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# SEC Rule 105 and Price Discovery in the Secondary Market

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**SEC Rule 105 and Price Discovery in the Secondary Market**

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**SEC Rule 105 and Price Discovery in the Secondary Market**


## ABSTRACT

Using a bootstrap technique, we compare the speed of the price discovery of SEOs issued during the SEC Rule 10b-21 period and those issued during the Rule 105 period on the offer day. We make several observations upon the adoption of Rule 105. After the adoption of Rule 105, the speed of price discovery slows and becomes less efficient on the offer day. We also observe a higher fraction of price discovery attributable to private information under Rule 105 that is consistent with the hypothesis that a shortened restricted period would lead to difficulty of exploring the information contained in the offer price discounts and result in high information asymmetry on the offer day.



*Key words:* Price discovery; SEC Rule 105 SEOs; Offer day.

*JEL Classification*: G14; G18

**SEC Rule 105 and Price Discovery in the Secondary Market**

## 1. INTRODUCTION

The primary objective of the present study is to examine the effects of SEC Rule 105 on the amount and timing of price discovery in the secondary market during the offer day. Rule 105 was adopted by SEC in April 1, 1997 to replace Rule 10b-21. Compared with its predecessor, Rule 105 has a shorter restricted period for short sales. It can be argued that a shortened restricted period creates a good opportunity for informed short sellers to trade prior to the restricted period and cover their positions using shares in the offering. This could result in the decrease in information efficiency of pre-offer closing price and lead to the difficulty of interpreting the information contained in offer price discounts and thus could slow down the speed of price discovery on the offer day.

The focus of our study is to contrast the SEOs issued during the Rule 10b-21 period with those issued during Rule 105 period. We expect the speed of price discovery in these two categories of SEOs should be different. Altinkilic et al. (2003) maintain that the difference between the actual and predicted discounts, discount surprise, is the most important component of information. Positive discount surprise reveals adverse information of the firm and investors will adjust their evaluation of the firm's stock downside accordingly. In contrast, negative discount surprise signals favorable information that has not been incorporated into stock price and thus should lead to the lift of stock price on the offer day. However, if pre-offer price is less informative, it becomes harder for investors to judge the accurate information component in discount surprise. Under this situation, the price discovery would slow down on the offer day.

We investigate the timing and efficiency of offer-day price discovery for SEOs issued on both Nasdaq and NYSE from 1993 through 2005. Three issues are examined: (1) speed of price adjustment on the offer day, (2) efficiency of price discovery on the offer day, and (3) the fraction of price discovery attributable to private information over the offer day.

First, we compare the amount of information that is incorporated into stock price during each 15-minute-interval throughout the offer day between SEOs issued under Rule 10b-21 and SEOs issued under Rule 105. We find that the price discovery for those SEOs issued during the Rule 10b-21 period is much faster than those issued during the Rule 105 period. We observe a higher fraction of price discovery occurs during close-to-open period before the adoption of Rule 105. We also find that during the Rule 10b-21 period, it takes shorter time to complete 75% of the offer-day price discovery.

Second, we check the efficiency of price discovery for each 15-minute-interval on the offer day. We find that offer-day price discovery for SEOs issued under Rule 105 is less efficient than that for SEOs issued under Rule 10b-21. Using the "unbiasedness regression" inspired by Biais, Hillion, and Spatt (1999), we find that after the adoption of Rule 105, the price discovery is not efficient until the last trading hours. In comparison, prior to the adoption of Rule 105, during the most time of the offer day, the price discovery is efficient, especially during the first trading hour.

Third, following Hasbrouck (1991a, 1991b)'s technique, we estimate the fraction of price discovery attributable to private information. We observe a higher ratio of private information to total information after the adoption of Rule 105, which is consistent with

the hypothesis that Rule 105 reduces the information efficiency of pre-offer closing price and leads to higher information asymmetry on the offer day.

Overall, the evidence shows that Rule 105 causes the low information efficiency of pre-offer stock prices and leads to the difficulty of interpreting the information contained in SEO discount and SEO discount surprise, which results in the slow speed and low efficiency of price discovery on the offer day.

The remainder of the paper is organized as follows. Section 2 describes the sample data and summary statistics. Section 3 examines the amount and timing of price discovery on the offer day. Section 4 analyzes the efficiency of offer-day price discovery. Section 5 investigates the fraction of price discovery attributable to private information. Section 6 concludes.

## 2. DATA AND SAMPLE CHARACTERISTICS

### 2.1 SAMPLE SELECTION

We gather our sample of SEO firms from the Securities Data Company (SDC), which provides the data related to the offering characteristics of SEO firms, such as offer price, offer proceeds, shares issued and number of shares outstanding. The sample consists of seasoned equity issues of ordinary common shares on Nasdaq or NYSE from January 1993 to December 2005. We exclude unit offerings, shelf offerings, closed-end fund, real estate investment trust (REIT), and American Depository Receipt (ADR) from our sample. Further, we only include the firms with offer prices higher than $5 and firms that are in NYSE's Trade and Quote (TAQ) database or the CRSP database. The final sample contains 2553 SEOs, including 1890 Nasdaq SEOs and 663 NYSE SEOs.

Intraday data were collected from the NYSE TAQ database. 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 Time are not included in the present study. Market information, such as stock prices, returns and market capitalization, was obtained from the CRSP database.

SDC database usually records date of announcing offer prices as offer date. However, some firms announce new offer prices after the market closes, and the effective offer date should be the next trading day of the SDC offer date. We follow the method suggested by Lease et al. (1991) and Corwin (2003) to correct the SDC offer date. Specifically, we identify the date following SDC offer date as effective offer date if the trading volume on the day following the SDC offer date is more than twice the volume of the SDC offer date and more than twice the average daily trading volume over the 250 days prior to the offer date.

### 2.2 DESCRIPTIVE STATISTICS

<Insert Table 1 here.>

Table 1 displays summary statistics for firm and offer characteristics for SEOs issued under Rule 10b-21 and under Rule 105. Issuing firms that issued after the adoption of Rule 105 are larger, with an average market capitalization of $1050.46 million on Nasdaq and $2751.59 million on NYSE. Average offer proceeds for SEOs issued under Rule 105 is much higher due to higher average offer price and higher average offered shares after the adoption of Rule 105.

<Insert Table 2 here.>

Table 2 summarizes trading activities and price changes on the offer day for SEOs issued under Rule 10b-21 and under Rule 105. NYSE-issued SEOs open later than Nasdaq-issued SEOs. On average, NYSE-issued SEOs open 16 minutes after 9:30:00 open during the Rule 10b-21 period, and open 15 minutes after market open during the Rule 105 period. In comparison, Nasdaq-issued SEOs open less than 3 minutes after market open during the Rule 10b-21 period, and open less than 1 minute after open during the Rule 105 period. We do not observe obvious change in SEO discounts for Nasdaq-issued SEOs after the adoption of Rule 105, but we observe a significant increase in SEO discounts for those NYSE-issued SEOs.

For Nasdaq-issued SEOs, the average price change from close to close increases but average price change from close to open decreases after the adoption of Rule 105, which indicates that a lower portion of price discovery occurs before the market open during the Rule 105 period. For NYSE-issued SEOs, we do not observe an obvious change in average close-to-close returns, but a large decrease in average close-to-open returns during the Rule 105 period.

For Nasdaq-issued SEOs, the opening trading volume is 0.48% of offered shares during the Rule 10b-21 period, but decreases to 0.29% during the Rule 105 period. However, the average offer day trading volume increases after the adoption of Rule 105, which leads to a lower ratio or opening trading volume and offer-day trading volume during the Rule 105 period. For NYSE-issued SEOs, the ratio of opening trading volume and offer-day trading volume also decreases during the Rule 105 period. The evidence indicates that, after the adoption of Rule 105, fewer traders transact at the market open.

Admati and Pfleiderer (1988) suggest that the timing of liquidity trading depends on the degree of competition among informed traders and the timing of informed traders depends on the degree of concentration of liquidity trading. Specifically, liquidity traders tend to trade when opinions of informed traders are homogeneous and the competition between informed traders is intense. However, Rule 105 complicates the interpretation of information contained in offer prices, which leads to the diversity of informed traders' opinion and weakens the competition among informed traders. The exacerbation of terms of trade for liquidity traders results in thin trading of liquidity traders, and this, in turn, leads to thin informed trading at the market open.

## 3. EMPIRICAL RESULTS

### 3.1 PRICE DISCOVERY

In the previous sections, we analyzed the effects of Rule 105 on speed of price discovery on the offer day. We expect that Rule 105 would reduce the information content of offer prices and would slow down the process of price discovery. In this section, we estimate the amount of new information impounded into stock price during the each 15-minute-interval for both Rule 10b-21 period and Rule 105 period.

#### 3.1.1 Weighted price contribution (*WPC*)

Following Barclay and Warner (1993), Cao et al. (2000) and Barclay and Hendershott (2003), the measure used to estimate the amount of price discovery is weighted price contribution (*WPC*) during each period.

For each 15-minute-interval i, WPC is determined as:

$$WPC_i = \sum_{s=1}^{S} \left( \frac{|ret_s|}{\sum_{s=1}^{S} |ret_s|} \right) * \left( \frac{ret_{i,s}}{ret_s} \right) \tag{1}$$

where $ret_{i,s}$ is the logarithmic price change over interval i for stock s and $ret_s$ is close-to-close stock return for stock s. The second term measures the fraction of price change during interval i relative to close-to-close return. The first term is the weight that is used to measure the contribution of each stock to the total absolute price change of all stocks on the offer day.

<Insert Table 3 here.>

As noted by Barclay and Warner (1993), the advantage of introducing weighting scheme when calculating average price contribution is to lessen the effects of extreme values among observations. Specifically, if absolute values of close-to-close return is very small, while price change in some interval is relatively large, then fraction of price change in that interval will be abnormally high, which will pull up the average price contribution in the interval. Weighted price contribution can avoid this problem by downweighting observations with low absolute price change on the offer day. However, the distribution of weighted mean is unknown, which leads to the difficulty of calculation of statistical inferences for weighted average of price contribution and statistical comparison of the amount of price discovery between SEOs issued during the Rule 10b-21 period and those issued during the Rule 105 period. Therefore, we employ bootstrap technique to conduct univariate tests for WPC and gauge statistical difference in WPC (detail provided in the Appendix).

Panel A of Table 3 displays interval-by-interval WPC for close-to-close return for the two Nasdaq-issued subsamples conditioned on whether the offer is issued before April 1, 1997 (Rule 105 implementation date) or not. Two main results can be seen from the analysis. First, most offer-day price discovery occurs during close-to-open period, the first trading hour and the last trading hour of the offer day. For those stocks issued on Nasdaq, about 40% of price discovery occurs prior to the market open, about 20% occurs during the first trading hour and about 10% occurs during the last trading hour. Secondly, the speeds of price discovery for SEOs issued during the Rule 10b-21 period are much faster than those issued during the Rule 105 period. During the Rule 10b-21 period, 44.66% of price discovery occurs during close-to-open period; in comparison, during the Rule 105 period, only 36.86% occurs during close-to-open period. The bootstrap test shows that the difference in close-to-open WPC is significant at the 1% level. On a further analysis, we find that during the Rule 10b-21 period, the amount of price discovery declines rapidly after the open and falls close to zero after ¾ trading hours. However, during the Rule 105 period, the price discovery persists almost over the whole trading day.

Panel B of Table 3 displays interval-by-interval WPC for close-to-close return for NYSE-issued SEOs during the Rule 10b-21 period and Rule 105 period. Similar to the results for Nasdaq-issued stocks, we observe slower price discovery after the adoption of Rule 105. During the Rule 10b-21 period, 56.73% of price discovery occurs prior to the market open, whereas during the Rule 105 period 52.82% occurs. Furthermore, significantly positive price discovery lasts for a shorter time during the Rule 10b-21 period than that during the Rule 105 period.

### 3.1.2 Cumulative weighted price contribution (*Cum_WPC*)

Panel A of Table 4 reports the cumulative weighted price contribution (*Cum_WPC*) based on close-to-close return during each 15-minute interval for Nasdaq-issued SEOs. We observe that during the trading hours, the amount of price discovery increases monotonically. Notably, the price discovery is faster for those SEOs issued before the adoption of Rule 105. During the Rule 10b-21 period, 75% of price discovery has completed after 1.5 trading hours; in comparison, during the Rule 105 period, it takes 2.25 trading hours to complete 75% of price discovery. Furthermore, during the first trading hours, the differences in price discovery for the two periods are significant at the 1% level. The gap shrinks gradually as the time goes by and become insignificant after three trading hours.

<Insert Table 4 here.>

Panel B of Table 4 reports the cumulative weighted price contribution during each 15-minute interval for both categories of SEOs. Similar to the results in Panel A, Rule 105 reduces the speed of price discovery. During the Rule 10b-21 period, it takes less than one trading hour to complete 75% of price discovery; however, during the Rule 105 period, it takes 1.75 hours to complete 75%.

## 3.2 Efficiency of Price Discovery

### 3.2.1 Unbiasedness regression

Biais et al. (1999) propose that the orders placed during the preopen period could be "noisy" or manipulative (noise hypothesis) or could be informative and equal the

conditional expectation of the asset value (learning hypothesis). Similarly, the price discovery occurred during the trading hours may also be due to the noisy trading of liquidity traders. Liquidity trading could result in temporary price move that would eventually reserve. Therefore, it is necessary to estimate the informativeness of stock prices and the efficiency of price discovery by using the "unbiasedness regression" inspired by Biais, Hillion, and Spatt (1999).

The following unbiasedness regression model is estimated:

$$close - close = \alpha + \beta_i (price_i - close) + \varepsilon_i \tag{2}$$

where we refer the closing price of the offer day to new equilibrium value of the asset and take offer price as the proxy for old market equilibrium prices. $price_i$ is indicative price for each 15-minute interval.

We estimate the cross-sectional regression for each 15-minute interval. If indicative price is conditional expectation of asset value, we are supposed to observe that the slope of the coefficient in the model is equal to one. If, otherwise, the price change during the first trading hours are mainly the result of noisy trading, the coefficient of the model is expected to be significantly different from 1.

<Insert Table 5 here.>

Panel A of Table 5 reports the slope coefficients in the model for the Nasdaq-issued SEOs. It can be observed that before the adoption of Rule 105, during the first and the last trading hours, the slope coefficients are not significantly different from 1, which indicates that the trading activities are informative and stock prices are efficient during these periods. In comparison, after the adoption of Rule 105, the slope coefficients are different from 1 until the last trading hour before the market close, which indicates that

during the most time of the trading period, the price discovery is less efficient. Furthermore, the bootstrap test for difference in slope coefficients between Rule 10b-21 period and Rule 105 period suggests that the offer-day price discovery during the Rule 10b-21 period is more efficient than those during the Rule 105 period.

Panel B of Table 5 reports the slope coefficients for the NYSE-issued SEOs. Similar to the results for Nasdaq-issued SEOs, we find that the offer-day price discovery prior to the adoption of Rule 105 is more efficient than that after the adoption of Rule 105. During the Rule 10b-21 period, the slope coefficients for each interval are all not significantly different from 1, whereas during the Rule 105 period, the slope coefficients are only close to 1 during the first half and the last one trading hours. The bootstrap test further corroborates that the offer-day price discovery is more efficient during the Rule 10b-21 period.

In addition, we estimate the adjusted R-squares for each interval and for each category of SEOs. Adjusted R-square can reflect the uncertainty remaining about the equilibrium of stock value after we take into account the information contained in the indicative stock prices. The uncertainty should decrease when more information is embedded into stock prices and thus the adjusted R-square should increase accordingly.

From Panel A of Table 5, we observe that R-squares for both categories of SEOs increase monotonically during the trading hours. During the Rule 10b-21 period, the R-square increases rapidly from 0.51 to 0.81 during the first 1.5 trading hours, and after 11:00 am, the R-square continues to increase but the increasing speed slows down obviously until it reaches 1 at the market close. In comparison, during the Rule 105 period, the R-square rises rapidly from 0.42 to 0.80 during the first two trading hours and

the speed of increase slows down after that. In particular, during the first 1.5 trading hours, the adjusted R-square for those SEOs issued during the Rule 10b-21 period is significantly higher than those for SEOs issued during the Rule 105 period. All of these evidences show that the efficient price discovery for SEOs issued during the Rule 10b-21 period occurs much later than that for SEOs issued during the Rule 105 period. The results for NYSE-issued SEOs are similar to those for Nasdaq-issued SEOs.

### 3.2.2 Convergence of stock price to equilibrium asset value

We mention in last section that when more and more information are impounded into stock price, stock price should be closer and closer to the market equilibrium asset value. Therefore, we should observe convergence tendency between stock price and close price during the offer day.

We measure the extent of divergence between stock price and offer-day closing price using the following formula:

$$divergence_i = abs(\log(close / price_i)) \tag{3}$$

where close is the closing price of the offer day, and $price_i$ is price at the end of each 15-minute interval.

<Insert Table 6 here.>

Panel A of Table 6 reports the extents of divergence to the offer day's closing price in each 15-minute interval for Nasdaq-issued SEOs. We find that divergence between stock price and closing price shrinks quickly during the two trading hours after the market open. In particular, the divergences of those SEOs issued before the adoption of Rule 105 are much smaller than those of SEOs issued after that. During the Rule 10b-21

period, the average divergence has been shrunk to 2.86 at the market open. However, during the Rule 105 period, the average divergence is 3.98. Until the last half trading hour, the divergences for Nasdaq-issued SEOs are much lower than those for NYSE-issued SEOs.

Similar results can be observed for NYSE-issued SEOs from Panel B of Table 6. At the market open, the average divergence between stock price and offer-day closing price for those SEOs issued during the Rule 10b-21 period is 1.39, compared with 1.91 for those SEOs issued during the Rule 105 period. Furthermore, throughout the offer day, the divergences for SEOs issued during the Rule 10b-21 period are much lower than those for SEOs issued during the Rule 105 period.

### 3.3 Public versus Private Information

Because of the implementation of Rule 105, pre-offer prices become less informative, which leads to the difficulty of interpreting the information contained in the offer prices. Therefore, during the Rule 105 period, the ratio of public information on the offer day should be relatively lower than that during the Rule 10b-21 period.

In this section, we decompose information into its public and private components following Hasbrouck (1991a, 1991b)'s technique. We estimate the following VAR models for each category of SEOs:

$$r_t = \sum_{i=1}^{p} \alpha_i r_{t-i} + \sum_{i=0}^{p} \beta_i x_{t-i} + \varepsilon_{1,t} \tag{4}$$

$$x_t = \sum_{i=1}^{p} \gamma_i r_{t-i} + \sum_{i=0}^{p} \delta_i x_{t-i} + \varepsilon_{2,t} \tag{5}$$

where $r_t$ denotes the percent change (in logarithm) in the quote midpoint subsequent to the t-th transaction. $x_t$ denotes the trading direction inferred by Lee and Ready (1991)'s method, which equals 1 for a buyer-initiated order and equals 0 for a seller-initiated order. The lags used in the equations are 10.

<Insert Table 7 here.>

Table 7 reports the ratio of private information to total information ($\sigma_x^2/\sigma_v^2$) for each category of SEOs. Consistent with our expectation, the ratio of private information to total information rises after the adoption of Rule 105. For those SEOs issued in Nasdaq, the fraction of price discovery attributable to private information is 8.03% during the Rule 10b-21 period, compared with 14.68% during the Rule 105 period. For NYSE-issued SEOs, the ratio of private information rises from 29.07% to 32.73% after the adoption of Rule 105.

## 4. CONCLUSION

In 1997, SEC adopted Rule 105 to shorten the restricted period of short sales in order to reduce the adverse effects on informed short sales. However, the shortened restricted period provides informed traders an opportunity to trade in a relatively narrow span of time immediately prior to the beginning of restricted period so that they can cover their short positions using offering shares. The timing of informed trading would lead to the lower information efficiency of pre-offer stock prices, and lead to the difficulty of interpreting the information component in the offer price discounts, which could slow down the price discovery on the offer date.

Using a bootstrap technique, we compare the speed of the price discovery of SEO issued during the Rule 10b-21 period and those issued during the Rule 105 period through the offer day. We observe a substantial decrease in the speed of price discovery after the adoption of Rule 105. We also find that, after the adoption of Rule 105, the trades during the offer day have large temporary price impacts that introduce noise in the stock prices and the price discovery is less efficient than that under Rule 10b-21. In addition, the convergences of stock prices to equilibrium asset values are lagged under Rule 105. Furthermore, we show that a higher fraction of price discovery attributable to private information under Rule 105 which is consistent with our hypothesis that shortened restricted period would lead to the difficulty of exploring the information contained in the offer price discounts and result in the high information asymmetry on the offer day.

## APPENDIX

We generate a bootstrap distribution under the null hypothesis of no difference of information efficiency of pre-offer stock price between Rule 10b-21 period and Rule 105 period. We merge the sample of 851 (311) Nasdaq (NYSE) SEOs issued before the adoption of Rule 105 and the sample of 1039 (352) Nasdaq (NYSE) SEOs issued after the adoption of Rule 105 together. Take a sample of 851 (311) SEOs randomly (with replacement) from the combined sample as "Rule 10b-21" sample and similarly draw a sample of 1039 (352) SEOs as "Rule 105" sample. We then calculate weighted average price discovery, convergence of stock price to equilibrium value and run Biais, Hillion, and Spatt (1999)'s unbiasedness regression model to get $\beta$ and adjusted R-square. We repeat this procedure 2,000 times to build up a distribution of sample statistics under the null hypothesis that the distribution of sample statistics for "Rule 10b-21" sample is the same as the distribution for "Rule 105" sample. The test on difference of sample statistics is one-sided.

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## Table 1
## Summary Statistics for Seasoned Offers

This table presents means [medians] for a sample of 2553 seasoned offers issued on Nasdaq or NYSE from January 1993 to December 2005. The statistics for Nasdaq-issued SEOs are reported in Panel A and the statistics for NYSE-issued SEOs are reported in Panel B. The sample is divided conditioned on whether the offer is issued before April 1, 1997 (Rule 105 implementation date) or not. The *p-value* is from a test of the restriction that means [medians] are equal across subperiod based on t-test [wilcoxon test]. Market capitalization equals the closing price times the number of shares outstanding of the day prior to the offer. Offer proceeds equals the offer price times the number of offered shares.

| | | By Category | | |
|---|---|---|---|---|
| | All | Rule 10b-21 | Rule 105 | *p-value* |
| Panel A: Nasdaq | | | | |
| Number of SEOs | 1890 | 851 | 1039 | |
| Market Capitalization ($ mil.) | 730.10<br>[281.78] | 338.96<br>[194.53] | 1050.46<br>[339.29] | 0.00<br>[0.00] |
| Offer Price ($) | 27.44<br>[22.00] | 22.10<br>[20.00] | 31.81<br>[23.75] | 0.00<br>[0.00] |
| Offered Shares ($ mil.) | 2.31<br>[2.00] | 1.92<br>[1.70] | 2.62<br>[2.10] | 0.00<br>[0.00] |
| Offer Proceeds ($ mil.) | 87.99<br>[55.50] | 56.10<br>[41.60] | 114.11<br>[71.00] | 0.00<br>[0.00] |
| Panel B: NYSE | | | | |
| Number of SEOs | 663 | 311 | 352 | |
| Market Capitalization ($ mil.) | 2084.25<br>[783.48] | 1328.94<br>[630.21] | 2751.59<br>[995.94] | 0.00<br>[0.00] |
| Offer Price ($) | 30.96<br>[27.31] | 29.41<br>[27.75] | 32.32<br>[26.98] | 0.03<br>[0.67] |
| Offered Shares ($ mil.) | 4.56<br>[3.00] | 3.73<br>[2.50] | 5.32<br>[3.29] | 0.00<br>[0.00] |
| Offered Proceeds ($ mil.) | 186.84<br>[113.90] | 134.66<br>[84.70] | 232.94<br>[137.05] | 0.00<br>[0.00] |

## Table 2
## Trading Activity and Price Change for SEOs

This table presents means [medians] for a sample of 2553 seasoned offers issued on Nasdaq or NYSE from January 1993 to December 2005. The statistics for Nasdaq-issued SEOs are reported in Panel A and the statistics for NYSE-issued SEOs are reported in Panel B. The sample is divided conditioned on whether the offer is issued before April 1, 1997 (Rule 105 implementation date) or not. The *p-value* is from a test of the restriction that means [medians] are equal across subperiod based on t-test [wilcoxon test]. Opening delay is the number of minutes from 9:30:00 to the opening trade. SEO discount is defined as -1 times the return from the previous day's closing transaction price to the offer price. Close-to-close return is defined as the return from the previous day's closing transaction price to the offer day's closing transaction price. Close-to-open return is defined as the return from the previous day's closing transaction price to the offer day's opening transaction price. Opening trading volume is the number of shares traded in the opening trade. Day 1 trading volume is the number of shares traded on the offer day.

| | By Category | | |
|---|---|---|---|
| | Rule 10b-21 | Rule 105 | *p-value* |
| Panel A: Nasdaq | | | |
| Opening Delay (min) | 2.70<br>[0.52] | 0.82<br>[0.08] | 0.00<br>[0.00] |
| SEO Discount (%) | 3.22<br>[2.29] | 3.14<br>[2.32] | 0.63<br>[0.74] |
| Close-to-close Return (%) | -0.37<br>[-0.63] | 0.75<br>[-0.05] | 0.00<br>[0.15] |
| Close-to-open Return (%) | -1.51<br>[-1.10] | -0.89<br>[-0.44] | 0.00<br>[0.00] |
| Opening Trading Volume<br>(% of offered shares ) | 0.48<br>[0.06] | 0.29<br>[0.03] | 0.29<br>[0.00] |
| Day 1 Trading Volume<br>(% of offered shares) | 112.18<br>[61.43] | 131.91<br>[78.22] | 0.33<br>[0.00] |
| Panel B: NYSE | | | |
| Opening Delay (min) | 16.54<br>[13.05] | 15.05<br>[10.24] | 0.32<br>[0.00] |
| SEO Discount (%) | 1.10<br>[0.43] | 1.80<br>[0.99] | 0.00<br>[0.00] |
| Close-to-close Return (%) | 0.39<br>[0.00] | 0.32<br>[-0.21] | 0.82<br>[0.17] |
| Close-to-open Return (%) | -0.22<br>[0.00] | 0.05<br>[0.00] | 0.23<br>[0.80] |
| Opening Trading Volume<br>(% of offered shares ) | 20.02<br>[11.97] | 34.94<br>[11.88] | 0.33<br>[0.93] |
| Day 1 Trading Volume<br>(% of offered shares) | 58.19<br>[38.66] | 110.95<br>[52.29] | 0.19<br>[0.00] |

## Table 3
## Weighted Price Contribution from Close to Close by Time Period

This Table presents the weighted price contribution of each 15-minute-interval to the close-to-close return for a sample of 2553 seasoned offers issued on Nasdaq or NYSE from January 1993 to December 2005. For each 15-minute-interval i the weighted price contribution is calculated as follows:

$$WPC_i = \sum_{s=1}^{S} \left( \frac{|ret_s|}{\sum_{s=1}^{S} |ret_s|} \right) * \left( \frac{ret_{i,s}}{ret_s} \right)$$

where $ret_{i,s}$ is the logarithmic price change over interval i for stock s and $ret_s$ is close-to-close stock return for stock s. The statistics for Nasdaq-issued SEOs are reported in Panel A and the statistics for NYSE-issued SEOs are reported in Panel B. The sample is divided conditioned on whether the offer is issued before April 1, 1997 (Rule 105 implementation date) or not. Values that are significantly larger than zero at the 0.05 level are denoted with an *. The *p-value* is from a test of the restriction that weighted price contributions are equal across subperiod based on bootstrap test. *p-values* that are lower than 0.01, 0.05, and 0.10 are denoted with *, **, and ***, respectively.

Panel A: Nasdaq

| 15-minute-interval | Rule 10b-21 | Rule 105 | *p-value (bootstrap)* |
|---|---|---|---|
| Close to open | 44.66* | 36.86* | *** |
| 1 | 14.64* | 13.57* | |
| 2 | 3.42* | 5.40* | |
| 3 | 4.62* | 3.98* | |
| 4 | 1.79 | 3.59* | |
| 5 | 2.53 | 1.49 | |
| 6 | 0.85 | 2.07* | |
| 7 | 1.33 | 2.24* | |
| 8 | 1.66 | 1.85* | |
| 9 | 1.40 | 1.62* | |
| 10 | 2.56* | 1.77* | |
| 11 | -0.54 | 1.27* | * |
| 12 | 1.44 | 1.41* | |
| 13 | -0.41 | 1.44* | * |
| 14 | 0.76 | 1.01 | |
| 15 | 1.60 | 1.09 | |
| 16 | -0.17 | 1.42* | |
| 17 | 2.14 | 1.11 | |
| 18 | -0.94 | 0.75 | |
| 19 | 2.74* | 1.80* | |
| 20 | 2.16 | 1.81* | |
| 21 | 0.78 | 1.79* | |
| 22 | 0.23 | 1.20 | |
| 23 | 1.55 | 2.96* | |
| 24 | 2.11 | 1.95* | |
| 25 | 2.73* | 3.20* | |
| 26 | 4.33* | 1.34 | ** |

## Table 3 (Continued)

| Panel B: NYSE | | | |
|---|---|---|---|
| 15-minute-interval | Rule 10b-21 | Rule 105 | *p-value (bootstrap)* |
| Close to open | 56.73* | 52.82* | |
| 1 | 0.02 | 2.16 | |
| 2 | 8.20* | 5.51* | |
| 3 | 4.02* | 4.87* | |
| 4 | 2.52 | 2.89* | |
| 5 | 2.04 | 1.05 | |
| 6 | 2.61* | 0.80 | |
| 7 | -1.45 | 2.00* | *** |
| 8 | 0.83 | 1.89* | |
| 9 | 0.48 | 1.04 | |
| 10 | 3.32* | 1.50 | *** |
| 11 | 1.88 | 2.14* | |
| 12 | 0.66 | 1.98* | |
| 13 | 1.61 | 1.08 | |
| 14 | 0.44 | 0.11 | |
| 15 | 1.78 | 1.07 | |
| 16 | 0.65 | 0.85 | |
| 17 | 1.91 | 0.90 | |
| 18 | 1.54 | 1.35 | |
| 19 | 1.79 | 1.75* | |
| 20 | 1.07 | 1.40 | |
| 21 | 0.51 | 1.93 | |
| 22 | -0.20 | 2.63* | ** |
| 23 | 2.62* | 1.75 | |
| 24 | 3.42 | 1.43 | |
| 25 | 2.54* | 3.02* | |
| 26 | -1.53 | 0.08 | |

## Table 4
## Cumulative Weighted Price Contribution from Close to Close by Time Period

This Table presents the cumulative weighted price contribution of each 15-minute-interval to the close-to-close return for a sample of 2553 seasoned offers issued on Nasdaq or NYSE from January 1993 to December 2005. For each 15-minute-interval i the weighted price contribution is calculated as follows:

$$WPC_i = \sum_{s=1}^{S} \left( \frac{|ret_s|}{\sum_{s=1}^{S} |ret_s|} \right) * \left( \frac{ret_{i,s}}{ret_s} \right)$$

where $ret_{i,s}$ is the logarithmic price change over interval i for stock s and $ret_s$ is close-to-close stock return for stock s. The statistics for Nasdaq-issued SEOs are reported in Panel A and the statistics for NYSE-issued SEOs are reported in Panel B. The sample is divided conditioned on whether the offer is issued before April 1, 1997 (Rule 105 implementation date) or not. Values that are significantly larger than 75 at the 0.05 level are denoted with an *. The *p-value* is from a test of the restriction that weighted price contributions are equal across subperiod based on bootstrap test. *p-values* that are lower than 0.01, 0.05, and 0.10 are denoted with *, **, and ***, respectively.

Panel A: Nasdaq

| 15-minute-interval | Rule 10b-21 | Rule 105 | *p-value (bootstrap)* |
|---|---|---|---|
| Close to open | 44.66 | 36.86 | *** |
| 1 | 59.30 | 50.43 | *** |
| 2 | 62.73 | 55.83 | *** |
| 3 | 67.35 | 59.81 | *** |
| 4 | 69.14 | 63.40 | ** |
| 5 | 71.67 | 64.89 | *** |
| 6 | 72.52* | 66.96 | ** |
| 7 | 73.84* | 69.21 | ** |
| 8 | 75.51* | 71.06 | ** |
| 9 | 76.91* | 72.68* | ** |
| 10 | 79.47* | 74.44* | *** |
| 11 | 78.93* | 75.72* | * |
| 12 | 80.37* | 77.13* | * |
| 13 | 79.97* | 78.57* | |
| 14 | 80.73* | 79.58* | |
| 15 | 82.33* | 80.67* | |
| 16 | 82.16* | 82.09* | |
| 17 | 84.30* | 83.20* | |
| 18 | 83.36* | 83.95* | |
| 19 | 86.10* | 85.75* | |
| 20 | 88.27* | 87.56* | |
| 21 | 89.04* | 89.35* | |
| 22 | 89.28* | 90.55* | |
| 23 | 90.83* | 93.51* | |
| 24 | 92.94* | 95.46* | |
| 25 | 95.67* | 98.66* | |
| 26 | 100.00* | 100.00* | - |

## Table 4 (Continued)

| Panel B: NYSE | | | |
|---|---|---|---|
| 15-minute-interval | Rule 10b-21 | Rule 105 | *p-value (bootstrap)* |
| Close to open | 56.73 | 52.82 | |
| 1 | 56.76 | 54.97 | |
| 2 | 64.96 | 60.49 | |
| 3 | 68.98 | 65.36 | |
| 4 | 71.50* | 68.24 | |
| 5 | 73.54* | 69.29 | |
| 6 | 76.14* | 70.09 | * |
| 7 | 74.70* | 72.10* | |
| 8 | 75.52* | 73.98* | |
| 9 | 76.01* | 75.02* | |
| 10 | 79.33* | 76.52* | |
| 11 | 81.21* | 78.67* | |
| 12 | 81.87* | 80.65* | |
| 13 | 83.47* | 81.73* | |
| 14 | 83.91* | 81.84* | |
| 15 | 85.69* | 82.91* | |
| 16 | 86.34* | 83.76* | |
| 17 | 88.25* | 84.67* | |
| 18 | 89.79* | 86.01* | * |
| 19 | 91.58* | 87.76* | * |
| 20 | 92.65* | 89.16* | * |
| 21 | 93.16* | 91.09* | |
| 22 | 92.96* | 93.72* | |
| 23 | 95.58* | 95.47* | |
| 24 | 99.00* | 96.90* | |
| 25 | 101.53* | 99.92* | |
| 26 | 100.00* | 100.00* | - |

## Table 5
## Unbiasedness Regressions by Time Period

This Table presents the slope coefficients and adjusted R-squares of unbiasedness regressions for each 15-minute-interval for a sample of 2553 seasoned offers issued on Nasdaq or NYSE from January 1993 to December 2005. For each 15-minute-interval i , the following regression model is estimated:

$$close - close = \alpha + \beta_i (price_i - close) + \varepsilon_i$$

The statistics for Nasdaq-issued SEOs are reported in Panel A and the statistics for NYSE-issued SEOs are reported in Panel B. The sample is divided conditioned on whether the offer is issued before April 1, 1997 (Rule 105 implementation date) or not. Slope coefficients that are significantly larger than 1 at the 0.05 level are denoted with an *. The *p-value* is from a test of the restriction that weighted price contributions are equal across subperiod based on bootstrap test. *p-values* that are lower than 0.01, 0.05, and 0.10 are denoted with *, **, and ***, respectively.

Panel A: Nasdaq

| 15-minute-interval | Slope Coefficient ($\beta$) | | | Adjusted R-square (*Adj.* $R^2$) | | |
|---|---|---|---|---|---|---|
| | Rule 10b-21 | Rule 105 | *p-value (bootstrap)* | Rule 10b-21 | Rule 105 | *p-value (bootstrap)* |
| Close to open | 1.02 | 1.22* | *** | 0.51 | 0.42 | ** |
| 1 | 1.02 | 1.24* | *** | 0.64 | 0.58 | * |
| 2 | 1.03 | 1.22* | *** | 0.68 | 0.64 | * |
| 3 | 1.05 | 1.21* | *** | 0.73 | 0.68 | * |
| 4 | 1.05* | 1.19* | *** | 0.75 | 0.71 | * |
| 5 | 1.06* | 1.21* | *** | 0.78 | 0.74 | * |
| 6 | 1.08* | 1.19* | *** | 0.81 | 0.76 | ** |
| 7 | 1.07* | 1.18* | *** | 0.82 | 0.78 | ** |
| 8 | 1.05* | 1.18* | *** | 0.82 | 0.80 | |
| 9 | 1.05* | 1.17* | *** | 0.83 | 0.82 | |
| 10 | 1.07* | 1.16* | *** | 0.86 | 0.82 | *** |
| 11 | 1.08* | 1.14* | ** | 0.86 | 0.83 | ** |
| 12 | 1.07* | 1.13* | ** | 0.86 | 0.84 | * |
| 13 | 1.06* | 1.13* | ** | 0.86 | 0.85 | |
| 14 | 1.05* | 1.12* | ** | 0.86 | 0.86 | |
| 15 | 1.06* | 1.11* | ** | 0.87 | 0.87 | |
| 16 | 1.06* | 1.10* | * | 0.88 | 0.88 | |
| 17 | 1.05* | 1.10* | ** | 0.88 | 0.89 | |
| 18 | 1.05* | 1.09* | * | 0.88 | 0.89 | |
| 19 | 1.03 | 1.08* | ** | 0.90 | 0.90 | |
| 20 | 1.03 | 1.07* | ** | 0.91 | 0.91 | |
| 21 | 1.02 | 1.05* | | 0.92 | 0.92 | |
| 22 | 1.03* | 1.05* | | 0.92 | 0.93 | |
| 23 | 1.02 | 1.02 | | 0.93 | 0.94 | |
| 24 | 1.01 | 1.02 | | 0.94 | 0.95 | |
| 25 | 0.98 | 0.99 | | 0.94 | 0.97 | |
| 26 | 1.00 | 1.00 | - | 1.00 | 1.00 | - |

## Table 5 (Continued)

Panel B: NYSE

| 15-minute-interval | Slope Coefficient ($\beta$) | | | Adjusted R-square (*Adj.* $R^2$) | | |
|---|---|---|---|---|---|---|
| | Rule 10b-21 | Rule 105 | *p-value (bootstrap)* | Rule 10b-21 | Rule 105 | *p-value (bootstrap)* |
| Close to open | 1.03 | 1.08 | | 0.74 | 0.59 | * |
| 1 | 1.04 | 1.11 | | 0.75 | 0.61 | * |
| 2 | 1.03 | 1.14* | * | 0.78 | 0.66 | |
| 3 | 1.05 | 1.16* | * | 0.83 | 0.72 | * |
| 4 | 1.06 | 1.13* | | 0.85 | 0.75 | * |
| 5 | 1.06 | 1.13* | | 0.86 | 0.76 | * |
| 6 | 1.05 | 1.15* | * | 0.87 | 0.79 | * |
| 7 | 1.06 | 1.15* | * | 0.87 | 0.81 | |
| 8 | 1.07 | 1.13* | | 0.89 | 0.82 | |
| 9 | 1.07 | 1.13* | | 0.90 | 0.83 | * |
| 10 | 1.06 | 1.13* | | 0.90 | 0.84 | * |
| 11 | 1.05 | 1.13* | * | 0.92 | 0.86 | * |
| 12 | 1.05 | 1.11* | | 0.92 | 0.87 | * |
| 13 | 1.04 | 1.10* | * | 0.92 | 0.88 | |
| 14 | 1.05 | 1.11* | | 0.92 | 0.89 | |
| 15 | 1.04 | 1.11* | * | 0.93 | 0.90 | |
| 16 | 1.02 | 1.10* | ** | 0.93 | 0.89 | |
| 17 | 1.02 | 1.11* | ** | 0.94 | 0.90 | * |
| 18 | 1.01 | 1.09* | ** | 0.94 | 0.90 | * |
| 19 | 1.00 | 1.08* | ** | 0.95 | 0.92 | |
| 20 | 1.00 | 1.07* | ** | 0.95 | 0.93 | |
| 21 | 1.00 | 1.06* | ** | 0.96 | 0.93 | ** |
| 22 | 1.02 | 1.03 | | 0.97 | 0.95 | ** |
| 23 | 1.00 | 1.02 | | 0.97 | 0.96 | |
| 24 | 0.96 | 1.01 | | 0.95 | 0.98 | |
| 25 | 0.96 | 0.99 | | 0.96 | 0.99 | |
| 26 | 1.00 | 1.00 | | 1.00 | 1.00 | - |

## Table 6
## Convergence of Stock Price to Equilibrium Value by Time Period

This Table presents the average convergence of stock price to equilibrium value of each 15-minute-interval for a sample of 2553 seasoned offers issued on Nasdaq or NYSE from January 1993 to December 2005. The extent of divergence between stock price and offer-day closing price using the following formula:

$$divergence_i = abs(\log(close / price_i))$$

where close is the closing price of the offer day, and $price_i$ is price at the end of each 15-minute interval. The statistics for Nasdaq-issued SEOs are reported in Panel A and the statistics for NYSE-issued SEOs are reported in Panel B. The sample is divided conditioned on whether the offer is issued before April 1, 1997 (Rule 105 implementation date) or not. The *p-value* is from a test of the restriction that weighted price contributions are equal across subperiod based on bootstrap test. *p-values* that are lower than 0.01, 0.05, and 0.10 are denoted with *, **, and ***, respectively.

Panel A: Nasdaq

| 15-minute-interval | Rule 10b-21 | Rule 105 | *p-value (bootstrap)* |
|---|---|---|---|
| Close to open | 2.86 | 3.98 | *** |
| 1 | 2.46 | 3.28 | *** |
| 2 | 2.24 | 2.98 | *** |
| 3 | 2.02 | 2.83 | *** |
| 4 | 1.95 | 2.71 | *** |
| 5 | 1.83 | 2.56 | *** |
| 6 | 1.75 | 2.47 | *** |
| 7 | 1.66 | 2.36 | *** |
| 8 | 1.64 | 2.26 | *** |
| 9 | 1.59 | 2.15 | *** |
| 10 | 1.47 | 2.09 | *** |
| 11 | 1.47 | 2.01 | *** |
| 12 | 1.43 | 1.94 | *** |
| 13 | 1.46 | 1.87 | *** |
| 14 | 1.46 | 1.83 | *** |
| 15 | 1.37 | 1.75 | *** |
| 16 | 1.30 | 1.69 | *** |
| 17 | 1.31 | 1.62 | *** |
| 18 | 1.28 | 1.60 | *** |
| 19 | 1.18 | 1.54 | *** |
| 20 | 1.12 | 1.43 | *** |
| 21 | 1.09 | 1.35 | *** |
| 22 | 1.02 | 1.27 | *** |
| 23 | 0.96 | 1.14 | *** |
| 24 | 0.85 | 1.01 | *** |
| 25 | 0.78 | 0.79 | |
| 26 | 0.00 | 0.00 | - |

## Table 6 (Continued)

| Panel B: NYSE | | | |
|---|---|---|---|
| 15-minute-interval | Rule 10b-21 | Rule 105 | *p-value (bootstrap)* |
| Close to open | 1.39 | 1.91 | *** |
| 1 | 1.37 | 1.82 | *** |
| 2 | 1.25 | 1.67 | *** |
| 3 | 1.12 | 1.54 | *** |
| 4 | 1.04 | 1.43 | *** |
| 5 | 0.96 | 1.37 | *** |
| 6 | 0.93 | 1.32 | *** |
| 7 | 0.93 | 1.25 | *** |
| 8 | 0.87 | 1.22 | *** |
| 9 | 0.85 | 1.18 | *** |
| 10 | 0.81 | 1.14 | *** |
| 11 | 0.73 | 1.10 | *** |
| 12 | 0.71 | 1.05 | *** |
| 13 | 0.70 | 1.03 | *** |
| 14 | 0.71 | 1.00 | *** |
| 15 | 0.67 | 0.96 | *** |
| 16 | 0.65 | 0.96 | *** |
| 17 | 0.59 | 0.93 | *** |
| 18 | 0.58 | 0.91 | *** |
| 19 | 0.56 | 0.86 | *** |
| 20 | 0.53 | 0.81 | *** |
| 21 | 0.49 | 0.75 | *** |
| 22 | 0.41 | 0.64 | *** |
| 23 | 0.38 | 0.54 | *** |
| 24 | 0.32 | 0.44 | *** |
| 25 | 0.19 | 0.24 | |
| 26 | 0.00 | 0.00 | - |

## Table 7
## Public and Private Information: Variance Decomposition

This table presents the means [medians] of variance component of stock prices on the offer day for a sample of 2553 seasoned offers issued on Nasdaq or NYSE from January 1993 to December 2005. The statistics for Nasdaq-issued SEOs are reported in Panel A and the statistics for NYSE-issued SEOs are reported in Panel B. The sample is divided conditioned on whether the offer is issued before April 1, 1997 (Rule 105 implementation date) or not. The following VAR system for quote revisions and trades are estimated:

$$r_t = \sum_{i=1}^{p} \alpha_i r_{t-i} + \sum_{i=0}^{p} \beta_i x_{t-i} + \varepsilon_{1,t}$$

$$x_t = \sum_{i=1}^{p} \gamma_i r_{t-i} + \sum_{i=0}^{p} \delta_i x_{t-i} + \varepsilon_{2,t}$$

where $r_t$ denotes the percent change (in logarithm) in the quote midpoint subsequent to the t-th transaction. $x_t$ denotes the trading direction inferred by Lee and Ready (1991)'s method, which equals 1 for a buyer-initiated order and equals 0 for a seller-initiated order. The lags used in the equations are 10.

| | $\sigma_x^2/\sigma_v^2$ | | |
|---|---|---|---|
| | Rule 10b-21 | Rule 105 | *p-value* |
| Nasdaq | 8.03<br>[4.80] | 14.68<br>[13.83] | 0.00<br>[0.00] |
| NYSE | 29.07<br>[27.15] | 32.73<br>[32.60] | 0.00<br>[0.00] |