VENTURE CAPITAL AND IPO LOCKUP EXPIRATION: AN EMPIRICAL ANALYSIS

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Abstract

Most initial public offerings (IPOs) feature so-called “lockup” agreements, which bar insiders from selling the stock for a set period following the IPO, usually 180 days. We examine stock price behavior in the period surrounding lockup expiration for a sample of 2,529 firms over 1988 to 1997. We find that lockup expirations are, on average, associated with significant, negative abnormal returns, but the losses are concentrated in firms with venture capital (VC) backing. For the VC-backed group, the largest losses occur for “high-tech” firms and firms with the greatest post-IPO stock price increases, the largest relative trading volume in the period surrounding expiration, and the highest quality underwriters.

I. Introduction

Initial public offerings (IPOs) generally feature "lockup" agreements under which corporate insiders are prohibited from selling shares before a certain date, ranging from a month to several years following the IPO. Once the lockup period is over, insiders are free to sell, although they still remain subject to more general insider trading regulations.

In both theory and practice, insider sales play an important role because of potential informational asymmetries. Because the lockup expiration date represents the first opportunity for insiders to sell, significant share price revisions are possible as market participants infer private information from insider activity. In addition, the percentage of shares subject to lockup often exceeds 100 percent of the shares in public hands. As a result, the possibility of a large, sudden increase in supply exists, which may also impact share values.

Interest in lockup expirations has grown as evidenced by at least four recent working papers (Brau (1999), Brav and Gompers (1999), Field and Hanka (2000), Ofek and Richardson (2000)), a web site (www.ipolockup.com), and numerous articles in the popular press, including, as of February 14, 2000, a regular feature in the *Wall Street Journal*. Our goal in this study is to add to this literature by providing a detailed analysis of share price reactions to IPO lockup expirations. Based on a sample of 2,529 IPOs for the ten-year period ending in 1997, we find that lockup expirations are associated with significant price declines. The average abnormal return on the lockup expiration day is !.74 percent, and the cumulative abnormal return over the five-day surrounding period is !1.61 percent, both of which are significant at any conventional level. Moreover, the cumulative loss does not appear to be a transitory effect.

On closer inspection, the negative abnormal returns in the period surrounding lockup expirations are largely concentrated in the 45 percent of the firms in our sample with venture capital (VC) backing.

Such firms lose, on average, 3 to 4 percent of their value in this period, and "high-tech" firms with VC backing are particularly hard hit. Non-VC-backed firms lose relatively little value, regardless of industry.

In addition to industry classification and VC financing, we examine the influence of firm size, post-IPO stock price performance, stock price volatility, the percentage of shares subject to lockup, the length of the lock-up period, secondary (or follow-on) offerings, underwriter reputation, trading volume, and other variables. We consistently find little or no reaction for the non-VC sample. For the VC sample, post-IPO price performance, abnormal trading volume, pre-expiration stock price volatility, and underwriter reputation are the most significant of these effects. The largest losses in value occur for firms with (1) larger post-IPO stock price increases, (2) greater abnormal trading volume in the period surrounding lockup expiration, (3) greater pre-expiration stock price volatility, and (4) higher quality underwriters.

II. Background

A lockup provision is a contractual arrangement between insiders of a firm undergoing an IPO and the underwriter, in which insiders agree not to sell shares for a specified period, usually 180 days after the offer. Lockups are not required by law, but essentially all IPOs feature them. Insiders often own a large portion of the shares of a newly public firm. By restricting sales, the lockup agreement insures that insiders will maintain a significant economic interest in the firm following the IPO, thereby aligning the interests of old and new shareholders. Lockup agreements also limit the supply of shares available for trading, which may help support the issue price in the post-IPO period. Either way, the lockup agreement should increase the marketability of the IPO, thereby increasing its likelihood of success.

Lockups are not binding in that shares may be sold before expiration if consent is given by the underwriter. In addition, lockup expiration does not necessarily eliminate restrictions on insider sales. Insiders are still subject to Rule 144 and Rule 701, which place additional restrictions on insider trading (Rule 144 and 701 restrictions are described in the Form S-1 excerpt in the Appendix). Furthermore, newly public companies, particularly in recent years, are often engaged in merger and acquisitions and/or other material nonpublic activity, thereby further limiting insider selling possibilities. Thus, even though a lockup expires, it may be several years before an insider is legally allowed to sell.

To better illustrate some of the institutional features of lockup agreements, we briefly consider the case of Healtheon Corporation (now known as Healtheon/WebMD), which went public on February 11, 1999, at $8 per share. The stock closed at $31.375, for a one-day gain of 292 percent. Information on lockup provisions is public knowledge and can be found in, for example, a company's Form S-1 under the heading, "Shares Eligible for Future Sale." The relevant portion of Healtheon's Form S-1 is reproduced in the Appendix. As shown, following the IPO, Healtheon would have a total of 67.196 million shares outstanding (assuming the underwriters did not exercise overallotment options and no other outstanding options or warrants were exercised); however, after the offering, only 5.658 million shares, including 5 million shares sold in the IPO, would be freely tradable.

Under the terms of Healtheon's underwriting agreement, 52.254 million shares were subject to a 180-day lockup. Of these shares, 41.817 million would still be subject to volume and other limitations of Rule 144 after this date, implying that 52.254 ! 41.817 = 10.437 million shares would become tradeable without restrictions of any type. The final 9.283 million shares would become available to sell at various dates after lockup expiration. Under the terms of the lockup agreement, Healtheon insiders not only are

barred from selling the stock during the lockup period, but they are also barred from making any precommitment to sell and from entering into any transaction that transfers "the economic consequences of ownership."

Based on the information in Healtheon's S-1, the number of shares subject to the lockup exceeded the total shares sold to the public by a factor of about ten. Subject to Rule 144, an enormous increase in supply following the lockup period was possible. Healtheon's S-1 also reports that the underwriter, Morgan Stanley, has the right to release some of the locked-up shares.

Healtheon's 180-day lockup period expired on August 10, 1999, at which time the stock was selling for $31.75, down from its intraday peak of $126 on May 21, 1999. On the lockup expiration day, Healtheon's share price dropped by more than 20 percent. Numerous sources reported on the decline, generally blaming the lockup expiration. For example, Reuters New Service (August 10, 1999) stated, "Shares of Healtheon Corp. fell as the online health care company's inside shareholders got their first chance to take profits since the initial public offering in February."

III. Data and Preliminary Analysis

Our primary data source for this study is the Securities Data Co. (SDC) Global New Securities database. We obtain daily stock return data from the Center for Research in Security Prices (CRSP) file. The initial sample consists of all U.S. IPOs for the period January 1, 1988 through December 31, 1997. The starting date corresponds to the first entry in the SDC database containing a lockup provision, Jean Philippe Fragrances, Inc., which completed its IPO on January 15, 1988. Before this, SDC apparently did

not capture data on lockup provisions. The ending date is chosen based on our need for post-IPO stock market data from CRSP.

Sample Selection

According to SDC, there were a total of 5,324 U.S. publicly-traded initial common stock offerings in our sample period. We first eliminated 1,990 offerings, primarily consisting of closed-end funds, depository shares, REITs, reverse LBOs, spinoffs, and unit issues, leaving a potential sample of 3,334 firms. Of this group, 413 firms had no lockup agreement (according to SDC) and another 115 firms had lockup periods that were too short for study. Another 6 firms had missing lockup periods, and 2 firms had reported secondary offerings prior to the IPO. Finally, as is very common in IPO research, we eliminated 105 firms with offer prices less than $5. The final sample contains 2,693 firms.

Sample Characteristics

Figure I graphs the number of IPOs with lockup provisions from 1988 through 1997 as reported in the SDC database. In each year, IPOs are grouped based on whether the lockup period is less than 180 days, equal to 180 days, or greater than 180 days.

Figure I about here

As Figure I shows, there is a trend toward standardizing lockup lengths at 180 days. Early in our sample, there are roughly an equal number of IPOs in the three groups, but, by the end of the sample, almost no IPOs have lockups shorter than 180 days, and 80 - 90 percent are exactly equal to 180 days.

The trend toward standardized 180-day lockups has important implications for research such as Brav and Gompers (1999), who attempt to model the determinants of the length of the lockup period. They find, for example, that firms with greater informational asymmetries use longer lockups. However, because it appears that the variation in lockup lengths is sharply diminishing (and perhaps disappearing) through time, there is relatively little cross-sectional variation for such models to explain, at least in recent years. Why lockups lengths have become so standard is unclear, although Field and Hanka (2000) suggest that it may be related to standardization of underwriting spreads discussed in Chen and Ritter (1999).

The percentage of firms with lockup agreements is another concern. About 12 percent (413 of 3,334) of the firms we initially consider have no lockup agreement according to the SDC database. However, we examined S-1 filings for several dozen of these firms and found that, without exception, there actually was a lockup agreement. Thus, the incidence of lockup agreements is understated by SDC, perhaps significantly so. This is an important issue because some researchers explore factors that determine whether or not a lockup agreement is present in an IPO. If data errors are the primary reason for the apparent absence of a lockup, the results of such analyses may be misleading.

Table 1 provides greater detail on lockup agreements. Panel A examines the length of the lockup period for our sample of 2,693 firms. The average lockup period length is 224 days; however, 75 percent (2,032 of 2,693) of the firms have lockup periods of exactly 180 days. Lockup periods of greater than a year are observed in 211 cases. A few firms have very long lockup periods, reaching a maximum of 1,095 days for five firms.

Table 1 about here

Panel B of Table 1 reports the percentage of shares subject to lockup, measured as the number of locked shares divided by shares outstanding after the IPO. The SDC database contains this information for 1,614 of the 2,693 firms in our sample. A relatively small number of firms are excluded from Panel B because this ratio exceeds 1.0, presumably because of data entry errors. As shown, among the firms in this subsample, the median is 63.30 percent. The 25th percentile is 51.60, implying that, for over 75 percent of these firms, the number of locked shares exceeds the number of unlocked shares.

IV. Stock Price Reactions to IPO Lockup Expirations

In this section, we examine abnormal returns in the period surrounding lockup expirations for the firms in our sample. We begin by briefly discussing the methods used and the hypotheses examined. Overall results based on the whole sample follow, and subsequent sections provide results on various subsets of the sample.

Methods and Hypotheses

We employ standard event study methods using daily CRSP returns data. We use the CRSP value-weighted index in our market model estimations, and we examine abnormal returns using the standardized residual approach as in Patell (1976), Linn and McConnell (1983), and Schipper and Smith (1983). The lockup expiration day is day 0. We rely primarily on standard parametric *z*-statistics; however, we also calculate a nonparametric generalized binomial proportions test.

Our estimation period is seventy trading days, ending ten days before the event date. This estimation period represents a tradeoff. A longer period is desirable for more accurate estimates, but, if only

pre-event data are used, the length of the estimation period is necessarily limited by the relatively short lockup periods. In addition, we wished to exclude data from the post-IPO underwriter stabilization period. Of the 2,693 firms identified from the SDC database, we were not able to use 164 in our event study analysis, primarily because of differences in CUSIP numbers or missing returns data. Thus, our sample for the remainder of the paper consists of the 2,529 firms with data in both sources.

In terms of our hypotheses, the lockup expiration date is public knowledge, so our null hypothesis is that there will be, on average, a zero abnormal return observed in all cases. Presumably, conditional on the information available to them, market participants form rational expectations regarding insider sales and prices reflect those expectations. Furthermore, on the lockup expiration day, specific information about insider activities will not generally be available, so market participants are unable to directly observe insider activity.

Overall Sample Results

Table 2 provides the results of the overall event study analysis for the 2,529 firms in our sample for a period of 30 days beginning on day !6.

Table 2 about here

As shown in Table 2, the average abnormal return (AR) on day 0 is !.74 percent, which is significant at the .0001 level. The cumulative abnormal return (CAR) for the day !2 to day +2 window is !1.61 percent, which is similarly significant. The median CAR for this period is !1.47 percent, and negative CARs outnumber positive CARs by about 1.5 to 1. The conclusions from the parametric results

are fully supported by the proportions tests. Similar findings are reported by Brav and Gompers (1999), Field and Hanka (2000), and Ofek and Richardson (2000), and our conclusions are not sensitive to the choice of index or the particular event study methods used.

The results in Table 3 indicate that lockup expirations are associated with negative abnormal returns. Of course, it is conceivable that the observed negative abnormal returns are transient, due to price pressure and/or bid-ask "bounce," particularly given that our sample contains many smaller, Nasdaq-listed firms. However, Figure II plots the cumulative abnormal returns over the entire 30-day period covered in Table 2. As illustrated, there is no tendency for the prices to rebound shortly following lockup expiration. Instead, there appears to be a permanent decline of about 2 percent, virtually all of which occurs in the days surrounding the expiration of the lockup.[1]

Figure II about here

Partitioned Sample Analyses

The results in the previous subsection establish that IPO lockup expirations are, on average, associated with abnormal price declines. While the effect is highly significant statistically, a price decline of 1 percent or so is much smaller than the typical bid/ask spread in our sample and thus probably too small to be profitably exploited (see Ofek and Richardson (2000) for a more detailed discussion of this issue).

[1]Field and Hanka (2000) and Ofek and Richardson (2000) explicitly examine bid and ask prices around lockup expiration. Both studies report essentially parallel shifts, thereby reinforcing this conclusion. Also, Field and Hanka find no evidence that earnings announcements systematically occur near lockup expirations.

However, larger declines may exist for certain subgroups. Thus, our goal in this section is to determine whether the observed negative abnormal returns are concentrated in firms with certain characteristics. In subsequent subsections, we therefore partition our sample based on a variety of attributes and repeat the event study analysis.

Length of the Lockup Period. We first examine whether the length of the lockup period is a significant influence. We divide our sample into four groups based on the number of days in the lockup period using the divisions reported in Table 1. The results are in Table 3. As shown, firms with lockups of 180 days and less have a significant negative CAR over the (!2, +2) window, while firms with lockups greater than 180 days generally have insignificant abnormal returns, both on the event day and over a five-day window. Thus, the significant abnormal returns are concentrated in firms with shorter lockup periods.

Table 3 about here

Industry Analysis. To explore the possibility of industry effects, we divide our sample based on one-digit SIC codes. Table 4 provides the results. As shown, our sample is not evenly spread across the different groups. SIC codes 3 and 7 have the heaviest concentrations with 696 and 564 firms, respectively. SIC code 1 has only 70 firms. The remaining five are roughly even.

Table 4 about here

Examining the abnormal returns in Table 4, firms with a one-digit SIC code of 2 have the largest (in absolute value) AR on day 0 (!1.49 percent). The two largest (in absolute value) five-day CARs,

!2.29 and !2.39 percent, occur for SIC codes 2 and 3, respectively.[2] The day 0 AR is negative in every case, but the event day ARs and five-day CARs are generally not significant (at the 5 percent level) for industries 1,4, and 6. Overall, based on the five-day CARs, SIC codes 2 and 3 appear to suffer the most severe decline while firms with SIC codes 1, 4, and 6 are essentially unaffected.

In the SDC database, certain firms are classified as "high-tech" based on 4-digit SIC codes, but the reporting appears to be inconsistent. Rather than rely on this variable, we obtained the relevant underlying codes directly from SDC and applied them to the firms in our sample. While a relatively large number of specific codes are used, most fall under the 2-digit classifications of 28 (biotechnology and drugs), 35 (computer and related), 36 (electronics and communication), 38 (medical equipment), and 73 (software). Using this classification, we compare the results for high-tech and non-high-tech firms in Table 5.

Table 5 about here

As shown in Table 5, 1,048 firms in our sample, or about 40 percent, fall into the high-tech category. Examining the abnormal returns, it is clear that lockup expiration has a greater impact on these firms. The day 0 AR for high-tech firms is !1.2 percent compared to !.42 percent for the non-high-tech firms. Additionally, the five-day CAR for high-tech firms is more than triple that of non-high-tech companies (!2.75 percent versus !.80 percent). The most extreme losses appear to occur for companies classified

[2]To avoid a great deal of repetitious language, we will henceforth generally omit the qualifier "in absolute value" when the meaning is clear in context.

as high-tech with a primary SIC code of 2. These firms lose over 4 percent of their value in the period (!2, +2).

Venture Capital. Many IPOs feature venture capital (VC) financing, and several studies, including Barry, Muscarella, Peavy, and Vetsuypens (1990), Brav and Gompers (1999), Hamao, Packer, and Ritter (1999), and Megginson and Weiss (1991) have suggested possible differences between VC-backed and non-VC-backed firms. We therefore partition our sample into VC and non-VC firms in Table 6. A small number of firms have no classification in the SDC database and are omitted from this analysis.

Table 6 about here

As reported in Table 6, 1,137 firms, amounting to 45 percent of the sample, have VC backing. For these firms, the day 0 AR and five-day CAR are !1.25 percent and !2.81 percent, respectively. Although the abnormal returns for the remaining 1,372 non-VC firms are negative and significant, they are about four times smaller. Thus, VC firms suffer much larger declines in value. Brav and Gompers (1999) and Field and Hanka (2000) also find more significant declines for VC-backed firms.

One possible explanation for the results in Table 6 is that VC and non-VC firms may have very different characteristics. Table 7 presents basic summary statistics comparing various aspects of VC versus non-VC issues. The numbers shown are averages, with standard deviations in parentheses. The reported *t*-statistics test for differences in sample means.

Table 7 about here

Examining Table 7, the average offer sizes are similar at $37 versus $42 million. The VC firms have larger post-IPO returns, but the difference is not dramatic, particularly for the 180-day returns. The VC firms have a slightly larger percentage of shares locked up. However, the difference in lockup period length is highly significant, and the shorter lockup lengths for VC firms helps to explain our earlier finding that the negative abnormal returns are concentrated in firms with shorter lockup periods. Even so, when the analysis is restricted to VC and non-VC firms with lockups of exactly 180 days, the overall results are unaffected; the VC-backed firms have much larger losses in value. Overall, only two of the five means examined in Table 7 are statistically unequal (at the 1 percent level). Furthermore, with the possible exception of the length of the lockup period, the differences do seem particularly large from an economic standpoint.

Comparing Tables 5 and 6, another possible explanation for the VC versus non-VC difference is that the majority of the firms in the high-tech group are VC-backed. Barry et al. (1990) show that venture capitalists tend to focus or specialize in a subset of industries that are characterized as high-tech; 63.8 percent of their sample is concentrated in computer equipment, electrical and electronic components, instrumentation, and business services. To explore whether the differences in Tables 5 and 6 are due to backing or industry (or both), we divide our sample into four groups based on VC versus non-VC and high-tech versus non-high-tech. The results of this 2 × 2 analysis are reported in Table 8.

Table 8 about here

Table 8 shows that VC firms suffer larger declines in value. The largest abnormal returns are associated with firms that are classified as both VC-backed and high-tech. This group has a day 0 AR of ! 1.59 percent and a (! 2,+2) CAR of ! 3.33 percent. The next largest abnormal returns occur in the VC-

backed, non-high-tech group, which has a day 0 AR of !.65 percent and a (!2,+2) CAR of !1.91 percent. For the non-VC-backed firms, the high-tech group and non-high-tech group have similar day 0 abnormal returns of !.34 percent and !.35 percent and (!2,+2) CARs of !1.47 percent and !.36 percent, respectively. Based on pairwise *t*-tests, both the AR and CAR for the VC, high-tech group are significantly larger than those in the other three groups.

We further examine these four groups by plotting their CARs over the window (!5, +23) in Figure III. As illustrated, regardless of industry, the VC firms show significant declines in value of about 4 percent while the non-VC firms do not. In fact, the CAR over this time period is essentially zero for the non-VC firms. Overall, the results in Table 8 and Figure III strongly suggest the presence or absence of VC backing is an important factor, whereas high-tech industry classification matters much less.

Figure III about here

Our analysis thus far has considered lockup dates across a ten-year period. In Figure IV, we present the (!2, +2) CARs for each year in our sample. Our goal is to determine if the negative abnormal returns have persisted as awareness of lockup expirations has grown and to investigate whether the VC-backed firms consistently have greater losses.

Figure IV about here

The results in Figure IV show no evidence of a diminishing effect through time. For the overall sample, the CAR is significantly negative in seven of the ten years (Field and Hanka (2000) report a similar result). VC-backed firms have greater losses in all ten years. In fact, the non-VC firms have a significantly

negative CAR in only two years, and the CAR is actually positive in three of the ten years. In contrast, the VC-backed firms have a negative CAR every year, with highly significant values in eight of the ten years.

One explanation for this result is that VC firms have a comparative advantage when investing in complicated firms in their pre-IPO stages. Since the expertise required by VC firms is not easily obtained by market participants, venture capitalists act as gatekeepers for these investors. In addition, VC firms are not long-term, buy-and-hold investors. In this framework, the share price decrease we observe at lockup expiration is the result of portfolio rebalancing between VC investors and traditional equity investors, and the share price response is a liquidity event that occurs even though it is anticipated.[3]

Firm Size. Numerous studies in the finance literature have identified differences among companies according to firm size. We partition our entire sample into deciles based on total market values and then grouped our sample into VC- and non-VC-backed firms. Table 9 provides the results of this analysis based on market values computed using the 180-day post-IPO price.[4]

Table 9 about here

In Table 9, for the overall sample, lockup expiration has the most pronounced effects for the medium-to-larger firms (Brav and Gompers (1999) report a similar finding). As with our previous

[3]We thank an anonymous reviewer for suggesting this explanation.

[4]In Tables 9 - 11, we report results for deciles 1, 4, 7, and 10 only to save space. The full results are available on request.

analyses, this result appears to be primarily due to the VC firms; there seems to be no relation between market value and lockup expiration for the non-VC firms.

The fact that lockup expiration tends to be more important for larger firms is surprising. *A priori*, we might expect the reverse on the grounds that smaller firms tend to be riskier, have less analyst coverage, less liquidity, and might be associated with greater asymmetric information. We explore a possible explanation in the next subsection.

Post-IPO Stock Price Performance. The market value measures in Table 9 were calculated based on stock prices 180 days after the offering. An explanation for the odd result found is that the larger firms include those with the greatest share price appreciation and that firm size *per se* is not the issue. To disentangle these two effects, we first calculate a firm's "IPO size" as the IPO offering price multiplied by shares outstanding following the IPO. Assuming no additional shares are sold after the IPO, the firm's market value at a later date is equal to its IPO size multiplied by one plus the percentage increase in the share price relative to the offering price. Table 10 presents the results obtained when we break firm size into these two components for the 180-day post-IPO period. Because size seems does not seem to matter for the non-VC firms, we consider only the VC firms in Table 10.

Table 10 about here

The first part of Table 10 shows that when firm size is measured based on IPO size, there is no clear-cut relation between size and lockup expiration. This conclusion is reinforced when we group firms based on total (book) assets in the third part of Table 10. However, when we form decile portfolios based on post-IPO stock price performance, we find better performers suffer a larger decline

in share value at IPO lockup expiration. Based on the day 0 AR, decile 10, with an average post-IPO gain of 184.2 percent, is the hardest hit, losing an average of 2.15 percent on day 0 and more than 5 percent over the five-day surrounding period. The least affected firms are in decile 1. These firms, which have an average post-IPO loss of 53.3 percent, experience a statistically insignificant loss over the (!2,+2) period of !.63 percent.[5]

Volume Behavior. We examine the behavior of trading volume around lockup expiration. Figure V illustrates the average daily trading volume separately for VC and non-VC firms. Several things are immediately apparent, but the most noticeable is the spike in volume for the VC-backed firms following lockup expiration, which actually peaks on day +1. For these firms, average volume at its peak is roughly double its pre-expiration level, and it remains approximately 30 percent higher. A much smaller, but similar, pattern exists for the non-VC firms. Also, there is 50 to 100 percent greater average trading volume in the VC-backed firms.

Figure V about here

The results in Figure V (and in Tables 11 and 12 below) are fully consistent with the hypothesis that venture capitalists simply liquidate positions immediately following lockup expiration, thereby substantially increasing the supply. Under this scenario, the abnormal price decline can be interpreted as evidence of downward-sloping demand curves for stock. However, as noted in Field and Hanka (2000), evidence on this point is difficult to obtain because neither distributions of shares to venture

[5]The 180-day return includes the IPO initial return. We repeated this analysis just using the initial return and found a similar, but less distinct, pattern.

capital partners, nor their subsequent sale must be disclosed (venture capital distributions are discussed in Gompers and Lerner (1998)).

Brav and Gompers (1999) also conjecture that venture capital sales are the reason behind the volume spike and abnormal returns because many VC firms must distribute shares once the lockup expires, and, further, most investors who receive distributed shares sell them automatically. In the absence of direct evidence on this point, Brav and Gompers (1999) and Field and Hanka (2000) perform similar analyses that examine whether the abnormal returns around lockup expiration are related to the percentage of shares subject to lockup. Both studies find a significant negative relation, and both interpret this result as supporting the hypothesis that the abnormal returns are due, at least in part, to insider selling. We will revisit the evidence on this point in Section 7 below.

To investigate the behavior of trading volume, we calculate a measure of abnormal trading volume by dividing the average daily share volume during the (!2, +2) period by the average daily share volume over the 70-day estimation period used in our event study. We then form decile portfolios based on abnormal volume. Table 11 shows the results.

Table 11 about here

The first part of Table 11 examines the overall sample. As shown, the mean abnormal volume rises from a low of .15 to a high of 5.17, and the higher abnormal volume portfolios tend to experience the largest declines. The second and third parts of Table 11 repeat the analysis for the VC and non-VC firms. As we have consistently found, the effect is concentrated in the VC firms; there is essentially no

impact on the non-VC firms even though decile-average abnormal volumes range from .13 to 3.94. In fact, for decile 10, the five-day CAR is a significantly positive 2.45 percent for the non-VC firms.

In contrast, for the VC firms in Table 11, the largest losses are associated with decile 10. For this group, the average abnormal volume is 6.43, and the associated five-day CAR is !3.41 percent and highly significant. In contrast, the decile 1 abnormal volume is .17, and the abnormal returns are statistically insignificant.

In Table 12, we analyze the joint influence of post-IPO price performance and abnormal volume by dividing our sample into four groups based on whether abnormal volume is bigger or smaller than 1.0 and whether post-IPO performance is positive or negative. The results of this 2 × 2 analysis are reported separately for the VC firms (Panel A) and non-VC firms (Panel B).

Table 12 about here

Examining Panel A of Table 12, there are 361 VC firms that experience positive post-IPO stock price performance and also experience abnormal volume greater than 1.0. Over the (!2,+2) period, these firms lose an average of 3.75 percent of their value, which is the most significant loss among the four groups considered. In contrast, the 252 VC firms with negative post-IPO performance and abnormally low volume experience a statistically insignificant !.56 percent decline.

The remaining two VC groups are similar in that the five-day CAR is !3.28 percent for the low performance, high volume group and !3.21 percent for the high performance, low volume group. In contrast to the VC firms in Panel A, Panel B shows that neither performance nor volume consistently

matters for the non-VC firms. In fact, for the high performance, high volume group, the day 0 AR and five-day CAR are actually positive, albeit insignificant.

Taken together, Tables 9 through 11 consistently show that lockup expiration typically has a relatively small impact on non-VC firms. For VC firms, lockup expirations are associated with significant negative abnormal returns, especially for firms that have experienced post-IPO price increases. The losses are particularly pronounced for these firms when there is abnormally high volume at lockup expiration.

VI. Follow-On Offerings: A Brief Analysis

Many of the firms in our sample have a seasoned equity offering (SEO), also known as a secondary or follow-on offering, in our sample period. On some occasions, such offers are put together to facilitate insider sales. Presumably, the goal in such cases is to lessen the impact of large-scale insider selling by allowing the underwriter to market the issue and also alleviate concerns about seller motivation.

We examine our sample to determine whether SEOs are common around the time of lockup expirations and also whether SEOs are more common for VC firms. A total of 890 firms, amounting to about one-third of the sample, filed for an SEO by the end of our sample period, and 220 of the 890 firms actually file for an SEO before the lockup expiration date.

When we compare SEO filings for the VC and non-VC firms, we find the two groups are similar in terms of the number of SEOs filed and the number near the lockup expiration date. However,

there are almost 20 percent more non-VC firms than VC firms in our sample, so the VC firms file for SEOs somewhat more frequently on a percentage basis.

To determine whether SEO filings affect the results in previous sections, we repeated much of the analysis in this study after eliminating firms that file for SEOs anytime in the (!100, +3) window. We found no notable differences in the results.

VII. Multivariate Analyses

We now turn to multiple regression analysis to consider the joint effects of the various issue and firm characteristics investigated in previous sections. These regressions facilitate comparison of our results with other studies, particularly Brav and Gompers (1999) and Field and Hanka (2000). To further enhance comparability, we add some additional variables examined in other studies.

In our regressions, the five-day CAR is the dependent variable. The independent variables considered are:

VC	=	Dummy variable equal to 1 if firm is VC-backed; zero otherwise;
SDCTECH	=	Dummy variable equal to 1 if firm is "high-tech;" zero otherwise;
PER180	=	180 day, post-IPO stock price performance;
RATIO_V	=	Abnormal volume as defined in Section 4;
BIG3	=	Dummy variable equal to 1 if firm's underwriter is "big three;" zero otherwise;[6]
SD	=	Standard deviation of market model residuals from the 70-day event study estimation period;

[6]The "big three" underwriters are Goldman Sachs, Merrill Lynch, and Morgan Stanley. Over our sample period, these three are the dominant underwriters based on equity IPO market share. A detailed analysis of underwriter quality in this context is available from the authors on request.

LNSIZE	=	Natural logarithm of the total market capitalization based on the offering price and shares outstanding after the IPO;
LOCKTIME	=	Length of the lockup period in days;
SEO	=	Dummy variable equal to 1 if firm has an SEO within our sample period; zero otherwise; and
PERLOCK	=	Percentage of shares outstanding subject to lockup as defined in Section 3.

The results of this analysis, with *p*-values in parentheses, are presented in Table 13.

Table 13 about here

Examining the whole sample results in Panel A, the VC and high-tech dummies are consistently negative and significant, as are the 180-day stock price performance, and, to a lesser extent, underwriter quality. Firm size is significantly positive (at the 5 percent level), indicating that larger firms suffer smaller declines in value after controlling for performance. Abnormal volume, the length of the lockup, whether or not the firm does an SEO, and the residual standard deviation (with one exception) do not appear to be significant.

In the last regression in Panel A, the percentage of shares subject to lockup is included, which reduces the sample size by about 40 percent. Consistent with Brav and Gompers (1999) and Field and Hanka (2000), the coefficient is negative and significant (*p*-value = .021), indicating that firms with a greater percentage of shares locked up suffer larger declines in value. With the exception of the residual standard deviation, the results for the other variables are similar to the larger sample regressions.

Because much of our previous analysis suggests that VC and non-VC firms may be subject to different influences, we examine the two groups separately in Panels B (VC firms) and C (non-VC firms). The regressions are identical to those in Panel A, except the VC dummy is removed. Based on a

standard *F*-test (a "Chow" test), we reject the equality of the fitted regressions in every case at any conventional significance level. We conclude that there are significant differences in the VC and non-VC backed samples, and pooling may be inadvisable.

When the individual coefficient results for the two groups are compared, some obvious (and statistically significant) differences emerge. For example, abnormal volume is insignificant in the overall sample, however, it is significantly negative for the VC firms, but significantly positive for the non-VC firms. The residual standard deviation is generally not significant in the overall regressions, but it is generally negative and significant for the VC firms and positive and significant for the non-VC firms.

In addition, 180-day performance and underwriter quality are significant for the VC firms only, while size is significant for the non-VC firms only. The tech dummy is more significant for the non-VC firms as well. The length of the lockup and the presence of an SEO do not appear to matter for either group. Finally, the percentage of shares that are locked up has a similar coefficient in both cases, but it is significant only for the non-VC firms. Thus, we cannot conclude that VC-backed firms with the greatest percentage of locked shares will suffer larger losses when the lockup expires.

VIII. Summary and Conclusions

The vast majority of IPOs feature lockup agreements. Such agreements bar insiders from selling the stock for a set period following the IPO, usually 180 days. The lockup expiration date thus represents the first opportunity for insiders to sell in the secondary market. Because the percentage of a firm's shares subject to lockup is often 100 percent or more, a large, sudden increase in supply is

possible. Significant share price revisions may occur if market participants infer private information from perceived insider transactions.

To evaluate the effects of lockup expiration, we examine stock price behavior in the period surrounding the lockup expiration date for a sample of 2,529 firms over the period 1988 - 1997. We find that lockup expirations are, on average, associated with significant negative abnormal returns. We further find that the negative abnormal returns in the period surrounding lockup expiration are mostly due to the 45 percent of the firms in our sample with venture capital (VC) backing. Such firms lose, on average, three to four percent of their value in this period, and "high-tech" firms with VC backing are particularly hard hit. Non-VC-backed firms lose relatively little value, regardless of industry.

In addition to industry and VC financing, we examine the influence of firm size, post-IPO stock price performance, underwriter reputation, stock price volatility, the percentage of shares subject to lockup, the length of the lock-up period, secondary (or follow-on) offerings, trading volume, and other variables. We find little or no reaction for the non-VC sample. For the VC-backed sample, post-IPO price performance and trading volume are the most significant of these effects. The largest losses in value occur for firms with the largest stock price increases, firms that experience abnormally high trading volume in the period surrounding lockup expiration, and firms with greater stock price volatility during the pre-expiration period. Firms associated with high quality underwriters also appear to sustain larger losses in the period surrounding lockup expiration.

The results in this study raise some public policy issues. Although the relevant date is, in principle, public knowledge, should firms be required to inform shareholders just prior to expiration? At a minimum, it would seem reasonable for firms to disclose, in advance, when a lockup is going to be

released earlier than originally scheduled. Similarly, should insiders be required to disclose, in advance, their intentions once the lockup expires? Whether such disclosures would eliminate the losses suffered by shareholders around lockup expiration is an open question, but the possibility exists.

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Appendix: Healtheon Corporation's Lockup Agreement

The following is excerpted from Healtheon Corporation's Form S-1, filed February 10, 1999.

SHARES ELIGIBLE FOR FUTURE SALE

Prior to this offering, there has been no public market for the common stock of Healtheon. Future sales of substantial amounts of common stock in the public market, or the perception that such sales may occur, could adversely affect prevailing market prices.

Upon consummation of the offering, Healtheon will have an aggregate of 67,195,893 shares of common stock outstanding, based on the number of shares of common stock outstanding as of November 30, 1998, assuming that the U.S. underwriters do not exercise their over-allotment option and none of the outstanding options and warrants are exercised. Of the 67,195,893 shares outstanding after the offering, 5,658,184 shares, including the 5,000,000 shares sold in this offering, will be freely tradable without restriction under the Securities Act, except for any shares that may be purchased by "affiliates" of Healtheon. Shares purchased by Healtheon's affiliates will be subject to the volume and other limitations of Rule 144 of the Securities Act, or "Rule 144" described below. As defined in Rule 144, an "affiliate" of an issuer is a person who, directly or indirectly, through one or more intermediaries, controls, is controlled by or is under common control with the issuer. Upon the expiration of certain contractual "lock-up" restrictions described below, 52,254,368 shares will be eligible for sale 180 days after the date of this prospectus, with 41,817,104 of such shares subject to the volume and other limitations of Rule 144. The remaining 9,283,341 shares will become eligible for sale at various times

after that date, including 7,683,341 shares that will become eligible for resale between November 3 and November 6, 1999. All of these remaining shares will be subject to the volume and other limitations of Rule 144.

Each of Healtheon's directors and officers and certain other stockholders of Healtheon have agreed with Morgan Stanley & Co. Incorporated, for a period of 180 days after the date of this prospectus, not to:

- offer, pledge, sell, contract to sell, sell any option or contract to purchase, purchase any option or contract to sell, grant any option, right or warrant to purchase, lend, or otherwise transfer or dispose of, directly or indirectly, any shares of common stock or any securities convertible into or exercisable or exchangeable for common stock; or

- enter into any swap or other arrangement that transfers to another, in whole or in part, any of the economic consequences of ownership of the common stock, whether any such transaction described above is to be settled by delivery of common stock or other securities, in cash or otherwise.

Morgan Stanley & Co. Incorporated may choose to release some of these shares from such restrictions prior to the expiration of the 180-day period "lock-up" period, although it has no current intention of doing so.

Under Rule 144 as currently in effect, beginning 90 days after the date of this prospectus, a person who has beneficially owned restricted shares of common stock for at least one year, including the holding period of any prior owner who is not an affiliate, would be entitled to sell a number of the shares within any three-month period equal to the greater of (1) 1% of the then outstanding shares of the common stock or (2) the average weekly reported volume of trading of the common stock on the Nasdaq National Market during the four calendar weeks preceding such sale. Immediately after the offering, 1% of Healtheon's outstanding shares of common stock would equal approximately 671,959 shares. Under Rule 144, restricted shares are subject to manner of sale and notice requirements and requirements as to the availability of current public information concerning Healtheon. Under Rule 144(k), a person who is not deemed to have been an affiliate at any time during the 90 days preceding a sale, and who has beneficially owned the shares proposed to be sold for at least two years, including the holding period of any prior owner who is not an affiliate, is entitled to sell such shares without regard to the volume or other limitations of Rule 144 just described.

Immediately after this offering, there will be options to purchase approximately 11,827,385 shares of common stock outstanding, based on the number of options outstanding as of November 30, 1998. Subject to the provisions of the lock-up agreements described above, holders of these options may rely on the resale provisions of Rule 701 under the Securities Act. Rule 701 permits non-affiliates to sell their shares without having to comply with the volume, holding period or other limitations of Rule 144 and permits affiliates to sell their shares without having to comply with the holding period limitation of Rule 144, in each case beginning 90 days after the consummation of this offering. In addition, shortly

after this offering, Healtheon intends to file a registration statement on Form S-8 covering the 13,811,659 shares of common stock reserved for issuance under the 1996 Plan and the 1998 Purchase Plan based upon the number of options outstanding as of November 30, 1998. Shares of common stock registered under any registration statement will, subject to Rule 144 volume limitations applicable to affiliates, be available for sale in the open market, unless the shares are subject to vesting restrictions with Healtheon or the lock-up agreements described above.

TABLE 1. Sample Characteristics.

Panel A. Length of Lockup in Calendar Days (N = 2,693)					
Lock period	120≤x< 180	180	180<x≤365	>365	All
N	164	2,032	286	211	2,693
Mean	130	180	328	589	224
Median	120	180	360	545	180
Mode	120	180	365	730	180
Standard deviation	14	0	53	154	125

Panel B. Percentage of Shares Subject to Lockup (N = 1,614)					
Percentile	Mean	25%	50%	75%	99%
	59.54	51.60	63.30	71.74	88.77

Note: This table provides descriptive statistics for the length of lockup provisions and percentage of shares subject to lockup. Panel A reports the lockup provision in days for selected ranges of the lockup provision. Panel B reports summary statistics on the fraction of shares subject to lockup provisions. This variable is calculated as the number of shares locked divided by the number of shares outstanding after the offer. The data are from the Securities Data Company Global New Securities database from 1988 through 1997.

TABLE 2. Event Study Results: Entire Sample.

Day	Average Abnormal Return	Median Abnormal Return	*z*	N	Positive: Negative	Generalized Sign *z*
-6	0.12%	-0.06%	0.69	2529	1237:1292	1.30
-5	0.05	-0.12	0.52	2529	1199:1330	-0.21
-4	0.05	-0.11	0.25	2529	1205:1324	0.03
-3	-0.39	-0.29	-4.16	2529	1127:1402	-3.08
-2	-0.11	-0.13	-1.11	2529	1196:1333	-0.33
-1	-0.32	-0.34	-4.60	2529	1091:1438	-4.51
0	-0.74	-0.57	-9.22	2529	1045:1484	-6.34
1	-0.34	-0.37	-4.99	2528	1122:1406	-3.26
2	-0.10	-0.15	-0.52	2528	1185:1343	-0.75
3	0.00	-0.16	-0.55	2528	1183:1345	-0.83
4	-0.01	-0.09	-0.08	2528	1221:1307	0.68
5	-0.15	-0.17	-2.26	2528	1171:1357	-1.31
6	-0.05	-0.17	-1.46	2528	1167:1361	-1.47
7	0.13	-0.11	1.11	2528	1204:1324	0.01
8	0.06	-0.14	0.06	2528	1180:1348	-0.95
9	-0.08	-0.15	-1.28	2528	1203:1325	-0.03
10	-0.07	-0.17	-1.60	2528	1175:1353	-1.15
11	-0.05	-0.14	-0.77	2528	1190:1338	-0.55
12	-0.03	-0.07	-0.51	2528	1224:1304	0.80
13	-0.05	-0.17	0.02	2526	1177:1349	-1.03
14	0.07	-0.05	0.12	2525	1230:1295	1.10
15	-0.02	-0.07	-0.03	2524	1219:1305	0.68
16	-0.18	-0.19	-2.21	2524	1163:1361	-1.55
17	0.12	-0.07	0.89	2524	1223:1301	0.84
18	0.02	-0.13	0.87	2523	1203:1320	0.06
19	-0.17	-0.13	-1.86	2522	1196:1326	-0.20
20	0.06	-0.12	-0.08	2522	1203:1319	0.08
21	0.17	-0.10	1.24	2521	1200:1321	-0.02
22	-0.10	-0.07	-0.52	2520	1222:1298	0.88
23	0.10	-0.07	0.84	2520	1207:1313	0.28

	Cumulative Average Abnormal Return					
Days	Equally Weighted	Precision Weighted	Median CAR	*z*	Positive: Negative	Generalized Sign *z*
(-1,+1)	-1.39%	-1.34%	-1.35%	-10.86	1002:1527	-8.06
(-2,+2)	-1.61	-1.45	-1.47	-9.14	1031:1497	-6.90

Note: This table reports the event study results for the entire sample around lockup expiration. The standardized residual method and value-weighted index are used to compute and evaluate abnormal returns. Day 0 is the lockup expiration day. The windows (-1,+1) and (-2,+2) are reported. The generalized sign *z* tests the null hypothesis that the percentage of positive returns is the same as in the estimation period. The data are from the Securities Data Company Global New Securities database from 1988 through 1997.

TABLE 3. Event Study Based on Length of Lockup Period.

Lockup Period	N	Day 0 AR	*z*	(-2,+2) CAR	*z*
120≤x<180	158	-.24%	-1.09	-2.55%	-4.39
180	1,947	-.93	-10.21	-1.70	-8.36
180<x≤365	268	-.29	-.53	-1.01	-1.60
x>365	156	.38	.75	-.57	-.75

Note: This table reports the event study results based on the number of days a firm is subject to a lockup provision. Day 0 AR is the event day abnormal return followed by the corresponding *z*-statistic. (-2,+2) CAR is the cumulative abnormal return in the (-2,+2) window followed by the corresponding *z*-statistic. The standardized residual method and value-weighted index are used to compute and evaluate abnormal returns. The data are from the Securities Data Company Global New Securities database from 1988 through 1997.

TABLE 4. Event Study Results for Industry Classifications.

SIC 1-Digit Code	N	Day 0 AR	*z*	(-2,+2) CAR	*z*
1 Mining and construction	70	-.58%	-1.76	-.24%	-.29
2 Light manufacturing	287	-1.49	-5.15	-2.29	-3.92
3 Heavy manufacturing	696	-1.06	-6.69	-2.39	-6.34
4 Regulated industries	194	-.40	-1.11	.13	-.32
5 Wholesale and retail	300	-.61	-2.41	-1.74	-3.41
6 Financials	182	-.27	-1.52	0.20	-.73
7 Service	564	-.37	-2.88	-1.58	-4.38
8 Health service	232	-.65	-2.65	-1.59	-3.01

Note: This table provides the results of an industry analysis based on 1-digit SIC codes around lockup expiration. The standardized residual method and value-weighted index are used to compute and evaluate abnormal returns. Day 0 AR is the event day abnormal return followed by the corresponding *z*-statistic. (-2,+2) CAR is the cumulative abnormal return in the (-2,+2) window followed by the corresponding *z*-statistic. We excluded industries with 1-digit SIC codes of 0 and 9 because the sample size was fewer than 50 observations. The data are from the Securities Data Company Global New Securities database from 1988 through 1997.

TABLE 5. Event Study Results for High-Tech Firms.

Type of Firm	N	Day 0 AR	*z*	(-2,+2) CAR	*z*
Non-high-tech	1,481	-.42%	-4.09	-.80%	-4.17
High-tech	1,048	-1.20	-9.46	-2.75	-9.24
High-tech SIC code 2	135	-2.55	-6.24	-4.13	-4.73

Note: This table shows the difference between high-tech and non-high-tech firms around lockup expiration. High-tech firms are generated using a 4-digit SIC code classification scheme provided by Securities Data Company. The standardized residual method and value-weighted index are used to compute and evaluate abnormal returns. Day 0 AR is the event day abnormal return followed by the corresponding *z*-statistic. (-2,+2) CAR is the cumulative abnormal return around the window (-2,+2) followed by the corresponding *z*-statistic. The data are from the Securities Data Company Global New Securities database from 1988 through 1997.

TABLE 6. Venture Capital-Backed versus Non-Venture Capital-Backed Firms.

Type of Firm	N	Day 0 AR	*z*	(-2,+2) CAR	*z*
Venture	1,137	-1.25%	-9.51	-2.81%	-10.31
Non-venture	1,372	-.35	-3.95	-.62	-2.96

Note: This table compares venture capital-backed versus non-venture capital-backed firms. The standardized residual method and value-weighted index are used to compute and evaluate abnormal returns. Day 0 AR is the event day abnormal return followed by the corresponding *z*-statistic. (-2,+2) CAR is the cumulative abnormal return around the window (-2,+2) followed by the corresponding *z*-statistic. The data are from the Securities Data Company Global New Securities database from 1988 through 1997.

TABLE 7. Descriptive Statistics Comparing Venture versus Non-Venture Firms.

Variable	N	VC	N	Non-VC	*t*-stat
Offer amount (mil $)	1,156	37.19 (39.59)	1,506	42.00 (63.05)	-2.27
90-day performance (%)	1,127	27.38 (52.16)	1,434	20.20 (42.00)	3.86
180-day performance (%)	1,137	29.40 (72.12)	1,450	23.97 (67.09)	1.97
Shares locked (%)	784	60.47 (16.70)	821	58.66 (18.40)	2.06
Average number of days in lock period	1,160	191.62 (65.07)	1,511	249.30 (150.83)	-12.18

Note: This table provides descriptive statistics on VC versus non-VC firms. Offer amount is the offer price times the number of shares offered to the market. Performance is calculated as the 90-day and 180-day stock price minus the offer price divided by the offer price. Standard deviations are in parenthesis. The data are from the Securities Data Company Global New Securities database from 1988 through 1997.

TABLE 8. Event Study Comparison of Venture Capital-Backed (Non-Venture Capital-Backed) and High-Tech (Non-High-Tech) Firms.

	Venture	Non-Venture
High-Tech		
Day 0 AR	-1.59%	-.34%
(*z*)	(-9.52)	(-2.78)
(-2,+2) CAR	-3.33%	-1.47%
(*z*)	(-9.08)	(-3.01)
N	724	322
Non-Tech		
Day 0 AR	-.65%	-.35%
(*z*)	(-3.18)	(-2.98)
(-2,+2) CAR	-1.91%	-.36%
(*z*)	(-5.08)	(-1.71)
N	413	1,050

Note: This table provides the event study results for high-tech versus non-high-tech and venture capital-backed versus non-venture capital-backed firms. High-tech firms are generated using a 4-digit SIC code classification scheme provided by Securities Data Company. The standardized residual method and value-weighted index are used to compute and evaluate abnormal returns. Day 0 AR is the event day abnormal return followed by the corresponding *z*-statistic. (-2,+2) CAR is the cumulative abnormal return around the window (-2,+2) followed by the corresponding *z*-statistic. The data are from the Securities Data Company Global New Securities database from 1988 through 1997.

TABLE 9. Event Study Results Based on Market Value for Whole, Venture, and Non-Venture Samples.

	Entire Sample					Venture Capital					Non-Venture Capital				
Decile	Day 0	*z*	(-2,+2)	*z*	Mean	Day 0	*z*	(-2,+2)	*z*	Mean	Day 0	*z*	(-2,+2)	*z*	Mean
1	-.37%	-.22	-.97%	-.42	$13.2	-.91%	-.98	-2.66%	-2.32	$21.7	-.05%	.27	-.12%	.18	$10.5
4	-.73	-2.23	-2.29	-4.36	61.4	-1.85	-4.23	-1.90	-2.40	74.5	-.05	-.81	-1.10	-1.58	50.6
7	-1.41	-6.01	-2.37	-4.49	140.0	-1.85	-4.74	-2.82	-3.41	148.1	-.83	-2.92	-1.63	-2.32	134.5
10	-.59	-2.04	-1.54	-1.84	885.4	-2.13	-4.92	-4.91	-5.19	756.6	.13	.26	.47	1.32	989.7

Note: This table provides the event study results based on market values of each firm. Market value measures are calculated by multiplying the number of shares outstanding after the offer by the stock price for each firm. Deciles are increasing with market value (i.e., smallest firms in decile 1). The standardized residual method and value-weighted index are used to compute and evaluate abnormal returns. Day 0 is the event day abnormal return followed by the corresponding *z*-statistic. (-2,+2) is the cumulative abnormal return in (-2,+2) window followed by the corresponding *z*-statistic. Means are expressed in millions of dollars. Market value measures are based on the 180-day post-IPO stock price. The data are from the Securities Data Company Global New Securities database from 1988 through 1997.

TABLE 10. Event Study Results for Venture Capital-Backed Decile Portfolios Based on IPO Size, 180-Day Performance, and Total Assets.

	IPO Size					180-Day Performance					Total Assets				
Decile	Day 0	*z*	(-2,+2)	*z*	Mean	Day 0	*z*	(-2,+2)	*z*	Mean	Day 0	*z*	(-2,+2)	*z*	Mean
1	-1.52%	-2.03	-4.09%	-3.75	$25.2	-.57%	-1.25	-.63%	-.51	-53.3%	-1.15%	-1.59	-3.82%	-3.52	$11.8
4	-1.82	-4.35	-3.27	-3.84	68.9	-1.26	-3.05	-2.56	-2.91	-4.5	-.74	-1.57	-1.28	-1.84	30.5
7	-.83	-1.50	-2.96	-3.12	122.2	-1.18	-2.94	-2.69	-3.27	40.0	-1.23	-3.37	-2.62	-2.95	50.0
10	-1.73	-4.32	-4.04	-4.59	501.2	-2.15	-4.79	-5.03	-4.91	184.2	-.36	-1.16	-1.71	-2.80	493.4

Note: This table provides the event study results for venture capital-backed decile portfolios based on IPO size, 180-day performance, and total assets before the IPO. IPO size is calculated by multiplying the number of shares outstanding after the offer by the offer price. 180-day performance is measured as the 180-day return relative to the offer price. Total assets and IPO size are in millions of dollars. The standardized residual method and value-weighted index are used to compute and evaluate abnormal returns. Day 0 is the event day abnormal return followed by the corresponding *z*-statistic. (-2,+2) is the cumulative abnormal return in the (-2,+2) window followed by the corresponding *z*-statistic. The data are from the Securities Data Company Global New Securities database from 1988 through 1997.

TABLE 11. Event Study Results Based on Relative Volume for Whole, Venture, and Non-Venture Samples.

	Entire Sample					Venture Capital					Non-Venture Capital				
Decile	Day 0	*z*	(-2,+2)	*z*	Mean	Day 0	*z*	(-2,+2)	*z*	Mean	Day 0	*z*	(-2,+2)	*z*	Mean
1	-.26%	-1.25	-.54%	-1.32	.15	-.56%	-1.08	-1.35%	-1.61	.17	.02%	-.53	.11%	-.13	.13
4	-.02	-.52	-1.99	-2.99	.57	-.53	-1.05	-2.42	-2.78	.67	-.14	-.49	-1.29	-1.57	.49
7	-.37	-1.93	-1.82	-3.01	1.18	-1.46	-3.88	-2.53	-3.37	1.46	-.79	-2.39	-.96	-1.25	1.02
10	-1.01	-4.09	-.82	-2.09	5.17	-1.37	-3.20	-3.41	-4.20	6.43	-.41	-1.59	2.45	2.94	3.94

Note: Relative volume is defined as the ratio of the average volume during the event period (-2,+2) divided by the average volume during the 70-day estimation period. Deciles are increasing with relative trading volume (i.e., the smallest relative volume is in decile 1). The standardized residual method and value-weighted index are used to compute and evaluate abnormal returns. Day 0 is the event day abnormal return followed by the corresponding *z*-statistic. (-2,+2) is the cumulative abnormal return in the (-2,+2) window followed by the corresponding *z*-statistic. The data are from the Securities Data Company Global New Securities database from 1988 through 1997.

TABLE 12. Event Study Results of the Relation Between 180-day, Post-IPO Performance, and Relative Volume for Venture and Non-venture-backed Firms.

Panel A. Venture Capital-Backed

	Positive 180-Day Performance	**Negative 180-Day Performance**
Relative Volume Ratio Greater than 1		
Day 0 AR	-1.82%	-1.98%
(*z*)	(-7.76)	(-6.69)
(-2,+2) CAR	-3.75%	-3.21%
(*z*)	(-7.47)	(-5.23)
N	361	193
Relative Volume Ratio Less than 1		
Day 0 AR	-.93%	-.27%
(*z*)	(-3.89)	(-.60)
(-2,+2) CAR	-3.28%	-.56%
(*z*)	(-6.61)	(-.80)
N	331	252

Panel B. Non-Venture Capital-Backed

	Positive 180-Day Performance	**Negative 180-Day Performance**
Relative Volume Ratio Greater than 1		
Day 0 AR	.31%	-1.01%
(*z*)	(-.27)	(-3.35)
(-2,+2) CAR	.55%	1.38%
(*z*)	(1.89)	(.71)
N	324	171
Relative Volume Ratio Less than 1		
Day 0 AR	-.30%	-.71%
(*z*)	(-2.42)	(-2.79)
(-2,+2) CAR	-1.77%	-.93%
(*z*)	(-4.60)	(-1.54)
N	539	338

Note: This table presents the relation between 180-day, post-IPO performance, and relative volume for venture-backed firms (Panel A) and non-venture-backed firms (Panel B). Relative volume is defined as the ratio of the average volume during the event period (-2,+2) divided by the average volume during the 70-day estimation period. Performance is measured as the 180-day return based on the offer price. The standardized residual method and value-weighted index are used to compute and evaluate abnormal returns. Day 0 is the event day abnormal return followed by the corresponding *z*-statistic. (-2,+2) CAR is the cumulative abnormal return around the window (-2,+2) followed by the corresponding *z*-statistic. The data are from the Securities Data Company Global New Securities database from 1988 through 1997.

TABLE 13. Cross-sectional Regressions for Five-Day Cumulative Abnormal Returns.

Panel A. Full Sample Results

Regression	N	Intercept	VC	SDCTECH	PER180	RATIO_V	BIG3	SD	LNSIZE	LOCKTIME	SEO	PERLOCK	Adj. R^2
(1)	2458	-.05	-1.57	-1.23	-.01	.09	-1.04						
		(.879)	(.000)	(.004)	(.000)	(.400)	(.087)						.023
(2)	2458	.01	-1.57	-1.21	-.01	.09	-1.05	-.13					
		(.990)	(.000)	(.006)	(.000)	(.405)	(.087)	(.898)					.022
(3)	2456	-9.47	-1.62	-1.27	-.01	.09	-1.67	.50	.51				
		(.027)	(.000)	(.004)	(.000)	(.387)	(.012)	(.635)	(.026)				.024
(4)	2456	-10.31	-1.58	-1.26	-.01	.09	-1.70	.36	.55	.00			
		(.029)	(.000)	(.005)	(.000)	(.394)	(.011)	(.741)	(.025)	(.665)			.024
(5)	2456	-10.35	-1.58	-1.26	-.01	.09	-1.70	.36	.55	.00	-.06		
		(.029)	(.000)	(.005)	(.000)	(.393)	(.011)	(.740)	(.025)	(.661)	(.931)		.023
(6)	1494	-17.15	-1.24	-1.66	-.01	.00	-1.77	3.41	.96	.00	-.20	-.03	
		(.008)	(.028)	(.004)	(.035)	(.986)	(.050)	(.019)	(.005)	(.570)	(.829)	(.021)	.025

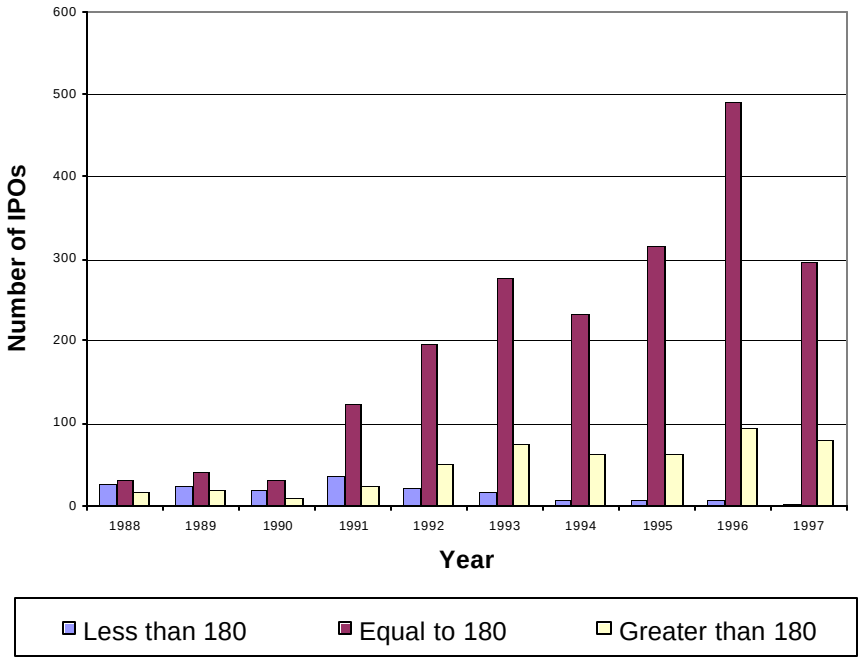
Panel B. Venture Capital Results

Regression	N	Intercept	SDCTECH	PER180	RATIO_V	BIG3	SD	LNSIZE	LOCKTIME	SEO	PERLOCK	Adj. R^2
(1)	1121	-.65	-1.30	-.02	-.33	-1.66						
		(.233)	(.034)	(.000)	(.015)	(.047)						.028
(2)	1121	1.77	-.77	-.02	-.37	-1.93	-5.87					
		(.064)	(.226)	(.000)	(.006)	(.021)	(.002)					.036
(3)	1121	-3.29	-.78	-.02	-.37	-2.20	-5.71	.27				
		(.675)	(.220)	(.000)	(.007)	(.018)	(.003)	(.515)				.035
(4)	1121	-.18	-.82	-.02	-.36	-2.16	-5.37	.16	-.01			
		(.983)	(.195)	(.000)	(.007)	(.021)	(.006)	(.713)	(.232)			.036
(5)	1121	.79	-.82	-.02	-.36	-2.11	-5.42	.11	-.01	.85		
		(.925)	(.196)	(.000)	(.008)	(.024)	(.006)	(.804)	(.207)	(.424)		.035
(6)	754	-6.22	-1.19	-.01	-.35	-1.94	.75	.43	-.01	.59	-.03	
		(.549)	(.133)	(.011)	(.018)	(.093)	(.773)	(.437)	(.369)	(.646)	(.242)	.020

Panel C. Non-Venture Capital Results

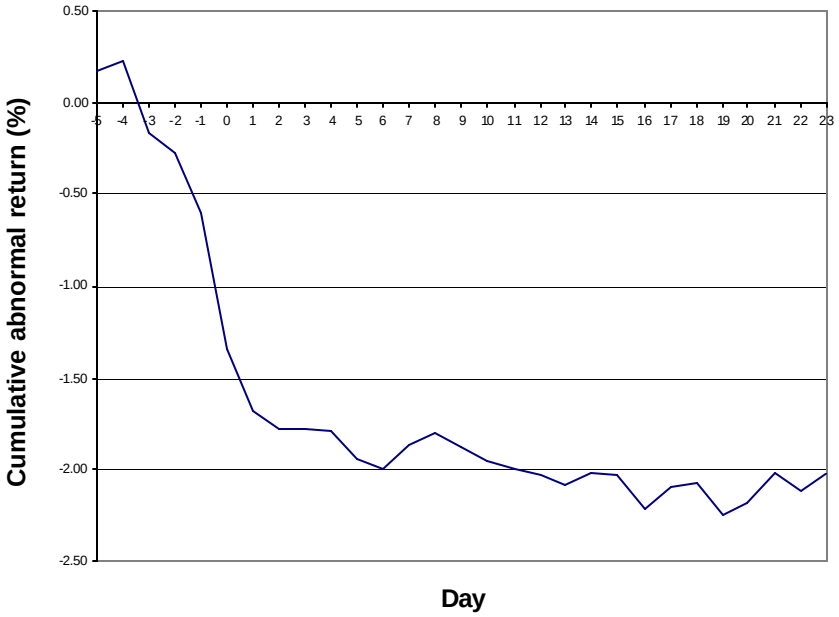
Regression	N	Intercept	SDCTECH	PER180	RATIO_V	BIG3	SD	LNSIZE	LOCKTIME	SEO	PERLOCK	Adj. R^2
(1)	1337	-1.35	-1.14	-.01	1.05	-.17						
		(.000)	(.059)	(.166)	(.000)	(.846)						.023
(2)	1337	-2.43	-1.44	.00	1.06	.12	2.54					
		(.000)	(.020)	(.363)	(.000)	(.896)	(.029)					.026
(3)	1335	-13.74	-1.55	.00	1.06	-.83	3.42	.61				
		(.006)	(.012)	(.314)	(.000)	(.397)	(.005)	(.024)				.029
(4)	1335	-15.27	-1.53	.00	1.05	-.90	3.16	.68	.00			
		(.006)	(.014)	(.308)	(.000)	(.362)	(.015)	(.020)	(.530)			.029
(5)	1335	-15.69	-1.57	.00	1.08	-.85	3.18	.70	.00	-1.44		
		(.005)	(.011)	(.616)	(.000)	(.385)	(.014)	(.016)	(.463)	(.161)		.030
(6)	740	-22.67	-2.21	.00	1.47	-1.02	4.35	1.16	.00	-1.94	-.04	
		(.005)	(.008)	(.914)	(.00)	(.486)	(.013)	(.008)	(.235)	(.152)	(.028)	.050

Note: This table provides the results of ordinary least squares regressions, with *p*-values in parentheses, of (-2,+2) day cumulative abnormal returns against a dummy variable equal to unity if the issue is VC-backed, 0 otherwise (VC), a dummy variable equal to unity if the issue is high-tech, 0 otherwise (SDCTECH), 180-day post IPO performance (PER180), abnormal volume (RATIO_V), a dummy variable equal to unity if the issue was underwritten by a big three underwriter, 0 otherwise (BIG3), the residual standard deviation over the 70-day estimation period (SD), the log of the amount offered (LNSIZE), the number of days a firm is subject to lockup provisions (LOCKTIME), a dummy variable equal to unity if the firm participated in a follow-on offering, 0 otherwise (SEO), and the fraction of shares locked to total shares outstanding (PERLOCK). High-tech firms are generated using a 4-digit SIC code classification scheme provided by Securities Data Company. 180-day performance is calculated as the stock price 180 days after the offer minus the offer price divided by the offer price. Abnormal volume is calculated as the average (-2,+2) window volume divided by the 70-day average volume during the estimation period. Morgan Stanley, Goldman Sachs, and Merrill Lynch represent the big three underwriters. The fraction of shares subject to lockup provisions is calculated as the number of shares locked divided by the number of shares outstanding. Panel A, B, and C provides results for the full sample, venture capital sample, and non-venture sample, respectively. The data are from the Securities Data Company Global New Securities database from 1988 through 1997.



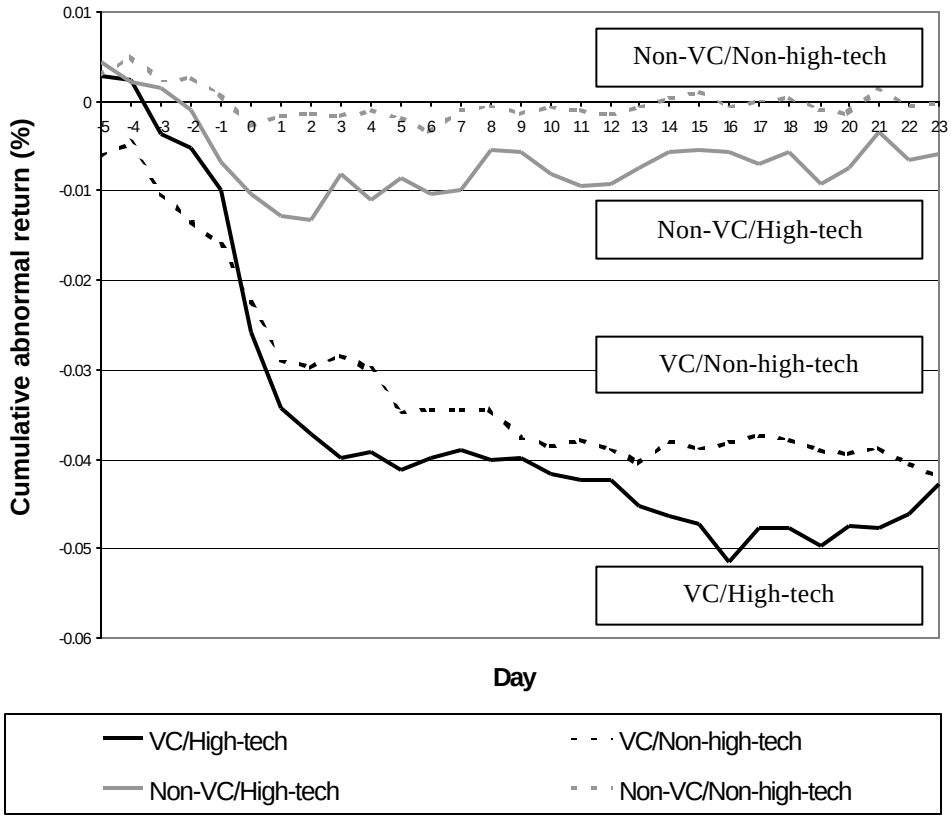
Note: This figure plots the number of IPOs and their lockup lengths in days in each year for our sample. The data are from the Securities Data Company Global New Securities database from 1988 through 1997. This figure plots the number of issues with lockup lengths less than 180 days, equal to 180 days, and greater than 180 days, respectively.

Figure I. Number of IPOs and Lockup Length by Year.



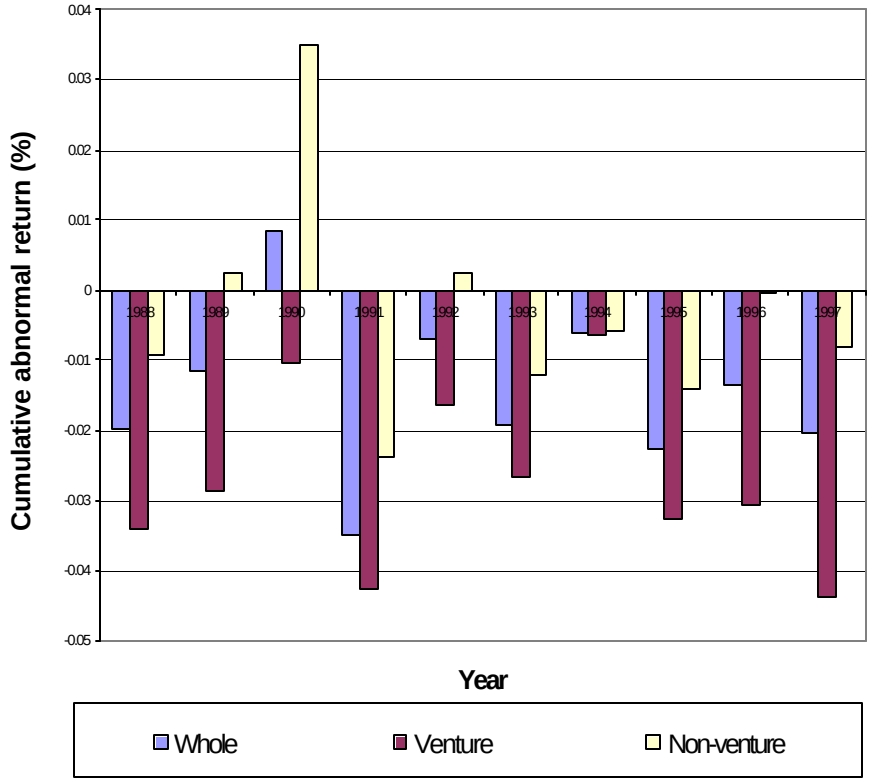
Note: This figure plots the cumulative abnormal return from day –5 to day +23 around lockup expiration for our sample of 2,529 firms. Cumulative abnormal returns are calculated using the value-weighted index. The data are from the Securities Data Company Global New Securities database from 1988 through 1997.

Figure II. Cumulative Abnormal Return.



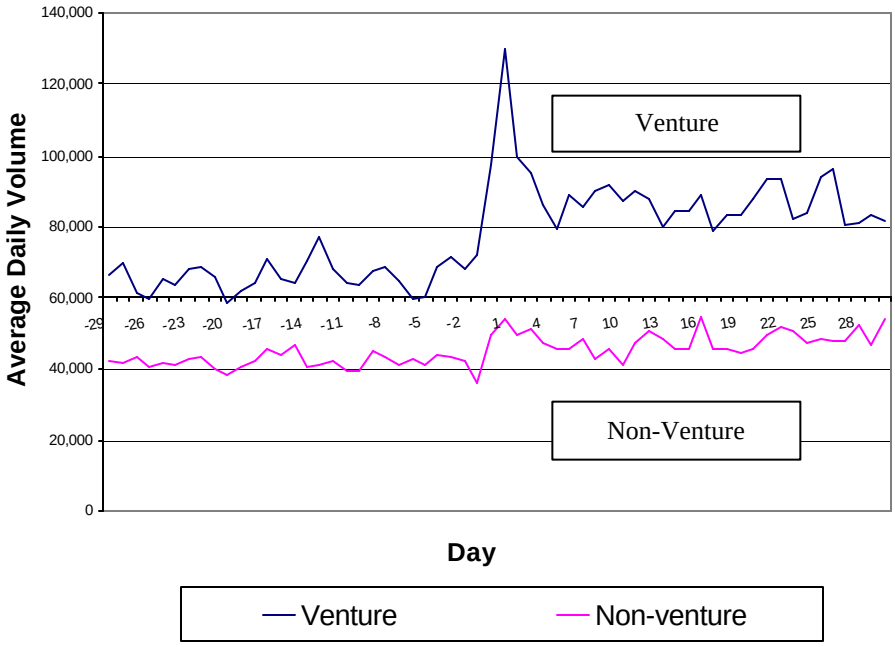
Note: This figure plots the cumulative abnormal return for those firms characterized in Table 8 over days –5 to +23. High-tech firms are generated using a 4-digit SIC code classification scheme provided by Securities Data Company. Cumulative abnormal returns are calculated using the value-weighted index. The data are from the Securities Data Company Global New Securities database from 1988 through 1997.

Figure III. Cumulative Abnormal Return for Venture Capital-Backed, Non-Venture Capital-Backed and High-tech, Non-High-Tech Firms.



Note: This figure plots the abnormal return around the (-2,+2) day window representing lockup expirations for our whole, venture-backed, and non-venture-backed samples, respectively. Cumulative abnormal returns are calculated using the standardized residual method and value-weighted index. The data are from the Securities Data Company Global New Securities database from 1988 through 1997.

Figure IV. Abnormal Returns by Year.



Note: This figure plots the average daily trading volume for venture-backed and non-venture-backed around lockup expiration. The data are from the Securities Data Company Global New Securities database from 1988 through 1997. Day 0 represents lockup expiration.

Figure V. Average Daily Trading Volume for Venture-Backed and Non-Venture-Backed Firms.