering will go through is made. If the offering will go through the decisions about the price and the number of shares to be sold are finalized. Share allocation is also decided at this point. If a price-range is used and the offer is oversubscribed, normally the high-end in the price-range is used and vice versa if the offer is undersubscribed. Once these decisions have been made the company and the underwriter make an underwriter agreement. In the agreement the underwriter agrees to sell the shares at the price that was decided. Among other things the agreement also clearly states that the insiders have no right sell or offer the shares in any form without the permission of the underwriter. The final decision about the length of the lockup period is made at this stage as well. Once everything is approved the lead underwriter and the rest of the syndicate members start to distribute shares to their clients.

Almost every time, the managing underwriter overallots the issue, thus creating a short a position by accepting more orders than there are shares to be sold. This is also known as the "green shoe". The overallotment option grants the underwriter to buy from the issuing company additional 15 percent (the limit set by the NASD, National Association of Securities Dealers) of the shares sold in the IPO at the offer price within 30 days. The reason for this option is to provide stabilization support for the share without exposing the underwriter to excessive risk. If the price of the share goes up in the market on the day it starts to trade, the underwriter can cover his short position by exercising the green shoe at the offer price and thus receiving additional profits (gross margin of seven percent for the additional shares). On the other hand if the price of the share goes below the offer price in the market, the underwriter does not exercise the option, but instead buys back all or part of the extra 15 percent of shares in the market. This gives the underwriter the possibility to support the stock price. The price support can only be done at or below the offer price, and it is limited to a relatively short period of time after the shares have started trading in the market. However, the overallotment is just a part of underwriter's larger responsibility to support the share in the market.

The last stage in the IPO process begins 25 days after the offer when the "quiet period" ends. Before this day the underwriters or other members of the syndicate are not allowed make any comments about the valuation or provide earnings estimates on the new company. The quiet period is mandated by the SEC and the ending of it, makes it possible for the market to get normal information (recommendations, market and earnings estimations etc.) about the company from the underwriters instead of just being depend on the information in the prospectus.

The IPO business is extremely profitable business for the investment banks, which is why there is a silent agreement among the underwriters not to compete with fees as they do not want it to turn into commodity business. (Chen & Ritter, 2000)

The need for large syndicates has fallen over time. Previously the lead underwriter needed a significant retail or institutional distribution network, if they did not have one. Nowadays the biggest underwriters, such as Goldman Sachs, Morgan Stanley and Merrill Lynch, with their large networks, do not need other investment bankers to assist in distributing an offering. And as they have large capital bases, risk sharing would seem to be important only for the biggest offerings. (Chen & Ritter, 2000)

2.1. The IPO lockup

Before the IPO the company management and other insiders including venture capitalists can have superior knowledge about the company's performance, future prospects and true value when compared to potential outside shareholders. For outside investors it might be even impossible to get any kind of detailed information about the company. Even if the outside investors were to receive direct information, it might be unreliable as the insiders have an incentive to make the company look better than it really is. Selling overvalued shares in an IPO benefits existing shareholders at the expense of the new shareholders. As the outside investors know that it is in the best interest of the insiders to exaggerate the value of the company, they presume that the offered shares are overvalued. (Brau, Lambson & McQueen, 2001) The function of the IPO lockup is to lower information asymmetries by making it impossible for the insiders to immediately cash out after the IPO. By the time the lockup expires the market should know the true value of the company, or at least there is a higher probability for it. So if the insiders do decide to cash out after the expiration, they "only" get what is rightfully theirs.

2.1.1. The length of the lockup and its information content

As previously stated, in recent years 180 days has become the standard length for the lockup period. In 1988, only 43 percent of lockups were exactly 180 days, but by 1996 the percentage had risen up to 90 percent. Lockup periods other than 180 days are normally 90, 270 or 365 days (Field & Hanka, 2001). All the previous studies mention the distribution of the length of the lockup period from the low of 45 days to the high of 1095 days. The reason for the longer lockup period is that companies that have greater information asymmetries need to have longer lockup periods so that it is made sure that the asymmetry will be eliminated before insiders can profit from their superior information. This includes companies with intangible assets, unprofitable companies, companies that go public with low quality (reputation) underwriters, and companies that are not backed by venture capitalists (Brav & Gompers, 2003). During the lockup period information transfers can occur through sales and earnings announcements, project completions and product acceptance, SEC filings and analyst scrutiny (Brau, Lambson & McQueen, 2001). Also small companies are potentially more likely to have longer lockup periods for the same reasons. Still the degree of asymmetry varies greatly in practice. For example in highly transparent industries where there might not even be any information asymmetry between insiders and the market, which could lead theoretically the lockup would not even be needed. Often it is the investors who request a longer lockup period if they see the issue being more risky than others (Mohan & Chen, 2001). However the underwriter and the possible venture capitalist also put their reputation on the line in the IPO, which reassures the investors for the quality of the company and lowers information asymmetries. If the IPO should have a high quality underwriter and a venture capitalist backing the issuer, the IPO should have a shorter lockup period on average.

Brav & Gompers (2003) made a regression analysis with the length of the lockup being the dependent variable. They found that larger companies, companies with higher quality underwriters, and companies backed with VC all have shorter lockup periods on average. Each of the variables in their analysis is likely associated with less informational asymmetry or fear of adverse selection. They also stated that lower book-to-market ratio, as a sign of higher information asymmetry, is associated with a longer lockup period. They also found out that the percent of shares locked is negatively related to the length of the lockup period. Mohan & Chen (2001) and Brau, Lambson & McQueen (2001) had similar results with their study. Brau, Lambson & McQueen (2001) similarly reported that companies using top-third investment banker or a Big Six auditor, or companies being VC-backed would have statistically shorter lockup periods than companies that do not obtain these certifications. The differences in lockup days between companies that used a prestigious investment bank and companies that did not were 105 days versus 246 days. The difference with or without using a top auditor was 144 days versus 277 days, and with the company using or not using VC financing was 192 days versus 217 days. Their findings are in line with Mohan & Chen (2001).

Brau, Lambson & McQueen (2001) found that such variables as project benefits and development costs alter the length of the lockup period. They came to the conclusion that companies with projects characterized by larger relative benefits offer IPOs with longer lockup periods and that companies with projects characterized by larger relative development costs offer IPOs with shorter lockup periods. They used a sample of 4,013 IPOs and 3,285 SEOs between 1988 and 1999, and also found that lockups are longer in "hot" new-issue markets.

If the lockup length is shorter than 180 days the reasons for it may be the ones mentioned in the previous chapters. However, Mohan & Chen (2001) suggest that other possibility might the fact that not all of the insiders have agreed to the requested lockup. According to a Wall Street Journal article especially Internet companies' executives have been keen to have the lockups loosened, and some investment bankers appear to be eager to please them (see Mohan & Chen, 2001). This might lead to shorter lockups or even in some cases to the fact that there is no lockup. If the issue has a shorter lockup the investors and the underwriter must be compensated for increased risk of the issue. This usually happens by deeper underpricing in the IPO to the extent that it is comparable to an otherwise similar issue.

Brav & Gompers (2003) investigated the possible substitute effect of the percent of shares locked and the length of the lockup period. Companies can commit by either locking up more shares or by agreeing to a longer lockup period. They did find that these two commitment devices were negatively related, but the relationship was not robust to the various regression specifications.

Theoretically companies can even use the percentage of locked shares or the length of the lockup period as a signaling device. High quality companies can either choose a longer lockup period or lock up more shares in order to separate themselves from low quality companies. (Brav & Gomperes, 2003)

2.2. Abnormal return at the expiration

Few studies have covered the abnormal return around the expiration of the lockup during the past couple of years. Most of studies (Bradley et al., 2000, Brav & Gompers, 2003 and Field & Hanka, 2001) also cover the effect of VC to the abnormal return, and have similar results. Bradley et al. reports the abnormal return of –2.81% for VC-backed companies, and the abnormal return of –0.62% for non-VC-backed companies. Brav & Gompers report the results of –2.55% and –0.57%, and Field & Hanka the results of –2.3% and –0.8% respectively. The first two used a time window of 5 days (-2,+2), and the latter a time window of 3 days (-1,+1). The sample size in Brav & Gompers and in Field & Hanka was exactly the same, altogether 1948 companies. Bradley et al. had a sample size of 2529 companies.

2.3. The explanations for the abnormal return

All previous studies concerning the expiration of the lockup are not completely unanimous with their conclusions. As mentioned in the introduction chapter the hypotheses that have some support are the downward sloping demand curves theory (Brav & Gompers, 2003, Field & Hanka, 2001 and Ofek & Richardson, 2000), unexpected insider sales near the unlock day (Field & Hanka) and larger-than-expected insider sales at expiration (Brav & Gompers and Ofek & Richardson). However, they all state that none of these hypotheses explain the abnormal returns in full. All of the supportive hypotheses are covered in more detail later on.

Few possible explanations for the abnormal return have been also rejected in the previous studies. Field & Hanka (2001) for example studied if the phenomenon was caused by a change in the proportion of trades at the bid price as insiders want to sell and therefore most of the trading would occur at the bid. The results saw parallel declines in both the bid and ask price and therefore this could not been seen as an explanation for the abnormal return. They also examined if there was an increase in trading costs, which would reduce the attractiveness of the shares and eventually cause the price drop. The hypothesis is tested through the bid-ask spread, widening would increase trading costs. They find that the absolute spread changes a little of if all, while the relative spread widens slightly and therefore giving little evidence of an increase in trading costs. However, they state that as the test only measures quoted spreads and would not detect an increase in the effective spread, the evidence power of the test is quite weak. Ofek & Richardson (2000) tested the liquidity effect, whether the required rate of return increased if the share was illiquid. But in this case as the share prices fell as liquidity increased, and thus there was no support for the theory. Last, the temporary price pressure hypothesis has been investigated by Field & Hanka, Brav & Gompers (2003) and Ofek & Richardson but theory does not stand. As the price pressure theory is also associated with the downward sloping demand curves, it is covered in detail in the next chapter.

2.3.1. Downward sloping demand curves theory

Slope of demand curves for shares has been studied in many occasions, normally being associated with the price effects of equity offerings and index inclusions. In both cases there is a sudden increase in either demand or supply of shares, which is usually accompanied by price changes. However, both events are also usually associated with information and temporary price pressure effects. (Kaul et al., 2000)

Scholes (1972) was the first to examine the demand curves. He studied the price impact of secondary equity distributions and found that the equity sales by insiders had the largest price impact. He concluded that the price changes were caused by information effects, and that stocks were very much price elastic. Mikkelson and Partch (1985) also studied secondary distributions and disagreed in part with Scholes (1972). They stated that the elasticity of demand for stocks is not significant in explaining the price impact of secondary offerings. The price change was more likely due to the revelation of adverse information, even in large offerings and block sales. However, they find that price impact was larger in absolute value for larger offerings, which was consistent with downward sloping demand curves.

Shleifer (1986) on the other hand examined the price impact of adding stocks to the S&P 500 index. If the companies that were added to the index did not have perfect substitutes, their price should increase as a result of demand by the index funds.

Shleifer (1986) did find evidence of downward sloping demand curves as the 246 companies added to the index between 1976 and 1983 experienced on average a permanent abnormal price increase of 2.79 percent. However, as Kaul et al. (2000) points out index additions do also convey information. Especially with largely followed indexes like the S&P 500 index, it reveals favorable information about the longevity and financial state of the company, which were gathered by an agency that specializes in rating companies. As the inclusion to index is kept secret until the change is announced, the information will not be included in the price until that day. So it is more likely that that additions are viewed as a positive sign than a negative. A study by Dhillon and Johnson (1991, see Kaul et al., 2000) supports this hypothesis. They found that the bond prices of the companies included to the index increased on the announcement despite the fact that the bonds are not tracked by the index funds.

The price pressure explanation was fortified by Harris and Gurel (1986, see Kaul et al., 2000). In this hypothesis the price increase is caused by the suppliers of liquidity who can demand higher prices during the temporary increase in demand from the index funds at the time of the inclusion. However, the share price should return to its original levels after the temporary demand has subsided, and this did not happen in full in their sample. At the inclusion the prices increased by 3.13 percent and came down 2.49 percent in the following 29 days. So the conclusion they had was not totally robust. On the other hand, Shleifer (1986) and Dhillon and Johnson (1991, see Kaul et al., 2000) did not find any evidence about return reversals following index inclusion. Dhillon and Johnson (1991) did even find evidence that the price increase would be permanent. So the existence of price pressure is still highly questionable.

Kaul et al. (2000) studied the modification of Toronto Stock Exchange (TSE) index. TSE redefined the public float limits, which increased the float for 31 companies. This event meant that the index funds had to purchase additional shares in order to rebalance their portfolio, just as in index inclusions. Furthermore the event was free from information effects as it was fully anticipated, data to calculate the new index weights was available, and it did not involve the addition of new stocks. They found excess returns of 2.34 percent in the week following the revised weights became effective. They also reported unusually high trading volume, which was consistent with fund balancing. The excess returns were not reversed during the following seven weeks, even though the volume returned to its original levels within two weeks. The event did not involve price pressure effects as the price increase outlived abnormal volume, which is inconsistent with the short-term price pressure hypothesis. Kaul et al. (2000) interpret these results to be supportive for the fact that downward sloping demand curves for stock do exist.

2.3.1.2. Demand curves and the lockup expiration

The expiration of the lockup is totally expected, as almost every IPO has a lockup agreement and it is always mentioned in the prospectus. So the market should be aware of the date of the expiration, and by that time the possible price impact caused by excessive sales by insiders should be built into the share price long before. However, the secondary sales by insiders that may occur right after the expiration do convey information. These unexpected excessive large sales are more likely to be seen as negative information about the state of the company, even if it might be just a case of diversification. Nevertheless, for these reasons Ofek and Richardson (2000) state that the event in itself does not contain any information effects, and therefore do not take information effects into account.

As studied by Ofek and Richardson (2000), the price drop occurring at the expiration is permanent. There is no meaningful bounce back within the following month. If there would be a price pressure, the drop should be just temporary. The largest pressure should occur at the actual day, and on that day the shares do experience 23% greater volume but it does not subside substantially on the following day. The temporary price pressure theory was also investigated by Field & Hanka (2001) and Brav & Gompers (2003), and they both had similar results as Ofek & Richardson. Thus, it can be stated that the evidence does not support price pressure around the expiration.

As mentioned before, Ofek and Richardson (2000) did find some evidence that supports that demand curves for shares are downward sloping in the long run. If the hypothesis were to work in full, there should be a strong negative correlation between the excess return and excess volume. When the supply of shares would permanently shift out, the price would stay on that level. However, there is only a mild negative correlation between these two. Still Ofek and Richadson (2000) argue that stocks that have gone through an IPO are very attractive to the downward sloping demand curve explanation due to few reasons. First, the stocks that have gone through an IPO do not have, on average, clear asset substitutes, so investors will sacrifice the arbitrage price to access these assets. Second, heterogeneity across investors can lead to downward sloping demand curves, as well unanimity about the company's valuation, which is very common for newly issued companies.

Brav & Gompers (2003) also find support for downward sloping demand curves. They state that in order for the hypothesis to explain the average price decline, the market must hold consistently incorrect prior beliefs about the how much equity will be sold at expiration and must therefore be consistently surprised by how many shares actually come to market. As the average abnormal return at expiration is clearly negative, the phenomenon is potentially consistent with downward sloping demand curves. Field & Hanka (2001) also fortify the existence of the phenomenon. However, as discussed later on, the costly arbitrage might prevent investors from undertaking investments that would correct the temporary mispricing even if they know how many shares were coming to market.

2.3.2. Unanticipated insider sales prior to unlock day

If the insiders sell, the market normally sees it as bad news and if an increase in the supply of shares occur, it may drive the price down the demand curve. Insider selling prior and near to the lockup expiration can make the market expect excessive sales at expiration. Field & Hanka (2001) tested the hypothesis with the data from all insider trades disclosed to the SEC. However, they state that the test had a weakness as it does not reflect insider sales that are known to the market but not reported to the SEC. Sales only by officers, directors and 10 percent block shareholders have to be reported and others are usually not, nor are the share distributions by the venture capitalists. Within the test they assume that insider sales within a week of the unlock day might influence the return on the unlock day.

The average abnormal return for the companies that reported insider sales during the week prior to the unlock day was –4.5 percent (median –5.1 percent) compared to –2,5 percent (median –2.0 percent) with companies that did not report insider sales. The difference between the two samples was statistically significant. But since the abnormal return remains significantly negative when no insider sales are reported, Field & Hanka conclude that the abnormal return is driven but not solely by worse-than-expected insider sales prior to the unlock day.

Brav & Gompers (2003) investigated insider sales prior to the lockup differently and had another conclusion. The examined the price reaction of insider sales prior to the lockup and the negative price effect of those sales was virtually eliminated within several days before the lockup. The effect was consistent with the temporary price pressure theory. Therefore this lead them to conclude that the negative abnormal return at the lockup expiration is driven by the peculiarity of the event itself rather than mere selling of insiders.

2.3.3. Larger than expected insider sales

Another explanation that had support was the insider sales that were systematically underestimated by the market participants. Ofek and Richardson (2000) examined the issue by breaking the sample by years. If underestimated supply shocks are an important determinant of price, variation would be expected from year to year in the price drop. The probability that the market participants would make the same systematic errors each year is very small. However, they witnessed similar stable drops each year. For further evidence that examined the excessive volume by year, and had the same result, they were also stable. Therefore they stated that the phenomenon is consistent through time. Also Brav & Gompers (2003) review larger than expected insider sales as a potential explanation.

2.4. The significant independent variables

Bradley et al. (2000) concentrated on studying the effects of numerous different company and IPO characteristic variables. The characteristics they examined were company size, post-IPO stock price performance, underwriter reputation, stock price volatility, the percentage of shares subject to lockup, the length of lockup period, secondary (or follow-on) offerings, trading volume, company industry (whether the company was considered high-tech) and the before mentioned VC-dummy. They studied the whole sample as well only the companies that were venture financed. For the VC-backed companies, post-IPO price performance and its standard deviation and also the trading volume were the most significant variables. Underwriter reputation and high-tech-dummy were also statistically significant. For the whole sample the most significant factor was the VC-dummy followed by the post-IPO price performance and high-tech industry.

Field & Hanka (2001) made three different regression, one for the whole sample, one for VC-backed and one for non-VC-backed companies. They found venture backing statistically the most significant for the whole sample. The other two significant variables were the percentage of shares locked and volume at expiration. These two variables were also the only significant ones for the VC-backed companies. For the non-VC companies the only significant factor was the high-tech-dummy. For Brav & Gompers (2003) the significant variables were the VC-dummy, the book-to-market ratio and the percentage of shares locked and for Ofek and Richardson (2000), whose study did not have a VC-dummy, the post-IPO price performance and its standard deviation as well as volume at expiration.

2.5. Other explanations

Keasler (2000) examined the effect of the duration of the lockup for the abnormal returns in a seven day event period. He discovered that the longer the lockup period was, the greater was the cumulative negative abnormal return. The results ranged from –1.43% (similar to other studies) with the 180-day lockup period to –6.94% with the 365-day lockup period. This is in line with Brav & Gompers (2003) who state that the length of the lockup and percentage of shares locked up are substitutes, and the higher the percentage was the higher was the negative abnormal return. Keasler did not separate whether the companies were or were not VC-backed.

Keasler (2000), however, did discover that abnormal return of the 365-day lockups was in fact for the most part due to selling prior to the actual lockup expiration day. The unrestricted investors, who anticipate the selling pressure by insiders, apparently liquidate prior to the event day and cover on the event day. As the longer lockup periods are usually associate with more volatile companies, the unrestricted investors expect them to liquidate more of their shares than the companies that have shorter lockup periods. Instead, the abnormal returns on the actual event day were positive, which, however, could be in part due the restricted investors who covered their position. Therefore Keasler concluded that all volatile stock movement with 365-day lockups were actually caused by the outsiders and not the insiders.

2.6. The possibility for an arbitrage

Even though the expiration is totally anticipated, the market is not rationally incorporating all public information into stock prices. The effect should be driven away, for example, by the arbitrageurs.

There are two types of investors how can gain from the anticipated price response at the expiration. First, the ones who already have the shares, sell them prior to the expiration, and buy them back after the expiration. Second, the ones who short their position prior to the expiration and then close it after the expiration. (Ofek & Richardson, 2000)

If the first type of investor sells its shares prior to the expiration, his gains are subject to short-term capital gains. If the investor holds his shares for additional six months, his gains will be subject to long-term capital gains. If the stock price should fall down 1%-2% (the average), it is not likely that it will be enough to compensate the investor for the higher tax liability. Because of this the investor has little incentive to take advantage of the expiration of the lockup, in addition to the trading fees that have to be accounted for. However, this implication is dependent on the marginal investor's tax bracket. (Ofek & Richardson, 2000)

For both types of investors the actual arbitrage strategy is hard to implement, even though it has been proven in finance literature that investor's effective cost of trading is much less than average the bid-ask spread. As Ofek & Richardson (2000) examined the spread at the expiration day, the outcome was that a one standard deviation decrease (increase) in the spread leads to an increase (decrease) in the stock price of 0.95%. From these results, they concluded that when spreads are high, it is difficult to arbitrage the lockup effect and it remains in full force. On the other hand, when the spreads are narrow, the lockup effect diminishes because of trading costs.

For the second type of investor's short selling strategy, Ofek & Richardson (2000) measured the amount of short interest in the stock relative to the number of shares outstanding (not subject to lockup). If the interest to short is high, then both locating the shares to short and the cost of shorting tend to be higher as well. Ofek and Richardson made a regression of their two CAR measures, which resulted in that the higher (lower) the short interest in the stock, the greater (smaller) the price decline. In other words, the bigger the gain the larger the costs, and for this reason, this strategy is not either tempting for the investor.

Brav & Gompers (2003) also came to a similar conclusion. They document that the transaction costs, calculated as the percentage bid-ask spread relative to the bid price, equals 6.4 percent on average, and are likely to eliminate the ability of investors to make money from the abnormal return they found. They also state the difficulty of borrowing shares in order to set up a short position given the small amount of shares that have been floated.

2.7. The abnormal volume

There are two explanations for the abnormal trading volumes that occur after the expiration of the lockup. The expiration releases a large amount of shares to the market, and usually the number of shares that were locked outnumbers the shares that were tradable before. However, a large part of the abnormal volume maybe caused by increased information flowing to the market as investors observe insiders' selling activity. (Brav & Gompers, 2003)

All of the studies concerning the abnormal returns have also examined abnormal trading volumes. The actual peak in the volume seems to happen on day +1. The results for that day ranges from +61 percent (Ofek & Richardson, 2000) to +80 percent (Field & Hanka, 2001) larger than its pre-event average. Volume then drops quickly to about +40 percent above its pre-lockup level, and remains at these levels (Bradley et al., 2000, Field & Hanka, 2001 and Ofek & Richardson, 2000).

The most important determinant of abnormal volume is VC-backing (Brav & Gompers, 2003 and Field & Hanka, 2001). While Field & Hanka report the three day abnormal volume being five times higher for the VC-backed companies than for the non-VC-backed companies, Brav & Gompers report it three times higher. However, both report the volume for VC-backed companies being over 70% larger than its pre-event average. When studying only VC-backed companies Field & Hanka find the three-day abnormal return variable clearly statistically significant, but with non-VC backed the variable not. This is consistent with the results of Brav & Gompers as both studies show that variable is not significant when the whole sample is investigated. Other variables that the previous studies find significant for abnormal volume are the pre-lockup share performance, underwriter ranking and the ratio of tangible assets to total assets.

2.7.1. The information content of the post lockup trading volumes

Trading amounts after the expiration of the lockup usually depend on how much are the insiders selling. If heavy trading occurs after the expiration the insiders are most likely selling some of their shares, which usually means the lack of trust that the insiders have for their company's future prospects, which has be seen as bad news for the market. On the other hand if the trading seems to be thin, the insiders are not selling, which can be seen as good news to the market. Mohan & Chen (2001) examined this hypothesis. They made two portfolios, one with companies that had experienced thin trading (compared to average trading amounts before and after the expiration) in the following 30 days after the expiration and one with companies that had experienced heavy trading. For the thin trading portfolio the average cumulative excess returns begin to increase approximately 30 days after the expiration and continue to increase to the end of their examination period of 250 days. As for the heavy trading portfolio, its value decreases more than 23% during the 90-day period after day 25 and stays on that level for the remainder of the examination period. The delay of approximately 30 days in both cases can be interpreted in two ways. First, all insiders do not need sell their shares immediately after the expiration, in addition a delay in releasing bad news has been documented in the finance literature. Second, the insiders must file a document to the SEC if there is change in ownership, and when taking this filing lag into account, the market can verify insiders' selling only 25 days (on average) after the transactions are actually done. Therefore these results show that thin trading immediately after the expiration signals a high-quality IPO company whereas heavy trading signals a poor-quality one.

2.8. Insider selling prior to lockup expiration

As the lockup agreement is done between the lead underwriter and the IPO company and not mandated by the SEC, it gives the insider the possibility to sell prior to the expiration of the lockup if the underwriter chooses to give its permission. Brav & Gompers (2003) find that 60% of the companies have insider sales prior to the expiration of the lockup. Nearly 12% of the companies have made more than ten insider transactions prior to the expiration with the average transaction occurring just over halfway through the lockup.

On the other hand, Field and Hanka (2001) find that only about one percent of companies publicly announce early release of the lockup in their sample, and six percent of companies disclose early sales of locked-up shares by at least one insider, usually a venture capitalist. However, they remind that their data does not include sales by low-level employees, share distributions etc. This leads to the likely conclusion that pre-expiration selling is usually done by low-level employees, and that the companies seldom disclose these sales as the amount of shares traded is insignificant and it does not effect the share price.

Companies that sell prior to the expiration are associated with less asymmetric information, i.e., larger companies, companies with higher quality underwriters, and VC-backed companies. They conclude that the lockup agreement is less important as a commitment device for high quality companies, and that the market is less concerned that these companies will exploit the possibility of selling overvalued shares. (Brav & Gompers, 2003) If an early release is authorized by the underwriter they however do make sure that the unlock days do not coincide with confounding events like earnings announcements (Field & Hanka, 2001).

3. Venture capital

The history of modern VC starts in the 1940's. Almost all the funds in the next decade were structured as publicly traded closed-end funds. The first VC limited partnership was founded in 1958 and they still accounted for a minority of the VC pool also during the 1960s and 1970s. The dramatic increase in capital flowing into the VC industry and in number of VC funds started in the late 1970's and continued in the early 1980's. The increase was so sudden in the early 1980's that for a short while the demand exceeded the supply as the inflows were so large and number of funds was more or less fixed, because of difficulties in starting a fund, which could take more than a year. During this period the limited partnership became the dominant form in VC funds. The growth in VC industry was reversed in the late 1980's because of overinvesting in various industries and the entry of inexperienced venture capitalists. (Gompers & Lerner, 1996)

In the limited partnership form, the venture capitalists are general partners and they control the fund's activities, not like the investors, who serve as limited partners. Investors role is to monitor the fund's performance and activities, attend annual meetings, but they are not involved in the day-to-day management of the fund. This brings out the problem with VC limited partnerships; once the funds have been collected, the limited partners have very little to say about how the funds are allocated. The general partner has the possibility to behave opportunistically, if the terms and regulations mentioned in the partnership are not specific enough. Venture partnerships have usually predetermined duration, with the most typical time being ten years, although extensions are often allowed. (Gompers & Lerner, 1996)

In the last ten to fifteen years VC has become an important area of finance for academic researchers. There are a few notable differences that differentiates it from mainstream corporate finance, with the significant one being the fact that VC is typically related to companies that are not quoted on stock markets. Others include active monitoring of management, multi-stage contracts and financing, which in particular may allow the investor to exercise more control over management. VC is highly suitable for companies that have non-redeployable or highly specialized assets. This combined with the greater uncertainty of cash flows especially in early stage new technology businesses suggests that VC financing is preferable to debt financing. (Wright & Robbie, 1998)

Wright & Robbie (1996) have also stated that venture capitalists place considerable emphasis on specific attributes of the potential investee company. Accounting information and target rate of return still are important elements in deal screening but the most emphasis is placed on getting more detailed information about the company through sensitivity analysis of financial information, discussions with personnel and accessing considerably more information of an unpublished and subjective kind.

VC financing appears on all the investment stages although the majority of financing by venture capitalists seems to take place at the later stage. The later stage investors are more interested in the market acceptance of the company's product as early stage investors emphasize a range of product strength and market growth characteristics, particularly as early stage investments are usually made in companies that are technology based with only little available data on market acceptance. (Wright & Robbie, 1998)

Venture capitalists portfolios are likely to be relatively undiversified compared to those of institutional investors, which also supports their need to closely monitor their investments. The illiquidity of venture capitalists' equity holdings makes governance via exit very difficult in the short term. (Wright & Robbie, 1998)

3.1. Fund raising

Most VC funds raise funds every two to five years. Only a small number VC funds may be raising funds at a particular time, and these funds are likely to be differentiated by size, industry focus, location, and reputation. Due to the fact that most VC fund managers believe that excessive growth reduces profits, they limit how often they will raise funds and also the size of the funds they raise is limited. In other words, VC funds are not perfect substitutes for each other. These factors prevent in a sudden increase in demand for VC investing services, which would lead to price increases. A year of rapid growth in inflows to VC funds tends to be followed by another rapid year of growth, however there is no correlation across several years. (Gompers & Lerner, 1996)

The managers who allocate investments for institutional investors often operate under limitations, which prevent them from investing in certain types of funds, and which might enforce them to invest within a certain time period. As the secondary market for existing VC funds is illiquid and very thin, the managers do not always get to invest into funds they might want to. However, the demand and supply hypothesis suggests that when the demand for VC services is high and as the supply is fairly fixed, which means that the number of restrictions should decline and that opportunistic behavior will greater among venture capitalists. (Gompers & Lerner, 1996)

The investment managers not also select the funds they invest in, but they also negotiate the terms and conditions of the VC limited partnership agreement if a new fund is being created. (Gompers & Lerner, 1996)

3.2. Investing

Venture capitalists often invest through syndicates in which one or more venture capitalists take the lead role in working with the portfolio company. In a study by Barry et al. (1990) where they studied 433 VC-backed IPOs between 1978 to 1987. The lead venture capitalist had an average of 19 percent ownership in the company. All VC-holdings in a company represented, on average, 34 percent of the outstanding shares. In the same study they documented that venture capitalists had about one-third of the board seats and had assisted these companies for about half of their corporate lives before the IPO. Venture capitalists usually finance their companies through staged investing. They use the staging process as a control mechanism. Prospects for the portfolio company are periodically re-evaluated. The shorter the time between financing rounds, the more frequently the venture capitalist evaluates and monitors the company's performance. This also forces the company to gather constantly information about its actions and future earnings prospects. Staged financing reduces the risk for VC-company that their portfolio company would suffer from bad management decisions and it gives them continuous reassurance that the future prospects of the company are intact.

3.3. Certification role of venture capitalists in IPOs

The fact that the company selling equity in the IPO is VC-backed assures the market that the offering price reflects all relevant private information. Company insiders have an incentive to conceal or delay the revelation of negative information in order to be able to sell their shares at a higher price. The likelihood of concealing this kind of information, which will eventually come out, is substantially smaller in IPOs that are VC-backed. Megginson & Weiss (1991) demonstrate three tests that have to be met to make the certification believable for outside investors. First, the certifying agent must have its reputational capital at stake. Second, the value of the reputation must be greater than the largest possible one-time payment, which could be obtained by certifying falsely. Third, the issuing company must pay the certifying agent for its services, and the cost must be an increasing function of the scope and potential importance of the information asymmetry regarding intrinsic firm value.

Therefore it is very important for the venture capitalist to establish a good and trustworthy reputation in order to get to the IPO market in the first place. Once this position has been stabilized it makes the VC fund more attractive for the entrepreneurs, pension fund managers and other institutional investors as well as to those who purchase shares in IPOs. Sahlman (1990) presented key factors why reputation is so important. First, successful venture capitalists are able to achieve very high returns, which are directly related to the age and historical performance of the VC fund, as well as to the size of its investment portfolio. Second, successful VC fund managers are able to establish other successful funds, which makes continuous deal and cash flows possible. Third, the VC fund manager market is relatively small, and individual performance is constantly monitored and valued.

3.4. Venture capital ownership

As previously mentioned, the average ownership by the venture capitalists in the issuing company is roughly a third before the IPO. Barry et al. (1990) had an average of 34.3% (sample of 433 VC-backed IPOs), Megginson & Weiss (1991) had an average of 36.3% (sample of 320), and Lin & Smith (1998) reported an average of 29.2% (sample of 497). However, both Barry et al. (1990) and Megginson & Weiss (1991) report that approximately in one quarter of the cases the venture capitalists owned more than half the shares. The average number of venture capitalists involved with the issuing company is three with the median being two. One quarter of the companies have four or more venture capitalists involved. The average percentage of board seats the venture capitalists held before the IPO was 33.4%, which normally means two seats. (Barry et al., 1990) Approximately in 80% of VC-backed companies the lead venture capitalist has a seat in the board, whereas the percentage for the non-leading investors is 43 (Lin & Smith, 1998).

3.4.1. Selling during the IPO

Possible reasons for a venture capitalist selling his shares in the IPO include, for example, alternative opportunities that offer higher risk-adjusted returns, or a belief that the shares would be overvalued by the market. As mentioned earlier a typical life span for a limited partnership is ten years. Due to this finite life, and the fact for the first five years the VC fund just takes cash in, all of this provides additional motivation to sell equity as early as possible i.e. in the IPO, even though if the expected return from continued involvement would be high. Discussions with venture capitalists have revealed that they prefer to sell as much of their position as possible in the IPO since remaining shares cannot be traded for several months because of the lockup and other regulations (SEC 144). The underwriter often limits or prohibits selling in the IPO because it could affect the issue price and the overall success of the offering, although it has to be remembered that venture capitalists have influence when the underwriter is being chosen. (Lin & Smith, 1998) However, it is more likely that the venture capitalist uses an underwriter it has used before, rather than choosing an unfamiliar underwriter (Megginson & Weiss, 1991).

Although in most IPOs the venture capitalists do not sell at all, Barry et al. (1990) and Lin & Smith (1998) do find that there are cases where they sell substantial percentages of their holdings. This is normally done by the lead venture capitalist, who is older, larger, more involved in IPOs and more likely to hold seats on the board. The lead venture capitalist has served on the board normally about three years before they go through with the IPO (Barry et al., 1990). The lead venture capitalist's larger ownership stakes and likelihood to hold more inside information suggests that their selling is more likely to convey information than selling by non-lead investors. There were secondary sales in 26.7% of the issues by the lead venture capitalists. (Lin & Smith, 1998) Based on the two studies, the lead investor owns from of 17 to 19 percent of the shares before the IPO and if they decide to sell, they reduce their ownership by approximately 20%. The amount of shares the lead investor sells accounts for a approx. 9% of the shares offered in the IPO (Lin & Smith, 1998).

Studies by Barry et al. (1990), Megginson & Weiss (1991), and Lin & Smith (1998) all show decline in the VC ownership during the IPO if all VC investors are taken into account. The decline is between 6% and 8.5% on average. However, Lin & Smith (1998) do report that if the lead investor does not sell, it is likely that other investors either also refrain from selling or the amounts to be sold are very small (1.1%).

Selling during the IPO is likely to take place in offerings in which the companies have established performance records, and where the underwriter and the lead venture capitalist have established reputation in bringing companies into the market. The lead venture capitalists who sell tend to have a longer history and have served more times as the lead than the ones that do not sell. (Lin & Smith, 1998) The VC financing agreement usually allows the lead venture capitalist to sell if the managers and officers of the company are selling (Sahlman, 1990). However Lin & Smith (1998) report that in their sample in 121 of the 239 cases where managers and officers sold, the lead investor did not, and in 15 of the 258 cases where the lead investor sold and the managers and officers did not. These results suggest that the lead investors often voluntarily decide not sell in the IPO.

Lin & Smith (1998) show results where venture capitalists with established reputation refrain from selling in the IPOs that are overpriced. Nevertheless, they are still expected to sell some of their ownership in an IPO that is not overpriced and get short-run profits in order to maintain reputation. If they don't sell in the IPO, the initial return from the IPO is significantly lower. Reputation is vital factor for the underwriter and for the venture capitalist, therefore also systematic underpricing can occur in the IPO because they are trying to avoid damage to their reputation and the possibility of a shareholder lawsuit if the stock price declines after the IPO. However, Lin & Smith (1998) find no significant differences between IPOs grouped according to venture capitalist reputation.

Despite some selling in the IPO does occur, Barry et al. (1990), Megginson & Weiss (1991) and Lin & Smith (1998) all came to the same conclusion that venture capitalists are not using the IPO just as an opportunity to cash out their holding and realize a return on investment. On the contrary, most venture capitalists do not sell any of their shares in the IPO.

3.4.2. Ownership changes and monitoring after the IPO

The fact that the venture capitalists hold such a significant portion of their ownership after the IPO provides a positive signal to the market. It can also be seen as venture capitalists commitment to still monitor the issuing company. The lead venture capitalist holds more than 85% (about 11% of the shares) of its post-IPO holdings still one year after the IPO, which is significantly more than the other VC investors. If all VC-investors are included, the ownership has declined by 28% in one year to 18% of all the shares. In 89% of the IPOs, the lead venture capitalist also holds his place on the company's board one year after the IPO. (Barry et al., 1990)

Lin & Smith (1998) examined VC ownership for a time period when at least three years had passed from the IPO. In 88% of the cases the lead venture capitalist no longer owned any shares of the particular company, but if they still owned shares, their ownership had stayed at about 11 %, which was the same percentage that Barry et al. (1990) reported to be the average after one year. If the lead venture capitalist still owned shares it had held its board seat in 77% of the cases. However, even though they would not own any shares, in 32% of the cases they still had a seat in the board. In a typical case if the lead venture capitalist had had two directors in the board, after three years they only had one, who however was in most cases a significant individual owner in the portfolio company. Lin & Smith (1998) state that the results are consistent with the finite life span nature of the VC limited partnerships, and that they show that VC commitments of advisory services and investment capital are not easily separable and that venture capitalists reduce equity holdings to redeploy advisory service resources.

3.5. Share distributions

Venture capitalists can liquidate their position in the company by selling the shares in market after the lockup, and distributing the proceeds to the investors. However, more frequently instead of selling the shares, the venture capitalist distributes the shares to the investors of the fund and also, to themselves.

There are a few reasons distribution of shares is ever more frequent. First, the rules made by SEC, which restrict sales by insiders. Insiders, which also include the venture capitalist, are only allowed to sell shares each quarter up to the greater of 1 percent of the outstanding equity or the average weekly trading volume. The venture capitalist may own a large portion of the company, and because of this rule, selling the entire stake may take a very long time. By distributing the shares to the limited partners, the fund can dispose their stake more quickly. However, if the limited partner has a board representation in the portfolio company or if it holds through other connection 10% of the portfolio company's equity, then the limited partner is considered to be an insider, which prevents share distribution. (Gompers & Lerner, 1998)

Second, tax reasons provide another explanation for share distribution. If the venture capitalist sells the shares and distributes the cash to its limited partners, the limited partners and the VC-fund are subject to immediate capital gains tax. The limited partners might prefer to postpone their tax payments by receiving the shares by distribution, and thus giving them flexibility about the timing when to sell the shares. These tax postponements only concern individuals and corporation, and not taxexempt limited partners such as pension funds and endowments. Third, if there is a fear that selling the shares in the market would have a negative effect on the price of the share, the venture capitalist may choose to distribute them in order to show better return for itself. The price of the share is the closing price on the market on the day distribution is declared. If the price should fall after the distribution, the limited partners will eventually receive less profit. Venture capitalists are keen to show better stated return in their books as they use that information when they raise money for new funds. In fact, they may be so keen to show good stated return that these incentives overcome their reputational concerns. At least many institutional investors and advisors also care about the VC-funds stated return as the they are compensated based on how well the funds they selected did against the benchmark. (Gompers & Lerner, 1998)

The compensation of the venture capitalist can be affected by the timing of the distributions. If the share distribution is made before the fund's committed capital is returned, the venture capitalist / general partner receives a larger portion of the profits as the shares are distributed in proportion to the partner's actual capital commitments. As the general partner has normally invested one percent of the fund's capital, they are entitled to their part of the distribution. If the committed capital has been returned, the shares can be only distributed to the limited partners. Although nowadays the venture capital agreement normally makes it possible for the venture capitalist to receive distributions at his own discretion prior to the return of the investor's committed capital. If the venture capitalist is unable to distribute any shares to itself, it may sell their portion of the overvalued shares in the market before it distributes them to the limited partners and at the same time letting the market notice that the distribution has occurred. (Gompers & Lerner, 1998)

A typical share distribution occurs twenty months after the IPO. Yet the distribution is skewed with the median being about twelve months, and in about 50% of the cases Gompers & Lerner (1998) examined, the first distribution occurred within the first year of the IPO. However, only one percent of the distributions occur within the first three months after the IPO as distributions are normally restricted as are insider sales during the IPO lockup period. They did not cover the percentage for 6 months (180 days) but still it seems that the many VC funds do distribute on latter part of the year following the IPO. When reviewing the results of their study, they led Field & Hanka (2001) to suggest that in many cases it is very likely that the distribution occurs on the unlock day.

Gompers & Lerner (1998) also report that there usually are multiple distributions for each firm because there are more than one venture capitalist involved with each company. Although the average amount of shares in a single distribution is 67% of the shares owned by the venture capitalist, they do tend distribute all of the shares at once.

Gompers & Lerner (1998) suggest that the limited partners of the VC fund may have incentives to disguise that a share distribution has taken place. First, the fact that venture capitalist usually owns a substantial part of the company and may have even multiple board seats, and as after the distribution an active and possibly a very important participant in the company is scattered. When the market would be informed about the distribution, it could be a negative impact on the price of the share. Second, the amount of shares that are publicly tradable increases rapidly. If the demand for shares is not totally elastic, the increased supply of shares results to a decrease in share price. This case of downward sloping demand curves was covered in detail in previously in this study. Also sudden increase in liquidity resulting from distributions could lead to a decrease in share price, although if liquidity is the primary reason for price movements, the share price should quickly recover thereafter.

It might take days before the market incorporates the distribution to the share price. Resulting from the fact that the decision about the distribution is usually made solely by the venture capitalist without consulting with any other outside advisors, so the leakage about it should be nonexistent. Also many distributions occur after the market closes.

The contracts surrounding the VC fund may also specify that the venture capitalist may be forced to distribute or to sell the shares soon after the IPO, which at the earliest means after the expiration of the lockup. If the distributions within a certain time are mandatory for the venture capitalist, the distribution should not transmit any negative information to the market. However, it turned out that there were no significant differences in the distributions between funds that had and funds that had not restrictions. The funds that had restrictions were allowed to defer their distributions, which lead to the result that on average the distribution occurred two weeks earlier with companies that did not have restrictions. The later after the IPO the distribution occurs the smaller is the negative impact on the share price. Gompers & Lerner (1998) also studied underwriter reputation in conjunction with distribution, and they came to the conclusion that companies going public with higher quality underwriters have less-negative impact on share price at distribution. Other examples of asymmetric information include, for example, the size of the company and the industry the company is in. They also, for that matter, correlate with the impact on the price; the greater the asymmetric information, the greater the negative impact.

4. Data and methodology

The data i.e. all lockup dates and all other VC-variables used in this study were gathered from Securities Data Corporation (SDC) database using the VentureXpert data on initial public offerings. The daily stock return data and the volume data were collected from the CRSP (Center for Research on Securities Prices) cd-rom. The initial sample consisted of all New York Stock Exchange (NYSE), Nasdaq and American Stock Exchange (AMEX) VC-backed IPOs, whose information was available for the author in the summer of 2001. The original sample had 1980 companies. The first unlock day in the sample was May 26, 1988, which was the first VC-backed company unlock date reported by the SDC. The CRSP data was available for the author until the end of year 2000. Although the event window was 201 days (100 days before the unlock day and 100 days after the unlock day), the priority in the study was given to the time before the unlock day. So all companies that had at least 30 days of stock return data after the unlock day were included in the study. The last unlock day in the sample was November 30, 2000. As a normal measure for this kind of study, all "penny stocks" (offer price under 5 dollars) were excluded from the sample. There were cases where CRSP did not recognize the companies' cusip codes from the SDC and sometimes there was a mismatch between SDC and CRSP. Those and also a few other companies were excluded for various reasons from the sample in order to make sure that all data was correct as possible. The data that was eventually used to calculate the abnormal return for the whole sample consisted of 1864 companies. However, for the linear regression, the sample was downsized to 1798 companies due to the fact that the companies excluded at that point were missing so many of the independent variables. When the regressions were run, the number of companies included was dictated by the number of observations that the SDC had for the particular variables. In the regressions for abnormal return and abnormal volume presented in chapter 5, the range in the number of companies included is from 431 to 1474.

The CRSP data can be trusted to be reliable. The accuracy of SDC database was tested by Field & Hanka (2001) by checking the actual data from 625 IPO prospectuses for the 1988 to 1992 period. They examined three variables, the number of shares offered, the length of the lockup period, and the number of shares locked up.

For the number of shares offered, they find an error rate of 0.5 percent. For the most important variable concerning this study, the length of the lockup, which determines the unlock day, they find an error rate of three percent. As for the number of shares locked up, the SDC is wrong in 26 percent of all cases due to incorrect interpretation of the numbers presented in the prospectus. Therefore they used a fraction of post-offer shares to express the number of shares locked up, which had approximately the correct mean. The same, more accurate, variable was used in this study instead of the before mentioned. Although the SDC was fairly inaccurate with the number of shares locked up, it is more likely that the database is more accurate in the variables used in this study. The variables that were used in this study (the number of VC-investors, average investment to company etc.) cannot be that easily subject to interpretation errors. However, it has to be mentioned that the author was not able to check the accuracy of the variables used in the study.

Table 1: Descriptive statistics of the sample

Offer Year	Sample Size	Shares Locked Up	No. of venture capitalists	Average Investment ($ Mil)	Length of Lockup Period <180	180	>180
1986-1988	50	51 %	8,74	3,87	44 %	42 %	14 %
1989	52	55 %	8,41	2,56	41 %	42 %	17 %
1990	53	46 %	8,00	2,73	45 %	41 %	14 %
1991	127	57 %	8,42	8,66	24 %	62 %	14 %
1992	179	58 %	7,43	4,41	10 %	74 %	16 %
1993	204	60 %	7,05	8,91	8 %	75 %	17 %
1994	154	57 %	5,61	7,70	8 %	74 %	18 %
1995	195	58 %	6,77	8,14	5 %	87 %	8 %
1996	258	57 %	5,99	7,00	3 %	90 %	7 %
1997	149	57 %	5,90	13,03	4 %	87 %	9 %
1998	89	54 %	5,75	12,45	2 %	95 %	3 %
1999	239	58 %	8,12	11,88	7 %	93 %	0 %
2000	115	61 %	9,58	13,15	7 %	93 %	0 %
Total	**1864**	**58 %**	**7,22**	**8,75**	**10 %**	**80 %**	**10 %**

The table presents how the sample is divided by offer year. The shares locked up column represents the average of post-IPO shares locked up and the number of venture capitalists column represents the average number of venture capitalists that invested in a company. Average investment by a venture capitalist in a company in presented in millions of U.S. dollars. The composition of sample by the length of lockup period is divided into three categories: under 180 days, 180 days, and over 180 days. The total averages of each column are presented below.

The statistics in table 1 show that the percentage of shares locked up has remained at the same level during the last decade. The average number of venture capitalists involved fell from 8.7 in the late eighties to 5.6 in 1993 just to pick up again and reach a new high in the year 2000 with 9.6. These numbers are considerably higher than the ones reported by Barry et al. (1990) who had the average of two (median three) venture capitalists per company. The average investment has risen dramatically after being around 3 $ million in the late eighties. In 1991 the average more than doubles itself to 8 $ million and stays on that level until 1996. In 1997 the average jumps 60 percent to 13 $ million and again stays on the level, this time to the end of the examination period. The length of the lockup period column shows how the 180-day lockup has become a market standard. Within the last three years in the examination period nearly 95 percent of all lockups have lasted for 180 days.

4.1. Issues with daily stock return data

Brown & Warner (1985) recognized three potential problems when using daily stock return data in an event study: the non-normality of the data, the bias and inconsistency of market model parameters caused by non-synchronous trading, and the difficulties in variance estimation. These are featured in the following.

4.1.1. The non-normality of daily data

The non-normality of daily stock return for an individual security is caused by the fact that the distributions of daily returns are fat-tailed relative to a normal distribution. However, according to the Central Limit Theorem (Billingsley, 1979, see Brown & Warner, 1985) the excess returns in the cross-section of securities are independent and identically distributed drawing from finite variance distributions. The distribution of the sample's mean excess return converges to normality as the number of securities increases. Since event studies normally focus on the cross-sectional sample mean of security excess returns, Brown & Warner (1985) decided to study the phenomena with small sample properties of the mean excess return. They found out that both phenomena were also true with excess returns, and that the non-normality of daily returns or daily excess returns has no obvious impact on event study methodologies.

As the sample size in this study is over 1800 securities, there should not be any fear of non-normality.

4.1.2. The bias of market model parameters

Ordinary least squares (OLS) estimates of market model parameters are biased and inconsistent when the return of a security and the return on the market index are each measured over a different trading interval. Scholes and Williams (1977, see Brown & Warner, 1985) stated that when using daily data, the bias can be severe. Therefore a variety of alternative techniques for β estimation has been used by authors of event studies. However, even when biases in β exist they do not necessarily imply misspecification in an event study. It can be constructed so that OLS residuals sum to zero in the estimation period so that a bias in the estimate of β is compensated for by a bias in α. Nevertheless, Brown & Warner (1985) studied OLS and the other procedures and concluded that there was no clear-cut benefit in the other procedures when measuring abnormal performance. Therefore the biases in estimating the market model are unimportant in tests for abnormal return. Even though OLS is commonly used in academic literature, the author of this study decided to use a procedure that did not include α or β to calculate the abnormal return, as there was no distinct difference in the results.

4.1.3. Variance estimation

There are three issues concerning variance estimation. First, daily excess returns can show serial dependence (such as autocorrelation) as a result of non-synchronous trading. Brown & Warner (1985) looked at conditions where explicit recognition of autocorrelation is useful by repeating all of their experiments with a simple autocorrelation adjustment. There were no significant changes, and the benefits of the adjustment seemed to be limited. Therefore there is no adjustment for serial dependence is made in this study.

Second, cross-sectional dependence of the security specific excess returns can induce bias in the results. Normally the variance of the mean excess returns is estimated from the time-series of estimation period mean excess returns. The procedure takes into account any cross-sectional dependence in the security specific excess returns. If there is positive cross-sectional dependence and no adjustment is made, the variance of the mean excess return will be systematically underestimated. Even if the degree of dependence is small, as in studies where event dates are not clustered, there is little bias in variance estimates. However, adjustment for cross-sectional dependence is not always necessary for reasonable test statistic specification and it can even be harmful compared to procedures, which assume independence. Even if the independence assumption is only an approximation, it can increase the efficiency of the variance estimator, which can make it easier to detect abnormal performance when it is present. Brown & Warner (1985) compared clustered and non-clustered event dates, and discovered that in both cases there are gains from assuming independence. However, when there is no clustering of event dates, the gains are substantial. In this study the event dates are non-clustered, and independence will be assumed.

Third, the variance of stock returns increases for the days immediately prior to and after events that are suspected to convey information to the market. Brown & Warner (1985) outline a few procedures of detecting variance increases. Using cross-sectional estimates, construction of a time-series of estimated variances, one for each day around the event, is possible, thus allowing detection of event period variance increases. On the other hand, the sample can be partitioned based on an economic model of the effects of the event, such as whether the event is "good news" or "bad news". The procedures can reduce the return variances of securities in each subsample. However, none of these procedures have been seen necessary in lockup studies, so therefore they are not used.

4.2. Event study method

The general applicability of the event study method has led to its wide use. It can be applied in evaluating the effects of a variety of firm-specific and economy-wide events on the value of a firm. Initially event studies were carried out to examine whether markets were efficient, in particular to examine how quickly the information was incorporated into the share price (Elton & Gruber, 1995, 149-150). In this case, it is used to evaluate the effects of the expiration of IPO lockups in share prices.

Event study process is conducted in the following order. First, the event date and period are defined for each lockup expiration in the sample. Then normal returns for each company in the sample are being estimated, followed by estimation of abnormal and cumulative abnormal returns to the shares. Last, the statistical significance of the event returns is being determined. Each of the steps will be described in detail in the following subsections. For more information about the event study process, see Elton & Gruber (1995, 150-152).

4.3. Event date and period

Event date is the day when the expected event that has an effect on equity value is to occur. In this case the event date is the day when the IPO lockup expires. The day will referred from now on as day 0. As previously mentioned the event dates for all of the companies in the sample were gathered from the SDC database. In order to examine the lockup effect in full, abnormal return and volume are also calculated for 10 days before and after the event date. The other dates are examined as some of the insiders might want to wait few days after the expiration to sell their shares. Other reason is to witness the possible anticipation of lockup expiration by outside investors by selling shares prior to the expiration.

In the previous IPO lockup studies, many different primary event periods have been used. Field & Hanka (2001) used a three-day period (-1, +1), Bradley et al. (2000) and Brav & Gompers (2003) used a five-day period (-2, +2), and Ofek & Richardson (2000) used two different primary event periods, a two-day period (-1, 0) and a five-day period (-4, 0). For this study as the primary event period, a five-day period of (-2, +2) was chosen, although other periods are also studied between day –10 and day +10. Similar periods were chosen for the examination of the abnormal volume.

4.3.1. Estimation period criterion

Before the abnormal and cumulative abnormal returns can be calculated, the normal return for each company has the estimated. Normal return is the return that would be expected if no event took place. The event window used was 100 days before and after the event date. The estimation period for the normal return has to selected so that it does not coincide with the event periods chosen and that there is not any signs of the event in the estimated normal return. The limit for the estimation period was set to ten days before the event day. Thus, the estimation period used in this study is 90 trading days (-100, -11) for the majority (1734 companies, 93 percent of entire sample) of the sample. In some cases there was no data available for the whole 100 days before the event date. The limit for the length of the estimation period to be included in the study was set to 50 trading days (-60, -11). Every company that did not meet the criteria was excluded from the study. 130 companies had the length of their estimation period between the maximum of 90 and the minimum of 50 trading days. The length of the estimation period in IPO lockup studies is necessarily limited when compared to other event studies due to relatively short lockup periods. However, the use of a longer estimation period than used in this study is questionable because the data from the post-IPO underwriter stabilization period has to be excluded. Regardless of the fact that the estimation period did coincide with post-IPO stabilization period, the companies that had lockup period of only 90 or 100 days were included in the study because the number of these companies was marginal.

4.4. Calculation of abnormal return

Various methods to calculate the abnormal and cumulative abnormal return has been used in the previous IPO lockup studies. All the methods were tried out in order to find out if there was any difference in the results. The raw returns were also calculated.

Bradley et al. (2000) used the traditional market model method to calculate the abnormal return. The market model is by far the most used model in event studies.

The basic version of the market model is estimated using the ordinary least squares (OLS) method as follows:

$$R_{it} = \alpha_i + \beta_i R_{mt} + e_{it}\ , \tag{1}$$

where R_{it} is the continuously compounded return of a stock i for day t, R_{mt} is the return on the CRSP equally weighted market index for day t, α_i and β_i are regression coefficients, and e_{it} is the statistical error term. α_i measures the mean return over the period not explained by the market and β_i measures the sensitivity of stock i to the market. α and β have been estimated by ordinary least squares regression for every stock from the 90-day estimation period data. Now, the expected return for stock is given by inserting the estimated values of α_i and β_i together with the actual return in the market. The equation for the expected return (ER_{it}) to the stock i for day t is defined as follows:

$$ER_{it} = \alpha_i + \beta_i R_{mt}\ . \tag{2}$$

After the expected return for each company is calculated, the abnormal returns can be estimated. The abnormal return (AR) for stock i for day t is the difference between the realized returns (R_{it}) and expected returns (ER_{it}). The equation for the abnormal return is as follows:

$$AR_{it} = R_{it} - ER_{it} = R_{it} - (\alpha_i + \beta_i R_{mt})\ , \tag{3}$$

Individual returns are aggregated and an average abnormal return across securities at any time t equals:

$$\overline{AR_t} = \frac{1}{n}\sum_{i=1}^{n} AR_{it} \tag{4}$$

where n is the number of companies in the sample. The reason for averaging across companies is that individual stock returns are noisy but the noise tends to cancel out when averaged across a large number of companies. The more companies there are in the sample, the better the ability to distinguish the effect of the event.

T-test is used to determine whether the abnormal returns differ significantly from zero. The t-value is calculated as follows:

$$t = \frac{\overline{AR_t}}{s(\overline{AR_t})/\sqrt{n}} \sim \text{t(n - 1)}, \tag{5}$$

where

$$s(\overline{AR_t}) = \sqrt{\frac{\sum_{i=1}^{n}(AR_{it} - \overline{AR_t})^2}{n-1}}. \tag{6}$$

In the equation t represents the t-value, $s(\overline{AR_t})$ is the standard deviation of the abnormal returns for day t and n is the number of companies.

The cumulative abnormal return (*CAR*) to stock i is the sum of the abnormal returns during the event period. In this method, the individual *CAR* is calculated for the (T_1, T_2) event period as follows:

$$CAR_i = \sum_{i=T_1}^{T_2} AR_{it}. \tag{7}$$

A different method to calculate *CAR* was used by Field & Hanka (2001) in their study:

$$CAR_i = \left[\prod_{t=T1}^{T2}\left(\frac{1+R_{it}}{1+R_{mt}}\right)-1\right], \tag{8}$$

where the expected return is simply the return on the market index. The formula can be used similarly for calculating the daily abnormal return.

The method used by Brav & Gompers (2003) has also the assumption that the expected return is simply the return on the market index. This formula can be also used similarly for calculating the daily abnormal return. The method was first introduced by Michaely, Thaler & Womack (1995) and the market index return can also be adjusted with the β of each stock. The both equations for *CAR* are as follows:

$$CAR_i = \prod_{t=T1}^{T2}(1+R_{it})-\prod_{t=T1}^{T2}(1+R_{mt}) \tag{9}$$

$$CAR_i = \prod_{t=T1}^{T2}(1+R_{it})-\prod_{t=T1}^{T2}(1+\beta_i R_{mt}). \tag{10}$$

The average *CAR*s for the entire sample or for smaller subsamples were calculated as follows:

$$\overline{CAR} = \frac{1}{n}\sum_{i=1}^{n} CAR_i, \tag{11}$$

As with the abnormal return, t-test is also used as to determine the significance of cumulative abnormal returns. The t-value is calculated as follows:

$$t = \frac{\overline{CAR_{T1,T2}}}{s(\overline{CAR_{T1,T2}})\Big/\sqrt{n}} \sim \text{t(n - 1)}, \tag{12}$$

where

$$s(\overline{CAR_{T1,T2}}) = \sqrt{\frac{\sum_{i=1}^{n}(CAR_{iT1,T2} - \overline{CAR_{T1,T2}})^2}{n-1}}. \tag{13}$$

The results were insensitive to the different methods (see table 4). The method eventually chosen for this study was the Michaely, Thaler & Womack (1995) -method without the beta adjustment, because this method made possible to calculate CARs for the whole event window period and for smaller periods as no estimated return was required with this method.

4.4.1 Testing of medians

As in previous studies, for both the abnormal return and for the cumulative abnormal return, the Wilcoxon signed rank test is used to test the significance of either the median abnormal return on day t or the median cumulative abnormal return for the period (T1, T2). In the test absolute differences relative to zero are obtained and ranked accordingly for all securities concerned. After the ranking a plus or minus sign is attached to each rank according to the original difference to zero. Finally, the signed ranks are summed, and the sum is denoted by *T*.

The Wilcoxon signed rank test z-statistic is then calculated as follows:

$$z = \frac{T-0}{\sigma\{\mathrm{T}\}}, \tag{14}$$

where

$$\sigma\{\mathrm{T}\} = \sqrt{\frac{\mathrm{n}(\mathrm{n}+1)(2\mathrm{n}+1)}{6}}. \tag{15}$$

4.5. Calculation of abnormal volume

The abnormal trading volume for the event period is measured relative to each company's pre-unlock mean daily trading volume. The volume data was available for 1864 companies in total. The estimation period used for abnormal volume is the same as for the returns. 90 trading days (-100, -11) was available for 1751 companies and the rest having at least a 50-trading day estimation period. The equation for the abnormal volume on day t is as follows:

$$AV_{it} = \frac{V_{it}}{\frac{1}{90}\sum_{t=-100}^{-11} V_{it}} - 1, \tag{16}$$

where V_{it} is the trading volume for company *i* on day *t*. As with the abnormal return, average abnormal volumes for the entire sample or for smaller subsamples were calculated as follows:

$$\overline{AV_t} = \frac{1}{n}\sum_{i=1}^{n} AV_i \tag{17}$$

T-test is used to determine whether difference of abnormal volume to zero is significant. The t-value is calculated as before expect this time with volume related parameters:

$$t = \frac{\overline{AV_t}}{s(\overline{AV_t})\Big/\sqrt{n}} \sim \mathrm{t(n-1)}, \tag{18}$$

where

$$s(\overline{AV_t}) = \sqrt{\frac{\sum_{i=1}^{n}(AV_{it} - \overline{AV_t})^2}{n-1}}\,. \tag{19}$$

4.6. Linear regressions

Linear regressions are made is to see the effects of the various venture capital-, share performance- and IPO-characteristics, the independent variables, to the dependent variables, the cumulative abnormal return and the cumulative abnormal volume around (-2, +2) the lockup expiration. 1798 lockup expirations are included in the regressions, however, due to the fact that not all of them have all of the independent variable data, the number of observations can be downsized considerably. Especially for the variables, percentage of shares locked and insider selling at the IPO, for which, the size of the data is considerably smaller. If these variables are included, the number of observations for the regressions cuts down to little over 400. In other cases the number of observations ranges between 1300 and 1500. Numerous regressions were made and in the first regression presented all of the independent variables are included expect a few expiration year variables that were seen to be unimportant. The number of variables was cut down for the latter regressions in order to get the number of observations higher and to get more insight on the results.

Some of the independent variables in the linear regression for the abnormal return, mainly the share performance- and IPO-specific, have been tested before by Brav & Gompers (2003), Bradley et al. (2000), Field & Hanka (2001) and Ofek &

Richardson, 2000). For the abnormal volume, the linear regression has been only conducted by Brav & Gompers (2003) and Field & Hanka (2001). The results will of this study are compared to previous studies. The linear regression results for the cumulative abnormal results are presented in chapter 6.2.1. and for the cumulative abnormal volume in chapter 6.3.1.

4.6.1. Verifying the correctness

The linear regression used in the study was checked for possible cases of multicollinearity and autocorrelation. Both can mislead the results, and therefore they can cause serious damage if they are disregarded.

Multicollinearity means the existence of perfect or less than perfect linear relationship between the explanatory variables in the regression. If multicollinearity is perfect, the regression coefficients of the variables are indeterminate and their standard errors are infinite. In a case of less than perfect multicollinearity, the coefficients are determinate but possess large standard errors, which means the coefficients cannot be estimated with great precision or accuracy. Large standard errors cause the confidence intervals to be larger, and therefore the probability of accepting a false hypothesis increases.

The simplest way to detect Multicollinearity is when the R^2 of the linear regression is high (between 0.7 and 1.0) and when zero-order correlations are also high but none or very few of the partial regression coefficients are individually statistically significant on the basis of the t-test. (Gujarati 1978, 181-183) None of the regressions made in this study had a R^2 larger than 0.35 and every regression also had multiple statistically significant explanatory variables. As this method did not indicate any kind of multicollinearity, the other more complicated methods were not used, and an assumption was made that the regressions did not suffer from multicollinearity.

The regression was also checked for autocorrelation (or serial correlation) among the disturbance term e_{it}. Autocorrelation does not ruin the unbiasedness and consistency properties of the regression estimators. However, these estimators are no longer efficient, which leads to the consequences that the confidence intervals will be unnecessarily wide and the tests of significance less powerful. The simplest way to detect autocorrelation is to use the Durbin-Watson *d* Test, which gives results ranging from 0 (positive correlation) to 4 (negative correlation) with 2 being no correlation. The test was made using the Limdep program, and the test was repeated many times with different regression variables combinations, ranging from using all the variables to limiting the amount to statistically significant variables. The range of the results was from 1.98 (with few statistically significant variables) to 2.00 (with all variables in the regression). Therefore it can assumed that no autocorrelation occurs in the regressions analyzed in this study.

5. Hypotheses

A regression model is used to test the sensitivity of the results. The dependent variables are the cumulative abnormal return and the cumulative abnormal volume from day –2 to day +2, although the emphasis is definitely placed on the abnormal return. This chapter presents the hypotheses (the expected results) for the independent variables.

Most of the independent variables define certain characteristics of companies' venture financing. There are also few variables included that are can be considered as a standard for an IPO lockup study, such as the percentage of shares locked up and IPO size among others. The standard deviation of post-IPO performance, post-IPO share performance, abnormal volume and cumulative abnormal return have been included as they are the variables that have been proven to be statistically significant in the previous studies concerning VC-backed IPO lockup expirations. For the fund data variables (fund size, number of funds' investment targets, proportion of funds' investments and fund age) the initial idea was to use ownership weighted averages, but it was impossible to get reliable data of the ownership stakes, so normal averages were used. All data on the variables were attained from the SDC database excluding all share performance and volume variables, which calculated from the CRSP data. A possible variable that could have been used for the study, average VC investment to a company, could also be obtained from the SDC but the as figures seemed so unreliable, it was dropped. All of the independent variables used and their anticipated reactions for abnormal return are outlined in the following. The outlining is only made from the point of view of the abnormal return, as previous studies have shown that negative price reaction accompanies positive volume reaction. Therefore an assumption can be made that the expected reaction of the abnormal volume is the opposite of the expected reaction of the abnormal return.

Number of venture capitalists. As revealed in the previous studies, if a venture capitalist is involved in the IPO, the share price is likely drop more on the lockup day. The effect can be explained by the reasons given by Gompers & Lerner (1998): the need to reduce the risk on their investments, the short lifespan of the funds, and contractual mandatory share distributions or selling. Therefore if the number of venture capitalists involved in the IPO is high, the negative price reaction will be greater as the likelihood of venture capitalists, who need to distribute or sell shares is higher.

Number of venture capital financing rounds. There should be a high correlation between this and the previous variable mentioned as the number of venture capitalists tends to rise if more financing rounds are needed. Therefore the reaction is also expected to be the same.

Total investment. If the total amount invested to a company going public is high, it is more likely that the risks by the venture capitalists are higher with the particular company. This variable has also positive correlation with the number of venture capitalists. Thus, more distributions or selling and a greater negative price reaction on the company's share are expected if the amount invested is high. A logarithm of the variable is used in the regression.

Length of investing period. The variable is calculated by reducing the date of first venture capital investment made to the company from the IPO date. If a venture capitalist has been financing a company for many years, it should want to reduce its investments in the company as soon as possible. As previously mentioned, the lifespan of the fund is also an issue here. The variable is also positively correlated with the number of venture capitalists, and therefore likelihood of a venture capitalist who wants to liquidate/distribute right at the expiration is higher. Therefore the longer the investing period, the greater should be the negative price reaction.

Length of lockup period. If the previously made arguments are considered, it would be more likely that a longer lockup period would result in greater negative price reaction as the investors would be more anxious to give up their ownership. However, previous studies show that a greater negative reaction is associated with lockup lengths of shorter than 180 days. But when the whole sample is considered and because of the result of the linear regression made by Brav & Gompers (2000), it is likely the longer lockup periods cause greater negative price reactions.

Percentage of shares locked up after IPO. The greater amount of shares locked up, the greater is the negative reaction expected as the investors are likely to have a greater need to reduce their ownership. The results of previous studies support the assumption.

Reduction in insider ownership. If insiders sell more of their ownership at the IPO, their need to reduce it at the expiration is lower, and also the percentage of shares locked up will be lower. The expected reaction is that the more they reduce their ownership at the IPO, the lower the negative price reaction will be. As the data for the variable is presented as a negative percentage change, the expected sign for the linear regression will be negative.

High-tech company. During the late 1990's high-tech-IPOs experienced extremely high share price performances, therefore the investors should be more eager to decrease the ownership in high-tech companies. The companies are categorized to high-tech and non-high-tech companies using the industry SIC codes gathered from SDC and a dummy is made for both categories. Most high-tech fall under the 2-digit standard industrial classifications (SIC-codes) of 35 (computer and office equipment), 73 (software), 36 (electronic and electronical equipment, however, not everything is included, for example household equipment and lighting) 36 (communications equipment), 48 (telecommunications). Biotech was not included, as it was not clearly identified from the categories. After the selection 523 companies were included in the high-tech category. The high-tech dummy should result to a greater negative price reaction, which has already been proven in the previous studies. However, the dummy used here cannot be entirely compared to the other studies because companies were chosen more precisely.

Individual investor. The dummy variable is made for companies that have had individual investors financing them among institutional VC-investors. The data was available from the SDC investor descriptions. The negative reaction should be greater on companies that have had individual investors as they are likely not to have as diversified portfolio as institutional investors and the investment is likely to represent a great proportion of their wealth. Therefore they need to reduce the risk of their portfolio more.

Lockup expiration year. A dummy variable is made for every year included (1988-2000) in the study. The negative reaction will undoubtedly be greater in the last years included in the study because of the stock hype. The previous studies have results until the year 1997, and they support the arguments.

Average fund size. The average size of funds that have invested to a company is calculated as equally weighted average. There is no clear connection with the variable and the CAR, therefore the expected reaction is left as unanswered. A logarithm of the variable is used in the regression.

Average number of funds' investment targets. Equally weighted average used here as well. If a fund invests only to a few companies, its risk is higher than in a company that has a more diversified portfolio. Therefore a low number of investment targets should result in a greater negative price reaction. A logarithm of the variable is used in the regression.

Average proportion of funds' investments. If a high proportion of fund's investments is made to a single company, the fund would be likely to reduce their risk at the lockup expiration. Equally weighted average is used. Thus greater negative reaction expected if on average the funds have invested a high proportion of their money to the particular company.

Average fund age. The variable is calculated as an average of the ages of the funds investing to the particular company. The age of a fund is calculated as the difference between fund vintage year and the lockup expiration day. The earliest fund vintage in the study is 1958 with the year 2000 being the latest. The same reaction as with the length of investing period is expected. The higher the average fund age is, more likely is the venture capitalist's need to reduce its investments in the company and the greater the negative price reaction will be.

IPO size. The variable is calculated by multiplying the number of outstanding shares with the IPO share price. Three of the previous studies have investigated this as well and all had findings that larger IPO size caused increased negative abnormal returns and therefore the coefficient is expected to be negative in this study as well.

Standard deviation of post-IPO share performance. The standard deviation is calculated from a 90-day period (-100, -10) before the lockup expiration. The results of previous studies show that the greater the standard deviation, the greater the negative price reaction, and the variable has been statistically significant.

Post-IPO share performance. The variable is calculated as a percentage from the price difference between IPO price and closing price on day –5. The greater the share performance, the greater the negative price reaction is expected as investors are more eager to cash their investments. The results of previous studies support the argument and the variable has been statistically significant.

Abnormal volume. The 5-day (-2, +2) abnormal volume is calculated as described earlier. Previous studies have proven that large positive volumes around the lockup expiration are associated with greater negative price reaction, and the variable has been statistically significant. A logarithm of the variable is used in the regression.

Cumulative abnormal return. The 5-day (-2, +2) cumulative abnormal return is calculated as described earlier. Although the main aim of this study is the abnormal return, the variable is also used as independent variable for the abnormal volume linear regression. Previous studies have proven that greater negative abnormal volume is associated with large positive and the variable has been statistically significant.

Table 2 summarizes all the data of the independent variables.

Table 2: Summary of independent variables

Variable		Count	Expected sign return	Expected sign volume	Log	in Short
Number of venture capitalists		1798	Negative	Positive		Venture capitalist
Number of venture capital financing rounds		1798	Negative	Positive		Financing round
Total investment ($ Mil.)		1708	Negative	Positive	YES	Total investment
Length of investing period (years)		1705	Negative	Positive		Investment length
Length of lockup		1798	Negative	Positive		Lockup length
Percentage of shares locked		997	Negative	Positive		Shares locked
Reduction in insider ownership		610	Negative	Positive		Insiders
Average fund size		1717	Not defined	Not defined	YES	Fund size
Average number of funds' investment targets		1769	Positive	Negative	YES	Fund targets
Average proportion of funds' investments		1713	Negative	Positive		Fund assets
Average fund age		1728	Negative	Positive		Fund age
IPO size		1798	Negat. / Posit.	Negat. / Posit.	YES	IPO size
Post-IPO share performance		1798	Negative	Positive	YES	Price performance
Standard deviation of post-IPO share performance		1798	Negative	Positive		Stdev
Abnormal volume		1798	Negative	-	YES	Volume
Cumulative abnormal return		1798	-	Negative		CAR
High-tech company (yes/no)		1778				
	Yes	523	Negative	Positive		Tech
	No	1255	(Not examined)			
Individual investors (yes/no)		1798				
	Yes	337	Negative	Positive		Individual
	No	1461	(Not examined)			
Lockup expiration year		1798				Ex"year"
	From	1988	Greater negative reaction / more volume			
	To	2000	expected in the latter event years.			

Count represents the number of observations used in the linear regression for the particular variable. Expected sign abnormal return represents the expected result of if the value of the variable is high whether the price reaction around (-2, +2) the lockup expiration will be positive or negative. Expected sign abnormal volume represents the expected result of if the value of the variable is high whether the reaction to volume around (-2, +2) the lockup expiration will be positive or negative. Log represents whether a logarithm of variable is used in the linear regression. In short represents the name used for the variable in tables 6 and 8, which represent the results of the linear regressions for the abnormal return and abnormal volume.

5.1. Independent variable statistics

Table 3 shows the descriptive statistics of the independent variables. A distinctive common factor that almost all of the variables have is the big difference in the minimum and the maximum values. The average number of venture capitalists investing in a company is 7.22, with the range being from 1 to as high as 49. As imagined the correlation is high with the number of venture capitalists and the number of financing rounds. The highest number of financing rounds is also very high, 21. Other surprisingly high results are the maximum length of investing period, 28 years and the maximum number of funds' investment targets, 287 companies. The statistics for the length of lockup period and percentage of shares locked up are in line with the previous studies. The result for the average insider holdings sold in the IPO can be considered to be at the expected range, 28 percent. On average the venture capitalists have had investments in 50 companies with the median being 43 companies. The average proportion of funds' investments is a little high, 7.2 percent, when compared to the number of investment targets. The median is most likely the better indicator here with 3.92 percent. The table also shows, on average, how profitable the IPOs have been for the owners. The mean pre-lockup price performance is 55 percent above the IPO price (median 20 percent), and also the maximum value shows the price going up the incredible 2389 percent most likely as a result of the tech-IPOs in the late 90's. About a third of the companies included in this study can be considered to be as high-tech, and there has been an individual investor involved in every fifth IPO. The cumulative abnormal return and cumulative abnormal volume –independent variables are not included here as they are covered as dependent variables in chapter six.

Table 3: Descriptive statistics of the variables

Variable	Mean	Median	St.dev	Min	Max
Number of venture capitalists	7,22	5	6,47	1	49
Number of venture capital financing rounds	4,17	3	3,12	1	21
Total investment ($ Mil.)	32,95	14,62	68,92	0,002	910,73
Length of investing period (years)	4,24	3,38	3,38	0,04	27,93
Length of lockup (days)	196	180	87	30	1095
Percentage of shares locked (%)	58 %	63 %	21 %	0 %	100 %
Reduction in insider ownership (%)	-28 %	-27 %	12 %	-100 %	-1 %
Average fund size ($ Mil.)	194	86	360	0,1	5700
Average number of funds' investment targets	50	43	37	1	287
Average proportion of funds' investments (%)	7 %	4 %	11 %	0 %	100 %
Average fund age (years)	10,19	9,64	5,28	0,05	39,74
IPO size ($ Mil.)	242	120	444	5	9913
Post-IPO share performance (%)	55 %	20 %	172 %	-100 %	2389 %
Standard deviation of post-IPO share performance	0,05	0,05	0,02	0,01	0,21

Variable		Percentage
High-tech company (yes/no)		
	Yes	29 %
	No	71 %
Individual investors (yes/no)		
	Yes	19 %
	No	81 %

The table shows the mean, the median, the standard deviation, the minimum and the maximum values for the independent variables used in the study. Except for "High-tech company" and "Individual investors" it shows the percentage for yes- and no-answers.

6. Results

In this chapter all results of the empirical analysis are displayed. First, is it shown that the results are insensitive to the different calculating methods of CAR. The results for the abnormal return are presented next and they include the overall sample results, regression analysis, year comparison and selected partitioned sample analyses. The overall sample results and regression analysis for abnormal volume ends the chapter.

6.1. Different calculating methods

In the previous studies, there were four different methods how to calculate CAR. All of these methods were presented in the methodology section. The aim here was to see if there was a significant difference in the results if different methods were used to calculate the same sample. As seen in table 4, the results are fairly insensitive to the method used. The greatest negative return is achieved when using the market model method (-3.23%) with the lowest being with the Michaely, Thaler & Womack–method (-2.78%). The results with the Field & Hanka- and the Michaely, Thaler & Womack–method are almost identical.

Table 4: Different calculation methods

CAR Calculation method	Abnormal returns				Equation No.
	(-2, +2)		(-1, +1)		
Market model method	-0,0323	**	-0,0252	**	Equation (7)
Field & Hanka - method	-0,0280	**	-0,0229	**	Equation (8)
Michaely, Thaler & Womack -method	-0,0278	**	-0,0228	**	Equation (9)
Michaely, Thaler & Womack -method with beta	-0,0301	**	-0,0237	**	Equation (10)
Raw return	-0,0243	**	-0,0210	**	

** Statistically significant at a 0.01 confidence level
The table represents the negative abnormal returns from the whole sample with different methods to calculate CAR. Two different time windows are presented: 5-day (-2, +2) and 3-day (-1, +1). The equation number refers to the number used in the methodology section as how the CAR is calculated. The raw return is also presented.

6.2. Abnormal return

Table 5 reports the complete results for the abnormal and the cumulative abnormal returns for selected time periods. The number of observations is 1864, except for the time period day +11 to day +100, which has 1737 observations.

First, the results for the pre-lockup period, from day –60 to day –11 are incoherent. The average car for the period is +3.1 percent, but the median for the same period is -2.6 percent. Both results are statistically significant. The only previous study with a similar pre-lockup period reported is Field & Hanka (2001) who show a +0.2 percent abnormal return. However their result includes all companies, not just VC-backed. Therefore the difference could be caused by the higher return among the VC-backed companies or by the observations in this study from the years between 1998 and 2000.

All the abnormal returns for the ten days before the expiration are negative, which differs from the previous studies as non-of them report negative results for all of the days. From day –5 on, the results start to be more negative and also statistically significant. The daily abnormal returns range from –0.26 percent to –0.6 percent. The medians give similar results. The actual peak in the results is the unlock day itself. The average abnormal return on day 0 is –1.5 percent with the median being –1.15 percent. The average is clearly more negative in any the other studies, for example, Field & Hanka (2001) only had the average of –0.9 percent.

After the expiration day, if the averages are examined, the effect fades away, as on day +3 the average is positive for the first in the examination period. The abnormal returns for the days +4 and +6 are as well positive. The return of day +5 (-0.29 percent) is the only statistically significant result. The medians, however, stay negative for the each of the ten days following the expiration.

Table 5: Results of abnormal return: entire sample

Abnormal return

Day	Average AR	t-statistic	Median AR	z-statistic	N
DAY -10	-0,17 %	-1,28	-0,33 %	-3,78**	1864
DAY -9	-0,32 %	-2,49*	-0,27 %	-4,22**	1864
DAY -8	-0,01 %	-0,10	-0,23 %	-1,92	1864
DAY -7	-0,14 %	-1,04	-0,20 %	-2,46	1864
DAY -6	-0,01 %	-0,08	-0,18 %	-1,90	1864
DAY -5	-0,40 %	-2,86**	-0,30 %	-4,78**	1864
DAY -4	-0,27 %	-2,09*	-0,35 %	-4,24**	1864
DAY -3	-0,26 %	-2,08*	-0,36 %	-4,23**	1864
DAY -2	-0,37 %	-3,02**	-0,32 %	-4,59**	1864
DAY -1	-0,60 %	-4,34**	-0,41 %	-5,89**	1864
DAY 0	-1,49 %	-10,18**	-1,15 %	-11,87**	1864
DAY +1	-0,16 %	-1,09	-0,32 %	-3,47**	1864
DAY +2	-0,08 %	-0,67	-0,22 %	-2,45	1864
DAY +3	0,14 %	1,17	-0,10 %	-0,54	1864
DAY +4	0,04 %	0,30	-0,10 %	-0,67	1864
DAY +5	-0,29 %	-2,18*	-0,23 %	-3,41**	1864
DAY +6	0,01 %	0,11	-0,15 %	-1,80	1864
DAY +7	-0,05 %	-1,00	-0,16 %	-1,55	1864
DAY +8	-0,05 %	-1,01	-0,18 %	-1,69	1864
DAY +9	-0,11 %	-1,41	-0,14 %	-1,87	1864
DAY +10	-0,11 %	-1,44	-0,24 %	-2,74**	1864

Cumulative abnormal return

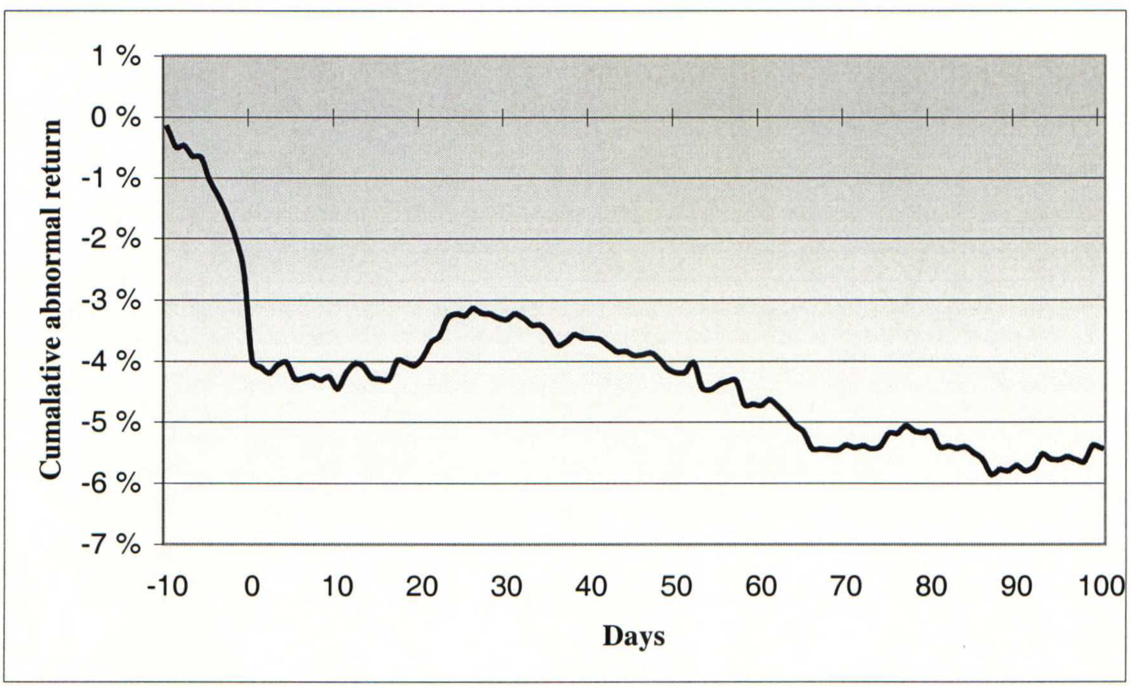
Day	Average CAR	t-statistic	Median CAR	z-statistic	
DAY -60 to -11	3,10 %	3,12**	-2,60 %	-12,64**	1864
DAY -10 to -3	-1,73 %	-5,17**	-1,99 %	-8,12**	1864
DAY -1 to +1	-2,20 %	-9,62**	-2,03 %	-12,37**	1864
DAY -2 to +2	-2,77 %	-10,20**	-2,65 %	-12,90**	1864
DAY -5 to +2	-3,78 %	-11,09**	-3,61 %	-13,66**	1864
DAY +3 to +10	-0,36 %	-1,09	-0,99 %	-2,97**	1864
DAY +11 to +100	-2,18 %	-1,93	-8,27 %	-6,41**	1737

* Statistically significant at a 0.05 confidence level
** Statistically significant at a 0.01 confidence level
T-test for means
Wilcoxon signed rank test for medians

The previous studies used the time periods (-1, +1) and (-2, +2) to measure the effect. The CARs for these periods are –2.2 percent and –2.77 percent respectively and they are statistically significant at 0.01 confidence level. The results are more negative than in any of the previous studies. If the result is calculated from day –5, the day when the drift clearly begins, until day +2, the result shows an average and a median of almost –4 percent. A similar drift that begins from day –5 is also reported by Field & Hanka (2001).

This study examines the share performance longer than any other, until day +100. The CAR for the period (+11, +100) is –2.2 percent, while the median is as much as –8.27 percent. The results of this study, as well as Bradley et al. (2000), Brav & Gompers (2003), Ofek & Richardson (2000) and Field & Hanka (2001), clearly show that the abnormal return seems to represent a permanent loss and no recovery occurs after the expiration effect. The negative effect seems to be even more significant with VC-backed companies as these results double the negative effect of the previous studies after the expiration. Figure 1 demonstrates the CAR from the day –10 until the day +100.

Figure 1: Cumulative abnormal return (-10, +100)



6.2.1 Regression analysis

One of the main interests of the study, will the increase in the number of venture capitalists also increase the negative abnormal return, turned out to be as expected. The increase in venture capitalists also increased the negative price reaction. In regression (1) the variable is not however statistically significant, but in the latter regressions the variable is clearly negative and statistically significant. As previously acknowledged there is a high positive correlation between the number of venture capitalists and the number of financing rounds. Therefore as expected, the coefficient for the number of financing rounds was also found negative. When further studied, number of venture capitalists was seen to be the more significant one, and the financing rounds variable was left out from the other regressions presented in table 6.

The total (amount of VC) investments variable gave surprising results. It was expected that more financing would have resulted in greater negative abnormal return. The actual result was quite the opposite, the coefficient was positive. In order to make any conclusions out of this, the matter requires more investigating, however, some answers could be drawn from the selected partitioned sample analyses in chapter 6.2.3.

The longer the length of the period the company had received venture financing increased negative abnormal return. The result was as expected as the likelihood of a venture capitalist that would forced to or just wanted to sell/distribute as soon as they could possibly due to the funds' regulations, lifespan etc. increases as longer periods correlate positively with the number of venture capitalists. The variable has statistical significance at 0.05 level. The coefficient for the length of the lockup period was also negative, although not significant, which is consistent with the results of Bradley et al. (2000).

Table 6: Regression results for CAR (+2,-2)

Variable	Expected sign	Reg. (1)	Reg. (2)	Reg. (3)	Reg. (4)
Constant		0,097	0,058	0,059	0,059
		(1,255)	(2,034)	(3,391)	(3,391)
Venture capitalist	-	-0,000	-0,002*	-0,001*	-0,001**
		(-0,249)	(-2,530)	(-2,432)	(-2,678)
Investment length	-	-0,000*	-0,000	-0,000*	-0,000*
		(-2,377)	(-1,651)	(-2,161)	(-2,181)
Fund size	?	-0,026	-0,028**	-0,017**	-0,017**
		(-1,656)	(-3,212)	(-2,556)	(-2,489)
Stdev	-	-1,112**	-0,757**	-0,691**	-0,713**
		(-3,079)	(-4,595)	(-4,651)	(-4,846)
Volume	-	-0,028*	-0,019*	-0,014	
		(-2,101)	(-2,345)	(-1,944)	
Price performance	-	-0,001	-0,020	-0,016	
		(-0,025)	(-1,692)	(-1,450)	
Individual	-	-0,04*	-0,013		
		(-2,471)	(-1,441)		
Tech	-	0,002	-0,003		
		(0,139)	(-0,409)		
IPO size	-	-0,003	0,014		
		(-0,137)	(1,401)		
Total investment	-	0,023	0,009		
		(1,632)	(1,172)		
Lockup length	-	-0,000	-0,000		
		(-1,383)	(-0,758)		
Financing round	-	-0,003			
		(-1,411)			
Fund targets	+	0,002			
		(0,092)			
Fund assets	-	-0,001			
		(-1,477)			
Fund age	-	0,003			
		(1,787)			
Shares locked	-	0,000			
		(0,087)			
Insiders	-	-0,043			
		(-0,747)			
Ex2000	-	-0,01			
		(-0,426)			
Ex1999	-	-0,029			
		(-1,306)			
Ex1997	-	-0,011			
		(-0,549)			
F		2,741**	5,464**	9,092**	12,190**
Adjusted R^2		0,078	0,036	0,033	0,030
N		431	1311	1425	1448

* Statistically significant at a 0.05 confidence level

** Statistically significant at a 0.01 confidence level

The table presents the results of four separate linear regressions. The dependent variable is the cumulative abnormal return from day –2 to day +2. Venture capitalist is the number of venture capitalists investing in a company. Investment length is the time between the first vc investment and the IPO date. Fund size is the average size of a fund investing in a company. Stdev is standard deviation of post-IPO share price performance. Volume is the abnormal volume around (-2, +2) the expiration of the lockup. Price performance is the post-IPO share price performance. Individual is a variable dummy, which indicates if an individual investment has financed the company. Tech is also a variable dummy, which indicates if the company can be categorized as tech-company. IPO size represents the financial size of the IPO. Total investment indicates all of the VC investment to the company. Lockup length represents the time between the IPO and the lockup expiration date. Financing round is the number of VC financial rounds that the company has made. Fund targets is the average number of companies that the VC has financed. Fund assets indicates the proportion of fund's assets that the been invested to the particular company. Fund age represents the average age funds' that have invested to the company. Shares locked is the percentage of shares locked of shares outstanding after the IPO. Insiders is the percentage of the insider ownership that has been sold at the IPO. Ex2000, Ex1999 and Ex1997 represent the variable dummies for the lockup expiration years. T-values are in parenthesis.

Positive post-IPO price performance and high price volatility causes more negative abnormal return. The standard deviation of the price performance -variable is consistently negative and statistically significant at 0.01 level. The findings of Bradley et al. (2000) and Ofek and Richardson (2000) were exactly the same. For the reasons why high standard deviation causes greater negative return and why the variable is statistically significant in all of the studies, the matter needs more investigation. However, one reason might be possible risk management by the venture capitalists. If they see high risks in their investment due to its high share price fluctuation, they might be more willing to sell/distribute quickly in order to invest the funds in a more secure asset. As for the actual price performance, the coefficient is negative as expected but does not appear to be significant. This result is consistent with Bradley et al., Brav & Gompers (2003) and Field & Hanka (2001).

The fund characteristic that did not have an expected result, the fund size variable, was statistically significant in the three latter regressions at 0.01 level. Larger fund size caused greater negative return. The reasons for the reaction are left unanswered, as there are too many possible explanations for the reaction to be either negative or positive. The other fund characteristic variables were not statistically significant. The average number of fund's investment targets and the average proportion of fund's assets (invested in a particular company) variables gave expected results. The higher the number of investment targets, the higher was the abnormal return. For the latter, the higher the proportion of assets, the greater was the negative return. The fund age variable, on the other hand, gave unexpected results. Higher age was expected to be associated with greater negative return and the result was the opposite. When the sample was divided into four subsamples according to fund age variable, it was, however, seen that the first group had a lower negative return than the other, but the negative return did not increase within the three last groups. This result most likely the caused the reaction in the regression.

The abnormal volume around the lockup expiration was also found to be statistically significant although not as significant as in the previous studies. Increased abnormal volume caused greater negative abnormal returns as previously expected.

The coefficient for the dummy variable for individual investors involved in the IPO was negative and even statistically significant in the first regression. The inclusion of an individual investor lead to increased negative abnormal return. The reason behind this, as previously suggested, could be the lack of diversification due the minor investing capital when compared to VC funds. On the other hand, the dummy variable for tech-companies gave mixed results, as the coefficient was both positive and negative in different regressions. The results of the previous studies concerning this variable were also quite mixed, and it also has to be noted the findings are not totally comparable due to different tech-company definitions.

The percentage of shares locked presented a positive coefficient and an unexpected result. Higher percentage did not lead greater negative abnormal return. Previously Field & Hanka (2001) had found the variable negative and statistically significant, Brav & Gompers (2003) and Bradley et al. (2000) just negative. The result of this study was only consistent with Ofek & Richardson (2000) had also found the coefficient positive. As the previous studies did not cover the years 1998-2000, the difference in time period used could be one the reasons to the difference in results, but the matter should be studied in more detail. On the other hand, the percentage of insider sales coefficient gave the expected result. The less they sold at the IPO, the greater was the negative return.

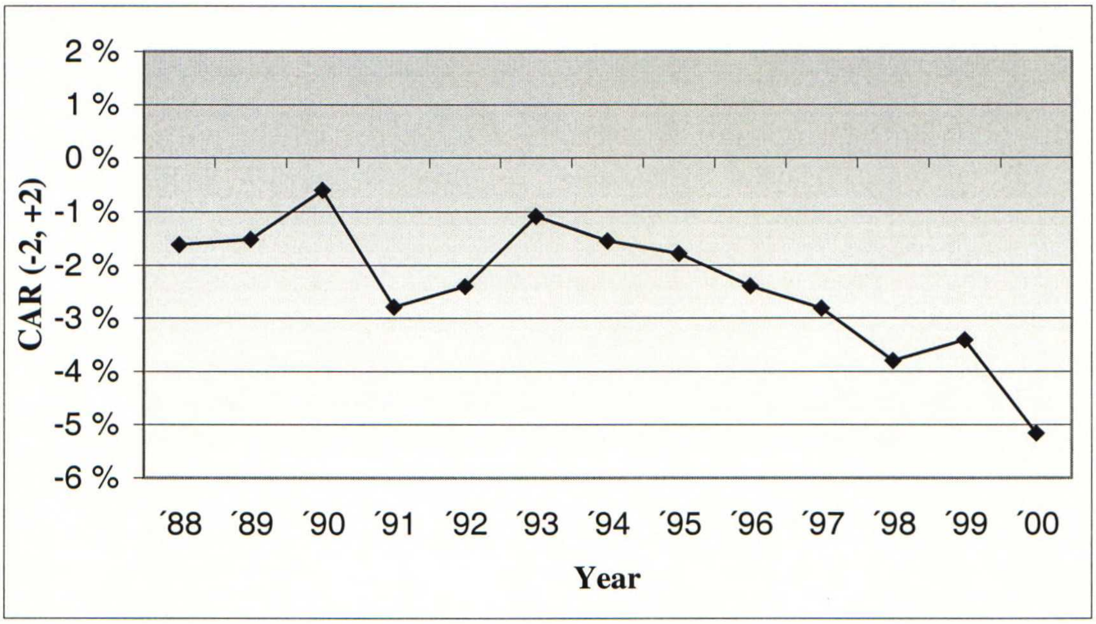
The linear regression did not give any clear direction for the IPO size coefficient; results were both positive and negative. Three of the previous studies have investigated the same variable and had negative coefficients, although none of them were significant. Instead of IPO size, Bradley et al. (2000) used the market value at expiration, which lead to a positive coefficient.

The expiration year dummy variables that were chosen for the first regression presented in table 6 were all from the latter examination years as these were seen the most interesting and possibly significant ones. All the coefficients were negative as expected but none of them was significant.

6.2.2. Year comparison

Figure 2 shows that 5-day (-2, +2) CAR for each of the years in the examination period. The results and the shape of the diagram are similar to those of Field & Hanka (2001). The 5-day CAR is negative each year ranging from –0.6 percent in 1990 to –5.2 percent in 2000. However, the results from the years 1988-1990, 1993 and 1995 are not statistically significant. The first two years examined sees the CAR at around –1.5 percent, then picking up in 1990 before a large drop to –2.8 in 1991. After picking up again, the negative CAR has steadily grown from the year 1993 (-1.1 percent) to year 1998 (-3.8 percent). Year 1999 sees the CAR at –3.4 percent before an another big fall, -1.8 percent to –5.2 percent in year 2000. The fall in the results in the year 2000 was pretty much expected as the stock market saw the crash in the hype that year. Venture capitalists have most likely sold more shares on right after the expiration as the share price commonly rose tenths of percents already within the lockup period and later that year they might have also seen the possibility of a loss as the stock market started its fall during the year. Field & Hanka (2001) also witnessed increase in the negative CAR, especially within the VC-backed companies. They stated that, when studying both VC- and non-VC backed, that the difference in the negative CAR between the two groups grew (VC-backed experienced more negative results) within the latter years of their examination years (until 1997).

Figure 2: Cumulative abnormal return by year

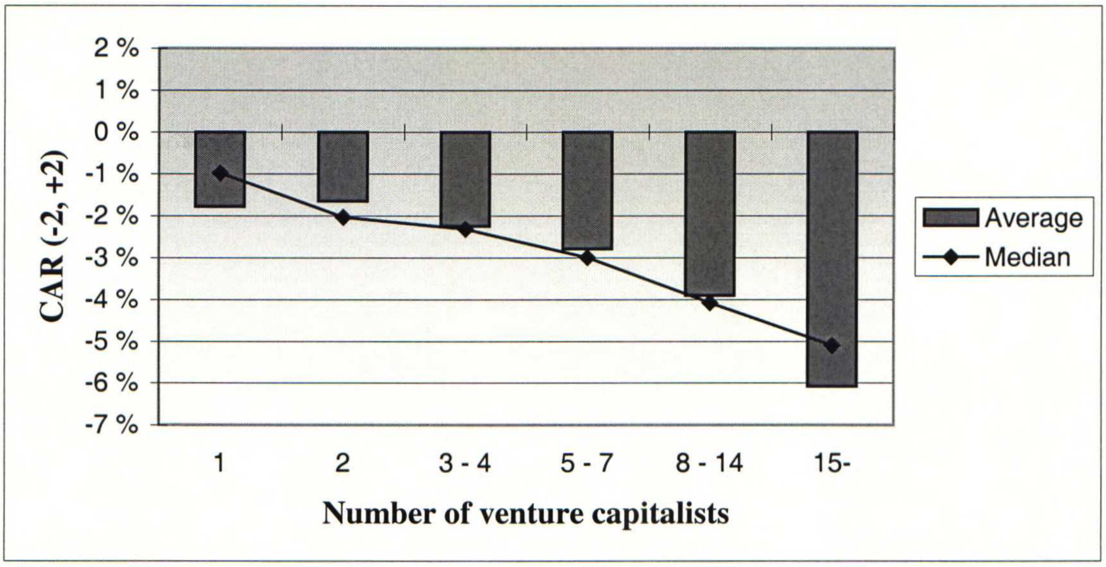


6.2.3. Selected partitioned sample analyses

The sample was divided into smaller subsamples based on three different variables that were the most interesting ones: the number of venture capitalists, the total (amount of VC) investments to a company and the length of the investing period. The comparison was made in order to see if there were discrepancies in the results with their statistical significance in the 5-day CAR and when compared to the results of the linear regression. Another interest was to see if these results would support the hypotheses made in the methodology section about the reaction of variables to the abnormal return. The subsamples were created by using the logical boundaries of the variable and by trying to make the sample sizes alike as possible. Brief description of similar results concerning individual investor and high-tech company -variables is also included in the chapter.

Figure 3 shows the results with the number of venture capitalists. The sample size within the six subsamples ranges from 190 to 371. All subsamples were statistically significant, when the number of venture capitalists was two, the confidence level was 0.05, otherwise 0.01. The averages clearly show that as the number of venture capitalists increases the negative CAR increases as well. Within the groups the least negative result occurs when there are two (-1.65 percent) and the most negative when there are more that 15 venture capitalists (-6.08 percent). The figure also shows the median being in line with the average. These results support the hypothesis made for the variable and the result of the linear regression.

Figure 3: Abnormal return: Number of venture capitalists

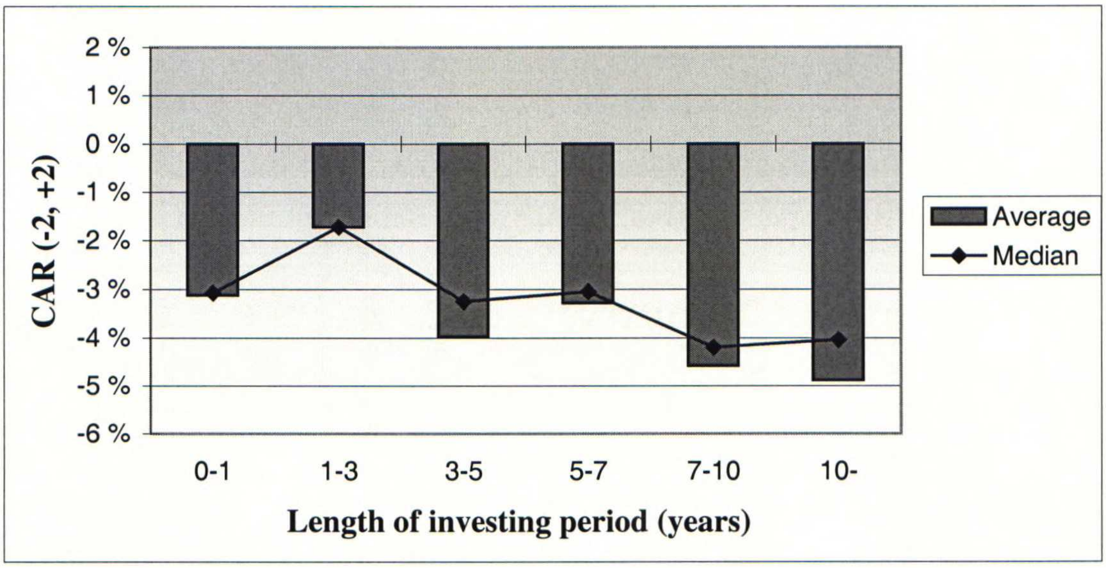


The study also included a dummy –variable whether there was an individual investor involved in the IPO. In 337 of the 1798 companies there was one or more individual investors involved. The five-day CAR for these companies resulted a negative return of –5,00% compared with the result of –2,40% for the companies that did not have individual investors. These results would indicate that individual investors are eager to sell on expiration day. Both results were statistically significant at 0.01 confidence level. A similar examination was conducted with the other dummy, the high-tech company –variable. 523 of the 1778 companies were considered to be high-tech and the five-day CAR for these companies was –3,2%. The results for the non-high-tech sample was –2,6%. The difference was expected, as it was likely that the high-tech companies have experienced greater price performance on average after the IPO, therefore making them more probable targets of asset liquidation. Though it has to be said that the difference between the two groups is not as large as expected. Both of these results were also statistically significant at 0.01 level.

The results for the length of investing period subsamples can be seen in figure 4. All of the subsamples were statistically significant at 0.01 confidence level. The results support in part the previous assumptions and results as the return is more negative when the investing period is longer. However, if the investing in three years or longer the average negative return does not increase clearly, as it stays around –4 percent.

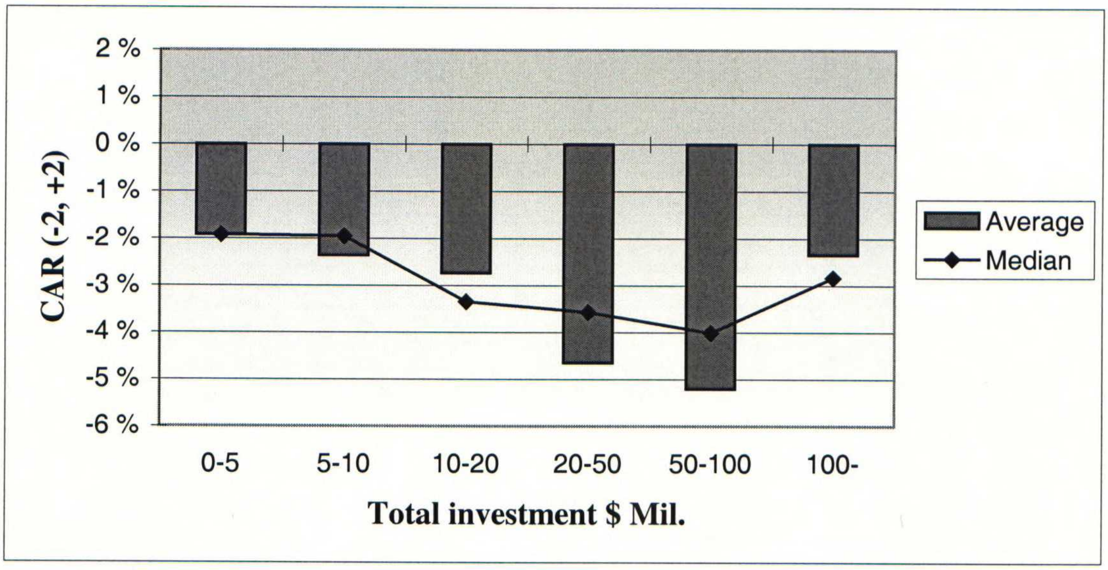
The sample size for the companies receiving financing for less than a year was smaller than the rest but it was interesting to see how the average and the median being nearly two times lower than in the next group. But in general it can be said that for investing periods shorter than three years (the first two groups) the average return is around –2 percent. More investigation is needed to understand why the negative return is higher for companies receiving venture financing less than a year and to fully understand why there is such a clear-cut line with before and after three years, even though it most likely due to the funds' finite lifespan.

Figure 4: Abnormal return: Length of investing period



The total amount of VC investments to a company –variable did not give expected results in the linear regression. It was expected that more capital invested in a company would have resulted in greater negative return. Figure 5 demonstrates why this did not happen. It can be clearly seen that the negative return increases in the first five groups (from –1.92 percent, 0-5 million dollars invested, to –5.20 percent, 50-100 million dollars invested), but the in last group that has companies that have over 100 million dollars worth of VC investments, the average and the median step up again to between -2 and -3 percent. Additional examination is required to explain the result of the last group. All of the results in this subsample were statistically significant at 0.01 confidence level.

Figure 5: Abnormal return: Total Investment



6.3. Abnormal volume

Table 7 shows the abnormal volume for each day beginning from ten days before to ten days after the lockup expiration, as well as the cumulative abnormal volume for the selected time periods. Close to the expiration the volume tends to a little over the average, with a slight peak of +18 percent above the average on day –4. A similar small day –4 peak is also witnessed by Field & Hanka (2001) and Brav & Gompers (2003). A day before the expiration the volume climbs to +22 percent. The actual peak happens on the expiration day and also the following, with both having the abnormal volume of +80 percent. When compared to the previous studies, this differs as none of the previous report a two-day peak. All others report a one-day peak on day +1. Field & Hanka and Bradley et al. (2000) both report the abnormal volume also for VC-backed companies as well as for the full sample. For the VC-backed they both show an abnormal volume of over 120 percent on day +1. For the expiration day they report an abnormal volume of +60 percent. The volume behavior at the expiration seems to differ slightly between the years 1998 and 2000 from the previous years. Part of the volume from day +1 seems to have done on the market a day earlier. For an explanation further study is required.

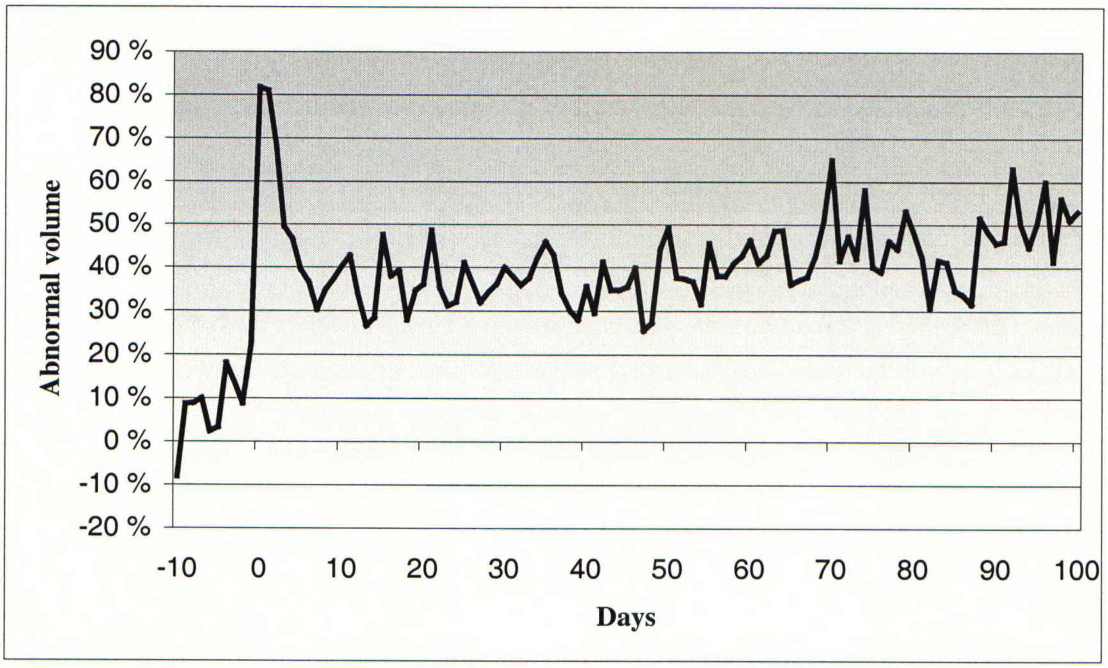
Table 7: Results of abnormal volume: entire sample

Abnormal volume and cumulative abnormal volume			
Day	**Average AV**	**t-statistic**	**N**
DAY -10	-0,08	-2,54*	1864
DAY -9	0,09	1,51	1864
DAY -8	0,09	1,65	1864
DAY -7	0,10	1,39	1864
DAY -6	0,02	0,54	1864
DAY -5	0,03	0,71	1864
DAY -4	0,18	2,59**	1864
DAY -3	0,14	2,36*	1864
DAY -2	0,09	1,81	1864
DAY -1	0,22	3,97**	1864
DAY 0	0,82	10,22**	1864
DAY +1	0,81	10,11**	1864
DAY +2	0,69	7,15**	1864
DAY +3	0,49	7,52**	1864
DAY +4	0,47	5,25**	1864
DAY +5	0,40	5,97**	1864
DAY +6	0,36	6,93**	1864
DAY +7	0,30	6,07**	1864
DAY +8	0,35	5,85**	1864
DAY +9	0,37	5,63**	1864
DAY +10	0,40	5,77**	1864
DAY -10 to -3	0,07	2,43*	1864
DAY -1 to +1	0,62	11,98**	1864
DAY -2 to +2	0,53	11,62**	1864
DAY +3 to +10	0,39	11,28**	1864
DAY +11 to +100	0,38	14,54**	1737

* Statistically significant at a 0.05 confidence level
** Statistically significant at a 0.01 confidence level
T-test for means

On day +2 the volume still stays high at almost +70 percent, but after that it drops to an average of +40 percent above the pre-lock average. As figure 6 shows within the next hundred days the volume stays between +30 percent and +60 percent, with the average steadily climbing to above +50 percent. These results are in line with both Bradley et al. (2000) and Field & Hanka (2001).

Figure 6: Cumulative abnormal volume (-10, +100)



6.3.1. Regression analysis

As expected, the increase in the number of venture capitalists and in the number of financing rounds increased abnormal volume around the expiration. High number of financing rounds correlates high number of venture capitalists, and as the number of venture capitalists increase, the likelihood of ones, who need to distribute or sell shares is higher. As the number of venture capitalists was found the more significant variable and also more interesting, it was used in the latter regressions. It was found to be statistically significant in all of the remaining regressions.

The total investment variable also returned an expected result. The variable, which meant the total amount of venture financing in a company, had a positive, although not significant, coefficient. The more the company had been venture financed, the greater was the abnormal volume.

The fund characteristics variables resulted interesting views. Both the average fund age, as well as, the average proportion of funds' investments were statistically significant at 0.05 level. The higher the average age of funds, the greater was the abnormal volume. The result was as expected and it could be reasoned by venture capitalists need to diversify holdings after long period of investing and the funds' restricted lifespan. As for the average proportion of funds' investments, the coefficient was negative and therefore the result was not the expected. Smaller proportion of ownership caused more abnormal volume. Average fund size variable was also statistically significant in the two latter regressions at 0.01 level. Smaller fund sizes caused more abnormal volume. As the results for the proportion of funds investments and fund size, both of them are not in line with the variables' results with abnormal return, therefore conclusions are hard to make. The final fund characteristics variable, average number of fund's investment targets, resulted expected values. If the number of targets was high it caused below average abnormal volume possibly because the need for diversification was lower.

One of the main positive coefficients for abnormal volume was the price performance, which had statistical significance at 0.01 level in all regressions. More positive post-IPO price performance resulted greater positive abnormal volumes around the expiration, as insiders are more eager to cash out. Field & Hanka (2001) also found the same variable statistically significant at 0.01 level. Brav & Gompers (2003) found the variable positive but not statistically significant. But the result for the standard deviation of price performance was not as expected. For CAR the standard deviation caused a greater negative reaction, and therefore a positive reaction for volume was expected. The result turned out to be negative and significant. However, for the cumulative abnormal return the result was as expected and consistent with Field & Hanka. The coefficient was negative and statistically significant.

Table 8: Regression results for volume (+2,-2)

Variable	Expected sign	Reg. (1)	Reg. (2)	Reg. (3)	Reg. (4)
Constant		-0,536	-0,546	-0,468	-0,450
		(-1,918)	(-2,049)	(-4,744)	(-5,655)
Price performance	+	0,300**	0,306**	0,261**	0,267**
		(3,772)	(4,007)	(6,873)	(7,220)
Lockup length	+	0,002**	0,002**	0,001**	0,001**
		(3,940)	(3,988)	(4,664)	(4,616)
IPO size	+	0,174*	0,191**	0,177**	0,184**
		(2,536)	(3,110)	(5,333)	(6,445)
Venture capitalist	+	0,007	0,008*	0,013**	0,014**
		(1,394)	(2,145)	(3,507)	(4,144)
Fund size	?	-0,047	-0,047	-0,074**	-0,087**
		(-0,829)	(-0,930)	(-2,765)	(-3,547)
Stdev	+	-4,546**	-4,207**	-1,388*	
		(-3,478)	(-3,602)	(-2,179)	
CAR	-	-0,37*	-0,341	-0,202*	
		(-2,071)	(-1,960)	(-2,155)	
Ex2000	+	0,114	0,08	0,100*	
		(1,382)	(1,200)	(2,485)	
Ex1998	+	0,176*	0,151	0,114**	
		(2,140)	(1,908)	(2,713)	
Fund assets	+	-0,007*	-0,007*	-0,003*	
		(-2,276)	(-2,357)	(-2,422)	
Fund age	+	0,012*	0,012*	0,006*	
		(2,086)	(2,133)	(2,390)	
Shares locked	+	0,001	0,002		
		(1,304)	(1,488)		
Insiders	+	0,416	0,413		
		(1,820)	(1,920)		
Total investment	+	0,009	0,009		
		(0,173)	(1,172)		
Fund targets	-	-0,067	-0,063		
		(-0,737)	(-0,705)		
Investment length	+	0,000	0,000		
		(0,743)	(0,864)		
Financing round	+	0,003			
		(0,366)			
Individual	+	0,003			
		(0,046)			
Tech	+	0,027			
		(0,597)			
Ex1996	+	0,08			
		(1,324)			
F		5,429**	7,406**	15,330**	27,767**
Adjusted R^2		0,178	0,182	0,105	0,083
N		431	433	1343	1474

* Statistically significant at a 0.05 confidence level

** Statistically significant at a 0.01 confidence level

The table presents the results of four separate linear regressions. The dependent variable is the abnormal volume from day –2 to day +2. Price performance is the post-IPO share price performance. Lockup length represents the time between the IPO and the lockup expiration date. IPO size represents the financial size of the IPO. Venture capitalist is the number of venture capitalists investing in a company. Fund size is the average size of a fund investing in a company. Stdev is standard deviation of post-IPO share price performance. CAR is the cumulative abnormal return around (-2, +2) the expiration of the lockup. Ex2000, Ex1998 and Ex1996 represent the variable dummies for the lockup expiration years. Fund assets indicates the proportion of fund's assets that the been invested to the particular company. Fund age represents the average age funds' that have invested to the company. Shares locked is the percentage of shares locked of shares outstanding after the IPO. Insiders is the percentage of the insider ownership that has been sold at the IPO. Total investment indicates all of the VC investment to the company. Fund targets is the average number of companies that the VC has financed. Investment length is the time between the first VC investment and the IPO date. Financing round is the number of VC financial rounds that the company has made. Individual is a variable dummy, which indicates if an individual investment has financed the company. Tech is also a variable dummy, which indicates if the company can be categorized as tech-company. T-values are in parenthesis.

The other variable that was statistically significant at 0.01 level in all regressions was the lockup length. Longer lockup periods caused more abnormal volume as expected. The result was also consistent with Brav & Gompers (2003). Another similar variable, the length of the period for how long the company received venture financing had also a positive effect on the abnormal return, although the coefficient was not found significant. Both of the results can be reasoned by the fact that after longer investing periods the need to diversify assets, to meet fund regulations or to exit the investment for any other reason is usually greater.

IPO size variable was positive and statistically significant in all regressions, in the three latter regressions even at 0.01 level. Neither Field & Hanka (2001) nor Brav & Gompers (2003) found the variable significant. However, Both did found it positive as well, although Field & Hanka only when they used the whole sample. When they used only VC data, the IPO size effect was negative. One possible assumption for the reason for the positive significance could be the growth in IPO sizes during the late 1990's (the previous studies did not cover the years 1998-2000) and therefore the effect would be caused by more or less by the stock hype.

The result with the amount of shares locked up variable was consistent with the previous studies. This study also found the coefficient positive but not statistically significant. Higher percentage of shares locked up resulted in greater abnormal volume. The results were in line with the variable that had the percentage of insider sales at the IPO. The coefficient was positive, which meant in this case that the less they sold at the IPO the more it resulted abnormal volume.

All of the expiration year dummy variables that were covered in regression (1) were all positive as expected. Years 1998 and 2000 are even statistically significant, year 1998 at regression (1) and (3) and year 2000 at regression (3). This cannot be considered as a surprise when again considering the stock hype. The results for the other dummy variables, tech-company and individual investors were positive as expected. But the results did not appear to be significant. The tech-dummy coefficient is in line with the results of Field & Hanka (2001).

The following table summarizes the expected reactions for the independent variables and the results from the regressions made for abnormal return and abnormal volume.

Table 9: Summary of the expected reactions and the results for abnormal return and abnormal volume

	Abnormal return		Abnormal volume	
Variable	**Expected sign**	**Result**	**Expected sign**	**Result**
Venture capitalist	negative	negative	positive	positive
Financing round	negative	negative	positive	positive
Total investment	negative	positive	positive	positive
Investment length	negative	negative	positive	positive
Lockup length	negative	negative	positive	positive
Shares locked	negative	positive	positive	positive
Insiders	negative	negative	positive	positive
Fund size	?	negative	?	negative
Fund targets	positive	positive	negative	negative
Fund assets	negative	negative	positive	negative
Fund age	negative	positive	positive	positive
IPO size	negative	neg. / pos.	positive	positive
Individual	negative	negative	positive	positive
Tech	negative	neg. / pos.	positive	positive
Stdev	negative	negative	positive	negative
Price performance	negative	negative	positive	positive
Ex2000	negative	negative	positive	positive
Volume	negative	negative	not included	not included
CAR	not included	not included	negative	negative

The table presents a summary of the expected reactions and results from the regressions. The dependent variables are the cumulative abnormal return and the cumulative abnormal volume from day –2 to day +2. Venture capitalist is the number of venture capitalists investing in a company. Financing round is the number of VC financial rounds that the company has made. Total investment indicates all of the VC investment to the company. Investment length is the time between the first VC investment and the IPO date. Lockup length represents the time between the IPO and the lockup expiration date. Shares locked is the percentage of shares locked of shares outstanding after the IPO. Insiders is the percentage of the insider ownership that has been sold at the IPO. Fund size is the average size of a fund investing in a company. Fund targets is the average number of companies that the VC has financed. Fund assets indicates the proportion of fund's assets that the been invested to the particular company. Fund age represents the average age funds' that have invested to the company. IPO size represents the financial size of the IPO. Individual is a variable dummy, which indicates if an individual investment has financed the company. Tech is also a variable dummy, which indicates if the company can be categorized as tech-company. Stdev is standard deviation of post-IPO share price performance. Price performance is the post-IPO share price performance. Ex2000 represents the variable dummy for the lockup expiration year 2000. Volume is the abnormal volume around (-2, +2) the expiration of the lockup. CAR is the cumulative abnormal return around (-2, +2) the expiration of the lockup.

7. Conclusions

A share lockup agreement can be nowadays found in every IPO prospectus and if the list of owners is looked at, in more and more cases, a name of a venture capitalist can also be found. Lin & Smith (1998) reported in that in the eighties, if a company had venture financing, they had an average of 2.6 venture capitalists per company. The sample in this study consisted of 1864 companies who had a lockup expired between 1986 and 2000 in NYSE, NASDAQ or AMEX. The average number of venture capitalists involved in a company was 7.2. Lockup agreements prevent the owners from liquidating their ownership right after the IPO and give market time to adjust and to reduce asymmetric information. From the venture capitalists point-of-view the lockup expiration is the first possibility to downsize the risk in their portfolio by diversifying, or in other words to sell at least a part of the shares. As the authorities have prevented the possibility of large scale selling by a previous owner right after the expiration, the venture capitalist goes round the regulations by distributing the shares to its owners, who have no regulations to prevent them from selling.

As previous studies have shown, even though the expiration date is knows the market seems to systematically underestimate the consequences, as the average cumulative abnormal return around the event is negative. Possible explanations for the phenomenon that have been presented are the downward sloping demand curves theory, larger than expected insider sales and also unanticipated insider sales prior to unlock day. As an explanatory variable, venture capitalists have been the greatest contributor to the cumulative abnormal return as well as for the abnormal volume. Bradley et al. (2000) even stated that the abnormal volume at the expiration is solely caused by the venture capitalists.

The aim of this study was to examine the relationship between the lockup and VC and to see how different VC- related variables effected the abnormal return and, therefore, possibly to enlighten the phenomenon. The same examination was done for abnormal volume as well. In addition, this study is also the first to examine expiration effect in the U.S. between the years 1998-2000, when the stock market hype thrived.

The drift in the share prices starts five days before the expiration date as the market prepares for the event. But still, on the expiration day, the prices fall the astounding 1.5 percent on average. On day +1 the market has stabilized and there is no statistically significant movement. Within the five-day period (two days before and after) the average return is -2.8 percent. The results reported here are clearly more negative than in the previous studies, most likely due to the addition of the years 1998-2000 in which the negative returns grew year by year. The share price movements were followed for a hundred days following the event and no recovery occurred during that time. In fact, the prices fell even more during the period.

A regression analysis was made in order to explain the cross-sectional variation in the abnormal return. Multiple venture capital -related, as well significant variables from the previous studies were used. For the most part the results were as anticipated but few offered surprises. The number of venture capitalists involved in the IPO was expected to be negatively related to the abnormal return, i.e. the more venture capitalists the greater would the negative return be. The reason behind the expected result was increased likelihood of the a venture capitalist that would forced to or just wanted to sell/distribute as soon as they could possibly due to the funds' regulations, lifespan or purely just for financial reasons. The result was as expected and statistically significant. The second statistically significant venture capital related variable was the length of the period that the companies had received venture capital financing. The variable was expected and proved to be negatively related, as the longer the period, the more likely was the number of venture capitalists involved and their reasons to liquidate to increase. The average fund size proved also to be statistically significant with a negative reaction to the abnormal return. Reasons for larger venture capital funds to cause more negative return would be only speculative within the scope of this study, therefore the answers are left for further examination. Two variables that have been significant in previous studies also proved to be here as well, the standard deviation of post-IPO share performance and abnormal volume. The standard deviation was the most significant of all the variables studied. Possibly due to risk management, the investors are keen to downsize their investments in a company whose value fluctuates. Abnormal volume's significance to the abnormal return is quite easily explained by their quite high negative correlation.

In order to examine how the abnormal return had changed through the years, the calculations were made individually for each year. Every year in the in examination period witnessed negative abnormal return. Within the first few years the negative return had no clear direction, but since 1993 it has grown steadily from –1.1 percent to -5.2 percent in 2000. These results have a high correlation with the general increase in venture capital financing in North America that was witnessed within the last few event years.

Abnormal volumes around the expiration were examined as well. The averages in the trading volume start to rise approximately four days before the expiration. On the expiration day the average volume increases by over 80 percent and similar volumes are also experienced on day +1. Thereafter the average decreases to the levels of +40 percent. Within the following hundred days the average slowly climbs to an average of +50 percent above the pre-lockup average. These results are otherwise in line the previous studies, except the two-day peak. Previous studies witness one-day peak on day +1. The difference might be caused by the abnormal market conditions seen during the hype, as well as, by fact that the market was starting to anticipate the expiration dates more closely in the late 1990's.

The regression made for the abnormal volume presented more statistically significant variables than it did for the return. Variables that were significant for the volume as well as for the return were the number of venture capitalists involved, fund size and the standard deviation of post-IPO share performance. The result of the first was as expected, positively related. On the other hand, the fund size variable turned out to negatively related and therefore is not line with its result in the regression for abnormal return. The standard deviation results were also surprising, high deviation caused less volume. These results are not in line the expected results nor with the regression made for abnormal return. The most significant variable for the abnormal volume turned out to be the post-IPO share performance. The results were as expected, greater share performance caused more abnormal volume. Other two highly significant were the lockup length and the size of the IPO, both of which came as expected, positively related. Variables that also had minor statistical significance in some of the regressions made were the expiration years 1998 and 2000, the average fund age and the average proportion of funds assets in a particular company. The first three variables had an excepted positive reaction for the volume but the latter had an unexpected negative reaction. The cumulative abnormal return also showed minor statistical significance and, as expected, greater negative returns caused more abnormal volume.

As previous studies have already shown the involvement of venture capitalists cause negative returns, this study clearly strengthens the hypotheses made and gives more insight on the matter. However, the subject still requires more investigating, as the results of some variables were unexpected. The next step would be on the venture capital side, if data on the actual share distributions and on the reasons behind the decisions can ever be collected.

The new information made available by this study for investors is the fact that, as they have started to pay more attention to the lockup expiration dates, they also should pay more attention to the companies' owners when preparing for the lockup expiration. Not only that the venture capitalists most likely sell part their ownership right at the expiration, more importantly they distribute the shares. The data that would help the market the most, as it might give indication of the magnitude of the reaction, is especially the number of venture capitalists involved in financing the particular company and the time period for how long the company has received venture capital. In order to try decrease the reaction, the venture capitalists could be made to disclose their plans concerning share distribution to its limited partners. However, that would not solve the problem, as the limited partners still would be allowed to do whatever they want with the shares.

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