The Role of Lockups in Initial Public Offerings

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In a sample of 2,794 initial public offerings (IPOs), we test three potential explanations for the existence of IPO lockups: lockups serve as (i) a signal of firm quality, (ii) a commitment device to alleviate moral hazard problems, or (iii) a mechanism for underwriters to extract additional compensation from the issuing firm. Our results support the commitment hypothesis. Insiders of firms that are associated with greater potential for moral hazard lockup their shares for a longer period of time. Insiders of firms that have experienced larger excess returns, are backed by venture capitalists, or go public with high-quality underwriters are more likely to be released from the lockup restrictions.

An initial public offering (IPO) often represents the first opportunity that a firm's founders and initial investors have to begin the process of realizing the value for their ownership stake in the firm.[1] We explore one particular aspect that regulates this cashing out by insiders, namely the structure of, the price reaction to, and the compliance with investment banker lockups, which restrict the ability of the firm's management and prepublic investors from selling their stock in the aftermarket for a period of time after the IPO. Our article provides three contributions on going public and financial markets. First, we explore why prepublic insiders agree to long holding periods after the IPO. We test three potential explanations: (i) lockups as a signal of quality, (ii) as a commitment device to alleviate moral hazard problems, and (iii) as a means for investment banks to extract additional compensation from issuing firms. Our analysis supports the commitment hypothesis. Specifically, investment banks impose longer lockups when the moral hazard in the aftermarket is higher. We conduct several tests of the signaling hypothesis and find no support for the idea that insiders signal their "quality" by locking

We thank Eli Berkovitch, Francesca Cornelli, Jennifer Francis, John Graham, Robert Hansen, J. B. Heaton, Reuven Lehavy, Roni Michaely, Maureen O'Hara (editor), Alessandro Penati, Jay Ritter, Nathalie Rossiensky, Bob Whaley, Richard Willis, two anonymous referees, and seminar participants at Cornell, Goldman Sachs Asset Management and Equity Capital Markets, and the conference on market abuse and insider trading held at Bocconi University. Jon Daniels, Morgen Peck, and especially Krishnamoorthy Narasimhan provided excellent research assistance. Support for this research was provided by the Fuqua School of Business, Duke University (to A. Brav) and Division of Research, Harvard Business School (to P. A. Gompers). Address correspondence to Alon Brav, Fuqua School of Business, Duke University, Box 90120, Durham, NC 27708, or e-mail: brav@mail.duke.edu.

[1] See Habib and Ljungqvist (1999). Baker and Gompers (2000) show that the vast majority of insiders do not sell any of their own shares at the time of the IPO.

The Review of Financial Studies Spring 2003 Vol. 16, No. 1, pp. 1–29

themselves for a longer period of time than insiders at lower-quality firms. Similarly we find little evidence in support of the possibility that investment banks impose lockups as a way to extract additional compensation from the firm's insiders.

Second, we also explore the price reaction at the time of the lockup expiration. Because the parameters of the lockup are well specified (in terms of length and number of shares locked) and known at the time of the IPO, if markets perfectly anticipated the release there should not be an abnormal price reaction at the time of the expiration. Indeed, even if demand curves for stocks slope downward, investors should correctly forecast on average the number of shares that insiders will sell at lockup expiration, and hence the average abnormal return should be zero. We find, however, a significant drop of 2% around the lockup expiration. Our evidence is consistent with downward sloping demand curves and costly arbitrage. In addition, we examine cross-sectional differences in the magnitude of the price decline and find that these are consistent with the predictions of the commitment hypothesis.

Third, because the lead underwriter has the ability to release locked-up shares early, we examine insider equity sales prior to expiration of the lockup. Under the commitment hypothesis, only insiders of firms that have greatly diminished moral hazard risk should be allowed to sell equity prior to the expiration of the lockup. Consistent with this prediction, we find that early release is associated with greater price increases between the IPO and lockup expiration, greater venture capital backing, and higher underwriter reputation.

Our article is related to several independent strands in finance. An enduring issue in the corporate finance literature has been the impact of trading by informed insiders on securities prices. An extensive body of research has examined trading by corporate insiders [e.g., Seyhun (1986, 1988)] and our article sheds additional light on this topic by documenting the extent of insider sales subsequent to the IPO. In addition, the article also relates to the literature that examines the role of reputation in the going-public process and the mitigation of adverse selection. Because the going-public process is potentially subject to Myers and Majluf's (1984) adverse selection problems, it may be in the firm's interest to agree to resolve the adverse selection problem by incurring a costly signal [Leland and Pyle (1977)]. Agreeing not to undertake any sale of equity for a prespecified period of time can function as such a signal.

Finally, several recent articles also focus on varying aspects of IPO lockups. Field and Hanka (2001) focus on explaining the price decline at lockup expiration.[2] Ofek and Richardson (2000) attempt to explain the price decline at

[2] Field and Hanka (2001) document the extent of early release by employing a small sample of insider transactions prior to lockup expirations (334 firms over a one-year period). In Section 3 we provide a thorough analysis of all insider transactions conducted by our sample firms. This extensive database and our competing hypotheses provide a framework within which we are able to explore both the extent of early release as well as the determinants of early insider sales.

lockup expiration and find no one explanation that is consistent with the data. They show, however, that transaction costs eliminate the ability of a trader to profit from the price decline. A third article examining the price decline at lockup expiration [Bradley et al. (2001)] focuses primarily on the role of venture capital backing in the price decline at lockup expiration.

1. IPO Lockup Contracts

1.1 Regulations governing lockups

When an issuing firm and an investment bank enter into an agreement to offer securities in an IPO, they sign an underwriter agreement. As Bartlett (1995) explains, these agreements typically include a covenant such as

> The Selling Securityholders agree that, without your (the investment bank's) prior written consent, the Selling Securityholders will not, directly or indirectly, sell, offer, contract to sell, make any short sale, pledge or otherwise dispose of any shares of Common Stock or any securities convertible into or exercisable for or any rights to purchase or acquire Common Stock for a period of 180 days following the commencement of the public offering of the Stock by the Underwriters.

Bartlett (1995) argues that the lockup, which is "typically" 180 days in length, "prevents a surplus of stock hitting the market all at once." The agreement to not sell or sell-short their equity holdings is governed only by this underwriter agreement. It is not mandated by any SEC or state securities laws that regulate insider trading.[3] It is important to note that the underwriter can release any of the securities subject to the lockup agreements at any time without notice. We provide evidence that early release is used extensively in our sample period.

The sale of restricted securities, that is, stock purchased in a private placement directly from an issuer before the company is public, is governed by SEC Rule 144. Rule 144 allows for the sale of restricted securities in limited quantities in the aftermarket. Specifically, a person who has beneficially owned shares of common stock for at least one year (two years before February 1997) is entitled to sell, within any three-month period, a number of shares that does not exceed the greater of 1% of the number of shares of common stock then outstanding or the average weekly trading volume during the four calendar weeks preceding the filing of a notice on Form 144 with respect to the sale.

[3] Specifically, Section 10(b) of the Securities Exchange Act of 1934, and Rule 10b-5 of the act are the primary provisions used by the Securities and Exchange Commission (SEC) to prevent insider trading where insiders are officers, directors, or anyone else owning 10% or more of the outstanding company shares. Section 16b of the 1934 act bans short-swing (within a six-month period) profit taking by insiders. In addition, under the Insider Trading and Securities Fraud Enforcement Act of 1988, corporations, brokerage firms, or other "controlling persons" who supervise a person who violates the insider trading rules may also be liable.

Finally, as Bettis, Coles, and Lemmon (2000) emphasize, insider trading is likely to be regulated by the firm itself. A large proportion of their sample firms have a policy in place restricting insider trading by employees, as well as prespecified blackout periods in which the company prohibits trading by insiders. Bettis, Coles, and Lemmon (2000) point out that insiders who are governed by these self-imposed company restrictions are sometimes granted permission to trade during the blackout periods for liquidity or diversification reasons.

1.2 Why do lockups exist?

The central question addressed in this article is why do IPO lockups exist. We explore three potential explanations for the existence of lockups. First, if the quality of a particular company is not observable by public investors, high-quality firms would be worried that potential investors would be less willing to pay a high price for their shares. Investors could not distinguish between high-quality and low-quality firms. Leland and Pyle (1977) develop a model in which the fraction of equity retained by insiders at the time of the IPO serves as a signal of quality. Insiders in high-quality firms are willing to hold more of their stock after the IPO and hence remain more undiversified because they can thereby commit to the quality of their companies.

Courteau (1995) extends the Leland and Pyle model to voluntary lockups [see also Welch (1989, p. 437)]. She builds a model in which insiders use the IPO lockup as a signaling device. High-quality firms signal their quality by agreeing to longer lockups. Because insiders hold undiversified portfolios, restricting the sale of stock for a longer period of time imposes a cost on them. If firms use lockups to signal, then higher-quality firms would agree to longer lockups. Insiders at low-quality firms would be unwilling to bear the cost of committing to long lockups.[4]

The signaling hypothesis gives several predictions about the structure of lockups depending on the motivation for the signal. That is, firms may want to signal their quality either to get a higher offering price at the IPO or to get a better price at a subsequent seasoned offering [e.g., Allen and Faulhaber (1989), Grinblatt and Huang (1989), Welch (1989)]. Our empirical tests are designed as in Michaely and Shaw (1994). In particular, we would expect that firms that signaled their quality through longer lockups would be more likely to raise their offering price in order to garner greater proceeds at the time of the IPO or else they would be more likely to issue equity in a subsequent seasoned equity offering.

[4] Other authors have explored alternative mechanisms by which managers can overcome this asymmetric information problem. Carter and Manaster (1990) show that firms going public with high-quality underwriters have lower underpricing. Carter and Manaster argue that the investment bank is able to credibly certify the quality of the offering because it stakes its reputational capital on the future performance of the offering. Investors require less of a discount to buy into the offering because the adverse selection problem is diminished. Barry, et al. (1990) and Megginson and Weiss (1991) examine a similar certification phenomenon with venture capital-backed companies.

A second hypothesis for the existence of lockups is that these agreements serve as a commitment device to alleviate moral hazard problems. In this case, it is the level of asymmetric information regarding the actions of the managers in the aftermarket that is critical. In this setting, firm quality is observable ex ante. However, in the aftermarket insiders may not act in the best interest of shareholders. Consequently, holding constant the quality of the firm, a firm whose moral hazard incentives in the aftermarket are likely to be large would have to accept a longer lockup in order to convince the public to buy stock in the offering. During the period of time in which insiders are prohibited from selling equity, information about the firm's future prospects will be revealed through SEC filings, news stories, and analyst reports. As a result, investors would be more willing to buy into the offering knowing that the insiders' ability to take advantage of them is reduced. Hence the lockup provision would be a commitment device.

The commitment hypothesis yields predictions that differ from the signaling alternative. Holding constant the quality of the firms, those that, ex ante, suffer from a greater potential for insiders to take advantage of shareholders would need longer lockups to induce investors to buy into the offering. This includes younger firms, firms with greater stock price volatility, and firms with characteristics such as low book-to-market ratios and low cash flow margins. In addition, firms that have other forms of certification or reputation will not need longer lockups, that is, reputation is an alternative commitment device. For example, a firm that can convince Kleiner Perkins to invest in it or Goldman Sachs to underwrite its offering is less likely to engage in opportunistic insider sales. Goldman Sachs and Kleiner Perkins would be unwilling to risk their reputations by being associated with companies whose insiders are more likely to take advantage of investors. This implies that venture backing and higher-reputation underwriters will be associated with shorter lockups.[5]

The commitment hypothesis also has implications for the types of firms that investment bankers will release from the lockup provision early and allow sales by insiders prior to the lockup expiration. First, if the rate with which information is produced is positively related to the presence of venture capitalists or the quality of the underwriter, then we should observe early release associated with venture capital backing or high underwriter rank. Second, if the firm has received a series of positive news announcements (proxied by a price run-up prior to the early release), then this news, in turn, is likely to be associated with a reduction in the information asymmetry problem. Therefore the chance that the insiders will take advantage of investors is lessened and insiders can be released from their lockup commitments.

[5] Indeed, it may be argued that underwriters may choose to write lockups that reflect their reputation. Specifically, the shorter the lockup, the more reputation is at stake since any adverse information occurring shortly after the lockup expiration will imply that the underwriter may not have done the due diligence appropriately. In a separating equilibrium, high-quality underwriters would impose shorter lockups on higher-quality firms.

In addition, if the lockup is a commitment device, then the level of the price reaction at lockup expiration will be affected by returns between the IPO and lockup expiration, venture capital backing, and underwriter ranking. The stock price reaction at lockup expiration should be lower for firms that are more informationally transparent. This includes firms with lower price volatility, high underwriter status, profitable firms, and firms that have been able to tap the seasoned equity offering ("SEO") market.

A third potential explanation for the use of lockups is that investment banks want to extract additional compensation from issuing firms. The lockup agreement only allows insider equity sales prior to lockup expiration if the lead underwriter consents. In this case, insiders would be forced to do a block trade through the lead underwriter or actually perform an SEO. In either case, the underwriter would make additional fees by either making a market in the firm's shares for the block transaction or else it would make fees from underwriting the SEO.

The underwriter market power story predicts that controlling for firm quality, lockups should be longer for firms underwritten by high-quality underwriters. The high-quality underwriters would extract more compensation by imposing longer lockups due to their greater prestige. Companies going public would be willing to agree to longer lockups if the higher-tier underwriters offer greater services. We would also expect that the probability of doing an SEO that retains the same lead underwriter at the IPO would be higher within the lockup period. That is, controlling for the length of time from IPO to SEO, firms doing a seasoned equity offering within the lockup period should be more likely to use the same underwriter.

2. Data Sources and Sample Description

We employ an initial sample of 2,871 IPOs conducted over the period 1988–1996 obtained from the Securities Data Company (SDC) database. To be included in the sample, firms must be listed on the Center for Research in Security Prices (CRSP) sometime after the offering but before the lockup expiration. We exclude IPOs by closed-end funds, real estate investment trusts (REITs), American depository receipts (ADRs), and any carveouts. Daily stock returns and volume data are obtained from the CRSP, while accounting data was obtained from Compustat. Information regarding the length of the lockup, number of shares locked, primary and secondary shares offered, and offer price are from SDC. In those cases where SDC has a missing lockup data field, we search the individual firm prospectus for the relevant information. In the initial analysis, 255 firms were lacking lockup length data. Of these, the appendix details how we were able to find information on 178 of those firms, giving us a final sample of 2,794 IPOs.

Table 1 provides descriptive statistics for the 2,794 IPOs. In panel A we provide the annual number of IPOs for the period 1988–1996. The volume of

Table 1
Descriptive statistics

Panel A

Year	1988	1989	1990	1991	1992	1993	1994	1995	1996	Total
IPOs	111	108	104	272	355	435	368	414	627	2,794

Panel B

	10th percentile	Median	Mean	90th percentile
Market value of equity (1992 $ million)	14.5	69.7	121.4	258.9
Book-to-market ratio	0.14	0.35	0.47	0.89
Underpricing (%)	−2.1	7.7	14.6	40.6
Percent of offering as primary shares	66.1	100	89.6	100
Average underwriter rank	3.0	8.0	6.8	9.0
Days of lockup	180	180	254	540
Fraction of post-IPO insiders shares locked (%)	51.7	93.1	83.9	99.0
Sales (1992 $ million)	1.1	34.4	119.8	306.2
Employment	34	257	918	6,500
Return on assets (%)	−36.4	3.4	−7.7	15.4

Panel C

Lockup days	<90	90–91	91–179	180	181–360	360–366	367–540	541–549	550–720	721–1,095
Observations	7	84	172	1,793	96	236	183	32	4	187
Percent of observations	0.25	3.00	6.16	64.17	3.44	8.45	6.55	1.15	0.14	6.69

Panel D

Sample	Number of observations	Days locked	Fraction of post-IPO insider shares locked (%)	Underpricing (%)
1) Full sample	2,794	254 [180]	57.0 [60.9]	14.7 [7.7]
2) Market value ≥ median	1,397	187 [180]	60.6 [64.6]	16.3 [9.8]
3) Market value < median	1,397	321 [180]	53.1 [56.6]	13.0 [5.6]
p-values for difference in means		0.00	0.00	0.00
4) Underwriter rank ≥ 8	1,413	193 [180]	59.2 [63.2]	14.7 [14.7]
5) Underwriter rank < 8	1,381	316 [180]	54.6 [60.9]	14.6 [14.6]
p-values for difference in means		0.00	0.00	0.89
6) Venture capital backed	1,177	202 [180]	58.5 [62.6]	15.3 [8.0]
7) Not venture capital backed	1,617	292 [180]	55.6 [59.6]	14.2 [7.5]
p-values for difference in means		0.00	0.00	0.22
8) IPO on or before 7/01/92	810	269 [180]	55.7 [59.1]	11.6 [6.0]
9) IPO after 7/01/92	1,984	248 [180]	57.5 [61.5]	15.9 [8.7]
p-values for difference in means		0.00	0.05	0.00

The sample is 2,794 IPOs from January 1, 1988, through December 31, 1996, for which we could find lockup information. Panel A provides the annual number of IPOs for our sample years 1988–1996. Panel B presents means and the 10th and 90th percentile information on various firm characteristics for the sample. Market value, in millions of dollars, is in 1992 constant dollars. Market value is calculated using the offering price and shares outstanding obtained from CRSP. Book-to-market ratio is the ratio of book equity to market equity in the first reporting period following the IPO (Compustat item 60) divided by the market capitalization at the IPO. Underpricing is the percent return on the first day from the offering price to the closing price. Percent of offering as primary shares is the fraction of the offering that is new shares. Underwriter rank is the Carter, Dark, and Singh (1997) underwriter reputation rank taking values from 1 (lowest rank) to 9 (highest rank). Days of lockup is the length of the underwriter lockup period. Fraction of post-IPO insider shares locked is the percentage of shares held by insiders after the IPO subject to the lockup restriction, for which we could find information. To eliminate the influence of outliers, when the number of shares locked exceeds the number of post-IPO shares held by insiders, we set the number of shares locked equal to 99% of post-IPO shares held by insiders. Sales is the value of sales in the first reporting period after the IPO in millions of 1992 dollars (Compustat item 12). Employment is the number of employees in the first reporting period after the IPO (Compustat item 29). Return on assets is the ratio of net income to total assets (Compustat items 258 and 6). Panel C provides the distribution of the time to expiration (in calendar days) of lockups. Panel D presents information on length of the underwriter lockup, percent of shares subject to the lockup, and underpricing. Both means and medians [in brackets] are presented. We report *p*-values for the test that the reported means are unequal (assuming unknown but equal variances).

IPOs for the first three years in the sample is quite low relative to the volume of IPOs in 1991–1996. Panel B provides means, medians, as well as 10th and 90th percentile information on various firm characteristics for the sample.[6]

Initial analysis of the lockup length shows considerable standardization. The 10th and 50th percentile lockups are all 180 days. This type of contract standardization is common in certain agreements. For example, Chen and Ritter (1999) find that investment bankers set gross spreads at 7% in the majority of the IPO deals in their sample. Gompers and Lerner (1999) show that 82% of venture partnership agreements allocate 20% of profits to the general partners of the venture funds. Insiders also appear to lockup a significant portion of their equity. The median firm locks up 93% of post-IPO insider shares, while even the 25th percentile firm locks up 52% of its post-IPO insiders' shares.

Panel C provides the distribution of the time to lockup expiration in calendar time starting with the lowest (less than 90 days) to the highest (1,095 days). It can be seen that while most lockups occur at monthly frequency, the majority of the contracts, 64%, are based on 180 days. There also appears to be a clustering of lockup lengths corresponding to annual intervals.

Panel D presents additional information on the length of the underwriter lockup, the percentage of shares held by insiders after the IPO that are subject to the lockup, and underpricing. The panel separates IPO firms on the basis of firm characteristics. Rows 2 and 3 provide cross-sectional differences in these characteristics by sorting the IPO sample into two size groups (market capitalization above and below the median firm size of $70 million). The groups reveal that smaller IPOs are locked up for a longer period of time. On average, smaller IPOs are locked up for 321 days while larger IPOs are locked for 187 days. If smaller firms are potentially more plagued by moral hazard problems, then insiders at smaller firms would have to agree to longer lockups in order to sell equity to the public. No discernable pattern appears in relation to the fraction of post-IPO insiders' shares subject to lockup. In addition, underpricing of smaller IPOs is significantly lower.

The next two rows present cross-sectional differences based on underwriter reputation, and rows 6 and 7 document the relationship between venture backing and these IPO characteristics. Both comparisons reveal that offerings

[6] Market value of equity is given in millions of 1992 dollars at the offering price. Book-to-market ratio is the ratio of book equity to market equity in the first reporting period following the IPO (Compustat item 60) divided by the market capitalization at the IPO. Underpricing is the percent return on the first day from the offering price to the closing price. Percent of offering which is primary shares is the fraction of the offering that is new shares. Underwriter rank is the Carter, Dark, and Singh (1997) underwriter reputation rank, taking values from 1 (lowest rank) to 9 (highest rank). Days of lockup is the length of the underwriter lockup period. Fraction of post-IPO insider shares locked is the percentage of shares held by insiders after the IPO subject to the lockup restriction, for which we could find information. To eliminate the influence of outliers, when the number of shares locked exceeds the number of post-IPO shares held by insiders, we set the number of shares locked equal to 99% of post-IPO shares held by insiders (Field and Hanka (2001)). Sales is the value of sales in the first reporting period after the IPO in millions of 1992 dollars (Compustat item 12). Employment is the number of employees in the first reporting period after the IPO (Compustat item 29). Return on assets is the ratio of net income to total assets (Compustat items 258 and 6).

with higher-tier investment banks or those having venture capital investors have significantly shorter lockups on average. This is consistent with the idea that firms with lower incentives for moral hazard in the aftermarket do not require strong commitment via long lockups. Underpricing is higher for both the high-reputation investment banker and the venture capital-backed IPOs.[7]

In the last set of rows we split the sample into two equal subperiods, that is, earlier and later IPOs. It is readily apparent that no significant time trend in lockup provisions exists. General lockup length and the fraction of the firm's equity that is locked are comparable. IPO underpricing, however, has increased in the latter time period [Ritter and Welch (2002)].

3. The Determinants of Lockup Length

3.1 Testing the predictions of the commitment hypothesis

We next explore the determinants of the lockup length. We report regression results in Table 2 which broadly support the commitment story. The dependent variable is the logarithm of the length of the lockup in days. Independent variables include the Carter, Dark, and Singh (1998) underwriter ranking of the lead investment bank, the log of the market value of the IPO in 1992 constant dollars, the fraction of the post-IPO insider equity subject to lockup, the firm's book-to-market ratio, a dummy variable indicating whether the firm was financed by a venture capitalist, the cash flow margin of the offering firm (defined as the ratio of the operating cash flow to sales), and the percent of offering that is primary shares. We also include an annual time indicator variable to control for possible year effects.

We find that larger firms, firms with higher-quality underwriters, and firms backed by venture capitalists all have shorter lockups on average. Each of these variables is likely associated with less informational asymmetry about firm value in the aftermarket. Firms with high-quality underwriters or venture backing are unlikely to take advantage of outside investors and therefore have less need for the commitment of a longer lockup. Lower book-to-market ratios, generally associated with high-risk, high-growth companies, are associated with longer lockup length. Similarly we find that higher cash flow margins are negatively related to lockup length.

We also find that the fraction of the offering that is primary shares is positively related to the lockup length. In other words, firms that have secondary sales in their IPO have shorter lockups. We interpret this as being consistent with the commitment story. Firms that can sell a higher proportion of secondary shares in their IPO are likely to have lower information asymmetry

[7] The positive association between underwriter rank and underpricing is consistent with the findings in Beatty and Welch (1996) and Krigman, Shaw, and Womack (2001). As the latter authors point out, the negative relationship between underwriter prestige and underpricing that was documented for the 1980s has reversed over the 1990s. Since our sample begins in the late 1980s, it is not surprising that we find a positive relationship.

Table 2
Regression results for length of lockup (Dependent variable–log of length of the lockup (in days))

Constant	6.33	6.54
	[15.96]	[203.10]
Venture capital backed?	−0.10	−0.11
	[5.54]	[7.47]
Log of the market value of equity (1992 $ million)	−0.13	−0.16
	[10.37]	[19.47]
Percent of post-IPO insider shares locked	0.0002	
	[0.42]	
Book-to-market ratio	−0.24	−0.26
	[5.45]	[8.61]
Cash flow margin (%)	−0.003	
	[1.72]	
Underwriter ranking	−0.05	−0.05
	[9.52]	[12.15]
Percent of offering that is primary shares	0.0026	
	[4.67]	
Percent of company's shares issued in the IPO	0.001	
	[1.24]	
Annual time dummy	−0.003	
	[0.58]	
Adjusted R^2	35.4	36.2
Number of observations	1663	2634

Regression results where the dependent variable is the log of the lockup length in days. The independent variables are: The log of the market value of the IPO in 1992 constant dollars. Market capitalization is the product of the offering price and shares outstanding which were obtained from CRSP. The Carter, Dark, and Singh (1997) underwriter reputation rank of the lead investment bank taking values from 1 (lowest rank) to 9 (highest rank). Percentage of post-IPO insider shares locked is the fraction of shares held by insiders after the IPO that are subject to the lockup restriction. To eliminate the influence of outliers, when the number of shares locked exceeds the number of post-IPO shares held by insiders, we set the number of shares locked equal to 99% of post-IPO shares held by insiders. Book-to-market ratio is the ratio of book equity to market equity in the first reporting period following the IPO (Compustat item 60) divided by the market capitalization at the IPO. A dichotomous variable taking the value 1 if the firm was financed by a venture capitalist. The cash flow margin of the offering firm calculated as the ratio of operating cash flow to sales (Compustat items 308 and 12). The percent of total shares offered as primary shares and the percentage of the company's shares, both primary and secondary, issued in the IPO relative to shares outstanding. An annual time indicator variable taking the values 1988 through 1996. To eliminate the possible influence of outliers, for each variable, we replace observations whose values are either lower than the 1st or higher than the 99th percentiles by the sample median. *t*-statistics are in brackets.

problems. If informational asymmetries were high in these firms, the public would not buy into offerings that had a large secondary component. The public would worry that the insiders were "cashing out." Finally, the insignificance of the annual time trend is consistent with the evidence in panel D of Table 1, that there are no systematic variations in lockup length over our sample period.[8,9]

To ascertain that having secondary shares sold at the IPO indicates a lower likelihood of information asymmetry problems, we also conduct a logit

[8] As an alternative to the annual dummy we included the annual volume of IPOs to better capture differences in lockup length that are due to "hot" versus "cold" markets. This variable is, however, insignificant as well.

[9] In unreported results, we repeated the analysis on lockup length including IPOs through the end of 2000 to address concerns that IPO lockups have become more standardized at 180 days. While the fraction of lockups that are exactly 180 days has increased, a large portion of this increase in 180-day lockups is due to changes in the composition of IPOs in the most recent period, that is, increasing average size, increasing underwriter ranking, and greater fraction of venture capital IPOs. The regression results for the length of the IPO in Table 2 remain qualitatively identical.

analysis in which we model the probability of a sale of secondary shares.[10] We find that all of our proxies for lower information asymmetry are positively related to the probability of secondary sales at the IPO. That is, secondary sales are significantly higher for venture capital-backed companies, higher underwriter status, high cash flow margins, and high tangibility of assets. This provides support for our earlier argument that firms in which we observe secondary sales are less informationally sensitive and do not require long lockups.

Finally, if investment banks extract additional compensation by imposing lockups on issuing firms, a hypothesis that we examine in greater detail in Section 6, we would expect that the length of the lockup, controlling for firm and market characteristics, should be positively related to the reputation of the underwriter. We find just the opposite: higher underwriter reputation is associated with shorter lockups. Overall we find evidence indicating that the lockup is a commitment device. Firms that are potentially subject to greater information asymmetry problems utilize longer lockups.

3.2 Testing the predictions of the signaling hypothesis

As was pointed out in the introduction, our tests of the signaling hypothesis hinge on the motivation for the signal. Firms may want to signal their type either to get a higher offering price at the IPO or to get a better price in a subsequent seasoned offering. First, the lockup length and amount locked are all specified in the prospectus well ahead of the IPO. Consequently one implication of the signaling story is that investors would be unable to separate firms *prior* to the submission of the prospectus. Yet during the period *subsequent* to the submission of the prospectus to the SEC, investors observe the signal and therefore high-quality firms should be able to revise their offering price prior to the IPO. We test this implication by calculating, for each firm, the percentage revision in the offering price from the midpoint of the initial offer range. If high-quality firms manage to separate themselves from low-quality firms, we should observe positive revisions (from the initial pooling price) for longer-lockup firms, as these companies are now able to obtain a higher offering price.

For each IPO we obtain the offering range from SDC and calculate the percentage revision from the midpoint of the range. Panel A of Table 3 presents our initial results. We are able to obtain price revisions for 2,786 firms that are then split into positive- and negative-revision subsets. We exclude from the analysis any firm for which the offering price equals the midpoint of the initial range in order to increase the power of our tests. There are 1,039 firms with positive price revisions and 1,094 firms with negative price revisions. We find, contrary to the signaling prediction, that firms that experienced a positive price revision are actually associated with shorter lockup lengths.

[10] These results are not reported and are available from the authors upon request.

Table 3
Tests of the signaling hypothesis

Panel A

Price revision from midpoint of offering range	Positive	Negative	*p*-value for difference in means
Number of IPOs	1039	1094	
Length of lockup (in days)	211	234	1.00
Post-IPO insider shares locked (%)	85.2	84.2	0.19

Panel B

	Number of IPOs	Lockup length (in days)	Post-IPO insider shares locked (%)	Frequency of SEOs (%)	Frequency of dividend initiations (%)
Lockup length > median	738	482	83.4	17.6	2.3
Lockup length < median	263	115	73.7	30.8	3.0
p-value for difference in means			0.00	1.00	0.74

The sample is 2,794 IPOs from January 1, 1988, through December 31, 1996, for which we could find lockup information. We obtain the IPO initial offering ranges from SDC. Price revision is the percent change from the midpoint of the range to the IPO offering price. Percentage of post-IPO insider shares locked is the fraction of shares held by insiders after the IPO that are subject to the lockup restriction. To eliminate the influence of outliers, when the number of shares locked exceeds the number of post-IPO shares held by insiders, we set the number of shares locked equal to 99% of post-IPO shares held by insiders. In panel A we split IPOs with available price revision into those with positive (negative) price revisions and report averages of lockup lengths and percent of post-IPO insider shares locked. The last column in the panel provides a one-tailed *t*-test and its associated *p*-value for the test that the reported average lockup length for the positive revision sample is higher than the average length of the negative revision sample (assuming unknown but equal variances). Panel B examines the incidence of SEOs and dividend initiations *within four years* of the IPO. We collect, from SDC, all SEOs done by our sample firms. The dividend initiation sample is derived by collecting, from CRSP, all ordinary cash dividends initiated by our sample firms. The sample is sorted into a subsample of IPOs whose lockup length is higher than the median lockup length (180 days) and a subsample whose lockup length is shorter than the median length. The last row in the panel provides *p*-values for the *t*-test that the average frequencies of SEOs and dividend initiations and percent shares locked for the longer lockup subsample are higher the average length of the negative revision sample (assuming unknown but equal variances).

The last column provides a one-tailed *t*-test and its associated *p*-value which strongly rejects the null hypothesis. Since it might be argued that the number of shares locked up is used as an additional signal, we verify that the latter variable is unrelated as well to the price revision. The last row in panel A provides the percentage of post-IPO insider shares locked for both subsamples. The sample averages are virtually identical at 85%, confirming the conclusion that the choice of lockup length is inconsistent with the signaling prediction.[11]

[11] In unreported results, we conducted three additional robustness tests. First, we defined positive (negative) offering price revisions as positive (negative) revisions that exceed the high (low) end of the initial range. The resulting sample of positive revisions now includes 556 firms whose lockup length is shorter than that of the subsample of 636 firms whose offering price was less than the low end of the initial filing range. Second, we examine separately the subsample of firms whose offering price equals the midpoint of the initial range. The signaling hypothesis implies that, in a separating equilibrium, we should not observe firms taking costly signal with no revision from the initial (pooling) price range. We find, however, that for this sample of 653 firms, the average lockup length is 353 days, which is significantly larger than the average length for the subsample of firms that experienced a positive price revision, form the initial midpoint. Third, we modeled the probability of a positive/negative price revision within a logit framework, allowing for both firm characteristics and lockup length to determine the direction of the revision. Consistent with the evidence in panel A, we found that lockup length is not positively associated with offering price revision as predicted by the signaling null.

An alternative motivation for a firm to signal its quality by setting a long lockup length is to get a better price in a subsequent seasoned equity offering [Welch (1989)]. We should therefore find firms with longer lockups having a higher incidence of equity offerings. Furthermore, as in Michaely and Shaw (1994), high-quality firms should have a higher incidence of dividend initiations as well.

Panel B of Table 3 presents our results. We first split the sample into a subsample of IPOs whose lockup length is higher than the median lockup length (738 firms) and a subsample whose lockup length is shorter than the median length (263 firms). We purposely exclude firms whose lockup length equals the median length (180 days) so as to make our test more powerful in detecting differences in quality due to differences in lockup length. We collect, from SDC, all seasoned equity offerings conducted by our sample firms within four years of their IPO. The dividend initiation sample is derived by collecting, from CRSP, all ordinary cash dividends initiated by our sample firms, also within four years of the IPO.

Comparison of the frequency of equity offerings reveals that firms with lockup lengths shorter than the median actually have a much higher probability of conducting a subsequent equity offering (30.8% versus 17.6%), contrary to the signaling prediction. This difference is large and significant, both economically and statistically. The same is true when we examine the frequency of dividend initiations. Firms with short lockups actually have a higher probability of initiating dividends (3% versus 2.3%). Finally, we also present differences in the percentage of shares locked up across the two samples since we want to rule out any confounding effects due to the possible role of shares locked as an additional signal. We find that firms that impose long lockups actually lock a *higher* percentage of their post-IPO shares (83.4% versus 73.7%), again refuting the notion that insiders incur two costly signals that, ex post, lead to a higher frequency of equity offerings and dividend initiations.

As a robustness check, in unreported results, we have also conducted a logit analysis in which we modeled the probability of an SEO (dividend initiation) as a function of both firm characteristics and lockup length. Our goal was to ascertain whether the conclusions drawn from panel B are robust to variations in firm characteristics that capture differences in information asymmetry. While the signaling hypothesis predicts that lockup length should be positively related to the probability of either event, we actually observed a statistically significant negative relationship. We therefore conclude that our empirical results are inconsistent with the predictions of the signaling hypotheses and that it is unlikely that the length of lockup is used by insiders to signal higher firm quality.[12]

[12] We have also explored the sensitivity of our results to the omission of IPO underpricing as an additional signal employed by the firm. Empirically we find a strong *positive* relationship between lockup length and

4. Insider Selling Prior to Lockup Expirations

In this section we explore the extent of insider equity sales prior to lockup expiration. Because the lockup agreement is not mandated by the SEC, but is only an agreement between the lead underwriter and the IPO firm, insiders can sell equity if the lead underwriter chooses to "break" the lockup. If the lockup is truly a commitment mechanism, we expect that only firms that have greatly reduced potential for insiders to take advantage of shareholders will be released from the lockup restrictions. As noted above, the commitment hypothesis predicts that firms with higher post-IPO abnormal returns, as well as firms that are associated with higher-tier investment banks and venture capitalists, will be more likely to be released early.

We obtain insider holdings data for the period January 1988 through May 1999, from Primark's cleansed insider data files. The information provided from this source is derived from individual reports mandated by the SEC (Form 3, Initial Statement of Beneficial Ownership of Securities; Form 4, Statement of Changes in Beneficial Ownership of Securities; and Form 5) and is supplemented by data from proxy statements. We determine which of these early sales occurred prior to lockup expiration and retain those transactions that passed their cleansing checks and updates (indicators R and H). Early sales associated with employee benefit plans, derivative transactions, Section 16(b) transactions (such as gifts), and other sales which are clearly unrelated to an early release are deleted. We eliminate insider sales when a comparison of aggregate sales on a given day exceed the reported share volume from CRSP and insiders' early sales that take place around seasoned equity offerings (obtained from SDC). The final sample consists of 1,436 events for 429 IPOs.

Table 4 presents a summary of insider sales prior to lockup expiration. We find that 15% of the firms have insider sales prior to the expiration of the lockup.[13] The average number of insider transactions, conditional on having insider sales prior to lockup expiration, is six, while the median is two. The average and median sales occur 60% of the way from the IPO to the lockup date. It is also noteworthy that the size of sales is quite small. Average (median) sales relative to shares locked up is 5.2% (0.8%). It can be seen that the average 30-day abnormal return (measured relative to the NASDAQ index) is 4.76%.[14]

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underpricing controlling for various firm characteristics and proxies for informational asymmetries. The observed complementarity of the two signals suggests that, controlling for information asymmetry and in a separating equilibrium, high-quality firms chose to lock themselves for a longer period of time and to have high underpricing. When we repeat the tests in Table 3, conditioning on underpricing, we find stronger evidence against the signaling predictions. This result is not surprising in light of the evidence in the literature that underpricing is not used as a signal to convey firm quality [e.g., Michaely and Shaw (1994)].

[13] We include firms that do not appear in the database as firms with no insider sales.

[14] Field and Hanka (2001) find that 17%, 54 of their subsample of 334 IPOs, have insider sales prior to lockup expiration.

Table 4
Summary statistics on insider early sales prior to lockup expirations

	Percentile					
	10th	25th	Median	Mean	75th	90th
Average number of early sales	1	1	2	6	5	14
Average time since IPO as fraction of lockup length (%)	24	50	69	64	84	95
Shares locked relative to shares outstanding (%)	29	48	60	62	69	76
Shares sold early relative to shares locked (%)	0.05	0.17	0.83	5.22	3.32	9.75
Shares locked relative to post-IPO insiders' shares (%)	50	80	92	83	98	99
30-day abnormal return prior to early sale (%)	−16.05	−7.97	2.28	4.76	13.56	28.80
Daily share turnover 30 days prior to early sale (%)	0.25	0.45	0.74	1.21	1.36	2.26

We obtain our insider holdings data for the period January 1988 through May 1999 from Primark's Cleansed Insider Data Files. The information provided from this source is derived from individual reports mandated by the SEC (Form 3, Initial Statement of Beneficial Ownership of Securities; Form 4, Statement of Changes in Beneficial Ownership of Securities). We determine which of these early sales occurred prior to lockup expiration and retain those transactions that passed their cleansing checks and updates (indicators R and H). Early sales associated with employee benefit plans, derivative transactions, Section 16(b) transactions (such as gifts) and other sales which are clearly unrelated to an early release are deleted. We eliminate insider sales when a comparison of aggregate sales on a given day exceed the reported share volume from CRSP and insiders' early sales that take place around seasoned equity offerings (obtained from SDC). The final sample consists of 1,436 events by 429 IPOs. Firms that do not appear in our insider holdings database are considered as firms with no transactions. We calculate the 10th, 25th, 50th, 75th, and 90th percentiles and the mean for various early sale characteristics for those IPOs for which insider sales data are available. In row 1 we report distribution characteristics on the average number of early sales. For example, the mean number of insider sales, prior to lockup expiration, by one of the 429 IPOs is six. Row 2 provides the average time of sale since the IPO. For each sale we calculate the ratio of the time since the IPO relative to the length of the lockup. If, for a given IPO, insiders sold shares in multiple events, we average the resulting ratios. For example, the mean time since the IPO for a sale to occur is at 64% of the specified lockup length. In row 3 we calculate the ratio of shares locked to shares outstanding for each IPO in which a sale occurred. To eliminate the influence of outliers, when the number of shares locked exceeds the number of post-IPO shares held by insiders, we set the number of shares locked equal to 99% of post-IPO shares held by insiders. Row 4 provides information on the percentage of insider shares sold relative to shares locked. Specifically, for each IPO we calculate the ratio of all shares sold early to the shares locked. In row 5 we calculate the percentage of shares held by insiders after the IPO that are subject to the lockup restriction. In row 6 we calculate, for each IPO, the average 30-day buy-and-hold abnormal return measured relative to the NASDAQ index. For example, the mean abnormal return preceding a sale is 4.76%. Row 7 provides information on average daily turnover measured over the period beginning 30 days preceding a sale through a day before the transaction. Both daily volume and shares outstanding are from CRSP. If a firm had more than one insider sale, we average the resulting turnover measures.

Table 5 presents summary statistics on firms that are released from lockups and those that are not released. The sample of insider sales consists of 1,436 events by 429 IPOs. We report descriptive statistics both for the sample IPOs in which insider sales occurred versus the remaining IPO in which sales did not occur. We find that insiders sell prior to lockup expiration in firms that are associated with less moral hazard, that is, larger firms, firms with higher turnover, firms backed by venture capitalists, and firms with higher abnormal returns in the preceding 30-day period. Investors are likely to be very concerned by insider selling activity at low-liquidity firms, firms not backed by venture capital, and firms with low returns because of the higher level of asymmetric information.

A final set of tests relating to insider transactions is presented in Table 6. We estimate logit regressions to determine which firms are more likely to have insiders released prior to lockup expiration. The dependent variable in Table 6 takes the value of one if an early sale occurred prior to the

Table 5
Characteristics of firms with and without early insider sales prior to lockup expiration

Did early sales occur?	Yes	No	*p*-value of difference
Number of IPOs	429	2,317	
Average number of insider sales	6	—	
Sale time as fraction of lockup length (%)	64	—	
Shares locked relative to shares outstanding (%)	62	—	
Shares locked relative to post-IPO insiders' shares (%)	83	—	
Sum of shares sold early relative to shares locked (%)	5.22	—	
30-day abnormal return (%)	4.76	0.03	0.00
Daily share turnover over 30 days prior to sale (%)	1.27	0.01	0.00
Market capitalization	137	118	0.06
Underwriter rank	6.7	6.8	0.71
How many are venture backed? (%)	49	40	0.00

For a detailed description of the construction of the insider database see Table 3. The sample of insider sales consists of 1,436 events by 429 IPOs. We report descriptive statistics both for the sample IPOs in which insider sales occurred versus the remaining 2,317 IPOs in which sales did not occur. Note that the sum of the two subsamples does not add up to 2,974, as we discard events in which insiders' sales coincide with seasoned equity offerings. The variables, average number of insider sales, sale time as a fraction of lockup length, shares locked relative to shares outstanding, shares locked relative to post-IPO insiders' shares, and the sum of shares sold relative to shares locked are described in Table 3. For the no-sale sample we measure the 30-day abnormal return as the abnormal return over the whole lockup period standardized to 30 days. Similarly the daily share turnover for the no-sale IPOs is measured over the whole lockup period. Underwriter rank is the Carter, Dark, and Singh (1997) underwriter reputation rank taking values from 1 (lowest rank) to 9 (highest rank). In the last row we report the frequency of venture-backed IPOs in each subsample. We report *p*-values for the test that the reported averages are unequal (assuming unknown but equal variances).

Table 6
Logit analysis of early release

Variable	Estimate	Standard error	*p*-value
Intercept	9.873	2.163	0.001
Prior abnormal return	0.224	0.023	0.000
Turnover (%)	0.065	0.077	0.402
Underpricing (%)	0.019	0.002	0.000
Venture backing	0.901	0.115	0.000
Lockup length in days	0.005	0.0004	0.000
Log of market value of equity (1992 $ million)	0.355	0.059	0.001
Percent of post-IPO insider shares locked	−0.005	0.002	0.025
High-tech industry	0.300	0.103	0.004
Annual time dummy	−0.151	0.024	0.000
Percent concordant		79.7	
Pseudo R^2		22.1	

The sample is 1,436 insider sales prior to lockup expiration by 429 IPOs and 2,317 IPOs where no sales occurred. We calculate the probability that an early sale occurs prior to the expiration of the lockup agreement. The sum of the two subsamples does not add up to 2,974, as we discard events in which insiders' sales coincide with seasoned equity offerings. The explanatory variables are: The abnormal return prior to an insider sale, measured over the period beginning 30 days prior to a sale through a day beforehand. It is calculated as the difference between the firm's annualized buy-and-hold return minus the annualized NASDAQ return over the same time period. If no sale occurred, we use the annualized abnormal return calculated from the end of the IPO day through the end of the lockup period. Turnover is the average daily share turnover measured over the period beginning 30 days preceding a sale through a day before the transaction. If no sale occurred, we use the average daily turnover measured from the end of the IPO day through the end of the lockup period. Percentage of post-IPO insider shares locked is the fraction of post-IPO shares held by insiders which are subject to the lockup restriction. To eliminate the influence of outliers, when the number of shares locked exceeds the number of post-IPO shares held by insiders, we set the number of shares locked equal to 99% of post-IPO shares held by insiders. A high-tech industry dichotomous variable which is constructed using a subsample of 1,003 IPOs from the following industries: computer manufacturing (SIC codes 3570–3579), electronic equipment (SIC codes 3660–3669, 367–3679, 3610–3659, 3680–3699), computer and data processing services (SIC codes 7370–7379), optical, medical, and scientific equipment (SIC codes 3810–3849), and communications (SIC codes 4800–4899). The remaining variables are the firm underpricing, measured as the percent return from the offering price to the first day closing price, a venture capital dichotomous variable taking the value 1 if the firm was venture backed, the length of the underwriter lockup in days, log of market value of equity in 1992 dollars, and an annual time dichotomous variable taking the values 1988 through 1996. To eliminate the possible influence of outliers, for each explanatory variable (except for the dichotomous variables) we replace observations whose values are either lower than the 1st or higher than the 99th percentiles by the sample median. We report the standard errors for each variable as well as the associated *p*-values. Percent concordant is the percentage times that the fitted model correctly predicts an early release.

lockup expiration. As predicted by the commitment hypothesis, firms that have reduced information asymmetry problems are more likely to have early insider sales. The abnormal return over the preceding 30-day period is positively related to the probability of early sales. Firms with higher returns are likely to have received a series of good news events and investors would be less concerned about management "cashing out." Similarly venture capital backing and larger firm size are all related a greater probability of early lockup release. Large firms likely have more information available about the firm, and venture capital-financed firms have the reputation of their venture capital investors to certify the firms' quality. Finally, firms with a greater fraction of their post-IPO insider shares locked up are less likely to have insiders selling shares prior to the lockup expiration, consistent with the greater need for insiders in these firms to commit to not selling equity.

5. Event-Day Abnormal Return

5.1 Summary statistics

In this section we explore the market price reaction around lockup expiration. Because the parameters of the lockup are well specified in the IPO prospectus, a simple rational expectations prediction is that the average price reaction at the time of the expiration should be insignificantly different from zero. We first test this implication and then examine cross-sectional differences in abnormal returns around this event. In this way we are able to provide additional evidence about the role of investment banks and the function of the lockup provision. The commitment story predicts lower abnormal returns for firms that have had good news or are less subject to moral hazard. The signaling hypothesis, however, has little to say on cross-sectional differences in abnormal returns. Hence Section 6.2, in which we explore differences in prices reaction to lockup expiration, is dedicated to tests of the commitment hypothesis.

We calculate abnormal returns for each IPO beginning on day $t-10$ through $t+10$ as the difference between the IPO firm's buy-and-hold return and the benchmark buy-and-hold return. We follow Michaely, Thaler, and Womack (1995) and use the return on a market index as a benchmark return. We employ the New York Stock Exchange–American Stock Exchange (NYSE–AMEX) value weight index throughout the analysis below.[15] In Figure 1 we plot the average abnormal buy-and-hold return over the 21 event days. From day -10 through day -2, abnormal returns appear to be quite small. From day -1 to day $+2$, however, abnormal returns are large and negative. Prices drop by nearly 1.5% around lockup expiration.

[15] Our results are qualitatively similar if we use other benchmark returns such as the NYSE–AMEX equal weight index, S&P 500, or the NASDAQ buy-and-hold returns.

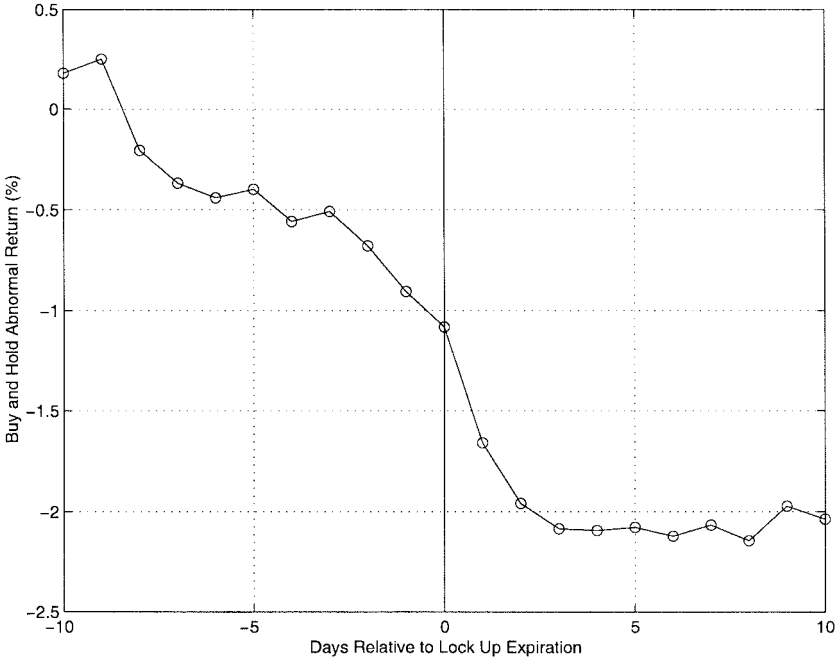

Figure 1
Buy-and-hold abnormal return around lockup expiration

While at first glance the price decline appears to be consistent with a simple downward-sloping demand curve story, it is difficult to explain the pattern within a rational expectations framework. The literature on additions to the S&P 500 show that the price increase occurs when a firm's addition to the S&P 500 is announced [Shleifer (1986), Harris and Gurel (1986), Beneish and Whaley (1996)]. The price rises on the announcement because investors know that there will be increased demand in the future from index funds when the firm is added to the index. Similarly, in the case of underwriter lockups, investors know that a larger fraction of shares are freely tradable after a certain date. The market should anticipate the number of shares sold at lockup expiration correctly, on average, and abnormal return should be insignificantly different from zero [Allen and Postlewaite (1984)]. In order for downward-sloping demand curves to explain the average price decline that we observe, the market must hold consistently incorrect prior beliefs about how much equity will be sold at expiration and must therefore be consistently surprised by how many shares actually come to market.

Costly arbitrage [Pontiff (1996)] might prevent investors from undertaking investments that would correct the temporary mispricing, even if they know how many shares were coming to market. Investors may not want to try to "bet against" the stock by selling it short, because these firms are very

Table 7
Event time percentage abnormal returns

Days from lockup expiration	AR (%)	*t*-statistic	Percent negative	BHR (%)	*t*-statistic
−10	0.18	1.69	51.8	0.18	1.69
−9	0.12	1.24	52.2	0.25	1.93
−8	−0.40	3.92	55.3	−0.21	1.34
−7	−0.10	0.97	52.5	−0.37	2.20
−6	−0.02	0.22	51.4	−0.44	2.39
−5	0.12	1.17	51.4	−0.40	2.01
−4	−0.09	0.92	52.8	−0.56	2.64
−3	0.12	1.11	51.7	−0.51	2.25
−2	−0.15	1.40	54.3	−0.68	2.74
−1	−0.15	1.37	52.4	−0.91	3.59
0	−0.12	1.26	55.2	−1.08	4.10
+1	−0.52	5.00	57.0	−1.66	6.01
+2	−0.19	1.70	54.0	−1.96	6.92
+3	−0.07	0.76	52.1	−2.09	7.15
+4	0.06	0.60	51.6	−2.09	6.97
+5	0.07	0.66	51.2	−2.08	6.72
+6	0.04	0.35	52.5	−2.12	6.70
+7	0.12	1.03	52.3	−2.07	6.24
+8	0.01	0.09	53.6	−2.14	6.37
+9	0.29	2.60	50.7	−1.97	5.76
+10	−0.02	0.14	52.1	−2.04	5.58

Daily abnormal returns and buy-and-hold abnormal returns around lockup expiration. The sample is 2,794 IPOs from January 1, 1988, through December 31, 1996. Since 45 firms delist before their stated lockup expiration, the sample size is reduced to 2,749 IPOs. The benchmark return is the NYSE–AMEX value weighted market return. Buy-and-hold return is calculated from event day −10 through event day +10. Abnormal return is calculated as the difference between the IPO buy-and-hold return and the buy-and-hold return on the NYSE–AMEX value weighted index. We report the average daily abnormal return, denoted AR, and the average buy-and-hold abnormal return, denoted BHR, in the table below. For each event day we also calculate the percentage of negative daily abnormal returns. *t*-statistics are calculated using the cross-sectional standard deviation of the firm abnormal returns.

volatile. Good news may come to market that increases the price and causes a loss on the short position before the expiration of the lockup. Indeed, 40% of the event-day abnormal returns that we calculate are actually positive. Furthermore, we find that transaction costs, calculated as the percentage bid-ask spread relative to the bid price, equal 6.3% on average, and are likely to eliminate the ability of investors to make money from the abnormal return that we document.[16] Finally, it may simply be hard to borrow shares in order to set up a short position given the small amount of shares that have been floated. Therefore, even if the market knows with a high degree of certainty the number of shares that will come to market, costly arbitrage may imply that the price may still decline on average at the expiration of the lockup.

Table 7 provides the daily abnormal returns as well as the buy-and-hold returns. The table reveals that each of the daily average abnormal returns (ARs) from day −3 to day +2 are negative, although only the AR on day +1 is significant. Table 7 also tabulates the buy-and-hold abnormal returns around lockup expiration. Buy-and-hold abnormal returns peak at

[16] For this calculation we use bid and ask prices from CRSP on NASDAQ-listed firms for the period beginning 30 days prior to the lockup expiration through one day before the event.

-2.14% and t-statistics are significantly negative for all buy-and-hold returns from day -7 through day $+10$.[17,18]

The propensity of insiders to sell at the termination of the lockup leads us naturally to examine whether volume is abnormally high around the event. Some of this abnormal volume represents shares that are being sold on the market for the first time. A large part of the volume, however, may be due to increased information flowing to the market as investors observe insiders' selling activity. We are interested in examining whether the price drops at lockup expiration are associated with greater abnormal volume. We calculate abnormal volume as in Brav and Heaton (1999). We obtain the daily volume from CRSP and define normal volume as the mean daily volume in day $t-71$ through day $t-11$ relative to the event day. Abnormal volume is the daily volume in an event day minus the mean daily volume, relative to the daily mean volume. To eliminate the effect of outliers on the analysis we set observations greater than the 99th percentile in each event day equal to the median observation.

The results are presented in Figure 2. Nearly all event days prior to the lockup expiration have an insignificant abnormal volume, except for those on day -3 through day -1, which are marginally significant. Abnormal volume from day 1 onward, however, is positive and statistically significant peaking at 56%. In unreported results we find that abnormal volume does not revert back to zero when we increase the event window, indicating the volume has permanently changed.

5.2 Cross-sectional differences in abnormal returns

In this section we report additional information regarding the negative average abnormal return documented earlier. Our goal is to examine whether cross-sectional differences in abnormal returns around this event can shed light on the competing hypotheses for the existence of lockups. The analysis, presented in Table 8, is similar to Field and Hanka (2001). But while their regressions focus on downward-sloping demand curves, we focus on the potential level of asymmetric information related to firm value. The dependent variable is the buy-and-hold abnormal return from two days prior to two days after the expiration of the underwriter lockup. The independent variables

[17] We also examine the sensitivity of our event study results to the computation of returns [Ball, Kothari, and Wasley (1995)] and to potentially confounding events. First, to address the concern that the abnormal return we document is an artifact of movement of daily closing prices within the bid-ask spread, we calculate daily returns using bid-to-bid prices for those IPOs with available data on CRSP. Since CRSP provides daily closing bid and ask prices for NASDAQ stocks, we employ this subset in the following analysis. We find that the results from Table 7 are not an artifact of trading and market microstructure problems. The bid-to-bid analysis reveals price declines from day -1 to day $+1$ of similar magnitude. Field and Hanka (2001) find similar evidence.

[18] In an earlier draft we also examined whether the lockup expirations coincide with unexpectedly bad earnings announcement news. To this end, we collect, from the Zacks database, all earnings announcements that occur within two days of the lockup expiration. We found, however, that the average abnormal return is of the same magnitude as for the remaining sample.

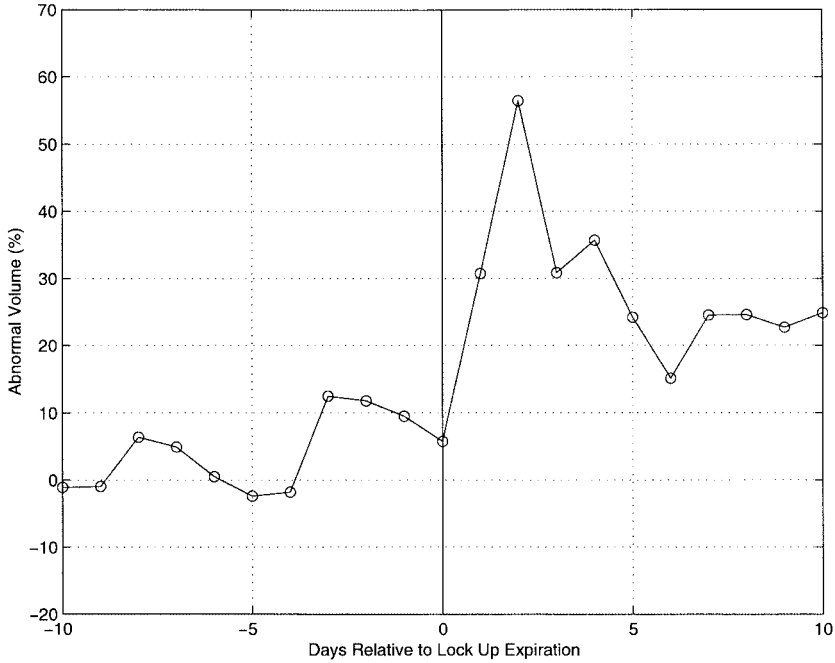

Figure 2
Abnormal volume around lockup expiration

are a dummy variable indicating whether the abnormal return between IPO and lockup expiration is above the median, the log of the market value of the IPO in 1992 constant dollars, the percentage of post-IPO insider shares locked, the percentage of total shares offered as primary shares, the percentage of the company's shares, both primary and secondary, issued in the IPO relative to shares outstanding, the firm's market-to-book ratio, a dummy variable indicating whether the firm was financed by a venture capitalist, the Carter, Dark, and Singh (1998) underwriter ranking of the lead investment bank, the firm's stock price volatility, the cash flow margin of the offering firm, a dummy variable that equals one if the firm performed a seasoned equity offering between the IPO and lockup expiration, a dichotomous variable taking the value 1 if insider sales occurred before lockup expiration, and a dummy variable that equals one if any of the original IPOs had any secondary shares.

The inclusion of variables indicating a firm's status as having performed a seasoned equity offering, having issued secondary shares, or having insiders' sales prior to the expiration of the lockup controls for a reduced desire by insiders in the firm to sell after the lockup expiration. Similarly, in unreported results we find that doing a seasoned equity offering prior to the lockup expiration or having secondary shares in the offering are both positively

Table 8
Regression results for buy-and-hold abnormal returns around lockup expirations (Dependent variable: buy-and-hold abnormal return from two days before to two days after lockup expiration)

Constant	0.12	0.83
	[0.04]	[0.77]
Abnormal return prior to lockup expiration above median abnormal return	0.15	
	[0.33]	
Log of the market value of equity (1992 $ million)	−0.18	
	[0.60]	
Book-to-market ratio	0.65	
	[0.60]	
Venture capital backed?	−1.12	−1.12
	[0.60]	[2.89]
Underwriter rank	0.07	
	[0.58]	
Percentage of post-IPO insider shares locked	−0.02	−0.02
	[1.76]	[2.11]
Percent of offering that is primary shares	0.004	
	[0.17]	
Percent of company's shares issued in the IPO	0.02	0.03
	[1.13]	[2.10]
Cash flow margin	0.05	
	[1.06]	
Did the firm do an SEO after the IPO and before lockup expiration?	2.02	1.78
	[2.48]	[2.32]
Did IPO have any secondary shares?	0.91	
	[1.33]	
Did insiders sell any shares prior to lockup expiration?	0.46	
	[0.85]	
Firm's stock price volatility	−0.30	−0.30
	[1.85]	[2.37]
Adjusted R^2	1.3	1.4
Number of observations	1149	1,818

The dependent variable is the percentage buy-and-hold abnormal return from two days prior to two days after the expiration of the underwriter lockup. The independent variables are: the Carter, Dark, and Singh (1997) underwriter reputation rank of the lead investment bank, taking values from 1 (lowest rank) to 9 (highest rank). The log of the market value of the IPO is in 1992 constant dollars. Percentage of post-IPO insider shares locked is the fraction of shares held by insiders after the IPO that are subject to the lockup restriction. To eliminate the influence of outliers, when the number of shares locked exceeds the number of post-IPO shares held by insiders, we set the number of shares locked equal to 99% of post-IPO shares held by insiders. The percentage of total shares offered as primary shares. The percentage of the company's shares, both primary and secondary, issued in the IPO relative to shares outstanding. Book-to-market ratio is the ratio of book equity to market equity in the first reporting period following the IPO (Compustat item 60) divided by the market capitalization at the IPO. A dichotomous variable taking the value 1 if the firm was financed by a venture capitalist. The cash flow margin of the offering firm calculated as the ratio of operating cash flow to sales (Compustat items 308 and 12). The length of the underwriter lockup in days. A dichotomous variable taking the value 1 if the buy-and-hold abnormal return since the offering was above the median firm's abnormal return. A dichotomous variable taking the value 1 if the firm conducted a seasoned equity offering before the lockup expiration. A dichotomous variable taking the value 1 if insider sales occurred before lockup expiration (insider transactions prior to lockup expiration are described in Table 4). Stock price volatility measured as the daily standard deviation of the firm's abnormal return in the period beginning one day after the IPO and ending seven days prior to the lockup expiration. A dichotomous variable taking the value 1 if the firm sold secondary shares in the IPO. To eliminate the possible influence of outliers, for each variable, we replace observations whose values are either lower than the 1st or higher than the 99th percentiles by the sample median. *t*-statistics are in brackets.

related to our quality variables, including venture capital backing, underwriter ranking, and cash flow margin.[19]

The regression results are consistent with the commitment hypothesis. We find that the firms status as a seasoned equity-offering firm, having sold secondary shares, and early insider sales are related to smaller price drops, although only the seasoned equity-offering dummy is statistically significant. Insiders at these firms are less likely to sell shares at the lockup expiration, hence information asymmetry problems are reduced. Furthermore, to the extent that price volatility proxies for information asymmetry, the negative coefficient is consistent with the idea that lower transparency is associated with larger negative abnormal returns. The negative relationship, however, is also consistent with the discussion in Section 5.1 in which costly (risky) arbitrage limits the ability of arbitrageurs to short sell before lockup expiration.

On the other hand, the presence of venture capital investors and having a greater fraction of shares locked up are both associated with larger price declines. Both of these variables likely proxy for a greater number of shares which are brought to market at the time of the lockup expiration. While we would ideally be able to track all sales at the lockup expiration, including those by venture capitalists, Gompers and Lerner (1998) note that when venture capitalists distribute equity to their investors, they are not required to report this event to the SEC. As such, we cannot tabulate how many shares are actually sold by insiders on the lockup expiration date. In addition, many investors in venture capital funds have automatic sell policies at the time they receive shares in a distribution [see Gompers and Lerner (1998)], and hence more shares will be sold, on average, for venture capital-backed firms than similar firms not backed by venture capital at the lockup expiration. What is clear, however, is that a large number of venture capitalists distribute shares to their investors at the lockup expiration date and many investors sell. Consequently a larger number of shares are likely to come to market at the lockup expiration for venture capital-backed companies.

Overall, the evidence from the price decline at lockup expiration is consistent with the earlier results relating to the use of IPO lockups to overcome information asymmetry. Price declines for firms which are less informationally sensitive appear to be smaller than other IPO firms.

[19] In unreported results, we also included in the regression a high-tech industry dichotomous variable to control for possible industry effects which may influence the nature of information and adverse selection. It was constructed using industry classifications from Brav (2000) and included a subsample of 1003 IPOs from the following industries: computer manufacturing (SIC codes 3570–3579); electronic equipment (SIC codes 3660–3669, 3670–3679, 3610–3659, 3680–3699); computer and data processing services (SIC codes 7370–7379); optical, medical, and scientific equipment (SIC codes 3810–3849); and communications (SIC codes 4800–4899). We found that coefficient on this variable was insignificant, however.

6. Does the Underwriter Make Additional Compensation From Lockups?

Until now we have only been able to examine the commitment hypothesis versus the signaling alternative. In this section we attempt to directly address the hypothesis that underwriters impose lockups on issuing firms to extract additional compensation. This could either be through forcing early sales to be traded by the market maker of the lead underwriter or by having the offering firm do a seasoned equity offering through the same investment bank. In the first case, the underwriter would make the bid-ask spread on the early sales by trading the insiders' shares. In the latter case, the investment bank would make additional fees underwriting the seasoned offering.

We first examine whether there are large market-making profits made during the period of the lockup. We calculate a potential upper bound on the fees that the underwriter could have earned by taking all insider sales prior to lockup expiration and multiplying the number of shares sold by the bid-ask spread on the particular trading day. In this way we can infer the largest gain the investment bank could have earned. First, it is important to note that only 429 of the 2,794 IPOs have any sales prior to lockup expiration. Even in those cases, the size of the transactions are relatively small, on average 5.2% of shares locked (median 0.8%). The average market-maker fee that could have been earned by the lead underwriter in this sample, conditional on an insider sale occurring, was $45,578 (median fee $9,375). These results are in agreement with the results of Ellis, Michaely, and O'Hara (2000), who show that market making brings very little revenue to investment banks after the IPO.

A second test of the underwriter market power story entails examining firms that subsequently do seasoned equity offerings. If the underwriter is using the lockup to gain additional income, then any seasoned offering within the lockup period should be more likely to use the same investment bank as the lead underwriter, controlling for other firm and investment banker characteristics. To test this prediction we follow Krigman, Shaw, and Womack (2001), who have recently examined the determinants of underwriter changes in follow-on offerings. We first obtain information on seasoned equity offerings conducted by our sample IPOs from SDC. We include all seasoned offerings if they occur within four years of the IPO (896 events) and record those SEOs in which a firm has decided to switch its lead underwriter. The underwriter market power hypothesis predicts that if a firm does a seasoned offering, the probability of using the same lead underwriter should be higher if the offering occurs within the lockup period, controlling for the variables which Krigman, Shaw, and Womack (2001) have found significant in influencing the decision of managers to switch underwriters.

Table 9 presents regression results for the SEOs. The dependent variable takes the value one if the firm performs a seasoned equity offering and uses a

Table 9
Logit regression for the probability of switching underwriter in a seasoned equity offering

Variable	Estimate	Standard error	*p*-value
Intercept	7.508	2.073	0.000
Logarithm of the expected proceeds from the IPO	−1.272	0.277	0.000
Percent revision in the IPO offering amount	−1.956	0.468	0.000
Change in the underwriter rank	0.378	0.064	0.000
Days from IPO to SEO	0.003	0.0003	0.000
Net gain/loss of lead all-star coverage	0.284	0.180	0.115
Is the SEO within the lockup period	0.060	0.268	0.822
Percent concordant		78.7	
Pseudo R^2		20.1	

The sample is 896 seasoned equity offerings that took place within four years of the IPO for our sample of 2,794 firms. Data on seasoned equity offerings comes from SDC. The dependent variable takes the value one if the firm performs a seasoned equity offering and uses a different lead underwriter from the lead underwriter that was used in the IPO. Independent variables include the natural logarithm of the expected IPO proceeds, defined as the log of the shares offered times the midpoint of the initial filing range. The actual revision to the IPO offering amount defined as the number of shares offered times the change in the price from the midpoint of the filing range to the final offer price, divided by the expected proceeds. The change in the rank of the underwriter from the IPO to the SEO, where underwriter rank is the same as in Carter, Dark, and Singh (1997). The net gain/loss of lead all-star coverage after the SEO formed as in Krigman, Shaw, and Womack (2001), by collecting information on analyst inclusion in the first, second, or third All-America research team. These data are collected from the October issues of *Institutional Investor* for the period 1988–1999. The number of days from the IPO to the SEO, and a dummy variable that equals one of the SEOs occurs before the expiration of the lockup. To eliminate the possible influence of outliers, for each nondichotomous variable, we replace observations whose values are either lower than the 1st or higher than the 99th percentiles by the sample median. Percent concordant is the percentage times that the fitted model correctly predicts an underwriter switch.

different lead underwriter from the lead underwriter that was used in the IPO. The independent variables are defined as in Krigman, Shaw, and Womack (2001). They are the natural logarithm of the expected IPO proceeds, defined as the log of the shares offered times the midpoint of the initial filing range; the actual revision to the IPO offering amount, defined as the number of shares offered times the change in the price from the midpoint of the filing range to the final offer price, divided by the expected proceeds; the change in underwriter rank from the IPO to the SEO, where underwriter rank is from Carter, Dark, and Singh (1998); the number of days from the IPO to the SEO; the net gain/loss of lead all-star coverage after the SEO, formed as in Krigman, Shaw, and Womack (2001), by collecting information on analyst inclusion in the first, second, or third All-America research team.[20] Finally, we include a dummy variable that equals one if the SEO occurs before the expiration of the lockup. The latter variable should be negatively related to the probability of switching, according to the underwriter compensation hypothesis.

Consistent with Krigman, Shaw, and Womack (2001), we find that the issuer is more likely to switch underwriters when the underwriter of a seasoned offering has a higher rank, that is, offering firms are more likely to "trade up" in terms of investment banks. Similarly an increase in all-star coverage is positively associated with the probability of switching, which, as Krigman, Shaw, and Womack (2001) point out, reflects the importance of

[20] The data are collected from the October issues of *Institutional Investor* for the period 1988–1999.

research coverage to the choice of underwriter. We also find that the probability of changing underwriters is higher the longer the time between the IPO and the SEO as documented by James (1992). Finally, the logarithm of the expected proceeds from the IPO and the percent revision in the IPO offering amount are negatively related to the probability of switching. However, the probability of retaining the same underwriter is unrelated to whether the seasoned offering is within the lockup period or not. This evidence appears to reject the underwriter market power hypothesis because the lockup variable should have increased the probability of retaining the lead underwriter.

7. Conclusion

The use of underwriter lockups has received considerable attention in the business press and our article explores their use and impact on financial markets. In particular, we explore the reason that underwriter lockups exist. We find support for the notion that lockups serve as a commitment device to overcome moral hazard problems subsequent to the IPO. Firms that are unprofitable, that have low book-to-market ratios, that go public with lower-quality underwriters, and are not venture capital-backed have significantly longer lockups. In addition, while 15% of the firms in our sample experience insider sales prior to the expiration of the lockup agreement, early sales by insiders are more likely in firms that have lower incentives for moral hazard. This includes firms that have had higher post-IPO returns, firms that go public with high-quality underwriters, and firms that were financed by venture capitalists. Evidence from the price decline at the lockup expiration indicates that the negative abnormal return is smaller for firms that are more informationally transparent. We find little evidence to support the signaling hypothesis, which predicts that firms would signal their quality to increase the offering price or perform a future seasoned equity offering. Finally, we conduct additional tests that refute the hypothesis that investment banks are able to extract additional compensation by imposing longer lockups.

Our article leaves several questions unanswered. For example, what is the experience with lockups internationally? Is the trading behavior by insiders and the price reaction at expiration similar? What is the role, if any, of analysts around lockup expirations?[21] How do these restrictions relate to the laws

[21] Brav and Gompers (2000) provide evidence on the role of analysts around lockups expirations. We show that analysts, both affiliated and unaffiliated, tend to issue more optimistic earnings forecasts at the time of the lockup expiration. There appears to be no significant difference in the accuracy of affiliated and unaffiliated analyst earnings forecasts. Affiliated analysts, however, tend to issue more favorable recommendations prior to, and at the time of, the lockup expiration. Our findings are consistent with either earnings management or the management of analyst expectations by insiders. It is possible that IPO firms tend to "boost" earnings around the lockup expiration and the analysts extrapolate this trend in their earnings forecasts. Similarly insiders may choose to release more favorable information just prior to lockup expiration to boost analysts' recommendations. Because the insiders sell little of their holdings at the IPO and are restricted from selling until after the lockup expiration, engaging in earnings management prior to the release is clearly in their self-interest [Rajan and Servaes (1995), Brav, Cornelli, and Heaton, (2001), Aggarwal, Krigman, and Womack (2001)].

governing insider trading and information disclosure? In addition, our work potentially provides some insights into policy concerning lockup provisions and insider sales. Should the SEC regulate these IPO lockup contracts?

Finally, the average abnormal return that we document at lockup expiration needs to be more fully explored. We show that the price reaction at the lockup expiration equals −2% on average. This abnormal return is potentially consistent with costly arbitrage and downward-sloping demand curves or investors' incorrect prior beliefs regarding the extent of insider sales. Several recent articles, including Field and Hanka (2001), have documented this price decline as well, but its existence has not been fully explained. Future work will hopefully provide deeper insights into the reasons why this price decline exists and whether the price decline is temporary or permanent.

Appendix: Search for Lockup Information When Missing

In our original sample of 2,871 IPOs from SDC, 255 contained no information on a lockup provision. In order to determine whether any of these firms did or did not have a lockup governing their offering, we took the 255 companies and their IPO dates. We then searched for the company prospectuses on Global Access, Microfiche, Laser Disclosure CD-ROM, and the Edgar database on www.sec.gov. Of the 255 companies, we were unable to locate prospectuses for 45 (entered as "N/A" in our table). For the remaining 210 companies, we looked for information on their lockup agreements in the prospectuses under "Shares Eligible for Future Sale," "Underwriting," and "Additional Market Information." From the 210 companies with available prospectuses, 32 did not have any lockup agreement. The remaining 178 companies were then categorized according to the nature of their lockup agreements: 153 companies had a lockup agreement with the underwriters, 22 had lockup agreements according to SEC Rule 144, and 3 had some shares entered in a lockup agreement with the underwriter and other shares restricted by SEC Rule 144. The results are summarized in Table A.1.

Table A.1

Total companies	255
Company IPO prospectuses not available (N/A)	45
Available prospectuses	210
Companies with no lockup agreement	32
Companies with lockup agreements	178
Companies with underwriter lockup agreements	153
Companies with shares restricted under SEC Rule 144	22

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