THE JOURNAL OF FINANCE • VOL. LI, NO. 2 • JUNE 1996

An Empirical Investigation of Short-Selling Activity Prior to Seasoned Equity Offerings

ASSEM SAFIEDDINE and WILLIAM J. WILHELM, JR.*

ABSTRACT

We investigate the nature and magnitude of short-selling activity around seasoned equity offerings, the relation between short-selling activity and issue discounts, and the consequences of the Securities and Exchange Commission (SEC's) adoption of Rule 10b-21 in response to concerns about manipulative short-selling practices. Seasoned offerings are characterized by abnormally high levels of short selling and option open interest. Higher levels of such activity are related to lower expected proceeds from the issuance of new shares. Where it could not be circumvented, Rule 10b-21 appears to have curbed short-selling activity and reduced issue discounts.

PRIOR TO 1988, MARKET participants claimed that it was common for traders to establish short positions prior to seasoned equity offerings for the sole purpose of producing an artificial discount in the price of new shares. Although one need not wait for a seasoned offering to pursue this strategy, critics argued that the ability to cover a short position with shares purchased at the fixed offer price made the shares of issuing firms exceptionally vulnerable to price manipulation. The perceived gravity of the threat of manipulation around seasoned equity offerings is reflected in the SEC's adoption of Rule 10b-21 on August 25, 1988.[1] By prohibiting the use of shares purchased at the offer price to cover short positions established after the filing of a registration statement (or Form 1-A), Rule 10b-21 sought to increase the cost of manipulation through selective restraint of short-selling activity.

In this article we investigate the nature and magnitude of short-selling activity around seasoned equity offerings and the relation between short-selling activity and issue discounts for 474 seasoned equity offerings by NYSE-

* Safieddine is from the Eli Broad College of Business, Michigan State University; Wilhelm is from the Wallace E. Carroll School of Management, Boston College. We thank Christopher Baum, Larry Benveniste, Scott Gibson, Kathleen Hanley, Edie Hotchkiss, Ed Kane, S. Joseph Khoury, Tim Mech, Hamid Mehran, Vikram Nanda, Dennis Sheehan, participants at the 1994 meeting of the Western Finance Association, the referees and René Stulz for helpful comments. We also thank Eleanor Cordner of the American Stock Exchange for providing a portion of the short interest data used in the study. Earlier drafts of the article were circulated under the title "An Empirical Investigation of Manipulation in Seasoned Equity Offerings."

[1] The Securities and Exchange Commission (SEC) first addressed the issue of price manipulation prior to public offerings in 1972 (Securities Exchange Act Release No. 9824) by suggesting that some forms of short-selling activity may violate the anti-manipulative provisions of the Exchange Act. The SEC followed this observation in 1974 with the first of three proposals for curbing manipulative activity around seasoned equity offerings. None of the proposals were adopted by the SEC. See SEC Release No. 33-6798; 34-26028; File No. S7-18-87 for further details.

and AMEX-listed firms. Exchange-traded firms are generally larger and more liquid than their Nasdaq counterparts. Moreover, short sellers of exchange-traded firms are constrained by the uptick rule and more severe limits on naked short selling (see Kadlec, Loderer and Sheehan (1994)). Thus, our sample should be biased against the concerns underlying the adoption of Rule 10b-21.

In spite of this bias, we find that short interest between the announcement of a seasoned offering and the offer date is approximately three times the level observed during the three months preceding the announcement. Short interest returns to normal levels following the offer date. In general, heightened short-selling activity is associated with larger issue discounts. Following the adoption of Rule 10b-21 pre-offer short interest is significantly lower than preadoption levels. Moreover, where the Rule appears to have been a binding constraint on market activity, issuing firms suffered smaller issue discounts.

Our findings also provide evidence of regulatory arbitrage in cases where the issuing firm has listed options. Although options transactions can substitute for short selling, Rule 10b-21 does not constrain option trading prior to seasoned offerings.[2] Similar to the pattern in short interest described earlier, option open interest increases sharply prior to seasoned offerings and declines just as sharply following the offer date. In contrast to the short-interest pattern, the pattern in open interest is *more* pronounced following the adoption of Rule 10b-21. Further, issuing firms with listed options face larger expected issue discounts than firms without listed options following the adoption of the Rule. Taken as a whole, the evidence suggests that where it was not easily circumvented, Rule 10b-21 constrained short-selling activity prior to seasoned offerings and reduced the expected cost of issuance.

In the following section, we outline the rationale for the adoption of Rule 10b-21 and explore the theoretical foundation for claims of manipulation around seasoned offerings. Section II describes the data used to investigate these claims and the consequences of the adoption of the Rule. The empirical evidence is presented in Section III. Section IV concludes the article.

I. Theory and Hypotheses

The SEC's rationale for adopting Rule 10b-21 rests on two observations about seasoned offerings believed to make the market vulnerable to manipulation. First, the seasoned equity offer price is conditioned on secondary market trading in existing shares. If individual trading strategies can influence the informativeness of secondary market prices, they can also influence the offer price for new shares. Secondly, the offer price for new shares is fixed. Under ordinary circumstances, short sellers cover their positions with shares purchased in the open market. Critics contended that the ability to purchase

[2] The SEC's ongoing review of antimanipulation regulation of securities offerings (see Federal Register, Vol. 59, No. 80, April 26, 1994, p. 21691) considers the prospect of extending Rule 10b-21 to transactions in related securities.

shares at the fixed offer price caused short selling in association with seasoned offerings to be less risky.[3]

Although there may be some merit to the notion that purchasing shares at the fixed offer price mitigates the risk of short selling, there is considerable uncertainty surrounding an individual investor's allocation of shares at the offer price. Seasoned offerings are attractive to investors if for no other reason than because shares purchased in the offering are not subject to the commissions faced when purchasing existing shares. Thus, seasoned offerings are commonly oversubscribed. When oversubscription occurs, new shares are rationed, and it is no longer clear that short sellers who expect to cover their positions from the offering face significantly less risk than their counterparts engaged in ordinary short-selling practices.

Several theoretical models bear directly on the SEC's rationale for the adoption of Rule 10b-21. Parsons and Raviv (1985) shed light on the dependence between the offer price for new shares and the secondary market price for existing shares. Rock (1986) observes that when investors are asymmetrically informed, rationing of oversubscribed offerings causes uninformed investors to receive relatively large (small) allocations of the least (most) attractive offerings. Faced with this *winner's curse*, uninformed investors will rationally participate in seasoned offerings only if shares are sold at a discount from the secondary market price. Gerard and Nanda (1993) extend these insights by showing that the winner's curse can be aggravated (and issue discounts inflated) by (manipulative) strategies that reduce the informativeness of the existing secondary market.

One such strategy involves short selling the issuing firm's existing shares prior to the offer date in spite of private information suggesting that the firm is undervalued in the market. Although trading contrary to one's private information is costly, it also diminishes the informativeness of secondary market prices, and therefore increases the issue discount. If the trader's expected allocation of new shares and the marginal effect on the issue discount are sufficiently large, the expected profits from covering the short position at the offer price can exceed the expected costs of trading contrary to private information. When this is true, Gerard and Nanda (1993) predict both increased short-selling activity prior to seasoned offerings and a direct relation between such activity and issue discounts.

Of course, the motivation for a short sale is unobservable. The period of time between the announcement of a seasoned offering and the offer date could be characterized by a systematic arrival of negative information. If so, an increase in short-selling activity would be a rational, non-manipulative response to the arrival of new information. If this is true, however, we should observe a *permanent* price decline. Further, Gerard and Nanda (1993) observe that if the primary consequence of the adoption of Rule 10b-21 is to constrain nonmanipulative short selling, market efficiency will be compromised and the (*temporary*) issue discount will increase.

[3] See SEC Release No. 33-6798; 34-26028; File No. S7-18-87, pp. 10–11.

Finally, some firms are certainly less likely than others to face an information environment that would support manipulative short selling. Utilities, for example, are subject to extensive regulatory oversight and are therefore more transparent than industrial firms (see Baghat and Frost (1986)). Thus, if there is a relation between short-selling activity and issue discounts *and* it is a consequence of investors being asymmetrically informed, evidence of the relation should be less pronounced among utilities.

A second set of hypotheses arises from the availability of exchange-traded options for some issuing firms. If the options market and the secondary market for existing shares are linked by arbitrage, option transactions are a substitute for direct short selling as a means of influencing the offer price for new shares.[4] Thus we predict a weaker link between direct short-selling activity and issue discounts prior to the adoption of Rule 10b-21 for firms where it is possible to substitute synthetic short positions for direct short selling.

Cox and Rubinstein (1985) suggest several reasons that options could be the preferred means of taking a short position in the issuing firm. First, options offer a means of circumventing the restriction of short sales to "plus ticks" or "zero-plus ticks." Further, purchasing a put, for example, generally requires less net equity than shorting the stock directly. Finally, option commissions tend to be lower than stock commissions when adjusted to provide comparable exposure to the underlying stock. On the other hand, dynamic strategies involving options (see Footnote 4) may incur relatively high transactions costs.

Finally, Rule 10b-21 does not constrain the establishment or covering of synthetic short positions. Thus, even if the Rule curbs direct short selling, it may do little to curb the manipulative activity envisioned by Gerard and Nanda (1993) for issuing firms with listed options. This implies that firms with listed options should exhibit larger issue discounts than firms without listed options following the adoption of Rule 10b-21.

II. Sample Design and Description

The sample is drawn from the population of 2,647 seasoned equity offerings during the 1980–1991 period reported in the *Investment Dealers' Digest (IDD) Corporate Financing Database*. Sample issues are firm commitment, underwritten public offerings. Best efforts and unit offerings are excluded as are issues where equity is offererd jointly with debt, preferred stock, or warrants.

Inclusion in the sample requires the availability of either the date on which the offering was announced in the *Wall Street Journal* or the date on which the

[4] Senchack and Starks (1993) and Figlewski and Webb (1993) provide evidence on the degree to which options are used as a substitute for direct short selling. There are a variety of strategies one could follow to establish an implicit short position through options. Simply buying put options or writing call options establishes an implicit short position that varies in magnitude with the option's delta. A constant equity exposure can be established through either a put-call-parity-based replication of the underlying equity or through a dynamic strategy involving options and borrowing or lending. We refer to the outcomes from the range of strategies used to establish implicit short positions as synthetic short positions.

offering was registered with the SEC. *Wall Street Journal Index* announcements of seasoned equity offerings are rare after 1984. For issues brought to market after this date we use the registration date obtained from *Lexis/Nexis* as a proxy for the announcement date.[5] We also require at least one observation of the level of short-selling activity between the announcement and offer dates. Since short interest records are not available for Nasdaq firms, 1,310 offerings by nonexchange-listed firms are excluded from the sample.

Monthly short interest reports produced by the exchanges provide the only direct measure of the level of short-selling activity around seasoned equity offerings. Both the New York Stock Exchange (NYSE) and American Stock Exchange (AMEX) maintain records of short interest as of the 8th of each month.[6] Short interest data for AMEX-listed firms is obtained directly from the Equity Surveillance Department of the exchange, and is therefore complete. Short interest data for NYSE-listed firms is obtained from monthly reports published in the *Wall Street Journal*. Inclusion in these reports requires that either current short interest or the change in short interest from the preceding month exceed a specified minimum level.[7] Thus the NYSE sample reflects a selection bias toward firms exhibiting a relatively high level of short interest. Failure to meet the conditions for inclusion in the monthly reports excludes 609 offerings by NYSE-listed firms from the sample.

Sample firms are also required to trade for at least 250 days preceding the announcement or registration date and to exhibit no stock splits or stock dividends within 10 trading days of the offer date. Daily return and volume data as well as the number of common shares outstanding are drawn from the 1992 University of Chicago Center for Research in Security Prices (CRSP) data files.

Our analysis focuses on two measures of the issue discount: 1) the return calculated from the close of trading on the day before new shares are offered to the offer price or 2) the return calculated from the offer price to the first closing price following the offer. Lease, Masulis, and Page (1991) point out that accurate calculation of these returns with publicly available data is difficult because some offerings appear to occur after the close of trading on the offer date indicated by IDD. Kadlec, Loderer, and Sheehan (1994) observe, however, that even the time stamp on Dow Jones News Retrieval Newswire stories does not necessarily identify the true time of the offer. Thus it is necessary to

[5] Masulis and Korwar (1986) note that registration generally occurs several days after the announcement of an offering. The sample mean of 34 days between the announcement date and the offer date and the sample mean of 28 days between the registration date and the offer date are consistent with this observation.

[6] Asquith and Meulbroek (1993) provide a detailed account of short interest reporting and publication practices.

[7] Prior to June 1983, a firm's short interest was reported if there was a minimum of 20,000 shares in outstanding short interest or if there was a change in excess of 10,000 shares from the previous month's level. Minimum requirements were then raised to 40,000 shares outstanding or a 20,000 share change. In November 1986, the minimum requirements were increased again to 100,000 shares outstanding or a 50,000 share change.

develop classification methods designed to minimize the measurement error associated with misidentification of the offer date.

A pronounced empirical regularity associated with seasoned offerings suggests a data-driven heuristic for identifying the offer date. Seasoned offerings are characterized by a sharp increase in trading volume in the aftermath of the offer. In our sample, the average volume on the IDD-reported offer date is approximately four times the mean daily volume during the 60 days preceding the announcement of the offering. Based on this empirical fact, we construct the following rule. Since the uncertainty surrounding the offer date arises from the possibility that selling of the offer begins *after* the close of trading on the IDD-reported offer date, if trading volume on the day after the IDD-reported offer date is more than twice the level observed on the IDD-reported offer date, we designate the day after IDD-reported date as the offer date. Otherwise, the IDD-reported date is retained as the offer date. Close-to-offer and offer-to-close returns are then centered on this date. This classification strategy leads to 18.4 percent of our sample having an offer date different from the IDD-reported offer date.

The final sample consists of 474 issues; 409 by NYSE-listed firms, and 65 by AMEX-listed firms. Issuing-firm age ranges from 6 to 92 years with a mean of 35.87 years since incorporation. The mean dollar value of shares issued is $111 million, or about 7 percent of the market value of common shares outstanding. Industrial issuers account for 355 offerings (320 different firms), with the remaining issues offered by utilities (105 different firms with a two-digit SIC code = 49). With the exception of several years, sample issues are relatively evenly distributed over the sample period with 53 offerings in 1980, 46 in 1981, 27 in 1982, 58 in 1983, 15 in 1984, 55 in 1985, 48 in 1986, 41 in 1987, 17 in 1988, 32 in 1989, 26 in 1990, and 56 in 1991. Thus, the sample includes 356 offerings prior to the adoption of Rule 10b-21 and 118 following adoption.

III. Empirical Evidence

A. *Univariate Analysis*

Table I presents summary statistics for a measure of (relative) short interest and two proxies for the issue discount. Panel A of Table I contains summary statistics prior to the adoption of Rule 10b-21. Postadoption summary statistics are reported in Panel B. In addition to reporting evidence for the full sample, Table I provides summary statistics for subsamples of industrial firms, utilities, and firms with and without listed options.

The first proxy for the issue discount is the close-to-offer return (R0) calculated from the last closing price before the offer. The −0.55 percent mean close-to-offer return for the 356-firm sample prior to the adoption of Rule 10b-21, although larger than the −0.28 percent return reported by Loderer et al. (1991) for NYSE/AMEX firms, is virtually identical to the −0.54 percent return reported by Smith (1977). The offer-to-close return (R1) calculated from the first closing price subsequent to the offer is presented as an alternative

Table I

Selected Holding-Period Percentage Returns for Seasoned Equity Offerings, 1980–1991

R_0 is the ratio of the offer price to the closing price on the day before issue, minus one ($\times$ 100). R_1 is the ratio of the closing price on the issue day to the offer price, minus one ($\times$ 100). Relative short interest (RSI) is the ratio of short interest between announcement and offer date to (mean) short interest preceding the announcement. For $R0$ and $R1$, the t-statistic p-value is the probability value of the t-test of the hypothesis of zero mean. For relative short interest the t-statistic p-value is the probability value of the t-test of the hypothesis of mean = 1; non-parametric significance levels are based on two-tailed sign test; percent zero (negative) is the percent of zero (negative) returns.

	First Quartile	Median	Mean	Third Quartile	t-Statistic (p-Value)	Sign-Test (p-Value)	Percent Zero	Percent Negative
Panel A: Pre-Adoption								
All offerings (sample size = 356)								
R0	−0.75	0	−0.55	1.62	0.00	0.00	38	41
R1	−0.64	0	0.52	1.54	0.00	0.00	25	29
RSI	0.91	1.30	3.37	3.04	0.00	0.00		
Offerings by industrial firms with listed options (sample size = 48)								
R0	−0.70	0	−0.42	0.11	0.11	0.15	30	45
R1	−0.55	0	0.26	0.65	0.33	0.36	29	30
RSI	0.95	1.23	2.49	1.97	0.00	0.00		
Offerings by industrial firms without listed options (sample size = 220)								
R0	−2.16	−0.37	−0.72	1.59	0.00	0.00	15	52
R1	−1.27	0.31	0.62	2.19	0.00	0.00	14	33
RSI	0.93	1.20	3.30	2.51	0.00	0.00		
Offerings by utility firms with listed options (sample size = 15)								
R0	−0.49	0	−0.52	0.96	0.21	0.59	20	33
R1	0	0.49	0.88	1.37	0.65	0.31	27	20
RSI	0.79	1.73	5.87	3.32	0.03	0.00		
Offerings by utility firms without listed options (sample size = 73)								
R0	−0.66	0	−0.07	0.84	0.85	0.73	32	36
R1	−0.68	0	0.27	0.74	0.47	0.52	29	41
RSI	0.48	1.30	3.65	3.31	0.00	0.00		

proxy for the issue discount. The sample return of 0.52 percent lies between the 0.12 percent return observed by Loderer et al. (1991) and the 0.82 percent return reported by Smith (1977). A comparison of means and medians indicates that the distributions of both R0 and R1 are skewed. However, both parametric and nonparametric tests indicate that in each case the proxy for the issue discount is statistically different from zero at conventional levels (p-values less than 0.01 for each test).[8]

[8] Since the distributions of R0, R1, and the relative short interest variable, RSI, described later are not symmetric, we use a two-tailed sign test for all nonparametric tests of location within a

Table I—Continued

				Panel B: Post-Adoption				
				All offerings (sample size = 118)				
R0	−1.95	0	−0.46	−0.70	0.21	0.17	20	46
R1	−0.39	0	0.45	1.23	0.10	0.02	29	25
RSI	0.99	1.20	2.47	2.12	0.00	0.00		
				Offerings by industrial firms with listed options (sample size = 26)				
R0	−3.16	−1.05	−1.98	0.16	0.00	0.05	8	67
R1	0	0.87	1.44	2.53	0.00	0.01	17	16
RSI	0.95	1.24	2.42	2.17	0.00	0.00		
				Offerings by industrial firms without listed options (sample size = 61)				
R0	−1.89	0	0.01	2.15	0.89	0.79	17	43
R1	−1.08	0	0.00	1.19	0.94	0.85	32	31
RSI	0.99	1.23	2.79	2.77	0.00	0.00		
				Offerings by utility firms with listed options (sample size = 8)				
R0	−0.56	−0.12	−0.09	0	0.85	0.46	37	50
R1	0	0.25	0.35	0.32	0.21	0.31	25	12
RSI	0.98	1.18	1.17	1.28	0.12	0.07		
				Offerings by utility firms without listed options (sample size = 23)				
R0	−0.47	0	−0.34	0	0.56	0.62	38	37
R1	0	0	0.70	0.59	0.21	0.72	38	24
RSI	0.97	1.00	2.16	1.49	0.00	0.00		

Panel B indicates that both proxies for the issue discount decline following the adoption of Rule 10b-21 (R0 (−0.46 percent) and R1 (0.45 percent)). Only the median level of R1 is statistically different from zero at conventional levels (using a two-tailed sign test) following the adoption of Rule 10b-21. Although not reported in Table I, both parametric tests of differences in means and nonparametric (Wilcoxon-Mann-Whitney) tests of differences in location indicate that the differences between the pre- and postadoption proxies for the issue discount are statistically significant at the 0.05 level.

The relative short interest variable (RSI) is calculated by dividing the level of short interest reported between the announcement of the offering and the offer date (exclusive) by the mean level of short interest reported during the three months preceding the offering announcement. Thus, RSI is designed to reflect abnormal levels of short-selling activity prior to seasoned offerings.[9] On average the interval between the announcement and offer dates spans 34 calendar days. The mean of 13.94 calendar days between the short interest reporting date and the offer date suggests that on average the short interest reporting date occurs approximately at the midpoint between the announcement and offer dates.

sample. The Wilcoxon-Mann-Whitney test is used for all nonparametric tests for differences across samples.

[9] When the interval between the two dates contains more than one monthly short interest report, the numerator of RSI reflects the short interest report nearest the offer date.

Table II

Mean Relative Short Interest (RSI) Reported by the Number of Days Between the Short Interest Reporting Date and the Offer Date

Number of Days	Number of Observations	Mean RSI
30	10	0.835
29	6	0.447
28	13	1.256
27	10	1.419
26	10	1.522
25	10	1.541
24	8	1.382
23	13	1.456
22	11	1.640
21	13	1.660
20	9	1.946
19	16	1.677
18	26	2.151
17	22	1.509
16	12	2.179
15	23	1.773
14	16	2.393
13	15	2.395
12	14	2.707
11	16	2.832
10	19	2.887
9	16	2.849
8	15	3.734
7	15	3.506
6	64	3.148
5	7	6.499
4	11	7.033
3	54	8.680

Monthly reporting of short interest also implies that our measure of relative short interest does not always reflect short positions established immediately before the offer date. Thus, if short-selling activity is concentrated in a relatively narrow span of time immediately preceding the offer date, our results will tend to understate its importance. Table II presents the mean level of RSI for reporting dates corresponding to 30 calendar days prior to the offer date through 3 days prior to the offer date.[10] The mean level of RSI ranges from a minimum of 0.447 for the 6 observations with a reporting date 29 days prior to the offer date to a maximum of 8.68 for the 54 observations with a reporting date 3 days prior to the offer date. The -0.37 ($p < 0.05$) Spearman rank correlation coefficient between RSI and the number of days between the short interest reporting date and the offer date confirms that short-selling activity increases as the offer date approaches.

[10] There were no cases in which short interest was reported either 1 day or 2 days prior to the offer date.

The mean value of 3.37 for RSI prior to the adoption of the Rule indicates that short interest during the period between the announcement of a seasoned equity offering and the offering date is approximately three times its normal level. Once again, comparison of the sample mean and median indicates that the distribution of RSI is right-skewed. Similar to the results for the issue discount proxies, both parametric and nonparametric (sign) tests reject the hypothesis that RSI = 1.0 at the 0.01 level. Although not reported in Table I, short interest returns to normal levels after the offer date. The ratio of the level of short interest reported in the first monthly report following the offer date to the mean level of short interest reported during the three months preceding the offering announcement is 1.31 and not statistically different from 1.0 at conventional significance levels.

Similar to the behavior of the issue discount proxies, RSI exhibits a marked decline following the adoption of Rule 10b-21. Both parametric and nonparametric (Wilcoxon-Mann-Whitney) tests indicate that the difference is statistically significant. On the other hand, the level of short-selling activity between the announcement and offer dates remains approximately twice its normal level. This suggests that either some fraction of abnormal short-selling activity is associated with strategies not influenced by the Rule, or that strategies that call for covering a short position with shares purchased at the offer price remain profitable even when closed at post-offer prices.

Distinguishing between industrial and utility firms and those with and without listed options yields several insights. Consistent with the findings of Bhagat and Frost (1986), issue discounts for utilities are not statistically different from zero either before or after the adoption of Rule 10b-21. On the other hand, relative short interest is very high relative to that of industrial firms prior to the adoptions of Rule 10b-21. This is largely a consequence of the fact that the mean number of days between the short interest reporting date and the offer date for utilities (8.16) is much smaller than for industrial firms (15.40).

More important to the analysis to follow is the fact that only industrial firms with listed options exhibit a statistically significant issue discount following the adoption of the Rule, and this discount is comparatively large (For R0, mean: −1.98 percent, median: −1.05 percent). As we demonstrate in the following section, this characteristic of industrial firms with listed options remains after controlling for other factors likely to influence the magnitude of the issue discount.

If option strategies are used as substitutes for direct short selling of the underlying stock, we should also observe a temporary increase in open interest in an issuing firm's options prior to the firm's offer date. The Chicago Board Options Exchange (CBOE) maintains a machine-readable daily record of open interest and trading volume subsequent to October, 1985. Among our sample firms, 24 with CBOE-listed options brought new issues to market after this date; 15 before the adoption of Rule 10b-21, 9 after the Rule's adoption. For each of these firms we standardize daily open interest during the interval around the offer date by the mean level of daily open interest during the three

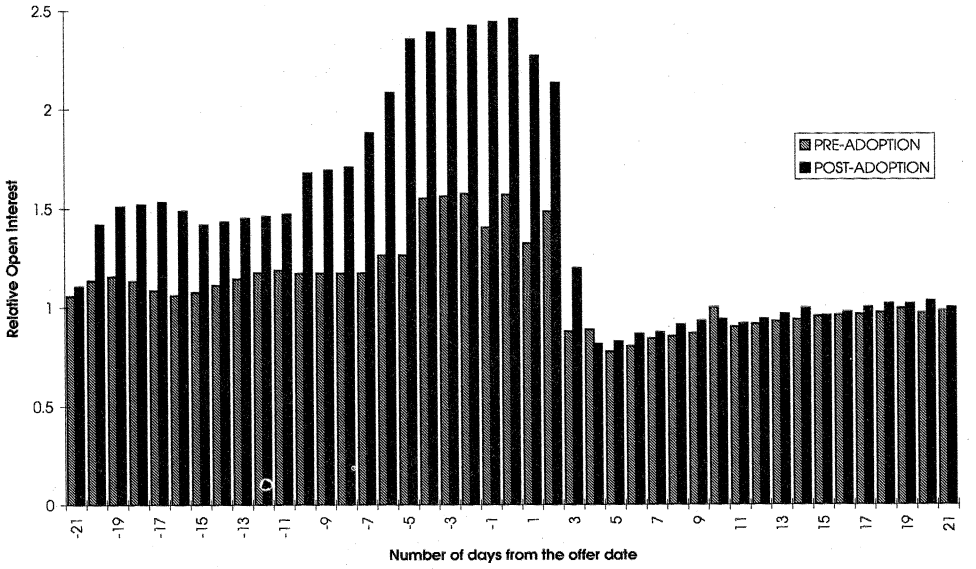

Figure 1. Daily mean relative open interest for the period surrounding seasoned equity offer dates. For issuing firms with Chicago Board Options Exchange (CBOE)-listed options, daily relative open interest is the daily open interest for a given day standardized by the mean daily open interest during the three months preceding the issuing firm's seasoned offering announcement date. Daily means are calculated from the daily relative open interest observed for 15 issuing firms prior to the adoption of Rule 10b-21, and for 9 issuing firms following the Rule's adoption. Day 0 is the offer date.

months preceding the offering announcement to obtain a relative measure of daily open interest. Similar to the measure of relative short interest, significant deviations from 1.0 indicate abnormal levels of open interest.

Figure 1 illustrates a striking pattern in option open interest around seasoned offerings. Prior to the adoption of Rule 10b-21, relative open interest is not statistically different from 1.0 for any day during the interval beginning 21 days (day −21) prior to the offer date (day 0) and extending to 5 days (day −5) prior to the offer date. For days −4 through 0, relative open interest is statistically different from 1.0 at the 0.05 level. Mean relative open interest peaks at approximately 1.5 times its "normal" level. Although open interest remains elevated for two days following the offer date, there is more variability in the level of relative open interest among the 15 preadoption firms so that neither observation is statistically different from 1.0. By day +3 mean relative open interest is approximately 1.0 and exhibits little variation through day +21.

The post-adoption pattern is similar, but more pronounced. Mean relative option open interest is statistically different from 1.0 from day −20 through day +2. Once again, we observe a sharp increase in open interest during the several days preceding the offer date (peaking at approximately 2.5 times its normal level), and a similarly sharp decline in open interest following the offer.

In contrast to the relative short interest variable, there is no evidence of skewness in relative open interest—the pattern observed in Figure 1 pervades the 24 firm sample. Thus, the open interest data is consistent with the substitution of option strategies for direct short selling both before and, more strikingly, after the adoption of Rule 10b-21.

Using Table I to compare RSI for firms with and without listed options provides further evidence of a substitution effect. Prior to the adoption of Rule 10b-21, the mean level of RSI is greater among firms without listed options. This is true among both utilities and industrial firms, and the differences are statistically significant at the 0.01 level. The Wilcoxon-Mann-Whitney test confirms this result for utilities, but not for industrial firms. Following the adoption of Rule 10b-21 neither parametric nor nonparametric tests reject the hypothesis that RSI is the same for firms with and without listed options. Thus the preadoption results are consistent with substitution of option strategies for direct short selling where possible. In contrast, there is no evidence of a substitution effect following the adoption of Rule 10b-21. One interpretation of the latter result is that the options market is now the primary (and perhaps the only) avenue for executing strategies that call for covering a short position with shares purchased at the offer price. This interpretation is consistent with the relatively large discounts associated with firms with listed options following the adoption of Rule 10b-21. We explore this issue at greater length in the following section.

Several features of our measures of each variable deserve further consideration. The issue discounts reported in Table I are calculated with respect to closing prices on the day before and the day of the offering. Eckbo and Masulis (1992), however, find differences between issue discounts calculated in this manner and discounts calculated using daily high and low prices. We provide similar information about our sample in Table III. As expected, use of the daily high (low) price inflates (deflates) the issue discount. Prior to the adoption of Rule 10b-21, the issue discount remains statistically different from zero except for the case where R1 is determined by the low price for the offer day. In contrast, postadoption issue discounts are not statistically different from zero. Thus, the general conclusions drawn from Table I are robust to these alternative specifications of the issue discount.

The use of RSI as a measure of abnormal short-selling activity implicitly assumes that normal short-selling activity is largely independent of normal trading activity. An alternative hypothesis is that short interest is a function of general interest in a stock, and that the increase in short interest is simply a consequence of a general increase in trading volume. The data do not support this conjecture. Although trading volume as a whole does increase during the pre-offer period, average daily trading volume is only 1.5 times its normal level.[11] Further, despite a sharp increase in trading volume, both short interest and option open interest decline subsequent to the offer date.

[11] Kadlec et al. observe a similarly modest pre-offer increase in volume for NYSE and AMEX issues and interpret this finding as contrary to the Lease, Masulis, and Page (1991) hypothesis

Table III

Selected Holding-Period Percentage Returns for Seasoned Equity Offerings, 1980–1991

High_R0 is the ratio of the offer price to the high price on the day before issue, minus one (× 100). High_R1 is the ratio of the high price on the issue day to the offer price, minus one (× 100). Similarly, Low _R0 and Low_R1 are calculated from daily low prices. The *t*-statistic *p*-value is the probability value of the *t*-test of the hypothesis of zero mean. Nonparametric significance levels are based on two-tailed sign test; percent zero (negative) is the percentage of zero (negative) returns.

	First Quartile	Median	Mean	Third Quartile	*t*-Statistic (*p*-Value)	Sign-Test (*p*-Value)	Percent Zero	Percent Negative
Panel A: I. Pre-Adoption								
(A) All offerings (sample size = 356)								
High_R0	2.20	−0.62	−0.84	0.25	0.00	0.00	15	62
High_R1	−0.25	0.68	0.83	2.22	0.00	0.00	10	19
Low_R0	−1.87	−0.22	−0.49	0.48	0.04	0.00	9	54
Low_R1	−0.81	0.13	0.29	1.64	0.17	0.15	10	39
Panel B: I. Post-Adoption								
(A) All offerings (sample size = 118)								
High_R0	−3.45	−0.15	−0.61	2.37	0.33	0.65	16	47
High_R1	−1.12	0.10	0.55	2.93	0.25	0.08	11	30
Low_R0	−2.89	−0.04	−0.38	2.32	0.54	0.93	7	44
Low_R1	−2.12	0	0.14	2.75	0.76	0.99	14	43

Our conclusions could also be distorted if the denominator of RSI is near zero for a segment of the sample. Recall, however, that the selection bias among NYSE firms (86 percent of the sample) toward firms with a relatively high level of absolute short interest limits the potential for this form of distortion. The remaining AMEX firms were screened for this problem. Finally, the preceding conclusions are robust to a respecification of RSI where short interest reported between the announcement of the offering and the offer date is standardized by the number of shares outstanding.

Finally, although the skewness observed in the issue discount presents some minor statistical problems in the regression analysis to follow, it is in keeping with the spirit of the asymmetric information theory outlined in the preceding section and the fact that buyers of new shares do not incur commissions. In the absence of an asymmetric information problem, we expect to observe new shares selling at a slight premium above the preceding secondary market price so that prices net of commissions and the effective bid-ask spread equilibrate (see Loderer, Sheehan, and Kadlec (1991)). Therefore, in principle, transactions costs savings establish the lower (upper) bound on R1 (R0), and we would expect this to be similar across issues. On the other hand, we would not expect

that offer price behavior is a consequence of buyers foresaking the secondary market in favor of shares purchased at the offer.

all firms to be similarly vulnerable to the asymmetric information problem described by Gerard and Nanda (1993). If the manifestation of the asymmetric information problem is short-selling induced issue discounts, we would expect to find the least (most) vulnerable firms characterized by relatively low (high) levels of abnormal short-selling activity and issue discounts. Both the centering around zero and the skewness in the distributions of R0 and R1 are consistent with the net effect of a relatively stable commission-induced premium and a more variable discount associated with a winner's curse.

B. Multivariate Analysis

Although the univariate analysis suggests that Rule 10b-21 influenced issue discounts and the level of short-selling activity, it does not establish whether discounts, short-selling activity, and options market activity are in any way related. Moreover, the tests for differences in means and medians do not control for other factors that may have influenced the post-adoption declines in both issue discounts and short-selling activity or the differences between the subsamples presented in Table I. In this section we undertake a multivariate regression analysis to investigate these issues.

We specify the issue discount as a function of RSI and a set of variables included to control for cross-sectional differences in issuing firms. Since the seasoned offering literature focuses largely on explaining cross-sectional variation in announcement effects (see Masulis and Korwar (1986), for example), we take guidance from the initial public offering (IPO) literature in modeling the issue discount.[12] For example, Beatty and Ritter (1986) predict that as ex ante uncertainty about the value of the issuing firm increases, the winner's curse intensifies and expected IPO underpricing increases. We hypothesize that the winner's curse associated with a seasoned offering is similarly influenced by ex ante uncertainty and use the daily return standard deviation (STDDEV) as a proxy for risk. STDDEV is calculated over the 200-trading-day interval beginning 250 trading days before the offer announcement date. Comparison of STDDEV to estimates over the pre- and post-offer-date intervals yielded no evidence of nonstationarity in the daily return standard deviation over the sample period.

Carter and Manaster (1990) argue that more prestigious underwriters of initial public offerings (IPOs) have an incentive to maintain their reputation by marketing low risk firms for which the winner's curse will be less pronounced. Benveniste and Wilhelm (1990) suggest that prestigious underwriters are those that have been most successful in their information-gathering efforts. Since this argument rests on the ability of the underwriter to exercise leverage over a core of repeat investors, it stands to reason that this leverage

[12] There is no evidence of correlation between discounts and abnormal returns cumulated over the offering announcement date and the preceding day (Spearman Correlation = -0.018, $p = 0.71$). Further, experiments with asymmetric information proxies used to control for cross-sectional variation in seasoned offering announcement effects (see, for example, Choe, Masulis, and Nanda (1993)), did not improve the explanatory power of our model.

could be extended to control pre-offer trading activity in the case of a seasoned offering. It is also plausible that high quality underwriters conduct more thorough due diligence.[13] Thus, we specify the variable RANK according to the ordinal ranking system developed by Carter and Manaster, and predict a negative relation between an issue's discount and the underwriter's reputation.[14]

Finally, we include three dummy variables in the issue discount equation. The first, EXCHANGE, takes the value of 1 for issuing firms traded on the NYSE and 0 for AMEX-traded firms. Although the evidence reported by Loderer et al. (1991) suggests that differences between Nasdaq and the exchanges dominate differences between the exchanges, there is some evidence of cross-exchange variation in the close-to-offer return (R0). The other dummy variables are included to allow for the potential differences between industrials and utilities and firms with and without listed options outlined in section II. OPTION takes the value of 1 for issuing firms with exchange-traded options and 0 otherwise. SIC takes the value of 1 for utilities and zero for industrial firms.

Thus, the specification for the issue discount equation is:

$$\text{Issue Discount} = f(\text{RSI, STDDEV, RANK, EXCHANGE, OPTION, SIC}), \quad (1)$$

where R0 and R1 serve as proxies for the transitory issue discount.

Table IV summarizes the results from ordinary least squares estimation of equation (1) before and after the adoption of Rule 10b-21 for both issue discount proxies.[15] RSI is the ratio of short interest during the pre-offer period to average short interest during the three month period preceding the pre-offer period. Similar results are obtained using the alternative proxies for the issue discount reported in Table III and when RSI is respecified as short interest standardized by shares outstanding.

Since the evidence presented in Table I suggests that the distribution of both issue discount proxies is nonnormal, it is likely that the distribution of the error term in equation (1) is also nonnormal. We use the Shapiro-Wilk test of normality to investigate this possibility (see Judge, Griffiths, Hill, Lutkepohl, and Lee (1985), pp. 826–827), and reject the null hypothesis that the regression disturbances are normally distributed under both specifications of the issue discount. Although conventional t tests remain asymptotically justified, we report bootstrap t-statistics calculated by the shift method described by

[13] We thank one of the referees for suggesting this possibility.

[14] All results are robust to a dummy variable specification of RANK where RANK = 1 for issues underwritten by firms with a Carter and Manaster ranking >5, and 0 otherwise.

[15] The close-to-offer return, R0, is multiplied by −1 to facilitate comparison between the two specifications of the issue discount.

Table IV

Regressions of the Discount on Explanatory Variables

OLS estimation of the equation:

$$\text{Discount} = f(\text{RSI, EXCHANGE, RANK, OPTION, STDDEV, SIC})$$

The issue discount is proxied by either the close-to-offer return, R0, or the offer-to-close return, R1. RSI is the relative short interest during the interval between the announcement and offer dates. EXCHANGE is a dummy variable taking the value of 1.0 for NYSE-listed firms, and 0.0 otherwise. RANK is the Carter and Manaster (1990) ranking for the issuing firm's underwriter. OPTION is a dummy variable taking the value of 1.0 for stocks with listed options, and 0.0 otherwise. STDDEV is the standard deviation of the issuing firm's returns, measured over 200 trading days, ending 50 days before the announcement date (-249,-50). SIC is a dummy variable taking the value 1.0 for utility firms and 0.0 for industrial firms. Bootstrap *t*-statistics are in parentheses.

		Independent Variable							
	Constant	RSI	EXCHANGE	RANK	OPTION	STDDEV	SIC	F	R^2
R0 (Pre)	0.02952	0.00136	−0.00282	−0.00336	−0.00155	0.01647	−0.01278	14.57	0.1979
(N = 331)	(2.97)**	(4.10)**	(−0.87)	(−3.72)**	(−0.40)	(0.34)	(−3.15)**		
R0 (Post)	0.08701	−0.00060	−0.00937	−0.00759	0.02549	−0.03879	−0.03780	9.66	0.3441
(N = 100)	(4.16)**	(−0.24)	(−1.23)	(−3.76)**	(4.09)**	(−1.33)	(−4.94)**		
R1 (Pre)	0.03789	0.00119	−0.00520	−0.00346	−0.00143	−0.00102	−0.01191	13.28	0.1825
(N = 331)	(3.70)**	(3.56)**	(−1.27)	(−3.96)**	(−0.49)	(−0.02)	(−3.08)**		
R1 (Post)	0.05492	0.00006	0.00406	−0.00676	0.02249	−0.01359	−0.02637	18.50	0.5146
(N = 100)	(3.79)**	(0.07)	(0.82)	(−6.20)**	(4.32)**	(−0.93)	(−4.23)**		

** significant at the 1 percent level.

* significant at the 5 percent level.

Noreen (1989). This approach assumes only that the shape of the bootstrap sampling distribution approximates the underlying sampling distribution.[16]

The issue discount model appears otherwise well-specified in the sense that the estimated coefficients generally carry the predicted signs. Moreover, the coefficient estimates are robust to the specification of the issue discount. The coefficients associated with RANK indicate that issues brought to market by more reputable underwriters are subject to smaller issue discounts both before and after the adoption of Rule 10b-21. In contrast, neither EXCHANGE nor STDDEV exhibit explanatory power.

More importantly, there is a statistically significant relation between relative short interest and both proxies for the issue discount prior to the adoption of Rule 10b-21.[17] This result is consistent with the joint hypothesis that discounts are a consequence of asymmetric information and that the asymmetric-information problem can be aggravated by short sellers. The fact that utilities face smaller issue discounts, as indicated by the negative coefficient associated with SIC, lends further support to this conclusion. Finally, the availability of exchange-traded options has little explanatory power prior to the Rule's adoption; firms with and without listed options face similar expected issue discounts.[18]

Following the adoption of Rule 10b-21 there is no evidence of a statistically significant relation between issue discounts and relative short interest. On the other hand, the post-adoption coefficients associated with RSI are not statistically different from the pre-adoption coefficients. These results are at least partially related to the sharp decline in the standard deviation of RSI from 6.16 to 3.92 following the adoption of the Rule. Although this decline in dispersion is consistent with the Rule having imposed a binding constraint on the market, it also limits the precision with which the post-adoption coefficients associated with RSI can be estimated.

Interpretation of the post-adoption results is complicated by the fact that it is necessary to distinguish between at least three plausible consequences of the adoption of the Rule. First, it is possible that the Rule had no real impact in which case we would not expect to observe a difference between the pre- and post-adoption coefficients associated with RSI. However, in light of the sharp

[16] Although the bootstrap t-statistics are somewhat more conservative than conventional t tests, conclusions from the bootstrap and conventional tests are qualitatively identical. This is consistent with Noreen's large sample experimental evidence.

[17] This result is not driven by outliers. Truncation of the sample by excluding observations associated with the largest and smallest 1 percent of the residuals produces virtually identical coefficients and no qualitative change in the outcome of the significance tests. We obtain similar results when the sample is truncated at the 5 percent and 10 percent levels.

[18] Options markets prefer to list options on more volatile stocks holding other factors constant. Inclusion of both OPTION and STDDEV in the model may therefore make estimation of their independent effects difficult. We investigate this possibility by reestimating equation (1) using firm age as a proxy for ex ante uncertainty. Although this specification is more natural in the context of IPOs (see Ritter (1991)), it is also less likely to introduce multicollinearity. The result is robust to this alternative specification.

declines in both the level and dispersion of short-selling activity, this interpretation seems inappropriate.

Alternatively, the Rule may have attenuated but not eliminated the short-selling activity it sought to curb. In this case we should observe a decline in the level and dispersion of short-selling activity, but not necessarily a structural change in the relation between issue discounts and RSI. Finally, it is possible that the adoption of Rule 10b-21 destroyed any existing link between issue discounts and abnormal short-selling activity. However, this would require that the cost of strategies that previously influenced discounts became prohibitive as a consequence of the relatively mild constraint on short selling imposed by the Rule. The fact that we observe no evidence of a relation between issue discounts and RSI following the Rule's adoption and no difference between the pre- and post-adoption coefficients associated with RSI suggests that the data simply do not permit discriminating between the second and third possibilities.

The other striking result in the post-adoption regressions is the statistically significant, positive coefficient associated with OPTION. In other words, firms with listed options face larger expected issue discounts than firms without listed options following the adoption of Rule 10b-21. This finding is independent of whether the issuing firm is drawn from the industrial or utility segment of the sample, and suggests that options trading offers a means of circumventing the Rule.

The regression analysis suffers from an errors-in-variables problem in the sense that short interest measured from the 8th of the month is used as a proxy for the unobservable level of short selling during the period immediately preceding the seasoned offering. Table II suggests that if manipulative short selling is occurring, it is likely to be concentrated in the several days prior to the offer date. Since the mean (and median) interval between the short interest reporting date and the offer date is approximately 14 days, our measure of RSI will in many instances fail to reflect abnormal pre-offer activity.

We assess the consequences of this data constraint by partitioning the sample according to whether the number of days between the short interest reporting date and the offer date is greater than or less than the median. For new issues where the short interest reporting date is relatively close to the offer date, the results from estimation of equation (1) are similar to those reported in Table IV. In contrast, the coefficient associated with RSI for issues where the reporting date is more than 14 days from the offer date is not statistically significant. In neither case is the relation between relative short interest and the issue discount statistically significant following the adoption of the Rule. Thus, any bias appears to be in the direction of conservatism—we are less likely to observe a relation between issue discounts and relative short interest as a consequence of the data constraint.[19]

[19] We have also investigated whether our results are sensitive to the timing of the offering. Choe, Masulis, and Nanda (1993) find that negative reactions to offering announcements are smaller during expansionary periods of the business cycle. We find no evidence that the link

The regression results reported in Table IV are also subject to equality constraints on the slope coefficients for issuing firms with and without listed options and for utilities and industrial firms. If options are used as a substitute for (manipulative) short selling, we would be less likely to observe a statistically significant relation between issue discounts and relative short interest for firms with listed options. Likewise, if the link between issue discounts and relative short interest is a consequence of asymmetric information, it is less likely to exist among utilities. In Table V we report evidence consistent with these hypotheses from unconstrained regressions where slope coefficients are permitted to differ across firms with and without listed options and across industrials and utilities. Consistent with the evidence reported in Table IV, we find a statistically significant relation between R0 and RSI only during the period prior to the adoption of Rule 10b-21. We now see, that only industrial firms and firms without listed options are characterized by this relation. Although not reported in Table V, the results obtained using R1 as the issue discount proxy are qualitatively identical.

V. Conclusion

Regardless of one's interpretation of the evidence, seasoned offerings are characterized by abnormally high levels of short selling and option open interest. Higher levels of such activity are related to lower expected proceeds from the issuance of new shares. Finally, where regulatory arbitrage is not possible, the adoption of Rule 10b-21 appears to have curbed short-selling activity and reduced issue discounts.

Although our results suggest that seasoned equity offer prices are influenced by trading activity in existing shares and options, it is less clear whether the results should be interpreted as evidence of a form of manipulation similar to that envisioned by Gerard and Nanda (1993). However, several facts are consistent with this interpretation. First, the relation between short-selling activity and issue discounts exists among industrial firms, but not among utilities. Moreover, nonmanipulative short-selling should produce permanent price effects. Although we focus on short-horizon price effects, Kadlec et al. find that the months immediately preceding and following seasoned offerings are characterized by a temporary price decline centered on the offer date. Finally, Gerard and Nanda (1993) suggest that if Rule 10b-21 inhibits nonmanipulative short-selling activity, it could inadvertently increase the expected issue discount by detracting from secondary market price efficiency. Where circumvention of the Rule is not possible, however, our evidence suggests this has not occurred.

between discounts and short-selling activity is similarly related to the business cycle. Further, the logarithm of dollar volume of common stock issues measured over the month of the stock offering does not have explanatory power in the regression model. Our results are also insensitive to the proximity of the offer date to the issuing firm's most recent earnings announcement (see Korajczyk, Lucas, and McDonald (1991)).

Table V

Regressions of the Discount on Explanatory Variables for Selected Subsamples

OLS estimation of the equation:

$$\text{Discount} = f(\text{RSI, EXCHANGE, RANK, OPTION, STDDEV, SIC})$$

The issue discount is proxied by either the close-to-offer return, R0, or the offer-to-close return, R1. RSI is the relative short interest during the interval between the announcement and offer dates. EXCHANGE is a dummy variable taking the value of 1.0 for NYSE-listed firms, and 0.0 otherwise. RANK is the Carter and Manaster (1990) ranking for the issuing firm's underwriter. OPTION is a dummy variable taking the value of 1.0 for stocks with listed options, and 0.0 otherwise. STDDEV is the standard deviation of the issuing firm's returns, measured over 200 trading days, ending 50 days before the announcement date (-249,-50). SIC is a dummy variable taking the value 1.0 for utility firms and 0.0 for industrial firms. Bootstrap t-statistics are in parentheses.

	Independent Variable								
	Constant	RSI	EXCHANGE	RANK	OPTION	STDDEV	SIC	F	R^2
R0 (Pre/No Options)	0.03126	0.00155	−0.00213	−0.00361		0.01303	−0.01285	16.31	0.2216
(n = 270)	(2.88)**	(4.13)**	(−0.64)	(−3.60)**		(0.01)	(−2.79)**		
R0 (Post/No Options)	0.09647	−0.00067	−0.01073	−0.00823		−0.05789	−0.03346	6.18	0.2699
(n = 71)	(3.86)**	(−0.26)	(−1.21)	(−3.57)**		(−1.65)	(−3.46)**		
R0 (Pre/Options)	0.01365	−0.00092	−0.00450	−0.00086		0.02252	−0.00718	1.75	0.0588
(n = 61)	(0.65)	(−1.11)	(−0.68)	(−0.44)		(1.06)	(−0.93)		
R0 (Post/Options)	0.09172	0.00121	−0.01757	−0.00648		0.02636	−0.05169	7.03	0.5185
(n = 29)	(4.99)**	(0.22)	(−1.32)	(−2.22)*		(0.67)	(−4.27)**		
R0 (Pre/Industrials)	0.02259	0.00171	−0.00177	−0.00283	−0.00109	0.01987		13.23	0.1966
(n = 250)	(2.03)*	(4.11)**	(−0.35)	(−2.94)**	(−0.40)	(1.48)			
R0 (Post/Industrials)	0.07225	0.00154	−0.00977	−0.00620	0.03244	−0.03953		2.57	0.1141
(n = 62)	(3.19)**	(0.52)	(−0.78)	(−3.02)**	(3.58)**	(−0.94)			
R0 (Pre/Utilities)	0.06288	−0.00052	−0.01107	−0.00645	0.00119	−0.02143		1.53	0.0324
(n = 81)	(2.63)**	(−0.45)	(−1.43)	(−2.46)*	(0.60)	(−1.32)			
R0 (Post/Utilities)	0.08253	−0.00176	−0.00906	−0.01224	0.01022	−0.00307		4.33	0.3106
(n = 38)	(2.32)*	(−0.77)	(−0.94)	(−2.99)**	(1.29)	(−0.08)			

** significant at the 1 percent level.

* significant at the 5 percent level.

REFERENCES

Asquith, Paul, and Lisa Meulbroek, 1993, Short sales: The long of it, Working paper, M.I.T.

Beatty, Randolph P., and Jay R. Ritter, 1986, Investment banking, reputation, and the underpricing of initial public offerings, *Journal of Financial Economics* 15, 213–232.

Benveniste, Lawrence M., and William J. Wilhelm, 1990, A comparative analysis of IPO proceeds under alternative regulatory environments, *Journal of Financial Economics* 28, 173–207.

Bhagat, Sanjai, and Peter A. Frost, 1986, Issuing costs to existing shareholders in competitive and negotiated underwritten public utility equity offerings, *Journal of Financial Economics* 15, 233–260.

Carter, Richard, and Steven Manaster, 1990, Initial public offerings and underwriter reputation, *Journal of Finance* 45, 1045–1068.

Choe, Hyuk, Ronald W. Masulis, and Vikram Nanda, 1993, Common stock offerings across the business cycle: Theory and evidence, *Journal of Empirical Finance* 1, 3–31.

Cox, John C. and Mark Rubinstein, 1985, Options markets, (Prentice-Hall, Englewood Cliffs, NJ).

Eckbo, Espen, and Ronald W. Masulis, 1992, Adverse selection and the rights offer paradox, *Journal of Financial Economics* 32, 293–332.

Figlewski, Stephen, and Gwendolyn P. Webb, 1993, Options, short sales, and market completeness, *Journal of Finance* 48, 761–778.

Gerard, Bruno, and Vikram Nanda, 1993, Trading and manipulation around seasoned equity offerings, *Journal of Finance* 48, 213–246.

Judge, George G., W. E. Griffiths, R. Carter Hill, Helmut Lutkepohl, and Tsoung-Chao Lee, 1985, The theory and practice of econometrics, (John Wiley and Sons, New York, NY).

Kadlec, Gregory B., Claudio F. Loderer, and Dennis P. Sheehan, 1994, Issue day effects for common stock offerings: Causes and consequences, Working paper, Pennsylvania State University.

Korajczyk, Robert A., Deborah J. Lucas, and Robert L. McDonald, 1991, The effect of information releases on the pricing and timing of equity issues, *Review of Financial Studies* 4, 685–708.

Lease, Ronald C., Ronald W. Masulis, and John R. Page, 1991, An investigation of market microstructure impacts on event study returns, *Journal of Finance* 46, 1523–1536.

Loderer, Claudio F., Dennis Sheehan, and Gregory B. Kadlec, 1991, The pricing of equity offerings, *Journal of Financial Economics* 29, 34–58.

Masulis, Ronald W., and Ashok N. Korwar, 1986, Seasoned equity offerings: An empirical investigation, *Journal of Financial Economics* 15, 91–118.

Noreen, Eric W., 1989, Computer intensive methods for testing hypotheses, (John Wiley and Sons, New York, NY).

Parsons, John E., and Artur Raviv, 1985, Underpricing of seasoned issues, *Journal of Financial Economics* 14, 377–397.

Ritter, Jay R., 1991, The long-run performance of initial public offerings, *Journal of Finance* 46, 3–28.

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

Senchack, A. J., and Laura T. Starks, 1993, Short-sale restrictions and market reaction to short-interest announcements, *Journal of Financial and Quantitative Analysis* 28, 177–194.

Smith, Clifford W., Jr., 1977, Alternative methods for raising capital: Rights vs underwritten offerings, *Journal of Financial Economics* 5, 273–307.