

Does Insider Trading Impair Market Liquidity?

Evidence from IPO Lockup Expirations

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Journal of Financial and Quantitative Analysis,

Volume 78, 2005, p1073-1109

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This paper has benefited from the comments of an anonymous referee and the editor, Jonathan Karpoff, Ian Domowitz, Jeff Fleming, Gerald Garvey, Gustavo Grullon, Joel Hasbrouck, Heather Hulburt, David Ikenberry, George Kanatas, Michelle Lowry, Harold Mulherin, Chris Muscarella, Barbara Ostdiek, Dennis Sheehan, Elizabeth Tashjian, Albert Wang, James Weston, and seminar participants at the Penn State University, Peking University, Tsinghua University, Rice University, Vanderbilt University, the 2002 Western Finance Association Meetings, and the 2002 APFA/PACAP/FMA Finance Conference. Thanks to Wilson Kong for excellent research assistance, and the Smeal College for research support. All errors are

our own.

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Abstract

We test the hypothesis that insider trading impairs market liquidity, by analyzing intraday trades and quotes around 1,497 IPO lockup expirations in the period 1995-1999. We find that, while lockup expirations are associated with considerable insider trading for some IPO firms, they have little effect on effective spreads. By contrast, two other liquidity measures, quote depth and trading activity, improve substantially. In the 23% of lockup expirations where insiders disclose share sales, spreads actually decline. These findings indicate that a large body of well-informed, blockholding insider traders can enter a market from which they had previously been absent, and substantially change trading volume and share price, without impairing market liquidity.

I. Introduction

Insider trading is legally restricted in the U.S. and most other Western countries (Bhattacharya and Daouk (2001)).¹ Many U.S. firms supplement these laws with additional private restrictions (Bettis, Cole and Lemmon (2000)). These restrictions are justified partly by the hypothesis that insider trading creates a lemons problem that impairs market liquidity. This prediction flows from standard asymmetric information models including those of Copeland and Galai (1983), Glosten and Milgrom (1985), Kyle (1985), and Leland (1992).

We test the hypothesis that insider trading impairs market liquidity, by analyzing a comprehensive sample of 1,497 IPO lockup expirations in the period 1995-1999. Lockup expirations are an attractive venue for testing information asymmetry models, as they mark the abrupt, pre-announced, large-scale entry of informed, blockholding insider traders into the equity markets for young, growth firms with high potential for information asymmetry. In our sample, 23% of lockup expirations are followed by disclosure of insider selling, usually by officers and directors. This represents only a lower bound on post-expiration insider selling, as some sales are not disclosed. Contrary to our hypothesis, we find only small and temporary increases in the effective bid-ask spread (on the order of 3% of the spread width) lasting less than a week. We find no long-term change in effective spreads, while measures of market depth and trading activity improve substantially. More detailed tests fail to reveal signs of increased information asymmetry or of hidden liquidity impairments that are masked by the benefit of increasing the

¹ In the U.S., trading on the basis of “material, non-public information” is banned under Rule 10b-5 of the Securities Exchange Act of 1934. Section 16 of the Act bans short selling by “Insiders” (officers, directors, and 10% blockholders), allows the firm to recover any profits that insiders make on positions held for less than six months (the short-swing rule), and requires insiders to disclose their trades on Form 4 no later than the tenth day of the following month.

number of tradable shares. For the 23% of our sample firms that disclose insider trading, we find that spreads actually decline. Overall, there is an improvement in market liquidity after lockup expirations.

We argue that the liquidity changes around lockup expirations represent an upper bound on the liquidity impairment due to insider trading in more typical periods. Thus we conclude that, under most circumstances, liquidity is not impaired by insider trading. Perhaps the simplest explanation for our result is that expected losses to insiders are minor compared with the other costs of trading.

The paper is organized as follows. The next section presents an overview of lockup agreements, develops our testable hypotheses, and briefly discusses prior literature. Section III describes our data and methods. Section IV presents the empirical results. Concluding remarks are provided in Section V.

II. Development of Hypotheses

Nearly all IPOs feature lockup agreements: contracts between underwriters and the pre-IPO shareholders that bar share sales for a specified period after the IPO, usually six months. Typically, the locked-up shares constitute two thirds of the public float, and more than 80% of the locked-up shares are owned by insiders. For an analysis of the terms of lockups, see Brav and Gompers (2002).

Bradley, Jordan, Roten and Yi (2001), Field and Hanka (2001), and Ofek and Richardson (2000) find that lockup expirations result in a permanent, 40% increase in trading volume, and statistically significant stock price declines of about 1.5%. Field and Hanka (2001) test several hypotheses to explain this abnormal return.

One of the hypotheses examined by Field and Hanka (2001) is that the price drop is caused by an increase in trading costs, measured by the size of the bid-ask spread. Contrary to the trading costs hypothesis, however, they find little change in quoted, closing spreads. These results do not suggest a decline in liquidity, but can be dismissed as showing only that liquidity cannot be summarized by volume and closing quotes. Market makers do not expect to trade at their closing quotes, and for Nasdaq firms (most IPOs) the quoted spread is typically not offered by any single individual, but is rather a composite of the bid and ask from two different market makers that are each quoting wider spreads. Alternatively, lockup expirations may result in no net change in liquidity because the increase in asymmetric information costs is obscured by the liquidity benefits from increased trading volume.

Here we address these issues by looking at better measures of liquidity. Using these better measures of liquidity, we actually find that, contrary to our hypothesis, lockup expirations seem to improve market liquidity. Moreover, when we control for whether the share price drops or rises in the pre- to post-lockup expiration windows, we find only minor increases in spreads for firms with price decreases, probably due to minimum absolute spreads imposed by tick size, and we find large increases in quote depth and trading volume. These results suggest that the price drop typically experienced upon lockup expiration is not due to a decrease in liquidity. Thus, using better measures of liquidity than Field and Hanka (2001), we find no evidence in favor of the trading costs hypothesis (that is, that the price drop observed upon lockup expiration is due to an increase in trading costs). The conclusion reached by Field and Hanka (2001) is that the price drop observed upon lockup expiration may be caused (at least partly) by downward-sloping demand curves and/or consistently larger-than-expected insider sales.

Lockup expirations have several nice attributes that permit clean empirical tests. The expiration event is visually obvious in time series plots of volume and price, so there is little ambiguity about the relevant event date. The lockup period is largely standardized at 180 days following the IPO, so the timing of the expiration is relatively exogenous for any given firm and does not systematically coincide with other events like earnings announcements. The lockup applies only to insider sales and not to purchases, so its expiration should produce distinctive, asymmetric changes in bid-side and ask-side depth. Finally, lockup expirations are common enough that we can construct a large sample of relatively independent events.

A. Who actually sells shares around lockup expirations?

Field and Hanka (2001) show that locked-up shares are divided roughly evenly among executives, venture capitalists, and other blockholders. When the lockup expires, these well-informed insiders are suddenly freed to sell their shares, subject to the volume constraints of Rule 144.² Under SEC Rule 16(a), all officers, directors, and 10% blockholders are required to disclose their trades via Form 4 no later than the tenth day of the month after the transaction. Examining these disclosures for the period around lockup expirations, we find that 23% of firms report insider sales in the month after the lockup expiration, and most of the sales are by insiders that one would expect to be well informed. For example, executives (e.g., Chairman of the board, CEO, President, Officers and Directors, and other Officers) account for about two thirds of the insider sellers and one third of the shares sold. Most of the remainder of insider sales comes from non-executive directors of the firm.

² Under Rule 144 of the Securities Act of 1933, all shares issued outside of a registered offer, including shares held since before the IPO, are “Restricted shares.” Rule 144 requires that such shares be held at least a year before sale (two years if prior to Feb. 1997), requires sales to be disclosed on Form 144, and limits the total quarterly sales by any individual to the greater of the average weekly trading volume or one percent of the total shares outstanding.

B. Issues that insiders face around lockup expirations

Insider sales may be categorized as either diversification trades or as information trades, depending on whether the seller is motivated primarily by a desire to convert shares into cash, or by a private belief that the shares are overvalued. After lockup expirations, we expect substantial diversification selling because the founders and early investors often have a large fraction of their personal wealth tied up in the firm. We also expect substantial information selling, because the expiration is the insiders' first opportunity to sell shares without advance disclosure and, hence, is their first opportunity to act on their private beliefs about the firm's true value without bearing the full cost of any price declines resulting from disclosure of their trades. Furthermore, in the period immediately following lockup expiration it will be uniquely difficult to prosecute insiders for illegal, information-based selling, as the information-motivated sellers cannot be distinguished from the liquidity-motivated sellers.

C. Liquidity theories and hypotheses

In standard asymmetric information models, risk-neutral competitive market makers trade with both informed and uninformed traders. Informed traders impose losses on the market maker, who compensates by widening the spread or reducing quote depth. See, for example, Copeland and Galai (1983), Glosten and Milgrom (1985), Kyle (1985), and Leland (1992). These types of models apply in the context of lockup expirations. The shareholders affected by the lockup (the founders and early investors) are probably better informed than other investors, particularly since IPO firms tend to be young firms whose value consists mainly of intangible growth opportunities. More formally, in most models a trader is "informed" if and only if his trades tend to foreshadow subsequent price changes. By this definition, the insiders who trade

after lockup expirations seem to be informed, as their trades (as subsequently disclosed to the SEC) are associated with economically and statistically significant drops in share price.³

In these asymmetric information models, insiders' diversification trading is not distinguishable from other non-information trading. Alternatively, Saars' (2001) demand uncertainty model predicts that diversification trading can impair liquidity. The idea is that an insider sell order may foreshadow a sustained insider selling campaign that will eventually increase the supply of shares enough to depress the price. If so, then market makers will tend to regret buying from insiders. We expect this mechanism to operate with unusual force in our sample, as the lockup expiration marks the release of a substantial pent up supply of shares, typically two thirds of the total float. Unfortunately, as Saar (2001) points out, standard statistical tests cannot distinguish this demand-uncertainty effect from the information asymmetry effect. (Looking ahead, our empirical results render this distinction moot: we find neither effect.) Collectively these two theories, information asymmetry and demand uncertainty, imply our first hypothesis, expressed here in alternative form:

H1: Following lockup expirations, bid-ask spreads widen and quote depths decline.

Hypothesis H1 predicts a gross liquidity impairment. It is possible that the effects of lockup expirations are more subtle. For example, any liquidity impairment due to insider trading might be overshadowed by the liquidity improvement from an increased number of tradable

³ Under more normal circumstances (not around lockup expirations) there is considerable debate about whether insider traders are "informed." For evidence on this issue see, e.g., Damodaran and Liu (1993), Halpern (1974), Mandelker (1974), Jaffe (1974), Finnerty (1976), Baesel and Stein (1979), Keown and Pinkerton (1981), Penman (1982, 1985), Elliot, Morse and Richardson (1984), Givoly and Palmon (1985), Seyhun (1988 and 1992), Hirschey (1989), Lin and Howe (1990), John and Lang (1991), Seyhun and Bradley (1997), Noe (1999), and Lakonishok and Lee (2001).

shares. We test for such effects with multivariate controls for trading volume, and by decomposing the spread into separate fixed cost and asymmetric information components, following, e.g., Glosten and Harris (1988), Stoll (1989), George, Kaul and Nimalendran (1991), and Madhavan, Richardson and Roomans (1997). The fixed cost component includes costs of handling the order, financing inventory, maintaining an exchange seat, and profits. The asymmetric information component measures the size of the lemons problem due to the combined effects of information asymmetry and demand uncertainty. Formally, our next hypothesis is:

H2: Following lockup expirations, the asymmetric information component of the spread widens, but the fixed-cost component narrows or remains constant.

Our data also permit simpler, more transparent tests. Lockups prohibit insider sales but not insider purchases, so any effects of lockup expirations should be concentrated in seller-initiated trades. Hence we expect to observe asymmetric changes in bid-side and ask-side quote depth. This pattern should be discernible even if confounding factors are changing both the bid and the ask depth by similar amounts. Formally, our hypothesis is:

H3: Following lockup expirations, bid-side quote depth declines relative to ask-side quote depth.

Finally, the liquidity consequences of lockup expirations may depend on trade size. If insider sellers are trying to generate meaningful profits without attracting attention to themselves, then they may prefer medium-sized trades, say 1,000-10,000 shares. Barclay and Warner (1993) support this hypothesis by showing that medium-sized trades tend to be the most informed. If so, then post-expiration spread increases should be most pronounced for medium-

sized trades. Such a pattern should be discernible even if spreads are generally trending upward or downward. Formally, our final hypothesis is:

H4: Following lockup expirations, effective spreads on medium-sized trades widen relative to spreads on small or large trades.

D. Related literature on liquidity consequences of insider trading

This paper is closely related to the growing literature on the empirical relation between insider trading and market liquidity. Cornell and Sirri (1992) examine insider trading around Anheuser Busch's tender offer for Campbell Taggart, using ex post court records to identify insider trades, and conclude that trading volume and liquidity increased when insiders were active. Bettis, Cole and Lemmon (2000) examine a sample of 284 firms whose internal policies restrict insider trading, and find that effective spreads increase by about two basis points (or 0.02% of share price) during "trading windows" when insiders are allowed to trade. Venkatesh and Chiang (1986) examine earnings and dividend announcements, and find that spreads widen only around unusual earnings announcements: those that are separated from a previous announcement by more than ten days but less than thirty days. Lee, Mucklow and Ready (1993) use intraday data and find evidence that spreads widen around earnings announcements, especially in the minutes immediately prior to the announcement, but they express doubt about whether the resulting increase in trading costs is economically significant. Of course, liquidity is only one component of a broader debate on the merits of insider trading. A good overview of this debate can be found in Leland (1992).

III. Data and Methods

A. Data

Our initial sample is all IPOs in the Securities Data Corporation (SDC) New Issues database, in the period 1995-1999. For a firm to be included in the sample, we require at least three months of Trade and Quote (TAQ) data (obtained from the NYSE) both prior to and after the expiration day. Thus, the earliest expiration day for our sample firms is April 1995, and the latest expiration date is June 1999. (We have TAQ data through September 1999.) We exclude carveouts, stocks with issue price below \$5, REITs, ADRs, unit offers, and firms that conduct a seasoned equity offer before the lockup expires (seasoned offer dates are also from SDC). These exclusions leave a potential sample of 1,534 firms. For each firm, we obtain a complete record of trades and quotes for the period from 30 days before the lockup expiration to 30 days after. We apply standard screens to eliminate trades and quotes flagged as opening, non-standard delivery trades, as well as all Best Bid/Offer (BBO) ineligible quotes. BBO-ineligible quotes are closing quotations, trading halts, pre-opening indications, and non-firm quotations. Our results are qualitatively unchanged if we apply more stringent screens for trading activity. After excluding 37 firms that have fewer than ten days with valid TAQ data in either the pre- or post-expiration windows, we are left with a final sample of 1,497 firms.

An attractive feature of lockup expirations is that they are relatively exogenous events, not systematically timed to coincide with confounding events like earnings announcements. To verify this claim we plotted the frequency of earnings announcements around our sample expiration days (results not reported; data from Dow Jones and First Call). We found no pattern other than a weekly seasonal. (Lockup expirations tend to be on Mondays, while earnings

announcements are most common on Tuesday.) We also replicate our main tests in the subsamples with and without earnings announcements and find qualitatively similar results.

B. Sample Characteristics

Table 1 presents summary statistics for the sample firms. The typical IPO offers one third of the total outstanding shares, leaving two thirds of the shares in the hands of pre-IPO shareholders, almost all of which are locked up. Most lockups are for 180 days, but the mean lockup period is somewhat longer, at 196 days. The average issue value was \$69 million.

Table 1 about here

In the 30-day period before lockup expiration, our sample has an average daily trading volume of 70,105 shares, and a median volume of 37,663 shares. Looking only at Nasdaq firms, our sample has a median daily volume of 35,801 shares, which is about 80% of the 45,658 share median daily volume for all Nasdaq firms in our 1995-1999 sample period. The NYSE firms in our sample have a median daily volume of 49,290 shares, which is about 70% of the 72,683 share median daily volume for all NYSE firms in our sample period.

The average pre-lockup daily number of trades is 59 (median of 21), with an average daily turnover of 0.47% (median 0.33%). Twenty-five percent of the sample firms have fewer than ten trades per day during the pre-expiration period, so a substantial fraction of our sample firms are relatively illiquid. The average pre-lockup trade size is 1,717 shares (median 1,438), with an average quoted spread of 43.8 cents (median 38.9 cents) and average effective spread of 32.7 cents (median 28.7 cents). The average relative quoted spread is 3.6% (median 3.0%), and the average relative effective spread is 2.7% (median 2.3%). The average quoted depth before lockup expiration is 796 shares (median 745 shares).

Figure 1 plots the time series of daily trading volume, showing the large post-expiration changes in trading volume that have been reported previously in Bradley, et al (2001) and Field and Hanka (2001). After the lockup expiration, the sample mean and the median trading volume increase significantly. The mean percentage change in volume (reported later) is much larger, due to some large percentage volume increases for thinly-traded firms.

Figure 1 about here

C. Insider Sales

For all our sample firms, we collect SEC Form 4 disclosures for insider sales in the thirty-day period immediately following lockup expiration. About 23% of firms disclose insider sales in the month after lockup expiration. Summary statistics are presented in Table 2 and indicate that lockup expirations are followed by substantial share sales from insiders that we expect to be well informed. Most of the insider sellers are officers and directors. The Chairman, CEO, President and other director-officers account for 24% of all insider sellers, while other officers comprise 44% of all insider sellers. Non-officer directors account for 22% of all insider sales. By dollar value, officers account for 35% of insider selling, while 55% of dollar value sold comes from directors who are not officers. Notably, venture capitalists who are also board members account for only 7% of the post-lockup insider sellers, yet they account for 30% of the total value sold.

Table 2 about here

When executives sell after the lockup expiration, they tend to sell substantial amounts. The average sale by the Chairman of the Board is over \$3.5 million, while the median sale is almost one million dollars. For the CEO, the average sale is also over \$3.5 million, with a

median of over half a million dollars. For other officers who are also directors, the average sale is about \$2.3 million (median \$360,000.) Sales by directors who are not officers of the firm are larger, particularly for venture capitalists, who sell about \$13.5 million on average (median \$2.5 million.)

The last three columns of Table 2 show the distribution of the upper bound of individual trade sizes as reported to the SEC. These numbers are probably overstated, as insiders may use a single Form 4 to report aggregated sales over short periods. Most individual sales are relatively small and hence are not likely to be negotiated block sale transactions. The one exception may be sales reported by venture capitalists, which are substantially larger than other insider sales, but we cannot tell whether these indicate block trades or aggregations of many small trades.

D. Methods

D.1. Measuring the bid-ask spread

We compute several measures of bid-ask spreads. The quoted spread is defined as the difference between the bid and ask, while the relative quoted spread is defined as the quoted spread divided by the quote midpoint. The effective spread is defined as twice the absolute difference between the transaction price and the midpoint of the prevailing quoted spread. Most of our tests will focus on the relative effective spread (the effective spread expressed as a percentage of the quote midpoint), which we judge to be the best single measure of trading costs when both spread and share price may change concurrently.

For each firm, we compute the daily average spread for each day in the pre- and post-expiration windows, take the mean of the thirty daily averages, then compute the percentage difference between the means in the pre- and post-expiration windows. Our univariate tests measure the cross-sectional mean and median of these 1,497 firm-level percentage changes.

While most of our results are presented for the event window $[-30,+30]$, we also conducted our tests with the window $[-60,+60]$ and obtained qualitatively similar results.

D.2. Measuring market depth and trading activity

We compute several measures of market depth and trading activity. Ask depth is defined as the number of shares offered for sale at the ask price. Bid depth is defined similarly. Average number of shares per transaction, average number of daily transactions, and average daily volume are defined in the obvious manner. The depth-to-spread ratio, a measure of net improvement in liquidity, is defined as the sum of the bid and ask depth divided by the quoted relative spread. These measures are averaged over firms, days, and quote updates in the same manner as spreads are averaged.

D.3. Decomposing the spread

We apply a standard decomposition of the spread into an asymmetric information component, θ , and a fixed-cost component, ϕ , using the decomposition model described in Madhavan, Richardson and Roomans (1997), hereafter MMR. Formally, intraday price changes are assumed to follow:

$$p_t - p_{t-1} = (\phi + \theta)x_t - \phi x_{t-1} + \varepsilon_t + \xi_t + \xi_{t-1} \quad (1)$$

where p_t is the transaction price at time t , and x_t is a trade-direction indicator that takes a value of 1 if the trade is buyer-initiated, -1 if the trade is seller-initiated, and 0 if the trade is a cross. The indicator variable is obtained using the inference procedure suggested by Lee and Ready (1991).⁴

⁴ The trade is assumed to be seller initiated if the price is below the spread midpoint, buyer-initiated if the price is above the midpoint, and a cross if the trade is at the midpoint. Ellis, Michaely, and O'Hara (2000) find that this procedure works well for Nasdaq stocks. We also try an alternative inference procedure suggested by Ellis *et al*, and find qualitatively similar results.

The term ε reflects the innovations in beliefs about share value, and ξ reflects errors caused by price discreteness. For each firm, parameter estimates are obtained from the pooled intraday price changes from all the days in the event window, excluding the price changes from the close to the subsequent open. For a detailed description of this decomposition and of our GMM estimation procedure, see Madhavan, Richardson and Roomans (1997).

IV. Results

A. *Post-expiration changes in spreads and depth*

Figure 2 shows the time series of daily mean effective spreads for the 61-day event window centered on the lockup expiration. The upper panel shows effective spreads measured in pennies per share; the lower panel shows relative effective spreads measured as a percentage of share price. The results indicate a noticeable drop in absolute spreads, but little change in relative spreads, suggesting that spread changes mirror the share price declines that accompany lockup expirations.

Figure 2 about here

We also examine daily percentage deviations from the pre-expiration mean over the [-30,-6] period (results not shown). We find that relative effective spreads widen by 3-4% in the period [-2,+5] but then return to their pre-expiration levels. The temporary widening of the effective spread has small magnitude but is statistically significant.

Figure 3 presents the time series of quote depth, an additional measure of liquidity. Contrary to our hypothesis, quote depth trends upward after the lockup expiration.

Figure 3 about here

Table 3 presents formal tests for a persistent change in liquidity, by comparing several measures of liquidity for the thirty day periods before and after lockup expirations. Consistent with Figure 2, absolute spreads decline, but relative spreads show no clear pattern, with oppositely signed mean and median change. The mean change in the relative effective spread is +1.9%, but the median change is -2.6%. The same ambiguous pattern emerges in the block trade subsample. The disagreement between the signs of the mean and median indicates that spread changes are skewed, with a majority of firms enjoying narrower spreads after the lockup expiration, while a few firms see spread increases of a somewhat larger magnitude. A detailed examination of the data indicates that this skewness is pervasive and is not driven by just a few extreme observations.

Table 3 about here

We expect that the results may depend on the exchange mechanism. Our sample is dominated by Nasdaq firms (1,274 firms), with only 223 (15%) being traded on the NYSE. In unreported tests we find no statistically significant long-term spread changes in either the NYSE or Nasdaq subsamples.

While we see no clear changes in spreads, Table 3 shows clear increases in several measures of depth. The mean change in quote depth is about +22% (median of 4%), and the mean change in the depth-to-spread ratio is +27% (median of 10%). Contrary to our hypothesis, bid-side quote depth does not decline relative to ask-side quote depth. Finally, the last row of Table 3 shows that, consistent with a general increase in liquidity, the post-expiration increase in trading volume is due to increases in both trade size and number of trades.

B. Changes in the asymmetric information component of the spread

Here we test the hypothesis that lockup expirations widen the asymmetric information component of the spread but not the fixed component. Table 4 presents our spread decomposition estimates for the thirty-day pre- and post-expiration periods. The coefficients are reasonable in the sense that they are similar to those reported elsewhere, e.g., in Cao, Choe and Hatheway (1997), Glosten and Harris (1988), and Madhavan, Richardson and Roomans (1997). Our detailed analysis of firm-level estimation results reveals that the MRR model fits the data similarly well during both the pre- and post-expiration periods.

Table 4 about here

The main result is that the asymmetric information component, θ , does not change after the lockup expires. In the post-expiration period, the mean fitted value of θ is 2.41 cents per share, virtually identical to the 2.40 cents in the pre-expiration period. The difference is not statistically significant. The fixed cost component, ϕ , declines from 12.03 cents to 11.57 cents, a statistically insignificant reduction of 0.46 cents. The time series of abnormal effective spreads suggests that the short-term effects of the lockup expiration are larger than the long-term effects. To test whether there is a significant short-term increase in asymmetric information costs, we also estimate the model in the period [+1,+10]. The results show a slightly increased asymmetric information component and slightly reduced fixed-cost component, consistent with the changes one would predict from simultaneous increases in insider trading and total trading volume. However, once again, the change in the asymmetric information component has small magnitude and is not statistically significant.

It is worthwhile to point out that results of spread decomposition should be interpreted with caution. Simulation study performed by Saar (2001) indicates that the asymmetric information component of the spread produced by traditional decomposition models may pick up the effects of investor uncertainty. In other words, the estimated asymmetric information component may bundle information about investor preferences and endowments with private information about the firm. However, since the demand uncertainty model cannot be estimated by using intraday data, we leave the question of decomposing spreads into asymmetric information, demand uncertainty, and fixed-cost components for future research.

C. The relation between spread changes and trade size

We now test the hypothesis that post-expiration spread increases are concentrated in medium-sized trades. Table 5 shows pre- to post-expiration changes in relative effective spreads for various classes of trade size. The results generally indicate favorable liquidity changes for large trades relative to small trades. Contrary to our prediction, effective spreads for medium-sized trades (1,000-5,000 shares or 5,000-10,000 shares) actually decline relative to those for smaller or larger trades. The most pronounced difference is a median 8% decline in the spreads on trades of 5,000-10,000 shares. Thus, the relation between trade size and spread changes does not support the hypothesis that effective spreads on medium-size trades widen relative to small or large trades.

Table 5 about here

D. Multivariate tests

Spreads and quote depth are functions of share price, trading activity, trade size, and volatility, all of which are likely to change when the lockup expires. To test whether these confounding factors affect our results, we estimate multiple regression models of the relative

effective spread and quote depth, with controls for price change, trading activity, and volatility (results not shown). The sample for this test includes two observations per firm: one observation for the mean of the 30-day pre-expiration period and another for the mean of the 30-day post-expiration period. The coefficients on all the control variables have the predicted signs and are highly significant. In the quote depth model, the coefficient on a post-expiration dummy implies a post-expiration depth increase of 60 shares, or 7.5% of the pre-expiration average quote depth of 800 shares. However, in the spreads model, the post-expiration effect is not statistically significant in any specification. (Details available on request.) Thus, we find substantial post-expiration increases in quote depth that are not explained by concurrent changes in price, volume and volatility, but we find no abnormal change in spreads.

E. The effects of price changes

The relative spread is known to be a declining function of share price, due to minimum tick size and other factors (Harris (1994)). Prices tend to drop after lockup expirations, and in our multivariate spread model, the bulk of the explanatory power (39% of a maximum 43%) comes from the control for price changes. To investigate further, we partition the sample by the sign of the post-expiration price change. The results, shown in Table 6, indicate that price changes and spread changes are strongly related. When prices decline, the relative effective spread widens by an average of 12% (median of 6%). Conversely, when prices rise, the relative effective spread narrows by an average of 10% (median of 12%). These changes are much larger than those we observe in the combined sample, and results for a subsample of firms with larger price changes are even more extreme. Among the 185 firms whose price increases more than 20%, fully 90% show narrower effective spreads. Conversely, spreads widen in 77% of the 192

firms whose price falls more than 20%. Thus, it appears that spread changes after lockup expirations are driven primarily by price changes.

Table 6 about here

F. Insider Sales

In this subsection, we investigate more directly the effects of insider trading and answer the question of whether the effect of insider sales is different for illiquid and liquid stocks. We first partition our sample into two equal-sized subsamples, illiquid and liquid firms according to daily average number of trades during the pre-lockup period.⁵ Next, we break our sample into two further subsamples: those firms that report insider sales to the SEC via Form 4, and those firms that do not report insider sales. We then repeat our main tests on each of the four subsamples.

The results are reported in Table 7. As expected, comparing Panels A and B, we observe that spreads tend to be higher in illiquid stocks. However, holding liquidity constant, we find that insider selling (as revealed by Form 4 disclosures) is not associated with spread increases. In fact we find the reverse. When insiders sell, relative effective spreads actually narrow in both the illiquid and liquid subsamples, and the difference is insignificant. Averaged across the illiquid and liquid subsamples (not reported in the table), we find that firms reporting insider sales see their relative effective spreads decline by a statistically significant (though economically small) 4.4% (median of 8.7%). Further, the average effective spread on block trades (10,000 shares or more) decreases by 5.2% (median decrease of 12.2%). Thus, it is not the case that spreads widen when insiders are selling; in fact, the reverse is true.

⁵ We also use daily average share volume during the pre-event period as an alternative partitioning variable and find qualitatively similar results.

The average increase in quote depth is similar across the four subsamples: all are close to 20%. However, the average increase in share volume is significantly different for firms with and without insider sales, regardless of whether the stock is illiquid or liquid during the pre-lockup period. For example, for illiquid (liquid) stocks, the average increases in daily share volume are 19% and 56% (0.2% and 25%), respectively, for firms without and with insider sales reported, and the difference is significant at the 5% level. Thus, after controlling for pre-lockup liquidity, we find a significantly larger reduction in the effective spread and a significantly larger increase in volume for firms with insider sales.

Finally, we compare changes in spreads, depth, and volume between illiquid and liquid stocks, controlling for insider sales (to conserve space, the results are not reported in the table). However, we find no significant differences in the effective spread measures, and we find a significant difference (at the 5% level) in daily volume between illiquid and liquid stocks such that illiquid stocks experience higher increases than do liquid stocks. For example, for those firms with insider sales reported, the increase in daily volume is 56% for illiquid stocks, but only 25% for liquid stocks. Collectively, our results suggest that the improvement in liquidity (as measured by the effective spread and volume) is larger for those firms with the participation of insiders, and that the improvement in liquidity (as measured by volume) is larger for illiquid stocks.

Table 7 about here

Perhaps one explanation for our earlier result is that insider selling enhances liquidity by increasing the number of tradable shares. The lockup expiration marks not only the arrival of new insider traders, but also the arrival of their newly-tradable shares. Any shares sold by insiders will increase the publicly tradable float, and the subsequent re-trading of these new

shares could create long-term liquidity benefits that obscure the long-term costs of increased asymmetric information. Such effects should have been captured by the controls for trading activity in our multivariate model, or by our spread decomposition model, but as a robustness check we replicate our tests in a subsample where there is little or no increase in the number of tradable shares because insiders do not sell. We reason that the hypothesized liquidity impairment is caused not by actual insider sales (which are largely unobservable until after the fact) but rather by the ex ante possibility that insiders *might* sell. However, any liquidity improvements due to an increase in the number of tradable shares will be caused only by actual insider sales. Thus, if we examine a subsample with no insider selling, we should observe the costs of *potential* insider selling, unobscured by any benefits from *actual* insider selling.

Unfortunately, SEC disclosures are neither complete enough nor accurate enough to demonstrate the absence of insider selling. For example, venture capital partnerships frequently distribute IPO shares directly to their limited partners. Such distributions, and the subsequent open-market sale of the distributed shares, need not be reported (see Gompers and Lerner (1998)). Thus, it is possible for firms to experience insider sales, even though no SEC Form 4 disclosures are made. As a result, we cannot be confident that the firms listed in Table 7 as not reporting insider sales actually experienced no insider selling. Therefore, to identify a clean subsample of firms that we are certain had no disclosed (or undisclosed) insider selling, we hand-collect ownership data from IPO prospectuses and subsequent proxy statements. Specifically, we compare the share ownership disclosed in the IPO prospectus with that disclosed in the first proxy statement after our event window. When the two documents indicate no reduction in the holdings of the pre-IPO shareholders, we conclude that no significant insider sales occurred in our event window.

Since this test is labor intensive, we limit our attention to a relatively small subsample. We restrict the sample to the firms whose IPOs occurred after May, 1996, the first date for which we can obtain prospectus data. We then sort first by year and then by firm name, and select every fourth firm. This procedure yields a subsample of 246 firms, of which we could obtain usable data for 216.

A weakness of this test is that the prospectus and the proxy do not itemize all shareholdings, only those of officers, directors, and 5% blockholders, so we cannot track share sales by pre-IPO shareholders who are not insiders. On average, we are able to account for 84% of the total locked-up shares (median=93%). Our method may also miss an increase in the public float due to incentive shares that are received by insiders after the IPO and then sold at lockup expiration. However, such sales should be rare, as incentive shares typically do not vest for at least a year.

We find that, in 113 firms (52%), the pre-IPO shareholders did not sell any of their shares, and in another 15 firms (7%), their share sales amounted to less than 0.5% of the shares outstanding. Thus, in 128 firms (59%) insiders hang on to virtually all of their shares until at least the first proxy date after the expiration window, typically about a year after the IPO. For these firms, we can be reasonably certain that the publicly tradable float did not materially increase during our event window.

For the 128 firms with little or no insider selling, Table 8 presents the pre- to post-expiration changes in several measures of liquidity. Despite the relatively small sample, the statistical power of the tests is sufficient to reach some order-of-magnitude conclusions. The pre- to post-expiration changes in bid-ask spreads show the same ambiguous pattern that was observed in the full sample, with positive mean but negative median. The changes in quote

depth have substantially positive mean and median. For all the measures of trading activity, the mean change is positive but the median change is small or negative, indicating that changes in trading activity are skewed. Overall these results indicate that the conclusions we draw from the broader sample are not driven by the increase in the tradable float due to insider sales.

Table 8 about here

V. Conclusions

To test whether insider trading affects market liquidity, we analyze the liquidity changes around the expirations of 1,497 IPO lockup agreements in the period 1995-1999. Lockup expirations mark the sudden release of a near-total prohibition on insider selling, and represent the first occasion in which an extremely well informed group of blockholding insiders — the founders and early investors in a firm — can profit from their inside knowledge by selling their shares at the same price offered to non-insiders. Since lockup expirations typically occur in high-growth firms with a limited public history, the information asymmetry between insiders and outsiders is potentially severe. Empirically, lockup expirations are significant events, resulting in large, sudden changes in price and trading volume.

Analyzing SEC disclosures, we find that lockup expirations result in substantial selling by officers and directors. However, when we compare the periods before and after lockup expiration, we find only small and temporary increases in the effective bid-ask spread, on the order of 3-4% of the spread, or about 0.12% of share price, lasting about a week. Over longer horizons we find no significant increase in spreads, and what spread changes we do observe seem to be driven by price changes. Quote depth, average trade size and number of trades per day all increase substantially. In the 23% of firms where insiders disclose share sales, spreads

actually decline. More detailed tests reveal no increase in the adverse selection component of the spread and no evidence of increased asymmetric information costs that might be masked by the general increase in trading activity. Overall, contrary to predictions of both the asymmetric information and demand uncertainty models, lockup expirations seem to improve liquidity. The simplest interpretation for our results, that lockup expirations seem to improve liquidity, is that expected losses due to insider trading are small relative to the other costs of making a market, and hence have little effect on spreads and quote depth.

Future research might further investigate the impact of insider trading on market liquidity. Under current laws, the insiders in our sample are free to trade on the basis of their general opinions about the firm's quality and valuation, but they may be reluctant to trade on the basis of their specific knowledge of impending events that might trigger large price changes and subsequent SEC investigation (Muelbroek (1992)). Future research could test whether this distinction is important, by examining the liquidity changes around lockup expirations or other significant events in countries and time periods in which insider trading is not regulated.

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FIGURE 1
Trading Volume Around Lockup Expirations

The sample is 1,497 U.S. lockup expirations in the period 1995 through 1999. Data are from TAQ.

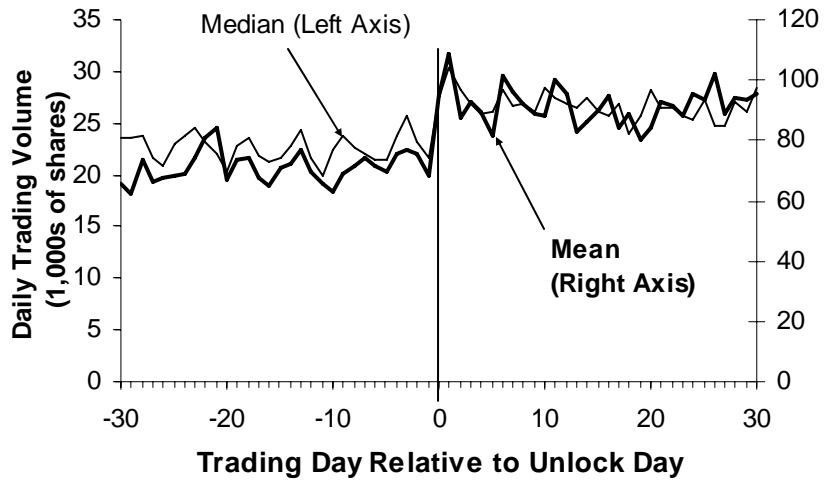


FIGURE 2

Average Effective Spreads Around Lockup Expirations

Effective spreads are measured in pennies per share; relative effective spreads are measured as a percentage of the quote midpoint. The effective spread is calculated as $2 \times |P_t - M_t|$, where P_t is the transaction price at time t and M_t is the midpoint of the bid and ask quotes in effect at time t . The sample is 1,497 U.S. lockup expirations in the period 1995 through 1999. Data are from TAQ.

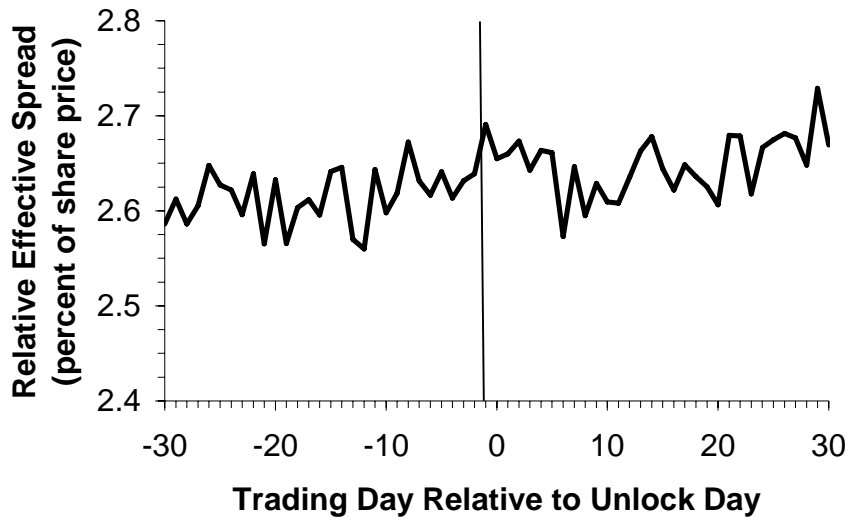
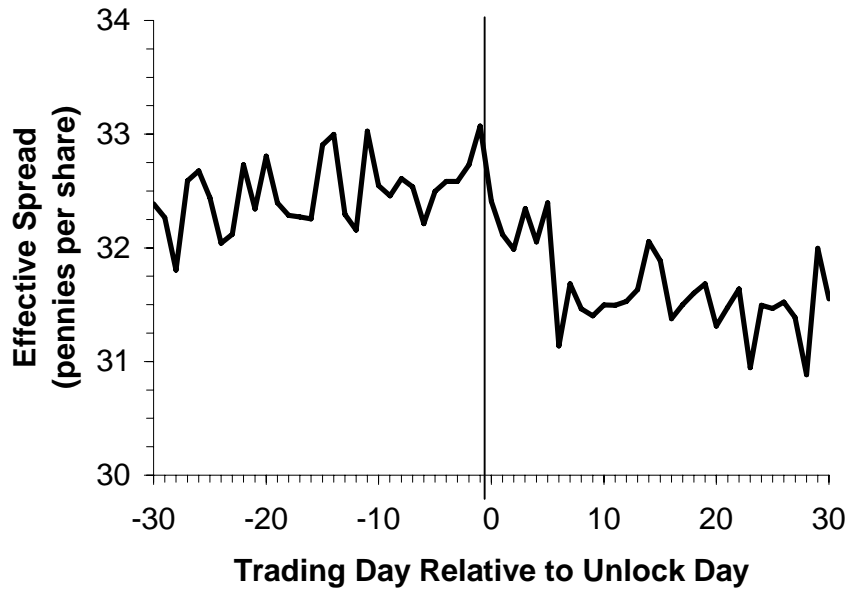


FIGURE 3

Average Quote Depth Around the Lockup Expiration

Plotted values are the average of the bid-side and ask-side depth, the minimum number of shares that the market maker guarantees to transact at the quoted price. The sample is 1,497 U.S. lockup expirations in the period 1995 through 1999. Data are from TAQ.

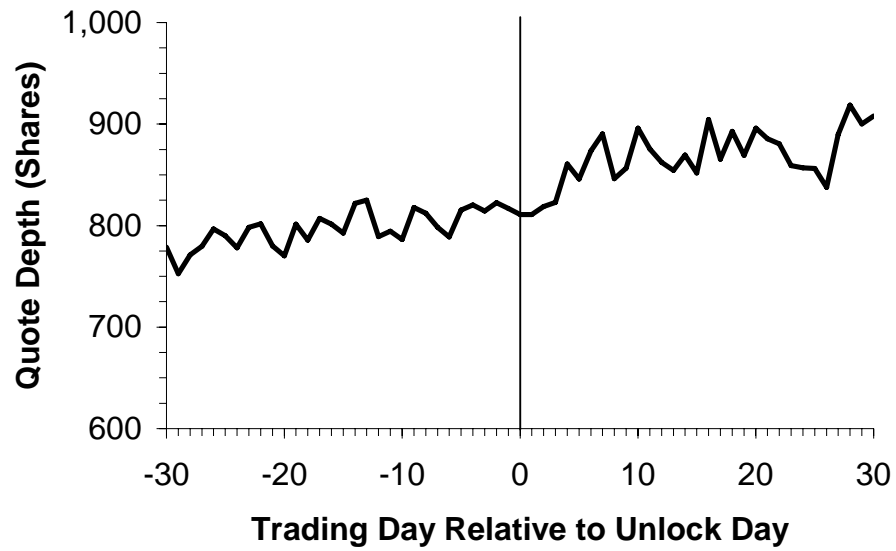


TABLE 1
Summary Statistics for Sample Firms

The sample is 1,497 U.S. lockup expirations in the period 1995 through 1999. Pre-lockup variables are measured in the 30-day period before lockup expiration. Issue value is the amount raised (in millions) in the offering. The effective spread is calculated as $2 \times |P_t - M_t|$, where P_t is the transaction price at time t and M_t is the midpoint of the bid and ask quotes in effect at time t . Quoted depth is the average of the bid-side and ask-side quote depth. Effective and quoted spreads are measured in pennies per share; relative effective and relative quoted spreads are measured as a percentage of the quote midpoint.

Variable	Mean	Std.Dev.	Median	Min	Q1	Q3	Max
Percent of total shares sold in IPO	33%	16%	31%	3%	22%	40%	100%
Lockup period (days)	196	78	180	30	180	181	1081
Issue value (\$ million)	\$69	\$180	\$35	\$3	\$22	\$59	\$3963
Pre-lockup daily volume (shares)	70,105	124,376	37,663	2,020	19,842	72,806	1,517,638
Pre-lockup number of daily trades	59	201	21	2	10	45	4,725
Pre-lockup daily turnover (volume/shares outstanding)	0.47%	0.49%	0.33%	0.01%	0.18%	0.58%	5.7%
Pre-lockup trade size (shares)	1,717	1,084	1,438	270	1,036	2,088	17,973
Pre-lockup quoted spread	43.8¢	20.8¢	38.9¢	5.6¢	29.8¢	53.3¢	201.4¢
Pre-lockup effective spread	32.7¢	18.3¢	28.7¢	4.8¢	18.8¢	41.2¢	125.9¢
Pre-lockup relative quoted spread	3.6%	2.5%	3.0%	0.3%	2.0%	4.4%	46.6%
Pre-lockup relative effective spread	2.7%	1.8%	2.3%	0.3%	1.4%	3.4%	17.8%
Pre-lockup quoted depth (shares)	796	736	745	185	494	977	17,536

TABLE 2
Distribution of Insider Sales After Lockup Expirations

This table reports the distribution of reported insider sales in the window [0, 30] after the unlock date for the 347 firms (23% of the sample) that report insider sales on SEC Form 4. Multiple transactions by the same shareholder are aggregated, except in the *Individual Trade Size* columns. Individual Trade Size gives the upper bound of individual trade sizes as reported to the SEC, as insiders may use one SEC Form 4 to report aggregated sales over short periods.

Insider Seller	% of All Sellers	% of Total Value Sold	\$ Sales by Insider Type		Individual Trade Size		
			Mean	Median	Q1	Median	Q3
Employees	68%	35%	\$ 1,526,274	\$ 279,364	2,500	5,000	15,000
<i>Chairman of the Board</i>	7%	8%	\$ 3,594,499	\$ 944,000	5,000	12,500	35,000
<i>CEO</i>	5%	6%	\$ 3,556,971	\$ 558,250	5,000	11,600	32,273
<i>President</i>	3%	3%	\$ 3,165,956	\$ 837,250	5,000	7,500	33,585
<i>Other Officer, also Director</i>	9%	7%	\$ 2,286,633	\$ 361,619	2,500	5,000	15,428
<i>Other Officer, Non-Director</i>	44%	10%	\$ 695,310	\$ 208,092	2,000	5,000	10,000
Directors who are not officers	22%	55%	\$ 7,397,433	\$ 499,750	2,100	7,083	24,450
<i>Venture Capitalists</i>	7%	30%	\$13,504,721	\$2,468,916	4,799	16,138	86,054
<i>Non-Venture Capitalists</i>	16%	25%	\$ 4,819,682	\$ 402,988	2,000	5,000	15,800
Beneficial owners not affiliated with firm	5%	7%	\$ 4,121,975	\$ 562,480	2,000	6,000	30,000
<i>Venture Capitalists</i>	1%	3%	\$ 7,946,174	\$4,522,125	5,000	20,000	50,000
<i>Non-Venture Capitalists</i>	4%	4%	\$ 3,095,971	\$ 380,000	2,000	5,000	22,000
Former Employees and Former Directors	4%	2%	\$ 1,492,402	\$ 450,000	3,000	7,000	16,000
<i>Former Employees</i>	3%	1%	\$ 2,499,371	\$1,222,600	2,500	5,500	15,500
<i>Former Directors</i>	1%	1%	\$ 1,146,256	\$ 449,250	5,000	9,800	16,000
Total	100%	100%	\$ 2,965,730	\$345,869	2,500	6,000	17,455

TABLE 3
Tests for Persistent Univariate Changes in Liquidity

Reported statistics are based on the distributions of the 1,497 firm-level means in the 30-day periods before and after the lockup expiration day. The effective spread is calculated as $2 \times |P_t - M_t|$, where P_t is the transaction price at time t and M_t is the midpoint of the bid and ask quotes in effect at time t . The Depth-to-Spread Ratio is (Bid Depth + Ask Depth)/(Relative Quoted Spread). When comparing results across columns, note that the percentage change in the mean does not necessarily equal the mean percentage change. The sample is 1,497 U.S. lockup expirations in the period 1995 through 1999. Intraday data are from the TAQ database. Because of the scarcity of block trades, the sample size for the block trade spread results is 263 firms.

Variable		Before	After	% Change	% Positive
Quoted Spread (pennies)	<i>Mean</i>	43.8	43.4	-0.1	
	<i>(Std Err)</i>	(0.5)	(0.6)	(0.6)	44%
	<i>Median</i>	38.9	38.5	-1.2	
Effective Spread (pennies)	<i>Mean</i>	32.7	31.9	-1.1	
	<i>(S.E.)</i>	(0.5)	(0.5)	(0.6)	42%
	<i>Median</i>	28.8	27.3	-2.6	
Relative Quoted Spread (percent)	<i>Mean</i>	3.6	3.7	3.4*	
	<i>(S.E.)</i>	(0.1)	(0.1)	(0.7)	47%
	<i>Median</i>	3.0	3.0	-1.0	
Relative Effective Spread (percent)	<i>Mean</i>	2.7	2.7	1.9*	
	<i>(S.E.)</i>	(0.1)	(0.2)	(0.7)	46%
	<i>Median</i>	2.3	2.3	-2.6	
Relative Effective Spreads on Trades of 10,000 Shares or More	<i>Mean</i>	1.2	1.2	3.9	
	<i>(S.E.)</i>	(0.1)	(0.1)	(2.5)	46%
	<i>Median</i>	1.0	1.0	-2.8	
Bid-Side Quote Depth	<i>Mean</i>	797	859	21*	
	<i>(S.E.)</i>	(23)	(21)	(2)	58%
	<i>Median</i>	749	785	4*	
Ask-Side Quote Depth	<i>Mean</i>	795	875	22*	
	<i>(S.E.)</i>	(15)	(17)	(2)	57%
	<i>Median</i>	742	799	4*	
Depth-to-Spread Ratio	<i>Mean</i>	704	810	27*	
	<i>(S.E.)</i>	(26)	(30)	(2)	60%
	<i>Median</i>	510	556	10*	
Number of Daily Trades	<i>Mean</i>	59	73	32*	
	<i>(S.E.)</i>	(5)	(9)	(3)	52%
	<i>Median</i>	22	24	8*	
Trade Size (Shares)	<i>Mean</i>	1,717	1,827	18*	
	<i>(S.E.)</i>	(28)	(28)	(2)	57%
	<i>Median</i>	1,438	1,560	5*	
Daily Volume (Shares)	<i>Mean</i>	70,105	50,171	58*	
	<i>(S.E.)</i>	(3,214)	(4,980)	(4)	57%
	<i>Median</i>	37,663	43,890	14*	

*Indicates significance at the 5% level using two-tailed t-test (for mean) or signed rank test (for median).

TABLE 4
GMM Estimates of the Spread Components

This table reports cross-sectional averages of the estimated parameters of the Modhavan, Richardson and Roomans (1997) model. θ is the asymmetric information cost per share, ϕ is the fixed cost per share. The implied spread is the difference between implied bid and ask prices and is given by $2(\phi+\theta)$. The proportion of asymmetric information cost relative to the implied spread is $\theta/(\phi+\theta)$. Standard errors are given in parentheses; all coefficients are statistically significant. The sample is 1,497 U.S. lockup expirations in the period 1995 through 1999. Day zero is the lockup expiration day.

	Period 1: [-30, -1]	Period 2: [1, 30]	Period 3: [1, 10]
θ = Asymmetric information cost per share (cents)	2.40 (0.04)	2.41 (0.07)	2.45 (0.05)
ϕ = Fixed cost per share (cents)	12.0 (0.2)	11.6 (0.2)	11.4 (0.2)
Implied Spread (cents)	28.9 (0.4)	28.0 (0.5)	27.6 (0.5)
Proportion of asymmetric information cost (%)	21.7 (0.5)	21.7 (0.5)	22.6 (0.5)

TABLE 5**Changes in Relative Effective Spreads by Trade-Size Category**

Reported statistics are based on the distributions of the 1,497 firm-level means in the 30-day periods before and after the lockup expiration day. The relative effective spread is calculated as $2 \times |P_t - M_t| / M_t$, where P_t is the transaction price at time t and M_t is the midpoint of the bid and ask quotes in effect at time t . When comparing results across columns, note that the percentage change in the mean does not necessarily equal the mean percentage change. Standard errors (S.E.) are in parentheses. The sample is 1,497 U.S. lockup expirations in the period 1995 through 1999. Intraday data are from the TAQ database.

Trade Size		Before	After	% Change
100-500 (shares)	<i>Mean</i>	2.8%	2.8%	2.1%*
	<i>(S.E.)</i>	(0.1)	(0.1)	(0.8)
	<i>Median</i>	2.5	2.4	-2.7
	<i>% Positive</i>			45%
501-1,000	<i>Mean</i>	2.5	2.5	2.4*
	<i>(S.E.)</i>	(0.1)	(0.1)	(0.1)
	<i>Median</i>	2.1	2.0	-2.9
	<i>% Positive</i>			46%
1,001-5,000	<i>Mean</i>	2.4	2.4	2.1*
	<i>(S.E.)</i>	(0.1)	(0.1)	(0.8)
	<i>Median</i>	2.0	2.0	-3.5
	<i>% Positive</i>			46%
5,001-10,000	<i>Mean</i>	1.6	1.5	1.7
	<i>(S.E.)</i>	(0.1)	(0.1)	(1.6)
	<i>Median</i>	1.3	1.2	-7.9*
	<i>% Positive</i>			41%
> 10,000	<i>Mean</i>	1.3	1.2	3.9
	<i>(S.E.)</i>	(0.1)	(0.1)	(2.5)
	<i>Median</i>	1.0	1.0	-2.8
	<i>% Positive</i>			46%

*Indicates significance at the 5% level, using two-tailed *t*-test (for mean) or signed rank test (for median).

TABLE 6

Changes in Spreads and Quote Depth by Post-Expiration Price Change

Reported statistics are based on the distribution of percentage changes between the pre- and post-expiration windows, [-30,-1] and [+1,+30]. “Price Falls” and “Price Rises” are based on the average share price over the pre- and post-expiration windows. The relative effective spread is calculated as $2 \times |P_t - M_t| / M_t$, where P_t is the transaction price at time t and M_t is the midpoint of the bid and ask quotes in effect at time t . Quote depth is the average of the bid and ask depth, the number of shares the market maker guarantees to transact at the quoted price. Standard errors (S.E.) are in parentheses. The sample is 1,497 U.S. lockup expirations in the period 1995 through 1999. Intraday data are from the TAQ database.

		Price Falls (n=796)	Price Rises (n=701)
Percent Change in Relative Effective Spread	<i>Mean</i>	12.2*	-10.1*
	<i>(S.E.)</i>	(1.1)	(0.7)
	<i>Median</i>	6.4*	-12.4*
	<i>% Positive</i>	62%	23%
Percent Change in Quote Depth	<i>Mean</i>	24.6*	17.8*
	<i>(S.E.)</i>	(2.6)	(2.0)
	<i>Median</i>	6.0*	1.8*
	<i>% Positive</i>	60%	55%

**Indicates significance at the 5% level using two-tailed t-test (for mean) or signed rank test (for median)*

TABLE 7

The Effect of Lockup Expiration on Effective Spreads, Depth, and Volume for Firms that Do or Do Not Report Insider Sales

Summary statistics for effective spreads, depth, and volume during the 30-day periods before and after the expiration day. The sample firms are partitioned by daily average number of trades during the pre-lockup period and also partitioned by whether insiders disclosed share sales in the 30-day post-expiration period. By SEC Rule 16(a), all trades by officers, directors, and 10% blockholders must be disclosed on Form 4. The “% Change” column is based on the distribution of firm-level percentage changes. The effective spread is calculated as $2 \times |P_t - M_t|$, where P_t is the transaction price at time t and M_t is the midpoint of the bid and ask quotes in effect at time t . Quote Depth is the average of the bid and ask depth. The sample period is 1995 through 1999. Reported statistics are based on the distributions of the firm-level means and changes.

Panel A: Illiquid stocks

Variable		No Insider Sales Reported (n=605)			Form 4 Insider Sales (n=144)			P-value for difference in % change for insider trades vs. no reported insider trades
		Before	After	% Change	Before	After	% Change	
Effective Spread (Pennies)	Mean	35.1	35.0	0.8	45.0	42.4	-4.7*	0.03*
	Median	31.7	30.5	-1.8	42.2	38.6	-7.6*	
Relative Effective Spread (Percent)	Mean	3.4	3.5	5.5*	3.3	3.1	-2.9	0.00*
	Median	3.0	3.0	0.6	3.0	2.8	-9.6*	
Quote Depth	Mean	786	867	20*	677	730	21*	0.93
	Median	750	780	5*	744	777	1*	
Daily Volume (Shares)	Mean	22,860	30,418	19*	26,651	54,931	56*	0.00*
	Median	19,196	22,360	17*	24,153	43,560	48*	

Panel B: Liquid stocks

Variable		No Insider Sales Reported (n=550)			Form 4 Insider Sales (n=198)			P-value for difference in % change for insider trades vs. no reported insider trades
		Before	After	% Change	Before	After	% Change	
Effective Spread (Pennies)	Mean	25.8	25.1	-1.1	35.3	33.1	-4.8*	0.04*
	Median	22.1	20.9	-3.4*	31.7	30.2	-7.3*	
Relative Effective Spread (Percent)	Mean	2.0	2.0	2.0	1.8	1.7	-5.5*	0.00*
	Median	1.8	1.7	-2.1	1.7	1.6	-8.2*	
Quote Depth	Mean	842	918	18*	755	827	19*	0.66
	Median	756	804	4*	714	818	5*	
Daily Volume (Shares)	Mean	110,063	127,709	0.2	135,076	194,104	25*	0.00*
	Median	66,896	69,368	-2.0	82,670	106,706	21*	

*Indicates significance at the 5% level using two-tailed t-test (for mean) or signed rank test (for median)

TABLE 8**Liquidity Changes in Firms with No Change in Insider Ownership**

Percentage changes in spreads, quote depth, and trading activity between the 30-day periods before and after the IPO lockup expiration day. Reported statistics are based on the distribution of firm-level percentage changes. Quote depth is the average of bid-side and ask-side depth. The sample is 128 U.S. firms in which insiders retained more than 99.5% of their shares until at least the first proxy date after the expiration event window. Data are from TAQ.

		% change
Relative Effective Spread	<i>Mean</i>	4.2
	<i>(S.E.)</i>	(2.6)
	<i>Median</i>	-1.9
	<i>% Positive</i>	47%
Quote Depth	<i>Mean</i>	31.1*
	<i>(S.E.)</i>	(6.6)
	<i>Median</i>	15.6*
	<i>% Positive</i>	69%
Number of Daily Trades	<i>Mean</i>	11.4
	<i>(S.E.)</i>	(6.7)
	<i>Median</i>	-6.4
	<i>% Positive</i>	44%
Trade Size (Shares)	<i>Mean</i>	13.7
	<i>(S.E.)</i>	(7.5)
	<i>Median</i>	2.6
	<i>% Positive</i>	52%
Daily Share Volume	<i>Mean</i>	29.4*
	<i>(S.E.)</i>	(10.4)
	<i>Median</i>	-2.7
	<i>% Positive</i>	46%

*Indicates significance at the 5% level using *t*-test (for mean) or signed rank test (for median)