

Strategic Delivery Failures in U.S. Equity Markets

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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 dataset of the entire cross-section of U.S. equities, we document the pervasiveness of delivery failures and provide evidence consistent with the hypothesis that market makers strategically fail to deliver shares when borrowing costs are high. We also discuss the implications of these findings for short-sale constraints, short interest, liquidity, price volatility, and options listings in the context of the recently adopted Securities and Exchange Commission Regulation SHO.

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 failures can result from errors or delays caused by investors holding securities in physical rather than book-entry form. Recent work by Evans, Geczy, Musto, and Reed (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 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.¹

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.”² 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 should become more tightly constrained when Rule 203 becomes effective in January 2005.

This paper has three goals. First, it provides an empirical description of delivery failures in U.S. equity markets prior to Regulation SHO. It then provides evidence

¹ Although Evans, Geczy, Musto, and Reed (2003) introduce the idea of strategic fails for equity markets, Fleming and Garbade (2002) provide a detailed discussion of strategic fails in Treasury markets.

² See SEC adopting release, page 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. This paper addresses Rule 203.

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. Finally, it discusses the implications of Rule 203 of Regulation SHO for short-selling constraints, short interest, liquidity, price 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 errors or 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 accounted for a higher percentage of short interest pre-Regulation SHO than previously understood.

In summary, these 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. Stocks that trade on the Over-the-Counter Bulletin Board and Pink Sheets are likely to be among the hardest hit. 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 (e.g., for introductions to the literature, see Chen, Hong and Stein, 2002; Lamont and Thaler, 2003). In particular, it extends our understanding of short sales and short interest in U.S. equity markets (e.g., see Desai, Ramesh, Thiagarajan, and Balachandran, 2002; Chen and Singal, 2003; Christophe, Ferri, and Angel, 2004), stock loan markets (see D'Avolio, 2002; Duffie, Garleanu, and Pedersen, 2002; Geczy, Musto, and Reed, 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 I describes the institutional framework that provided opportunities for strategic delivery failures in equity markets in the past and the changes in requirements under Regulation SHO. Section II provides the empirical description of delivery failures prior to Regulation SHO. Section III presents the evidence consistent with strategic delivery failures. Section IV discusses the implication of Regulation SHO for short-sale constraints, short interest, liquidity, price volatility, and options listings, and offers suggestions for future research.

I. Institutional framework in which delivery failures can occur

I.A. The clearing and settlement process

In U.S. equity markets, sellers are required to deliver shares in return for payment by the third day following the transaction (i.e., “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 thru 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 any failure-to-deliver (and matching failure-to-receive) position, if it exists, for each issue for each clearing member.

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 failed deliveries on T+3.³

Clearing members have the option to participate in NSCC’s Stock Borrow Program. Specifically, the participating members authorize the NSCC to lend their shares, held in book-entry form at the DTC, to attempt to cover or avoid fail-to-deliver positions. The Stock Borrow Program is not always sufficient to eliminate or avoid fails, however. And the NSCC does not lend more shares than it has available through the Stock Borrow Program.⁴

³ 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.

⁴ See NSCC Comment Letter on Proposed Regulation SHO, dated April 7, 2004, available at <http://www.sec.gov/rules/proposed/s72303.shtml>.

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. The NSCC then notifies clearing members with fail-to-deliver positions in that security by sending “re-transmittal notices”. If more than one clearing member has a fail-to-deliver position in that security and the amount of shares requested for the buy-in is less than the total failed shares, some clearing members may not be sent re-transmittal notices. The NSCC prioritizes notification according to the age of the failure-to-deliver position: members with the oldest fail positions receive the re-transmittal notices.⁵ If these clearing members do not deliver shares as requested within 2 days after the buy-in request, the failure-to-receive party has the option to request that NSCC buy in the securities. The NSCC then executes the buy-in order to purchase the shares and passes any loss on to the parties that failed to deliver.

Evans, Geczy, Musto, and Reed (2003) provide evidence that buy-ins may be rarely requested. Using fails and 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. Evans et al emphasize that it is unclear whether this low buy-in rate (0.12%) is typical for other market participants.

Various explanations have been suggested for why clearing members do not always request buy-ins. First, regardless of whether shares are delivered, long and short positions are marked-to-market each day. Long positions that fail to receive shares forego the opportunity to lend shares, but this may not present much of an opportunity cost as short interest levels and lending as a percentage of shares outstanding are quite

⁵ See NSCC Comment Letter on Proposed Regulation SHO, page 7.

low on average.⁶ Another possible explanation is that those who are active lenders in the stock loan market may have to recall loans they themselves have made before requesting buy-ins. An additional consideration is that the bought-in shares may have a high probability of failing-to-deliver, especially in the case of hard-to-borrow, illiquid stocks. For example, those who receive re-transmittal notices have 2 days to deliver shares. Shares can then be bought-in, but these shares do not settle for another 3 days. These shares in turn may fail-to-deliver. The fail-to-receive party will have expended effort, a week will have passed, and he or she will still have a fail-to-receive position in the security.

I.B. Short sales pre-Regulation SHO

The NYSE and NASD require that their members accept or enter orders to sell short only if prior arrangements have been made to borrow the stock or they have other acceptable assurances that the stock can be borrowed and delivered on the settlement date. Members often maintain “easy-to-borrow” lists of the securities which they believe can be readily borrowed. Specifically, stock loans for these securities typically are arranged after the short sale is executed.⁷ Some members maintain “hard-to-borrow” lists to alert them to stocks that are difficult or expensive to borrow. Some members may rely on “customer assurances” that stocks can be borrowed, although recent NYSE examinations indicate that this practice is “problematic”.⁸

⁶ D’Avolio (2002) reports that as of June 2001, short interest in listed stocks was 1.7% of market capitalization, and that for second quarter 2001, only 7% of U.S. equity loan capacity was utilized. The exceptions to this may be around voting dates and dividend record dates (see Christoffersen, Geczy, Musto, and Reed, 2002 and 2004).

⁷ In addition to NSCC’s Stock Borrow Program, 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, Garleanu, and Pedersen (2002) provide descriptions of the U.S. markets for stock loans.

⁸ See NYSE Comment Letter on Proposed Regulation SHO, dated March 1, 2004.

These NYSE and NASD rules are applicable to all stocks, including those traded over-the-counter. Short sales by specialists, market makers, and odd-lot dealers are exempt to the extent that they are fulfilling their obligations as market makers, however. NASD rules further exempt short sales that are made for hedging or arbitrage purposes.⁹

NYSE rules dictate that its members can fail to deliver shares only after a diligent effort has been made to borrow shares. NASD rules prohibit further selling in an issue if the party currently has an open failure-to-deliver position for at least 60 days in that security. NASD has a mandatory close-out requirement (Rule 11830) that applies to Nasdaq securities with total fails-to-deliver of at least 0.5% of shares outstanding and at least 10,000 shares. Positions in these securities that have failed-to-deliver for at least 10 business days must be closed out by the broker-dealer who represents the seller. NASD exempts market making, hedging, and arbitrage transactions from this close-out requirement, however.

I.C. Short sales post-Regulation SHO

Rule 203 of Regulation SHO, with a compliance date of January 3, 2005, 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.

With regard to the locate requirement, the SEC adopting release states:

“Rule 203(b) creates a uniform Commission rule requiring a broker-dealer, prior to affecting a short sale in any equity security, to ‘locate’ securities available for borrowing. For covered securities, Rule 203 supplants current overlapping SRO [i.e., self-regulatory organizations NYSE and NASD] rules. Specifically, the rule prohibits a broker-dealer from accepting a short sale order in any equity security from another

⁹ 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>.

person, or effecting a short sale order from the broker-dealer's own account unless the broker-dealer has (1) borrowed the security, or entered into an arrangement to borrow the security, or (2) has reasonable grounds to believe that the security can be borrowed so that it can be delivered on the date delivery is due. The locate must be made and documented prior to effecting a short sale, regardless whether the seller's short position may be closed out by purchasing securities the same day."¹⁰

Broker-dealers can rely on easy-to-borrow lists as "reasonable grounds" if the lists are less than 24 hours old. Short sales executed by market makers, including specialists and options market makers, are exempt from the locate requirement. Hedges by non-market makers are not exempt.

With regard to the mandatory close-out requirement, Rule 203 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.¹¹ Rule 203 further requires that 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.¹²

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-

¹⁰ SEC Regulation SHO Adopting Release, pages 27-28.

¹¹ The stock then discontinues its threshold status as soon as its aggregate fails no longer exceed the threshold parameters for 5 consecutive settlement days.

¹² 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.

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.

Market makers, including specialists and options market makers, are not exempt from the close-out provisions. Nor are they exempt from the prior-borrowing requirement for additional short sales by those with extended fails in threshold securities. Short sales by hedgers and arbitrageurs are not exempt. There is a limited exception for options market makers that hedge options positions established prior to the security’s achieving threshold status.

Table 1 provides a comparison of borrowing, delivery, and close-out requirements pre- and post-Regulation SHO.

I.D. Strategic fails pre-Regulation SHO

Prior to adopting Regulation SHO, the SEC requested comments from market participants. Comments from market makers suggest delivery failures pre-Regulation SHO may be, at least in part, the result of strategic fails by equity and options market makers.

The comment letter of the Specialist Association of the NYSE, dated February 13, 2004, states:

“specialists on the NYSE are subject to meaningful affirmative obligations to make markets at all times... These affirmative obligations require them to make markets even when a listed security, for whatever reason, has become temporarily illiquid or when a significant balance exists between the buy and sell sides of the market for that security. Making markets under such circumstances necessarily entails risk that, when a specialist goes short to satisfy demand and provide liquidity to buyers, the specialist may

encounter unusual and sometimes insurmountable difficulty in obtaining securities to borrow and deliver against those short sales.”¹³

The NASD comment letter states that without a market maker exemption from the proposed delivery requirements, “thinly traded stocks will become less liquid and more vulnerable to disorderly markets and short squeezes.”¹⁴

The comment letter from Knight Trading Group argues that a lack of an exemption for equity market makers:

“could have a significant impact on market makers for bulletin board stocks, which tend to be the most illiquid. 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. The Commission’s proposal which forces the market maker to cover its short position in the abbreviated timeframe ... will greatly alter the market maker’s risk-reward balance, likely tipping the scales against selling short to meet temporary imbalances in buying interest. This loss of market maker liquidity will add to the volatility of stocks already highly prone to wide price swings due to their illiquid nature.”¹⁵

The comment letter further notes:

“The Commission’s proposal would also create an opportunity for the prospective sellers to ‘squeeze’ the market maker, by offering the stock at artificially high prices that the market maker has little choice but to accept due to regulatory time constraints.”¹⁶

With regard to options market makers, Susquehanna Group International’s comment letter states:

“The absence of exemptions from these provisions for options market makers will have a chilling effect on their willingness to commit capital to the markets. The substantial risk will be reflected in reduced liquidity and efficiency in the marketplace,

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

¹⁴ See comment letter, NASD, dated March 25, 2004.

¹⁵ See comment letter, Knight Trading Group, dated January 6, 2004.

¹⁶ See comment letter, footnote 23.

which will result in additional costs to the public. It could also prompt a departure of market makers in significant numbers.”¹⁷

The Pacific Exchange’s comment letter states that without an exemption for options market makers (“OMM’s”), the proposed rule’s delivery requirements:

“will make it essentially impossible for OMM’s to fulfill their obligations and will completely disrupt the options market. OMM’s will likely be restricted by their clearing firms from trading hard-to-borrow securities, which will make it impossible to hedge exposure arising from their market making activities. As a result, OMM’s ability to provide liquidity to the market place will be decreased. Such an effect will impair the OMM’s to make markets and eventually increase costs to investors.”¹⁸

The comment letter jointly written by the American Stock Exchange, the Chicago Board Options Exchange, the International Securities Exchange, the Options Clearing Corporation, the Pacific Exchange, and the Philadelphia Exchange, echoes the concerns expressed by the Pacific Exchange, further arguing 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.”¹⁹

As discussed in the last section, equity and options market makers had the opportunity to fail strategically prior to Regulation SHO because they were exempt from NYSE and NASD “locate” requirements and from NASD’s mandatory close-out requirement. As discussed in Section I.A., *some* fails may be unintentional, simply the result of human or mechanical error or delays because long sales are made by retail investors who hold shares in physical form. It is unlikely that unintentional errors or delays explain long-lived fails-to-deliver, however. Thus, we will categorize fails as short-lived or long-lived (“persistent”) fails using various fail-age cutoffs. The following

¹⁷ See Susquehanna Group International’s comment letter, dated March 19, 2004.

¹⁸ See the Pacific Exchange’s comment letter, dated February 6, 2004, page 4.

¹⁹ See Joint Options Exchange comment letter, dated February 9, 2004.

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.

Options are listed on roughly one-third of the equity issues that are listed on NYSE, AMEX, and Nasdaq.²⁰ Options market makers may maintain short stock positions for longer periods than equity market makers. Thus, 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.

²⁰ Very few stocks traded on the OTCBB or Pink Sheets have options listings. The exceptions are recently de-listed issues (e.g., UAL) that trade over-the-counter post-delisting. Options on these stocks can continue to trade until their expiration.

II. 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. These include stocks listed on the NYSE, AMEX, and Nasdaq, as well as those stocks 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.

To obtain the complete dataset of all U.S. stocks, 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 www.yahoo.com for all OTCBB and Pink Sheet stocks.
- Total shares outstanding, from the Center for Research in Securities Prices (“CRSP”), Compustat, and Bloomberg.
- Monthly short interest for listed shares, from NYSE, AMEX, and Nasdaq.
- Institutional holdings, from Thomson/Spectrum/CDA.
- 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.²¹

For listed stocks, the dataset includes all ordinary shares, as defined by CRSP.²² For stocks not listed on NYSE, AMEX, or Nasdaq (i.e., “unlisted stocks”), the dataset 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.²³

Table 2 shows descriptive statistics for the dataset.²⁴ 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 dataset 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 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. Institutional ownership (institutional holdings divided by shares outstanding) averages 41% for listed stocks. Not surprisingly, institutional ownership of the unlisted stocks is negligible (1.3%). Monthly short interest (short interest divided by shares outstanding) averages 2.6% for listed stocks for the

²¹ www.optionsclearing.com.

²² We exclude ADRs, shares of beneficial interest, and units. Specifically, we keep cusips with ShrCD = 10, 11, 12, 14, 15, or 18.

²³ 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.

²⁴ We calculated the statistics shown in Table 2 for each of the 3 settlement dates. Table 2 reports the average over the 3 periods.

period. Short interest data are unavailable for the unlisted stocks. 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). 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.

A preliminary conclusion from Table 2 is that stocks with fails tend to be larger cap stocks with greater turnover and higher levels of institutional ownership and short interest. A different picture emerges when we further examine stocks by the relative magnitude of their fails and the age of their fails, however. For example, 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.²⁵

To illustrate the pervasiveness of fails, Figures 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

²⁵ 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.

cutoff point only if they have fails of at least one share of that age or older.²⁶ Data are shown separately for each of the 3 fails dataset dates. Figure 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. Figure 2 (upper panel) shows that for unlisted shares, the percentage of issues with fails declines more slowly with position age. The middle panels of Figures 1 and 2 show total amounts of failed shares as a function of position age. They show that although these totals also decline with position age, there are a substantial portion of fails that persist for several months or more.

The bottom panels of Figures 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 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 Figure 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 be those fails that 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, Figure 2).

The results presented in Table 2 and Figures 1 and 2 provide evidence that for most issues, a very small percentage of transactions create short-lived, possibly inadvertent, fails-to-deliver. In addition, there are a substantial number of issues that

²⁶ Although the x-axis in Figures 1 and 2 is right-truncated at a position age of 40 settlement days for illustrative purposes, for many of the issues, fails last beyond the 40 days shown.

experience long-lived fails. We further compare the characteristics of short-lived and long-lived fails in Section III as we test for evidence consistent with strategic fails by market makers.

III. Empirical evidence consistent with the hypothesis of strategic delivery failures

We are interested in determining the extent to which the fails documented in Section II 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. As discussed in Section I.D., 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 other short sellers. It is possible that naked short sales pre-Regulation SHO are made to some extent by non-market makers (e.g., hedgers, arbitrageurs, or those who may have found some way to circumvent the NYSE and NASD “affirmative determination” rules described in Section I.B.). As described in Section I.D., the comments of equity and options market makers suggest that to the extent persistent fails are a result of *their* strategic fails, we should observe that the likelihood of persistent fails increases with borrowing costs, options listing, and illiquidity.

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,
- Increases if the issue has had its initial public offering in the last 12 months, and
- Increases with Internet message board activity.²⁷

If persistent fails are due to strategic fails because borrowing costs are high, we should observe the same relationships between these variables and the likelihood of persistent fails. Market cap will also act as a proxy for liquidity. Our regressions will also include an options dummy. D’Avolio’s proxy for Internet message board activity (the number of contributors to a stock’s Yahoo Finance message board in the month) is unavailable for our time period and will be omitted from our analysis.

Figure 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 determined from the pooled observations of listed and unlisted stocks. Figure 3 reports the average probability of the 3 time periods at each breakpoint. The probability of having fails of at least one day increases with

²⁷ D’Avolio 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. D’Avolio also 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.

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 through 10th largest market cap deciles.

The probability of fail as a function of fail age and institutional ownership is shown in Figure 4. For the lowest 3 deciles of institutional ownership, observations are pooled because institutional ownership in the bottom 2 deciles and for some observations in the third lowest decile is zero. The probability of persistent fails (i.e., fails of at least 5 days) decreases with institutional ownership.

Figures 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 Figure 5. While D'Avolio concludes that higher turnover stocks are more expensive to borrow, Figure 5 suggests that persistent fails are more likely for stocks with lower turnover. Turnover may be strongly correlated with market cap and/or institutional ownership, however.

The results of logit regressions of the likelihood of persistent fails are reported in Table 3. 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). We run logit regressions using each of the following 4 proxies for persistent fails:

- The stock has at least one failed share for more than 5 consecutive settlement dates (Table 3, panel A),

- The stock has failed shares in an amount that is at least 0.5% of total shares outstanding and at least 10,000 shares for more than 5 consecutive settlement dates (Table 3, panel B),
- The stock has at least one failed share for more than 10 consecutive settlement dates (Table 3, panel C), and
- The stock has failed shares in an amount that is at least 0.5% of total shares outstanding and at least 10,000 shares for more than 10 consecutive settlement dates (Table 3, panel D).

We use the 5-day minimum cutoff for persistent fails consistent with the Regulation SHO definition of “threshold” security. We examine the 10-day cutoff because that is the criteria for determining when mandatory close-out provisions take effect under Regulation SHO. The amount cutoffs of at least 0.5% of total shares outstanding and at least 10,000 shares are consistent with the Regulation SHO “threshold” criteria. Regulation SHO establishes the 0.5%/10,000 share cutoffs to focus on “large, extended fails to deliver.”²⁸ 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” proxies.

The unconditional probability of an issue 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).

For all of the regressions, the estimates are negative and significant (at the 1% level) for institutional ownership. The glamour dummy is positive and significant (at the 1% level) for all of the regressions. The estimates for the IPO dummy and the cash flow

²⁸ See Regulation SHO adopting release, page 39.

variable are not significant at conventional levels in any of the regressions. There is some evidence that higher turnover and options listing each increase the likelihood of large amounts of persistent fails (i.e., panels B and D). But they provide no incremental explanatory power for persistent fails of smaller magnitude (panels A and C). The likelihood of persistent fails decreases with market cap, but estimates are not significant when we include stocks for which fails are a smaller percentage of shares outstanding for less than 10 days (i.e., panel A).

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 persistent fails are a greater percentage of shares outstanding.

As a robustness check, we performed OLS 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.²⁹ Except for the indicator variables for glamour stock, IPO, and options listing, variables are standardized by calculating their z score for the time period. For example, for fail age ("FA"):

$$\text{Standardized } FA_{Stock\ i} = (FA_{Stock\ i} - \text{Mean } FA) / \text{Standard deviation of } FA,$$

where mean and standard deviation are cross-sectional and calculated for each of the 3 time periods. Observations for stocks with no fails (i.e., average fail age is zero) are included in the regressions.

Results of the OLS regressions are given in Table 4. Estimates for market cap and institutional ownership are negative and significant at the 1% level for all 3 time periods. The glamour dummy is positive and significant at the 1% level for all 3 time

²⁹ See Section II, footnote 24.

periods. Turnover, cash flow, and the IPO dummy are not significant in any of the regressions. There is some evidence that options listing increases the age of fails. In summary, the results of the OLS regressions in Table 4 provide some evidence that the fail age increases with borrowing costs, options listing, and illiquidity.

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, we expect fails to be uncorrelated with short interest levels.

Figure 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. Figure 6 provides these results separately for minimum weighted-average fail-age cutoffs of one, five, ten, fifteen, and twenty days. Figure 6 suggests that the probability of having large fails, regardless of age cutoff,

increases with short interest decile. 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. He concludes (as suggested by Chen, Hong, and Stein, 2002) that at the very lowest short interest deciles, stocks just may be 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 the relationship between short interest and delivery failures, 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.

IV. 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.

These findings suggest that 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. Stocks that trade on the Over-the-Counter Bulletin Board and Pink Sheets had average institutional holdings of only 1.3% of shares outstanding and are likely to be among the hardest hit.
- Options listings will decrease for stocks that are expensive to borrow.
- Short interest will decrease, especially for expensive-to-borrow stocks.
- 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.

These predictions may provide interesting areas for future research.

References

- Chen, Hong, and Stein, 2002, "Breadth of Ownership and Stock Returns," *Journal of Financial Economics*, 66, 171-205.
- Chen and Singal, 2003, "Role of Speculative Short Sales in Price Formation: The Case of the Weekend Effect," *Journal of Finance*, 58(2), 685-705.
- Christoffersen, Geczy, Musto, and Reed, 2002, "The Market for Record-Date Ownership," working paper, Wharton.
- Christoffersen, Geczy, Musto, and Reed, 2004, "How and Why Do Investors Trade Votes, and What Does It Mean?" working paper, Wharton.
- Christophe, Ferri, and Angel, 2004, "Short-Selling Behavior Prior to Earnings Announcements," *Journal of Finance*, 59(4), 1845-1875.
- D'Avolio, 2002, "The Market for Borrowing Stock," *Journal of Financial Economics*, 66, 271-306.
- Desai, Ramesh, Thiagarajan, and Balachandran, 2002, "An Investigation of the Informational Role of Short Interest in the Nasdaq Market," *Journal of Finance*, 57(5), 2263-2287.
- Duffie, Garleanu, and Pedersen, 2002, "Securities Lending, Shorting, and Pricing," *Journal of Financial Economics*, 66, 307-339.
- Evans, Geczy, Musto, and Reed, 2003, "Failure is an Option: Impediments to Short Selling and Option Prices," working paper, Wharton and University of North Carolina.
- Fleming and Garbade, 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, Musto, and Reed, 2002, "Stocks Are Special Too: An Analysis of the Equity Lending Market," *Journal of Financial Economics*, 66, 241-269.

Jones and Lamont, 2002, "Short Sale Constraints and Stock Returns," *Journal of Financial Economics*, 66, 171-205. 66, 207-239.

Lamont, 2003, "Go Down Fighting: Short Sellers vs. Firms," working paper, University of Chicago and NBER.

Lamont and Thaler, 2003, "Can the Market Add and Subtract? Mispricing in Tech Stock Carve Outs," *Journal of Political Economy*, 111, 227-268.

Reed, 2003, "Costly Short Selling and Stock Price Adjustment to Earnings Announcements," working paper, Wharton.

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> <ul style="list-style-type: none"> ○ Equity market makers ○ Options market makers ○ Hedgers ○ Arbitrageurs | <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> <ul style="list-style-type: none"> ○ Equity market makers ○ Options market makers |
| Forced delivery | <p>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.</p> | <p>Same as pre-Regulation SHO.</p> |
| 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> <ul style="list-style-type: none"> ○ Equity market makers ○ Options market makers ○ Hedgers ○ Arbitrageurs | <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> <ul style="list-style-type: none"> ○ Pre-existing fail positions ○ New short sales that are options market makers’ hedges for pre-existing option positions |
| Other deterrents | <p>NASD rules prohibit further short selling by those with fails-to-deliver of that security for at least 60 days.</p> | <p>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).</p> |

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. Further definitions of variables and data sources are provided in Section II.

| | <u>Listed on NYSE, AMEX, or Nasdaq</u> | | <u>Traded on OTCBB or Pink Sheets</u> | |
|--------------------------------|--|---------------------------------|---------------------------------------|---------------------------------|
| | <u>All stocks</u> (1) | <u>Stocks with fails</u> (2) | <u>All stocks</u> (3) | <u>Stocks with fails</u> (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% | 1.3% | 1.6% |
| Median | 36.0% | 39.8% | 0.0% | 0.0% |
| 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 | 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 |

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, and options 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. Persistent fail proxies and explanatory variables are further defined in Section III.

| <u>Time period</u> | <u>Log of market capitalization</u> | <u>Institutional ownership</u> | <u>Turnover</u> | <u>Cash flow</u> | <u>Glamour dummy</u> | <u>IPO dummy</u> | <u>Options dummy</u> | <u>Memo: Unconditional probability</u> |
|---|-------------------------------------|--------------------------------|-----------------|------------------|----------------------|------------------|----------------------|--|
| <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 | -0.020 | -0.008 | 0.019 | -0.001 | 0.358 | -0.171 | 0.047 | 45.0% |
| p-value | 0.167 | <0.001 | 0.343 | 0.965 | <0.001 | 0.632 | 0.552 | |
| Nov. 2003 | | | | | | | | |
| Estimate | -0.010 | -0.009 | 0.014 | -0.005 | 0.344 | -0.127 | 0.061 | 41.3% |
| p-value | 0.506 | <0.001 | 0.411 | 0.842 | <0.001 | 0.780 | 0.456 | |
| Jan. 2004 | | | | | | | | |
| Estimate | -0.013 | -0.008 | 0.007 | 0.018 | 0.365 | -0.553 | 0.010 | 43.1% |
| p-value | 0.378 | <0.001 | 0.581 | 0.485 | <0.001 | 0.363 | 0.905 | |
| <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 | -0.106 | -0.012 | 0.040 | 0.018 | 1.228 | -0.039 | 0.170 | 4.4% |
| p-value | 0.001 | <0.001 | 0.019 | 0.722 | <0.001 | 0.970 | 0.459 | |
| Nov. 2003 | | | | | | | | |
| Estimate | -0.060 | -0.018 | 0.034 | 0.020 | 1.203 | -11.506 | 0.383 | 3.9% |
| p-value | 0.068 | <0.001 | 0.029 | 0.726 | <0.001 | 0.974 | 0.111 | |
| Jan. 2004 | | | | | | | | |
| Estimate | -0.083 | -0.021 | 0.029 | 0.027 | 0.891 | -10.874 | 0.424 | 4.0% |
| p-value | 0.009 | <0.001 | 0.028 | 0.302 | <0.001 | 0.973 | 0.088 | |

Table 3 (continued)

Logit regressions of the likelihood of persistent fails

| <u>Time period</u> | <u>Log of market capitalization</u> | <u>Institutional ownership</u> | <u>Turnover</u> | <u>Cash flow</u> | <u>Glamour dummy</u> | <u>IPO dummy</u> | <u>Options dummy</u> | <u>Memo: Unconditional probability</u> |
|--|---|------------------------------------|-----------------|------------------|----------------------|------------------|----------------------|--|
| <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 | -0.035 | -0.011 | -0.020 | 0.018 | 0.372 | 0.031 | 0.017 | 32.6% |
| <i>p</i> -value | 0.024 | <0.001 | 0.325 | 0.513 | <0.001 | 0.935 | 0.844 | |
| Nov. 2003 | | | | | | | | |
| Estimate | -0.046 | -0.012 | -0.004 | 0.046 | 0.406 | 0.119 | 0.127 | 28.0% |
| <i>p</i> -value | 0.003 | <0.001 | 0.779 | 0.297 | <0.001 | 0.809 | 0.177 | |
| Jan. 2004 | | | | | | | | |
| Estimate | -0.045 | -0.012 | 0.007 | 0.014 | 0.389 | -0.758 | 0.027 | 29.0% |
| <i>p</i> -value | 0.003 | <0.001 | 0.566 | 0.608 | <0.001 | 0.330 | 0.771 | |
| <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 | -0.118 | -0.014 | 0.023 | -0.008 | 1.106 | 0.190 | 0.440 | 3.5% |
| <i>p</i> -value | <0.001 | <0.001 | 0.140 | 0.822 | <0.001 | 0.852 | 0.081 | |
| Nov. 2003 | | | | | | | | |
| Estimate | -0.055 | -0.017 | 0.026 | 0.020 | 1.320 | -12.062 | 0.361 | 3.4% |
| <i>p</i> -value | 0.116 | <0.001 | 0.107 | 0.723 | <0.001 | 0.980 | 0.162 | |
| Jan. 2004 | | | | | | | | |
| Estimate | -0.075 | -0.022 | 0.028 | -0.032 | 0.999 | -11.537 | 0.486 | 3.1% |
| <i>p</i> -value | 0.035 | <0.001 | 0.029 | 0.226 | <0.001 | 0.982 | 0.082 | |

Table 4**OLS regressions of the likelihood of persistent fails**

This table reports results of OLS regressions of fail age on explanatory variables that proxy for borrowing costs, liquidity, and options listings. Regressions were run separately for each time period of fails data (Sep. 2003, Nov. 2003, and Jan. 2004). Non-indicator variables are standardized by their z score for the time period. Variables are further defined in Section III.

| <u>Time period</u> | <u>Log of market capitalization</u> | <u>Institutional ownership</u> | <u>Turnover</u> | <u>Cash flow</u> | <u>Glamour dummy</u> | <u>IPO dummy</u> | <u>Options dummy</u> | <u>Adjusted R-Squared</u> |
|--------------------|-------------------------------------|--------------------------------|-----------------|------------------|----------------------|------------------|----------------------|---------------------------|
| Sep. 2003 | | | | | | | | |
| Estimate | -0.141 | -0.049 | -0.104 | 0.008 | 0.093 | 0.094 | 0.019 | 3.78% |
| p -value | <0.001 | <0.001 | 0.195 | 0.394 | <0.001 | 0.442 | 0.495 | |
| Nov. 2003 | | | | | | | | |
| Estimate | -0.128 | -0.064 | -0.104 | 0.007 | 0.100 | -0.080 | 0.050 | 4.16% |
| p -value | <0.001 | <0.001 | 0.169 | 0.381 | <0.001 | 0.585 | 0.055 | |
| Jan. 2004 | | | | | | | | |
| Estimate | -0.121 | -0.061 | -0.884 | 0.007 | 0.096 | -0.002 | 0.040 | 3.69% |
| p -value | <0.001 | <0.001 | 0.212 | 0.452 | <0.001 | 0.994 | 0.138 | |

Table 5**Average Failed Shares and Short Interest versus Short Interest Decile**

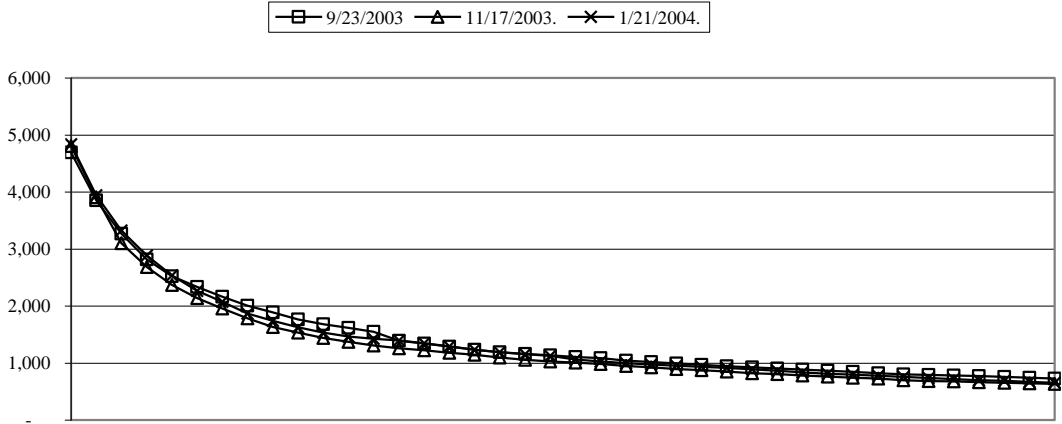
This table reports average short interest and fails-to-deliver as a percentage of shares outstanding for each short interest decile. Data on fails-to-deliver are from the National Securities Clearing Corporation for 3 dates: Sept. 23, 2003; Nov. 17, 2003; and Jan. 21, 2004. Monthly short interest data 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) | <u>13.85</u> | <u>0.61</u> | <u>4.4%</u> |
| Overall | 2.61 | 0.15 | 5.7% |

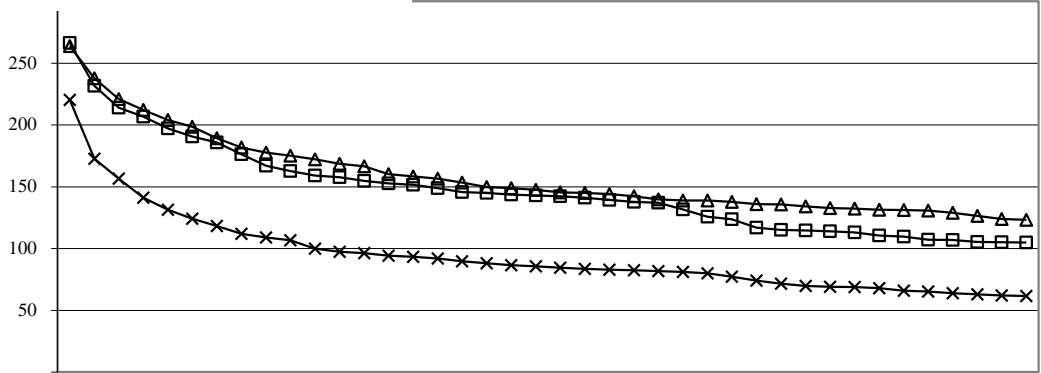
Figure 1

Fails by Position Age: Stocks Listed on NYSE, AMEX, or Nasdaq

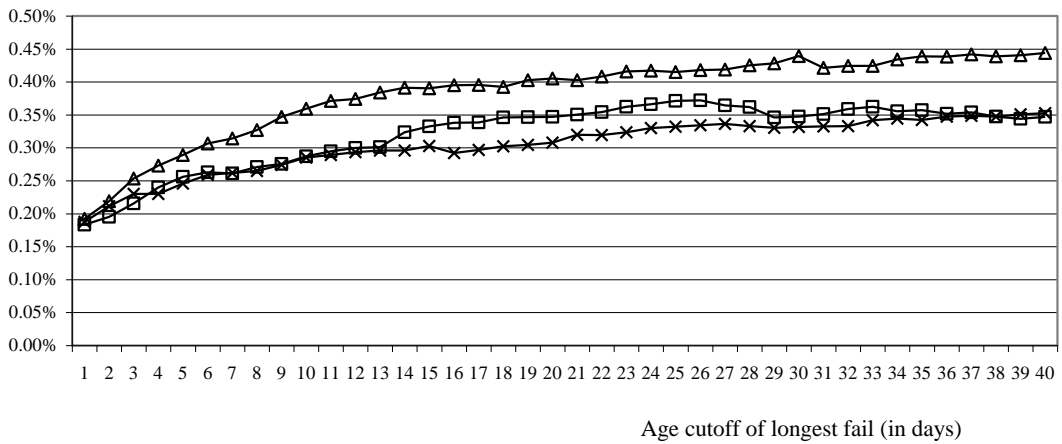
Number of listed issues with fails



Total of failed listed shares (in millions)



Failed shares/shares outstanding, for issues with fails

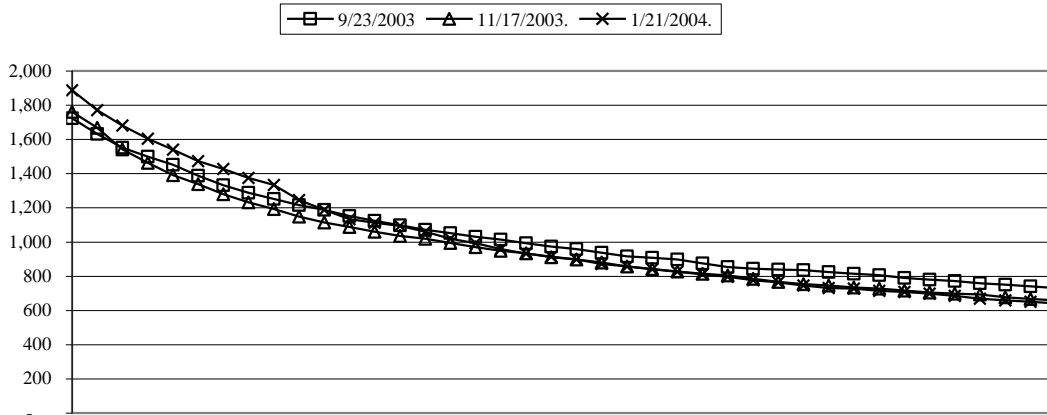


Age cutoff of longest fail (in days)

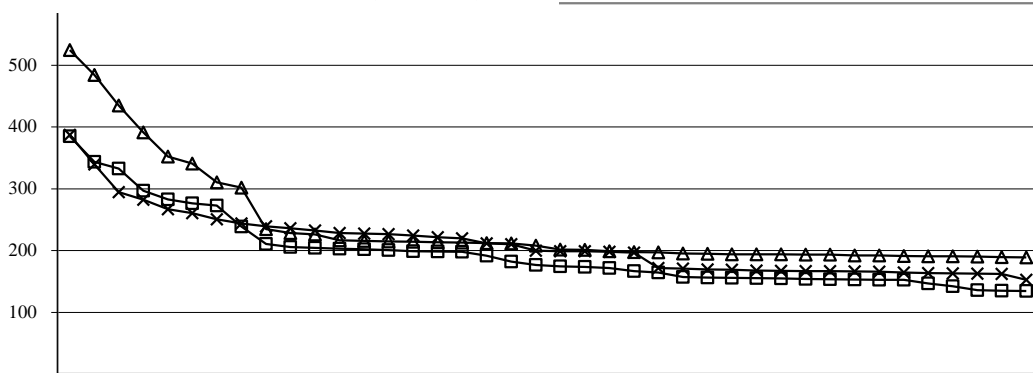
Figure 2

Fails by Position Age: Over-the-Counter Bulletin Board and Pink Sheet Stocks

Number of OTCBB and Pink Sheet issues with fails



Total of OTCBB and Pink Sheet shares (in millions)



Failed shares/shares outstanding, for issues with fails

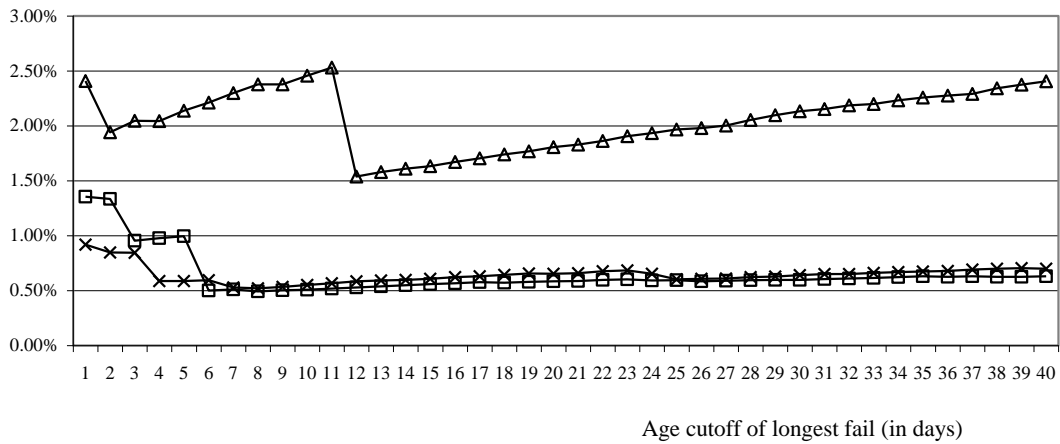


Figure 3

Probability of Fail versus Market Cap Decile

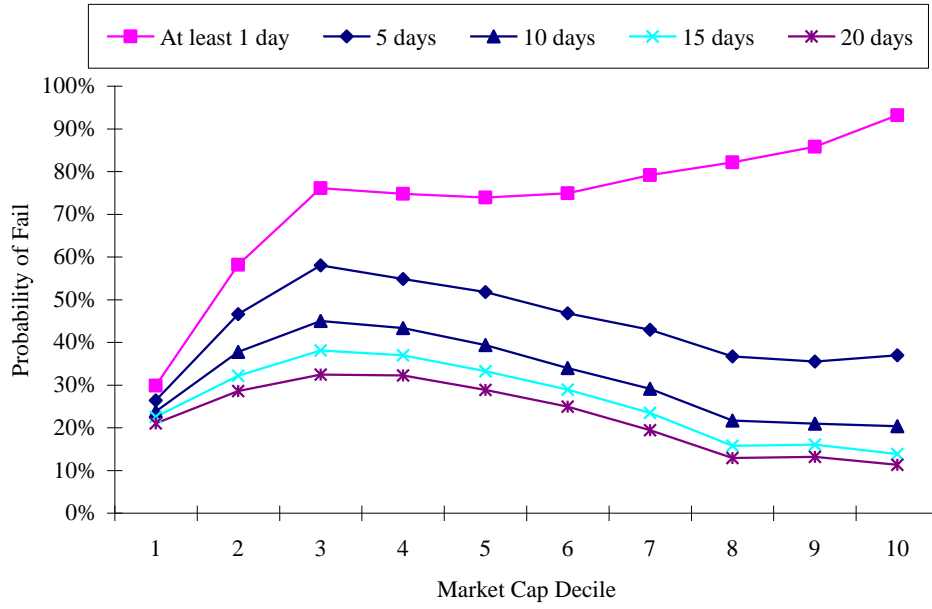


Figure 4

Probability of Fail versus Institutional Ownership Decile

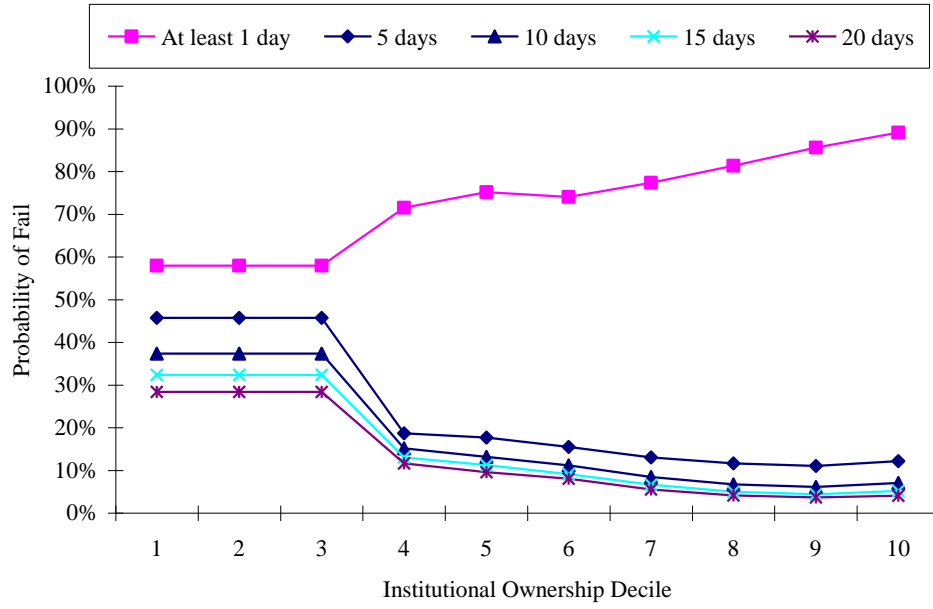


Figure 5

Probability of Fail versus Turnover Decile

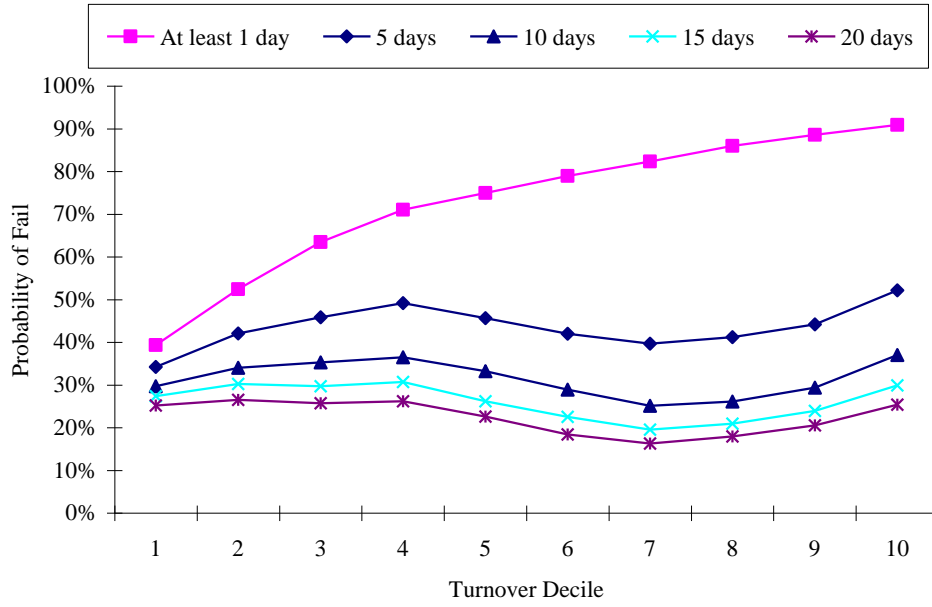


Figure 6

Probability of Fail versus Short Interest Decile

