

Short Selling in Initial Public Offerings

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Abstract

A number of academic papers have used short sale constraints in the immediate aftermarket of IPOs to explain short-term pricing anomalies that are subsequently reversed in the long-term. Using newly available data, this paper documents that short selling is prevalent early in the aftermarket trading of IPOs. Greater short selling is observed in IPOs with positive changes in offer price, high initial returns and large trading volume. Although large levels of underpricing may be indicative of overvaluation, we find that short selling does not appear to limit *observed* underpricing. This finding is inconsistent with theoretical models that predict high initial returns, in part, by assuming constraints on short sales. Using data on failures to deliver, we test whether short sellers appear to avoid the perceived restrictions of the equity lending market by “naked” short selling. The level of failures to deliver, however, are uncorrelated with the amount of short selling and are more likely to occur in IPOs that are hypothesized to be price supported. Thus, we conclude that short selling in IPOs is neither as constrained as suggested by the literature nor the result of “naked” short sales.

Short Selling in Initial Public Offerings

1. Introduction

One of the longstanding puzzles in finance has been the pricing of initial public offerings. Many papers have assumed that constraints on short selling, immediately following an IPO, contribute to pricing inefficiencies in the short-term (Hanley, Lee, and Seguin (1996), Houge et al (2001), Ofek and Richardson (2003), Derrien (2006), and Ljungqvist, et al (2006)) which are subsequently reversed in the long-term (Miller (1977) and Ritter (1991)).

The assumption that short selling is difficult immediately after an IPO is based upon the perceived high cost of borrowing shares (Ljungqvist, Nanda and Singh (2006)), limits on underwriter lending shares during the first month of trading (Houge, et al (2001)), the lock-up of insider shares which restrict supply (Ofek and Richardson (2000)), and difficulties in locating shares prior to the closing of the offer. We test whether these potential constraints restrict short selling in the immediate aftermarket of IPOs by examining newly available data on actual short selling transactions.

Contrary to popular belief, we find that short selling occurs in 99.5% of the IPOs in our sample on the offer day and the majority of first day short sales occur at the open of trading. The average level of short sales on the offer day exceeds 7% of the shares offered and subsequently declines over the first month of trading. By the fifth trading day, the ratio of short selling to volume is only slightly lower than that documented by Diether, Lee, and Werner (2007a) for a large cross-section of stocks. We interpret this finding as an indication that the level of short selling in IPOs approaches an “equilibrium” level quickly.¹

¹ While short selling is slightly below that documented by Diether, Lee, and Werner (2007a) by the fifth trading day, the level of short selling as a percentage of volume on the first trading day is lower than that reported for a typical

The literature provides two theories as to the expected effect of short sale constraints on the pricing of IPOs. First, Miller (1977) suggests that investor overoptimism combined with the inability to short sell the security leads to higher initial returns than would otherwise occur. More recently, the models of Derrien (2006) and Ljungqvist, Nanda and Singh (2006) predict that underwriters and issuing firms take advantage of investor sentiment or irrational exuberance by pricing issues above their intrinsic value. In this case, investor sentiment combined with short selling constraints leads to a higher change in offer price, greater underpricing and an aftermarket trading price that exceeds the “true” value of the security.

Second, underwriter price support in the aftermarket of IPOs may lead to predictable price declines after these activities cease (Aggarwal (2000) and Ellis, Michaely and O’Hara (2000)). It has been suggested that the ability of underwriters to economically sustain price stabilization in the near term and hence, higher than equilibrium prices, is partially related to constraints on short selling (Hanley, Lee and Seguin (1996)).

We test whether short sale constraints contribute to the observed pricing in both of these cases. Our results indicate that the magnitude of short selling on the first trading day is positively and significantly related to the change in offer price, the first day return from the offer price to the open and initial trading volume but unrelated to IPOs that are hypothesized to have underwriter price support.² These findings partially support models of investor sentiment or overoptimism in that short sellers appear to be attracted to issues in which underpricing is greatest and the potential for overvaluation is highest. However, the ability of short sellers to

stock. The difference in short selling on the first trading day in an IPO, as compared to seasoned stocks, may be due to the fact that the volume on the first trading day is extremely large.

² We cannot tell whether this result is due to a lack of demand to sell short price supported IPOs or to greater short sale constraints. Geczy, Musto, and Reed (2002) document that “dog” or cold IPOs tend to have higher rebate rates which suggests that short sale constraints might be responsible for our low observed level of short selling in this subset of IPOs.

limit *observed* underpricing is inconsistent with models of investor sentiment that predict high initial returns, in part, by constraints on short selling.³

We further examine whether the assumption regarding the supposed difficulties in locating or borrowing shares is valid by testing the hypothesis that short sellers are engaging in “naked” short selling activities. According to the SEC web site, “a “naked” short sale is a short sale where the seller does not borrow or arrange to borrow the securities in time to make delivery to the buyer within the standard three-day settlement period [and, as] a result, the short seller fails to deliver securities to the buyer when settlement is due (known as a “failure to deliver” or “fail to deliver”).”⁴ Failures to deliver, in practice, are often used as a measure for the presence “naked” short selling.⁵ Using a unique database, we examine whether short sales immediately following the IPO are positively correlated with failures to deliver. To our knowledge, we are the first paper to examine the relationship between short selling and failures to deliver.

Like short selling, we find that failures to deliver are prevalent early in the aftermarket trading of IPOs. Approximately 61% of the IPOs in our sample have failures to deliver of at least 10,000 shares on *the first* standard settlement day.⁶ In fact, almost 1/3 of IPOs have enough fails to deliver over the first five standard settlement days to qualify for the Regulation SHO

³It could obviously be the case that the level of initial return in these offers might have been higher if fewer short sales were able to be executed.

⁴ <http://www.sec.gov/spotlight/keyregshoissues.htm>

⁵ The Commission has stated that fails to deliver can be indicative of abusive or manipulative naked short selling and can deprive shareholders of the benefits of ownership, such as voting and lending, See page 8 of the release proposing to amend Regulation SHO (SEC Release No. 34-54154, July 14, 2006).

⁶ The first settlement date refers to three days after the issue starts trading in the stock market. This is also the first day that a failure to deliver can occur.

threshold list on the first possible date and almost 40% appear on the list within the first month of trading.⁷

Contrary to the hypothesis that failures to deliver in IPOs are due to “naked” short selling, we find that high levels of fails to deliver are not associated with high levels of short selling. There is no evidence that short sellers are systematically engaging in “naked” short selling in IPOs.

We do show, however, that failures to deliver are more likely to occur in IPOs that are hypothesized to be price supported. This suggests that failures to deliver in price supported IPOs may arise from the mechanics of the offering process. Underwriters generally allocate more shares in an IPO than are offered (e.g., Hanley, Lee and Seguin (1996) and Aggarwal (2000)). If the initial return is positive, the underwriter covers this overallocation by exercising the overallotment option. In the case of IPOs needing price support, the underwriter will purchase shares in the open market to cover the overallocation. Unless all overallocated shares are purchased in the market on the first trading day, these overallocated shares could result in fails to deliver if investors sell them before the underwriter can purchase the shares. Therefore, underwriter price support activities could result in failures to deliver in the short-term.⁸

We also examine the impact of borrowing costs on the level of short selling and find that loan fees on T+3 are increasing in the level of short selling on T+0. This finding calls into

⁷ When a stock has a fail to deliver level of at least 10,000 shares and 0.5% of the shares outstanding for five consecutive settlement days, the trading venue listing the stock is required to place it on a list known as the Regulation SHO threshold list.

⁸ The creation of an uncovered short position by underwriters in connection with an offering is a permissible activity that facilitates an offering and is different from the delivery obligations relating to “uncovered short selling” of securities that is discussed in the Regulation SHO adopting release (SEC Release No. 34-50103, July 28, 2004 and 69 FR 48008, August 6, 2004). These are two distinctly different activities. Underwriters cover the overallocation either through the exercise of the overallotment option or through open market purchases (also known as “syndicate short covering”). Syndicate short covering, which is defined in Regulation M as “the placing of any bid or the effecting of any purchase on behalf of the sole distributor or the underwriting syndicate or group to reduce a short position created in connection with the offering,” is regulated by Rule 104 of Regulation M, which governs certain aftermarket activities in connection with an offering. The Commission has proposed amendments to Rule 104 of Regulation M (see SEC Release No.33-8511, December 9, 2004).

question the interpretation of prior studies that the higher cost of borrowing for IPOs, relative to other stocks, is an impediment to short selling.

Finally, we test whether short selling is related to subsequent returns over the first trading day and the first three months after the IPO. We find no relation in the near term but cumulative short selling over the first month shows a weak negative relation to the cumulative return over the second and third months of trading. When loan fees are taken into consideration, first day short selling is significantly related to returns over the first three months. We interpret these results as an indication that short sellers in IPOs may be informed about subsequent price movements.

Overall these findings call into question prior studies' interpretations on the role of short sale constraints in the pricing of IPOs. Recent evidence by Geczy, Musto and Reed (2002), on rebate rates, suggests that IPO shares are available for borrowing as soon as the first settlement day but that access to these shares may be limited to only some investors. Even though they find that most IPOs are on special and thus, are expensive to borrow, we find that short sellers are active in IPOs. We interpret these results as evidence that short selling is not as constrained in IPOs as the literature has suggested and implies that factors other than short sale constraints may be responsible for the observed high level of initial returns in IPOs.⁹

The paper is organized as follows: A brief literature review is presented in Section 2, section 3 describes the data and summary statistics, Section 4 examines the determinants of short selling, Section 5 investigates potential "naked" short selling, and Section 6 investigates the cost of

⁹ We note that our tests are unable to determine whether all demand for short selling is fully satisfied. However, many of the papers referenced above assume that short selling is impossible during the first few trading days and our results indicate that this claim is untrue.

borrowing shares and subsequent price movements. Section 7 provides a summary of the results and the conclusions.

2. Impact of Short Sale Constraints on IPO Pricing

Several theoretical papers have suggested that overoptimism by investors, coupled with short sale constraints, is a potential explanation of for the well-documented underpricing and subsequent overvaluation of IPOs (Miller (1977), Derrien (2005), and Ljungqvist, Nanda, and Singh (2006)).¹⁰ Miller (1977) argues that if underwriters price issues according to their own assessments of the “true” value of the security, then the offer price “will be below the appraisals of the most optimistic investors who actually constitute the market for the security.” Derrien (2005) and Ljungqvist, Nanda and Singh (2006) extend this argument to a theoretical framework and assume that IPOs cannot be sold short in the secondary market. By disallowing short sales, investor optimism drives the market price of IPOs far above the true value resulting in overvaluation in the secondary market

Several papers find evidence consistent with this argument. Houge, Loughran, Suchanek and Yan (2001) present evidence that measures of divergence of opinion have predictive power in explaining poor long-run returns. They argue that regulatory rules place constraints on short sales. When examining carve-out IPOs, Lamont and Thaler (2003) find evidence of mispricing between the value of the 3Com and Palm and they argue that “the demand for certain shares by irrational investors is too large relative to the ability of the market to supply these shares via short sales, creating a price that is too high.” They argue that “the short sale market works sluggishly.” However, they find there is substantial short interest in carve-outs in the first month

¹⁰ In this paper we will assume that divergence of opinion, investor sentiment and overoptimism generally refer to the same general phenomenon.

after the IPO. Mitchell, Pulvino, and Stafford (2002) provide additional evidence that carve-outs are overpriced due to short sale constraints, but introduce the risk of upward price movements as a significant impediment to the profitability of short sales. Finally, Ofek and Richardson (2003) contend that short sale constraints after the IPO are responsible for the Internet bubble. They argue that only upon lockup expiration did sufficient shares become available for shorting.

More recently a number of papers question the short sale constraint argument. Dorn (2007), Ausseness, Pichler, and Stomper (2003) and Cornelli, Goldreich and Ljungqvist (2006) examine pre-IPO markets that allow short selling and still find evidence of investor overoptimism in the trading of IPOs.¹¹

More direct evidence on the costs of short selling is presented by D'Avolio (2002) and Geczy, Musto and Reed (2002).¹² In particular, Geczy, et. al.'s results indicate that although IPOs are initially more expensive to short in the first month of trading, the overall cost of shorting is fairly small at around 3% at issuance and this value declines to approximately 1.5% per year. They also conclude, contrary to Ofek and Richardson (2003), that the cost of short selling around lock-ups does not appear to be an impediment. Their evidence is the first to suggest that short selling may be available earlier in the IPO process than previously thought.

The literature remains inconclusive on the presence or impact of short selling on the pricing of IPOs because the measures of short selling immediately after the IPO must be inferred by other means such as proxies for divergence of opinion, price support and rebate rates. Further, data on short interest is often not available close to the IPO offer date and such data cannot shed

¹¹Grey market trading involves some sort of short position (usually by an institution) that is sold to investors (usually retail). Short sales are covered by allocations in the IPO.

¹² D'Avolio defines a stock as an IPO if it went public within the last year.

light on how quickly short sellers enter the market. Thus, it is only recently that we are able to ascertain whether theories regarding the pricing of IPOs are correct in their assumption of the lack of short selling and, by inference, whether such constraints are a plausible explanation for underpricing.

3. Data and Summary Statistics

a. IPO Sample

The sample of IPOs and their offering characteristics is from Securities Data Corp. (SDC) from January 1, 2005 through December 31, 2006. The sample period, beginning January 2005, is chosen because it begins after the implementation of Regulation SHO and is associated with the public release of the Regulation SHO Pilot data which contains short selling transaction information. In order for an IPO to be included in the final sample, we require that the IPO have at least 30 consecutive days of trading on CRSP, have preliminary offer prices in SDC and no prior trading history.¹³ After excluding closed-end funds, the final number of IPOs in the sample is 388.¹⁴

Table 1, Panel A presents initial statistics on the IPO sample. On average, the mean offer amount is \$188 million. The sample has a negative change in offer price of -4.18% indicating a relatively conservative IPO market. The change in offer price is defined as the percent difference between the offer price and the mid-point of the original preliminary offer price filing

¹³CRSP®, Center for Research in Security Prices. Graduate School of Business, The University of Chicago. Used with permission. All rights reserved. crsp.chicago.edu

¹⁴ We did remove one IPO with an excessively high level of both short selling and failures to deliver, because it appears to be an outlier. This IPO had twice the level of short selling and fails to deliver as the next highest IPO. The inclusion of this one outlier affects the results.

range noted in SDC (Hanley (1993)). Approximately 39% of IPOs have offer prices above the midpoint of the preliminary offer price range and 48% have offer prices below the midpoint.

Panel B of Table 1 presents summary statistics on the first day return and trading volume. Like Aggarwal and Conroy (2000), most of the first day return occurs at the open. The mean first day return is 9.07% and the time period covered by this study is characterized by relatively “normal” levels of average first day returns.¹⁵ Trading volume on the offer date is over 50% of the shares offered (similar to that found in Ellis, et al (2000) and Corwin, et al (2004)) which is much greater than the average trading volume on a given day for an individual stock.

b. Short Selling

In order to examine whether short selling is present in the immediate aftermarket of trading in IPOs, we collect information on transactions involving short sales for the first month of trading from the Regulation SHO pilot data. The data is compiled from nine markets: Amex, Arca Exchange, Boston Stock Exchange, Chicago Stock Exchange, NASD, NASDAQ, National Stock Exchange, NYSE and Philadelphia Stock Exchange. Individual short sale transactions are then aggregated into daily short sales for each IPO.¹⁶

All but two IPOs in our sample have short sales on the offer day. As shown in Table 1, Panel C, short sales comprise 12% of the trading volume and over 7% of the shares offered.¹⁷ This finding clearly indicates that short sales are both non-trivial and are an integral part of the IPO price process on the first trading day.

¹⁵ For comparison statistics, see Jay Ritter’s website at [http://bear.cba.ufl.edu/ritter/IPOs2005Factoids%20\(2\).pdf](http://bear.cba.ufl.edu/ritter/IPOs2005Factoids%20(2).pdf)

¹⁶ The short selling data used in this paper does not include any short selling by the underwriter (syndicate) in connection with an offering.

¹⁷ There is no adjustment to volume between NYSE and NASDAQ IPOs.

Figure 1 shows the time distribution of short sales on the offer day by trading market. Thirty six percent of the IPOs in the sample trade on the NYSE or Amex while 64% trade on the NASDAQ. In all markets, the largest amount of short selling occurs close to the open. On average, 30% of short sales in NYSE IPOs occur in the first half hour of trading and this percentage is the maximum for the day. Although NASDAQ IPOs have no short selling between 9:30 and 10:00, this lack of short sales is due to the fact that no IPOs in the sample open before 10:00 on the offer day. As shown in Figure 1, short selling for the full sample of NASDAQ IPOs, peaks between 11:00 to 11:30.

In order to determine if differences in the opening affect the pattern of short sales throughout the day, we further classify the sample of NASDAQ IPOs by opening time. When we partition the sample by opening time, we find a similar pattern for NASDAQ IPOs as for NYSE IPOs. The highest level of short selling in NASDAQ IPOs occurs during the first half hour of trading with between 34% and 44% of the day's short sales occurring in this half-hour window depending on the time of the open. Short selling in both NYSE/Amex and NASDAQ IPOs falls after the first half hour and levels out around noon with a slight increase at the end of the day. Overall, these results indicate that there appear to be few impediments to short selling early in the trading process.

Figure 2 presents short selling as a percent of shares offered, trading volume and daily returns over the first month of trading. As can be seen in the graph, the initial trading day has the highest proportion of return, volume, and short sales. Short selling occurs over the first month of trading although the levels are quite small in relation to the first few trading days. The volume of trading and daily returns exhibit similar time-series properties with a rapid decline after the IPO and a leveling off for the remainder of the first trading month.

Figure 3 presents the time-series pattern of short selling as a percent of volume over the first month of trading, by exchange. Recent studies, that also use the Regulation SHO pilot data such as Diether, Lee, and Werner (2007a), find that short sales constitute approximately 24% of the daily trading volume in NYSE-listed stocks and 31% of volume in NASDAQ-listed stocks. As shown in Figure 3, the level of short selling quickly levels off by the fifth or sixth trading day.¹⁸ Although the magnitude of short sales as a percent of volume remains lower for NYSE IPOs (15%) and NASDAQ IPOs (25%), than that documented by Diether, Lee and Werner (2007a), it appears from Figure 3 that short selling as a percent of volume begins to approach average levels very quickly.

4. Determinants of Short Selling

The findings of the previous section indicate that short selling is prevalent early in the trading process. To better understand the implications of this result for theories on IPO pricing, this section examines alternate hypotheses regarding the types of IPOs where short selling may be greatest. As stated above, overvaluation may occur in IPOs for two possible reasons. First, investor sentiment or divergence of opinion increases the value of the IPO beyond the “true” value. In this case, over-optimism leads to large initial returns because of high demand but results in overpricing. Thus, one hypothesis (*Overoptimism Hypothesis*) is that short selling will be high in offers with greater divergence of opinion, as proxied by positive revisions in the offer price from the preliminary file range and high initial returns.¹⁹

¹⁸ While Diether, et.al find a much higher level of short sales relative to volume than the average short sale on the first trading day reported in our study, the amount of trading volume on the offer day for IPOs is substantially larger than the average daily trading volume for an individual stock making an exact comparison difficult.

¹⁹ Note that this hypothesis does not directly test these theories as the theories predict that short selling constraints themselves create the overvaluation.

Short sellers might also be attracted to offerings that are overpriced because of underwriter price support. Numerous papers such as Aggarwal (2000), Boehmer and Fische (2006), and Lewellen (2006) show that underwriters engage in price support activities in the aftermarket for IPOs. Although there is some debate in the literature regarding the impact of price support activities, at least some studies have found that IPOs exhibit significant price declines by the end of the first month after underwriters cease supporting the price. (See, for example, Hanley, Lee and Seguin (1996) and Hanley, Kumar and Seguin (1993)). This price decline may attract short sellers to IPOs that are more likely to be price supported. Short sellers, knowing that the underwriter stands ready to buy shares at a potentially inflated price, will attempt to take advantage of the subsequent price decline. A second hypothesis (*Price Support Hypothesis*) is that short selling will be high in offers more likely to have underwriter price support.

Table 2 presents univariate statistics on the level of short selling by classifying the sample of IPOs into quartiles based upon the first day return. IPOs in the two lowest quartiles have low first day returns. These IPOs are more likely to have underwriter price support as the percentage of IPOs that we define as price supported (see definition below) exceeds 2/3 of the IPOs in the quartile. In contrast, IPOs in the highest two quartiles have significantly positive first day returns and are more likely to be associated with offers that have a higher potential for overoptimism.

Consistent with the overoptimism hypothesis and contrary to the hypothesis that price support attracts short sellers, the greatest amount of short selling as a percent of shares offered is in IPOs in the highest two quartiles. IPOs in the highest two quartiles have significantly greater average short selling relative to shares offered both on the offer day and over the first month of trading as compared to the lowest two quartiles. (Indeed, there are no significant differences in

the level of short selling between the two lowest quartiles.) This table indicates a dichotomy in the amount of short selling with the level of short selling increasing in positive first day returns but relatively constant in low or negative first day returns.

We further analyze the determinants of short selling using a regression analysis with short selling on the offer day as a percent of shares offered as the dependent variable. Independent variables include the first day return at the open measured from the offer price to the opening price (*First Day Return from Offer Price to Open*), the change in offer price measured as the percentage difference of the offer price from the midpoint of the preliminary offer price range (*Change in Offer Price*), and first day trading volume as a percent of shares offered (*Volume_{T+0}/Shares Offered*). Note that both the change in offer price and the first day return at the open should be relatively unaffected by the level of short selling because they are determined before the market opens, although we concede that sell volume at the open (which may include short sales) could be informative.

Prior research in IPOs has found that trading volume and initial return are related and significantly correlated (see Aggarwal (2002) and Krigman, Shaw and Womack (1999)). Although not presented, we also find a high degree of correlation between short selling as a percent of shares offered, trading volume as a percent of shares offered and initial return. The change in offer price is not as highly correlated with the other variables but is still significantly so. Therefore, caution must be used when including all of these variables in a regression analysis as they may capture the same economic effect.

To examine whether short selling is related to price support, we include a dummy variable (*Price Supported IPO*) equal to 1 if: a) the initial return is equal to zero or b) the IPO is in the bottom quartile of the percent of the overallotment option exercised (as collected from

Bloomberg)²⁰ or c) in the top quartile for the percent of trades, using TAQ, executed at the offer price on the first trading day. We use a combination of the three measures because a number of IPOs may have price support even if the initial return is not zero.²¹ Aggarwal (2000), Ellis et. al. (2000), and Lewellen (2006) find that underwriters exercise less of the overallotment option when they engage in price support activities in the market. In addition, we expect that IPOs that have no change in price on the offer day or greater trades at the offer price, regardless of the initial return, are more likely to have underwriter price support.

We also include two variables that control for short sale constraints. First, the percentage float (*Float*) has been used in previous literature as a measure of borrowing constraints (Ofek and Richardson (2003) and Cook, Kieschnick, and VanNess (2006)). Thus, the smaller is the public float, as measured by the ratio of shares offered to shares outstanding from CRSP, the greater are the supposed short sale constraints.

Second, regulatory constraints such as the Uptick Rule and NASDAQ Bid Test Rule (*Ability to Execute* _{$T+0$}) could also affect the level of short selling by restricting the ability to trade on the offer day (see the Pilot Report by the Office of Economic Analysis of the U.S. Securities and Exchange Commission for more information).²² For the NASDAQ Bid Test, we measure the percentage of the trading day when the rule allows short sales to execute against the bid price. For the Uptick Rule, we add the percentage of trades on upticks during periods when the rule does not allow short sales to execute against the bid price. The rationale for treating execution constraints in this manner is as follows: If a short sale can execute against the bid

²⁰ Underwriters typically have an option to purchase additional shares from the issuer following the IPO. This option is called the overallotment option or the “green shoe” option.

²¹ While each of these measures are correlated, they are not perfect substitutes.

²² “Economic analysis of the short sale price restrictions under the Regulation SHO Pilot,” by the Office of Economic Analysis is available at <http://www.sec.gov/news/studies/2007/regshopilot020607.pdf>.

price, then it can be executed without delay and this occurs much more often for the Bid Test than for the Uptick Rule. Note, however, that a short sale can still execute even if it cannot execute against the bid. Instead, the short sale must wait for a buy order willing to pay a price at which the short sale can execute. For the Uptick Rule, this is any price greater than the previous one. Therefore, the adjustment in the calculation for the Uptick Rule helps capture the ease of short selling.

Finally, we include a dummy variable equal to one for IPOs that trade on the NASDAQ (*NASDAQ*) to control for differences in market structure. Indeed, several recent studies note a difference between the level of short selling on the NYSE or Amex and on NASDAQ (Alexander and Peterson (2006), Diether, Lee, and Werner (2007a), Diether, Lee, and Werner (2007b), and the Pilot Report by the Office of Economic Analysis of the U.S. Securities and Exchange Commission) that may be due to market structure, regulation, or selection bias.

The results of the various regression models in Table 3 support the overoptimism hypothesis but not the price support hypothesis. Both the first day return at the open and the change in offer price are positively and significantly related to short sales indicating that short selling is more prevalent in IPOs that are expected to experience significant price increases rather than price declines.²³

Trading volume as a percent of shares offered is also positively and significantly related to the short sales as a percent of shares offered. If volume is measuring the degree of overoptimism, this result provides additional support for that hypothesis. However, greater trading volume could also signal that it is easier for short sellers to locate shares for lending. In addition, the greater the amount of short selling, the higher may be the trading volume.

²³ In order to control for skewness in the data, we conducted a number of robustness tests including winsorizing the data to the 99th and 95th percentile as well as taking logs of (1+variable). The results remain qualitatively similar.

However, adjusting volume for the level of short selling or using raw volume and raw short sales has no effect on the regression results.

Consistent with the univariate results, we find that short sales are either unrelated to or significantly lower in price supported IPOs. This provides further evidence that short sellers are either unable or unwilling to short price supported IPOs.

The coefficients on the variables that capture potential constraints on short selling, i.e. the percentage float and the ability to execute short sales, are also generally insignificant. The negative and occasionally significant coefficient on percentage float is counter to the use of this variable as a measure of short sale constraints. The result on the ability to execute short sales suggests that price test restrictions are not a significant deterrent to short selling.

Consistent with recent literature (Alexander and Peterson (2006), Diether, Lee, and Werner (2007a), and Diether, Lee, and Werner (2007b)), the coefficient on the NASDAQ dummy is highly significant and positive. This finding indicates that IPOs on non-specialist markets have higher short selling than IPOs on specialist markets. It is not clear, however, whether this is related to the structure and regulation of the market or the types of companies that choose to go public on the NYSE/Amex or NASDAQ.²⁴

Collectively, our findings suggest that IPOs that are more underpriced and more likely to have overoptimism have greater short selling than other IPOs. Although Miller (1977), Derrien (2006), and Ljungqvist, Nanda and Singh (2006) argue that informed investors are precluded from taking advantage of overoptimism because of short sale constraints, our results indicate that at least some investors are able to engage in short selling. We find no evidence in support of the hypothesis that short selling occurs in IPOs that are likely price supported.

²⁴ Corwin and Harris (2001) examine the listing decision of IPOs.

5. Are Short Sellers in IPOs Engaged In Naked Short Selling?

The observed high level of short selling, coupled with the presumed difficulty in borrowing shares and the potentially high cost of lending (Geczy, Musto and Reed (2002)), begs the question of whether short sellers are able to avoid those constraints by engaging in naked short selling. According to the SEC web site, “a “naked” short sale is a short sale where the seller does not borrow or arrange to borrow the securities in time to make delivery to the buyer within the standard three-day settlement period [and, as] a result, the short seller fails to deliver securities to the buyer when settlement is due (known as a “failure to deliver” or “fail to deliver”).”²⁵ Thus, failures to deliver are often used as a measure for “naked” short selling.²⁶

In this section, we analyze whether IPOs with large short selling have subsequent failures to deliver. We examine failures to deliver both on the daily aggregate level and by whether the IPO has persistent delivery failures. We use data on failures to deliver sent to the SEC from the National Securities Clearing Corporation’s (NSCC) Continuous Net Settlement (CNS). The NSCC reports the level of failures to deliver to the SEC and several SROs daily for stocks that

²⁵ Regulation SHO or Regulation SHO, for short, was adopted in 2004 and provides regulations, among others, that govern locating shares prior to a short sale as well as the delivery of shares. Under Rule 203 of Regulation SHO, the broker facilitating a short sale must “locate” the stock prior to the trade.²⁵ “Locate” refers to the requirement under Regulation SHO that a broker-dealer have reasonable grounds to believe that the security can be borrowed for delivery on the T+3 settlement date. Note that the locate requirement is not the same as actually borrowing the security. The broker may locate these shares in its own inventory, from a prime broker, or large institutional investors through a custodial bank. The broker-dealer can rely on “easy to borrow” lists for a locate if they satisfy the “reasonable grounds” standards of Regulation SHO Rule 203. Brokers may satisfy the reasonable grounds requirement if they rely on easy to borrow lists so long as those lists are less than 24 hours old, and the securities on the list are readily available such that it would be unlikely that a failure to deliver would occur. These standards are described in Section V.A. of release number 34-50103. See <http://www.sec.gov/spotlight/keyregshoissues.htm> for more information.

²⁶ See, for example, Angel (2006) and plus press articles such as “Games Short Sellers Play,” by Bob Drummond, Bloomberg Markets, September 2006, and “Failed Trades” by Liz Moyer, Forbes, August 18, 2006. The media has referred to the Regulation SHO threshold list as the “naked short selling” list. Evans, Geczy, Musto, and Reed (2006) discuss some of the economics of failures to deliver.

have aggregate failures of at least 10,000 shares. The data contains the balance of fails to deliver as of a given day.²⁷

a. *Level of Failures to Deliver*

Figure 4 presents daily fails to deliver as a percent of the shares offered in addition to daily short selling. Fails to deliver are shown on the graph three days earlier (N-3) than short sales to account for the standard settlement process. Note that fails to deliver, unlike short sales, represent a balance outstanding rather than new transactions. Consistent with the pattern of short sales, the initial settlement day has the highest proportion of fails to deliver with a decline over time. While some fails to deliver are resolved after the first settlement date, many appear to persist beyond the first few days.²⁸

Table 4 presents statistics on aggregate fails to deliver in excess of 10,000 shares on the first settlement day (T+3). If an IPO is not in the data on the first settlement day, the number of fails to deliver is set to zero although technically the IPO may not be in the data because the level of fails is less than 10,000 shares. The average fails to deliver, relative to shares offered, is 4.23% which is lower than the average level of short sales documented in Table 1. As a percentage of short sales, fails to deliver, on average, are over 10 times greater. This average, however, may be misleading because of skewness in the ratio due to some IPOs with small short sales but large fails. However, it is interesting to note that some IPOs have fails on T+3 that far exceed their

²⁷ Note that the CNS data is a net failure to deliver. Therefore, the balance is not related to any individual transaction but to the net position of the clearing member. Our data is not as comprehensive as the data studied by Boni (2006) as it does not also include failures to receive, but our data does contain a much longer time series. Some data on aggregated failures to deliver are available at <http://www.sec.gov/foia/docs/failsdata.htm>.

²⁸ The average IPO takes four days for its fails to deliver to fall below 0.5% of shares outstanding (not shown), which is the cutoff for the Regulation SHO threshold list.

short selling. (The two IPOs without short sales are not included.) We find that the median fails to deliver to short sales on the first trading day is approximately 30%.

In Table 4, we further split the sample of IPOs with failures to deliver between those that have fails on the first settlement day (Panel B) and those that have fails anytime between T+4 and T+24 (Panel C). The vast majority of IPOs in our sample have fails to deliver sometime during the first 21 trading days. Two hundred and thirty-seven IPOs (61% of the sample) have fails to deliver on T+3, 134 IPOs have fails to deliver between T+4 and T+24, and 17 IPOs have no fails to deliver at any time during the first month of trading.²⁹

There is a difference between the two samples with IPOs with fails to deliver on the first settlement day having a slightly lower mean initial return and a higher average fails to deliver as a percent of either the shares offered or short sales. When fails to deliver do not occur on T+3, most IPOs have fails not long after T+3 as the sample has a median fail date of T+5.

b. *Determinants of Failures to Deliver*

In this section, we further examine the relation between short selling and both transitory and persistent fails to deliver. We define an IPO as having persistent fails to deliver if the IPO is on the Regulation SHO threshold list on the first possible date (T+7).

When a stock has a fail to deliver level of at least 10,000 shares and 0.5% of the shares outstanding for five consecutive settlement days, the trading venue listing the stock is required to place it on a list known as the Regulation SHO threshold list.³⁰ The earliest an IPO can be on the

²⁹ These 17 IPOs may not show up either because they had no fails to deliver or any fails to deliver were below 10,000 shares.

³⁰ Once a stock is placed on the threshold list, Regulation SHO includes additional delivery requirements. For more information on Regulation SHO and the requirements described in this section, see the rules (17 CFR 242.203) and adopting release for Regulation SHO (SEC Release No. 34-50103, July 28, 2004).

list is eight days after the issue date (T+7) in order to allow three days for the first settlement and five days of high fails to deliver. Threshold list information is collected from daily Regulation SHO lists on the NYSE, Amex, and NASDAQ.

There are 113 IPOs (almost 30% of the sample) on the threshold list on the first possible date (T+7) which indicates that many IPOs have persistent fails to deliver. This seems particularly high when considering that only about 2% of NYSE, Amex, and NASDAQ stocks qualified for the threshold list per day in May 2006.³¹ An additional 42 IPOs are on the threshold list sometime during the first 30 trading days. Although not shown, when an IPO is on the threshold list on day T+7, it remains on the threshold list for a median of 12 settlement days.

In Panel A, of Table 5, we regress the level of fails to deliver on T+3 on short sales using a Tobit specification to accommodate the large number of IPOs with zero fails to deliver. We include the same independent variables as in the previous short selling regressions. We hypothesize that if short selling, at the time of the IPO, is due to the failure to locate the shares or naked short selling, regressing failures to deliver on the same variables as in the short selling regressions in Table 3 should result in similar relationships.

Our results indicate that the factors that influence short selling are *not* related to fails to deliver and the coefficient on the level of shorts sales is insignificant in each regression. Contrary to popular believe, this finding suggests that fails to deliver on the first settlement date (T+3) are not related to short sales on the offer date (T+0). Further, the coefficients on initial return, change in offer price, and volume are also insignificant.³²

³¹ See “Fails to Deliver Pre- and Post-Regulation SHO,”: <http://www.sec.gov/spotlight/failstodeliver082106.pdf>.

³² An alternative explanation for fails to deliver in IPOs is the possibility that some investors, for whom brokers are unable to locate shares or who would otherwise be unable to short sell because of regulatory restrictions, cause their brokers to mark the short trades as long. There is evidence that such marking of long sales as short have occurred in follow-on equity offers. (See “SEC and NYSE settle enforcement actions against Goldman Sachs unit for its role in

In Panel B of Table 5, we test whether persistent or long-lived fails to deliver are related to the level of short selling by conducting a probit analysis using a dummy variable for whether the IPO is on the threshold list on T+7. In general, the results in Panel B are consistent with the results in Panel A. We find no evidence that the first trading day level of short sales is related to persistent failures to deliver.³³

The most striking result of Panels A and B is that price supported IPOs are significantly more likely to have high levels of fails to deliver and to be on the threshold list. We explore how this may occur in the next section. Overall, these findings suggest that fails to deliver in IPOs are not due to short selling, in general, or naked short selling, in particular.

c. *Could Failures to Deliver Be Due to Underwriter Price Support?*

The results in Table 5 indicate that the coefficient on Price Supported IPO is significantly positive indicating that IPOs that may have underwriter price support are more likely to have failures to deliver. In this section, we give a possible explanation of how the mechanics of underwriter price support may result in failures to deliver.

Underwriters typically oversell the number of shares in the IPO (Aggarwal (2000) and Jenkinson and Jones (2007)) and must cover this overallocation either with the exercise of the overallotment option or by purchases in the open market. Generally, the underwriter will cover its shares in the open market when the market trading price is near or less than the offer price in

customers' illegal trading scheme" Release 2007-41). However, absent actual evidence of such conduct, our data cannot confirm this explanation. Indirectly, our evidence suggests that mismarking could potentially be related to failures to deliver in IPOs because failures to deliver are greater when short sales are more constrained by the Uptick Rule or Bid Test. It is a violation of Regulation SHO Rules 200 and 203 (17 CFR 242.200 and 242.203) for a broker to mark a short sale as a long sale, or to lend securities for delivery on a long sale or fail to deliver on a long sale unless the broker had been reasonably informed by the seller that it owns the securities and could deliver them in time for settlement.

³³ Using cumulative short sales over the first 5 days of trading does not alter the results.

order to provide price support. Aggarwal (2000) finds that underwriter purchases in the open market, in order to cover its overallocation, occur for 10 to 15 days after the IPO. Therefore, any shares that are overallocated in the offer but not covered either through the immediate exercise of the overallotment option or underwriter market purchases on T+0 cannot settle on T+3.³⁴ (For the purposes of this discussion, we will term the shares oversold and allocated by the underwriter but not yet delivered as “uncovered” until the underwriter transfers shares to the investor either through the exercise of the overallotment option or by buying in the open market.)

There may be investors, however, who are unaware that they were allocated uncovered shares and who may wish to sell. The sale of these uncovered shares will then result in a fail to deliver until such time that the underwriter either purchases the shares in the open market or exercises the overallotment option and subsequently transfers the shares to the investor (technically, the broker’s clearing member).

Table 5 also documents that an IPO has higher fails to deliver on day T+3 if it is traded on the NYSE or Amex. This finding may also be related to price support in that underwriters on a specialist market may find it more difficult to provide price support through open market purchases. Ellis, et al (2000) documents that the lead underwriter is always a market maker for NASDAQ listed IPOs. In contrast, for NYSE/Amex IPOs, it is unlikely that the specialist and the underwriter will be affiliated (Corwin, Harris and Lipson (2004)). The underwriters’ ability to act as market makers improves their ability to directly cover their overallocated position. In the case of a specialist market, frictions may exist which preclude underwriters directly

³⁴ T+3 is almost always the closing day for the IPO and we find that if the overallotment option is to be exercised, it is often exercised upon closing of the IPO. Our data does not directly measure the number of allocation shares that do not settle.

purchasing shares in the open market to cover the overallocation which may result in more fails to deliver in specialist markets.

6. Borrowing Costs and Return Predictability

In this section, we further analyze the nature of short selling constraints by examining whether borrowing costs are a detriment to short selling. In addition, we test whether short selling is related to subsequent price movements over the first three months of trading.

We obtain information on borrowing costs, over the first month of trading, from a dataset of rebate rates provided by an anonymous data source. A total of 260 out of 388 IPOs (67%) have rebate rate data and we cannot determine whether a missing value in the data may be due to the absence of rebate rates for all security lenders or only for our source, in particular.

A probit analysis is conducted to determine whether bias may exist in the type of stocks covered by our data. As shown in Panel A of Table 6, the differences between the IPOs that are covered by our data source and those that are not appear to be related to the level of short selling and the trading market. We are more likely to observe rebate rates for IPOs that have high short selling and are traded on the NYSE or Amex.

Panel B of Table 6 presents the determinants of the cost of borrowing. For the IPOs for which data is available, the daily loan rate is calculated as the annualized federal funds rate minus the rebate rate. We then calculate the weighted average daily loan rate using the number of shares lent by the data vendor.

If the expected cost of borrowing deters short sellers from entering the market on T+0, then the relationship between the level of short selling on the offer day and loan fees on T+3 should be negative. Prior studies have used the finding of Geczy, Musto and Reed (2002), that IPOs

have higher loan fees, on average, than seasoned stocks, as evidence of constraints on short selling. On the contrary, we find that higher loan fees are related to higher, not lower, levels of short selling and our results provides additional insight into the Geczy, Musto, and Reed (2002) finding that loan fees are greatest for IPOs with high initial returns. We show that the high level of short selling on the first trading day is a good predictor of the level of loan fees on T+3 and interpret these results as an indication that borrowing costs appear not to be an impediment to short selling in IPOs.

Like Geczy, Musto and Reed (2002), we do find some evidence that potential price support is related to the loan fee. Interestingly, we find a marginally significant relation between failures to deliver and loan fees even though the level of failures to deliver and short selling are unrelated.

To further examine the cost of borrowing and subsequent returns, Table 7 presents univariate statistics for IPOs without rebate rates in our data and by quartiles of the level of loan fees for all other IPOs. Although IPOs have higher loan fees than other stocks, on average, we show that the average monthly loan fee appears to be economically small at least for the three lowest quartiles.

Initial returns are increasing in the level of loan fees for all but the highest quartile. Short sales, whether on the offer day or over the first month of trading, confirm the findings of the previous table and are increasing in the level of loan fees. Cumulative short sales are almost 38% of shares offered for the highest quartile of loan fees compared to only 13% for the lowest level. Failures to deliver are also increasing in the level of the loan fee but the magnitude of the difference between the highest and lowest quartiles is small. Failures to deliver are 4.92% of shares offered in the highest quartile and 3.31% of shares offered in the lowest quartile.

A comparison of monthly loan fees and subsequent price movements over the first and third months indicates that loan fees are relatively small in comparison to returns.³⁵ We calculate buy-and-hold returns adjusted for the Nasdaq Composite Index over the first month and first three months of trading. All but one of the returns, even after adjusting for loan fees, is not significantly different from zero.

Finally, Table 8 provides evidence on the return predictability of short selling over the first month and the first three months of trading. Prior studies on short selling, for example, Diether, Lee and Werner (2007a), find that the level of short sales is negatively related to subsequent returns. As our dependent variable, we calculate buy-and-hold returns adjusted for the Nasdaq Composite Index over three different time periods: Panel A) the offer day intraday return from the open to the close, Panel B) the one month return from the close of the offer day to the end of the first month and Panel C) the return over the second and third months of trading. We adjust standard errors for clustering by month of the IPO.

In Panel A, we find no evidence that the level of short selling affects the intraday return on the offer day. Although short sellers are attracted to IPOs that open at a high return, the level of short selling is not related to changes in the price after trading begins. The only independent variable that is related to intraday returns is the Price Support dummy variable, which is negative as expected.

Panels B and C examine the effect of the level of short sales over a longer time horizon. The level of short selling, whether on the offer day or cumulatively over the first month of

³⁵ The average level of the loan fee documented here is slightly lower than Geczy, Musto and Reed (2002) but this is to be expected as our measure of loan fees is a weighted average of the loan fees over the first trading month.

trading, has no relation to returns over a one month horizon.³⁶ If we extend the time period to the second and third months after the IPO, we find that only cumulative short selling over the first month of trading has a weakly, significant negative relation to subsequent price changes.

Finally, in Panel D, we examine whether the level of short selling is related to three month returns after incorporating loan fees. We measure the three month return with loan fees as the buy-and-hold NASDAQ Composite index adjusted return over the first three months of trading excluding the initial return plus the loan fee (measured over the first month of trading and multiplied by three).³⁷ Even after the cost of borrowing is taken into account, we find that the level of short selling, on the first trading day, is negatively related to subsequent returns. Cumulative short selling has no effect. Our findings on returns in Table 6, however, cast doubt on whether the marginal short sale is highly profitable. Thus, we conclude that short sellers are unlikely candidates to substantially mitigate any overvaluation even if they are able to predict subsequent returns.

7. Summary and Conclusions

Using short sale transactions data recently made publicly available in conjunction with the Regulation SHO Pilot, we explore the nature of short selling in initial public offerings. Many academic papers have assumed that short selling is constrained early in the IPO process and that such constraints contribute to the high level of underpricing of some IPOs. In contrast, we find

³⁶ The one month returns is significantly and negatively related to both the level of short selling on the first trading day and cumulative short sales over the first month if clustering is not used.

³⁷ We are currently in the process of collecting rebates rates over the entire three month period but for the current tests we have the weighted average loan fee only over the first month of trading. We multiply the monthly loan rate by 3 as an estimate of the three month loan rate. Since the cost of borrowing is likely to be highest in the first month of trading, we believe this is a conservative estimate of the cost of borrowing.

that short selling is prevalent on the initial trading day and many short sales occur close to the open.

Tests of whether short selling is related to price support (Hanley, Kumar, Seguin (1993), Aggarwal (2002), Lewellen (2006) or to overoptimism (Miller (1977), Derrien (2006), Cornelli, Goldreich and Ljungqvist (2006) and Ljungqvist, Nanda and Singh (2006)) indicate that short selling is clustered in IPOs that have positive initial returns. This result is consistent with models of overoptimism that suggest that short sellers should attempt to take advantage of sentiment investors in overpriced IPOs but inconsistent with the assumption that they cannot do so because of binding short sale constraints.

The perceived inability of short sellers to borrow securities for settlement is one of the primary reasons cited by others for constraints on short selling in IPOs. We test whether short sellers are avoiding regulatory constraints on locating and borrowing shares for shorting (i.e. engaging in “naked” short selling) by examining whether IPOs with greater short selling are also more likely to have failures to deliver. While we document that most IPOs have failures to deliver on the first settlement date and approximately 30% of IPOs in the sample qualify for the Regulation SHO threshold list on the first possible date, our findings do not indicate that the level of short selling on the offer date is related to fails to deliver or to the qualification for the threshold list. In fact, the factors that are correlated with increased short selling are uncorrelated with fails to deliver. We argue that fails to deliver are potentially related to underwriter price support activities and present evidence that the level of failures to deliver are related to a variable indicating a high probability of underwriter price support. Thus, we conclude that the observed short selling is not due to “naked” short sales.

Finally, we present evidence that short sellers may be informed as to subsequent price declines. The greater is the short selling on the first trading day, the lower is the three month adjusted return. However, we find evidence that the short selling does not appear to be highly profitable. Therefore, short sellers are unlikely to significantly mitigate the magnitude of the underpricing.

Collectively, these results allow us to conclude that short selling constraints are not as onerous in the IPO aftermarket as assumed in the IPO literature. This leaves open the interpretation of theories of underpricing and overvaluation that suggests that overoptimism results in greater underpricing because of short sale constraints.

Our results also complement Schultz (2008), who finds no evidence that the loosening of short sale constraints around lock-ups lead to an increase in the supply of shares causing the collapse of internet stocks. Although our sample period is after the tech bubble, our results may have implications for the argument that an increase in the supply of shares from lock-up expirations lead to the collapse of the internet stock bubble (e.g., Ofek and Richardson (2003)). Our results suggest that such expirations may not affect short sale constraints as much as previously thought, because short selling is prevalent in early IPO aftermarkets long before such lock-ups expire.

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Table 1
Summary Statistics on IPOs

The sample includes 388 IPOs issued between January 1, 2005 and December 31, 2006 excluding closed-end funds. Short sales are from Regulation SHO Pilot data downloaded from nine markets: Amex, Arcaex, Boston, Chicago, NASD, NASDAQ, National, NYSE and Phlx. Offer amounts, offer prices and shares offered are from SDC and exclude the exercise of the overallotment option. Percent float is the ratio of shares offered to shares outstanding from CRSP. Change in offer price is the percent difference between the final offer price and the midpoint of the preliminary offer price range in the prospectus. The percent positive (negative) change in offer price is the percent of IPOs whose final offer price exceeds (is less than) the midpoint of the offer price in the preliminary price range. The percent positive (negative) change in offer price is the percent of IPOs whose final offer price exceeds the midpoint of the offer price in the preliminary price range. The first day return is from the offer price from SDC to the first trading day closing price on CRSP Volume is the daily number of shares traded from CRSP.

<i>Panel A: Offering Statistics</i>		
Variable	Mean	Median
Offer Price	\$14.82	\$14.50
Offer Amount (in mils)	\$188.53	\$114.23
Percent Float	46.88%	33.52%
Change in Offer Price	-4.18%	0.00%
Percent Positive Change in Offer Price	39.43%	-
Percent Negative Change in Offer Price	47.68%	-
<i>Panel B: Offer Day Trading Statistics</i>		
Variable	Mean	Median
First Day Return from Offer Price to Open	9.07%	2.84%
First Day Return from Open to Close	0.62%	0.00%
First Day Return	9.58%	4.17%
Trading Volume/Shares Offered	58.94%	53.80%
<i>Panel C: Offer Day Short Selling</i>		
Variable	Mean	Median
Short Sales _{T+0} /Shares Offered	7.26%	5.56%
Short Sales _{T+0} /Trading Volume _{T+0}	12.02%	10.36%
Short Sales _{T+0} /Shares Outstanding	3.02%	1.94%

Table 2**Comparison of First Day Trading and Short Selling by Quartiles of First Day Returns**

The sample includes 388 IPOs issued between January 1, 2005 and December 31, 2006 excluding closed-end funds. Short sales are from Regulation SHO Pilot data downloaded from nine markets: Amex, Arcaex, Boston, Chicago, NASD, NASDAQ, National, NYSE and Phlx and are scaled by shares offered, trading volume on the offer day and shares outstanding after the offer. Offer amount and shares offered are from SDC and excludes the exercise of the overallotment option. Percent float is the ratio of shares offered to shares outstanding from CRSP. An IPO is considered Price Supported if the first day return is equal to zero or the IPO is in the bottom quartile of the percent of the overallotment option exercised collected from Bloomberg or top quartile for the percent of trades, using TAQ, executed at the offer price on the first trading day. The first day return is from the offer price from SDC to the first trading day closing price on CRSP. Change in offer price is the percent difference of the final offer price from the midpoint of the preliminary offer price range in the prospectus. The percent positive (negative) change in offer price is the percent of IPOs whose final offer price exceeds the midpoint of the offer price in the preliminary price range. Volume is the daily number of shares traded from CRSP. Medians are in parentheses.

	First Day Return			
	Lowest	Quartile 2	Quartile 3	Highest
Number of IPOs	85	109	97	97
Offer Amount (in mils)	\$181.24	\$173.53	\$200.07	\$200.25
Percent Float	48.89%	44.38%	42.17%	57.00%
Percent of Price Supported IPOs	71.76%	67.89%	12.37%	1.03%
First Day Return from Offer Price to Open	0.04% (0.00%)	1.56% (0.29%)	9.41% (7.14%)	25.11% (21.58%)
First Day Return from Open to Close	-4.70% (-3.57%)	-0.31% (0.00%)	0.72% (1.43%)	6.20% (5.60%)
First Day Return	-4.78% (-3.53%)	1.11% (0.48%)	9.72% (9.70%)	31.54% (26.20%)
Change in Offer Price	-12.55%	-13.51%	0.08%	9.38%
Percent with Positive Change in Offer Price	9.41%	12.84%	58.76%	76.29%
Percent with Negative Change in Offer Price	76.47%	66.97%	30.93%	17.53%
Volume _{T+0} /Shares Offered	48.49% (46.39%)	46.56% (37.88%)	60.41% (59.57%)	80.53% (74.63)
Short Sales _{T+0} /Shares Offered	5.48% (4.07%)	5.20% (3.44%)	7.37% (5.67%)	11.00% (7.80%)
Short Sales _{T+0} /Trading Volume _{T+0}	11.47% (8.77%)	10.17% (9.91%)	13.50% (10.61%)	13.12% (10.69%)
Short Sales _{T+0} /Shares Outstanding	2.39% (1.35%)	2.07% (1.21%)	3.15% (2.26%)	4.49% (2.93%)
Cumulative Short Sales _{T+0 to T+21} /Shares Offered	12.83% (10.57%)	13.27% (9.97%)	18.94% (14.13%)	33.38% (20.55%)

Table 3
Regression Analysis on Offer Day Short Sales

The sample includes 388 IPOs issued between January 1, 2005 and December 31, 2006 excluding closed-end funds. The dependent variable is the offer day short sales as a percent of the offer amount. Short sales are from Regulation SHO Pilot data downloaded from nine markets: Amex, ArcaEx, Boston, Chicago, NASD, NASDAQ, National, NYSE and Phlx, aggregated and then scaled by offer amount. Shares offered are from SDC and exclude the exercise of the overallotment option. The first day return is from the offer price from SDC to the first trading day closing price on CRSP. Change in offer price is the percent difference of the final offer price from the midpoint of the preliminary offer price range in the prospectus. Volume is the daily number of shares traded from CRSP. Price Supported IPO is a dummy variable equal to 1 if the first day return is equal to zero or the IPO is in the bottom quartile of the percent of the overallotment option exercised collected from Bloomberg or top quartile for the percent of trades, using TAQ, executed at the offer price on the first trading day. Percent float is the ratio of shares offered from SDC to shares outstanding from CRSP. The ability to execute is estimated using TAQ and measures the extent to which the Uptick Rule or NASDAQ Bid Test allows short sales to execute. NASDAQ is a dummy variable equal to 1 if the IPO trades on either the NASDAQ, 0 if it trades on the NYSE or the Amex. t-values are in parentheses. ***, **, * indicates significance at the 1%, 5% or 10% levels.

Variable	Model 1	Model 2	Model 3	Model 4
Intercept	0.052 (4.42)***	0.071 (6.23)***	-0.017 (1.72)*	0.074 (5.78)***
First Day Return from Offer Price to Open	0.193 (9.51)***			
Change in Offer Price		0.174 (9.98)***		
Volume T_{+0} /Shares Offered			0.002 (21.39)***	
Price Supported IPO	0.001 (0.22)	0.005 (0.71)	-0.002 (-0.47)	-0.022 (-3.31)***
Float	-0.006 (-1.80)*	-0.008 (-2.32)**	0.0004 (0.15)	-0.006 (-1.42)
Ability to Execute T_{+0}	-0.019 (-1.22)	-0.020 (-1.25)	-0.024 (-2.01)**	-0.015 (-0.84)
NASDAQ	0.025 (4.10)***	0.034 (5.47)***	0.023 (5.01)***	0.028 (4.06)***
Adjusted R ²	0.24	0.26	0.57	0.06

Table 4
Summary Statistics on Fails to Deliver

The sample includes 388 IPOs issued between January 1, 2005 and December 31, 2006 excluding closed-end funds. Daily fails to deliver for IPOs is from NSCC's Continuous Net Settlement which includes stocks with aggregate fails to deliver of at least 10,000 shares. Short sales are from Regulation SHO Pilot data downloaded from nine markets: Amex, ArcaEx, Boston, Chicago, NASD, NASDAQ, National, NYSE and Phlx, aggregated. Shares offered are from SDC and exclude the exercise of the overallotment option. The first day return is from the offer price from SDC to the first trading day closing price on CRSP.

<i>Panel A: All IPOs First Settlement Day (T+3)</i>		
Variable	Mean	Median
Fails to Deliver/Shares Offered	4.23%	2.29%
Fails to Deliver/Short Sales _{T+0}	1,083.37%	30.32%
<i>Panel B: 237 IPOs with First Fail on First Settlement Day (T+3)</i>		
Variable	Mean	Median
First Day Return	9.14%	3.67%
Fails to Deliver/Shares Offered	6.92%	5.73%
Fails to Deliver/Short Sales _{T+0}	1,779.50%	99.70%
<i>Panel C: 134 IPOs with First Fail Later Than First Settlement Day (T+4 to T+24)</i>		
Variable	Mean	Median
First Day Return	10.88%	5.44%
First Fails to Deliver/Shares Offered	0.86%	0.46%
First Fails to Deliver/Short Sales _{T+0}	31.47%	7.99%
Day of First Fails to Deliver	6.14	5.00

Table 5

Analysis on Fails To Deliver and Probability of Being on Threshold List on T+7

The sample includes 388 IPOs issued between January 1, 2005 and December 31, 2006 excluding closed-end funds. Dependent variables are first settlement day fails as a percent of shares offered and a dummy variable if the IPO is on the threshold list on day T+7. Daily fails to deliver for IPOs is from NSCC's Continuous Net Settlement which includes stocks with aggregate fails to deliver of at least 10,000 shares. Information is collected from daily threshold lists on the NYSE, Amex, and NASDAQ. Short sales are from Regulation SHO Pilot data downloaded from nine markets: Amex, ArcaEx, Boston, Chicago, NASD, NASDAQ, National, NYSE and Phlx, aggregated and then scaled by offer amount (excluding the exercise of the overallotment option). The first day return is from the offer price from SDC to the first trading day closing price on CRSP. Change in offer price is the percent difference of the final offer price from the midpoint of the preliminary offer price range in the prospectus. Volume is the daily number of shares traded from CRSP. Price Supported IPO is a dummy variable equal to 1 if the first day return is equal to zero or the IPO is in the bottom quartile of the percent of the overallotment option exercised collected from Bloomberg or top quartile for the percent of trades, using TAQ, executed at the offer price on the first trading day. Percent float is the ratio of shares offered from SDC to shares outstanding from CRSP. The ability to execute is estimated using TAQ and measures the extent to which the Uptick Rule or NASDAQ Bid Test allows short sales to execute. NASDAQ is a dummy variable equal to 1 if the IPO trades on either the NASDAQ, 0 if it trades on the NYSE or the Amex. t-values are in parentheses for Tobit regressions and z scores for Probit analysis. ***, **, * indicates significance at the 1%, 5% or 10% levels.

Variable	Panel A Tobit Regression Dependent Variable: Level of Fails				Panel B Probit Analysis Class Variable: On Threshold List at T+7			
	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4
	Intercept	0.058 (3.49)***	0.059 (3.63)***	0.061 (3.80)***	0.055 (3.12)***	-0.331 (-1.20)	-0.242 (-0.89)*	-0.290 (-1.09)
Short Sales _{T+0} /Shares Offered	0.40 (0.64)				0.524 (0.47)			
First Day Return		0.016 (0.57)				-0.485 (-0.94)		
Change in Offer Price			0.0038 (0.14)				-0.428 (-1.01)	
Volume _{T+0} /Shares Offered				0.100 (0.76)				-0.076 (-0.34)
Price Supported IPO	0.037 (4.48)***	0.039 (4.12)***	0.037 (4.09)***	0.038 (4.50)**	0.552 (3.79)***	0.464 (2.81)***	0.475 (3.02)***	0.531 (3.62)***
Float	-0.008 (-0.81)	-0.008 (-0.83)	-0.008 (-0.83)	-0.008 (-0.79)	0.040 (0.48)	0.036 (0.43)	0.044 (0.52)	0.034 (0.41)
Ability to Execute _{T+0}	-0.046 (-2.17)**	-0.048 (-2.23)**	-0.047 (-2.19)**	-0.047 (-2.22)**	-0.631 (-0.98)	-0.3375 (-0.91)	-0.352 (-0.96)	-0.360 (-0.98)
NASDAQ	-0.038 (-4.45)***	-0.038 (-3.63)***	-0.0374 (-3.80)***	-0.037 (-4.44)***	-0.509 (-3.39)***	-0.483 (-3.30)***	-0.509 (-3.46)***	-0.492 (-3.36)*
χ^2	42.43	42.35	42.05	42.60	26.16	26.83	26.95	26.05

Table 6
Determinants of the Cost of Borrowing

The dependent variables are for 1) the probit model the probability the IPO will have a rebate rate from the anonymous data source during the first 26 days of trading and 2) for the regression model the weighted average loan fee (the daily rebate rate minus the daily fed funds rate) over the first 24 days of trading from an anonymous data source. The sample includes 388 IPOs issued between January 1, 2005 and December 31, 2006 excluding closed-end funds. Short sales are from Regulation SHO Pilot data downloaded from nine markets: Amex, ArcaEx, Boston, Chicago, NASD, NASDAQ, National, NYSE and Phlx, aggregated and then scaled by offer amount (excluding the exercise of the overallotment option). Daily fails to deliver for IPOs is from NSCC's Continuous Net Settlement which includes stocks with aggregate fails to deliver of at least 10,000 shares. Price Supported IPO is a dummy variable equal to 1 if the first day return is equal to zero or the IPO is in the bottom quartile of the percent of the overallotment option exercised collected from Bloomberg or top quartile for the percent of trades, using TAQ, executed at the offer price on the first trading day. Percent float is the ratio of shares offered from SDC to shares outstanding from CRSP. The ability to execute is estimated using TAQ and measures the extent to which the Uptick Rule or NASDAQ Bid Test allows short sales to execute. NASDAQ is a dummy variable equal to 1 if the IPO trades on either the NASDAQ, 0 if it trades on the NYSE or the Amex. z-scores are in parentheses for the Probit analysis and t-values for the OLS regressions. ***, **, * indicates significance at the 1%, 5% or 10% levels.

Variable	<i>Panel A</i> Probit Analysis Dependent Variable: Probability of Observing IPO in Rebate Rate Data		<i>Panel B</i> Regression Analysis Dependent Variable: Average Weighted Loan Fee From T+3 to T+21			
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Intercept	0.493 (1.73)*	0.510 (1.80)*	1.514 (2.67)***	1.422 (2.92)***	1.975 (3.25)***	2.338 (4.08)***
Short Sales _{T+0} /Shares Offered	3.683 (3.12)***		0.122 (5.66)***			
Cumulative Short Sales _{T+0 to T+21} / Shares Offered		1.447 (3.18)***		0.491 (10.69)***		
Fails to Deliver _{T+3} /Shares Offered					0.067 (2.12)**	
Price Supported IPO	-0.168 (-1.17)	-0.146 (-1.02)	0.309 (1.01)	0.517 (1.92)*	-0.093 (-0.28)	0.091 (0.29)
Float	0.085 (0.73)	0.084 (0.73)	0.032 (0.24)	0.062 (0.50)	-0.039 (-0.26)	-0.041 (-0.28)
Ability to Execute _{T+0}	0.067 (0.18)	0.033 (0.09)	-1.011 (-1.33)	-1.127 (-1.69)*	-0.873 (-1.09)	-0.978 (-1.22)
NASDAQ	-0.498 (-3.26)***	-0.508 (-3.32)***	-0.267 (-0.89)	-0.355 (-1.36)	0.266 (0.83)	0.101 (0.33)
χ^2 /Adj. R ²	22.43	25.13	0.12	0.32	0.03	0.00
N	388	388	259	259	259	260

Table 7
Univariate Statistics on the Cost of Borrowing

The sample includes 388 IPOs issued between January 1, 2005 and December 31, 2006 excluding closed-end funds. The weighted average loan fee (by loan amount) is equal to the rebate rate minus the fed funds rate over the first 26 days of trading and is collected from an anonymous data source. The first day return is from the offer price from SDC to the first trading day closing price on CRSP. Short sales are from Regulation SHO Pilot data downloaded from nine markets: Amex, ArcaEx, Boston, Chicago, NASD, NASDAQ, National, NYSE and Phlx, aggregated and then scaled by offer amount (excluding the exercise of the overallotment option). Daily fails to deliver for IPOs is from NSCC's Continuous Net Settlement which includes stocks with aggregate fails to deliver of at least 10,000 shares. First month and three month returns are the buy-and-hold return minus the return on the NASDAQ Composite Index. Three Month Return With Loan Fees is the NASDAQ Composite index adjusted return over the first three months of trading excluding the first day return plus the loan fee (measured over the first month of trading and multiplied by three). Price Supported IPO is a dummy variable equal to 1 if the first day return is equal to zero or the IPO is in the bottom quartile of the percent of the overallotment option exercised collected from Bloomberg or top quartile for the percent of trades, using TAQ, executed at the offer price on the first trading day. NASDAQ is a dummy variable equal to 1 if the IPO trades on the NASDAQ, 0 if it trades on the NYSE or the Amex. Information is collected from daily threshold lists on the NYSE, Amex, and NASDAQ. Medians are in parentheses. ***, **, * indicates returns/profits are significantly different from zero at the 1%, 5% or 10% levels.

Variable	First month weighted average loan fees				
	No rebate rate	Quartile 1	Quartile 2	Quartile 3	Quartile 4
Number of IPOs	129	65	64	65	65
Month Weighted Loan Fee From T+3 to T+24	NA	0.01% (0.01%)	0.05% (0.05%)	0.15% (0.14%)	0.39% (0.33%)
First Day Return	5.14%*** (1.00%)	8.39%*** (5.85%)	11.47%*** (7.53%)	15.50%*** (6.87%)	11.87%*** (4.76%)
Short Sales _{T+0} /Shares Offered	6.07% (4.32%)	5.58% (4.35%)	7.05% (5.40%)	8.49% (6.59%)	10.26% (6.89%)
Cumulative Short Sales _{T+0 to T+21} /Shares Offered	14.83% (11.72%)	13.40% (9.80%)	16.31% (14.64%)	20.57% (16.36%)	37.64% (20.41%)
Fails to Deliver _{T+3} /Shares Offered	4.37% (1.40%)	3.31% (1.10%)	3.88% (2.74%)	4.52% (2.99%)	4.92% (3.50%)
One Month NASDAQ Adjusted Return	-0.34% (-0.59%)	2.47%* (0.52%)	2.42% (1.03%)	-1.26% (-0.90%)	2.76% (0.19%)
Three Month NASDAQ Adjusted Return	1.69% (-0.17%)	4.41% (-0.33%)	3.07% (2.01%)	0.55% (-4.88%)	4.60% (2.08%)
Three Month NASDAQ Adjusted Return With Loan Fees	NA	4.45% (-0.29%)	3.22% (2.22%)	1.02% (-4.51%)	5.78% (3.10%)
Percent Price Supported IPOs	45%	35%	30%	35%	38%
Percent NASDAQ IPOs	74%	57%	50%	60%	69%
Percent on Threshold List T+7	34%	18%	23%	28%	37%

Table 8
Short Term Price Effects

The dependent variables are the first day return from the open to the close (Panel A), the NASDAQ Composite index adjusted return over the first month of trading (Panel B), the second and third months of trading (Panel C) and the three month profit (Panel D). Three Month Return With Loan Fees is the NASDAQ Composite index adjusted return over the first three months of trading excluding the first day return plus the loan fee (measured over the first month of trading and multiplied by three). The sample includes 388 IPOs issued between January 1, 2005 and December 31, 2006 excluding closed-end funds. Short sales are from Regulation SHO Pilot data downloaded from nine markets: Amex, ArcaEx, Boston, Chicago, NASD, NASDAQ, National, NYSE and Phlx, aggregated and then scaled by offer amount (excluding the exercise of the overallotment option). Price Supported IPO is a dummy variable equal to 1 if the first day return is equal to zero or the IPO is in the bottom quartile of the percent of the overallotment option exercised collected from Bloomberg or top quartile for the percent of trades, using TAQ, executed at the offer price on the first trading day. Percent float is the ratio of shares offered from SDC to shares outstanding from CRSP. The ability to execute is estimated using TAQ and measures the extent to which the Uptick Rule or NASDAQ Bid Test allows short sales to execute. NASDAQ is a dummy variable equal to 1 if the IPO trades on either the NASDAQ, 0 if it trades on the NYSE or the Amex. t-values are in parentheses for OLS regressions and adjusted for monthly clustering. ***, **, * indicates significance at the 1%, 5% or 10% levels.

Variable	<i>Panel A</i> First Day Return from Open to Close	<i>Panel B</i> One Month Return From First Day Close		<i>Panel C</i> Return From End of Month One through Month Three		<i>Panel D</i> Three Month Return With Loan Fees (N=259)	
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Intercept	-0.004 (-0.23)	0.078 (3.03)***	0.052 (2.46)	0.267 (0.65)	0.021 (0.54)	0.093 (1.96)*	0.062 (1.44)
Short Sales _{T+0} /Shares Offered	-0.046 (-0.76)	-0.218 (-1.37)		-0.291 (-1.48)		-0.510 (-1.74)*	
Cumulative Short Sales _{T+0 to T+21} / Shares Offered			0.049 (1.33)		-0.081 (-1.89)*		-0.028 (-0.71)
Price Supported IPO	-0.043 (-5.33)***	-0.078 (-5.58)***	-0.067 (-4.77)***	-0.018 (-0.77)	-0.019 (-0.81)	-0.102 (-2.87)***	-0.094 (-2.67)***
Float	-0.006 (-1.41)	0.006 (1.36)	0.008 (1.93)*	0.0003 (0.07)	0.0003 (0.09)	0.007 (0.88)	0.009 (1.31)
Ability to Execute _{T+0}	0.039 (1.90)*	-0.063 (-2.05)*	(-0.059) (-2.01)*	0.019 (0.48)	0.023 (0.57)	-0.004 (-0.07)	-0.002 (-0.03)
NASDAQ	0.017 (2.07)**	0.009 (0.74)	-0.00071 (-0.06)	0.018 (0.60)	0.017 (0.58)	0.031 (0.88)	0.018 (0.60)
Adj. R ²	0.08	0.09	0.08	0.01	0.01	0.05	0.03

Figure 1
Intraday Short Selling

The sample includes 388 IPOs issued between January 1, 2005 and December 31, 2006 excluding closed-end funds. Short selling is a percent of total shares shorted on the offer day. Short sales are from Regulation SHO Pilot data downloaded from nine markets: Amex, Arcaex, Boston, Chicago, NASD, NASDAQ, National, NYSE and Phlx. Exchange listing information is from CRSP. The NASDAQ sample is partitioned into subsamples based on opening time. The 10:00 opening time refers to IPOs that opened between 10:00 and 10:29:59. The 10:30 opening time refers to IPOs that opened between 10:30 and 10:59:59.

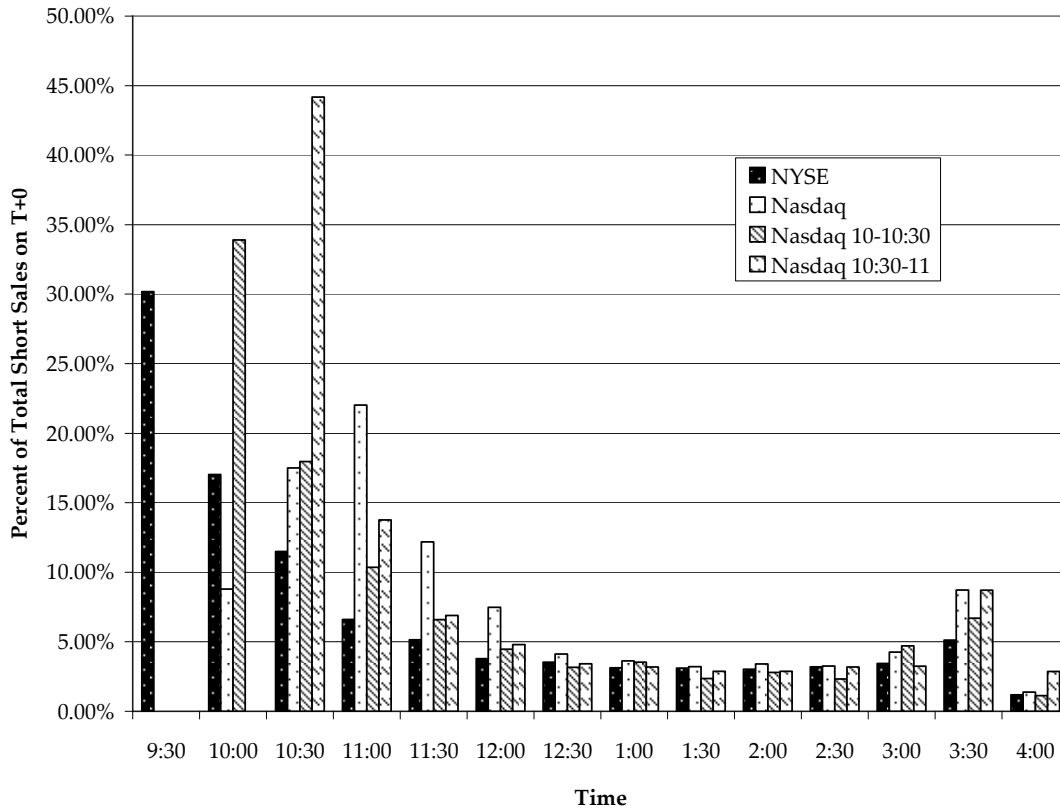


Figure 2
Short Selling, Returns and Trading Volume

The sample includes 388 IPOs issued between January 1, 2005 and December 31, 2006 excluding closed-end funds. Short selling is a percent of shares offered. Shares offered are from SDC and excludes the exercise of the overallotment option. Short sales are from Regulation SHO Pilot data downloaded from nine markets: Amex, Arcaex, Boston, Chicago, NASD, NASDAQ, National, NYSE and Phlx. The first day return is from the offer price from SDC to the first trading day closing price on CRSP. Daily returns after the offer date are from CRSP. Volume is the daily number of shares traded from CRSP scaled by the number of shares offered.

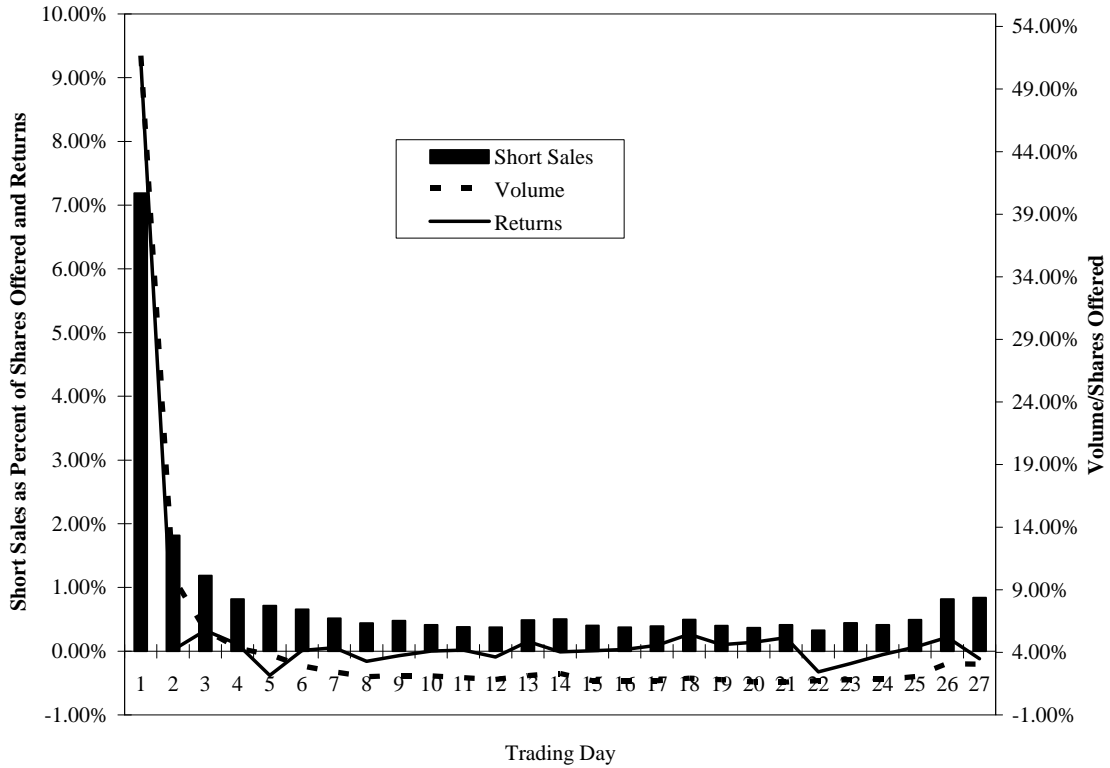


Figure 3
Short Selling as a Percent of Volume

The sample includes 388 IPOs issued between January 1, 2005 and December 31, 2006 excluding closed-end funds. Short sales are from Regulation SHO Pilot data downloaded from nine markets: Amex, Arcaex, Boston, Chicago, NASD, NASDAQ, National, NYSE and Phlx. Exchange listing and daily volume (in shares) are from CRSP. Volume is the daily number of shares traded from CRSP scaled by the number of shares offered.

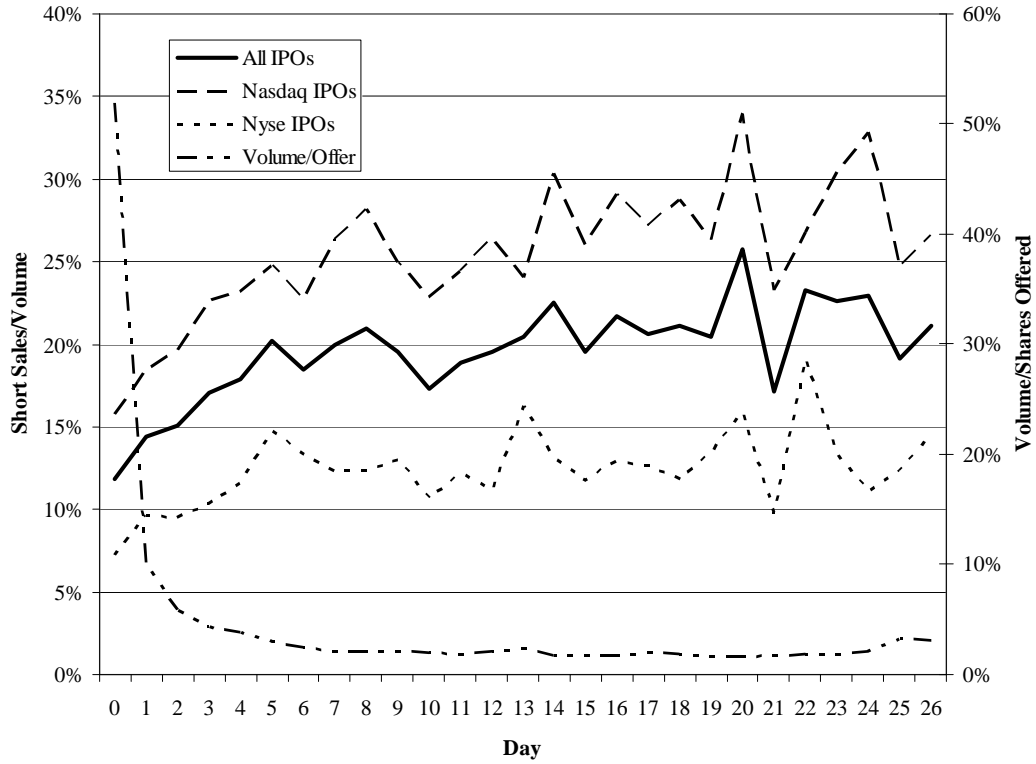


Figure 4
Short Selling and Failures to Deliver

The sample includes 388 IPOs issued between January 1, 2005 and December 31, 2006 excluding closed-end funds.. Short sales and fails to deliver are a percent of shares offered. Shares offered are from SDC and excludes the exercise of the overallotment option. Short sales are from Regulation SHO Pilot data downloaded from nine markets: Amex, Arcaex, Boston, Chicago, NASD, NASDAQ, National, NYSE and Phlx. Daily fails to deliver for IPOs are from NSCC's Continuous Net Settlement which includes stocks with aggregate fails to deliver of at least 10,000 shares. Fails to deliver on T+N are shown three trading days prior (N-3).

