

The Expiration of IPO Share Lockups

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ABSTRACT

We examine 1,948 share lockup agreements that prevent insiders from selling their shares in the period immediately after the IPO (typically 180 days). While lockups are in effect, there is little selling by insiders. When lockups expire, we find a permanent 40 percent increase in average trading volume, and a statistically prominent three-day abnormal return of -1.5 percent. The abnormal return and volume are much larger when the firm is financed by venture capital, and we find that venture capitalists sell more aggressively than executives and other shareholders. We find limited support for several hypotheses that may explain the abnormal return, but no complete explanation.

MOST IPOs FEATURE SHARE LOCKUP AGREEMENTS, which prohibit insiders and other pre-IPO shareholders from selling any of their shares for a specified period. The typical lockup lasts for 180 days, and covers most of the shares that are not sold in the IPO. The terms of the lockup, including the expiration or “unlock” date, are disclosed in the IPO prospectus. Lockups serve several purposes. They reassure the market that key employees will continue to exert themselves for at least a few months; they provide a credible signal that insiders are not attempting to cash out in advance of imminent bad news; and they may aid the underwriters’ price support efforts by temporarily constraining the supply of shares. While the lockup is in effect, trading in the IPO firm is distinctly different from trading in established firms. Only a fraction (typically about one-third) of the outstanding shares can trade, and there is little selling by employees, executives, or other pre-IPO shareholders. On the unlock day, insiders are suddenly allowed to sell up to the volume limits of Rule 144,¹ potentially tripling the public float and increasing the information asymmetry between traders.

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¹ Rule 144 applies to shares that are issued outside of a registered offering. Such shares cannot be publicly sold until they have been held for at least one year (or two years prior to February 18, 1997). After this holding period (which may already be satisfied at the IPO) in any quarter an insider can sell no more than the maximum of one percent of the total shares outstanding, or the average weekly trading volume. When sold, the shares are deemed registered. Sales of more than 500 shares or \$10,000 must be disclosed to the SEC on Form 144 no later than the date of sale, but there are exceptions for private sales to qualified investors, sales of stock acquired in incentive plans, and sale of stock held by noninsiders for more than three years. Information on these restrictions can be found at www.RestrictedSecurities.com or at www.Law.UC.edu/CCL/.

The popular press' interest in lockup expirations is fueled primarily by the fear that insiders will flood the market with sell orders. In fact, many IPO prospectuses warn of this possibility. For example, the prospectus for Health-eon Corporation's February 1999 IPO warned that: "The market price for our common stock could fall dramatically if our stockholders sell large amounts of our common stock in the public market following this offering. These sales, or the possibility that these sales may occur, could make it more difficult for us to sell equity or equity-related securities in the future." Indeed, on August 16, 1999, *The Wall Street Journal* noted that "shares of Health-eon fell 18.5% on the day its lockup agreements expired." A week later, on August 25, 1999, *The Wall Street Journal* quoted Bob Gabele, an analyst at First Call/Thomson Financial: "As the expiration date approaches, shareholders get nervous. There's so much fear over these lockups. It's the question du jour now." Upcoming unlock dates are now listed on several Web sites and in a weekly table in *The Wall Street Journal*.²

We examine a sample of 1,948 IPO lockup agreements in the 10-year period from 1988 through 1997.³ Around the scheduled unlock day, we find a permanent 40 percent increase in trading volume and a statistically prominent three-day abnormal return of -1.5 percent. Both of these effects are roughly three times larger in venture-backed firms compared to non-venture-backed firms, and this "venture capital" effect grows stronger over our sample period. We also examine insider share sales in the year after the IPO, and find direct evidence that venture capital investors sell more aggressively than other pre-IPO shareholders.

The abnormal return is not the result of a few extreme observations. Sixty-three percent of the abnormal returns are negative, and the median is more negative than the mean. Both the median and the mean are negative in each of the 10 years of our sample period, and are larger in more recent years. We find limited support for several hypotheses that might explain the abnormal return, but no complete explanation. We find permanent, parallel declines in both the bid and ask price, so the abnormal return is not caused by a change in the proportion of trades at the bid price, temporary price pressure, or increased trading costs. Cross-sectional tests suggest that the abnormal return may be partly, but not completely, caused by downward sloping demand curves or by consistently larger-than-expected insider sales.

The abnormal returns around the unlock day are not large enough to provide short-term profits for traders who must transact at the bid and ask. Nonetheless, this predictable price drop challenges the more extreme versions of the market efficiency hypothesis, as it is difficult to understand how

² Web sites that list upcoming unlock dates include www.UnlockDates.com, www.IPOLockups.com, www.IPOExpress.com, www.IPOPros.com, and www.IPOHome.com.

³ We have recently become aware of other papers on IPO lockup agreements by Brav and Gompers (1999), Bradley et al. (2001), Brau and McQueen (2000), and Ofek and Richardson (2000).

the events of the unlock day could be consistently worse than expected, or why traders would willingly buy shares at the ask price in the week before the scheduled unlock day.

Prior to the scheduled unlock day, the lockup can be released at the discretion of the underwriter. In our sample, about one percent of firms publicly announce early release, and six percent of firms disclose early sales of locked-up shares by at least one insider, usually a venture capitalist. Thus, early release was rare during our sample period. Our results provide only a lower bound on the frequency of early shares sales, as our data do not include sales by low-level employees, share distributions by venture capital partnerships, or effective share sales via hedging techniques such as forwards, puts, collars, or borrowing against shares. In addition, early sales may have become more common in the years after our sample period.

Our results suggest some avenues for future research. For example, we find that insiders seldom disclose share sales before the unlock day, and unlock days typically do not coincide with confounding events like earnings announcements. Thus, unlock days provide relatively clean venues for testing models of asymmetric information, allowing a direct comparison of the same security with and without substantial trading by insiders. During our sample period, investors were almost never reminded of upcoming unlock dates, but this is no longer the case, providing an opportunity for comparison of similar events with and without public scrutiny.

The first section describes our data and methods. Section II describes the main results and robustness checks. Section III tests hypotheses that may explain the result. Section IV examines ownership changes after the IPO. Section V examines the frequency of early insider sales. Section VI concludes.

I. Data and Methods

A. The Sample

We use information from Securities Data Corporation (SDC) to identify our sample of initial public offerings. We also use SDC for most data on the offering details, as well as to identify lockup expiration dates. When SDC lists no lockup date, we hand-collect lockup dates from offering prospectuses. Stock return data are from the 1997 Center for Research on Securities Prices (CRSP) tapes. The initial sample consists of the 3,233 IPOs in the SDC database that have complete CRSP data for our 101-day event window, and an unlock day in the period from April 27, 1988 (the first unlock date reported by SDC) to October 20, 1997 (the last date for which we are able to measure returns for 50 trading days after the event). We exclude 263 mutual-to-stock conversions and non-common stock offers (unit offers, REITs, and ADRs); 300 “penny stocks” with a price below five dollars; 403 carveouts; 355 firms with earnings announcements within three days of the expiration day (earnings announcements dates were obtained from First Call); and 331 firms that made seasoned offers before the unlock day or within two weeks

after the unlock day (SEOs often result in early release of the lockup).⁴ After allowing for overlap between our exclusion criteria, our final sample consists of 1,948 firms. We checked for selection bias by replicating our tests on the whole sample of 3,233 firms, and we found little change in the main results.

We checked the accuracy of the SDC data by comparing them to the actual data from 625 IPO prospectuses for the 1988 to 1992 period (this is the sample period used in Field and Karpoff (2000)). We examine 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 (which is stated plainly on the first page of the prospectus), we find an error rate of 0.5 percent. For the length of the lockup period (which is also stated plainly in the prospectus, but not on the first page), we find an error rate of three percent, plus some inconsistency in choosing whether to report the first or last release date for the 11 percent of firms that have staged (multidate) lockup releases. For the number of shares locked up (which requires a bit more effort to extract from the prospectus), we find that the SDC variable is wrong 26 percent of the time, usually because of incorrect interpretation of the numbers presented in the prospectus. For another 19 percent of firms, the number of shares locked up is not available from SDC even though it is given in the prospectus. Thus, for this variable, SDC data are wrong or missing in 45 percent of cases. In spot checks, we find similar errors in the later years of our sample period. When the SDC data on the number of shares locked up are wrong, they are off by an average of 38 percent. In our tests, we express the number of shares locked up as a fraction of postoffer shares. We find that the fraction implied by SDC data has approximately the correct mean, but the correlation coefficient with the correct fraction is only 0.5. By contrast, we find a 0.7 correlation between the (correct) fraction of shares locked up and the fraction of shares not sold in the IPO. Therefore, in our cross-sectional regressions we use the fraction of the shares not sold in the IPO as a proxy for the fraction locked up, though our results are not dramatically different when we use the noisier measure.

For our direct tests of insider sales around the unlock day, we obtain insider trading data for the last 13 months of our sample period from Individual Investor (for more information on these data, see www.InsiderTrader.com). By SEC Rule 16(a), all trades by officers, directors, and ten percent blockholders must be disclosed on Form 4 no later than the tenth day of the month after the transaction. Form 4 disclosures may be filed electronically (via Edgar) or via paper; our dataset includes both types of filings. Five

⁴ For example, on October 29, 1999, Goldman Sachs announced a seasoned equity offer for recent IPO eToys to finance eToys' projected high marketing expenditures. Goldman simultaneously announced that it was releasing nonemployee shareholders (but not employees) from the lockup agreement. eToys' stock price fell 16 percent on the announcement, and fell another 10 percent on November 2 when the shares were actually unlocked. Seasoned offers that include secondary offers may tend to be organized when a large number of insiders wish to sell.

percent blockholders are required to disclose changes in their ownership in amended Forms 13d or 13g. We examine all 13d and 13g filings and amendments by hand, and infer a share sale whenever a filing reports a sale, or when it reports total shareholdings less than those reported in an earlier filing by what appears to be the same owner. Our tests will not detect share sales that are not reported to the SEC, most notably sales by low-level employees and share distributions by venture capital partnerships.

Although upcoming lockup expirations are now widely reported, this was not the case during our sample period. We scanned the *Dow Jones News Service* and found mentions of less than one percent of the unlock events in our sample, almost always after the fact.

B. Summary Statistics

Table I reports the sample size, fraction of venture-financed firms, mean fraction of shares offered, mean fraction of shares subject to lockup, and the distribution of the length of the lockup period for each year in our 1988 to 1997 sample period. The fraction of firms backed by venture capital is about 48 percent, with little variation over the sample period. In all years, the mean offer size is about a third of the total shares outstanding after the IPO, assuming no exercise of the overallotment option. Figure 1 plots the distribution of the fraction of shares offered, and shows that most of the offers in our sample were for between 20 and 40 percent of the shares outstanding after the IPO.

As shown in Table I, the fraction of shares locked up plus the fraction of shares offered sums to about 95 percent of the postoffer shares. Thus, not all of the pre-IPO shareholders are subject to lockup agreements. Officers and directors are almost always locked up, as are shareholders who sell part of their holdings at the IPO. In most firms, five percent blockholders are also locked up. Thus, in cases where the lockup does not apply to all shares, the exempted parties are usually atomistic shareholders, which may include low-level employees as well as recipients of “friends and family” shares. Over the 1988 to 1992 period for which we have data hand-collected from prospectuses, we find that 91 percent of the shares retained by pre-IPO shareholders are locked up, and another four percent are effectively locked up by the holding period restriction of Rule 144. Thus, on average 95 percent of the shares retained by pre-IPO shareholders cannot be sold before the unlock date.

Table I reveals a marked trend toward a standardized lockup period of 180 days. In 1988, only 43 percent of lockup periods were exactly 180 days. By 1996, more than ninety percent of lockup periods were 180 days. This trend toward a standardized lockup period is reminiscent of Chen and Ritter’s (2000) finding that the underwriter’s spread became largely standardized at seven percent over the same period. Our evidence suggests that Chen and Ritter’s result reflects a general standardization of IPO terms in the early 1990s. Lockup periods other than 180 days are usually 90, 270, or 365 days.

Table I
Sample Size and Distribution of Lockup Period, by Year of IPO

Sample is 1,948 U.S. IPOs with lockup agreements in the period 1988 to 1997. "Fraction of shares locked up" is taken from the IPO prospectus for years 1988 to 1992, and from SDC data in subsequent years. Lockup period statistics for 1997 are excluded because of the selection bias from excluding firms with unlock dates after October 20.

Issue Year	Sample Size	Fraction of Firms Financed by Venture Capital	Mean Fraction of Post-IPO Shares Sold in Offer	Mean Fraction of Post-IPO Shares Locked Up	Mean Lockup Period (Days)	Composition of Sample by Length of Lockup Period		
						<180	180	>180
1988	56	45%	28%	63%	172	45%	43%	13%
1989	69	52%	29%	64%	168	39%	54%	7%
1990	60	55%	34%	61%	165	43%	52%	5%
1991	187	58%	35%	62%	183	22%	68%	10%
1992	253	52%	34%	61%	196	9%	77%	13%
1993	285	51%	34%	63%	188	8%	84%	9%
1994	248	42%	34%	63%	196	6%	80%	14%
1995	282	49%	33%	64%	191	4%	88%	9%
1996	432	46%	31%	64%	184	4%	91%	5%
1997	76	34%	31%	64%				
Total	1,948	48%	33%	63%	187	11%	80%	9%

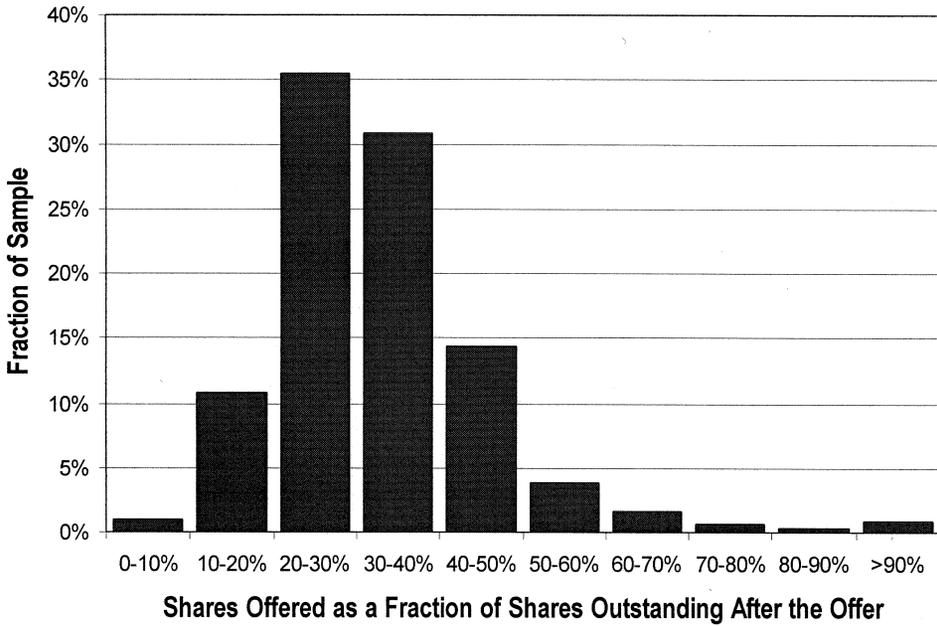


Figure 1. Distribution of offer sizes. Sample is 1,948 U.S. IPOs with lockup agreements in the period 1988 to 1997, excluding mutual-to-stock conversions, unit offers, IPOs with an offer price below \$5, equity carveouts, firms with follow-on offerings, and firms with concurrent earnings announcements around lockup expiration. Plotted values include both domestic and international tranches, and assume no exercise of the over-allotment option. If the over-allotment option is exercised (as it generally is when the share price goes up after the offer) then the number of shares offered will usually increase by 15 percent.

C. Calculation of Abnormal Returns

We measure the abnormal return as the raw return deflated by the return on the CRSP value weighted index (all returns are measured inclusive of dividends). We calculate the three-day abnormal return for each firm as follows:

$$CAR_i = \left[\prod_{t=-1}^{+1} \left(\frac{1 + R_{i,t}}{1 + R_{m,t}} \right) - 1 \right] \tag{1}$$

where $R_{i,t}$ is the simple return on firm i on day t relative to the unlock day, and $R_{m,t}$ is the simple return on the CRSP value weighted market index. We also examined raw returns, market model residuals, returns normalized by the equal weighted index, and returns over a seven day (-5 to +1) event window. Our results are insensitive to these choices.

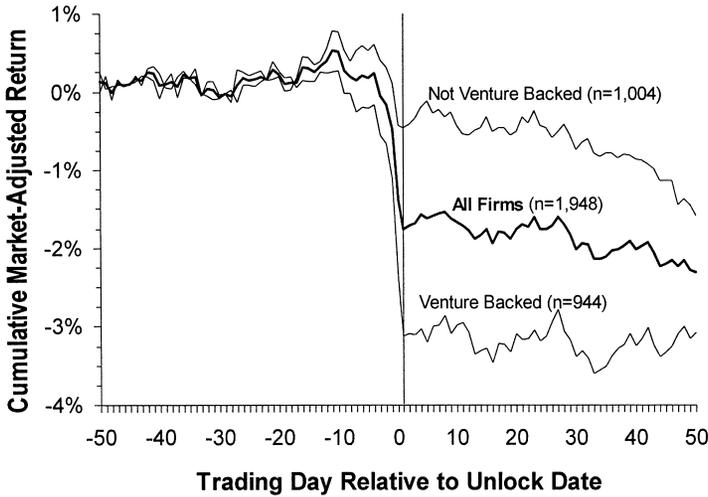


Figure 2. Market-adjusted returns around the unlock day. Market-adjusted return is measured relative to the CRSP value-weighted index. Sample is 1,948 U.S. IPOs with lockup agreements in the period 1988 to 1997.

D. Calculation of Abnormal Volume

Abnormal daily trading volume is measured relative to each firm's pre-unlock mean daily trading volume, as

$$\text{Abnormal Volume } \varpi_{i,T} = \frac{V_{i,T}}{\frac{1}{-6} \sum_{t=-50}^{-6} V_{i,t}} - 1 \quad (2)$$

where $V_{i,T}$ is the trading volume (from CRSP) for firm i on day T . Most tests examine the three-day average abnormal volume, computed as the average of equation (2) over days -1 to $+1$. Some tests also examine total three-day volume, which is expressed as a fraction of the publicly tradable float (shares issued but not locked up) but is not adjusted for the firm's average trading volume.

II. Results

A. Abnormal Returns Around the Unlock Day

Figure 2 presents a time series plot of the average cumulative market-adjusted return, and shows that share price declines sharply around the unlock day, especially among venture financed firms.

Figure 2 shows that the abnormal return seems to represent a permanent loss. For the period from 5 days before the unlock day through 50 days after, the CAR is significantly negative at -2.7 percent ($t = -4.5$). Market-

Table II
Abnormal Returns Around the Unlock Day

Sample is 1,948 U.S. IPOs with lockup agreements in the period 1988 to 1997. The CAR for firm *i* is defined as:

$$CAR_i = \left[\prod_{t=-1}^{+1} \left(\frac{1 + R_{i,t}}{1 + R_{m,t}} \right) - 1 \right] \tag{1}$$

where $R_{i,t}$ is the return on day *t* for firm *i*, and $R_{m,t}$ is the CRSP value-weighted index return on day *t* (day 0 is the unlock day). *T*-statistics are in parentheses. The seven-day and three-day cumulative abnormal returns surrounding the unlock day are shown in bold.

Period	CAR %	
	Mean	Median
Day -50 to -6	0.2 (0.4)	-1.5**
Day -5	-0.0 (-0.5)	-0.1
Day -4	0.1 (0.8)	-0.1
Day -3	-0.3** (-3.2)	-0.2**
Day -2	-0.0 (-0.5)	-0.1
Day -1	-0.3** (-2.8)	-0.3**
Day 0	-0.9** (-8.7)	-0.5**
Day +1	-0.3** (-3.2)	-0.3**
Day -5 to +1	-1.9** (-8.7)	-2.2**
Day -1 to +1	-1.5** (-9.8)	-1.5**
Day +2 to +10	0.2 (0.7)	-0.5
Day +11 to +50	-1.0 (-1.9)	-2.0**
Fraction with negative CAR for days -1 to +1	63%	
Sample size	1,948	

** Significantly different from zero at the 1 percent level (two-tailed *t* test for means, signed rank test for medians). All tests assume independence of the observations, and thus are likely to overstate significance, particularly for longer term returns.

adjusted returns over various event windows are tabulated in Table II. Sixty-three percent of market-adjusted returns are negative. The three-day mean and median abnormal returns are both -1.5 percent, whereas the seven-day

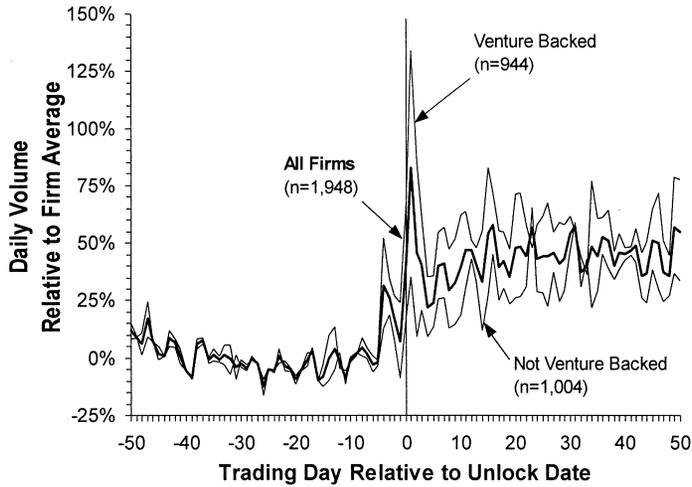


Figure 3. Abnormal trading volume around the unlock day. Volume is measured relative to each firm's mean volume over days -50 to -6 . Sample is 1,948 U.S. IPOs with lockup agreements over the period 1988 to 1997.

abnormal return is -1.9 percent (median = -2.2 percent). More than half of the three-day abnormal return occurs on the unlock day. Cumulative market model residuals give similar results, as do raw returns and returns net of the equal-weighted index. Finally, the results are qualitatively unchanged if we expand the sample to include all 3,233 firms with CRSP data, so the results are not driven by sample selection bias. Regardless of the benchmark, event window, and sample, the mean abnormal return is more than seven standard errors below zero, significant at $p < 0.001$, and a signed rank test rejects a positive median at $p < 0.001$.

B. Abnormal Trading Volume Around the Unlock Day

Figure 3 plots the sample mean of the daily abnormal volume, as defined in equation (2). Figure 3 shows that, for the whole sample, volume increases temporarily to 80 percent above average on the day after the unlock day. Volume then drops quickly to about 40 percent above the pre-unlock level, and remains at approximately that level throughout our 50-day (2.5 calendar month) postevent window. Thus, unlocking the insiders' shares seems to result in a permanent 40 percent increase in trading volume.

C. Cross-sectional Determinants of the Abnormal Volume and Return

Table III presents the mean abnormal return and trading volume for various subsamples, and Table IV presents pooled OLS models of the abnormal return and volume, as functions of several likely controls. Results are shown separately for venture- and non-venture-financed firms.

Table III

Abnormal Percentage Returns Around the Unlock Day for Various Subsamples

“Price has Risen” and “Price has Fallen” are based on the cumulative split-adjusted return from the offer price to day -6 . CAR is the three-day cumulative abnormal return, relative to the CRSP value-weighted index, in percent. Sample is 1,948 U.S. IPOs with lockup agreements in the period 1988 to 1997. T -statistics are in parentheses.

	All	Venture Capital Backed	Not Venture Capital Backed	Price has Risen	Price has Fallen	Nasdaq	NYSE	Tech	Non-tech	Lockup <180 Days	Lockup >180 Days
CAR day -1 to $+1$	-1.5^{**} (-8.7)	-2.3^{**} (-9.2)	-0.8^{**} (-4.2)	-1.7^{**} (-9.0)	-1.2^{**} (-4.2)	-1.7^{**} (-9.4)	-0.8^{**} (-2.8)	-2.4^{**} (-7.7)	-1.2^{**} (-6.6)	-1.3^{**} (-3.1)	-0.8 (-1.6)
Fraction with negative CAR	63%	65%	60%	63%	61%	63%	59%	66%	61%	66%	60%
Percent deviation from mean trading volume days	44** (9.0)	75** (9.0)	15** (2.8)	46** (8.0)	40** (4.4)	48** (8.7)	25* (2.4)	69** (7.1)	34** (6.1)	37* (2.5)	8 (0.9)
Sample size	1,948	944	1,004	1,307	641	1,604	297	560	1,388	214	173

*, ** Significantly different from zero at the 5 percent and 1 percent levels, respectively (two-tailed t -test).

Table IV

Pooled OLS Models of Abnormal Returns and Volume Around the Unlock Day

Sample is 1,948 lockup expiration days in the period 1988 to 1997. Abnormal returns and volume are measured over days -1 to $+1$. Abnormal return is measured relative to the CRSP value-weighted index. Abnormal volume is relative to each firm's average three-day trading volume in days -50 to -6 . Fraction of post-IPO shares locked up is proxied by the fraction of post-IPO shares retained by the pre-IPO shareholders. Underwriter market share is the fraction of same-year IPOs (by dollar value) underwritten by the same investment bank. Dependent variables are Winsorized at the 1 percent and 99 percent tails. T -statistics are in parentheses.

Dependent Variable	Three-day Abnormal Return (Percent)			Log of (1 + Three-day Abnormal Volume)		
	All	Venture Capital	Non-venture Capital	All	Venture Capital	Non-venture Capital
Intercept	-3.1 (-0.9)	4.9 (0.8)	-6.1 (-1.6)	-1.9** (-3.1)	-0.2 (-0.2)	-2.5** (-3.3)
Dummy variable for tech firm	-0.5 (-1.5)	0.5 (1.0)	-1.8** (-3.6)	0.12* (2.0)	0.14 (1.8)	0.09 (0.9)
Dummy variable for venture backing	-1.2** (-4.0)			0.30** (5.5)		
Dummy variable for NYSE listing	0.4 (0.8)	0.9 (1.1)	-0.2 (-0.4)	0.17 (0.2)	-0.09 (-0.6)	0.10 (1.0)
Size = Log (Issue Price \times Shares Outstanding)	0.3 (1.2)	-0.2 (-0.5)	0.4 (1.7)	0.06 (1.7)	-0.02 (-0.3)	0.10* (2.3)
Underwriter market share	-4.5 (-1.6)	-2.1 (-0.5)	-4.0 (-1.0)	0.40 (0.8)	1.4* (2.0)	-0.8 (-1.1)
Run-up = Log(1 + cumulative return from IPO to Day -6)	-0.7 (-1.4)	-1.0 (-1.3)	-0.2 (-0.3)	0.30** (3.3)	0.35** (2.9)	0.22 (1.6)
Dummy variable for 1992-1994 (relative to 1988-1991)	-0.3 (-0.7)	0.4 (0.5)	-1.0 (-1.6)	-0.046 (-0.6)	0.013 (0.1)	-0.10 (-0.9)
Dummy variable for 1995-1997 (relative to 1988-1991)	-0.8 (-1.8)	-0.6 (-0.9)	-1.0 (-1.6)	0.064 (0.8)	0.171 (1.5)	-0.035 (-0.3)
Fraction of post-IPO shares locked up	-2.5* (-2.2)	-5.6** (-2.7)	-1.0 (-0.8)	0.36 (1.8)	0.34 (1.0)	0.32 (1.3)
Log(1 + three-day abnormal volume)	-0.3* (-2.1)	-0.65** (-3.3)	0.1 (0.8)			
Three-day abnormal return (percent)				-0.4 (-1.4)	-1.0** (-2.8)	0.5 (1.1)
Adjusted R^2	0.023	0.029	0.011	0.041	0.031	0.015

*, ** Significantly different from zero at the 5 percent and 1 percent levels, respectively (two-tailed t test).

C.1. Venture Financing

Among the venture-financed firms, the three-day abnormal return is almost three times larger than non-venture-financed firms, -2.3 percent versus -0.8 percent, and the three-day abnormal volume is five times higher, 75 percent above normal rather than 15 percent. The multivariate models in Table IV indicate that these results are not due to correlations between venture capital financing and the control variables. These results suggest that venture capitalists sell more aggressively than do other pre-IPO investors, or (perhaps more likely) venture capital partnerships distribute shares to limited partners who sell the shares quickly. Gompers and Lerner (1998) examine venture capital share distributions to four institutional investors. They do not report the incidence of distributions on the unlock day, but they report that about half of the time the first distribution occurs within a year of the IPO. Suggestively, they also find price drops of about two percent around venture capital distributions.

C.2. Other Cross-sectional Variables

The univariate tests in Table III imply that most of the control variables are associated with significant differences in the abnormal returns around the unlock day. However, the multivariate tests in Table IV indicate that most of these univariate differences vanish when controlling for the effects of other variables, most notably venture capital financing.

Tables III and IV show that the price run-up since the IPO is a significant predictor of abnormal trading volume, consistent with Shefrin and Statman (1985), Ferris, Haugen, and Makhija (1988), and Odean (1998), who show that investors are more eager to sell when the price has risen than when it has fallen. However, this effect is confined to venture-financed firms, and the price run-up does not predict the abnormal return in the multivariate tests. The abnormal return is larger among "Tech" firms (defined as those with primary three digit SIC codes of 357, 367, 369, 382, 384, and 737⁵), but Table IV shows that this effect is confined to firms that are *not* venture financed. Nasdaq firms experience larger abnormal volume and returns, perhaps because Nasdaq trade reporting tends to relax the Rule 144 volume restrictions by double counting trades,⁶ but these effects are not significant

⁵ SDC provides additional information on the high-tech orientation of some IPO firms, but spot checks indicate that this information is not reliable. For example, NVidia Corp, a producer of mainstream PC graphics chips, is classified as "Superconductors," and EcoScience Corp, a producer of greenhouse tomatoes and agricultural chemicals, is classified as "Vaccines/Specialty Drugs."

⁶ Nasdaq trade volume tends to be inflated because matching buy and sell orders go through the market maker instead of being crossed directly. The resulting double counting will tend to relax the Rule 144 limits on insider trading volume. On the unlock day, Rule 144 permits a single insider to sell a number of shares equal to the greater of one percent of the total shares outstanding or the average weekly trading volume. By inflating weekly trading volume, Nasdaq double counting will tend to increase the maximum allowable sale.

in the multivariate tests. Firms with high-quality underwriters experience somewhat larger (more negative) abnormal returns, and this effect is marginally significant in the multivariate tests ($t = -1.6$), but in unreported tests, we find that the apparent effect of underwriter quality is highly sensitive to the choice of the event window. (Underwriter quality is measured by the underwriter's percentage market share, by dollar value, of IPOs in the relevant year.)

D. Robustness Checks

D.1. Is This a Day 180 Effect?

We are not aware of any confounding events on day 180 after the IPO. For example, day 180 was not a capital gains tax threshold during our sample period. However, there may be events on day 180 of which we are not aware, so to ensure that we are observing a "Lockup" effect, rather than a "Day 180" effect, we look separately at lockups with periods more or less than 180 days. Table III shows that, for the 214 lockups with periods less than 180 days, the three-day abnormal return is a significant -1.3 percent ($t = -3.1$). For the 173 lockups with periods longer than 180 days, the three-day abnormal return is a marginally significant -0.8 percent ($t = -1.6$). As a further check, we examine the abnormal returns for the 1,310 IPOs that are issued during our sample period but do not have share lockups. These are mostly financial firms, especially closed-end funds and bank and S&L conversions in which there are no preissue shareholders. Among these firms, the abnormal return over the period from 175 to 181 days after the IPO is an insignificant -0.4 percent (which is significantly different from the abnormal return around unlock that we observe for firms with lockup agreements). Thus our results seem to be driven by lockup expiration, rather than by some other event that happens 180 days after the IPO.

D.2. Cross-Sectional Correlation of Errors

Even a rigorously efficient market will not always predict future events perfectly, and the market's prediction errors are likely to be cross-sectionally correlated, inflating the t -statistics in a pooled sample. We test the persistence of our main results by partitioning our sample period into 10 individual years, based on the year in which the lockup expires. Table V shows abnormal returns for each year of our sample period, separated by presence or absence of venture financing. In the whole sample, in all 10 years, both the mean and the median abnormal returns are negative. The mean is significantly less than zero (at the 95 percent confidence level) in all but the first three years. The mean ranges from -0.6 percent (in 1990) to -2.4 percent (in 1997), and the fraction of abnormal returns that are negative ranges from a low of 55 percent (in 1990) to a high of 73 percent (in 1989). Venture-backed firms have larger (more negative) abnormal returns in each year

Table V
Results by Year of Unlock

Sample is 1,948 U.S. IPOs with lockup agreements in the period 1988 to 1997. Firms are grouped by the year in which the lockup agreement expired. CAR is the sample mean of the three-day cumulative abnormal return over days -1 to $+1$, relative to the CRSP value-weighted index.

Unlock Year	All Firms				Venture-backed				Non-venture-backed				CAR % Difference: Venture vs. Non-venture
	<i>N</i>	CAR %	<i>t</i>	% Neg	<i>N</i>	CAR %	<i>t</i>	% Neg	<i>N</i>	CAR %	<i>t</i>	% Neg	
1988	30	-1.3	-1.8	63	13	-1.2	-1.0	54	17	-1.4	-1.5	71	0.2
1989	49	-1.2	-1.3	73	24	-2.0	-1.4	79	25	-0.4	-0.4	68	-1.5
1990	94	-0.6	-1.1	55	51	-0.9	-1.1	59	43	-0.3	-0.4	51	-0.6
1991	90	-1.7*	-2.0	64	62	-3.3**	-3.4	71	28	1.9	1.4	50	-5.2**
1992	256	-1.7**	-5.4	65	143	-1.9**	-4.2	66	113	-1.5**	-3.3	65	-0.4
1993	219	-1.1*	-2.2	58	101	-1.8*	-2.5	59	118	-0.4	-0.7	56	-1.4
1994	312	-1.0**	-2.7	59	147	-1.4*	-2.1	59	165	-0.7	-1.7	59	-0.6
1995	197	-1.4**	-2.7	59	82	-2.7**	-2.7	57	115	-0.4	-0.9	60	-2.3**
1996	418	-1.7**	-4.5	63	213	-2.8**	-4.6	68	205	-0.7	-1.5	58	-2.1**
1997	283	-2.4**	-5.8	67	108	-4.0**	-4.8	73	175	-1.4**	-3.4	63	-2.5**

*, ** Significantly different from zero at the 5 percent and 1 percent levels, respectively (two-tailed *t* test), assuming independence of observations.

except 1988. The abnormal return tends to be larger and more significant in the later years of the sample, as does the difference between venture- and non-venture-financed firms. Thus the abnormal returns around the unlock day, as well as their relation to venture financing, do not seem to represent isolated events.

III. Hypotheses

In this section we evaluate several hypotheses that may explain why we observe negative abnormal returns around lockup expirations. The following subsections consider, in turn, whether the abnormal return is an illusion caused by an increase in the proportion of trades executed at the bid price; whether the abnormal return is just a temporary dip caused by price pressure; whether the abnormal return represents a loss in value due to increased trading costs; whether the abnormal return is caused by downward sloping demand curves; and whether the abnormal return is caused by insider sales that consistently exceed investors' (biased) expectations. The first hypothesis (an increase in the proportion of trades at the bid) is consistent with market efficiency. The second hypothesis (temporary price pressure) may be consistent with some forms of market efficiency, for example, the liquidity equilibrium modeled in Grossman and Miller (1988). The remaining three hypotheses are not consistent with market efficiency, as they imply that the market consistently fails to anticipate the predictable events on the unlock day.

A. An Increase in the Proportion of Trades at the Bid

If transaction prices normally represent a mix of trades at the bid and the ask, but transactions around the unlock day tend to be insider sell orders that are executed at the bid, then transaction prices around the unlock day will imply a spurious, temporary negative return even if there is no change in bid or ask prices. Prior research has found that this bid-ask effect may contribute to abnormal returns around the execution days of seasoned equity offers (Lease, Masulis, and Page (1991)), around the execution days of stock splits (Maloney and Mulherin (1992)), and in the "when issued" trading of spinoffs (Ezzell, Miles, and Mulherin (1999)).

To test for a bid-ask effect in our sample, Figure 4 plots changes in the daily closing bid and ask price (from CRSP), adjusted for the contemporaneous changes in the CRSP value-weighted index, normalized by the bid price on day -50. In this plot, the sample is restricted to Nasdaq firms, for which CRSP reports closing bid and ask. Figure 4 shows that the abnormal return around the unlock day is driven by permanent, parallel drops in both the bid and ask price. Consequently, the abnormal return is not driven by a change in the proportion of trades at the bid.

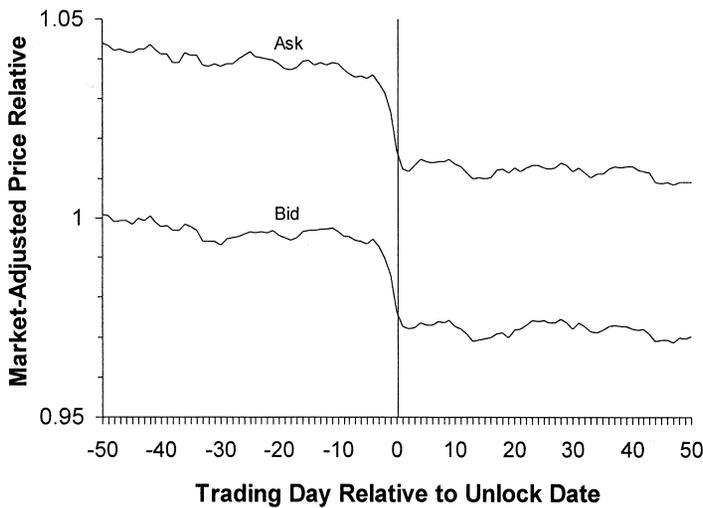


Figure 4. Market-adjusted changes in bid and ask prices around the unlock day. Prices are normalized by bid price at day -50, and are adjusted for changes in the CRSP value-weighted index. Sample is 1,510 Nasdaq IPOs over the period 1988 to 1997.

B. Price Pressure

On the unlock day, a large flow of insider sell orders may temporarily depress the share price due to “price pressure.” More precisely, a temporary price drop may be necessary in equilibrium in order to attract liquidity providers. The previous literature has found mixed evidence for price pressure. Mikkelson and Partch (1988), Barclay and Litzenberger (1988), and Kadlec, Loderer, and Sheehan (1997) examine price changes around the execution days of seasoned equity offers, finding price drops that are largely, if not entirely, reversed within a few days. Hess and Frost (1982), however, find no price drop, temporary or otherwise, around 152 seasoned offers by utility firms in the period 1975 to 1977. Harris and Gurel (1986) and Lynch and Mendenhall (1997) find temporary price changes around the announcement of S&P 500 index changes.

A defining attribute of price pressure is that its effect is temporary. (When the effect is permanent, it is interpreted as a downward sloping demand curve, which is examined below.) However, Figures 2 and 4 and Table II show that the abnormal return around the unlock day seems to be permanent, with little or no rebound in subsequent days or weeks. Thus, we reject the price pressure hypothesis.

The predictable, permanent share price drop at the unlock date violates semistrong form market efficiency, but does not represent an obvious short-term profit opportunity. Figure 4 shows that the bid and ask prices do not fall far enough to reward the strategy of selling short at the bid price before

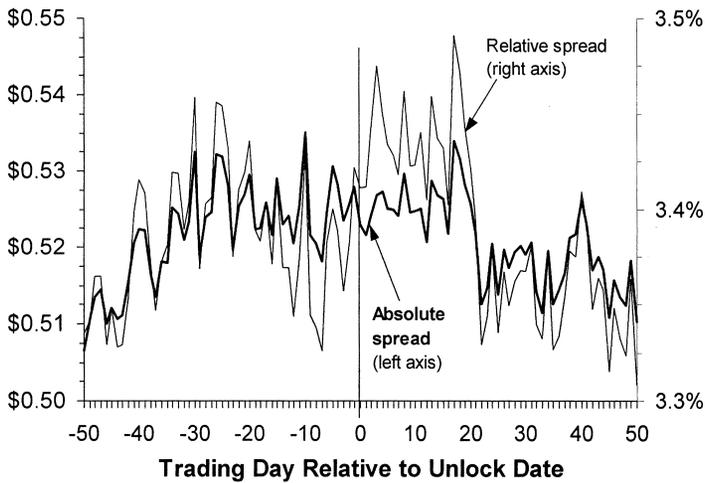


Figure 5. Average quoted bid-ask spreads around the unlock day. Sample is 1,510 Nasdaq IPOs with lockup agreements over the period 1988 to 1997.

the unlock day and then covering at the ask price after the unlock day. This conclusion also holds in the subsample of firms that are venture financed. (Results not shown.)

C. Trading Costs

Although we cannot explain why the market consistently fails to anticipate the events of the unlock day, we can at least shed some light on what, exactly, the market fails to anticipate. Here we evaluate the hypothesis that the price drop is caused by an increase in trading costs that reduces the attractiveness of the shares. Our argument is similar to that of Barclay and Smith (1988), who find that share repurchases tend to widen the bid-ask spread, presumably due to the adverse selection cost from trading against the firm. However, Miller and McConnell (1995) find no such effect in a different time period. Vijh (1994) also argues that trading costs may explain abnormal returns around the execution of equity spinoffs.

In our setting, an increase in trading costs should take the form of wider spreads, imposed by a market maker who must now trade against informed insiders. However, Figure 4 suggests that any widening of the spread is small. This impression is confirmed by Figure 5, which plots the cross-sectional mean of the quoted spread over our event window. The figure shows a strong day-of-the-week effect in the spread (because of the weekend, unlock days tend to fall on Monday). The figure also shows intriguing longer-term spread changes occurring well before and well after the unlock day. However, immediately around the unlock day, the absolute spread changes little, if at all, whereas the relative spread widens slightly (from about 3.35 per-

cent to about 3.45 percent) because of the drop in the share price. Thus, we find little evidence of a meaningful increase in trading costs. A weakness of this test is that it measures only quoted spreads, and, hence, would not detect an increase in the *effective* spread due to a reduced frequency of price improvement.

D. Downward-Sloping Demand Curves

When insiders sell their shares, the public is asked to hold a greater number of shares. The demand curve hypothesis predicts that the public's demand curve slopes downward, so the share price will fall, permanently. Practitioners sometimes refer to this effect as a "scarcity premium" for IPOs with a small public float. The difference between the demand curve hypothesis and the price pressure hypothesis is the difference between a permanent stock effect and a temporary flow effect. A demand curve effect is caused by a permanent increase in the stock of shares that must be owned by the public, whereas a price pressure effect is caused by a temporary flow of sell orders.

Early tests for downward-sloping demand curves found mixed results, and were inconclusive because they examined events that were confounded by the simultaneous release of information. Examples include Scholes (1972) and Mikkelsen and Partch (1986). Cleaner evidence for downward-sloping demand curves has been found by Bagwell (1992) in Dutch auction share repurchases, by Shleifer (1986) and Lynch and Mendenhall (1997) around S&P 500 Index changes, and by Kaul, Mehrotra, and Morck (2000) in changes in the weightings of a Canadian stock index. Kandel, Sarig, and Wohl (1999), however, find largely flat demand curves in the share orders for Israeli IPOs.

The demand curve hypothesis predicts that the magnitude of the abnormal return depends on the magnitude of the increase in the supply of shares. Consistent with this prediction, Table IV shows that the abnormal return around the unlock day is significantly more negative when a larger fraction of the outstanding shares are locked up, at least among venture-financed firms.

A more conclusive test can be obtained by exploiting the observation that total trading volume represents an upper bound on the volume of insider sell orders, and, hence, on the increase in the supply of shares. If the abnormal return is caused by the increase in the supply of shares, then we should observe an abnormal return only in the cases where the trading volume around the unlock day is a meaningful fraction of the float. Figure 6 shows a scatterplot of the relation between abnormal return and total three-day trading volume, measured as a fraction of the shares that could trade before the unlock day. On the far left side of the figure, where the total three-day trading volume is less than one percent of the pre-unlock float, there appears to be a clear preponderance of negative abnormal returns. This visual impression is accurate: among the 407 firms where the total three-day trading volume is less than one percent of the public float, 60 percent have

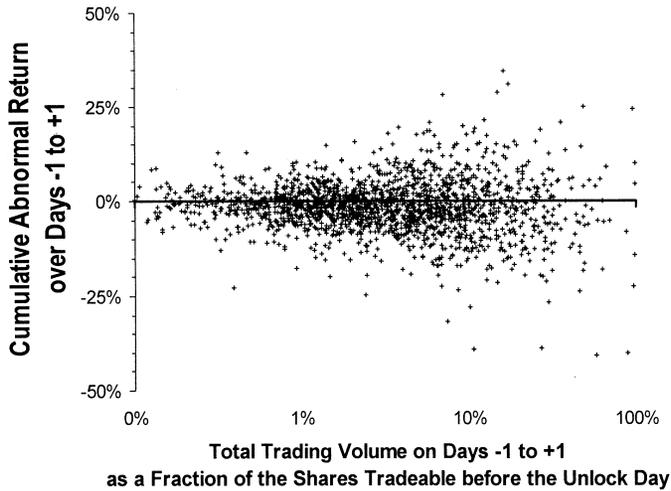


Figure 6. The relation between trading volume and abnormal returns. Cumulative abnormal returns are measured relative to the CRSP value-weighted index. Public float is defined as the total number of shares outstanding as of the IPO date less the shares covered by the lockup agreement. Sample is 1,948 U.S. IPOs over the period 1988 to 1997. The horizontal axis is scaled logarithmically. Values in excess of 100 percent are plotted as 100%.

negative three-day abnormal returns, with a mean of -0.9 percent ($t = -4.5$). If we consider only the 1,155 firms whose three-day trading volume is below their own pre-unlock mean trading volume, the three-day abnormal return is a significant -1.2 percent ($t = -8.5$).

Thus we find significant negative abnormal returns when trading volume constitutes less than one percent of the pre-unlock float, and when trading volume is below average for the firm. This implies that the abnormal return cannot be entirely attributed to the immediate consequences of downward-sloping demand curves. However, it remains possible that the abnormal return is caused by news that future insider sales are likely to be large enough to drive the price down the demand curve. This hypothesis is tested in the next section.

E. Worse-than-Expected Insider Sales

Insider sales tend to convey bad news, as they suggest a diminution of insider's incentives, a lack of insider confidence, and an increase in the supply of shares that may drive the price down the demand curve. If current insider sales are a predictor of future insider sales, then even modest insider sales could have a large effect on stock price. If this effect drives the abnormal return, then the abnormal return should be confined to the firms with insider sales. If there are no insider sales around the unlock day, then the abnormal return around the unlock day should be zero or even positive. We test this hypothesis with data on all insider trades disclosed to the SEC. A

weakness of this test is that it does not reflect insider sales that are known to the market but not reported to the SEC. Share sales by officers, directors, and 10 percent block shareholders must be reported to the SEC, but share sales by low-level employees and small angel investors without board seats are usually not reported, nor are share distributions by venture capital partnerships.

To ensure that we have complete data for the sample firms, this test includes only the 334 firms that have unlock days after October 20, 1996 (the beginning of our insider trading data), and that appear at least once in our insider trading data set, which extends through 1999. Of these 334 firms, we find that 58 (17 percent) report at least one insider share sale in the two-week period centered on the unlock day. (We assume that any insider sales within a week of the unlock day might influence the return on the unlock day, because the reported sale dates may not be completely accurate.) The average reported insider sales represent seven percent of the outstanding shares (median = 0.3 percent) and 21 percent of the shares that could trade before the unlock day.

Among the 58 firms that report insider sales near the unlock day, the mean three-day abnormal return is -4.5 percent ($t = -4.9$). The median is -5.1 percent, and 76 percent are negative. By contrast, for the 276 firms with no reported insider sales near the unlock day, the mean abnormal return is -2.5 percent ($t = -5.8$). The median is -2.0 percent, and 64 percent are negative. The difference between the two samples is statistically significant with either a t test ($p = 0.04$) or a Wilcoxon signed-rank test ($p = 0.02$). Thus the abnormal return is significantly more negative when insiders report share sales near the unlock day. This suggests that the abnormal return is caused in part by worse-than-expected insider sales. However, since the abnormal return remains significantly negative when no insider sales are reported, we conclude that the abnormal return is probably not driven solely by worse-than-expected insider sales.

IV. Ownership Changes after the IPO

The evidence presented in Tables III and IV and Figures 2 and 3 demonstrates that the abnormal returns around the unlock day are driven largely by firms backed with venture capital. The simplest interpretation of this result is that, more than most investors, venture capitalists tend to exit the firm as soon as possible after the IPO. However, an alternative hypothesis is that venture capitalists do not exit more aggressively, but merely concentrate their share sales more on the unlock day. Indeed, some venture capital firms distribute shares to their limited partners on the unlock day as a matter of policy. Another possibility is that venture financing is associated with some unknown firm characteristic that generates high selling volume on the unlock day. We test these hypotheses by directly examining the changes in the share ownership of venture capitalists, and other pre-IPO owners, in the year after the IPO.

Unfortunately, we cannot directly measure share sales by venture capitalists on the unlock day because, as noted by Gompers and Lerner (1998), venture capitalists' share distributions to their limited partners need not be disclosed to the SEC. We infer sales and distributions in the first public year by examining how the post-IPO share ownership reported in the IPO prospectus differs from that reported in the proxy statement issued approximately one year later.

For this test we focus on the 1988 to 1992 period for which we have hand-collected data from prospectuses and proxy statements. We assume no exercise of the over-allotment option. We measure ownership by insiders and by each corporate investor with either a five percent ownership stake in the post-IPO firm or representation on the board of directors. Corporate investors include venture capitalists, insurance companies, investment banks, private investment companies, pension funds, and other corporations.

Panel A of Table VI shows that, immediately after the IPO, the average ownership structure depends strongly on whether there is a corporate investor, but does not depend strongly on whether the corporate investor is a venture capitalist. As one might expect, when the firm has corporate investors, the outside directors tend to own more shares (27 percent versus 7 percent) and executives tend to own fewer shares (16–23 percent versus 47 percent). Venture and non-venture corporate investors have similar average percentage ownership, suggesting that the apparent venture capital effect in unlock day returns may be due to the presence of any corporate investor, regardless of whether that investor is a venture capitalist. However, Table VI shows that this is not the case. Venture-financed firms experience a significant –2 percent abnormal return around the unlock day, whereas firms with non-venture corporate investors lose only an insignificant –0.3 percent, and firms with no corporate investors gain an insignificant 0.2 percent. (These abnormal returns are smaller than those observed in the whole sample, because these tests cover the early years of our sample, when the unlock day effect was smaller.)

Panel B shows ownership a year after the IPO. A comparison of Panels A and B reveals that, in the first year after the IPO, ownership by venture capitalists falls from 23 percent of total shares outstanding to 17 percent. In the same firms, ownership by executives falls only from 16 percent to 15 percent, and ownership by other corporate investors actually increases from 25 percent to 28 percent. These changes reflect both the changes in the holdings of the original, pre-IPO investors and the arrival of new investors. Panel C shows only the ownership changes of the original, pre-IPO corporate investors, as a fraction of their holdings immediately after the IPO. In the year after the IPO, venture capitalists sell or distribute 29 percent of their stake (median = 17 percent), nearly the same result as reported by Barry et al. (1990) for an earlier sample period. These venture capitalist sales are significantly larger than the 20 percent (median = 0) sold by the non-venture corporate investors in the same firms. Thus, we conclude that venture capitalists sell their shares more aggressively than other pre-IPO shareholders.

Table VI
Ownership of IPO Firms Grouped by Presence
of Venture Capital and Other Corporate Blockholders

This table reports ownership structure for firms that went public during 1988 to 1992. The sample consists of 344 venture-financed firms and 464 non-venture-financed firms (223 which have corporate blockholders and 241 with no corporate blockholders as of the IPO). Five percent corporate investors include any corporate entity owning at least five percent of the firm's shares (includes venture capital investors). "Corporate investors on board" includes any corporate entity with representation on the board of directors. Panel A shows the ownership structure immediately after the IPO, from the IPO prospectus (assuming no exercise of the overallotment option.) Panel B shows average ownership approximately one year later, from the proxy statement. Panels A and B reflect both the changes in the positions of the pre-IPO shareholders, and the arrival of new shareholders. Panel C reflects only the changes in the shareholdings of the pre-IPO shareholders, as a fraction of their holdings immediately after the IPO.

	Venture-capital-backed	Non-venture-backed		
		All Non-VC	Have Corporate Blocks	No Corporate Blocks
Abnormal return around unlock (days -1, +1)	-2.0%	-0.04% [‡]	-0.3% [‡]	0.2% [‡]
Panel A: Average ownership immediately after the IPO				
Officers and Directors	44%	52% [‡]	50% [‡]	54% [‡]
Executives	16%	36% [‡]	23% [‡]	47% [‡]
Outside directors	27%	16% [‡]	27%	7% [‡]
5% Corporate investors	32%	15% [‡]	31%	0% [‡]
5% Venture capitalists	23%			
Corporate investors on board	25%	13% [‡]	27%	0% [‡]
Venture capitalists on board	19%			
Panel B: Average ownership one year after the IPO				
Officers and directors	37%	48% [‡]	46% [‡]	50% [‡]
Executives	15%	33% [‡]	22% [‡]	43% [‡]
Outside directors	22%	15% [‡]	24%	8% [‡]
5% Corporate investors	28%	16% [‡]	31%	3% [‡]
5% Venture capitalists	17%			
Corporate investors on board	19%	12% [‡]	24% [‡]	1% [‡]
Venture capitalists on board	14%			
Panel C: Average (median) first-year net decrease in the holdings of the pre-IPO shareholders, as a percentage of the shares they own immediately after the IPO				
Corporate investors	27% (18%)	19% [†] (2% [‡])		
Venture capitalists	29% (17%)			
Non-venture capitalists	20% (0%)	19% (2% [‡])		
Sample size	344	464	223	241

^{†,‡} Significantly different from the venture-capital-backed group at the 5 percent and 1 percent levels, respectively.

V. Reported Insider Sales Before the Unlock Day

Lockup agreements typically specify that the underwriter can release the lockup before the scheduled unlock day without public notice. Our conversations with underwriters indicate that they feel pressure to grant early

release, particularly when the insider is a venture capital firm with whom the underwriter would like to conduct future business. In addition, if the stock price is high relative to the offer price, and trading volume is not too thin, the underwriter will occasionally grant small, partial early release to executives who need cash for personal reasons. Here we provide evidence on the frequency of early release.

We searched the *Dow Jones New Service* for mentions of early lockup releases for all 1,948 firms in the sample. We find announcements of early release for only 22 firms, or about 1.1 percent of the sample. Two-thirds of these early releases were granted by two underwriters, Morgan Stanley and Alex Brown & Sons, though these underwriters collectively managed only 17 percent of the IPOs in our sample. Early release tends to be granted when firms are doing well; among the 22 firms that announce early release, the mean share price run-up from the IPO to day -6 was 44 percent, versus 10 percent in the rest of the sample.

To measure how frequently underwriters grant early release without a public announcement, we look at insider share sales reported to the SEC. We have data on insider trade disclosures for a subsample of 165 firms in which both the IPO date and the unlock date fall in the period October 1996 to October 1997. For these firms, we examine all reported insider sales in the period from one week after the IPO to one week before the unlock day. Our data include share sales by officers, directors, and 10 percent blockholders (on Form 4) and sales by five percent blockholders (on Forms 13d and 13g), but do not include share sales by low-level employees or other atomistic shareholders, or distributions by venture capital partnerships. In 47 firms (28 percent) we find at least one reported sale before the scheduled unlock day. However, further investigation, detailed in the Appendix, reveals that only 13 of these events can be considered a material violation or relaxation of the original lockup agreement. Of the thirteen apparent violations, only two include significant sales by multiple executives (an average of nine percent of the public tradable float), and in both these cases, an early lockup release was publicly announced. The remaining 11 (unannounced) early sales are divided roughly evenly between sales by a single executive and sales by venture capital funds. Notably, the early sales by venture capital funds are dramatically larger. On average, the early sales by venture capital funds represent 30 percent of the sellers' holdings (median 13 percent), and 29 percent of the publicly tradable float (median 26 percent). By contrast, the unannounced early sales by executives represent an average of only 2.2 percent of the seller's holdings (median 1.9 percent) and 0.6 percent of the publicly tradable float (median 0.3 percent). The single case of an unannounced early sale of more than three percent of an executive's holdings, which occurred in Memberworks Inc., is a modest share sale by a former executive who was fired three years before the IPO and had recently sued the firm.

Lockup agreements often mention unspecified "limited exceptions" to the prohibition on early sales, so we cannot be sure that very small share sales even require the underwriter's permission. If we confine attention to early

sales of more than two percent of the public float or 10 percent of the insider's holdings, we find six early sales: two publicly announced sales by executives and four unannounced sales by venture capital funds.

If insiders wish to sell a large number of shares, the firm may organize a secondary equity offer. All firms with equity offers before the unlock day are excluded from our sample, and this exclusion removed four firms from our insider trading subsample. Counting these four firms, a total of 10 of 169 firms (six percent) report substantial sales of locked-up shares before the scheduled unlock day. This estimate represents only a lower bound on the frequency of share sales and SEOs before the scheduled unlock date, as some share sales may not be disclosed to the SEC, particularly sales by low-level employees and share distributions by venture capital partnerships. In addition, an unknown fraction of lockup agreements might be evaded by insiders' use of "zero cost collars" or other investment vehicles.⁷

VI. Conclusion

Although the lockup expiration date is known at the time of the IPO, around the expiration day we find a statistically prominent abnormal return of -1.5 percent, concurrent with an apparently permanent 40 percent increase in trading volume. This anomalous abnormal return is robust to various sample specifications and benchmarks, and grows larger over the course of our ten-year sample period. The abnormal return is not quickly reversed, and is not due to obvious microstructure effects like a widening of the spread or a change in the proportion of trades at the bid price. Although the abnormal return does not represent a short-term profit opportunity for traders who must transact at the bid and ask, nonetheless it challenges the more extreme versions of the efficient markets hypothesis, as it is difficult to understand how the events of the unlock day could be consistently worse than expected, or why a rational trader would buy at the ask price in the week before the unlock day.

Consistent with the hypothesis that the abnormal return is caused by downward-sloping demand curves, we find that the abnormal return is more negative when trading volume is abnormally high. However, we also find a highly significant negative abnormal return in those cases where the total

⁷ A "zero cost collar" is a combination of put and call options in which the insider effectively gives away the upside potential of the stock in exchange for eliminating the downside risk. For a discussion of these derivatives, see Bettis, Bizjak and Lemmon (1999). Lockups could also be partially evaded by borrowing against shares, or by use of a "variable forward sale," a forward contract to sell shares. Since 1996, insiders' derivative positions must be reported in Table 2 of Form 4, but most insider trading data sources (including ours) do not report these disclosures. Another executive hedging vehicle is an exchange fund, in which executives from several firms transfer their shares to the fund in exchange for shares of the fund. Such actions must be reported as share sales and would show up in our insider trading database. The wording of most lockup agreements clearly prohibits hedging via an exchange fund. At the time of this writing, a good source of information on these hedging techniques can be found at www.RestrictedSecurities.com.

volume around the unlock day is less than one percent of the public float. Thus, the abnormal return cannot be entirely explained by the increase in the supply of shares, though it could be caused by a change in the market's expectations about the future supply of shares.

Consistent with the hypotheses that the abnormal return is caused by worse-than-expected news about insider sales, we find that the return is significantly more negative when insiders disclose share sales on the unlock day. However, the abnormal return remains highly significant when there are no reported insider sales. Thus, news about insider sales seems to be a factor in the abnormal return, but is probably not the only factor, though it is possible that the abnormal return is driven by rumors of share sales that are not reported to the SEC.

Both the abnormal return and the abnormal volume around the unlock day are much larger when the firm is financed by venture capital. In the year after the IPO, holdings by venture capitalists fall significantly more than those of executives and other pre-IPO investors. Thus venture capitalists sell their shares more aggressively than do other pre-IPO investors. The abnormal return is also somewhat more negative for high-tech firms, Nasdaq firms, and firms with higher quality underwriters, but these differences are not significant in multivariate tests, or are sensitive to the choice of event window.

Prior to the scheduled unlock day, shareholders can be released from the lockup agreement, without public notice, at the discretion of the underwriter. In about six percent of IPOs, insiders report substantial early sales of locked-up shares, due to a partial or total early release of the lockup, a follow-on offer, or (perhaps) a violation of the lockup. In our sample, early share sales by multiple executives are always publicly announced, but early sales by venture capital funds are not, though the early sales by venture capital funds are much larger.

Appendix: Detailed Investigation of Reported Insider Sales Before the Unlock Day

The initial sample for this inquiry is the 186 firms in which both the IPO date and the unlock date fell in the October 1996 to October 1997 period for which we have insider trading data. Of these firms, 165 (89 percent) report at least one transaction in our insider trading data set, which extends through October 1999. Of these 165 firms for which we believe we have complete data, we examine all insider sales in the period from one week after the IPO to one week before the scheduled unlock day. In 47 cases (28 percent) at least one insider reports an early sale.

Of the 47 cases with early sales, 12 consist entirely of shares that were not covered by the lockup because they were purchased at the IPO or in the open market after the IPO. One case (Quadramed Corp.) represents an error in the SDC dataset, which reports a 180-day lockup when the actual lockup

period is 90 days. In another case (Javelin Systems), we are unable to determine the nature of the sale because we could not locate the IPO prospectus. Another eight cases consist entirely of share sales to the underwriter to satisfy the overallotment option. Three cases of apparent block sales seem to be transfers between different accounts controlled by the same individual, as a comparison of the proxy statements before and after the transaction shows no reduction of the putative sellers' ownership. The remaining 22 cases are detailed in Table A1. Five cases appear to represent gifts or minor shuffles between an individual's accounts, as they are privately negotiated sales of small numbers of shares with no price disclosed. Close examination of the IPO prospectuses reveals that another four cases were permitted under the fine print of the lockup agreement. This leaves 13 instances (discussed in the text) in which the lockup was either violated, or released early with no public announcement.

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Table A1
Early Share Sales Among 150 IPOs in the Period October 1996 to October 1997

Table includes all insider share sales, in excess of previous nonoption purchases, before the scheduled expiration of the lockup agreement, as disclosed on SEC Forms 4, 13d, and 13g. "Days Early" indicates calendar days between the insider sale date and the scheduled unlock date. "% of float" indicates the increase in the number of tradable shares, defined as all outstanding shares not covered by the lockup. "Venture capital fund" indicates a venture capital firm or a private partnership that has provided the firm with equity capital before the IPO.

Firm	Issue Date	Unlock Date	Days Early	Shares Sold	% of Holding	% of Float	Underwriter
Panel A: Unannounced early sales by executives that apparently violate the original lockup							
Euronet Services	06-Mar-97	02-Sep-97	139	70,000	2.2	1.3	Barings
IA Corp	08-Nov-96	07-May-97	63	500	1.9	0.0	Alex Brown & Sons
MemberWorks	18-Oct-96	16-Apr-97	117	39,300	6.7	1.5	Robertson Stephens
Metro Info Svcs	29-Jan-97	28-Jul-97	55	6,000	0.1	0.2	Robert W. Baird
National-Oilwell	28-Oct-96	26-Apr-97	44	10,000	2.0	0.3	Merrill Lynch
Procom Technology	17-Dec-96	15-Jun-97	136	9,300	0.1	0.3	Montgomery
Mean			92	22,517	2.2	0.6	
Median			90	9,650	1.9	0.3	
Panel B: Publicly announced early lockup releases							
NeoMagic Corp	13-Mar-97	09-Sep-97	69	292,495	7.2	9.7	Morgan Stanley
Yurie Systems	05-Feb-97	04-Aug-97	63	300,000	2.0	7.5	Alex Brown & Sons
Mean			66	296,248	4.6	8.6	

Panel C: Early sales by venture capital funds that apparently violate the original lockup							
Advanced Radio Telecom	05-Nov-96	04-May-97	61	44,629	1.5	2.0	Merrill Lynch
GeoTel Communications	20-Nov-96	19-May-97	76	573,832	13.0	26.1	Alex Brown & Sons
Miami Computer Supply*	11-Nov-96	08-Aug-97	220	333,744	20.7	33.4	Friedman Billings Ramsey
Peregrine Systems	08-Apr-97	05-Oct-97	67	1,602,934	100.0	69.7	UBS
Triangle Pharmaceuticals	31-Oct-96	29-Apr-97	130	500,000	12.5	11.9	Dillon Read
Mean			111	611,028	29.5	28.6	
Median			76	500,000	13.0	26.1	
Panel D: Minor private transactions (private sales of less than 1% of holdings or float, at price of zero)							
Advance Paradigm	08-Oct-96	06-Apr-97	110	7,350	6.2	0.3	Hambrecht & Quist
Dover Downs Ent.	03-Oct-96	01-Apr-97	116	18,000	0.3	0.7	Merrill Lynch
SeaMED	18-Nov-96	17-May-97	135	1,000	0.1	0.1	Piper Jaffray
Steel Dynamics	21-Nov-96	20-May-97	153	6,000	0.4	0.1	Morgan Stanley
Template Software	29-Jan-97	28-Jul-97	34	13,000	0.9	0.6	Volpe Welty
Mean			110	9,070	1.6	0.3	
Median			116	7,350	0.4	0.3	
Panel E: Early sales by executives that were allowed under the terms of the lockup							
Gulf Island Fabrication	03-Apr-97	30-Sep-97	140	50,000	2.9	2.5	Morgan Keegan
Pluma	10-Mar-97	06-Sep-97	86	12,000	99.7	0.4	JP Morgan
Specialty Catalog Corp	17-Oct-96	12-Oct-97	166	374,667	25.3	25.0	GKN Securities
Sun Hydraulics	09-Jan-97	08-Jul-97	41	8,000	0.4	0.4	AG Edwards & Sons
Mean			108	51,956	32.0	7.1	

* In the case of Miami Computer Supply, the insider seller is the Pittsburgh Investment Group, LLC, a private partnership that provided pre-IPO financing but does not call itself a venture capital firm.

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