Short Selling Around Seasoned Equity Offerings

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We use daily short-selling data to examine whether short selling around seasoned equity offerings (SEOs) reflects informed or manipulative trading. Around SEO announcements, we find no evidence of informed short selling. Around issue dates, higher levels of pre-issue short selling are significantly related to larger issue discounts for non-shelf-registered offerings. This evidence is consistent with manipulative trading. We show that SEC Rule 105 constrains some but not all manipulative trading. Our results reverse previous research that uses monthly short-interest data, because daily data allow more powerful tests. Our evidence helps explain the increased popularity of shelf registrations. Although short selling usually enhances price efficiency, we document a situation where short selling reduces price efficiency. (*JEL* G14, G32, G38)

In this article, we explore the relation between short selling and returns around seasoned equity offerings (SEOs). According to the literature, there are at least two general motives for short selling during SEO periods: information and manipulation. If the SEO issuance reduces the costs or risk of a short position (by providing an opportunity to cover the short position at a fixed, discounted SEO price with no commissions, for example, see Safieddine and Wilhelm 1996), then it will be easier for traders with negative private information to trade on this information during the SEO period. Furthermore, before the announcement, investors may receive private information about the forthcoming SEO announcement and decide to short sell on this information. The literature also

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addresses the possibility that manipulative traders will short sell between the announcement and the offer date of an SEO, with the expectation of covering the short position at a lower offer price (e.g., Gerard and Nanda 1993; Safieddine and Wilhelm 1996; Kim and Shin 2004).

Using a sample of SEOs between January 2005 and December 2006, our first research question examines whether short selling around SEOs is informed or manipulative.[1] We find no evidence of informed short selling around SEO announcements. Around issue dates, we find that higher levels of short selling before the offer are strongly related to larger issue discounts, consistent with the predictions of Gerard and Nanda (1993) given manipulative trading. These effects are significant only for the non-shelf offerings in our sample. We find little evidence of manipulative trading around shelf offerings.

Based on these results, our second research question examines the effectiveness of Securities and Exchange Commission (SEC) restrictions on short selling around SEOs. In April 1997, the SEC adopted Rule 105 to replace Rule 10b-21. This rule change significantly relaxed the restrictions on short selling around SEOs. During our sample period, Rule 105 prohibited traders from covering short sales made within five days of the offering with shares obtained in the offering.[2] If Rule 105 is binding, short sellers who want to cover their positions with shares from the offering can only trade up to six days before the issue. We document substantial abnormal short selling that is significantly related to larger issue discounts, both when unconstrained and when constrained by Rule 105. These results suggest that Rule 105 has not effectively eliminated manipulative short selling closer to the issue date.

Gerard and Nanda (1993) model the relation between manipulative short selling before an SEO and the pricing of the offering. In their model and consistent with practice, the issuer prices the SEO at a discount from the secondary market closing price the day before the offering. The SEO issue price is conditional on order flow, so the strategic trader can affect the issue discount through the impact of his trades on net order flow. One of the main empirical predictions of their model is that manipulative trading reduces the informativeness of the secondary market net order flow, exacerbating the winner's curse problem and increasing the issue discount.

Empirical work examining short selling around SEOs has focused exclusively on testing this model, examining the relation between short sales and the issue discount. Due to data limitations, research has tested this hypothesis

[1] In Gerard and Nanda (1993), manipulative short sellers trade against their private information for the purpose of manipulating the offering price. Since they have received a private signal, manipulative traders are also informed. For purposes of exposition, in this article, we use the term "informed short selling" to describe trading by informed traders who trade consistent with their private information, and "manipulative short selling" to describe trading by informed traders who trade against their private information to manipulate the offering price.

[2] Rule 10b-21, adopted in August 1988 to prevent manipulative short selling around SEOs, prohibited using shares purchased in an SEO to cover short positions. In contrast to Rule 105, Rule 10b-21 applied to any short sale established between the initial filing and offer dates.

either directly using coarse, monthly short-interest data (Safieddine and Wilhelm 1996; Singal and Xu 2005), or indirectly by examining the impact of changes in SEC regulations on the relation between short sales and the issue discount (Corwin 2003; Kim and Shin 2004; Autore 2007). Prior research that relies on monthly short-interest data suffers from at least two limitations: The sample is restricted to SEOs that have a short-interest observation between the filing and offer dates, and the data are unable to capture the increasingly short-term trading strategies used by short sellers (Diether 2008; Diether, Lee, and Werner 2009).[3] Thus, short-interest data have reduced power to detect abnormal short selling immediately prior to the issue date, when manipulative strategies are most likely to occur.[4] Analyses of regulatory regime changes are very sensitive to the particular sample periods chosen and are subject to possible spurious results due to time trends in SEO discounts (Autore 2007; Intintoli and Kahle, forthcoming).

Our major advantage relative to prior research is that we use transactions-level short-sale data, aggregated to the daily level. SEC Regulation SHO required publicly available transactions-level short-sale data beginning in January 2005. We collect daily short-selling data from January 2005 through December 2006. With our database, we are able to consider all SEOs, and examine changes in daily short-selling activity throughout the SEO period in detail.

Using these data, we extend existing research with three major contributions. Prior research rejects the manipulative trading hypothesis after Rule 10b-21 became effective (Safieddine and Wilhelm 1996; Kim and Shin 2004; Singal and Xu 2005). However, lack of evidence of manipulative trading could simply reflect lack of power in the tests. We also find no evidence of manipulation when using monthly short-interest data for our sample of SEOs. With more powerful daily data, our results contradict prior research and support the manipulation hypothesis. Ours is the first article since the SEC implemented rules restricting such behavior to provide direct evidence that pre-issue short selling is associated with larger SEO discounts.

Second, we contribute to the literature on shelf registrations. Relatively few recent papers have explicitly examined shelf registrations, despite their dramatic increase in popularity (Heron and Lie 2004; Autore, Kumar, and Shome 2008; Bethel and Krigman 2008). Our results show that manipulative short selling around SEOs is confined to non-shelf offerings. Shelf registrations allow issuers to avoid the costs of manipulative trading and therefore reduce the overall cost of SEOs. This finding provides one possible explanation for the recent increase in shelf registrations.

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3 There are no monthly short-interest observations between the announcement and issue date for almost half of the SEOs in our sample.

4 Barclay and Litzenberger (1988) and Safieddine and Wilhelm (1996) specifically note that data limitations may prevent existing studies from providing direct evidence regarding the effect of short sales on issue discounts.

Finally, several recent papers find that short sellers are informed and contribute to price efficiency (e.g., Boehmer, Jones, and Zhang 2008; Boehmer and Wu 2008; Karpoff and Lou, forthcoming). We find evidence consistent with this result for short selling during benchmark, non-SEO periods. However, we also document that short selling makes prices less efficient immediately prior to SEO issue dates. Our results therefore add to the literature examining the general impact of short selling on price efficiency.

On June 20, 2007, the SEC unanimously approved amendments to strengthen Rule 105.[5] Under the new rule, anyone who has executed a short sale in the five-day period before an SEO would be prohibited from even purchasing shares in the offering. (Previously, Rule 105 allowed short sellers to purchase shares in the offering, but not to use those shares to cover short positions taken within five days.) According to the *Wall Street Journal* (Burns 2006), this rule was motivated by the observation that some short sellers have been avoiding the constraints imposed by Rule 105. In its ruling, the SEC states "... the Commission has become aware of non-compliance with Rule 105, and in some cases strategies used to disguise Rule 105 violations" (Federal Register, August 10, 2007, p. 45094).[6] Our empirical results are consistent with these observations.

The remainder of the article is organized as follows. In Section 1, we discuss the relevant theory and develop our hypotheses. Section 2 describes the sample. Section 3 reviews results of tests about short selling around the announcement date, and Section 4 discusses results for the issue date. Section 5 concludes.

1. Theory and Development of Hypotheses

Our goal is to explore the relationship between short selling and returns around SEOs. As discussed above, short selling during this period may be informed or manipulative. Consistent with asymmetric information models (e.g., Diamond and Verrecchia 1987), informed short sellers are traders who receive negative private information about a firm, and short sell to profit from this information. As described by Safieddine and Wilhelm (1996, p. 729), manipulative short selling is a strategy that involves "establish[ing] short positions prior to seasoned equity offerings for the sole purpose of producing an artificial discount

[5] The new rule became effective on October 9, 2007. Regulation SHO data collection ended in the summer of 2007.

[6] For example, Ascend Capital, LLC, a hedge fund adviser, was fined in 2003 for violations of Rule 105. On three separate occasions, they sold short shares in a firm with an upcoming SEO in the five days before the offering and also obtained new shares in the offering. Then, a month or so later, they simultaneously executed crossing limit order trades (buys and sells) at the same price, which closed both their open short position and their open long position. Thus, they effectively covered their short positions with shares received in the offerings. (See Ascend Capital, LLC, Exchange Act Rel. No. 48,188.) This is one of many recent compliance actions by the SEC related to violations of Rule 105.

in the price of new shares." For completeness, we also allow for the possibility of short selling during this period for reasons other than private information or manipulation; these reasons might include hedging or noise trading.[7] In this section, we first develop several hypotheses to distinguish between informed and manipulative short selling during SEO periods. Then, we develop predictions to examine the effectiveness of Rule 105.

1.1 Announcement effects

SEOs are associated with negative announcement returns of around 2% (e.g., Ritter 2003). Short sellers with private information about the forthcoming SEO announcement may (subject to legal restrictions) choose to short sell before the announcement. Christophe, Ferri, and Angel (2004) test for the presence of informed traders before earnings announcements by examining the cross-sectional relationship between abnormal short selling prior to earnings announcements and abnormal announcement (days 0, +1) returns.[8] Analogously, informed short selling before SEO announcements should be related to SEO announcement returns.

If short sellers have private information about the SEO announcement, then:

H1A. Short selling will be abnormally high before the announcement date.

H1B. Abnormal short selling before the announcement will be negatively related to abnormal returns on the announcement date.

Harris and Raviv (1993) and Kim and Verrecchia (1994) present asymmetric information models in which traders receive common signals but differ in their ability to interpret them. Within the context of SEOs, short sellers may be able to interpret the negative information more effectively than other traders. In this case, they will trade more aggressively when the SEO contains more negative news.

If short sellers are especially skilled at processing the information contained in the SEO announcement, then:

H2A. Short selling will be abnormally high on the announcement date.

H2B. Abnormal short selling on the announcement date will be negatively related to the announcement date abnormal return.

We do not expect any manipulative short selling before the SEO announcement. Similarly, there should be no abnormal short selling by other types of short sellers prior to the SEO announcement.

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[7] Numerous papers discuss underwriter stabilization activities after initial public offerings (IPOs) and SEOs. We discuss potential underwriter short selling around SEOs and the implications for our results in more detail in Section 4.4.

[8] Christophe, Ferri, and Angel (2004) examine an information event in which the timing is relatively well known in advance. In contrast, the timing of SEO announcements is typically unanticipated.

1.2 Issue date effects

Abnormal levels of short selling between the announcement and issue date could reflect informed or manipulative short selling. However, as we discuss below, the impact of these various types of short selling on both the issue discount and subsequent returns should be different.

Gerard and Nanda (1993) develop a theoretical model of SEO pricing with informed and uninformed bidders. Given the model parameterization, informed bidders are unable to absorb the whole offer. Therefore, the issuer must set the offer price such that uninformed bidders have zero expected profits; otherwise, they would not participate. Gerard and Nanda show that the equilibrium SEO issue price, P_Q^*, under these conditions will be (Proposition I, p. 220):

$$P_Q^* = E\left[\tilde{V}|Q\right] + \frac{Cov\left[\tilde{\alpha}_U, \tilde{V}|Q\right]}{E\left[\tilde{\alpha}_U|Q\right]}, \tag{1}$$

where $\tilde{\alpha}_U$ is the number of new shares allocated to uninformed bidders, $\tilde{V}$ is the end of period value of the stock, and Q is secondary market net order flow. Note that $Cov[\tilde{\alpha}_U, \tilde{V}|Q]$ is negative. Uninformed traders tend to get more shares in deals with lower fundamental values, the standard winner's curse problem.

Since $P_Q^* \leq E[\tilde{V}|Q]$, the SEO offer price will be set at a discount to $E[\tilde{V}|Q]$, the equilibrium price absent an SEO. The magnitude of the discount will depend on the severity of the winner's curse problem. Secondary market order flow, Q, affects the equilibrium offer price through its impact on the equilibrium price absent an SEO and the impact on the second term, the discount. Manipulative traders won't necessarily profit through the first term, because the market price responds to the selling pressure (Kyle 1985). So, without the SEO, there is no opportunity for profitable manipulation. However, manipulative trading increases the discount by reducing the informativeness of the secondary market net order flow. Gerard and Nanda show that even if traders have positive information, they may want to sell before the offering to conceal their information. This strategy is optimal if they can recover secondary market losses by purchasing at a sufficiently reduced price in the offering. Therefore, manipulative short selling may be profitable because of the impact of secondary market trading on the discount.

Safieddine and Wilhelm (1996), Altinkiliç and Hansen (2005), and Singal and Xu (2005) use monthly short-interest data between the announcement and offer dates to test for manipulative trading. Similarly, Corwin (2003), Kim and Shin (2004), and Autore (2007) test whether the issue discount changed after 10b-21. These papers specifically reject the hypothesis of manipulative trading after the introduction of 10b-21. As discussed above, short-interest data lack power to examine this hypothesis, and regime changes suffer from potentially spurious results due to time trends in discounts. We revisit this question using much more powerful short-selling data.

According to Gerard and Nanda (1993), informed short selling makes market prices more efficient, but manipulative short selling makes market prices less efficient. More informative prices imply smaller issue discounts in the Gerard and Nanda model, while inefficient prices imply larger issue discounts.

H3A. Higher levels of informed short selling before SEO issue dates should be associated with smaller issue discounts.

H3B. Higher levels of manipulative short selling before SEO issue dates should be associated with larger issue discounts.

We emphasize that these trading strategies are not necessarily mutually exclusive. Some informed traders may be trading with their private information, and others may be trading against their private information to manipulate the offering price. Empirically, we only observe whether short selling in the aggregate is relatively more consistent with return predictions based on one strategy or the other.

We expect that short selling between the announcement and issue dates will be negatively related to returns over this period, but we cannot use this prediction to distinguish between informed and manipulative short selling. A short seller trading on negative private signals should help prices adjust to new, lower fundamental values more quickly. If short selling is manipulative, market makers may lower quotes in response to high short-selling pressure to induce purchases (e.g., for inventory considerations). However, the price impact of manipulative short selling should be temporary, but the price impact of informed short selling should be permanent.

H4A. Informed short selling before SEO issue dates should be associated with a permanent price decline.

H4B. Manipulative short selling before SEO issue dates should be associated with a post-issue price recovery.

We also examine the effectiveness of SEC rules designed to restrict manipulative trading around SEOs. During our sample period, SEC Rule 105 constrained short selling by restricting the ability of short sellers to cover short positions established within five business days of the offer date with securities purchased in the offering. If Rule 105 is binding, then short selling must occur at least six days before the issue if traders want to cover their positions with shares from the offering.[9] Therefore, we expect short selling to peak six days before the issue date.

H5. If Rule 105 is effective, short selling at least six days before the issue date should be greater than short selling closer to the issue date.

9 Gerard and Nanda (1993) note the possibility that restrictions on short selling before SEOs may affect informed as well as manipulative short sellers. We illustrate the timing of these short-selling constraints for one of our sample firms in Figure 1.

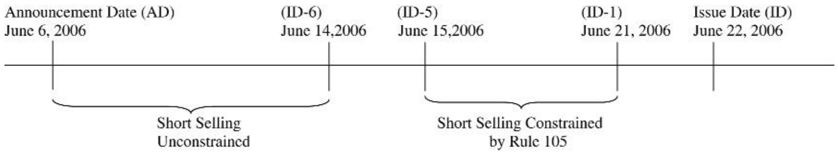

Figure 1
Time line of unconstrained and constrained short selling due to Rule 105
On June 22, 2006, Brady Corp. (BRC) issued 4 million shares at a price of $36 per share. The deal was announced on June 6, 2006. This time line shows the days when short selling between the announcement and issue dates is unconstrained, and when short selling is constrained by Rule 105.

Although this prediction allows us to test the effectiveness of Rule 105, we cannot use it to identify whether Rule 105 is affecting informed or manipulative trading. However, as discussed above, these two types of trading strategies have different predicted relations with the issue discount and post-issue performance. If Rule 105 is binding and short selling is informed, higher levels of short selling up through day -6 relative to the SEO issue date should be associated with smaller issue discounts and a permanent price decline. In contrast, if Rule 105 is effective and short selling is manipulative, higher levels of short selling up through day -6 should be associated with larger issue discounts and a post-issue price recovery.

2. Data and SEO Sample Characteristics

2.1 Short sale data

Pursuant to the SEC-mandated Regulation SHO (RegSHO), adopted on June 23, 2004, all Self-Regulatory Organizations (SROs) must make all tick-by-tick short-sale data publicly available.[10] We collect these transactions-level short-sale data from all SROs for the period January 1, 2005, through December 31, 2006.[11] The data include (for every transaction that included a short sale) ticker, date, trade time, price, total volume, short-sale volume, and an indicator to denote trades that are exempt from certain short-sale rules. Although the RegSHO data include short sales, they do not flag associated covering transactions. Therefore, we are unable to provide any direct evidence as to how short sales are covered.

We aggregate the short-sale volume by date and firm. This leaves us with a dataset of daily short-sale volume for each firm in our sample. We combine this daily short-sale volume with daily total trading volume from CRSP to construct various measures of short-selling intensity.

10 Edwards and Hanley (2010) use these data to examine short selling immediately after IPOs.

11 The SROs include NYSE, NASDAQ, Amex, NASD ADF, National Stock Exchange, Boston Stock Exchange, Chicago Stock Exchange, Philadelphia Stock Exchange, and Archipelago Exchange (ArcaEX). RegSHO data are available from January 1, 2005, through the termination of the RegSHO pilot study on August 6, 2007.

2.2 SEO data

We search the Securities Data Corporation (SDC) Global New Issues database for all U.S. Public Common Stock firm commitment offerings that were issued between January 1, 2005, and December 31, 2006. We exclude IPOs, rights offerings, unit issues, closed-end funds, REITs, simultaneous international offerings, and offerings by non-U.S. firms. We also exclude issues that were pure secondary offerings, but do include mixed offerings that contain both primary and secondary shares.[12] These initial screens provide a sample of 456 SEOs issued by 402 unique firms.

We search various newswire services on Factiva to identify the announcement date for each SEO. While SDC does provide a filing date for each offering, this may be different from the actual announcement date, particularly for shelf offerings, which often have vague filing statements. We use the timestamp from the newswire to assign an announcement date. If the announcement came after the close of trading, the following trading day is identified as the announcement date. Identifying an announcement date for shelf offerings is particularly challenging. Autore, Kumar, and Shome (2008) find that only a small percentage of shelf filings actually lead to an offer. Thus, filing dates for shelf filings that simply state that the issuer "may sell shares periodically," but contain no specifics about an actual offering, are not identified as announcement dates. Follow-up announcements or initial shelf-filing statements that *do* contain specifics about the number of shares offered are counted as announcement dates. For many shelf offerings, no announcement date prior to the offer date is identifiable, and the only announcement associated with the offering is of the pricing of the deal itself, which occurs on the issue date. These observations likely represent either universal filers who are not required to specify a particular security until the offer date, allowing them to issue debt and/or equity without advanced notice under the universal shelf rule, or accelerated SEOs, as discussed in Bortolotti, Megginson, and Smart (2006) and Gao and Ritter (2008).[13]

To identify the offer date, we apply the volume correction procedure outlined in Corwin (2003), which correctly accounts for offerings that occur after the close of trading on the SDC reported offer date (Lease, Masulis, and Page 1991). This correction procedure results in the reclassification of 67% of our sample offer dates, which is consistent with Corwin (2003). We collect daily return and volume data from CRSP. D'Avolio (2002) notes that about one-third of stocks in his sample with prices under $5 appear impossible to short. Based on this observation, we exclude SEOs with a stock price the day before the issue date of less than $5 per share. After combining the SEO data with the

[12] Heron and Lie (2004) discuss the different information effects of secondary share offerings versus primary share offerings.

[13] The universal shelf rule was implemented by the SEC in October 1992. Universal filers account for 85% of shelf filings in the sample of Autore, Kumar, and Shome (2008).

RegSHO short-sale data and CRSP data, we are left with a final sample of 414 offerings by 362 unique firms.

2.3 SEO sample characteristics

Table 1 provides summary statistics for our SEO sample. Overall, the average offering issued 6.21 million shares and raised $132 million in proceeds. The mean relative offer size, which represents the percentage of pre-issue shares outstanding that were issued in the offering, is 19.1%. The offering characteristics differ across markets. The majority (285) of our sample offerings are from firms listed on NASDAQ, with 109 on the NYSE and 20 on Amex. The NYSE offerings are characterized by more shares offered, larger offering proceeds, and higher offering price but lower relative offer size and smaller issue discounts.

The information contained in the announcement of a shelf offering may be different from that in the announcement of a non-shelf offering (e.g., Heron and Lie 2004). Also, the use of shelf registrations has increased dramatically in recent years (Autore, Kumar, and Shome 2008; Bethel and Krigman 2008). Of the 414 offerings in our sample, 263 (63.5%) are shelf offerings. In contrast, only 5.4% of the SEOs in Heron and Lie's (2004) sample from 1980 to 1998 were shelf offerings. As shown in Table 1, shelf offerings tend to be made by larger firms with higher stock prices and lower standard deviation of pre-offer returns. The issue discount is 2.82% for shelf offerings and 3.63% for non-shelf offerings. The mean number of trading days between announcement and offering (not reported in the table) is 6.8 days for shelf offerings and 29.5 days for non-shelf offerings.

We divide the total sample into three subsamples based on the number of days between the announcement date (AD) and the issue date (ID).[14] Rule 105 applies to short sales made within 5 days of the offering, so this breakpoint allows for tests of the rule's effectiveness. There are 88 offerings for which there is no announcement before the issue date (AD = ID), 90 offerings with from 1 to 5 trading days between announcement and issue date [$0 < (\text{AD-ID}) \leq 5$], and 236 offerings with more than 5 trading days between announcement and issuance [$(\text{AD-ID}) > 5$]. Firms for which the announcement date equals the issue date are larger and more actively traded than those with a waiting period.

3. Announcement Date Results

Our first tests examine short-selling and abnormal returns before SEO announcements. According to hypotheses H1A and H1B, any abnormal short

[14] Given that SEC rules are specified in terms of trading days rather than calendar days, we conduct all of our analysis based on trading days. Throughout the rest of the article, we will refer to the number of trading days between the announcement and the issue dates as the *waiting period*. Technically, the waiting period is the period of time between the filing of the registration statement and when it is declared effective by the SEC. We adapt the term slightly for expositional purposes.

Table 1
Firm and offering characteristics for the SEO sample

		By Market			By Registration Method		By Length of Waiting Period		
	Total	NYSE	Amex	NASDAQ	Non-shelf	Shelf	AD=ID	0<(AD-ID)≤5	(AD-ID)>5
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
N	414	109	20	285	151	263	88	90	236
Shares Offered (mil.)	6.21	8.80	5.72	5.26	4.77	7.04	6.46	7.15	5.76
Offer Price ($)	22.11	30.42	11.15	19.70	19.82	23.42	23.61	26.10	20.02
Offer Proceeds ($ mil.)	131.65	236.82	65.20	96.09	90.94	155.03	139.65	171.39	113.51
Relative Offer Size (%)	19.06	12.59	30.43	20.74	26.96	14.52	11.70	13.63	23.88
Gross Spread (%)	4.81	3.46	5.70	5.23	5.53	4.38	3.28	4.69	5.34
Close-to-Offer Return (%)	−3.11	−1.87	−6.06	−3.38	−3.63	−2.82	−3.47	−2.06	−3.38
Offer-to-Close Return (%)	2.92	1.53	2.83	3.46	3.66	2.50	1.84	1.84	3.74
Pre-Issue Shares Outstanding (mil.)	61.41	140.38	23.57	33.87	21.63	84.26	134.23	68.98	31.37
Pre-Issue Marketcap ($ mil.)	1466.06	3638.76	305.35	716.55	474.49	2035.36	3111.79	1908.15	683.81
Pre-Issue Volume (000s)	887.86	1726.26	447.72	598.09	282.76	1235.27	1357.35	1300.68	555.36
Pre-Issue Date Closing Price	22.66	30.98	11.80	20.23	20.45	23.92	24.28	26.51	20.58
Issue Date Closing Price	22.61	30.79	11.38	20.27	20.46	23.84	23.94	26.48	20.64
Std Dev Returns (%)	2.70	1.99	3.67	2.90	2.86	2.61	2.20	2.55	2.94

This table gives mean values of various firm and offering characteristics for our sample of 414 seasoned equity offerings (SEOs) from January 2005 through December 2006. Results are reported for the full sample (column 1), by market (columns 2–4), for shelf offerings versus non-shelf offerings (columns 5–6), and for different subsamples according to the length of the waiting period (columns 7–9). Offer Proceeds equals the Offer Price times the number of Shares Offered. Relative Offer Size is the number of shares offered as a percentage of Pre-Issue Shares Outstanding. Gross Spread is the gross underwriter spread on the deal. Close-to-Offer Return is the percentage difference between the closing price the day before issuance and the offer price. Offer-to-Close Return is the percentage difference between the Offer Price and the closing price on the day of issuance. Pre-Issue Shares Outstanding, Marketcap, Volume, and Closing Price are all taken the day before the issue date. Std Dev Returns is the standard deviation of daily returns calculated over the 30 trading days ending 11 days prior to the offering.

selling before the SEO announcement should be attributable to informed short selling, and informed short selling before the announcement should be negatively related to abnormal announcement returns.

To test these hypotheses, we construct several statistics to measure abnormal returns and trading. Consistent with Christophe, Ferri, and Angel (2004), we define abnormal short selling for an individual firm on day t, $ABSS[t]$, as

$$ABSS[t] = \frac{SSVOL[t]}{AVESS} - 1, \tag{2}$$

where $SSVOL[t]$ is the total short-selling volume on day t for that firm, and $AVESS$ is the average daily short-selling volume for that firm during the benchmark period. We define the benchmark period as all of the days in our sample period (January 2005 through December 2006), excluding days in the window from day -10 relative to the announcement date through day $+10$ relative to the issue date.[15]

Similarly, we define abnormal trading volume for an individual firm on day t, $ABVOL[t]$, as

$$ABVOL[t] = \frac{VOL[t]}{AVEVOL} - 1, \tag{3}$$

where $VOL[t]$ is the total trading volume for the firm on day t (as reported on CRSP), and $AVEVOL$ is average daily trading volume for this firm during the benchmark period.[16]

As we will show, short selling is high on days when total trading volume is also high. To examine whether short selling increases disproportionately with total trading volume, we compute an additional measure, abnormal relative short selling ($ABRELSS[t]$):

$$ABRELSS\,[t] = \frac{(1 + ABSS\,[t])}{(1 + ABVOL\,[t])} - 1 = \left[\frac{(SSVOL\,[t]/AVESS)}{(VOL[t]/AVEVOL)}\right] - 1. \tag{4}$$

To explore the robustness of our results to our measure of short selling, in some subsequent tests we use an alternative definition of short selling. Short selling relative to total volume on the same trading day, $RELSS[t]$, is defined as

$$RELSS\,[t] = \frac{SSVOL\,[t]}{VOL[t]}. \tag{5}$$

Finally, to measure abnormal returns on day t, $ABRET[t]$, we compute the return on day t in excess of the return on the CRSP Value Weighted Index on that day, $CRSPVWIND[t]$:

$$ABRET\,[t] = RET\,[t] - CRSPVWIND\,[t]. \tag{6}$$

15 In cases where the filing date is before our designated announcement date, we also exclude from the benchmark period days in the window from day -10 through day $+10$ around the filing date.

16 Consistent with the literature, we exclude from the sample any firm day on which trading volume is zero.

Table 2
Trading activity and short-selling intensity around SEOs

Panel A: Means

	Raw Measures			Abnormal Measures			
Window	SSVOL	VOL	RELSS	ABSS	ABVOL	ABRELSS	ABRET
1: [AD-5, AD-1]	239,728	741,291	0.3140	0.1093	0.0037	0.0508***	0.0009
2: [AD]	339,883	1,309,309	0.2995	0.8993***	1.1654***	0.0304	−0.0231***
3: [AD+1, ID-1]	193,241	485,037	0.3593	0.4397***	0.0934**	0.2338***	−0.0004
4: [ID]	640,948	3,110,956	0.1928	6.6725***	9.6348***	−0.3237***	−0.0037
5: [ID+1, ID+5]	242,644	895,676	0.2611	0.6223***	0.7981***	−0.1177***	0.0004

Panel B: Medians

	Raw Measures			Abnormal Measures			
Window	SSVOL	VOL	RELSS	ABSS	ABVOL	ABRELSS	ABRET
1: [AD-5,AD-1]	63,985	216,124	0.3083	−0.2615***	−0.3073***	0.0341	−0.0007
2: [AD]	127,787	447,901	0.3045	0.3290***	0.4016***	−0.0633	−0.0182***
3: [AD+1, ID-1]	57,082	187,644	0.3561	−0.1876*	−0.2629***	0.1264***	−0.0010***
4: [ID]	327,316	1,968,687	0.1727	2.8207***	6.2285***	−0.4046***	−0.0072*
5: [ID+1, ID+5]	84,420	368,353	0.2458	0.0435***	0.2884***	−0.1688***	0.0002

Panel C: Difference in Means

	Raw Measures			Abnormal Measures			
Window	SSVOL	VOL	RELSS	ABSS	ABVOL	ABRELSS	ABRET
(2-1)	100,155**	568,709***	−0.0145	0.7900***	1.1617***	−0.0204	−0.0239***
(3-2)	−146,642***	−824,963***	0.0598***	−0.4596***	−1.0720***	0.2034***	0.0226***
(4-3)	447,707***	2,624,963***	−0.1665***	6.2328***	9.5414***	−0.5575***	−0.0036
(5-4)	−398,304***	−2,214,324***	0.0683***	−6.0502***	−8.8367***	0.2060***	0.0044

This table summarizes measures of trading volume and short-selling intensity for various windows around the SEO announcement date and issue date. SSVOL is daily short-sale share volume. VOL is daily total share volume. ABSS is daily short-sale volume divided by average short-sale volume calculated over the benchmark period. ABVOL is daily total volume divided by average total volume calculated over the benchmark period. ABRELSS is abnormal short-sale volume divided by abnormal total volume. RELSS is daily short-sale share volume divided by daily total share volume. ABRET is the abnormal return calculated as the daily stock return minus the CRSP value-weighted index return. We measure these variables as daily means or medians over various windows relative to the SEO announcement date (AD) and issue date (ID). [AD-5, AD-1] is the window from five days prior to the AD through one day prior to the AD. The other windows are analogously defined. Panel A and Panel B give the mean and median daily value, respectively, where the asterisks denote statistical significance for a *t*-test (means) or Wilcoxon rank sum test (medians) that the value is different from zero. Panel C contains the difference in means across various sets of windows. ***, **, * denote statistical significance at the 1%, 5%, and 10% levels, respectively, for the abnormal measures and differences in means.

As can be seen from Table 2, the mean announcement date abnormal return is −2.3%, which is statistically different from zero at the 1% level. These results are consistent with the magnitude of SEO announcement returns found in prior research (e.g., Asquith and Mullins 1986; Mikkelson and Partch 1986).

Table 2 reports the results of statistical tests of abnormal trading activity during the pre-announcement period (H1A). There is no evidence that either short selling or volume immediately before the announcement is greater than benchmark periods. Mean values for *ABSS* and *ABVOL* are both insignificantly different from zero, and median values are significantly negative. There is some evidence that the decrease in short selling is disproportionately smaller than the decrease in total trading volume; the mean pre-announcement value of

ABRELSS is significantly positive, but the median value is not significantly different from zero. These results suggest that there may be relatively higher short selling in a subset of stocks. Overall, however, these results contradict H1A.

Hypothesis H1B predicts that abnormal short selling before the announcement will be negatively related to abnormal returns on the announcement date. Following Christophe, Ferri, and Angel 2004, to test this prediction, we run regressions of the form

$$ABSS\,[AD-5, AD-1] = \beta_0 + \beta_1 ABRET\,[AD] + \beta_2 ABRET\,[AD-5, AD-1] + \beta_3 ABVOL\,[AD-5, AD-1] + \varepsilon. \quad (7)$$

All variables are measured over the specified intervals. For example, *ABSS*[*AD-5,AD-1*] is the daily average of *ABSS* in the five trading days prior to the announcement date. According to H1B, $\beta_1 < 0$, which implies that informed short sellers anticipate and short sell more before SEO announcements with relatively more bad news. Table 3, Panel A, reports results of this regression for

Table 3
Regressions of preannouncement or announcement-date short selling on announcement-date returns

Panel A: Preannouncement Short Selling Regressed on Announcement-Date Abnormal Returns

	ABSS[AD-5,AD-1]	RELSS[AD-5,AD-1]	ABRELSS[AD-5,AD-1]
Intercept	0.101	0.024	0.057
	(2.92)	(1.33)	(2.69)
ABRET[AD]	−0.258	0.118	0.354
	(−0.35)	(1.06)	(0.78)
ABRET[AD-5,AD-1]	−1.411	0.667	2.694
	(−0.71)	(2.24)	(2.22)
ABVOL[AD-5,AD-1]	1.254		
	(40.02)		
RELSS[Benchmark]		0.980	
		(16.56)	
N	410	410	410

Panel B: Announcement Date Short Selling Regressed on Announcement-Date Abnormal Returns

	ABSS[AD]	RELSS[AD]	ABRELSS[AD]
Intercept	0.181	0.055	0.060
	(1.91)	(2.04)	(1.64)
ABRET[AD]	−0.085	0.275	1.262
	(−0.04)	(1.67)	(1.62)
ABVOL[AD]	0.615		
	(21.73)		
RELSS[Benchmark]		0.841	
		(9.59)	
N	410	410	410

This table reports results of regressions of preannouncement short selling (Panel A) or announcement-date short selling (Panel B) on announcement-date abnormal returns. The dependent variables are abnormal short selling (ABSS), relative short selling (RELSS), or abnormal relative short selling (ABRELSS). Additional independent variables include controls for normal volume. t-statistics are in parentheses.

the full sample.[17] As can be seen in Panel A, β_1 is statistically indistinguishable from 0. As robustness, we repeat tests of equation (1) with relative short selling (*RELSS*[*AD-5*,*AD-1*]) or abnormal relative short selling (*ABRELSS*[*AD-5*,*AD-1*]) as dependent variables. Results from these regressions support our conclusions. Short selling during this period is not significantly negatively cross-sectionally related to abnormal announcement returns.

Our second set of hypotheses predicts that if short sellers are especially skilled at processing the information contained in the SEO announcement, then short selling will be abnormally high on the announcement date, and abnormal announcement-date short selling will be negatively related to announcement-date returns. According to Table 2, both short selling and total volume are abnormally high on the announcement date. For example, short selling is 90% above normal (measured for that firm during the benchmark period), and total volume is 117% above normal. However, there does not appear to be a disproportionate increase in short selling; neither the mean nor the median value of *ABRELSS* is significant.

In Table 3, Panel B reports results of regressions of abnormal announcement-date short selling on contemporaneous returns. Two of the three coefficients are positive, and none are significantly negative. H2B predicts a negative relation between abnormal announcement-date short selling and contemporaneous returns. Overall, therefore, our results do not support hypotheses H2A or H2B.

Collectively, results in this section show no evidence of informed short selling either before or on the announcement date.

4. Issue Date Results

4.1 Issue discount

Testing the relation between short selling before the offer date and the issue discount should allow us to distinguish between manipulative and informed short selling. Under the model of Gerard and Nanda (1993), informed short selling before the offer date should be associated with smaller issue discounts (H3A), while manipulative short selling should be associated with larger issue discounts (H3B). To test these hypotheses, we run regressions of SEO issue discounts on various firm and offering characteristics similar to Corwin (2003), and include measures of short-selling intensity prior to the issue date.

The issue discount is measured as the close-to-offer return: the percentage difference between the SEO offering price and the closing price the day before the offering. Consistent with the literature, we multiply this number by negative one before using it as the dependent variable in our regressions. Therefore, positive coefficients on our short-selling measures are consistent

[17] Similar results hold for subsamples based on the length of the waiting period and based on shelf versus non-shelf registration.

with manipulative short selling, and negative coefficients are consistent with informed short selling.

The explanatory variables are designed to capture various characteristics of the firm or offering that are known to influence the issue discount, and are primarily motivated by the findings of Altinkiliç and Hansen (2003) and Corwin (2003). Firms with higher levels of asymmetric information should have larger issue discounts. To control for these effects, we include the logarithm of the firm's market capitalization the day before the offering (*LogMktCap*) and the standard deviation of the firm's stock return over the 30-day period ending 11 days prior to the offering (*Volatility*). *RelOfrSize* is the number of shares offered in the SEO divided by the number of shares outstanding prior to the offering, and is used to capture any price-pressure effects related to the market's ability to absorb the new shares. *CARPos* (*CARNeg*) is the cumulative abnormal return over the five days preceding the offering if it is positive (negative), and zero otherwise. These variables should control for price changes prior to the offering. *LogPrice* is included to capture any issue discount effects related to underwriter pricing practices such as setting SEO offer prices at the closing bid rather than the closing transaction price (Lee, Lochhead, Ritter, and Zhao 1996). *BE/ME*, the ratio of book value of equity from the most recent fiscal year-end divided by the market value of equity at the end of the month prior to issue, is included to capture any cross-sectional relation between this ratio and the costs of and demand for short selling (Jones and Lamont 2002). *Offer Price Cluster* is a dummy variable equal to one if the decimal portion of the offer price is 0.00, 0.25, 0.50, or 0.75. This variable should capture the clustering of SEO offer prices at even quarters (Mola and Loughran 2004).[18] We include a dummy for NYSE/Amex-listed firms to capture differences across dealer and auction markets. Previous research uses institutional ownership to proxy for short-sale constraints since it represents the supply of lendable shares (Nagel 2005). We therefore include *Inst. Ownership* (defined as the percentage of total shares held by institutions as of the quarter-end prior to the issue date). Finally, we include a dummy for shelf-registered offerings, as well as interactions based on this dummy (discussed below) to capture differences in offer type.

To test our hypotheses, we include in these regressions various measures of short-selling intensity defined in the previous section. To be included in these regressions, we need to measure the amount of short selling between the announcement and issue dates, so observations where there is no waiting period are excluded from these tests.[19] Table 4 contains the results of our OLS regressions for the offerings that have a waiting period. Coefficients on the control

[18] Despite the fact that our sample period entirely post-dates the switch to decimal pricing, 72% of our offers occur at even quarters.

[19] Data on all of our control variables are available for 325 of the 326 observations in the sample with a waiting period.

variables in our regressions are generally in the direction predicted by previous research. We highlight that *CARNeg* has a significantly negative relation with the issue discount, implying that firms with more negative abnormal returns in the five days prior to issuance have larger underpricing. This variable could be capturing some of the effects of short selling and its influence on pre-offer prices.

Table 4
Regressions of SEO discount on pre-issue short selling

	1	2	3	4	5	6
Intercept	0.1249	0.1251	0.1212	0.1180	0.1146	0.1151
	(2.46)	(2.49)	(2.43)	(2.34)	(2.24)	(2.33)
Log MktCap	−0.0047	−0.0047	−0.0046	−0.0043	−0.0035	−0.0044
	(−1.68)	(−1.70)	(−1.66)	(−1.56)	(−1.20)	(−1.61)
Volatility	0.0128	0.0195	0.0106	0.0432	0.0420	0.0078
	(0.09)	(0.15)	(0.08)	(0.32)	(0.31)	(0.06)
Rel Ofr Size	−0.0049	−0.0148	−0.0172	−0.0122	−0.0119	−0.0136
	(−0.28)	(−0.84)	(−0.98)	(−0.69)	(−0.68)	(−0.77)
CARPos	0.1999	0.2126	0.2081	0.2024	0.2107	0.2113
	(3.50)	(3.76)	(3.69)	(3.57)	(3.71)	(3.78)
CARNeg	−0.3351	−0.3294	−0.3346	−0.3360	−0.3281	−0.3281
	(−8.89)	(−8.84)	(−9.00)	(−8.87)	(−8.75)	(−8.93)
Log Price	−0.0064	−0.0067	−0.0065	−0.0069	−0.0071	−0.0065
	(−1.59)	(−1.67)	(−1.62)	(−1.70)	(−1.76)	(−1.66)
BE/ME	−0.0057	−0.0069	−0.0059	−0.0063	−0.0070	−0.0037
	(−0.84)	(−1.02)	(−0.89)	(−0.91)	(−1.02)	(−0.55)
Offer Price Cluster	0.0147	0.0138	0.0142	0.0143	0.0138	0.0140
	(3.54)	(3.36)	(3.47)	(3.46)	(3.32)	(3.44)
NYSE Dummy	0.0073	0.0069	0.0074	0.0067	0.0026	0.0063
	(1.63)	(1.56)	(1.69)	(1.52)	(0.51)	(1.44)
Inst. Ownership	−0.0171	−0.0158	−0.0162	−0.0160	−0.0145	−0.0152
	(−2.37)	(−2.21)	(−2.28)	(−2.23)	(−2.01)	(−2.15)
Shelf Dummy	0.0019	0.0021	0.0054	0.0040	0.0040	0.0060
	(0.43)	(0.49)	(1.18)	(0.86)	(0.86)	(0.49)
ABRELSS[ID-10,ID-1]		0.0093	0.0128			
		(3.02)	(3.63)			
Shelf * ABRELSS[ID-10,ID-1]			−0.0137			
			(−1.99)			
ABSS[ID-10,ID-1]				0.0057		
				(2.79)		
Shelf * ABSS[ID-10,ID-1]				−0.0043		
				(−1.66)		
ABVOL[ID-10,ID-1]				−0.0043		
				(−1.10)		
RELSS[ID-10,ID-1]					0.0456	
					(2.13)	
Shelf * RELSS[ID-10,ID-1]					−0.0089	
					(−0.29)	
RELSS[Benchmark]					−0.0921	
					(−2.83)	
ABRELSS[ID-5,ID-1]						0.0047
						(2.19)
ABRELSS[ID-10,ID-6]						0.0186
						(3.86)
Shelf * ABRELSS[ID-5,ID-1]						0.0006
						(0 08)

(*continued*)

Table 4
Continued

	1	2	3	4	5	6
Shelf * ABRELSS[ID-10,ID-6]						−0 0250 (−2.87)
Adj. R^2	0.3626	0.3787	0.3846	0.3735	0.3766	0.3998
N	325	325	325	325	325	325

This table presents results of regressions of the SEO discount on various firm and offering characteristics, and measures of trading activity and short-selling intensity prior to the issue date (ID). The sample includes only those firms that have a waiting period. The SEO discount is defined as the negative value of the percentage difference between the offer price and the previous day's closing price. Log MktCap is the logarithm of market capitalization the day before issuance. Volatility is the standard deviation of daily returns calculated over the 30 trading days ending 11 days prior to the offering. Rel Ofr Size is the number of shares offered as a percentage of pre-issue shares outstanding. CARPos (CARNeg) is the cumulative abnormal return over the five days prior to ID if positive (negative), and zero otherwise. Log Price is the logarithm of the price on the day before issuance. BE/ME is the ratio of book equity from the most recent fiscal year-end to the market value of equity at the end of the month prior to the issue date. Offer Price Cluster is a dummy variable equal to one if the decimal portion of the offer price is .00, .25, .50, or .75. NYSE Dummy is a dummy variable equal to one if the firm is traded on the NYSE or Amex. Inst. Ownership is the percent of total shares held by institutions. Shelf Dummy is a dummy variable equal to one if the offering is a shelf registration. Short selling is measured as abnormal relative short selling (ABRELSS), abnormal short selling (ABSS), and relative short selling (RELSS). Volume is measured as abnormal volume (ABVOL). Shelf*SSVar is an interaction term between Shelf Dummy and the short-selling variable. [ID-10, ID-1] is the window from ten days prior to the ID through one day prior to the ID. The other windows are analogously defined. *t*-statistics are in parentheses.

The key variable we use to measure short-selling intensity is *ABRELSS*. This measure captures abnormal short selling after controlling for abnormal volume, both of which are likely to be high around an SEO. We measure *ABRELSS* over specific windows prior to the issue date. However, we truncate this window in cases where the waiting period is less than ten days to exclude short sales on days prior to the announcement date. The coefficient on *ABRELSS*[*ID-10,ID-1*] in Model 2 is positive and highly significant. Under the Gerard and Nanda 1993 model, this result is consistent with the manipulative short-selling hypothesis H3B. Short selling seems to be originating from traders trying to manipulate the offer price downward.[20] Similar results hold in untabulated regressions using *ABSS*[*ID-10,ID-1*] or *RELSS*[*ID-10,ID-1*] as the measure of pre-issue short selling.

According to Autore (2007), shelf registrations were originally exempt from Rule 105, because the SEC did not believe shelf registrations were as susceptible to manipulation as traditional offerings. However, the increased frequency of shelf offers as well as the potential for manipulative trading led the SEC to remove this exemption in September 2004. To allow the relation between pre-issue short selling and the issue discount to differ between shelf and non-shelf offerings, we include our short-selling measures both individually and

[20] Diether, Lee, and Werner (2009) document that short sellers increase their trading following positive returns. In unreported tests, we interact *ABRELSS*[*ID-5,ID-1*] with cumulative abnormal returns calculated over the interval [ID-10,ID-6]. The results from these regressions confirm that the significant relationship between the SEO discount and *ABRELSS* is not the result of increased short-sale activity in response to lagged positive returns.

interacted with the *Shelf* dummy. The coefficients on the short-selling measures are all significantly positive. Higher levels of short selling are associated with larger issue discounts for the non-shelf registrations. The coefficients on the interaction term between the *Shelf* dummy and pre-issue short selling are negative in Models 3 through 5, and statistically significant in Model 3.[21] The relationship between pre-issue short selling and the issue discount for shelf registrations differs from that for non-shelf offerings. Furthermore, unreported statistics testing the combined effect of the coefficients on short selling and the interaction terms for shelf registrations show no significant relation. Manipulative short selling appears to be concentrated in non-shelf registrations.[22] This finding offers one potential explanation for the recent increase in popularity of shelf registrations.

Note also that the coefficient on *RELSS* calculated during the benchmark period is negative and significant (Model 5). As Gerard and Nanda (1993) point out, restrictions on short selling may be costly to issuers if they constrain informed short sales. This result suggests that firms that normally have higher levels of relative short selling have smaller issue discounts, consistent with the finding in the literature that short sellers usually increase price efficiency. However, firms with higher relative short selling prior to the SEO have larger issue discounts, supporting the view that short selling before the issue date is making prices less informative. These results extend the literature examining the general impact of short selling on price efficiency. Model 6 in Table 4 presents results relating to the impact of Rule 105, which we discuss in Section 4.3. Explanatory power in all model specifications is good, with an adjusted R^2 of at least 0.36 in each case.

As noted above, prior research found no evidence of manipulative short selling after Rule 10b-21 became effective. However, previous studies have been limited by lack of data, testing the impact of manipulative trading using monthly short-interest data. To compare our results more directly to prior research, we collect monthly short-interest data for our sample of SEOs.[23] We are able to identify a monthly short-interest reporting date between the announcement and issue date for 173 of the 325 SEOs included in the issue discount regressions. We conduct an analysis similar to Safieddine and Wilhelm

[21] To control for the possibility that bad news drives short selling immediately prior to the issue date, we collect news announcements from the *Wall Street Journal* during the week prior to the issue date. Of the 325 SEOs analyzed in Table 4, only 9 have news announcements during this period. The results in Table 4 do not change if we control for news announcements.

[22] For robustness, we duplicate our main tests excluding SEOs with an extremely long waiting period of more than 50 days. Results are substantially similar to those reported in the article. We also repeat regressions in Table 4 with Amihud's (2002) illiquidity variable or with percentage bid-ask spreads as additional explanatory variables to capture asymmetric information. Inferences about short selling do not change with the inclusion of these additional control variables.

[23] Following Safieddine and Wilhelm (1996), we define relative short interest (*RSI*) as the level of short interest reported between the announcement and issue dates, divided by the mean level of short interest reported during the three months preceding the announcement. If more than one short-interest observation occurs between the announcement date and the issue date, we use the observation closest to the issue date.

(1996, Table II), calculating mean abnormal short interest and *ABRELSS*[*ID-10,ID-1*] by day according to the number of days between the RSI reporting day and the issue date. In untabulated results, RSI is significantly positive only when reported one and two days before the issue date. In contrast, *ABRELSS* [*ID-10,ID-1*] is significant for several days before the offer. *ABRELSS* has greater power to detect abnormal pre-issue short selling.

In Table 5, Models 1 and 2 report results of the issue discount regressed on monthly short interest and the other explanatory variables included in Table 4. This measure captures abnormal short interest during the SEO period, analogous to our measures of abnormal short selling. Consistent with prior research, results in Models 1 and 2 show no evidence of manipulative short selling (Safieddine and Wilhelm 1996, in post-10b-21 regressions; Singal and Xu 2005). The coefficients on abnormal short interest are statistically insignificant.[24] In Models 3 through 5, we repeat the regressions from Table 4 (Models 3 through 5) for the subsample of firms with short-interest data. The *t*-statistics on all of the short-selling variables are lower than in Table 4, consistent with lower power due to a smaller sample size. More importantly, however, results in these regressions show that the coefficients on daily short selling are consistently positive, and still significant for *ABRELSS*[*ID-10,ID-1*] and *ABSS*[*ID-10,ID-1*]. Although there is no evidence of a relationship between monthly short interest and the issue discount, we continue to find a significant relationship between daily short selling and the issue discount, controlling for differences in samples. The lack of evidence of manipulative trading in prior research appears to be attributable to lack of power in the short-interest data.

Overall, the primary conclusion from these regressions is that abnormally high levels of short selling are related to larger issue discounts. Although the SEC noted the potential for manipulation in shelf registrations, our results show significant evidence of manipulative trading only for the non-shelf registrations in our sample.

Safieddine and Wilhelm (1996) and Kim and Shin (2004) discuss the potential use of transactions in the options market as a substitute for short selling to manipulate prices and increase issue discounts. Although short selling is constrained by SEC regulations, trading in the options market is not constrained. To control for the possibility that traders use the options market to manipulate prices, we collect daily options trading volume from OptionMetrics in the Wharton Research Data Services database. Of the 325 SEOs included in Table 4, 154 (47%) have options trading volume leading up to the issue date. We rerun the tests reported in Table 4 separately for subsamples with and without put option volume on days [ID-5,ID-1]. Results of these regressions (available on request) show that the relation between pre-issue short selling and the

[24] Consistent with our argument that short-interest data lack power to explain the issue discount, a simple correlation matrix also shows that relative short interest is less strongly correlated with issue discounts than our short selling measures are.

Table 5
Regressions of SEO discount on pre-issue short selling for firms with short-interest data

	1	2	3	4	5
Intercept	0.1542	0.1530	0.1266	0.1461	0.1313
	(2.37)	(2.34)	(1.97)	(2.28)	(1.98)
Log MktCap	−0.0054	−0.0054	−0.0040	−0.0045	−0.0031
	(−1.48)	(−1.48)	(−1.12)	(−1.26)	(−0.80)
Volatility	0.0619	0.0491	0.0762	0.0928	0.1414
	(0.34)	(0.26)	(0.43)	(0.52)	(0.78)
Rel Ofr Size	−0.0390	−0.0390	−0.0464	−0.0441	−0.0452
	(−1.91)	(−1.91)	(−2.31)	(−2.18)	(−2.23)
CARPos	0.0940	0.0965	0.0934	0.0964	0.1115
	(1.19)	(1.22)	(1.20)	(1.25)	(1.41)
CARNeg	−0.1911	−0.1892	−0.2050	−0.1812	−0.1846
	(−3.32)	(−3.28)	(−3.62)	(−3.24)	(−3.24)
Log Price	−0.0134	−0.0132	−0.0146	−0.0162	−0.0152
	(−2.31)	(−2.26)	(−2.55)	(−2.82)	(−2.61)
BE/ME	0.0179	0.0180	0.0161	0.0139	0.0163
	(2.06)	(2.07)	(1.89)	(1.61)	(1.87)
Offer Price Cluster	0.0227	0.0227	0.0233	0.0209	0.0216
	(3.99)	(3.98)	(4.13)	(3.76)	(3.78)
NYSE Dummy	0.0008	−0.0003	0.0007	−0.0002	−0.0041
	(0.13)	(−0.04)	(0.11)	(−0.03)	(−0.61)
Inst. Ownership	−0.0071	−0.0069	−0.0060	−0.0061	−0.0074
	(−0.75)	(−0.72)	(−0.65)	(−0.67)	(−0.79)
Shelf Dummy	0.0060	0.0070			
	(1.04)	(1.19)			
RSI	0.0004	0.0008			
	(0.63)	(1.01)			
Shelf* RSI		−0.0009			
		(−0.80)			
ABRELSS[ID-10,ID-1]			0.0126		
			(2.99)		
Shelf * ABRELSS[ID-10 ID-1]			−0.0184		
			(−2.03)		
ABSS[ID-10,ID-1]				0.0049	
				(2.05)	
Shelf * ABSS[ID-10,ID-1]				−0.0020	
				(−0.52)	
ABVOL[ID-10,ID-1]				0.0020	
				(0.36)	
RELSS[ID-10,ID-1]					0.0362
					(1.54)
Shelf * RELSS[ID-10,ID-1]					−0.0049
					(−0.11)
RELSS[Benchmark]					−0.1022
					(−2.61)
Adj. R^2	0.2485	0.2469	0.2848	0.2945	0.2707
N	173	173	173	173	173

This table reports regressions of SEO discounts on various firm and offering characteristics and measures of short-selling intensity prior to the issue date (ID) for the subsample of firms from Table 4 that have a short-interest observation between the announcement and issue dates. Models 1 and 2 in this table present results of regressions of the SEO discount on abnormal short interest prior to the issue date (ID). The SEO discount is defined as the negative value of the percentage difference between the offer price and the previous day's closing price. Relative Short Interest (RSI) is the level of short interest reported between the announcement and issue dates, divided by the mean level of short interest reported during the three months preceding the announcement. Other explanatory variables are as defined in Table 4. For comparison, Models 3 through 5 repeat regressions reported in Table 4, for the subsample of firms with short-interest data.

issue discount is statistically significant only for the subsample of firms without put options.[25] This finding is consistent with predictions if options transactions can substitute for short selling. The relation between short selling and issue discounts is stronger when traders do not have the opportunity to trade in an alternative market, the options market.

4.2 Post-issue performance

Another means of distinguishing between informed and manipulative short selling is to look at the effect of short selling prior to the issue date on post-issue performance. Several studies test for a post-issue price recovery for a few days after a new equity issuance, with mixed results (e.g., Scholes 1972; Altinkiliç and Hansen 2005).

To test hypotheses H4A and H4B directly, we regress post-issue performance on various measures of pre-issue short-selling intensity. Meidan (2005) analogously regresses post-issue returns on pre-issue returns to test whether price pressure before SEOs is temporary or permanent. However, he notes that an errors-in-variables problem arises when using total return to proxy for the temporary return component, which causes the slope coefficient to be biased toward zero. Our specification is subject to a similar concern.

Corwin (2003, Figure 2) plots abnormal returns from day [ID-5] through [ID+5] to test the manipulative trading hypothesis. Kim and Shin (2004) examine the relation between abnormal returns during the five days preceding the offer date (their proxy for pre-issue short selling) and abnormal returns extending 5 or 30 days post-issue. Analogously, we regress post-issue returns measured over days [ID+1,ID+5] on pre-issue short selling measured over days [ID-5,ID-1]. To allow for a difference between shelf and non-shelf registrations, we include the *Shelf* dummy variable, as well as an interaction between this dummy and our short-selling measures in these regressions.

Results of this analysis are reported in Table 6, Models 1 through 3. Results are insignificant at the 5% level.[26] Insignificantly positive coefficients are consistent with either informed short selling or lack of power in the tests.

4.3 Effectiveness of Rule 105

We next turn our attention to the question of whether SEC rules designed to restrict manipulative short selling are effective. Rule 105 prohibits traders from using shares obtained in the SEO to cover short positions established within

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[25] We also conduct regressions similar to those in Safieddine and Wilhelm (1996), including a dummy variable, OPTION, in our regressions of the issue discount. This dummy variable equals 1 for firms if there is put option trading volume during days [ID-5,ID-1] and zero otherwise. When included in unreported regressions similar to those in Table 4, the coefficient on this variable is insignificantly negative.

[26] We ran several other specifications of these regressions, including short-selling variables measured over days [ID-3,ID-1], abnormal returns measured for eight days post-issue, results sorted by exchange listing, and regressions with no shelf dummy variables, with similar results. Results in the remaining columns of Table 6 relate to Rule 105 and are discussed below.

Table 6
Regressions of post-issue returns on pre-issue short selling

	Waiting Period Greater than 0			Waiting Period Greater than 5 Days					
	Preissue [ID-5,ID-1]			Preissue [ID-5,ID-1]			Preissue [ID-10,ID-6]		
(×100)	1	2	3	4	5	6	7	8	9
Intercept	0.092	−0.003	0.065	0.082	0.045	0.068	0.072	0.315	0.113
	(1.17)	(−0.01)	(0.79)	(0.96)	(0.16)	(0.78)	(0.85)	(1.22)	(1.34)
Shelf Dummy	−0.129	0.296	−0.037	−0.055	0.314	−0.049	−0.080	−0.072	−0.120
	(−1.17)	(0.93)	(−0.33)	(−0.40)	(0.79)	(−0.35)	(−0.60)	(−0.21)	(−0.95)
ABSS	−0.002			0.029			0.019		
[preissue]	(−0.06)			(0.75)			(0.14)		
Shelf * ABSS	0.014			−0.088			0.064		
[preissue]	(0.24)			(−0.78)			(0.46)		
ABVOL	0.049			−0.083			−0.123		
[preissue]	(0.51)			(−0.65)			(−0.92)		
RELSS		0.855			1.105			0.074	
[preissue]		(1.66)			(1.97)			(0.13)	
Shelf * RELSS		−0.949			−0.994			−0.073	
[preissue]		(−1.22)			(−0.98)			(−0.07)	
RELSS		−0.856			−1.356			−0.84	
[Benchmark]		(−1.19)			(−1.53)			(−0.92)	
ABRELSS			0.053			0.059			−0.049
[preissue]			(0.91)			(0.96)			(−0.34)
Shelf * ABRELSS			−0.200			−0.195			−0.029
[preissue]			(−1.15)			(−0.86)			(−0.13)
N	326	326	326	236	236	236	236	236	236

This table reports results of regressions of returns after the issue date on pre-issue short selling for the full sample of events with a waiting period, and for the subsample of firms with at least five days in the waiting period. Pre-issue short selling is defined as abnormal short selling (ABSS), relative short selling (RELSS), or abnormal relative short selling (ABRELSS). Pre-issue short selling is measured over days [ID-5,ID-1] in Models 1–6, and over days [ID-10,ID-6] in Models 7–9. Post-issue abnormal returns are measured over days [ID+1,ID+5] in all models. Additional regressors include controls for normal volume, a dummy variable SHELF equal to one for shelf registrations, and terms interacting SHELF with pre-issue short selling, *t*-statistics are in parentheses.

the preceding five days. Thus, there are greater costs and risks to manipulative short selling during this five-day period if the shares used to cover the short position must be purchased in the open market, rather than being received at the discounted offering price. This increased cost is illustrated in Figure 2, which shows the opening and closing prices on the issue date relative to the SEO offer price. Despite the pricing of the SEO at a 3.11% average discount to the previous day's closing price (Table 1), the *opening* price on the issue date is only 1.01% below the previous day's closing price.[27] By closing time on the issue date, the average market price is only 0.43% below the previous day's close. This price movement on the issue date significantly increases the cost of covering pre-offer short sales with open market purchases.

According to H5, if Rule 105 is effective, short selling at least six days before the issue date should be greater than short selling closer to the issue date. Table 7 contains both mean and median levels of various measures of

[27] Opening prices were collected from intraday TAQ data.

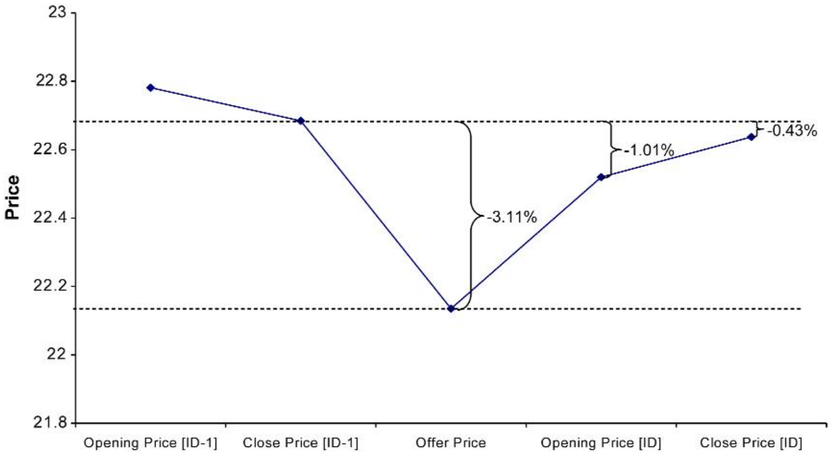

Figure 2
Opening and closing prices around the SEO issue date
Average opening and closing prices before and on the issue date, relative to the SEO offer price.

short-selling intensity by event day prior to the issue date for the subsample of offerings with at least five days in the waiting period. The results in Table 7 show that virtually all measures of short-selling intensity increase almost monotonically as the issue date nears, with a noticeable spike in short-selling activity one day before issuance. There is some evidence that Rule 105 is a binding constraint for some short sellers; *SSVOL* and *ABRELSS* show higher levels of short selling on day −6 than on day −5, for example. However, the stronger evidence suggests abnormal short selling immediately before the issue date.[28] For example, in Panel A of Table 7, mean abnormal short-selling levels (*ABSS*) are only significantly different from zero in the four days before issuance. Median abnormal short selling (*ABSS*) in Panel B is significantly *negative* six days before the issue date, and does not become positive until two days before issuance. The monotonic increase in *ABRELSS* as the issue date approaches is illustrated in Figure 3. These results strongly suggest that Rule 105 does not effectively prevent short selling immediately prior to SEO issue dates.

We are also interested in determining whether Rule 105 affects informed or manipulative trading strategies. To address this question, in Model 6 of Table 4, we separate *ABRELSS*[*ID-10,ID-1*] into two subsets based on the number of days before the issue date. Results in this model show that there is a significant relationship between pre-issue short selling and the issue discount

[28] Unreported tests using intraday short-sale volume show that abnormal short selling (*ABSS*) in the last hour of trading is statistically larger than abnormal short selling over the rest of the day on [ID-1]. This result does not hold for any of the other days leading up to the issue date. Since many SEOs are priced after the close of trading on [ID-1], this evidence confirms that short sellers are particularly active right before the pricing.

Table 7
Trading activity and short-selling intensity prior to issue date when Rule 105 applies: (AD − ID) > 5

Panel A: Means

	Raw Measures			Abnormal Measures			
Window	SSVOL	VOL	RELSS	ABSS	ABVOL	ABRELSS	ABRET
[ID-1]	239,058	555,360	0.4283	2.0409***	0.6575***	0.6303***	−0.0087***
[ID-2]	145,274	358,995	0.3965	0.7895***	0.0679	0.5590***	−0.0023
[ID-3]	114,481	292,988	0.3930	0.6449*	−0.0079	0.4359***	−0.0014
[ID-4]	106,164	296,027	0.3688	0.1872*	−0.0889	0.3987***	−0.0004
[ID-5]	109,432	302,369	0.3497	0.1102	−0.0549	0.2032***	0.0018
[ID-6]	112,674	338,301	0.3446	0.0547	−0.0969	0.2055***	−0.0053***
[ID-7]	115,397	334,068	0.3398	0.1387	−0.0281	0.1764***	−0.0014
[ID-5, ID-1]	142,305	359,603	0.3860	0.7791***	0.1179**	0.4508***	−0.0022**
[ID-10, ID-6]	117,398	359,242	0.3234	0.0491	−0.0449	0.1341***	−0.0029**
Difference	24,907	361	0.0626	0.7299	0.1628	0.3167	0.0007
(p-value)	(0.1991)	(0.9945)	(<.0001)	(<.0001)	(0.0240)	(<.0001)	(0.6805)

Panel B: Medians

	Raw Measures			Abnormal Measures			
Window	SSVOL	VOL	RELSS	ABSS	ABVOL	ABRELSS	ABRET
[ID-1]	103,249	286,979	0.4214	0.8628***	0.3662***	0.4703***	−0.0063***
[ID-2]	62,161	173,000	0.3960	0.0444***	−0.1762**	0.3367***	−0.0036*
[ID-3]	55,299	151,882	0.4001	−0.1796	−0.2585***	0.2920***	0.0001
[ID-4]	47,097	145,900	0.3576	−0.2237**	−0.3797***	0.1956***	−0.0030
[ID-5]	43,187	134,923	0.3377	−0.1673	−0.2864***	0.1494***	0.0019
[ID-6]	43,073	131,371	0.3277	−0.3078**	−0.2903***	0.1089***	−0.0031***
[ID-7]	47,752	133,420	0.3293	−0.2709	−0.3089***	0.0820**	−0.0027
[ID-5, ID-1]	53,516	159,413	0.3858	−0.0867	−0.1845***	0.2802***	−0.0023**
[ID-10, ID-6]	42,012	129,695	0.3165	−0.3261***	−0.3572***	0.0498**	−0.0031***
Difference	11,505	29,718	0.0694	0.2394	0.1727	0.2304	0.0008
(p-value)	(0.0459)	(0.3336)	(0.0000)	(0.0000)	(0.0530)	(0.0000)	(0.2873)

This table contains measures of daily trading volume and short-selling intensity in the seven days leading up to the issue date for the subsample of firms that have a waiting period longer than five days. SSVOL is daily short-sale share volume. VOL is daily total share volume. ABSS is daily short-sale volume divided by average short-sale volume calculated over the benchmark period. ABVOL is daily total volume divided by average total volume calculated over a benchmark period. ABRELSS is abnormal short-sale volume divided by abnormal total volume. RELSS is daily short-sale share volume divided by daily total share volume. ABRET is the abnormal return calculated as the daily stock return minus the CRSP value-weighted index return. These variables are the mean or median taken each day prior to the issue date (ID). For example, [ID-1] is the day that occurs one trading day prior to the issue date. [ID-5, ID-1] is the window from five days prior to the ID through one day prior to the ID. The other periods are analogously defined. Panel A (Panel B) contains the mean (median) daily value, where the asterisks denote statistical significance for a t-test (Wilcoxon rank sum test) that the value is different from zero. The bottom section of each panel gives the p-value that there is a difference in means (medians) across the two five-day windows. ***, **, * denote statistical significance at the 1%, 5%, and 10% levels, respectively, for the abnormal measures.

for the non-shelf offerings both when unconstrained (days –6 through –10) and when constrained by Rule 105 (days –1 through –5). In unreported results, we regress the SEO issue discount on the various control measures and the daily level of *ABRELSS* for each of the seven days prior to issuance. The relation between pre-issue short selling and the issue discount is the strongest on day –6. The coefficients on *ABRELSS* six and seven days before issuance are positive and significant. These results are consistent with short selling by manipulative traders who adhere to Rule 105 and transact before its deadline. The coefficient

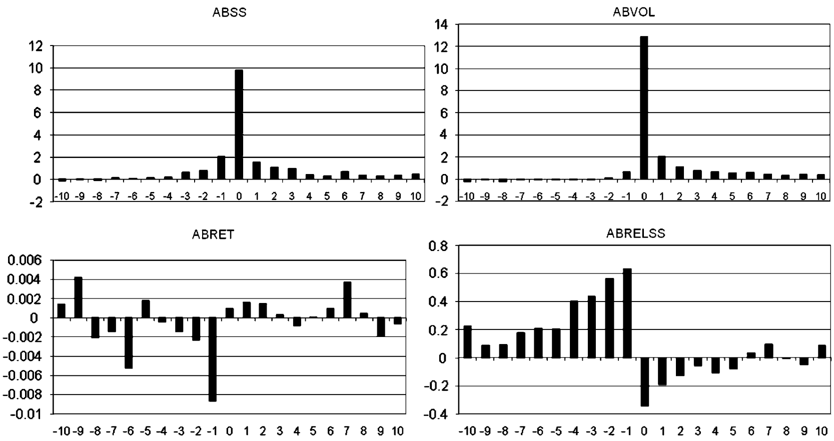

Figure 3
Daily trading activity and returns around the SEO issue date
Mean abnormal short selling, volume, and returns by event day relative to the Issue Date, (AD − ID) > 5.

on *ABRELSS* two days before issuance is also significantly positive. Clearly, Rule 105 does not appear to be effective in restricting all manipulative short selling right before issuance. Results for shelf registrations, combining the coefficients on *ABRELSS* and the interaction term, are again statistically indistinguishable from zero on all days, indicating no relation between pre-issue short selling and the issue discount for shelf registrations.

Finally, we look at the relationship between Rule 105 and post-issue performance. For the subsample of firms with at least five days in the waiting period, in Table 6 we report results of regressions of post-issue returns on pre-issue short selling when constrained by Rule 105 [ID-5,ID-1] and when unconstrained by this rule [ID-10,ID-6]. These results show no significant relationship between abnormal short selling on days –10 through –6 and post-issue returns. In contrast, the coefficient on *RELSS*[*ID-5*,*ID-1*] is significant in Model 5. Although the other short-selling measures are not significant, these results weakly suggest that any relationship between pre-issue short selling and post-issue returns is concentrated during the period when short selling is supposed to be constrained.

Taken in sum, the results in this section provide convincing evidence that Rule 105 is not having its intended effect of eliminating manipulative short selling prior to non-shelf registered seasoned equity offerings.

4.4 Underwriter price stabilization

Underwriters may stabilize IPOs and SEOs by allocating more than 100% of offered shares, and covering this short position by exercising the overallotment option and/or by purchasing shares in the aftermarket (e.g., Wilhelm

1999; Aggarwal 2000). Although we focus on informed and manipulative short selling, underwriters represent another possible class of short sellers around SEOs. Aggarwal (2000) shows that weaker IPOs have larger total short positions and that these short positions are more likely to be covered in the aftermarket rather than by exercising the overallotment option. If weaker SEOs have more underwriter short selling and are more likely to be stabilized by short covering in the aftermarket, these stabilization efforts could lead to price recovery.

We do not believe that underwriter stabilization activities drive our post-issue results, for several reasons. Any underwriter short selling in the primary market will not be reported in our database of secondary-market short selling. Also, the SEC notes that the short position is created when the underwritten shares are allocated, which occurs on the issue date.[29] None of our hypotheses relate to issue-date short selling. Furthermore, according to Edwards and Hanley (2010), underwriter price support is more likely to be present in deals with low first-day returns. We find that pre-issue short selling does not vary with first-day returns as predicted, given underwriter short selling in anticipation of price support.[30] Finally, using short-covering data for IPOs, Aggarwal (2000) finds a significantly negative relationship between the percentages of shares short-covered in the aftermarket and post-issue returns. In contrast, we find no significant relationship or a weakly positive relation between pre-issue short selling and post-issue returns. Collectively, therefore, underwriter short covering does not appear to drive our results.

5. Conclusions

This article examines the relationship between short selling and returns around seasoned equity offerings. First, we develop several hypotheses to distinguish between manipulative and informed short selling around announcement and issue dates. Overall, we find no evidence of informed short selling around SEO announcements. Around issue dates, higher levels of pre-issue short selling are associated with larger issue discounts, consistent with manipulative trading.

Next, we examine the effectiveness of SEC rules designed to restrict manipulative short selling before SEOs. Substantial abnormal short selling occurs within five days of the issue date, suggesting that Rule 105 is not effective. Short selling at least six days prior to the issue date is significantly related to issue discounts, as expected if traders follow Rule 105. However, we also find evidence that short selling closer to the issue date is significantly related to

29 Excerpt from SEC Current Issues and Rulemaking Projects Outline, November 14, 2000 (http://www.sec.gov/divisions/corpfin/guidance/ci111400ex_regs-k_sss.htm).

30 We also conduct the regressions in Table 6 for subsamples of SEOs partitioned according to whether the first-day returns are positive or negative, and whether the first-day returns are above or below the median first-day return for the sample. None of the coefficients on short selling is significant for any of these subsamples.

larger issue discounts. The SEC recently tightened rules restricting manipulative trading around SEOs. This rule change was motivated by the observation that some short sellers have been able to avoid constraints associated with Rule 105. Our empirical results are consistent with this observation.

This research makes three main contributions to the literature. Safieddine and Wilhelm (1996) find evidence of manipulative trading before Rule 10b-21, but no evidence afterward. Subsequent research also rejects the hypothesis of manipulative trading around SEOs. With more powerful daily short-selling data, we are able to provide direct evidence in support of Gerard and Nanda's (1993) model of manipulative trading, despite SEC restrictions on such behavior. Second, we find little evidence of manipulative trading around shelf offerings. Given the increasing popularity of shelf registrations, our results provide important new information for corporate managers choosing their SEO registration method. Finally, our finding that short selling makes prices less efficient immediately prior to SEO issue dates contributes to the current literature examining the general impact of short selling on price efficiency.

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