

# Strategic delivery failures in U.S. equity markets<sup>☆</sup>

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## Abstract

Sellers of U.S. equities who have not provided shares by the third day after the transaction are said to have “failed-to-deliver” shares. Using a unique data set of the entire cross-section of U.S. equities, we document the pervasiveness of delivery failures and evidence consistent with the hypothesis that market makers strategically fail to deliver shares when borrowing costs are high. We then show that many firms that allow others to fail to deliver to them are themselves responsible for fails-to-deliver in other stocks. Finally, we discuss the implications of these findings for short-sale constraints, short interest, liquidity, and options listings in the context of the recently adopted SEC Regulation SHO. © 2005 Elsevier B.V. All rights reserved.

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## 1. Introduction

U.S. equity shares are normally delivered three days after the transaction. Sellers that have not provided shares by that time are said to have “failed-to-deliver”. Inadvertent

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failures can result from errors or delays caused by investors holding securities in physical rather than book-entry form. Recent work by Evans et al. (2003) introduces the idea of *strategic* failures-to-deliver, which result when short sellers *choose* not to deliver shares that would be expensive to borrow. Evans et al. (2003) show that strategic failures by options market makers can reduce short-selling constraints for stocks that have options listed. More generally, strategic fails may extend beyond those of options market makers, thus reducing short-sale constraints for non-option stocks as well.<sup>1</sup>

On July 28, 2004, the Securities and Exchange Commission (SEC) adopted Regulation SHO to modify rules for short sales in U.S. equity markets. The adopting release states that one objective is to restrict “naked” short selling, which “generally refers to selling short without having borrowed the securities to make delivery.”<sup>2</sup> Toward that objective, Rule 203 of Regulation SHO imposes a number of new borrowing and delivery requirements on short-sellers, including additional requirements for stocks with long-lived delivery failures. To the extent Regulation SHO reduces strategic delivery failures, short selling will become more tightly constrained.

This paper has four goals. First, it provides an empirical description of delivery failures in U.S. equity markets prior to Regulation SHO. It then provides evidence consistent with the hypothesis that pre-Regulation SHO, equity and options market makers strategically failed to deliver shares that were expensive or impossible to borrow. Third, it examines various explanations that have been suggested by market participants as to why firms allow others to fail to deliver shares to them. Finally, it discusses the implications of Regulation SHO for short-selling constraints, short interest, liquidity, volatility, and options listings.

We find that prior to Regulation SHO, most U.S. equity issues experienced at least a small percentage of failures-to-deliver each day. While the average amount of failed shares is very small as a percentage of shares outstanding (0.15% for listed stocks and 0.91% for unlisted stocks), a substantial fraction of issues (42% of listed stocks and 47% of unlisted stocks) had persistent fails of 5 days or more. About 4% of U.S. equity issues had fails that would have classified them as “threshold” securities with mandatory close-out requirements under Regulation SHO.

We argue that long-lived (“persistent”) fails are more likely the result of strategic fails rather than inadvertent delivery delays. Consistent with the hypothesis that pre-Regulation SHO, equity and options market makers strategically failed to deliver shares that were expensive or impossible to borrow, we find some evidence that these long-lived fails were more likely to occur when stocks were expensive to borrow, as proxied by institutional ownership, book-to-market, and market cap. We find some evidence that strategic fails were more likely for stocks with options listings, consistent with the conclusion of Evans et al. (2003) that options market makers strategically fail when stocks are expensive to borrow. We also provide evidence that strategic fails (i.e., naked short sales) likely

<sup>1</sup>Although Evans et al. (2003) introduce the idea of strategic fails for equity markets, Fleming and Garbade (2002) provide a detailed discussion of strategic fails in Treasury markets.

<sup>2</sup>See SEC adopting release, p. 7. In addition to Rule 203, Regulation SHO contains several other rules, including Rule 200, which defines security ownership for short sale purposes and provides specifications for aggregation of long and short positions and requirements for marking sales as “long”, “short”, or “short exempt”; and Rule 202T, which enables the SEC to conduct a pilot program to study elimination of the tick test Rule 10a-1. Regulation SHO can be obtained in full at [www.sec.gov](http://www.sec.gov). This paper addresses Rule 203.

accounted for a higher percentage of short interest pre-Regulation SHO than previously understood.

Market participants have suggested various explanations for why firms that fail to receive shares allow these fails to persist. We document that many of the firms that allow others to fail are themselves responsible for fails-to-deliver in other stocks. We provide empirical evidence consistent with the hypothesis that many firms allow others to fail strategically simply because they are unwilling to earn a reputation for forcing delivery and hope to receive quid pro quo for their own strategic fails.

Finally, our findings support comments of equity and options market makers that the inability to strategically fail to deliver shares post-Regulation SHO will reduce liquidity and increase short-sale constraints, particularly for stocks that are expensive to borrow. The findings also suggest that options listings will decrease for stocks that are likely to be expensive to borrow; short interest will decrease; and illiquid, expensive-to-borrow stocks will be more likely to experience temporary short squeezes and increased price volatility.

This paper contributes to the academic literature of short sale constraints generally (for introductions to the literature, see [Chen et al., 2002](#); [Lamont and Thaler, 2003](#)). In particular, it extends our understanding of short sales and short interest in U.S. equity markets (see [Desai et al., 2002](#); [Chen and Singal, 2003](#); [Christophe et al., 2004](#)), stock loan markets (see [D'Avolio, 2002](#); [Duffie et al., 2002](#); [Geczy et al., 2002](#); [Jones and Lamont, 2002](#)), and strategic delivery failures ([Evans et al., 2003](#); [Fleming and Garbade, 2002](#)). It is the first paper to our knowledge that documents the pervasiveness of delivery failures (i.e., naked short sales) for the entire cross-section of U.S. equities.

The paper is organized as follows. Section 2 describes the institutional framework that provided opportunities for strategic delivery failures in the past and the changes in requirements under Regulation SHO. Section 3 provides the empirical description of delivery failures prior to Regulation SHO. Section 4 presents the evidence consistent with strategic delivery failures. Section 5 examines the hypothesis that firms with fails-to-receive do not force delivery because they want to bank future goodwill. Section 6 discusses the implication of Regulation SHO for short-sale constraints, short interest, liquidity, price volatility, and options listings, and offers suggestions for future research.

## 2. Institutional framework in which delivery failures can occur

In U.S. equity markets, sellers are required to deliver shares in return for payment by the third day following the transaction (“T + 3”). Most trades are cleared and settled through the National Securities Clearing Corporation (NSCC) using a multilateral netting operation, called the Continuous Net Settlement (CNS) System. Many broker–dealers are either clearing members of NSCC or negotiate arrangements to clear through NSCC clearing members. Shares that are not delivered by T + 3 are called failures-to-deliver or “fails”. At the close of delivery processing each day, the NSCC determines failures-to-deliver and assigns matching failures-to-receive. The 3-day settlement period is generally too short to permit the physical delivery of shares. Instead, most shares are held in book-entry form at the Depository Trust Corporation (DTC). Some investors still hold physical securities, and sales of these shares can result in failures-to-deliver on T + 3.<sup>3</sup> Alternatively,

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<sup>3</sup>See [Lamont \(2003\)](#) for a discussion of how issuers may encourage investors to hold shares in physical form or withdraw shares from the stock loan market to prevent short selling.

failures-to-deliver occur if shares are sold short but not borrowed.<sup>4</sup> This is sometimes referred to as “naked short selling”.

Regulation SHO takes a two-pronged approach to reducing naked short sales. First, it spells out “locate” requirements, which specify the extent to which arrangements must be made to borrow stocks prior to short sales. Second, it requires mandatory close-outs of fail-to-deliver positions for stocks with persistent fails of substantial magnitude. Table 1 provides a comparison of borrowing, delivery, and close-out requirements pre- and post-Regulation SHO. Additional details are available in the Regulation SHO Proposing Release.<sup>5</sup>

With regard to the locate requirement, Regulation SHO requires that arrangements be made to borrow the security prior to the short sale unless the broker–dealer “has reasonable grounds to believe that the security can be borrowed so that it can be delivered on the date delivery is due.”<sup>6</sup> Broker–dealers can rely on “easy-to-borrow” lists as reasonable grounds if the lists are less than 24 h old.

With regard to the mandatory close-out requirement, Regulation SHO establishes parameters that define “threshold” securities. Clearing agency participants are required to purchase securities to close-out fail-to-deliver positions that exist in these threshold securities for 10 settlement days. A stock becomes a threshold security when it has an aggregate fail-to-deliver position (i.e., a total across all clearing members) of at least 10,000 shares and at least 0.5% of shares outstanding for 5 consecutive settlement days.<sup>7</sup> Any clearing participant with a fail-to-deliver position of at least 10 days in a threshold security may not make further short sales for its own account or accept short sale orders from others without prior borrowing or a bona-fide borrowing arrangement. The close-out provisions do not apply to fail-to-deliver positions established prior to the security’s achieving threshold status.<sup>8</sup>

The close-out provisions apply to stocks of all issuers that are registered under Section 12 or required to file under Section 15(d) of the Exchange Act. Thus, all stocks listed on NYSE, AMEX, and Nasdaq are covered as well as those that trade on the Over-the-Counter Bulletin Board (OTCBB). Some stocks that trade on the Pink Sheets are issued by companies that are not registered or required to file, and the stocks of these non-reporting issuers are not covered.

Short sales executed by market makers, including specialists and options market makers, are exempt from the locate requirement. They are not exempt from the close-out provisions, however. Nor are they exempt from the prior-borrowing requirement for additional short sales by those with extended fails in threshold securities. There is a limited

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<sup>4</sup>A substantial market exists for security loans of U.S. equities. The security lenders are typically buy-and-hold institutional investors. D’Avolio (2002) and Duffie et al. (2002) provide descriptions of the U.S. markets for stock loans. D’Avolio (2002) reports that as of June 2001, only 7% of U.S. equity loan capacity was utilized. Utilization may be higher around voting dates and dividend record dates (see Christoffersen et al., 2002, 2004).

<sup>5</sup>See “Current Regulations”, Section B, SEC Proposing Release, Regulation SHO, Release No. 34-48709, available at <http://www.sec.gov/rules/proposed/34-48709.htm>.

<sup>6</sup>SEC Regulation SHO Adopting Release, pp. 27–28.

<sup>7</sup>The stock then discontinues its threshold status as soon as its aggregate fails no longer exceed the threshold parameters for five consecutive settlement days.

<sup>8</sup>This exception applies unless the amount of fails of this grandfathered position decreases once the security achieves threshold status. In the event of a reduction in the size of the grandfathered position, only the reduced amount remains exempt from the close-out position.

Table 1

Comparison of locate, delivery, and close-out requirements pre- and post-Regulation SHO

|                                  | Pre-Regulation SHO                                                                                                                                                                                                                                                  | Post-Regulation SHO                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Locate requirements              | <p>Prior to short selling, there must be arrangements or acceptable assurances that the stock can be borrowed and delivered on the settlement date.</p> <p>Exempt:</p> <p>Equity market makers<br/>Options market makers<br/>Hedgers<br/>Arbitrageurs</p>           | <p>Prior to short selling, there must be arrangements or acceptable assurances that the stock can be borrowed and delivered on the settlement date.</p> <p>Exempt:</p> <p>Equity market makers<br/>Options market makers</p>                                                                                                                                                                                                                                                                               |
| Forced delivery                  | Any clearing member with a failure-to-receive position has the option of notifying the NSCC that it wants to try to force delivery (“buy-in”) the position.                                                                                                         | Same as pre-Regulation SHO.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Mandatory close-out requirements | <p>For Nasdaq stocks with fails of at least 0.5% of shares outstanding and 10,000 shares, positions that have failed for at least 10 days must be closed out.</p> <p>Exempt:</p> <p>Equity market makers<br/>Options market makers<br/>Hedgers<br/>Arbitrageurs</p> | <p>For stocks issued by Section 12 and Section 15(d) filers (i.e., stocks listed on NYSE, AMEX, Nasdaq; OTCBB stocks; and stocks of Pink Sheet filers) with total fails of at least 0.5% of shares outstanding and 10,000 shares for 5 consecutive days (i.e., “threshold” stocks), positions that have failed for at least 10 days must be closed out.</p> <p>Exempt:</p> <p>Pre-existing fail positions<br/>New short sales that are options market makers’ hedges for pre-existing option positions</p> |
| Other deterrents                 | NASD rules prohibit further short selling by those with fails-to-deliver of that security for at least 60 days.                                                                                                                                                     | Those with fails of at least 10 days in the above “threshold” stocks cannot make further short sales until fail position is closed out unless stock has been already borrowed (or arranged to borrow).                                                                                                                                                                                                                                                                                                     |

exception for options market makers that hedge options positions established prior to the security’s achieving threshold status.

Comments from market makers suggest that delivery failures pre-Regulation SHO may be, at least in part, the result of strategic fails by equity and options market makers. The NYSE Specialist Association’s comment letter on the Regulation SHO Proposing Release stated “the specialist may encounter unusual and sometimes insurmountable difficulty in

obtaining securities to borrow and deliver against those short sales.”<sup>9</sup> Knight Trading Group stated in its comment letter that “a market maker in a thinly traded stock often takes on the risk of selling short to a periodic surge in buying interest, knowing that it might take considerable time, even months, to trade out of that position in an orderly fashion, without causing temporary price aberrations.”<sup>10</sup> Commenters also predicted that the lack of a market maker exemption from delivery requirements will make thinly traded stocks “become less liquid and more vulnerable to disorderly markets and short squeezes.”<sup>11</sup> Some options market makers stated that without an exemption they would depart “in significant numbers”<sup>12</sup> and their ability to make markets would be impaired.<sup>13</sup> Others stated that:

“Even if proposed Rule 203(3) does not completely shut down options trading in thinly traded securities, it will certainly impair the ability of options market makers to make markets in these options and increase costs to investors.”<sup>14</sup>

### 3. Characterization of delivery failures of U.S. equities prior to Regulation SHO

The National Securities Clearing Corporation (NSCC) provided data on fails-to-deliver for all U.S. securities, including stocks listed on the NYSE, AMEX, and Nasdaq, and those that trade on the OTCBB and Pink Sheets. Data were provided separately for each of 3 settlement dates: September 23, 2003; November 17, 2003; and January 21, 2004. The data indicate total fails-to-deliver (in shares) for each clearing firm for each issue along with the position age (in days). This age is the number of consecutive days that the clearing firm has had at least one share of that security fail to deliver. The data also include the market price NSCC used to mark-to-market positions in that security that day.

We merged the NSCC fails data with the following data from other sources:

- Daily closing prices and trading volumes for the previous 20 trading days, from the NYSE TAQ database for all listed stocks and from Bloomberg and <http://www.yahoo.com> for all OTCBB and Pink Sheet stocks.
- Total shares outstanding, from CRSP, Compustat, and Bloomberg.
- Monthly short interest for listed shares, from NYSE, AMEX, and Nasdaq.
- Institutional holdings of 13f stocks, from Thomson/Spectrum/CDA.<sup>15</sup>
- The list of initial public offerings (IPOs) for the prior year, from the Securities Data Corporation (SDC).
- Financial statement data, from Compustat.
- Options listings, from the Options Clearing Corporation web site.<sup>16</sup>

<sup>9</sup>See comment letter, Specialist Association of the NYSE, dated February 13, 2004, p. 14. This and all other comment letters can be obtained at <http://www.sec.gov/rules/proposed/s72303.shtml>.

<sup>10</sup>See comment letter, Knight Trading Group, dated January 6, 2004.

<sup>11</sup>See comment letter, NASD, dated March 25, 2004.

<sup>12</sup>See Susquehanna Group International's comment letter, dated March 19, 2004.

<sup>13</sup>See the Pacific Exchange's comment letter, dated February 6, 2004, p. 4.

<sup>14</sup>See Joint Options Exchange comment letter, dated February 9, 2004.

<sup>15</sup>Holdings for many unlisted stocks are unavailable. Institutional investors report their holdings of 13f stocks only, and many unlisted stocks are not 13f stocks per the SEC official list posted on their web site.

<sup>16</sup>[www.optionsclearing.com](http://www.optionsclearing.com).

For listed stocks, the data set includes all ordinary shares, as defined by CRSP.<sup>17</sup> For stocks not listed on NYSE, AMEX, or Nasdaq (i.e., “unlisted stocks”), the data set includes all stocks that trade on the OTCBB or Pink Sheets that had total shares outstanding data available from CRSP, Compustat, or Bloomberg, and traded at least once in the prior 20 trading days.<sup>18</sup>

Table 2 shows descriptive statistics for the data set.<sup>19</sup> Statistics are reported separately for stocks listed on NYSE, AMEX, or Nasdaq (column 1) and OTCBB and Pink Sheet stocks (column 3). Descriptive statistics are also shown for the subset of stocks in each group that have fails-to-deliver of at least one share for at least one day. For example, there are 5,950 stocks in the data set that are listed on NYSE, AMEX, or Nasdaq. Column 2 shows that 4,778 stocks (80.3%) have fails-to-deliver. Of the 3,075 unlisted stocks (column 3), 1,790 issues (58.2%) have fails-to-deliver (column 4).

Comparison of the results in columns 1 and 3 shows that the listed stocks average substantially greater market capitalization than the unlisted stocks. Turnover (monthly trading volume divided by shares outstanding) averages 12.9% for listed stocks. Turnover for the cross-section of unlisted stocks has much greater variance, and many of these stocks have days with few or no transactions. While only one-fifth of listed issues are priced less than \$5/share, more than 90% of the unlisted stocks trade under \$5/share. Unlisted stocks are also more likely to fall into the “glamour” category, which we define as the bottom 3 deciles of book equity divided by market equity (NYSE breakpoints).<sup>20</sup> There were 91 IPOs within a year of the sample dates, and all were listed stocks. About one-third of the listed stocks had options listed on a U.S. options exchange. Options traded on less than 1% of unlisted stocks.

Although the percentage of stocks with at least one failed share for at least one day is quite high for listed stocks (80.3%), the amount of failed shares as a percentage of total shares outstanding is extremely low on average (0.19%, shown in column 2). For unlisted stocks with fails, fails are also low on average as a percentage of outstanding shares, but higher than for listed stocks (1.56%, column 4). Perhaps more striking is the comparison of the age of the fails positions for listed and unlisted stocks. The average age of fails is 13 days for listed stocks with fails and 56.6 days for unlisted stocks with fails. And the median for listed stocks is only 2.9 days, but 12.9 days for unlisted stocks.<sup>21</sup>

To illustrate the pervasiveness of fails, Figs. 1 and 2 show the number of issues and failed shares as a function of fail age for listed and unlisted stocks, respectively. The variable on the  $x$ -axis in each panel is age cutoff (in days). Stocks are included at each cutoff point only if they have fails of at least one share of that age or older.<sup>22</sup> Data are shown separately for

<sup>17</sup>We exclude ADRs, shares of beneficial interest, and units. Specifically, we keep cusips with ShrCD = 10, 11, 12, 14, 15, or 18.

<sup>18</sup>Some of our “unlisted stocks” are listed on exchanges outside the U.S. For example, some stocks that trade on the Pink Sheets are listed on Canadian exchanges.

<sup>19</sup>We calculate the statistics shown in Table 2 for each of the 3 settlement dates. Table 2 reports the average over the 3 periods.

<sup>20</sup>Although this categorization is consistent with the literature, it highlights the need for a better terminology for partitioning stocks, particularly for stock samples that include unlisted or “penny” stocks.

<sup>21</sup>In Table 2, if more than one clearing firm has a fails-to-deliver position in the stock, the stock’s age of fails is calculated as the weighted average of the fails position age of each clearing firm weighted by the shares failed by that clearing firm.

<sup>22</sup>Although the  $x$ -axis in Figs. 1 and 2 is right-truncated at a position age of 40 settlement days for illustrative purposes, fails last beyond the 40 days shown for many of the issues.

Table 2

Descriptive statistics for universe of stocks used in fails analysis

This table provides descriptive statistics for the stocks used in the analysis of delivery failures in U.S. equity markets. Data on delivery failures were provided by the National Securities Clearing Corporation for 3 dates: Sept. 23, 2003; Nov. 17, 2003; and Jan. 21, 2004. The statistics shown are the averages of those calculated for each of the 3 dates. Column 1 reports statistics for all ordinary shares listed on NYSE, AMEX, or Nasdaq. Column 2 reports statistics for the subset of these stocks with failures-to-deliver. Columns 3 and 4 report statistics similarly for Over-the-Counter and Pink Sheet stocks. Turnover is monthly trading volume divided by shares outstanding. Institutional ownership is institutional holdings divided by shares outstanding. Monthly short interest is short interest divided by shares outstanding. Institutional ownership and short interest data are not available (“NA”) for most unlisted stocks. “Glamour” stocks are those stocks with book equity divided by market equity in the bottom 3 NYSE-breakpoint deciles.

|                                 | Listed on NYSE, AMEX, or Nasdaq |                       | Traded on OTCBB or Pink Sheets |                       |
|---------------------------------|---------------------------------|-----------------------|--------------------------------|-----------------------|
|                                 | All stocks (1)                  | Stocks with fails (2) | All stocks (3)                 | Stocks with fails (4) |
| Number of stocks                | 5,950                           | 4,778                 | 3,075                          | 1,790                 |
| % that have fails               | 80.3%                           | 100.0%                | 58.2%                          | 100.0%                |
| Market cap (in \$ millions)     |                                 |                       |                                |                       |
| Mean                            | 2,269.3                         | 2,681.6               | 32.6                           | 32.8                  |
| Median                          | 240.2                           | 289.2                 | 1.9                            | 4.7                   |
| Turnover                        |                                 |                       |                                |                       |
| Mean                            | 12.9%                           | 14.3%                 | 244.6%                         | 87.4%                 |
| Median                          | 6.6%                            | 7.6%                  | 1.3%                           | 2.6%                  |
| Institutional ownership         |                                 |                       |                                |                       |
| Mean                            | 41.0%                           | 43.2%                 | NA                             | NA                    |
| Median                          | 36.0%                           | 39.8%                 | NA                             | NA                    |
| Monthly short interest          |                                 |                       |                                |                       |
| Mean                            | 2.6%                            | 2.9%                  | NA                             | NA                    |
| Median                          | 0.9%                            | 1.1%                  | NA                             | NA                    |
| Issues with price < \$5         | 20.7%                           | 20.4%                 | 92.5%                          | 93.7%                 |
| Issues with options listings    | 34.8%                           | 38.9%                 | 0.4%                           | 0.7%                  |
| Glamour stocks (as % of stocks) | 37.6%                           | 40.8%                 | 63.7%                          | 66.8%                 |
| Number of IPOs                  | 91                              | 73                    | 0                              | 0                     |
| Fails, % of shares outstanding  |                                 |                       |                                |                       |
| Mean                            | 0.15%                           | 0.19%                 | 0.91%                          | 1.56%                 |
| Median                          | 0.00%                           | 0.01%                 | 0.00%                          | 0.03%                 |
| Age of fails, in days           |                                 |                       |                                |                       |
| Mean                            | 10.5                            | 13.0                  | 33.0                           | 56.6                  |
| Median                          | 2.0                             | 2.9                   | 2.0                            | 12.9                  |

each of the 3 fails data set dates. Fig. 1 (upper panel) shows that for listed stocks, the number of issues with at least one failed share decreases sharply with position age. While close to 5,000 issues have at least one fail for at least one day, less than 2,000 issues have fails that are at least 9 days old. There are a substantial number of issues (about 1,000) with fails of at least 20 days or more, however. The middle panels of Figs. 1 and 2 show failed shares as a function of position age. They show that although these totals also decline with position age, a substantial portion of fails persist for several months or more.

The bottom panels of Figs. 1 and 2 show the relative amount of failed shares, conditional on fails. Specifically, for each issue with at least one failed share for at least

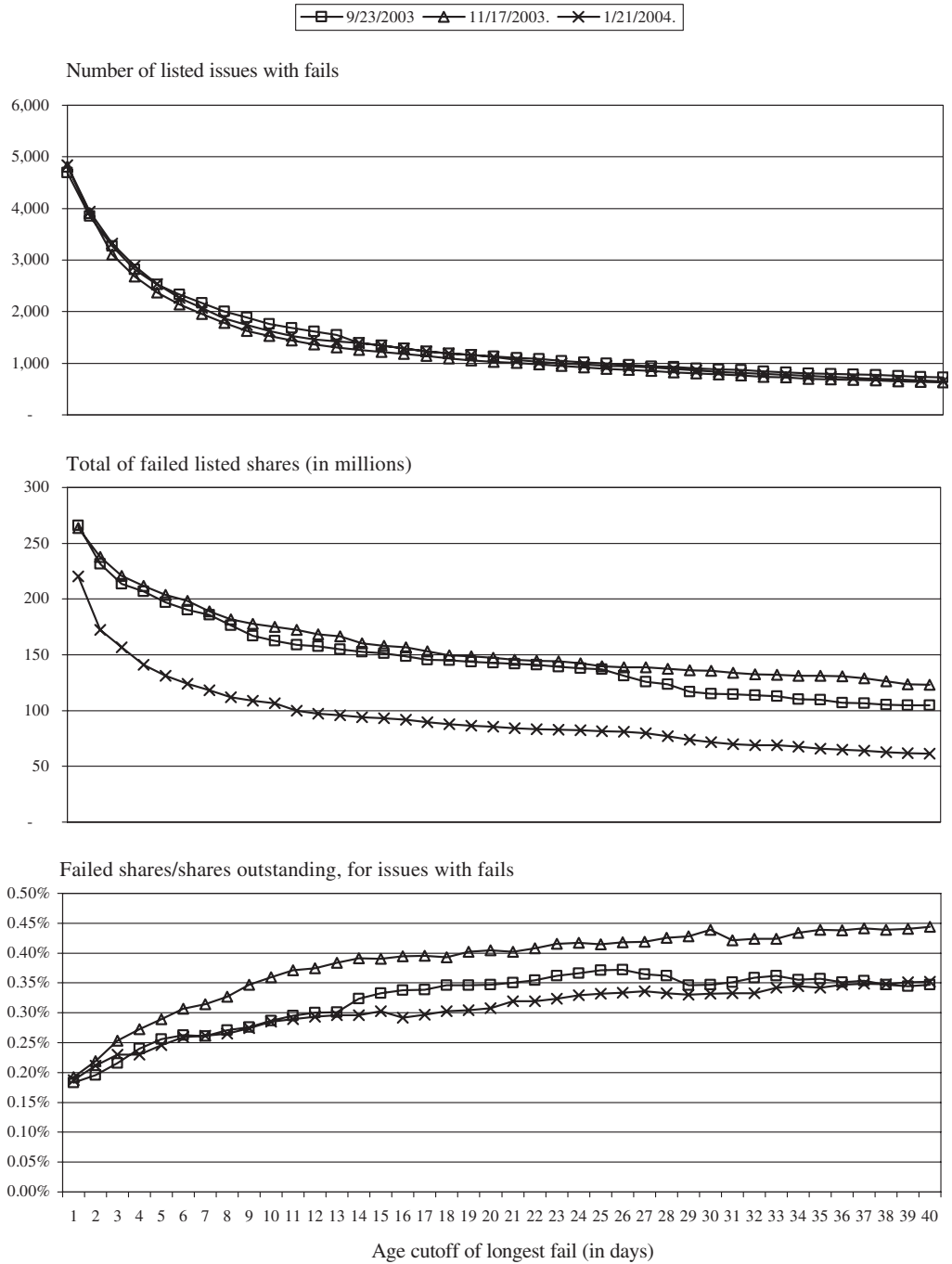


Fig. 1. Fails by position age: stocks listed on NYSE, AMEX, or Nasdaq.

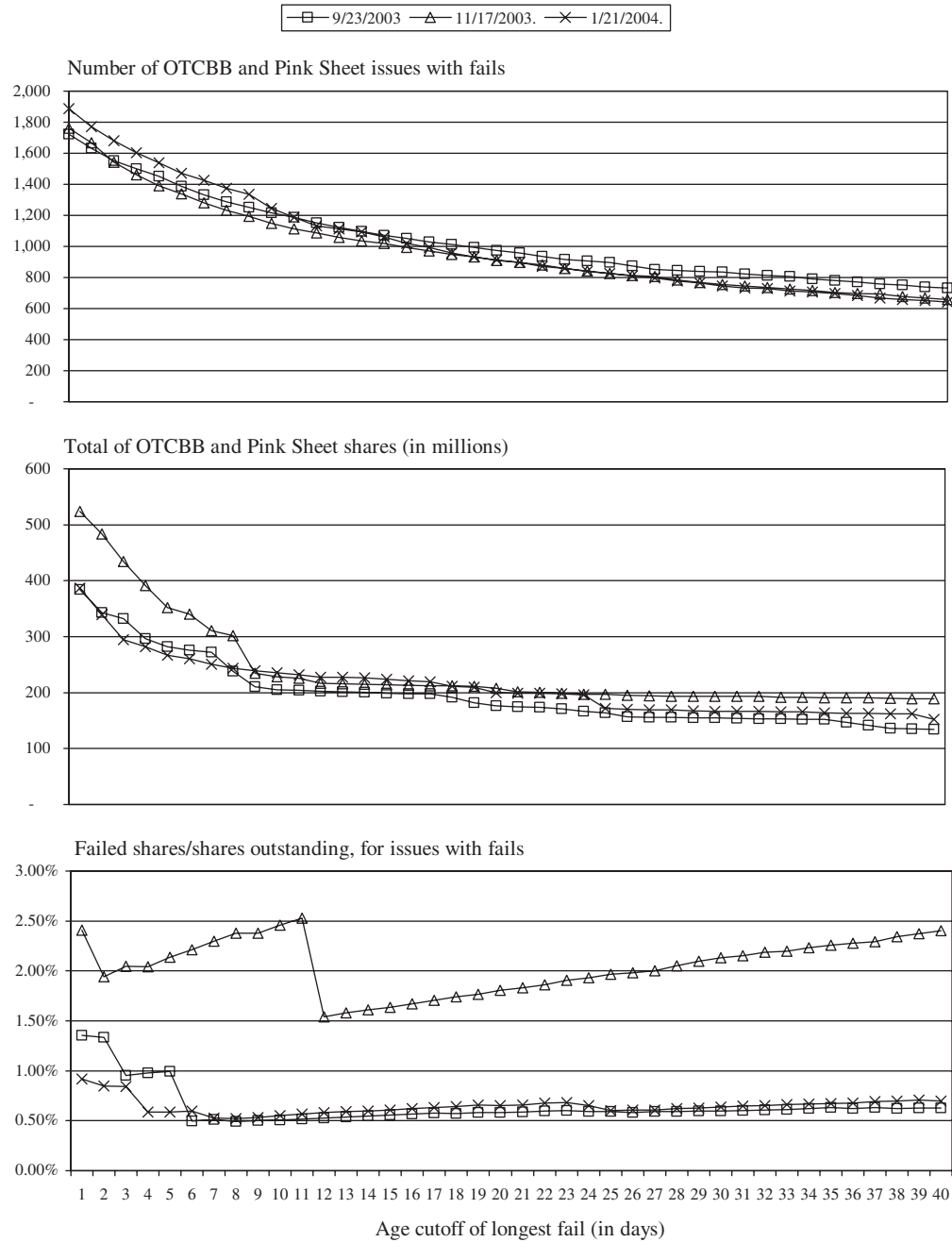


Fig. 2. Fails by position age: over-the-counter bulletin board and pink sheet stocks.

that many days (i.e., position age), the total amount of failed shares for that issue is divided by the issue’s total shares outstanding. The bottom panel shows the cross-sectional average for the stocks, conditional on at least one failed share of that age cutoff or older. The

bottom panel of Fig. 1 shows that regardless of position age, fails tend to be an extremely low percentage of total shares outstanding. For listed shares, inadvertent fails, which are likely to last less than a week, tend to make up a smaller percentage of total shares outstanding. This is not the case for OTCBB and Pink Sheet stocks (bottom panel, Fig. 2).

The results presented in Table 2 and Figs. 1 and 2 provide evidence that for most issues, a very small percentage of transactions create short-lived, possibly inadvertent, failures-to-deliver. In addition, a substantial number of issues experience long-lived fails. We further compare the characteristics of short-lived and long-lived fails in Section 4 as we test for evidence consistent with strategic fails by market makers.

#### 4. Empirical evidence consistent with the hypothesis of strategic delivery failures

We are interested in determining the extent to which the fails documented in Section 3 are the strategic fails of market makers. One challenge presented by the data is that we cannot distinguish with certainty fails that are strategic from fails that are the unintended result of errors or delays in stock delivery by long sellers. It is unlikely that unintentional errors or delays would explain long-lived (“persistent”) fails-to-deliver. Thus, consistent with the “threshold” criteria of Regulation SHO, we classify fail positions that last 5 settlement days or longer as strategic fails-to-deliver. Of course, this means we will underestimate strategic fails to the extent they last for less than 5 days.

Another challenge presented by the data is that while we observe fail positions by clearing firm, each clearing firm may clear for more than one broker–dealer, market maker, or customer. Thus, we cannot directly distinguish the fails of market makers from those of other short sellers. It is possible that naked short sales pre-Regulation SHO are made to some extent by non-market makers. Based on market makers’ comments (Section 2), the following empirical facts would be consistent with the hypothesis that persistent fails are due to strategic fails by equity and options market makers.

(1) *The likelihood of persistent fails in a security increases with its borrowing costs.*

D’Avolio (2002) documents that many listed stocks can be borrowed relatively cheaply. In fact, the short seller receives an interest rebate to compensate for the fact that in borrowing securities, he or she has made a security-collateralized cash loan to the security lender. However, some stocks (primarily low-priced, illiquid issues with little or no institutional ownership) are expensive to borrow (“special”). In extreme cases, security lenders may even demand a negative rebate. Evans et al. (2003) note that failing to deliver shares is economically equivalent to borrowing shares at a zero rebate rate.

(2) *The likelihood of persistent fails in a security increases if it has options listed.*

Roughly one-third of listed equity issues have options listed.<sup>23</sup> Options market makers may maintain short stock positions for longer periods than equity market makers. Thus,

<sup>23</sup>Very few stocks traded on the OTCBB or Pink Sheets have options listings. The exceptions are recently delisted issues (e.g., UAL) that trade over-the-counter post-delisting. Options on these stocks can continue to trade until their expiration.

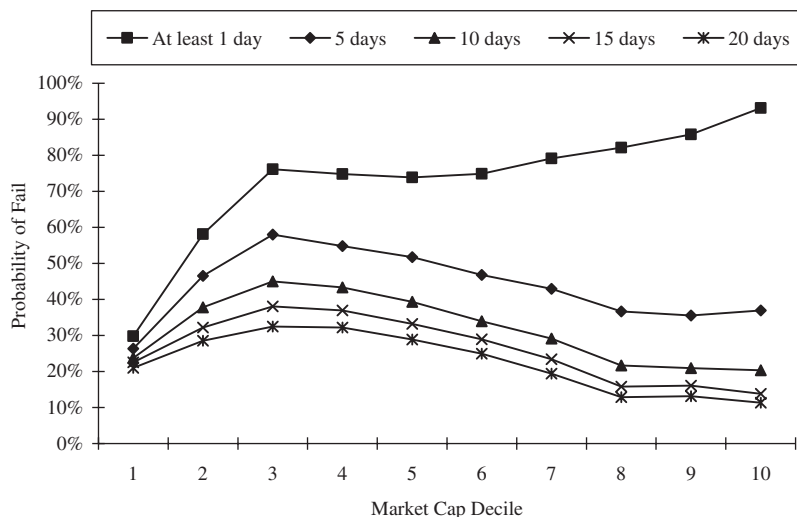


Fig. 3. Probability of fail versus market cap decile. It shows the probability that an issue has failures-to-deliver as a function of market cap decile and the minimum age of failed shares. Market cap decile breakpoints, calculated for each of the 3 time periods, are determined from the pooled observations of listed and unlisted stocks. Fig. 3 reports the probability, averaged across the 3 time periods, at each breakpoint.

strategic fails by options market makers may make stocks with options listings more likely to experience persistent fails pre-Regulation SHO.

### (3) *The likelihood of persistent fails in a security increases with illiquidity.*

As noted by Knight Trading Group, equity market makers may take “months” to cover short positions in illiquid stocks.

Proxies for borrowing costs are documented by D’Avolio (2002). He shows that the likelihood of a stock’s being expensive to borrow (“special”) decreases with market cap, decreases with the percentage of shares held by institutions, increases with turnover, decreases with cash flow (as a percentage of assets), increases for low book-to-market (“glamour”) stocks, and increases if the issue has had its initial public offering in the last 12 months.<sup>24</sup> If persistent fails are in fact strategic fails because borrowing costs are high, we should observe the same relationships between these variables and the likelihood of persistent fails. Market cap is also a proxy for liquidity.

First, we examine the relationships between fails and market cap, institutional ownership, and turnover, as a function of fail age. Fig. 3 shows the probability that an issue has failures-to-deliver as a function of market cap decile and the minimum age of failed shares. Market cap decile breakpoints, calculated for each of the 3 time periods, are

<sup>24</sup>D’Avolio finds that borrowing costs also increase with Internet message board activity. His proxy is unavailable for our time period however and will be omitted from our analysis. He also examines the effects of daily price volatility, dispersion of analyst forecasts, and an Internet sector dummy, and concludes these variables provide little or no incremental explanatory power. He finds some evidence that a “loser” momentum dummy increases the likelihood that a stock will be special, but estimates from the full-specification logit regressions are significantly positive for only 4 of the 18 time periods.

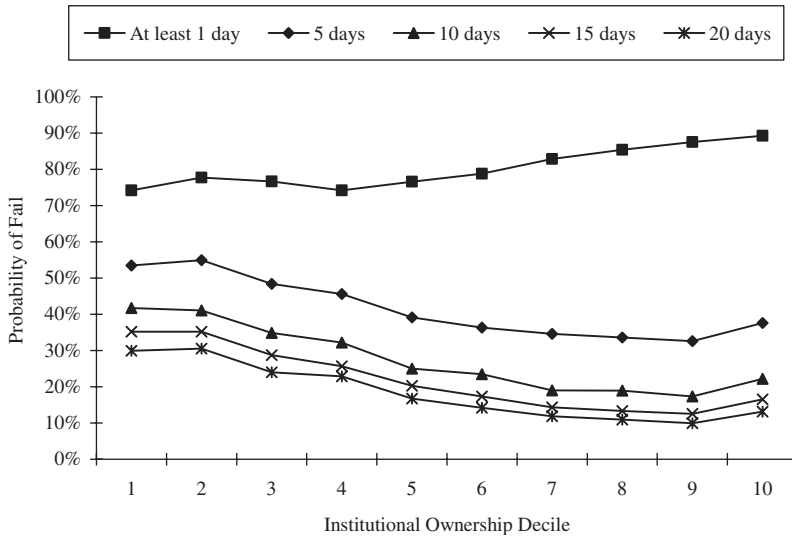


Fig. 4. Probability of fail versus institutional ownership decile. It shows the probability that an issue has failures-to-deliver as a function of institutional ownership decile and the minimum age of failed shares. Institutional ownership is institutional holdings divided by shares outstanding. Institutional ownership decile breakpoints, calculated for each of the 3 time periods, are determined from the pooled observations of listed stocks. Fig. 4 reports the probability, averaged across the 3 time periods, at each breakpoint.

determined from the pooled observations of listed and unlisted stocks. Fig. 3 reports the probability, averaged across the 3 time periods, at each breakpoint. The probability of having fails of at least one day increases with market cap. The probability of having *persistent* fails (i.e., fails that are at least 5 days old) generally decreases with market cap for the 3rd–10th largest market cap deciles, however.

The probability of fail as a function of fail age and institutional ownership (for listed stocks only) is shown in Fig. 4. The probability of persistent fails (i.e., fails of at least 5 days) decreases with institutional ownership.

Figs. 3 and 4 provide some evidence that the likelihood of persistent fails increases with borrowing costs as proxied by market cap and institutional ownership. The same cannot be said for turnover, as shown in Fig. 5. While D'Avolio concludes that higher turnover stocks are more expensive to borrow, Fig. 5 suggests that the relationship between persistent fails and turnover is unclear. Turnover may be strongly correlated with market cap and/or institutional ownership, however.

We perform logit regressions of the likelihood that a stock will have persistent fails. The explanatory variables are log of market cap, institutional ownership (shares of institutional holdings divided by shares outstanding), turnover (monthly trading volume divided by shares outstanding), cash flow (as a percent of assets, consistent with D'Avolio, 2002), a glamour dummy (set to one if the stock's book-to-market ratio is within the 3 lowest NYSE-breakpoint deciles), an IPO dummy (set to one if the stock had its IPO in the last 12 months), and an options dummy (set to one if the stock has options listed on a U.S. exchange). Because institutional ownership data are unavailable for unlisted stocks, we include an unlisted dummy (set to one for unlisted stocks) to prevent

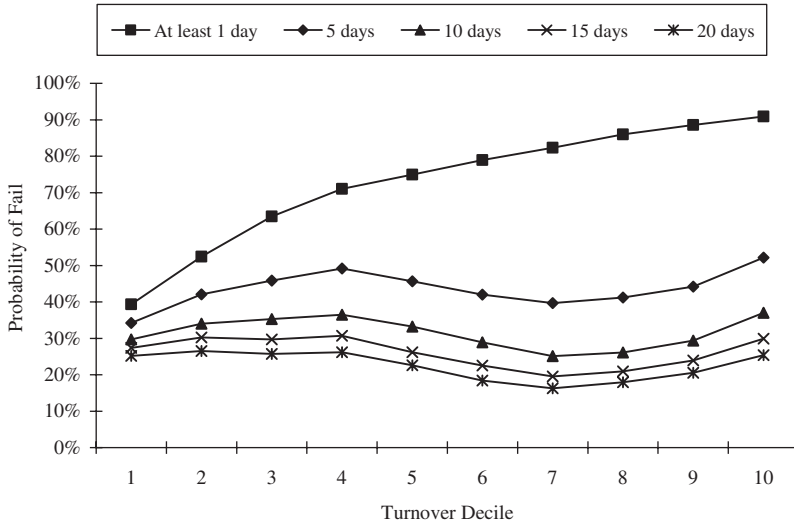


Fig. 5. Probability of fail versus turnover decile. It shows the probability that an issue has failures-to-deliver as a function of turnover decile and the minimum age of failed shares. Turnover is monthly trading volume divided by shares outstanding. Turnover decile breakpoints, calculated for each of the 3 time periods, are determined from the pooled observations of listed and unlisted stocks. It reports the probability, averaged across the 3 time periods, at each breakpoint.

institutional ownership from also proxying for listing. The regressions are run for 4 measures of persistent fails:

- (1) at least one failed share for more than 5 days (Table 3, Panel A),
- (2) failed shares of at least 0.5% of shares outstanding and at least 10,000 shares for more than 5 days (Table 3, Panel B),
- (3) at least one failed share for more than 10 days (Table 3, Panel C), and
- (4) failed shares of at least 0.5% of shares outstanding and at least 10,000 shares for more than 10 days (Table 3, Panel D).

The 5-day minimum cutoff is consistent with the Regulation SHO definition of “threshold” security. The 10-day cutoff is the criterion for when mandatory close-out provisions take effect. Cutoffs of at least 0.5% of shares outstanding and at least 10,000 shares are consistent with the Regulation SHO “threshold” criteria, established to focus on “large, extended fails to deliver.”<sup>25</sup> Because we are interested in strategic fails by market makers, even if they are of less magnitude, we also include the “at least one failed share” measures.

The unconditional probability of an issue’s having persistent fails is shown in the last column of Table 3. Roughly 4% of issues would have been classified as “threshold” securities under Regulation SHO (Panel B). About 3% of issues would have met the criteria for the Regulation SHO mandatory close-out requirements (Panel D).

<sup>25</sup>See Regulation SHO adopting release, p. 39.

Table 3

Logit regressions of the likelihood of persistent fails

This table reports results of logit regressions of the likelihood of persistent fails as a function of proxies for borrowing costs, liquidity, options listings, and exchange listings. Regressions were run separately for each time period of fails data (Sep. 2003, Nov. 2003, and Jan. 2004). Each Panel (A–D) reports regressions for a different proxy for persistent fails. Institutional ownership is institutional holdings divided by shares outstanding. Turnover is monthly trading volume divided by shares outstanding. Cash flow is as a percent of assets, consistent with D'Avolio (2002). "Glamour" stocks are those stocks with book equity divided by market equity in the bottom 3 NYSE-breakpoint deciles. IPO dummy is set to one if the stock had its IPO in the last 12 months. Options dummy is set to one if the stock has options listed on a U.S. exchange. Unlisted dummy is one for stocks not listed on the NYSE, AMEX, or the Nasdaq Market System.

| Time period                                                                                                                                                       | Log of market capitalization | Institutional ownership | Turnover | Cash flow | Glamour dummy | IPO dummy | Options dummy | Unlisted dummy | Memo: Unconditional probability |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|-------------------------|----------|-----------|---------------|-----------|---------------|----------------|---------------------------------|
| <i>Panel A: Dependent variable is indicator variable FAILS, which is 1 if the issue has fails for at least 5 days, and 0 otherwise.</i>                           |                              |                         |          |           |               |           |               |                |                                 |
| Sep. 2003                                                                                                                                                         |                              |                         |          |           |               |           |               |                |                                 |
| Estimate                                                                                                                                                          | 0.027                        | −0.007                  | 0.019    | 0.004     | 0.290         | −0.138    | −0.023        | 0.460          | 45.0%                           |
| p-value                                                                                                                                                           | 0.114                        | <0.001                  | 0.344    | 0.872     | <0.001        | 0.697     | 0.775         | <0.001         |                                 |
| Nov. 2003                                                                                                                                                         |                              |                         |          |           |               |           |               |                |                                 |
| Estimate                                                                                                                                                          | 0.044                        | −0.008                  | 0.015    | 0.001     | 0.272         | −0.076    | −0.022        | 0.512          | 41.3%                           |
| p-value                                                                                                                                                           | 0.010                        | <0.001                  | 0.403    | 0.983     | <0.001        | 0.867     | 0.787         | <0.001         |                                 |
| Jan. 2004                                                                                                                                                         |                              |                         |          |           |               |           |               |                |                                 |
| Estimate                                                                                                                                                          | 0.030                        | −0.008                  | 0.008    | 0.023     | 0.309         | −0.504    | −0.056        | 0.409          | 43.1%                           |
| p-value                                                                                                                                                           | 0.077                        | <0.001                  | 0.544    | 0.402     | <0.001        | 0.405     | 0.493         | <0.001         |                                 |
| <i>Panel B: Dep. variable is indicator FAILS, which is 1 if the issue has fails of at least 0.50% of shares outstanding for at least 5 days, and 0 otherwise.</i> |                              |                         |          |           |               |           |               |                |                                 |
| Sep. 2003                                                                                                                                                         |                              |                         |          |           |               |           |               |                |                                 |
| Estimate                                                                                                                                                          | −0.179                       | −0.013                  | 0.040    | 0.012     | 1.347         | −0.091    | 0.265         | −0.636         | 4.4%                            |
| p-value                                                                                                                                                           | <0.001                       | <0.001                  | 0.020    | 0.802     | <0.001        | 0.929     | 0.247         | 0.001          |                                 |
| Nov. 2003                                                                                                                                                         |                              |                         |          |           |               |           |               |                |                                 |
| Estimate                                                                                                                                                          | −0.130                       | −0.020                  | 0.034    | 0.014     | 1.310         | −11.563   | 0.473         | −0.603         | 3.9%                            |
| p-value                                                                                                                                                           | 0.001                        | <0.001                  | 0.030    | 0.798     | <0.001        | 0.973     | 0.048         | 0.003          |                                 |
| Jan. 2004                                                                                                                                                         |                              |                         |          |           |               |           |               |                |                                 |
| Estimate                                                                                                                                                          | −0.159                       | −0.023                  | 0.028    | −0.024    | 1.008         | −11.963   | 0.518         | −0.644         | 4.0%                            |
| p-value                                                                                                                                                           | <0.001                       | <0.001                  | 0.036    | 0.248     | <0.001        | 0.982     | 0.036         | 0.001          |                                 |
| <i>Panel C: Dependent variable is indicator variable FAILS, which is 1 if the issue has fails for at least 10 days, and 0 otherwise.</i>                          |                              |                         |          |           |               |           |               |                |                                 |
| Sep. 2003                                                                                                                                                         |                              |                         |          |           |               |           |               |                |                                 |
| Estimate                                                                                                                                                          | 0.017                        | −0.010                  | −0.019   | 0.024     | 0.296         | 0.066     | −0.061        | 0.484          | 32.6%                           |
| p-value                                                                                                                                                           | 0.351                        | <0.001                  | 0.332    | 0.412     | <0.001        | 0.862     | 0.497         | <0.001         |                                 |

Table 3 (continued)

| Time period                                                                                                                                                        | Log of market capitalization | Institutional ownership | Turnover | Cash flow | Glamour dummy | IPO dummy | Options dummy | Unlisted dummy | Memo: Unconditional probability |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|-------------------------|----------|-----------|---------------|-----------|---------------|----------------|---------------------------------|
| Nov. 2003                                                                                                                                                          |                              |                         |          |           |               |           |               |                |                                 |
| Estimate                                                                                                                                                           | 0.016                        | −0.011                  | −0.004   | 0.059     | 0.321         | 0.179     | 0.031         | 0.566          | 28.0%                           |
| p-value                                                                                                                                                            | 0.390                        | <0.001                  | 0.817    | 0.245     | <0.001        | 0.715     | 0.749         | <0.001         |                                 |
| Jan. 2004                                                                                                                                                          |                              |                         |          |           |               |           |               |                |                                 |
| Estimate                                                                                                                                                           | −0.002                       | −0.011                  | 0.008    | 0.018     | 0.329         | −0.700    | −0.040        | 0.400          | 29.0%                           |
| p-value                                                                                                                                                            | 0.933                        | <0.001                  | 0.518    | 0.524     | <0.001        | 0.367     | 0.690         | <0.001         |                                 |
| <i>Panel D: Dep. variable is indicator FAILS, which is 1 if the issue has fails of at least 0.50% of shares outstanding for at least 10 days, and 0 otherwise.</i> |                              |                         |          |           |               |           |               |                |                                 |
| Sep. 2003                                                                                                                                                          |                              |                         |          |           |               |           |               |                |                                 |
| Estimate                                                                                                                                                           | −0.167                       | −0.015                  | 0.023    | −0.010    | 1.186         | 0.152     | 0.498         | −0.433         | 3.5%                            |
| p-value                                                                                                                                                            | <0.001                       | <0.001                  | 0.144    | 0.757     | <0.001        | 0.882     | 0.047         | 0.041          |                                 |
| Nov. 2003                                                                                                                                                          |                              |                         |          |           |               |           |               |                |                                 |
| Estimate                                                                                                                                                           | −0.128                       | −0.019                  | 0.026    | 0.016     | 1.430         | −12.113   | 0.452         | −0.618         | 3.4%                            |
| p-value                                                                                                                                                            | 0.004                        | <0.001                  | 0.114    | 0.791     | <0.001        | 0.980     | 0.077         | 0.005          |                                 |
| Jan. 2004                                                                                                                                                          |                              |                         |          |           |               |           |               |                |                                 |
| Estimate                                                                                                                                                           | −0.133                       | −0.023                  | 0.027    | −0.033    | 1.090         | −11.616   | 0.553         | −0.499         | 3.1%                            |
| p-value                                                                                                                                                            | 0.003                        | <0.001                  | 0.036    | 0.194     | <0.001        | 0.981     | 0.046         | 0.026          |                                 |

The regression results in Table 3 indicate that the likelihood of persistent fails decreases with institutional ownership and increases for low book-to-market (“glamour”) stocks. The estimates for the IPO dummy and the cash flow variable are not significant at conventional levels in any of the regressions. The impact of market cap, turnover, or whether the stock is unlisted or has options listed depends on the magnitude of persistent fails. While higher turnover and options listing provide no incremental explanatory power for persistent fails of at least one share of persistent fails (panels A and C), they increase the likelihood of larger amounts of persistent fails (i.e., panels B and D). Similarly, the likelihood of persistent fails decreases with market cap when persistent fails are at least 0.5% of shares outstanding. Interestingly, trading on the OTCBB or Pink Sheets increases the likelihood of having at least one share of persistent fails but decreases the likelihood of having fails of at least 0.5%, after controlling for the other variables. Generally, the results of the logit regressions in Table 3 provide some evidence that the likelihood of persistent fails increases with borrowing costs, options listing, and illiquidity. The evidence is stronger when fails are large enough to meet the “threshold” stock criteria.

We also performed Tobit regressions of fail age as a function of the same set of explanatory variables for each of the 3 time periods. Fail age is the weighted average of the stock’s failed positions.<sup>26</sup> Stocks with no fails (i.e., average fail age is zero) are included in the regressions. Results (reported in Table 4) indicate fail age decreases with institutional ownership and increases for “glamour” stocks and unlisted stocks. These results clarify that if we control for market cap, book-to-market, and the other explanatory variables in our regressions, unlisted stocks have older fails (Table 4) and are *more* likely to have persistent fails of at least one share (Table 3, panels A and C) but *less* likely than listed stocks of having fails of magnitude great enough to become a “threshold” stock under Regulation SHO.

Finally, as we noted at the beginning of this section, using fail age as a classification scheme will underestimate strategic fails to the extent they last less than 5 days. This is a necessary precaution for the analysis to this point as comments from clearing members and the Regulation SHO adopting release indicate that short-lived fails can result from unintentional delivery delays for long sales. It is worth noting that short sales (and thus the timeframe for strategic fails) also can be short-lived, however. Reed (2003) indicates that the median stock loan duration is 3 days and the mode is just one day. To examine the possibility that short-lived fails, at least to some extent, are the result of strategic fails, we examine the relationship between fails and short interest. D’Avolio (2002) shows that borrowing costs (both fees and probability of being “special”) increase for the highest short interest deciles. This suggests that if fails result from strategic decisions not to borrow stocks against short sales when borrowing costs are high, then a stock’s fails will be positively correlated with its short interest. Alternatively, if short-lived fails are simply the result of inadvertent delays from long sales, fails should be uncorrelated with short interest levels.

Fig. 6 shows the probability of a stock’s having “large” fails as a function of its short interest decile. Results are for listed stocks only as short interest data are unavailable for the OTCBB and Pink Sheet stocks. Stocks are classified as having “large” fails if they have fails of at least 0.5% of shares and 10,000 shares, consistent with the Regulation SHO definition. Fig. 6 provides these results separately for minimum weighted-average fail-age

<sup>26</sup>See Section 3, footnote 21.

Table 4

Tobit regressions of fail age

This table reports results of Tobit regressions of fail age on explanatory variables that proxy for borrowing costs, liquidity, options listings, and exchange listings. Regressions were run separately for each time period of fails data (Sep. 2003, Nov. 2003, and Jan. 2004). Institutional ownership is institutional holdings divided by shares outstanding. Turnover is monthly trading volume divided by shares outstanding. Cash flow is as a percent of assets, consistent with D'Avolio (2002). "Glamour" stocks are those stocks with book equity divided by market equity in the bottom 3 NYSE-breakpoint deciles. IPO dummy is set to one if the stock had its IPO in the last 12 months. Options dummy is set to one if the stock has options listed on a U.S. exchange. Unlisted dummy is one for stocks not listed on the NYSE, AMEX, or the Nasdaq Market System.

| Time period | Log of market capitalization | Institutional ownership | Turnover | Cash flow | Glamour dummy | IPO dummy | Options dummy | Unlisted dummy |
|-------------|------------------------------|-------------------------|----------|-----------|---------------|-----------|---------------|----------------|
| Sep. 2003   |                              |                         |          |           |               |           |               |                |
| Estimate    | -0.306                       | -0.079                  | -0.152   | 0.952     | 7.861         | 9.913     | 2.906         | 12.639         |
| p-value     | 0.503                        | 0.004                   | 0.699    | 0.252     | <0.001        | 0.286     | 0.175         | <0.001         |
| Nov. 2003   |                              |                         |          |           |               |           |               |                |
| Estimate    | 0.415                        | -0.107                  | -0.166   | 0.308     | 7.750         | 2.045     | 2.574         | 15.407         |
| p-value     | 0.333                        | <0.001                  | 0.651    | 0.611     | <0.001        | 0.850     | 0.199         | <0.001         |
| Jan. 2004   |                              |                         |          |           |               |           |               |                |
| Estimate    | 0.090                        | -0.107                  | -0.018   | 0.803     | 8.124         | 1.074     | 3.024         | 10.654         |
| p-value     | 0.825                        | <0.001                  | 0.947    | 0.273     | <0.001        | 0.937     | 0.116         | <0.001         |

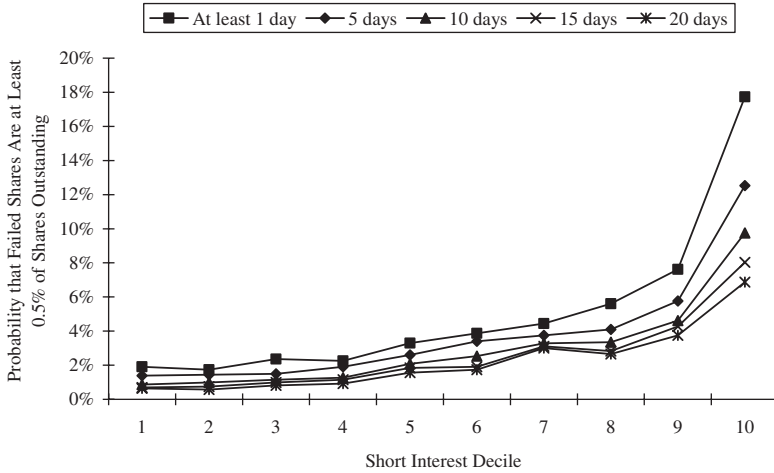


Fig. 6. Probability of fail versus short interest decile. It shows the probability that an issue has failed-to-deliver shares of at least 0.5% of its shares outstanding as a function of short interest decile and the minimum age of failed shares. Short interest is short interest divided by shares outstanding. Short interest decile breakpoints, calculated for each of the 3 time periods, are determined from the pooled observations of listed stocks. Fig. 6 reports the probability, averaged across the 3 time periods, at each breakpoint.

cutoffs of one, five, ten, fifteen, and twenty days. Fig. 6 suggests that the probability of having large fails increases with short interest decile for each of the age cutoffs. These findings provide further evidence consistent with the hypothesis that, at least to some extent, fails result from strategic decisions not to borrow stocks against short sales when borrowing costs are high. However, it is important to note that D'Avolio finds that borrowing costs versus short interest decile are U-shaped. Specifically, stocks with the least short interest are also expensive to borrow. He concludes (as suggested by Chen et al., 2002) that at the very lowest short interest deciles, stocks are not shorted *because* they are too expensive to borrow. In contrast, we find no U-shape for fails versus short interest. One possible explanation is that naked short sellers (i.e., those who strategically fail) are unwilling to be the lone bet against the crowd. In fact, they may base their decisions to be short, at least in part, on signals provided by legitimate short sellers. Another explanation is that naked short sales simply account for a large fraction of reported short interest (prior to Regulation SHO).

To further examine this, we calculate average short interest and average delivery failures (of at least one day), each as a percentage of shares outstanding (Table 5). Average failures increase with short interest decile. At the lowest levels of short interest, fails exceed short interest. At the highest short interest deciles, fails are about 4% of short interest. Overall, fails average 5.7% of the short interest reported for listed stocks.

## 5. Why clearing members do not force delivery

Any clearing member with a failure-to-receive position has the option of notifying the NSCC that it wants to try to force delivery of ("buy in") some or all of that position. Evans et al. (2003) provide evidence that buy-ins may be rarely requested. Using fails and

Table 5

Average failed shares and short interest versus short interest decile

This table reports average short interest and fails-to-deliver as a percentage of shares outstanding for each short interest decile. Data on fails-to-deliver are from the National Securities Clearing Corporation for 3 dates: Sept. 23, 2003; Nov. 17, 2003; and Jan. 21, 2004. Monthly short interest data are from NYSE, AMEX, or Nasdaq for the most recent report prior to the fails report date. Short interest deciles are formed and cross-sectional averages calculated for each of the 3 time periods. Results are for stocks listed on NYSE, AMEX, or Nasdaq.

| Short interest decile | Average short interest as percent of shares outstanding | Average fails of at least one day as percent of shares outstanding | Average fails as percent of average short interest (%) |
|-----------------------|---------------------------------------------------------|--------------------------------------------------------------------|--------------------------------------------------------|
| 1 (Smallest)          | 0.01                                                    | 0.05                                                               | 500.0                                                  |
| 2                     | 0.05                                                    | 0.07                                                               | 140.0                                                  |
| 3                     | 0.15                                                    | 0.08                                                               | 53.3                                                   |
| 4                     | 0.33                                                    | 0.08                                                               | 24.2                                                   |
| 5                     | 0.66                                                    | 0.08                                                               | 12.1                                                   |
| 6                     | 1.14                                                    | 0.08                                                               | 7.0                                                    |
| 7                     | 1.82                                                    | 0.11                                                               | 6.0                                                    |
| 8                     | 2.95                                                    | 0.13                                                               | 4.4                                                    |
| 9                     | 5.11                                                    | 0.22                                                               | 4.3                                                    |
| 10 (Largest)          | 13.85                                                   | 0.61                                                               | 4.4                                                    |
| Overall               | 2.61                                                    | 0.15                                                               | 5.7                                                    |

buy-in data from one major options market maker for the period 1998–1999, they find that the market maker failed to deliver all or at least a portion of the shares in 69,063 transactions. The market maker was bought-in on only 86 of these positions. An interesting question is why clearing members that fail to receive shares allow the fails to persist.<sup>27</sup> The following explanations have been suggested by market participants.

- (1) Costs of failures to receive are small. Regardless of whether shares are delivered, long and short positions are marked-to-market each day. Although long positions that fail to receive shares forego the opportunity to lend them, short interest levels and lending as a percentage of outstanding shares are low on average.
- (2) Clearing member may have to recall stock loans that have been made via the National Securities Clearing Corporation (NSCC) before requesting buy-ins.<sup>28</sup>
- (3) Bought-in shares will themselves have a high probability of delivery failure.
- (4) Firms that fail to receive, by not forcing delivery, hope to bank future goodwill with those that fail to deliver.

Although short interest and stock loans are low unconditionally for the cross-section of stocks in U.S. markets, strategic delivery failures occur for stocks that are expensive to borrow and therefore valuable to receive to lend. Thus, the first explanation is an unlikely one when delivery failures are strategic. The costs of issuing loan recalls (explanation 2

<sup>27</sup>We thank the anonymous referee for suggesting that we examine this question. We also thank him or her for many helpful insights provided for this analysis.

<sup>28</sup>Clearing members have the option to participate in NSCC's Stock Borrow Program, in which they authorize NSCC to lend their shares.

above) or buying-in failed shares (explanation 3 above) are likely small and more than offset when stocks are special. Earning a reputation for forcing delivery may be quite costly, however. The clearing member that fails to receive shares of one stock may itself have fails-to-deliver of another stock or expect to fail to deliver shares in the future. Firms that never force delivery may earn a sort of “quid pro quo” from others. In addition, reputation concerns could extend beyond the clearing and settlement process. The party that does not force delivery might hope to bank goodwill (or at least not create ill will) with counterparties that are underwriters with access to potentially valuable IPO shares in the future. Counterparties from the same geographic area may know and interact with each other, further influencing the decision to allow the fail to continue.

To analyze whether reputation concerns and goodwill motivate firms that allow others to fail to deliver shares to them, we examine whether firms that fail to receive also have fails-to-deliver in other stocks. We also examine the extent to which underwriters are allowed to fail to deliver and the extent to which counterparties are in the same metropolitan area.

As noted in Section 3, we are able to observe from the data the fails-to-deliver (shares and price marked-to-market) for each clearing firm for each security along with the age of the fail (in days). We also are able to observe for each stock the clearing firms that have been allocated fails-to-receive by the NSCC. For fails-to-receive, we can observe the shares and price marked-to-market by clearing firm by stock. We do not observe how NSCC has matched the individual firms that fail to deliver with the individual firms that fail to receive shares, however. Nor do the data indicate the specific age of fails-to-receive for each firm. Thus, we know the age of fails to receive only if all the firms that fail to deliver that stock have fails of the same age. And we know the identities of those who have allowed fails only if the stock has just one firm that fails to deliver or one firm that fails to receive.

For example, if stock *X* has just one firm (Firm A) that fails to deliver for *Y* days and the NSCC assigns the resulting fails to 2 firms, then we know with certainty that each of those 2 firms has let Firm A fail to deliver for *Y* days. Unfortunately, if the stock has multiple firms with fails-to-deliver and multiple firms with fails-to-receive, then there can be ambiguity not just as to the age of the fails-to-receive of the various firms but also as to the identities of who has allowed whom to fail to deliver.

We handle these ambiguities by assigning fails-to-receive with fails-to-deliver by simply prorating fails-to-receive against fails-to-deliver. For example, suppose a stock has 2 firms (A and B) that fail to deliver and 2 firms (C and D) that fail to receive. We can observe from the data that Firm A fails to deliver 3 million shares for 10 days and Firm B fails to deliver 2 million shares for 1 day. If Firm C fails to receive 1 million shares and Firm D fails to receive 4 million shares, then we assume that Firm C has let Firm A fail to deliver  $(1 \cdot 3)/(3 + 2)$  million shares for 10 days and Firm B fail to deliver  $(1 \cdot 2)/(3 + 2)$  million shares for 1 day. Similarly, we assume that Firm D has let Firm A fail to deliver  $(4 \cdot 3)/(3 + 2)$  million shares for 10 days and Firm B fail to deliver  $(4 \cdot 2)/(3 + 2)$  million shares for 1 day.

To determine whether firms are underwriters and whether counterparties are in the same metropolitan area, we obtain clearing identifier numbers, firm names, and headquarter addresses from the Depository Trust Clearing Corporation web page directory of member firms. We match these against our data, which indicate clearing identifier numbers only. Using the firm names, we define a firm as an underwriter if it is one

Table 6

Why clearing firms do not force delivery

This table reports persistent and non-persistent fails-to-deliver by whether the firms that fails to deliver (“FTD”) or fails to receive (“FTR”) are underwriters or share the same metropolitan area for their headquarters. Persistent fails are defined as those that last for 5 days or longer. Non-persistent fails are those that last less than 5 days. The table also shows dollar-weighted betas and the number of firms that fail to deliver and fail to receive in the persistent and non-persistent categories. The number of the firms with the largest amount of fails that account for 50% and 75% of the fails in each category are shown. Finally, the number of firms in each category with no persistent and non-persistent fails to deliver or receive are given. Statistics are calculated for each of the 3 dates (Sept. 23, 2003; Nov. 17, 2003; and Jan. 21, 2004), and the averages are reported.

|                                                                            | Persistent fails |                  | Non-persistent fails |                  |
|----------------------------------------------------------------------------|------------------|------------------|----------------------|------------------|
| Total dollar volume (in billions)                                          | \$1.206          |                  | \$1.109              |                  |
| <i>Dollar volume of for which:</i>                                         |                  |                  |                      |                  |
| FTD is an underwriter                                                      | 26.7%            |                  | 55.0%                |                  |
| FTR is an underwriter                                                      | 47.7%            |                  | 44.0%                |                  |
| Neither is an underwriter                                                  | 37.7%            |                  | 26.7%                |                  |
| FTD and FTR have same location                                             | 35.0%            |                  | 65.3%                |                  |
| FTD and FTR have same location and neither is an underwriter               | 5.7%             |                  | 10.7%                |                  |
| Dollar-weighted beta                                                       | 0.97             |                  | 0.96                 |                  |
|                                                                            | Fails-to-deliver | Fails-to-receive | Fails-to-deliver     | Fails-to-receive |
| Number of clearing firms                                                   | 173              | 276              | 203                  | 278              |
| <i>Number of clearing firms whose combined fails in this category are:</i> |                  |                  |                      |                  |
| 50% of total fails in this category                                        | 6                | 16               | 8                    | 12               |
| 75% of total fails in this category                                        | 14               | 35               | 22                   | 28               |
| <i>Number of clearing firms with:</i>                                      |                  |                  |                      |                  |
| No persistent fails-to-deliver                                             | —                | 118              | 43                   | 119              |
| No non-persistent fails-to-deliver                                         | 13               | 96               | —                    | 97               |
| No persistent fails-to-receive                                             | 15               | —                | 23                   | 4                |
| No non-persistent fails-to-receive                                         | 14               | 3                | 22                   | —                |

of the top 20 managing underwriters or top 20 non-managing underwriters according to Cooney et al. (2004).<sup>29</sup>

As in the previous section, we define *persistent* fails as those that are at least 5 days old and use these as a proxy for strategic fails-to-deliver. Table 6 shows that for 26.7% of the persistent fails dollar volume, the clearing firm that fails to deliver is an underwriter.<sup>30</sup> Interestingly, for persistent fails, underwriters have a greater share of fails-to-receive (47.7% of fails) than of fails-to-deliver. Underwriters' share of persistent fails-to-deliver is also much less than their share of *non*-persistent fails (i.e., fails of less than 5 days), with underwriters responsible for 55.0% of non-persistent fails-to-deliver. Although about two-thirds (65.3%) of non-persistent fails and a third (35.0%) of persistent fails occur between clearing firms located in the same metropolitan area, this is often because one or both firms are underwriters, located in New York. When underwriters are excluded, the percentage of

<sup>29</sup>See Cooney et al. (2004) Panel D of Table IX for the top 20 manager banks based on IPO share allocation during 1999–2002 and Table VIII for the top 20 non-manager banks.

<sup>30</sup>The statistics reported in Table 6 are the averages of the statistics calculated for each of the 3 data sets (Sept. 2003, Nov. 2003, and Jan. 2004).

fails for which the firms that fail to deliver and fail to receive share the same geographic location drops to just 10.7% for non-persistent fails and to 5.7% for persistent fails.

Table 6 also reports dollar-weighted betas for persistent and non-persistent fails.<sup>31</sup> For each fails category, the dollar-weighted beta is close to 1 (specifically, 0.97 for persistent fails and 0.96 for non-persistent fails), which suggests that the decision to allow others to fail to deliver is not likely to be driven by stock risk considerations. Perhaps this is not surprising given that payment is not made until shares are delivered and clearing firm accounts are marked-to-market (with cash adjustments) daily by NSCC until shares are delivered.

More interestingly, Table 6 shows that of the 173 firms with fails-to-deliver, all but 15 have persistent fails-to-receive in other stocks. Persistent fails-to-receive are distributed across more clearing firms (276), and 118 of these are responsible for no persistent fails-to-deliver in any stocks. The 6 firms with the largest dollar volumes of persistent fails-to-deliver are responsible for half the persistent fail volume, with the next 8 firms accounting for another 25%.

To understand better which firms are allowed long-lived fails, we performed Tobit regressions of clearing firm total fails-to-deliver (dollar volume) as a function of whether the firm that fails to deliver is an underwriter (dummy equals 1 if so), the firm's persistent fails-to-receive, and non-persistent fails-to-deliver and fails-to-receive. More active firms are likely to have higher volumes of both non-persistent fails-to-deliver and non-persistent fails-to-receive. If active firms are more likely to fail to deliver strategically, then persistent fails-to-deliver will be positively related to both non-persistent fails-to-deliver and non-persistent fails-to-receive. If firms earn the right to fail to deliver strategically (i.e., have persistent fails-to-deliver) because they themselves allow others to fail to deliver to them, then a firm's persistent fails-to-deliver and its persistent fails-to-receive should be positively related.

The regressions were performed separately for each of the 3 time periods. We included all clearing firms in the data set in the regression, even if they had no fails-to-deliver. Although firms' strategic fails may be lumpy, they may always allow others to fail to deliver to them to preserve their reputation for not forcing delivery and to bank future goodwill. To test for this as best we can with our data limitations, we perform the regression also on the combined dataset. Specifically, to create the "combined dataset", we sum each of the firm's fail variables over the 3 time periods (i.e., Sept. 2003, Nov. 2003, and Jan. 2004).

The results, reported in Panel A of Table 7, indicate that the coefficient for the firm's non-persistent fails-to-deliver is positive and highly significant in all regressions. This positive relationship suggests that more active firms may be more likely to fail strategically. Persistent fails-to-deliver do not increase with the firm's volume of non-persistent fails-to-receive, however, which is also a proxy for the firm's activity. In fact, the positive relationship between a firm's persistent and non-persistent fails-to-deliver may have a more ominous explanation. All persistent fails-to-deliver begin (and would be measured for 4 consecutive days if we had continuous daily data) as non-persistent fails-to-deliver. Firms that consistently have more strategic fails-to-deliver must therefore also have non-persistent fails-to-deliver that will be measured as persistent fails only after 4 days. There is

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<sup>31</sup> Betas are calculated using daily returns for the prior year. The market return is based on all U.S. listed stocks. Dollar-weighted betas are calculated using the dollar amounts of fails in each stock as weights.

Table 7

Tobit regressions of clearing firm fails to deliver and receive

This table reports results of Tobit regressions of clearing firm persistent fails-to-deliver (Panel A) and persistent fails-to-receive (Panel B). Explanatory variables are an underwriter dummy, the clearing firm's non-persistent fails-to-deliver and fails-to-receive, and persistent fails-to-receive (Panel A) and persistent fails-to-deliver (Panel B). Regressions were run separately for each time period of fails data (Sep. 2003, Nov. 2003, and Jan. 2004) and also for the combined data sets. Fail variables are the clearing firm's totals across all stocks (in dollars). Variables are further defined in Section 5.

| Time period                                                 | Underwriter dummy<br>(10 <sup>7</sup> ) | Non-persistent fails-<br>to-deliver | Non-persistent fails-<br>to-receive | Persistent fails-to-<br>receive     |
|-------------------------------------------------------------|-----------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|
| <i>Panel A: Clearing firm's persistent fails-to-deliver</i> |                                         |                                     |                                     |                                     |
| Sep. 2003                                                   |                                         |                                     |                                     |                                     |
| Estimate                                                    | −0.416                                  | 0.448                               | −0.628                              | 0.471                               |
| p-value                                                     | 0.466                                   | <0.001                              | 0.035                               | 0.037                               |
| Nov. 2003                                                   |                                         |                                     |                                     |                                     |
| Estimate                                                    | −0.496                                  | 1.264                               | −0.234                              | −0.068                              |
| p-value                                                     | 0.309                                   | <0.001                              | 0.308                               | 0.715                               |
| Jan. 2004                                                   |                                         |                                     |                                     |                                     |
| Estimate                                                    | −0.437                                  | 0.584                               | −0.303                              | 0.464                               |
| p-value                                                     | 0.346                                   | <0.001                              | 0.120                               | 0.018                               |
| Combined data sets                                          |                                         |                                     |                                     |                                     |
| Estimate                                                    | −1.894                                  | 0.839                               | −0.429                              | 0.126                               |
| p-value                                                     | 0.159                                   | <0.001                              | 0.095                               | 0.520                               |
| Time period                                                 | Underwriter dummy<br>(10 <sup>7</sup> ) | Non-persistent fails-<br>to-deliver | Non-persistent fails-<br>to-receive | Non-persistent fails-<br>to-deliver |
| <i>Panel B: Clearing firm's persistent fails-to-receive</i> |                                         |                                     |                                     |                                     |
| Sep. 2003                                                   |                                         |                                     |                                     |                                     |
| Estimate                                                    | 0.830                                   | 0.101                               | 0.456                               | 0.018                               |
| p-value                                                     | <0.001                                  | <0.001                              | <0.001                              | 0.447                               |
| Nov. 2003                                                   |                                         |                                     |                                     |                                     |
| Estimate                                                    | 0.725                                   | 0.337                               | 0.430                               | −0.052                              |
| p-value                                                     | <0.001                                  | <0.001                              | <0.001                              | 0.078                               |
| Jan. 2004                                                   |                                         |                                     |                                     |                                     |
| Estimate                                                    | 0.552                                   | 0.120                               | 0.455                               | 0.030                               |
| p-value                                                     | <0.001                                  | <0.001                              | <0.001                              | 0.258                               |
| Combined data sets                                          |                                         |                                     |                                     |                                     |
| Estimate                                                    | 1.747                                   | 0.221                               | 0.445                               | −0.016                              |
| p-value                                                     | <0.001                                  | <0.001                              | <0.001                              | 0.505                               |

some evidence (for the September and January time periods) that persistent fails-to-deliver increase with the firm's persistent fails-to-receive, consistent with the goodwill explanation.

To better understand which firms *allow* long-lived fails, we next performed similar regressions using clearing firm total fails-to-receive as the dependent variable. The same explanatory variables were used as above except that the firm's persistent fails-to-receive were replaced with the firm's persistent fails-to-deliver. The results are reported in Panel B of Table 7. For each time period, a firm's fails-to-receive increase with its non-persistent fails-to-deliver and with its non-persistent fails-to-receive. This suggests that more active firms are more likely to allow others to fail to deliver strategically. Fails-to-receive also increase if the firm is itself an underwriter. For the November 2003 time

period, persistent fails-to-receive decrease as persistent fails-to-deliver increase. There is no evidence that firms with more persistent fails-to-receive are more likely to fail to deliver strategically.

The results in Table 6 indicate that firms that fail to deliver strategically sometimes are underwriters and sometimes share the same geographic area with those that allow them to fail. More often this is not the case, however. In fact, many of the firms that allow others to fail are responsible for fails-to-deliver in other stocks. Taken together, the results in Tables 6 and 7 suggest that many firms simply are unwilling to earn a reputation for forcing delivery and hope to receive quid pro quo, even if their own expected probability or frequency of failing to deliver is low.

## 6. Implications of Regulation SHO for U.S. equities

We document that, prior to Regulation SHO, most U.S. equity issues, listed and unlisted, experienced at least a small percentage of failures-to-deliver each day. A substantial fraction of issues (42% of listed stocks and 47% of unlisted stocks) had persistent fails of 5 days or more. About 4% of U.S. equity issues had fails that would have classified them as “threshold” securities with mandatory close-out requirements under Regulation SHO.

We find evidence consistent with the hypothesis that pre-Regulation SHO, equity and options market makers strategically failed to deliver shares that were expensive or impossible to borrow. We also provide evidence that strategic fails (i.e., naked short sales) likely accounted for a higher percentage of short interest pre-Regulation SHO than previously understood. These findings support comments of equity and market makers that the inability to strategically fail to deliver shares post-Regulation SHO will reduce liquidity and increase short-sale constraints. The following predictions may provide interesting areas for future research. Post-Regulation SHO:

- Liquidity will decrease and short-sale constraints will increase, particularly for stocks that are expensive to borrow. As institutions are more likely to be lenders in the market for stock loans, stocks with little institutional ownership will likely become even less liquid.
- Options listings will decrease for stocks that are expensive to borrow.
- Short interest will decrease, especially for expensive-to-borrow stocks.<sup>32</sup>
- As a result of or in anticipation of mandatory close-outs, illiquid, expensive-to-borrow stocks may be more likely to experience temporary short squeezes and increased price volatility.

Finally, we document that, at least pre-Regulation SHO, many of the firms that allow others to fail to deliver to them are themselves responsible for fails-to-deliver in other stocks. Our findings suggest that many firms allow others to fail strategically simply because they are unwilling to earn a reputation for forcing delivery and hope to receive quid pro quo for their own strategic fails.

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<sup>32</sup>Preliminary results by Diether et al. (2005) show that short-selling dropped quite significantly for Nasdaq stocks immediately after appearing on the Reg SHO threshold list during first quarter 2005.

## References

- Chen, J., Hong, H., Stein, J.C., 2002. Breadth of ownership and stock returns. *Journal of Financial Economics* 66, 171–205.
- Chen, H., Singal, V., 2003. Role of speculative short sales in price formation: the case of the weekend effect. *Journal of Finance* 58, 685–705.
- Christoffersen, S.E.K., Geczy, C.C., Musto, D.K., Reed, A.V., 2002. The market for record-date ownership. Working paper, Wharton.
- Christoffersen, S.E.K., Geczy, C.C., Musto, D.K., Reed, A.V., 2004. How and why do investors trade votes, and what does it mean? Working paper, Wharton.
- Christophe, S.E., Ferri, M.G., Angel, J.J., 2004. Short-selling prior to earnings announcements. *Journal of Finance* 59, 1845–1875.
- Cooney, J.W., Hill, C.L., Jordan, B.D., Singh, A.K., 2004. Who is #1? A new approach to ranking U.S. IPO underwriters. Working paper, Texas Tech.
- D’Avolio, G., 2002. The market for borrowing stock. *Journal of Financial Economics* 66, 271–306.
- Desai, H., Ramesh, K., Thiagarajan, S.R., Balachandran, B.V., 2002. An investigation of the informational role of short interest in the Nasdaq market. *Journal of Finance* 57, 2263–2287.
- Diether, K., Lee, K., Werner, I.M., 2005. Can short-sellers predict returns? Daily evidence. Working paper, Ohio State.
- Duffie, D., Garleanu, N., Pedersen, L., 2002. Securities lending, shorting, and pricing. *Journal of Financial Economics* 66, 307–339.
- Evans, R.B., Geczy, C.C., Musto, D.K., Reed, A.V., 2003. Failure is an option: impediments to short selling and option prices. Working paper, Wharton.
- Fleming, M.J., Garbade, K.D., 2002. When the back office moved to the front burner: settlement fails in the treasury market after 9/11. *Federal Reserve Bank of New York Economic Policy Review*, November, 35–57.
- Geczy, C.C., Musto, D.K., Reed, A.V., 2002. Stocks are special too: an analysis of the equity lending market. *Journal of Financial Economics* 66, 241–269.
- Jones, C.M., Lamont, O.A., 2002. Short sale constraints and stock returns. *Journal of Financial Economics* 66, 207–239.
- Lamont, O.A., 2003. Go down fighting: short sellers vs. firms. Working paper, Yale.
- Lamont, O.A., Thaler, R.H., 2003. Can the market add and subtract? Mispricing in tech stock carve outs. *Journal of Political Economy* 111, 227–268.
- Reed, A.V., 2003. Costly short selling and stock price adjustment to earnings announcements. Working paper, University of North Carolina.