International Review of Financial Analysis 29 (2013) 107–118

Contents lists available at ScienceDirect

International Review of Financial Analysis

Short sales constraint and SEO pricing

Charlie Charoenwong [a], David K. Ding [b,c,*,1], Ping Wang [a]

[a] Division of Banking and Finance, Nanyang Business School, Nanyang Technological University, Singapore 639798, Singapore
[b] School of Economics and Finance, College of Business, Massey University, Auckland, New Zealand
[c] Lee Kong Chian School of Business, Singapore Management University, Singapore 178899, Singapore

ARTICLE INFO

Article history:
Received 27 March 2013
Accepted 14 April 2013
Available online 3 May 2013

JEL classification:
G18
G14

Keywords:
Short sales constraint
Information content of stock prices
Seasoned equity offering (SEO)
SEC Rule 105

ABSTRACT

We examine the influence of SEC's Rule 105 on informed trading and the information content of stock prices around an SEO's offer day. We show that constraints on short sales inhibit informed trading and hamper incorporation of information into stock prices for offers whose traders have private adverse information and without options listing. The constraints contribute to increased price uncertainty and higher market sensitivity to seller-initiated trading. After controlling for other causes of SEO discounts, we find that the decrease in information content of stock prices just before an offer day has a significant impact on the SEO's value discount.

1. Introduction

This paper examines the effects of SEC Rule 105, which places restrictions on short sales during the period five trading days before a seasoned equity offering (SEO). Specifically, the rule prohibits short sellers during the five-day period prior to an offering from covering their short positions with shares received through the equity issue and is meant to reduce the possibility of manipulative short selling prior to the offering. Manipulative short sellers attempt to drive down the stock price prior to an SEO and cover their short positions by buying back at the discounted SEO offer price. However, in reducing the possibility of manipulative short selling, the rule also puts limits on informed short selling. With less informed short selling, stock prices could become less informative prior to SEOs. The paper provides evidence consistent with informed short sellers being driven from the market during the five days before SEOs.

There was a dramatic increase in the size of seasoned equity offering (SEO) discounts during the 1990s. For example, Corwin (2003) reports an average discount of 1.15% for seasoned equity offers from 1980 to 1989 and an average discount of 2.92% from 1990 to 1998. While the discount for SEOs seems to be smaller than the discount for initial public offerings (IPOs), it is still a large issuing cost for offering firms. Altinkilic and Hansen (2003) document that in the 1990s the issuing expense attributable to discounting was more than $2.6 billion, which is more than 50% of the underwriting fees paid to investment bankers.

Many studies (e.g., Corwin, 2003; Kim & Shin, 2004) attempt to explain the substantial increase in SEO discounts in the 1990s. They suggest that the adoption of SEC Rule 10b-21 was one of the main reasons for the large SEO discounts. Rule 10b-21, adopted by the National Association of Securities Dealers (NASD) on August 25, 1988, prohibited short sellers from covering their short positions established after the filing of registration statements or Form 1-A with securities purchased from an underwriter, broker, or dealer participating in the offering. NASD was concerned that investors would use pre-pricing short sales to drive the stock price down and obtain new issued shares at artificially low offer prices. Rule 10b-21 was designed to prevent manipulative short sales that could cause the market to function as an independent pricing mechanism and erode the integrity of the offer price. However, Gerard and Nanda (1993) argue that the adoption of Rule 10b-21 not only prevented manipulative conduct, but it also restricted informationally-motivated sales. According to Kim and Shin (2004), the implementation of Rule 10b-21 saw a substantial increase in SEO discounts. They claim that Rule 10b-21 reduced the information content of trading before equity offerings and increased uncertainty, and they conclude that the larger discounts in the 1990s were the result of Rule 10b-21. Corwin (2003) finds that the time-series increase in SEO discounts can be partially explained by Rule 10b-21's restriction on short sales. Altinkilic and Hansen (2003) suggest that this surprising

* Corresponding author at: School of Economics and Finance, College of Business, Massey University, Auckland, New Zealand. Tel.: +64 9414 0800; fax: +64 9441 8177.
E-mail addresses: d.ding@massey.ac.nz, davidding@smu.edu.sg (D.K. Ding).
[1] Tel.: +65 6828 0245; fax: +65 6828 0427.

1057-5219/$ – see front matter © 2013 Elsevier Inc. All rights reserved.
http://dx.doi.org/10.1016/j.irfa.2013.04.001

increase may be due to higher offer frequency and contracting competition in the 1990s or to the adverse effects of Rule 10b-21.

In order to create an exception for transactions that are unlikely to have a market impact, in March 1997, the SEC adopted Rule 105, Regulation M, to replace Rule 10b-21. Like Rule 10b-21, Rule 105 prohibits short positions established during the restricted period from being covered with securities obtained from an underwriter, broker, or dealer who is participating in an offering. However, Rule 105 only restricts short sales made five trading days before the offering's pricing rather than the potentially much longer restricted period of Rule 10b-21, which commenced with the filing of the registration statement, Form 1-A. Rule 105 shortens the restricted period because some short sales are motivated by a short seller's evaluation of the stock's future performance, which can contribute to pricing efficiency and should be treated differently from manipulative conduct. The SEC instituted Rule 105 to increase the information content of market prices, decrease uncertainty about stock value, and reduce the cost to issuers.

Henry and Koski (2010) examine short sales around SEOs. Similar to the present study, they investigate the effects of SEC Rule 105 on short sales prior to SEOs and find that Rule 105 constrains some but not all manipulative trading. However, the present study makes several important contributions that go beyond examining whether Rule 105 effectively regulates manipulative conduct without causing adverse effects on non-manipulative trading. First, it uses a longer five-year sample period starting one year after the new rule became effective. Second, intraday data is employed, allowing more powerful tests. Third, the study controls for stocks without listings on the options market as it could be argued that, when short selling is restricted, informed trading can still occur through the options market.

The present study analyzes the effects of short sales constraints imposed by Rule 105 on informed trading and information content of stock price from three fronts. First, the daily change in price uncertainty is observed during the restricted period. The measures of effects of short sales constraints on information content of stock price employed in this study are the change in intraday volatility, estimated using 5-minute returns, and the standardized unexpected trading volume, which is used as a proxy for investors' opinion divergence. Many studies (e.g., Altinkilic & Hansen, 2003; Kim & Shin, 2004) use the volatility of daily returns as a measure of price uncertainty; however, volatility of daily returns, which is generally defined as the standard deviation of daily close-to-close returns over the 30 trading days ending 11 days before an offer, reflects historical information and may be affected by the fluctuation in the whole market. In fact, informed trading before an issue can alter the information asymmetry between issuers and investors. Gerard and Nanda (1993) suggest that an informed short sale before an offering can increase the information content in the stock price. Danielsen and Sorescu (2001) claim that even when short selling is restricted investors still can react to negative information through the options market. Therefore, volatility calculated with historical prices is not a good proxy for a current information environment. Compared to volatility calculated from historical daily returns, intraday volatility is more useful for estimating time-varying volatility. It can capture day-to-day changes in price uncertainty during the restricted period, which is the focus of the present study. In addition, Fleming, Kirby, and Ostdiek (2003) show that intraday-return-based volatility plays a more important role in determining investing strategies. They evaluate the advantages of intraday volatility in the context of investment and find that volatility timing at the daily level outperforms volatility timing over a long horizon. Therefore, it is reasonable to choose intraday volatility as one of the measures of price uncertainty. Furthermore, due to the existence of constraints on short sales, unfavorable information cannot be incorporated into stock price immediately. Therefore, it becomes more and more difficult for investors to interpret the trading activities observed in the stock market and estimate the true value of stock prices, which will lead to greater divergence in investors' opinion. In this paper, we apply Garfinkel and Sokobin's (2006) method of using the standardized unexpected trading volume to measure the extent of investors' opinion divergence.

Second, the asymmetry of market makers' price sensitivity to the order flow of different trading directions (buy-initiated versus sell-initiated orders) is examined to discover if an increase in uncertainty during restricted period is the result of short sales constraints. According to Kyle (1985), market-markers should be more price-sensitive to order flow from expected informed trading volume. Following Chae (2005), we measure price sensitivity by regressing the change of transaction prices on signed trading volume. Rule 105 should only limit the behavior of short selling and restrict the incorporation of unfavorable information into stock prices. Therefore, as time goes by, the potential of seller-initiated informed trading increases. The cumulative effects of constraints on informed trading based on unfavorable information cause market makers to become more sensitive to seller-initiated trading than to buyer-initiated trading.

Third, using the three-tiered approach suggested by Lee and Radhakrishna (2000), possible informed transactions and liquidity transactions are identified, and the change in informed transactions and liquidity transactions are analyzed during the restricted period. Consistent with the predicted effects of short sales constraints, stocks that are not susceptible to these constraints experience larger increases in the number of informed transactions and smaller increases in the number of liquidity transactions.

The results of our study show that price uncertainty increases significantly during the restricted period for stocks susceptible to short sales constraints, especially on the trading day immediately before pricing, whereas an increase in price uncertainty is not obvious for stocks that are not susceptible to these constraints. These findings are consistent with the prediction that short sales constraints result in the decrease in information content of stock price and thus the increase in price uncertainty.

The results also show that, during the restricted period, market makers' asymmetric response to seller-initiated trading for stocks susceptible to short sales constraints becomes more apparent, whereas the asymmetry of market makers' price sensitivity hardly changes for stocks that are not susceptible to short sales constraints. These findings support the view that the flow of unfavorable information is inhibited by short sales constraints. We further examine the relationship between the cumulative effect of short sales constraints on the information content of stock price and the extent of SEO discounts. We find that, after controlling for other factors that may affect SEO pricing, such as price pressure, rounding of stock prices, and rent expropriation, the reduction in the information content of stock prices stemming from the short sales constraint is a main determinant of SEO discounts.

The remainder of this article is organized as follows: In Section 2, theories concerning the discounting of new offers are summarized, and testable hypotheses related to SEO discounting are developed; Section 3 describes the sample data and summary statistics; Section 4 discusses the influence of short sales constraints on information content of stock price; Section 5 describes the tests of hypotheses related to SEO discounting; in Section 6, the adjustment of stock price on the offer day is analyzed; and Section 7 concludes.

2. Literature review

2.1. Uncertainty and asymmetric information

Most theories about the underpricing of IPOs are based on the assumption of asymmetric information between equity issuers, investment bankers, and outside investors. On the one hand, if issuers are better informed than investors, then rational investors will be concerned about the so-called lemons problem: that is, it might

not be possible to distinguish between good and bad firms, and only low-quality issuers will offer the market's average price. Therefore, good issuers will discount their offer price to signal their quality and recoup this discount in subsequent equity issues, dividend announcements, or analyst coverage (Allen & Faulhaber, 1989; Chemmanur, 1993; Welch, 1989). On the other hand, if some investors have better knowledge about the price that the market can bear, then the issuer faces a placement problem.

Rock (1986) presents a model in which a group of investors has better information than the firm and other investors. He shows that if new shares are priced at their expected value these informed investors will drive out other investors when IPOs are good and withdraw from the market when IPOs are bad. Therefore, issuers have to place their IPOs at a discount in order for the shares to be purchased by uninformed investors. This argument has been dubbed the "winner's curse." Welch (1992) proposes an alternative explanation for IPO underpricing based on the assumption of better-informed investors. In his information cascade model, when IPO shares are sold sequentially, potential future investors can learn from the purchasing decisions of earlier investors, who presumably are more informed about the equity's value. This behavior, however, can rapidly lead to cascades in which investors will gradually ignore their private information and imitate earlier investors. As a result, offerings succeed or fail very soon, and issuers always underprice to avoid failure.

Because of the periodic earnings announcements made by companies and purchase recommendations released by financial analysts, the information asymmetry of SEOs is not as large as the information asymmetry of IPOs, but the uncertainty about stock prices still exists. Therefore, the study discussed in this article examines whether or not firms with high information asymmetry and uncertainty about a stock's value will have a larger SEO discount.

2.2. Constraints on informed trading

Research shows that the implementation of Rule 10b-21 increased issuing costs. For example, Gerard and Nanda (1993) claim that the limits on short sales prior to a new offer inhibit the release of new information and increase stock price uncertainty. In order to compensate for the additional risk absorbed by buyers of new shares, underwriters have to discount their offer price. Kim and Shin (2004) and Corwin (2003) show that SEO discounts increased substantially after the enforcement of Rule 10b-21. Although Rule 105 shortens the restricted period to five trading days, the possibility remains that non-manipulative transactions will be adversely affected by the restriction. In this article, the change in the uncertainty of stock value around an offer day is examined to determine whether the substantial increase in discounts during the trading days immediately before an offer day is due, in fact, to the unintended effect of the restrictions on informational short sales. The decrease in information content stock price on the pricing of SEOs is also estimated in this article.

2.3. Alternative explanations of SEO discounting

2.3.1. Permanent versus transitory price pressure

Research that examines the effects of price pressure has produced mixed results. For example, Corwin (2003) reports a positive and significant relation between the relative offer size and the extent of discounting. However, the multivariate models of Kim and Shin (2004) show that the coefficient of the relative offer size is positive but not significant at the 1% level. Altinkilic and Hansen (2003) find that larger offers have lower discounts, whereas a larger relative offer size (i.e., the number of new shares issued divided by the number of shares already outstanding) has a larger discount.

The theories of price pressure also vary. Some researchers (e.g., Mikkelson & Partch, 1985; Scholes, 1972) maintain that price pressure is temporary, and investors should be compensated for absorbing this temporary pressure. Other researchers (e.g., Asquith & Mullins, 1986) argue that price pressure leads to a permanent increase in supply and a corresponding permanent reduction in stock price. If the market is efficient, the downside price adjustment should be completed immediately after the announcement of the new offer. In other words, the closing stock price prior to an offer should have already incorporated the price pressure of a new offer and, therefore, it is not necessary for underwriters to artificially discount the offer price. In this present study, underwriters' response to an increased supply of shares is estimated to determine whether price pressure is permanent or transitory.

2.3.2. Pricing at closing bid and rounding of closing price

Research shows that sometimes SEOs are priced at the closing bid quote or at integers. For example, Corwin (2003) reports that 24.36% of new offers on the NYSE are priced at the closing bid quote. Mola and Loughran (2004) and Bradley, Cooney, Jordan, and Singh (2004) note that offer prices of both SEOs and IPOs cluster at integers. We examine whether the value discounts of SEOs are simply due to these two pricing practices.

2.3.3. Rent expropriation

Loughran and Ritter (2002) point out that lead underwriters tend to exploit the gains of issuers by underpricing for those investors who are more likely to repay the bank through future reciprocal deals. Affleck-Graves, Hedge, and Miller (1994) suggest that, if this hypothesis is true, then discounts will be higher when more good news is released about the firm, regardless of whether the news is private or public. Therefore, it was assumed that there was a positive relation between the positive cumulative abnormal returns over the five trading days immediately before the SEO and the extent of discounting.

3. Data

3.1. Data selection

The sample of SEO firms used in the present study was obtained from the Securities Data Company (SDC) database, which provides the offer date, gross proceeds, offer price, shares issued, and number of shares outstanding. The sample consists of 201 new equity issues on the NYSE from March 1998 to September 2002, excluding IPOs. The following criteria were used to screen the data. First, to be included in the sample, the issues had to be ordinary common shares and could not be a unit offering, shelf offering, closed-end fund, real estate investment trust (REIT), or American Depository Receipt (ADR). Second, firms with offer prices smaller than $1.00 were not included in the study. Third, firms that are not in NYSE's Trade and Quote (TAQ) database or the (CRSP) database were not included in this study.

As noted by Lease, Masulis, and Page (1991) and Corwin (2003), some firms announce new offer prices after the market closes, and the effective offer date should be the next trading day of the offer date. Safieddine and Wilhelm (1996) document that on an offer day trading volume increases sharply. Therefore, the effective offer date is identified by using a volume-based adjustment method. Specifically, if the trading volume on the day following the offer date is more than twice the volume of the offer date and more than twice the average daily trading volume over the 250 days prior to the offer date, the day following the offer date is considered the effective offer date.

Intraday data were collected from the TAQ database. Only trades executed on the NYSE are included. Raw transactions data, however, may contain some problems, such as misordered time series and the existence of data outside regular trading hours. Therefore, time series data are reordered and observations that lie outside the trading interval, between 9:30 am and 16:00 pm Eastern Standard Time, are not included in the present study. Market information, such as stock prices, returns, market index, and shares outstanding, was obtained from the CRSP database.

In order to identify whether a stock is listed on the options market, the database of monthly options trading volume was downloaded from the Chicago Board Options Exchange (CBOE) website.[2] If there was no record of options trading during the issuing month, this stock was identified as one with no listing on the options market.

3.2. Variable definitions and summary statistics

3.2.1. Measure of SEO discount

Following Altinkilic and Hansen (2003) and Corwin (2003), the discount of seasoned equity offerings is defined as follows:

$$DISCOUNT = \frac{P_{-1} - P_{offer}}{P_{-1}} \quad (1)$$

where P_{-1} is the closing transaction on the day immediately prior to the offer day, i.e., day −1, and P_{offer} is the offer price.

Summary statistics for the sample SEOs are provided in Table 1.

The average discount across the full sample is approximately 2.08%, which is lower than the average discounts in the 1990s but higher than the average discounts in the 1980s. This suggests that, although the adverse effect under Rule 105 is less severe than the adverse effect under Rule 10b-21, it is still present under the new rule. Of the 201 SEOs included in the sample, 81% are priced below the closing transaction price at day −1, and 8.5% are priced at the closing price. The remaining 10% are priced above the closing price.

3.2.2. Measures of reduction in information content of stock price

The first variable used to measure the increase in price uncertainty due to a reduction in information content of stock price is the change in intraday volatility prior to an offer relative to a benchmark period, ΔVOL_t, which is calculated as follows:

$$\Delta VOL_t = \frac{VOL_t}{VOL_{Benchmark}} - 1 \quad (2)$$

where $VOL_{Benchmark}$ is the intraday volatility during the benchmark period measured by the median of VOL from day −30 to −11. Following Andersen, Bollerslev, Diebold, and Ebens (2001), intraday volatility, VOL_t, is calculated as the square root of the total of sum of the squared 5-minute returns. That is,

$$VOL_t = 100 * \sqrt{\sum_{j=1}^{N_t} r_{t,j}^2} \quad (3)$$

where N_t is the number of 5-minute-intervals in day t, $r_{t,j}$ is the return in the jth interval, which is calculated as the difference of the logarithm of the last transaction price of the jth interval and the logarithm of the last transaction price of the (j-1)-th interval. The summary statistics listed in Table 1 shows that 69% of the issuing firms experience an increase in price uncertainty over the two trading days immediately prior to an offer.

Another variable used to measure the effects of short sales constraints on information content of stock prices is the standardized unexpected trading volume (SUV), which is calculated using a methodology that is similar to the market model approach (Garfinkel & Sokobin, 2006).

$$Volume_{it} = \hat{\alpha} + \hat{\beta}_1 \left|R_{it}\right|^{+} + \hat{\beta}_2 \left|R_{it}\right|^{-} + \varepsilon_{it}, where\ t = -120, \ldots, -11 \quad (4)$$

$$UVolume_{it} = Volume_{it} - \hat{\alpha} - \hat{\beta}_1 \left|R_{it}\right|^{+} - \hat{\beta}_2 \left|R_{it}\right|^{-}, where\ t = -5, \ldots, 5 \quad (5)$$

$$SUV_{it} = UVolume_{it} / S_{it} \quad (6)$$

where $Volume_{it}$ is the number of shares traded in stock i on day t. $|R_{it}|^{+}$ and $|R_{it}|^{-}$ denote the absolute value of positive daily return and absolute value of negative daily return for stock i on day t, respectively. S_{it} is the standard deviation of ε_{it} in model (4).

Garfinkel and Sokobin (2006) suggest that trading volume arises from three effects: Liquidity effects, informedness effects (the extent to which some investors are more informed), and consensus effects (the extent of agreement among investors). They assume that trading volume arising from informedness effects are related to price moves, and that trading volume from liquidity and consensus effects are uncorrelated with price moves. Therefore, the intercept estimated in Eq. (4) represents the trading volume due to liquidity effects and $\hat{\beta}_1$ and $\hat{\beta}_2$ capture the informedness effects. The unanticipated trading volume can be attributed to opinion divergence. Table 1 shows that, over the two trading days prior to an offer, about 83% of issuing firms experience a positive unexpected trading volume that is led by divergence in investors' opinions.

3.2.3. Type of information

In order to differentiate the type of private information held by informed traders prior to SEO pricing, we calculate the pre-pricing abnormal return, defined as the cumulative abnormal returns (CAR) over five trading days immediately before pricing, using the market model:

$$R_{it} = \hat{\alpha} + \hat{\beta} R_{mt}, where\ t = -120, \ldots, -11 \quad (7)$$

$$AR_{it} = R_{it} - \hat{\alpha} - \hat{\beta} R_{mt}, where\ t = -5, \ldots, -1 \quad (8)$$

$$CAR_i = \sum_{t=-5}^{-1} AR_{it} \quad (9)$$

where R_{it} is return for stock i on day t, R_{mt} is the NYSE equally-weighted index on day t, and AR_{it} is the abnormal return for stock i on day t. We can observe from Table 1 that about 68% of issuing firms experience negative cumulative abnormal return during the five trading days prior to an offer.

3.2.4. Measure of rounding of offer price

Corwin (2003) finds that underwriters tend to round off offer prices to even dollars or by $0.25 increments. From 1996 to 1998, more than 40% of offers were priced at even dollars. He therefore assigns a dummy variable that is equal to 1 if the decimal portion of the closing price is less than 0.25 and 0 if otherwise. However, it can be argued that this becomes a *de facto* consideration only when the *ex post* SEO is truly priced at a 0.25 increment. In the present study, Corwin's (2003) approach was modified, and $0.25 was chosen as unit price increments, and the rounding dummy is 1 if the offer price ends with 0.00, 0.25, 0.50, or 0.75 and, 0 if otherwise.[3]

4. Evidence of short sales' restrictions on informed trading

4.1. Constraints on short sales and change in intraday volatility

4.1.1. Evidence of restriction on informed trading

Many recent studies (e.g., Corwin, 2003; Kim & Shin, 2004) of SEOs take into account the significant impact of Rule 10b-21 on pricing. They

[2] http://www.cboe.com/data/AvgDailyVolArchive.aspx

[3] Although, since January 29, 2001, decimal pricing has been fully implemented on the NYSE, underwriters are still inclined to price at even eighth increments. In the present study's sample, 33 of 69 offers are priced at even eighth increments. The proportion of the sample with an offer price ending with $0.00, $0.25, $0.50, and $0.75 are 18.8%, 5.8%, 15.9%, and 4.4%, respectively.

Table 1
Summary statistics for seasoned offers.

Variables	Mean	Median	P90	Skewness	*t*-stat	*p*-value	Percent positive	Percent zero
Discount	2.0790	1.3956	5.3584	1.1671	10.0902	<0.0001	81%	8.5%
$VOL_{Benchmark}$	1.9877	1.7961	3.0119	1.8684	34.7663	<0.0001	–	–
$VOL_{[-2,-1]}$	2.5592	2.1995	3.9868	2.9801	24.6173	<0.0001	–	–
$\Delta VOL_{[-2,-1]}$	0.3247	0.2085	0.9787	2.7714	7.5664	<0.0001	69%	–
$SUV_{[-2,-1]}$	2.1287	1.2415	5.6416	4.9691	8.1566	<0.0001	83%	–
CAR	−3.2011	−3.0652	5.3005	−0.4918	−6.2695	<0.0001	32%	–
AMOUNT ($ mil)	254.78	153.95	553.30	5.4906	9.4970	<0.0001	–	–
OFFSIZE	−2.5092	−2.3511	−1.4788	−0.4750	−30.1794	<0.0001	–	–

This table lists summary statistics for 201 seasoned offers issued on NYSE from April 1998 to September 2002. Discount is defined as −1 times the return from the previous day's closing transaction price to the offer price. $VOL_{Benchmark}$ is the median of intraday volatility in the benchmark period (i.e. from day −30 to day −11). $VOL_{[-2,-1]}$ is the median of intraday volatility of two trading days immediately before an offer (i.e. from day −2 to day −1). $\Delta VOL_{[-2,-1]}$ is the change in intraday volatility over two trading days immediately before an offer relative to the median of intraday volatility in the benchmark period (i.e., from day −30 to day −11). $SUV_{[-2,-1]}$ is defined as the median of standardized unexpected trading volume of two trading days immediately before an offer (i.e. day −2 and day −1). *CAR* is the cumulative abnormal return of five trading days prior to an offer. *AMOUNT* is a logarithm of total dollar amount of offer (in $ million). *OFFSIZE* is defined as a logarithm of the ratio of offered shares to total shares outstanding prior to the offer.

contend that this rule not only prohibits manipulative trading, but also it unintentionally restricts informed traders from trading on bad private news.[4] According to this argument, price uncertainty increases prior to an offer.

The changes in intraday volatility around an SEO relative to the benchmark period are presented in Table 2. The results in Column (1) show that intraday volatility grows gradually during the five consecutive trading days prior to pricing and reaches its highest point on the day before an offer. On day −5, the change in intraday volatility is 16.14%, while on day −1, the change increases to 40.79%. This increased price uncertainty is consistent with the cumulative effects of the restraints on informed trading.

The proposition of constraints on informed trading is also supported by the finding that intraday volatility falls substantially after the offer day (on day 1, the change in price uncertainty relative to the benchmark period is about 26%, which is lower than the level on day −1 and 0) and continues to decline over the subsequent four trading days. The substantial decrease in information asymmetry after the offer day appears to be related to the subsequent relaxation of the limits on short sales and the resumption of informed trading.

4.1.2. Asymmetric influence on informed trading with favorable and unfavorable private information

Constraints on short sales restrict the dissemination of unfavorable private information about stocks, but they should have little effect on informed traders trading with favorable information. Therefore, if the increase in price uncertainty is due to the Rule's restraints on short sales, it is expected that for firms with favorable information the increase in uncertainty should be less significant. Altinkilic and Hansen's (2003) method is employed to discriminate among informed traders with different information. Essentially, they use the five-day cumulative abnormal returns (CAR) immediately before pricing to identify the type of potential information. If the five-day CAR is positive (negative), a firm is classified as one with favorable (unfavorable) private information that is less (more) susceptible to short sales constraints. Columns (2) and (3) in Table 2 present the subsample results conditioned on the sign of the five-day CAR. There is less restriction on informed trading for firms with potential favorable information; therefore, increases in uncertainty prior to an offer should be lower, if at all. Column (2) in Table 2 shows that changes in uncertainty for firms with favorable private information are between 18.89% and 24.52%. However, for firms with unfavorable private information, as shown in Column (3), increases in uncertainty are between 14.86% and 48.39%. Note that the cumulative increase in uncertainty on the day immediately before pricing is approximately 50% relative to the benchmark period. Furthermore, comparing the increases in uncertainty for these two subsamples, we find that during the pre-pricing period, with each passing day, the increase in uncertainty for firms with unfavorable information becomes progressively higher than the increase for firms with favorable information. From day −5 to day −3, the differences between the two subsamples are not significant even at the 10% level; on day −2 and day −1, the differences widen gradually and become significant at the 5% level. Accordingly, the results presented in Columns (2) and (3) in Table 2 indicate that the increase in uncertainty can, at least partly, be explained by the unintended restraints on informed trading on unfavorable private information.

4.1.3. Asymmetric influence on informed trading with favorable and unfavorable private information in the presence of options listing

Danielsen and Sorescu (2001) propose that even when there is a restriction on short sales informed traders still can trade on unfavorable information through the options market. Therefore, for a stock that is also listed on the options market, the increase in intraday volatility due to short sales constraints should be smaller than for stocks with no listings on the options market. In order to control for the effects of listings on the options market, the sample is divided into two subsamples. Column (4) presents the subsample results for firms with a positive five-day CAR or listed on the options market, and Column (5) shows the subsample results for firms with a negative five-day CAR and not listed on the options market. As illustrated in Column (5), after controlling for the substitutive effects of options listings, the cumulative effects of short sales constraints on firms that are more susceptible to short sales constraints become more significant. On day −1, the intraday volatility increases by 56.41%, which is significant at the 1% level. Furthermore, the *p*-value of the comparison test of the two subsamples reveals that during the three days immediately before pricing the increases in price uncertainty for stocks that are susceptible to short sales constraints are significantly larger than for stocks that are not susceptible to short sales constraints at less than the 10% level. This is especially so on day −1 when the differences of two subsamples are significantly different from zero at the 1% level. These results strongly support the hypothesis that the short sales constraints imposed by Rule 105 unintentionally restrict informed trading triggered by traders' rational estimation of firms' future performance and inhibit the incorporation of unfavorable information into stock prices.

[4] Note that informed trading does not refer to illegal insider trading; it refers to trading triggered by traders' rational estimation of stock prices based on public information, such as annual earnings or media reports.

Table 2
Change in intraday volatility.

Relative day	Change in intraday volatility						
	All	Seasoned offers with			Seasoned offers with		
	($n = 201$)	Positive five-day *CAR* ($n = 64$)	Negative five-day *CAR* ($n = 137$)	*t*-test (*p*-value)	Positive five-day *CAR* or with option listing ($n = 98$)	Negative five-day *CAR* and without option listing ($n = 103$)	*t*-test (*p*-value)
	(1)	(2)	(3)	(2) = (3)	(4)	(5)	(4) = (5)
−5	0.1614***	0.1889***	0.1486***	(0.6112)	0.1532***	0.1693***	(0.8267)
−4	0.1766***	0.1883***	0.1711***	(0.8275)	0.1359***	0.2154***	(0.2771)
−3	0.2168***	0.1724**	0.2376***	(0.4474)	0.1424***	0.2877***	(0.0752)*
−2	0.2416***	0.1248**	0.2961***	(0.0313)**	0.1476***	0.3310***	(0.0354)**
−1	0.4079***	0.2452***	0.4839***	(0.0125)**	0.2437***	0.5641***	(0.0013)***
0	0.3991***	0.2529***	0.4674***	(0.0485)**	0.2145***	0.5747***	(0.0005)***
1	0.2587***	0.1689**	0.3006***	(0.1932)	0.1645***	0.3482***	(0.0582)*
2	0.1976***	0.1320*	0.2282***	(0.2638)	0.1354***	0.2567***	(0.1337)
3	0.1778***	0.0743	0.2261***	(0.0481)**	0.1161**	0.2365***	(0.1018)
4	0.2287***	0.1338	0.2730***	(0.1517)	0.1314**	0.3213***	(0.0315)**
5	0.1830***	0.0496	0.2453***	(0.0092)***	0.1732***	0.2717**	(0.4526)

This table presents the mean of the change in intraday volatility around a new offer. Relative intraday volatility is the change in intraday volatility relative to the median of intraday volatility in the benchmark period, which is five trading days ending two weeks before an offer (i.e., from day −30 to day −11). *CAR*, which is used to divide the whole sample into subsamples, is the cumulative abnormal return of five trading days prior to an offer. The values in parentheses are the *p*-values of the *t*-test.
* Significant at the 10% level.
** Significant at the 5% level.
*** Significant at the 1% level.

4.2. Constraints on short sales and divergence in investors' opinions

As shown in the previous section, short sales constraints inhibit the incorporation of unfavorable information into stock prices, leading to a lower information content of the prices. The cumulative effect of the short sales constraint contributes to the difficulty of interpreting the trading activities in the stock market and the expectation of true stock values become harder. Therefore, we expect that, for stocks that are susceptible to short sales constraints, the divergence in investors' opinions will be greater.

In this section, the difference of opinions is measured by unanticipated trading volume calculated by using Eqs. (4) through (6). Table 3 presents the mean of unexpected trading volume around an offer. Column (1) of the table shows that, during the five trading days prior to an offer, the standardized unanticipated trading volume, which is a proxy for opinion divergence, grows gradually and is

Table 3
Standardized unexpected trading volume.

Relative day	Standardized unexpected trading volume						
	All	Seasoned offers with			Seasoned offers with		
	($n = 201$)	Positive five-day *CAR* ($n = 64$)	Negative five-day *CAR* ($n = 137$)	*t*-test (*p*-value)	Positive five-day *CAR* or with option listing ($n = 98$)	Negative five-day *CAR* and without option listing ($n = 103$)	*t*-test (*p*-value)
	(1)	(2)	(3)	(2) = (3)	(4)	(5)	(4) = (5)
−5	0.3561***	0.3772*	0.3462***	(0.8929)	0.2894**	0.4195***	(0.5138)
−4	1.0489**	1.3710	0.8984*	(0.6404)	0.9350	1.1573*	(0.7984)
−3	0.9690***	0.9344***	0.9852***	(0.8645)	0.7400***	1.1869***	(0.1277)
−2	1.4017***	0.9005***	1.6359***	(0.0751)*	0.8929***	1.8859***	(0.0390)**
−1	2.8556***	1.6353***	3.4257***	(0.0017)***	1.9314***	3.7349***	(0.0081)***
0	48.0879***	37.5363***	53.0171***	(0.1103)	32.9004***	62.5381***	(0.0069)***
1	8.0659***	5.2499***	9.3814***	(0.0091)***	5.5435***	10.4659***	(0.0114)**
2	4.1087***	3.1267***	4.5675***	(0.0759)*	2.9939***	5.1694***	(0.0213)**
3	3.9508***	2.8103***	4.4836***	(0.0591)	2.7993***	5.0465***	(0.0323)**
4	3.3027***	2.4013***	3.7238***	(0.0904)*	2.2279***	4.3254***	(0.0260)**
5	2.7570***	1.7561***	3.2245***	(0.0723)*	1.1530***	6.4046	(0.0265)**

This table presents the mean of standardized unexpected trading volume around a new offer. Standardized unexpected trading volume is calculated using a methodology that is similar to the market model approach.

$$Volume_{it} = \hat{\alpha} + \hat{\beta}_1 |R_{it}|^{+} + \hat{\beta}_2 |R_{it}|^{-} + \varepsilon_{it}, where\ t = -120, \ldots, -11$$

$$UVolume_{it} = Volume_{it} - \hat{\alpha} - \hat{\beta}_1 |R_{it}|^{+} - \hat{\beta}_2 |R_{it}|^{-}, where\ t = -5, \ldots, 5$$

$$SUV_{it} = UVolume_{it} / S_{it}$$

where $Volume_{it}$ is number of shares traded for stock i at date t. $|R_{it}|^{+}$ and $|R_{it}|^{-}$ denote absolute value of positive daily return and absolute value of negative daily return for stock i at date t, respectively. S_{it} is the standard deviation of ε_{it} in model (3).
CAR, which is used to divide the whole sample into subsamples, is the cumulative abnormal return of five trading days prior to an offer. The values in parentheses are the *p*-values of the *t*-test.
* Significant at the 10% level.
** Significant at the 5% level.
*** Significant at the 1% level.

mostly significant at the 1% level. This indicates that as the offer day approaches investors' opinion divergence becomes increasingly wider.

Columns (2) and (3) of Table 3 report the mean unanticipated trading volume for firms with a positive and negative 5-day CAR, respectively, where a positive (negative) CAR indicates a smaller (larger) susceptibility to short sales constraints. The comparison test shows that, as an offer day approaches, the difference of opinion divergence between the two subsamples becomes more apparent. On day −2, the divergence between the two subsamples is different at the 10% level and, on day −1, it is different at the 1% level. Furthermore, after controlling for the substitutive effects of options as synthetic short sales, the difference of opinion divergence between the two subsamples becomes more obvious, as shown in Columns (4) and (5) of Table 3. The *p*-value of the *t*-test shows that, on day −2, the opinion divergence differs at the 5% level; on day −1, it differs at the 1% level. We have shown from the evidence presented that short sales constraints inhibit informed trading of private unfavorable information and reduce the information content of stock prices.

4.3. Constraints on short sales and market' asymmetric sensitivity to trading directions

4.3.1. Asymmetric sensitivity to different trading directions

We check the robustness of our results on whether the increase in price uncertainty is the result of the restriction on informed trading of unfavorable information by examining market makers' asymmetric sensitivity to different trading directions during the restricted period. If short sales constraints inhibit the incorporation of potential unfavorable information into stock prices, it is reasonable to expect that the market would be more sensitive to seller-initiated trading during the restricted period than to buyer-initiated trades. Following Chae (2005), we measure market's price sensitivity by regressing the change in transaction prices on the signed trading volume. However, in order to differentiate the market's price sensitivity to a different trading direction, we include a dummy variable, *TrDirection*, in the following regression model.

$$\Delta P = \alpha + \beta_1 SignedVolume + \beta_2 SignedVolume * TrDirection \quad (10)$$

where ΔP is the change of transaction prices, *SignedVolume* is the product of trading volume and the trading sign (positive for a bid and negative for an ask) inferred by the methods suggested by Lee and Ready (1991), *TrDirection* is a dummy variable that equals 1 if the trade is buyer-initiated and 0 if the trade is seller-initiated.

A significant negative coefficient of the interaction term, β_2, indicates that the market is more sensitive to seller-initiated trading, and a significant positive coefficient means that the market is more sensitive to buyer-initiated trades. The market's sensitivity to buyer-initiated trading, *SEN_POS*, is represented by the sum of β_1 and β_2, whereas their sensitivity to seller-initiated trading, *SEN_NEG*, is β_1. The extent of market's asymmetric sensitivity, *ASYM*, can be measured by:

$$ASYM = \frac{SEN\_POS - SEN\_NEG}{SEN\_POS + SEN\_NEG} \quad (11)$$

The range of *ASYM* is between −1 and 1 because both *SEN_POS* and *SEN_NEG* are supposed to be non-negative.[5] A value of *ASYM* that is close to −1 indicates that market is more sensitive to seller-initiated trading and, a value closer to 1, more sensitive to buyer-initiated trading. When the value of *ASYM* is around 0, it implies that market tends to treat different trading directions equally.

[5] We winsorize *SEN_NEG* or *SEN_POS* to zero if they are negative.

Panel A of Table 4 shows the extent of market's asymmetric sensitivity to different trading directions. Column (1) shows that market's asymmetric sensitivity, *ASYM*, is significantly below 0 prior to the offer day, and that the value of *ASYM* falls gradually during the restricted period: that is, market responds more to seller-initiated trading than to buyer-initiated trading during the restricted period, and this asymmetry becomes more pronounced as the offer day approaches. This result is consistent with the prediction that short sales constraints inhibit the incorporation of unfavorable information into the stock price, which results in market's relatively more sensitive sensitivity to seller-initiated trading.

A comparison of Columns (2) and (3) of Panel A, Table 4, shows that the market responds more to seller-initiated trades in both subsamples conditioned on the sign of the five-day CAR than to buyer-initiated trades. We observe a significant difference in asymmetric sensitivity between the two groups on day −2 and −1 (*p*-values are 0.03 and 0.04, respectively). In order to control for the substitutive effects of listing on the options market, similar to the analysis of the increase in price uncertainty, a subsample is formed from stocks susceptible to short sales constraints that have a negative five-day CAR but are not listed on the options market. Column (4) shows that market's asymmetric sensitivity is between −0.09 and −0.22 before the offer day, while Column (5) shows that the asymmetric sensitivity is between −0.16 and −0.30, which is apparently lower than those in Column (4). The comparison of the two subsamples shows that on days −4, −2, and −1, the differences between the two subgroups are significant at less than the 10% level, which suggests that market is more sensitive to seller-initiated trading for those firms that are susceptible to short sales constraints. This evidence further supports the hypothesis that unfavorable informations are not reflected in stock prices when there are short sales constraints.

4.3.2. Change in asymmetric response to different trading directions

In order to analyze the change in the market's response to seller-initiated trading more clearly, we look at the change in asymmetric response, *ΔASYM*, which is measured by the difference between *ASYM* and the median of *ASYM* during the benchmark period (i.e., from day −30 to −11):

$$\Delta ASYM_t = ASYM_t - ASYM_{Benchmark} \quad (12)$$

The mean changes in asymmetric response for the whole sample and subsamples are listed in Panel B of Table 4. A positive (negative) change in asymmetric response indicates that the market's relatively higher sensitivity to seller-initiated trading becomes less (more) apparent relative to the benchmark period. Column (1) shows that, for the whole sample, changes in asymmetric sensitivity are significant at the 1% level from day −3 to day −1. Asymmetric sensitivity remains mostly steady for stocks with a positive five-day CAR during the restricted period, as shown in Column (2). In contrast, the changes of asymmetric sensitivity are significantly below 0, at the 1% level, for stocks with a negative CAR during the last two days of the restricted period. The result from the comparison *t*-test shows that, on day −4, the negative change in asymmetric sensitivity for firms with unfavorable information is significantly larger than for firms with favorable information.

The negative change in asymmetric sensitivity becomes more pronounced when the effects of listing on the options market are considered relative to the benchmark period. Column (5) of Table 4 shows that, for those stocks with a negative five-day CAR and not listed on the options market, the changes in asymmetric sensitivity are negative and largely significant during the restricted period. However, for stocks with a positive five-day CAR or are listed on the options market (i.e., stocks that are not susceptible to short sales constraints), the asymmetric sensitivity is significant at the 1% level only on day −3 during the restricted period. This evidence further demonstrates that, for those stocks that are more susceptible to short sales constraints, the

Table 4
Asymmetric sensitivity to different trading directions.

Relative day	All ($n = 201$)	Seasoned offers with			Seasoned offers with		
		Positive five-day *CAR* ($n = 64$)	Negative five-day *CAR* ($n = 137$)	*t*-test (*p*-value)	Positive five-day *CAR* or with option listing ($n = 98$)	Negative five-day *CAR* and without option listing ($n = 103$)	*t*-test (*p*-value)
	(1)	(2)	(3)	(2) = (3)	(4)	(5)	(4) = (5)
Panel A: Asymmetric sensitivity to different trading directions							
−5	−0.1536***	−0.1767***	−0.1427***	(0.6163)	−0.1432***	−0.1634***	(0.7476)
−4	−0.1772***	−0.0641	−0.2300***	(0.0168)**	−0.0930**	−0.2573***	(0.0132)**
−3	−0.2162***	−0.2471***	−0.2017***	(0.4681)	−0.2206***	−0.2119***	(0.8839)
−2	−0.2205***	−0.1165**	−0.2691***	(0.0256)**	−0.1383***	−0.2988***	(0.0095)***
−1	−0.2184***	−0.1335**	−0.2580***	(0.0428)**	−0.1613***	−0.2727***	(0.0504)*
0	0.1627***	0.1374***	0.1746***	(0.5386)	0.1399***	0.1844***	(0.4217)
1	0.1132***	0.1285***	0.1060***	(0.7058)	0.1551***	0.0733*	(0.1466)
2	0.0073	0.0341	−0.0053	(0.5921)	−0.0085	0.0222	(0.6401)
3	0.0214	0.0782	−0.0051	(0.2087)	0.0367	0.0069	(0.6266)
4	−0.0193	−0.0025	−0.0272	(0.7176)	−0.0026	−0.0352	(0.6146)
5	−0.0307	−0.0244	−0.0336	(0.9014)	−0.0191	−0.1351	(0.3135)
Panel B: Change of asymmetric sensitivity to different trading directions							
−5	−0.0480	−0.1008	−0.0233	(0.2869)	−0.0531	−0.0431	(0.8790)
−4	−0.0716**	0.0119	−0.1106**	(0.0819)*	−0.0029	−0.1370**	(0.0487)**
−3	−0.1106***	−0.1711***	−0.0823*	(0.1984)	−0.1305***	−0.0917*	(0.5594)
−2	−0.1150***	−0.0405	−0.1497***	(0.1269)	−0.0482	−0.1785***	(0.0498)**
−1	−0.1128***	−0.0575	−0.1386***	(0.1879)	−0.0712*	−0.1524***	(0.1765)
0	0.2683***	0.2133***	0.2939***	(0.2265)	0.2300***	0.3047***	(0.2184)
1	0.2187***	0.2045***	0.2254***	(0.7307)	0.2452***	0.1935***	(0.3630)
2	0.1128***	0.1101*	0.1141***	(0.9581)	0.0817*	0.1425***	(0.3538)
3	0.1270***	0.1542***	0.1143***	(0.5571)	0.1268***	0.1272***	(0.9956)
4	0.0862**	0.0735	0.0922**	(0.7933)	0.0875*	0.0850*	(0.9716)
5	0.0749*	0.0516	0.0858*	(0.6804)	0.0902**	−0.0639	(0.2702)

Panel A lists the mean of the asymmetric sensitivity (*ASYM*) to different trading directions around a new offer. *ASYM* is the ratio of the difference between market's sensitivity to buyer-initiated trading, *SEN_POS*, and seller-initiated trading, *SEN_NEG*, and a total of these two sensitivities. We estimate *SEN_POS* and *SEN_NEG* by regressing the following model: $\Delta P_t = \alpha + \beta_1 * SignedVolume_t + \beta_2 * SignedVolume_t * TrDirection_t$ where ΔP is the change of transaction prices, *SignedVolume* is the product of trading volume and the trading sign inferred by the methods suggested by Lee and Ready (1991), TrDirection is a dummy variable that equals 1 if the trade is buyer-initiated and 0 if the trade is seller-initiated. *SEN_POS* is equal to $\beta_1 + \beta_2$ and *SEN_NEG* is equal toβ_1. Panel B lists the mean of the change of asymmetric sensitivity to different trading directions around a new offer. Change of asymmetric sensitivity is the difference between the asymmetric sensitivity and the median of the asymmetric sensitivity over the benchmark period, which is five trading days ending two weeks before an offer (i.e., from day −30 to day −11). *CAR*, which is used to divide the whole sample into subsamples, is the cumulative abnormal return of five trading days prior to an offer. The values in parentheses are the *p*-values of the *t*-test.

* Significant at the 10% level.
** Significant at the 5% level.
*** Significant at the 1% level.

market becomes much more sensitive to selling activities on the market relative to the benchmark period. The sharp negative changes in asymmetric sensitivity support the proposition that short sales constraints restrict the incorporation of unfavorable information into stock prices.

4.4. Constraints on short sales and informed trading prior to pricing

A direct way of estimating the effects of short sales constraints is to observe the change of informed transactions during the restricted period. With the TAQ database, it is not possible to differentiate between transactions that are motivated by information trading and those that are initiated by liquidity demand. Several studies (e.g., Cready, 1988; Cready & Mynatt, 1991; Lee, 1992) use trade volume or trading value to distinguish between individual and institutional trades. Lee and Radhakrishna (2000) use a unique dataset (i.e., TORQ), which contains information about individual orders, to test the techniques used to identify institutional and individual orders. After comparing different strategies of classification, they classify trades of $5000 or less as individual trades and trades of $50,000 or more as institutional trades, resulting in a very low probability of error.

In the present study, the effects on trades triggered by investors' rational estimation of future stock price are analyzed. It may be reasonable to assume that institutional investors tend to have more resources at their disposal for analyzing firms' future performances compared to individual investors, and they should be more likely to initiate trades based on their rational estimation. Therefore, institutional orders are more likely to be information based. Using the three-tiered approach suggested by Lee and Radhakrishna (2000), all transactions are divided into three groups: information-based transactions (i.e., informed transactions), liquidity transaction (i.e., uninformed transactions), and transactions that are hard to identify.

4.4.1. Change in informed transactions

During the pre-pricing period, the options market may attract some informed transactions from the equity market. Previous studies (e.g., Amin & Lee, 1997; Cao, Chen, & Griffin, 2005) suggest that, around an information event, such as earnings or takeover announcements, informed traders are more likely to trade in the options market as it offers a high-leverage, more effective venue for informed trading. In order to remove the effects from the options market, stocks that have a listing in the options market are removed from the sample in the following sections, resulting in a new sample size of 142 issues.

Panel A of Table 5 shows the change in informed transactions relative to the benchmark period. A transaction is deemed a potential informed trade if the dollar volume of the transaction is larger than $50,000. In Column (1) of Panel A, we show that the number of informed transactions grows monotonically, at the 1% significance level, from day −5 to day −1. On the day immediately before pricing, the number of potential informed transactions rises by approximately 315% relative to the benchmark period. As predicted in the preceding analysis, due to short sales constraints, trading on unfavorable information will be largely restricted. Therefore, if the hypothesis about the effects of short sales constraints holds, then changes in the number of informed transactions of stocks that are susceptible to short sales constraints should be lower than those of stocks that are not susceptible to the constraints.

Table 5
Change in informed transactions and liquidity transactions.

Relative day	All ($n = 142$)	Seasoned offers without option listing and: with positive five-day *CAR* ($n = 103$)	with negative five-day *CAR* ($n = 39$)	*t*-test (*p*-value)
	(1)	(2)	(3)	(2) = (3)
Panel A: Change in informed transactions				
−5	0.3905***	0.5990**	0.4392***	(0.5834)
−4	0.6463***	1.0253***	0.7811***	(0.5060)
−3	1.2139***	1.4343***	1.5888***	(0.7493)
−2	1.4740***	1.3426***	2.0054***	(0.2145)
−1	3.1509***	3.1792***	4.1036***	(0.4071)
0	30.7828***	35.5858***	42.2607***	(0.5309)
1	7.1466***	7.5112***	9.4559***	(0.4789)
2	4.0716***	3.4157***	5.8847***	(0.1072)
3	3.5108***	3.7055***	4.7779***	(0.4758)
4	2.8504***	3.1005***	3.8010***	(0.4004)
5	2.5470***	2.0165***	3.7093***	(0.1192)
Panel B: Change in liquidity transactions				
−5	0.1584***	0.0822	0.1898**	(0.3797)
−4	0.1875***	0.1762**	0.2089**	(0.7774)
−3	0.2128***	0.1733*	0.2668***	(0.4488)
−2	0.2994***	0.2804	0.4681***	(0.3346)
−1	0.3539***	0.1389	0.6151***	(0.0011)***
0	1.3711***	1.0297***	2.0751***	(0.0039)***
1	1.0901***	1.0174***	1.5935***	(0.1124)
2	0.7916***	0.6216***	1.2103***	(0.0290)**
3	0.6882***	0.3906***	1.0779***	(0.0020)
4	0.6557***	0.5352***	0.9833***	(0.0598)*
5	0.5200***	0.3469**	0.8112***	(0.0131)**

Panel A shows the change in informed transactions around a new offer. Transactions with a dollar volume larger than $50,000 are considered informed transactions. The change in informed transactions is computed relative to the median number of informed transactions over the benchmark period, which is five trading days ending two weeks before an offer (i.e., from day −30 to day −11). Panel B lists the cumulative change in informed transactions around a new offer. Cumulative change in informed transactions is the total change in informed transactions from previous trading days. Panel C lists the change in liquidity transactions around a new offer. Transactions with a dollar volume lower than $5000 are considered liquidity transactions. Change in liquidity transactions is the change in liquidity transactions relative to the median of the number of liquidity transactions over the benchmark period, which is five trading days ending two weeks before an offer (i.e., from day −30 to day −11). *CAR*, which is used to divide the whole sample into subsamples, is the cumulative abnormal return of five trading days prior to an offer. The values in parentheses are the *p*-values of the t-test.

* Significant at the 10% level.
** Significant at the 5% level.
*** Significant at the 1% level.

Columns (2) and (3) of Panel A, Table 5, present the changes in the number of informed transactions of subsamples conditioned on the sign of the five-day CAR. Contrary to our expectation, the comparison shows that changes in informed transactions for stocks that are susceptible to short sales constraints are not significantly lower than those for stocks that are not susceptible to the constraints during the last two trading days before an offer. However, this result may be due to the fact that, as an offer date approaches, stock market manipulators may have already begun to trade with their private information in order to distort the stock prices. Because it is impossible to differentiate manipulative transactions from the informed ones, we attempt to mitigate this problem by observing the change in uninformed transactions instead.

4.4.2. Change in uninformed transactions

Admati and Pfleiderer (1988), Foster and Viswanathan (1990), and Chae (2005) suggest that if liquidity traders have timing discretion they will postpone their trading when they suspect the existence of informed trading. According to this argument, if informed transactions are restricted by short sales constraints, liquidity transactions will sharply increase. Panel B of Table 5 shows the change in liquidity transactions during the restricted period for the complete sample and subsamples. Column (2) of the panel reveals that liquidity trading only changes marginally during the restricted period for those stocks that are not susceptible to short sales constraints. However, for stocks that are susceptible to the constraints, the increase in liquidity trading is significant throughout the entire restricted period (see Column (3)). In addition, the comparison test shows that, on day −1, the change in liquidity transactions of the subsamples differs significantly at the 1% level. The activity of liquidity traders further reflects the restriction on informed transactions imposed by short sales constraints.

5. SEO discounting and effect of short sales constraints on information content of stock prices

The empirical predictions of the main theories that explain the determinants of SEO discounting are summarized in Table 6, which shows the directions of the expected empirical relationships between the hypothesized explanatory variables and SEO discounting. The uncertainty and asymmetric information hypotheses predict a positive contribution from the benchmark volatility; the price pressure hypothesis expects the offer value and size to be positively related to SEO discounting; the hypothesis that informed trading is restrained expects a positive contribution from intraday volatility changes and unexpected trading volume but a negative contribution from changes in asymmetric sensitivity prior to the offer day; the offer price rounding hypothesis expects offers that are priced at $0.25 increments to have a positive impact on SEO discounting; and the rent expropriation hypothesis predicts a positive contribution from a positive CAR during the five trading days prior to an offer.

In order to estimate the determinants of SEO discounts, the following multivariate regression on various explanatory variables is conducted:

$$\begin{aligned} DISCOUNT = {} & \beta_0 + \beta_1 VOL_{benchmark} + \beta_2 \Delta VOL_{[-2,-1]} + \beta_3 SUV_{[-2,-1]} \\ & + \beta_4 \Delta ASYM_{[-2,-1]} + \beta_5 AMOUNT + \beta_6 OFFSIZE + \beta_7 CAR \\ & + \beta_8 CAR\_POS + \beta_9 CARDUM + \beta_9 BID\_PRC + \beta_{10} ROUNDING + \varepsilon \end{aligned} \quad (13)$$

where *DISCOUNT*, is defined as −1 times the return from the previous day's closing transaction price to the offer price; $VOL_{Benchmark}$ is the median intraday volatility during the benchmark period (i.e., from day −30 to day −11); $\Delta VOL_{[-2,-1]}$ is the median of the changes in intraday volatility over two trading days immediately before an offer relative to the median of intraday volatility during the benchmark period; $SUV_{[-2,-1]}$ is defined as the median unexpected trading volume in the two trading days immediately before an offer, i.e., days −2 and −1; $\Delta ASYM_{[-2,-1]}$ is change of asymmetric sensitivity over the two trading days immediately before an offer relative to the median asymmetric sensitivity during the benchmark period; *CAR* is the cumulative abnormal returns of the five trading days immediately prior to an offer; *CAR_POS* is equal to *CAR* if positive and 0, if otherwise; *CARDUM* is a dummy variable that is equal to 1 if *CAR* is positive and 0, if otherwise; *AMOUNT* is the natural logarithm of the total dollar amount of an offer (in $ million); *OFFSIZE* is defined as a logarithm of the ratio of offered shares to total shares outstanding prior to the offer; *BID_PRC* equals the percentage difference between the closing bid and closing transaction price; and *ROUNDING* is a dummy variable that equals 1 if an offer is priced at $0.25 increments and 0, if otherwise.

The results of Eq. (13) are presented in Table 7. The univariate relationship between SEO discount and the cumulative effect of short sales constraint on the information content of stock prices are shown in Columns (1) to (3) of the table. Column (1) shows that the SEO discount is positively related to price uncertainty during the benchmark period, $VOL_{Benchmark}$, and to the change in price uncertainty, $\Delta VOL_{[-2,-1]}$. The former supports the hypothesis of uncertainty and asymmetric information, while the latter reveals that the increase of price

Table 6
Summary of empirical predictions related to SEO discounting.

	Explanatory variables and predicted relations								
Hypothesis	$VOL_{Benchmark}$	$\Delta VOL_{[-2,-1]}$	$SUV_{[-2,-1]}$	$\Delta ASYM_{[-2,-1]}$	*AMOUNT*	*OFFSIZE*	*CAR*	*Rounding*	*BID_PRC*
Uncertainty/information asymmetry	(+)								
Price pressure					(+)	(+)			
Restraints on informed trading		(+)	(+)	(−)					
Offer price rounding								(+)	
Pricing at the bid									(+)
Rent expropriation							(+) *CAR_POS*		

This table summarizes the directions of expected empirical relationships between the hypothesized explanatory variables and SEO discounting. The hypotheses are discussed in Section 2. Discounting is defined as −1 times the return from the previous day's closing transaction price to the offer price. $VOL_{Benchmark}$ is the median of intraday volatility in the benchmark period (i.e. from day −30 to day −11). $\Delta VOL_{[-2,-1]}$ is the change in average intraday volatility over two trading days immediately before an offer relative to the median of intraday volatility during the benchmark period (i.e., from day −30 to day −11). $SUV_{[-2,-1]}$ is defined as the median of standardized unexpected trading volume of two trading days immediately before an offer (i.e. day −2 and day −1). $\Delta ASYM_{[-2,-1]}$ is change of asymmetric sensitivity over the two trading days immediately before an offer relative to the median of asymmetric sensitivity in the benchmark period (i.e., from day −30 to day −11). *CAR* is cumulative abnormal return of five trading days prior to an offer. *CAR_POS* is equal to *CAR* if positive and 0 if otherwise. *AMOUNT* is a logarithm of total dollar amount of offer (in $ million). *OFFSIZE* is defined as the ratio of offered shares to total shares outstanding prior to an offer. Rounding is a dummy variable that equals 1 if the offer is priced at $0.25 increments and 0 if otherwise. *BID_PRC* equals the percentage difference between the closing price and the closing bid.

uncertainty due to the constraints on informed trading before an offer enlarges the discount of the offer. Columns (2) and (3) present the results of the other two variables used to measure the effects of short sales constraints on information content of stock price and information environment: $SUV_{[-2,-1]}$, which measures the opinion divergence, and $\Delta ASYM_{[-2,-1]}$, which measures the change of market's asymmetric sensitivity to different trading directions. The findings show that, consistent with the prediction in Table 6, the coefficient of $SUV_{[-2,-1]}$ is positive and significant at the 1% level and that the coefficient of $\Delta ASYM_{[-2,-1]}$ is negative and significant at the 10% level.

Furthermore, when we incorporate all of the three measures of cumulative effects of short sales constraints, as shown in Column (4), we find that the signs of the coefficients of all three variables are consistent with our predictions. The results are robust after controlling for other potential determinants of SEO discounts, such as *CAR*, *CARDUM*, *BID_PRC*, and *ROUNDING*. This result reveals that the exacerbation of information environment and the subsequent reduction in information content of stock prices due to the short sales constraint during the pre-pricing period are among the main reasons of SEO discounting. The results of the multivariate regression do not support the theories surrounding the hypothesis of discounts advanced by Corwin (2003) that some offers are priced at the closing bid as our results show that the coefficient of *BID_PRC* is not significant even at the 10% level.

The rent expropriation theory advanced by Loughran and Ritter (2002) predicts that underwriters expropriate profits from firms with good news. In other words, the magnitude of discounts is positively related to positive cumulative abnormal returns (*CAR_POS*). However, the results of the models in Table 7 argue against this prediction, with a negative and insignificant correlation between SEO discounting and *CAR_POS*. This evidence is contrary to the rent expropriation hypothesis. In addition, models (5) and (6) show that the coefficient on *ROUNDING* is positively significant at

Table 7
Determinants of SEO discounting.

	(1) (n = 201)	(2) (n = 201)	(3) (n = 201)	(4) (n = 201)	(5) (n = 201)	(6) (n = 201)	(7) (n = 201)	(8) (n = 134)
Intercept	−1.0222*	1.6523***	1.9688***	−1.2703**	−2.0215***	−2.0731***	−1.3466**	−2.1821
$VOL_{Benchmark}$	1.3566***	–	–	1.3705***	1.3197***	1.2629***	1.3797***	1.4515***
$\Delta VOL_{[-2,-1]}$	1.3573***	–	–	0.8787**	0.8876**	0.7631*	0.8940**	1.0120*
$SUV_{[-2,-1]}$	–	0.2021***	–	0.1226*	0.1136*	0.1193*	0.1238*	0.0947
$\Delta ASYM_{[-2,-1]}$	–	–	−0.9651*	−1.0273*	−0.9476*	−0.8637	−1.0528*	−0.9717
AMOUNT	–	–	–	–	–	–	–	0.0603
OFFSIZE	–	–	–	–	–	–	–	0.1307
CAR	–	–	–	–	–	0.0036	–	–
CAR_POS	–	–	–	–	–	−0.0005	–	–
CARDUM	–	–	–	–	–	–	0.1475	–
BID_PRC	–	–	–	–	–	0.6371	–	–
ROUNDING	–	–	–	–	1.1335**	1.1851***	–	1.1352**
Adj._R-square	0.1625	0.0623	0.0088	0.1882	0.2113	0.2111	0.1845	0.2369
F-stat	20.11	14.08	2.74	12.42	11.55	9.79	6.84	6.90

This Table lists coefficients (*p*-value) from regressions of discounting on firm and offer characteristics. The regression model is

$$DISCOUNT = \beta_0 + \beta_1 * VOL_{Benchmark} + \beta_2 * \Delta VOL_{[-2,-1]} + \beta_3 * SUV_{[-2,-1]} + \beta_4 * \Delta ASYM_{[-2,-1]} + \beta_5 * AMOUNT + \beta_6 * OFFSIZE + \beta_7 * CAR + \beta_8 * CAR\_POS + \beta_9 * CARDUM + \beta_9 * BID\_PRC + \beta_{10} * ROUNDING + \varepsilon$$

The dependent variable, *DISCOUNT*, is defined as −1 times the return from the previous day's closing transaction price to the offer price. $VOL_{Benchmark}$ is the median of intraday volatility in the benchmark period (i.e. from day −30 to day −11). $\Delta VOL_{[-2,-1]}$ is the change in intraday volatility over two trading days immediately before an offer relative to the median of intraday volatility during the benchmark period. $SUV_{[-2,-1]}$ is defined as the median of unexpected trading volume of two trading days immediately before an offer (i.e. day −2 and day −1). $\Delta ASYM_{[-2,-1]}$ is change of asymmetric sensitivity over the two trading days immediately before an offer relative to the median of asymmetric sensitivity in the benchmark period (i.e., from day −30 to day −11). *CAR* is the cumulative abnormal return of five trading days prior to an offer. *CAR_POS* is equal to *CAR* if positive and 0 if otherwise. *CARDUM* is a dummy variable that is equal to 1 if *CAR* is positive and 0 if otherwise. *AMOUNT* is a logarithm of total dollar amount of offer (in $ million). *OFFSIZE* is defined as offered shares divided by total shares outstanding prior to an offer. *BID_PRC* equals to percentage difference between closing bid and closing transaction price. *ROUNDING* is a dummy variable that equals 1 if an offer is priced at $0.25 increments and 0 if otherwise.

* Significant at the 10% level.
** Significant at the 5% level.
*** Significant at the 1% level.

Table 8
Adjustment of estimation of stock prices on the offer day.

	N	Mean	Median	Standard deviation	*p*-value (*t* test)	*p*-value (*sign* test)
Panel A: First-day returns between the subsamples where $CAR > 0$ and $CAR \leq 0$						
Full sample	201	0.3655	−0.3202	5.0051	0.3017	0.1746
$CAR > 0$	64	1.5305	0.2987	4.5297	0.0088***	0.6147
$CAR \leq 0$	137	−0.1790	−0.4975	5.1379	0.6847	0.0370**

Panel B: Tests of equality of first-day returns between the subsamples where $CAR > 0$ and $CAR \leq 0$

	p-value
Test of equality (*t* test)	0.0184**
Test of equality (Wilcoxon)	0.0085***
Test of equality (Median)	0.0596*

Panel C: Regression of first-day return

	Full sample			
	(1)	(2)	(3)	(4)
INTERCEPT	0.0229	0.9728***	−0.2356	0.8472**
ΔVOL_F	–	–	1.8781***	–
$SUV_{[-2,-1]}$	–	–	–	−0.1545*
CARDUM	1.5385**	–	1.6322**	–
CAR	–	0.1474***	–	–
SURPRISE	−0.6416***	−0.6418***	−0.7012***	−0.6417***
MKT_RETURN	0.5798**	0.5412**	0.6271***	0.5313**
Adj. R-square	0.1665	0.1924	0.2080	0.1579
F-stat	14.12	16.64	13.94	13.31

Panel A list the summary statistics of first-day return for two subsamples conditioned on the sign of five-day *CAR*. Panel B shows the result of testing the equality of first-day returns between two subsamples. Panel C is the regression of first-day returns against surprise discounting and constraints on informed trading. The regression model is as follows:

$$First-Day\_return = \beta_0 + \beta_1 * \Delta VOL_F + \beta_2 * SUV_{[-2,-1]} + \beta_2 * CARDUM + \beta_3 * CAR + \beta_4 * SURPRISE + \beta_5 * MKT\_RETURN + \varepsilon$$

The dependent variable, First-Day return is the return from the previous day's closing transaction price to offer day's closing transaction price. $SUV_{[-2,-1]}$ is defined as the median of unexpected trading volume of two trading days immediately before an offer (i.e. day −2 and day −1). *CAR* is the cumulative abnormal return of five trading days prior to an offer. *CARDUM* is a dummy variable that is equal to 1 if *CAR* is positive and 0 if otherwise. Surprise is the residual of model (5) in Table 7. ΔVOL_F is the change of intraday volatility on an offer day relative to the median of intraday volatility over two trading days immediately before an offer. *MKT_RETURN* is the return on the CRSP equal-weighted index on offer day. The values in parentheses are the *p*-values of the coefficients.

* Significant at the 10% level.
** Significant at the 5% level.
*** Significant at the 1% level.

the 1% level, supporting Mola and Loughran's (2004) hypothesis of offer price rounding.

The results of this study do not show any relationship between discounting and either measure of price pressure (i.e., *AMOUNT* and *OFFSIZE)*. However, further analysis of the correlation between the change in uncertainty and the relative offer size shows that they are positively and significantly correlated at approximately the 10% level. This means that the effects of the relative offer size may be captured by $\Delta VOL_{[-2,-1]}$. According to Myers and Majluf (1984), if there is information asymmetry between managers and investors, firms only issue equity when their stock is overpriced. Following this line of reasoning, a relatively larger offer size tends to increase the uncertainty of the stock price. Therefore, underwriters should compensate investors for the additional risk they face in buying the offered shares. This evidence supports the temporary price pressure hypothesis.

6. Downward adjustment of stock price on offer day

The results of the robustness test in Section 4 indicate that, on an offer day, after the constraints on informed trading are relaxed, informed traders resume their informed trading and incorporate their private information into the stock price. The first-day return reflects investors' adjustment of stock prices based on their rational estimation. If unfavorable private information is not released prior to an offer, the stock is most likely overpriced. Therefore, the downward adjustments of the estimated value for stocks with a higher increase in potential unfavorable information will be larger than for other stocks. The empirical results shown in Table 8 support this proposition.

Panels A and B of Table 8 show that the downside adjustment of stock prices on the offer day for stocks with favorable private information is significantly smaller than for stocks with unfavorable information. For stocks with potentially unfavorable information, the closing prices on the offer day are downward adjusted by about 0.50%, which is significant at the 5% level according to the sign test, while for stocks with potentially favorable information, the closing prices on the offer day grow by 0.30% relative to the closing price of day −1. Furthermore, the *t*-test and Wilcoxon test of equality between the two samples show that the differences in the adjustment of stock prices are significant at less than the 5% level. In order to further check for the effects of short sales constraints on stock prices, the following regression is performed:

$$First-Day\_return = \beta_0 + \beta_1 \Delta VOL_F + \beta_2 SUV_{[-2,-1]} + \beta_3 CARDUM + \beta_4 CAR + \beta_5 SURPRISE + \beta_6 MKT\_RETURN + \varepsilon \quad (14)$$

The dependent variable in Eq. (14) is the first day's return, which is defined as the return from the previous day's closing transaction price to offer day's closing transaction price. Four variables are included in the regression as proxies for the effects of short sales constraints. First, ΔVOL_F is the change in intraday volatility on an offer day relative to the median intraday volatility during the two trading days immediately preceding the offer (i.e., days −2 and −1). It is expected that the larger the decrease in intraday volatility on the offer day, the larger would be the downward adjustment of stock price, i.e., ΔVOL_F is expected to be positively correlated with the first-day return. Second, $SUV_{[-2,-1]}$ is the standardized unexpected trading volume over the two trading days before an offer. Larger values of $SUV_{[-2,-1]}$ would indicate a higher potential of being overpriced. Therefore, we expect that higher values of $SUV_{[-2,-1]}$ would lead to lower first-day returns. Third, *CARDUM* is a dummy variable that captures the sign of the five-day CAR; it is equal to 1 if $CAR > 0$ and equal to 0 if $CAR \leq 0$. We expect that firms with unfavorable information will experience a larger downward adjustment in their stock price on the offer day, i.e., the coefficient of *CARDUM* is expected to be positive. Fourth, we include *CAR* in the model to measure the potential existence of unfavorable private information because the higher the *CAR* is, the less likely that the private information is unfavorable. Thus, the sign of the coefficient of *CAR* is expected to be positive.

Two control variables that may affect the adjustment of stock prices on the first day are included in the regression shown in Eq. (14). The first, *SURPRISE*, captures the element of surprise in the discounting of the SEO on the first trading day and is measured by the residual of model 5 (Table 7).[6] It represents the discount beyond investors' aggregate expectation. As confirmed by Altinkilic and Hansen (2003), offer prices convey information that may alter the estimation of investors, and a major component of that information is the discounting surprise. The larger the unanticipated discount, the more investors will adjust their estimation downward. In addition, because part of the information contained in unanticipated discounts had already been acquired by some investors and should already have been incorporated into the closing price on day −1, the coefficient of

[6] $DISCOUNT = \beta_0 + \beta_1 VOL_{benchmark} + \beta_2 \Delta VOL_{[-2,-1]} + \beta_3 SUV_{[-2,-1]} + \beta_4 \Delta ASYM_{[-2,-1]} + \beta_{10} ROUNDING + \varepsilon$

SURPRISE is predicted to be higher than −1 but still negative. The second control variable is the market return, *MKT_RETURN*, as measured by the NYSE equally-weighted index on the offer day, reflecting the market movement on the offer day.

The regression results of the determinants of offer-day adjustments are presented in Panel C of Table 8. These results show a significantly negative relationship between the first-day return and the degree of discounting surprise. The coefficient of *SURPRISE*, which is less than −0.64 and significant at the 1% level, confirms that stock price adjustments, to a large extent, reflect the information contained in the offer price. The coefficient of *MKT_RETURN* is positive and significant at the 5% level, which indicates that first-day returns move contemporaneously with the market.

The positive correlation between the dummy variable, *CARDUM*, and stock price adjustment supports the hypothesis that for stocks that are less susceptible to short sales constraints (i.e., when *CARDUM* equals 1) there is less obvious downward adjustment of stock prices on the offer day. The positive coefficient of *CAR* provides further evidence that stocks that are susceptible to short sales constraints are more likely to be overpriced. Furthermore, the positive coefficient of ΔVOL_F and negative coefficient of $SUV_{[-2,-1]}$ in models (3) and (4) also indicate that the constraints on informed trading of unfavorable information cause stocks to be overpriced.

7. Conclusion

Prior to SEC's adoption of Rule 10b-21, the popular belief was that some investors could manipulate the stock price through short selling during the pre-pricing period. Market participants assumed that informed investors with favorable private information on the issuers would trade contrary to their private information to drive the market price down. Because the prices of new offers are typically based on the closing price prior to the pricing, such a manipulative conduct distorts the market price for the security, inhibiting the stock market from functioning as an independent pricing mechanism and eroding the fairness of offer price. In order to avoid such manipulative trading, National Association of Securities Dealers (NASD) adopted Rule 10b-21 and Rule 105 successively, trying to prohibit the potential manipulative conducts by effecting short sales prior to pricing to profit from buying new shares at lower offer price.

Previous studies have suggested that the constraints on short sales over the restricted period before pricing restrict the information-based short sales and thus increase the information asymmetry between informed and uninformed traders. However, none of them provided explicit evidence to support their suppositions. The study discussed in this article examines the change in information content of stock price around an SEO offer day and reveals that, for those offers with hidden adverse information, the constraints on short sales inhibit the incorporation of unfavorable information and cause a substantial increase in price uncertainty, lead to divergence in investors' opinion and result in market's relatively more sensitive response to seller-initiated trading. The evidence presented supports the proposition that the constraints of the SEC's Rule 105 reduce information content of stock price before an SEO offer.

Multivariate analysis suggests that, after controlling for other possible contributors for a value discount on an offer day, such as price pressure and rounding of SEO pricing, the decrease in information content of stock price due to Rule 105 significantly affects the pricing of SEOs. Due to the restraints of the Rule on informed trading based on bad news, stocks with private unfavorable information are more likely to be overpriced. Therefore, investors readjust their estimation of stock values according to the information released on the pricing day. The downward correction of value estimation causes the first-day returns of stocks with unfavorable private news to be larger than the first-day returns of stocks with favorable news.

References

Admati, A. R., & Pfleiderer, P. (1988). A theory of intraday patterns: Volume and price variability. *Review of Financial Studies*, *1*, 3–40.

Affleck-Graves, J., Hedge, S. P., & Miller, R. E. (1994). Trading mechanism and the components of the bid-ask spread. *Journal of Finance*, *49*, 1471–1488.

Allen, F., & Faulhaber, G. R. (1989). Signaling by underpricing in the IPO market. *Journal of Financial Economics*, *23*, 303–324.

Altinkilic, O., & Hansen, R. S. (2003). Discounting and underpricing in seasoned equity offers. *Journal of Financial Economics*, *69*, 285–323.

Amin, K. I., & Lee, C. M. C. (1997). Option trading, price discovery, and earnings news dissemination. *Contemporary Accounting Research*, *14*, 153–192.

Andersen, T., Bollerslev, T., Diebold, F., & Ebens, H. (2001). The distribution of realized stock return volatility. *Journal of Financial Economics*, *61*, 43–76.

Asquith, P., & Mullins, D. W. (1986). Equity issues and offering dilution. *Journal of Financial Economics*, *15*, 61–89.

Bradley, D., Cooney, J., Jordan, B., & Singh, A. (2004). Negotiation and the IPO offer price: A comparison of integer vs. non-integer IPOs. *Journal of Financial and Quantitative Analysis*, *39*, 517–540.

Cao, C., Chen, Z., & Griffin, J. M. (2005). Informational content of option volume prior to takeovers. *Journal of Business*, *78*, 1073–1109.

Chae, J. (2005). Trading volume, information asymmetry, and timing information. *Journal of Finance*, *60*, 413–442.

Chemmanur, T. J. (1993). The pricing of initial public offers: A dynamic model with information production. *Journal of Finance*, *48*, 285–304.

Corwin, S. A. (2003). The determinants of underpricing for seasoned equity offers. *Journal of Finance*, *58*, 2249–2279.

Cready, W. M. (1988). Information value and investor wealth: The case of earnings announcements. *Journal of Accounting Research*, *26*, 1–27.

Cready, W. M., & Mynatt, P. G. (1991). The information content of annual reports: A price and trading response analysis. *The Accounting Review*, *66*, 291–312.

Danielsen, B. R., & Sorescu, S. M. (2001). Why do option introductions depress stock prices? A study of diminishing short sale constraints. *Journal of Financial and Quantitative Analysis*, *36*, 451–484.

Fleming, J., Kirby, C., & Ostdiek, B. (2003). The economic value of volatility timing using "realized" volatility. *Journal of Financial Economics*, *67*, 473–509.

Foster, F. D., & Viswanathan, S. (1990). A theory of the intraday variations in volume, variance, and trading costs in securities markets. *Review of Financial Studies*, *3*, 593–624.

Garfinkel, J., & Sokobin, J. (2006). Volume, opinion divergence, and returns: A study of post-earnings announcement drift. *Journal of Accounting Research*, *44*, 85–112.

Gerard, B., & Nanda, V. (1993). Trading and manipulation around seasoned equity offerings. *Journal of Finance*, *48*, 213–245.

Henry, T. R., & Koski, J. L. (2010). Short selling around seasoned equity offerings. *The Review of Financial Studies*, *23*, 4389–4418.

Kim, K. A., & Shin, H. -H. (2004). The puzzling increase in the underpricing of seasoned equity offerings. *Financial Review*, *39*, 343–365.

Kyle, A. S. (1985). Continuous auctions and insider trading. *Econometrica*, *53*, 1315–1336.

Lease, R. C., Masulis, R. W., & Page, J. R. (1991). An investigation of market microstructure impacts on event study returns. *Journal of Finance*, *46*, 1523–1536.

Lee, C. (1992). Earnings news and small traders: An intraday analysis. *Journal of Accounting and Economics*, *15*, 265–302.

Lee, C., & Radhakrishna, B. (2000). Inferring investor behavior: Evidence from TORQ data. *Journal of Financial Markets*, *3*, 83–111.

Lee, C. M. C., & Ready, M. J. (1991). Trade size and components of the bid-ask spread. *Review of Financial Studies*, *8*, 1153–1183.

Loughran, T., & Ritter, J. R. (2002). Why don't issuers get upset about leaving money on the table in IPOs? *Review of Financial Studies*, *15*, 413–443.

Mikkelson, W. H., & Partch, M. M. (1985). Stock price effects and costs of secondary distributions. *Journal of Financial Economics*, *14*, 165–194.

Mola, S., & Loughran, T. (2004). Discounting and clustering in seasoned equity offering prices. *Journal of Financial and Quantitative Analysis*, *39*, 1–23.

Myers, S. C., & Majluf, N. S. (1984). Corporate financing and investment decisions when firms have information that investors do not have. *Journal of Financial Economics*, *13*, 187–221.

Rock, K. (1986). Why new issues are underpriced. *Journal of Financial Economics*, *15*, 187–212.

Safieddine, A., & Wilhelm, W. J. (1996). An empirical investigation of short-selling activity prior to seasoned equity offerings. *Journal of Finance*, *51*, 729–749.

Scholes, M. S. (1972). The market for securities: Substitution versus price pressure and the effects of information on share prices. *Journal of Business*, *45*, 179–211.

Welch, I. (1989). Seasoned offerings, imitation costs, and the underpricing of initial public offerings. *Journal of Finance*, *44*, 421–450.

Welch, I. (1992). Sequential sales, learning and cascades. *Journal of Finance*, *47*, 695–732.