

# **Fails-to-deliver before and after the implementation of Rule 203 and Rule 204**

## **Abstract**

We study the determinants of fails-to-deliver in the period before and after the implementation of Rule 203 (elimination of option market maker exception from the locate and close-out requirement) and Rule 204 ( $t+3$  close-out rule) in September 2008. We find a positive relationship between short selling and fails-to-deliver that weakens after the implementation of these rules. Fails-to-deliver are higher for stocks with low institutional ownership, low book to market, small market capitalization, high turnover, and put option availability. The relationship between short selling and these measures of borrowing costs is also weaker after the implementation of these rules.

## 1. Introduction

In the U.S. equity markets, sellers are required to deliver shares on a three-day cycle. For a trade that occurs on day  $t$ , the shares are required to be delivered on day  $t+3$ , else the position becomes “fails-to-deliver”. Fails-to-deliver (FTD) usually occurs for trades where the seller does not own the stock and is short selling (termed as naked short selling as per the Securities and Exchange Commission (SEC)) the stock without borrowing or arranging to borrow to deliver the stock in time. As per the SEC’s release 34-58775, the SEC has been concerned about the negative effects of FTD as it deprives shareholders of the ownership benefits (For e.g., voting and lending). Issuers and investors have also shown concerns about FTD in relation to manipulative naked short selling, which can undermine the confidence of investors. These investors, in turn, may be reluctant to commit capital to an issuer they believe to be subject to manipulative conduct. The SEC implemented Rules 203 and 204, discussed in detail in the following paragraphs, to curb naked short selling and reduce FTD. In this paper, we aim to examine the impact of these rules on the FTD.

There is a significant literature examining the impact of FTD on market liquidity, price, and volatility. Stokes (2009) studies the litigations based on naked short selling and the failures of naked short selling lawsuits and finds that naked short selling has not been proved to be linked to market manipulation. In fact, Fotak, Raman, and Yadav (2013) compare FTD trades with short sales that result in timely delivery. They find that they both lead to the same beneficial impact on liquidity and price efficiency. They do not find evidence that FTD trades are related to subsequent price declines or to the price decline in financial stocks during 2008. On the other hand, Lecce, Lepone, McKenzie, and Segara (2012) find that allowing naked short sales impairs market liquidity and increases market volatility. Autore, Boulton, and Braga-Alves (2011) find

that stocks reaching threshold levels of failures become significantly overvalued and Stratmann and Welborn (2014) find that stocks with high FTD experience abnormal negative returns, both in present and future periods. In spite of existence of any clear evidence of market manipulation using naked short selling, the SEC implemented locate and close-out requirement for short selling to reduce FTD.

Fotak, Raman, and Yadav (2013) report that almost all delivery failures originate exclusively as a result of short trades. In the presence of short sale constraints, stocks become overpriced (Asquith, Pathak, and Ritter (2005) and Chang, Cheng, and Yu (2007)). Option of failing to deliver allows short sellers to short stocks with high short sale constraints. Many market participants were concerned that naked short selling can manipulate stock prices in the downward direction (SEC's release no. 34-58775). Rule 203 and Rule 204 were aimed at curbing naked short selling, thus it is interesting to study the delivery failures after the SEC implemented these rules.

The SEC issued emergency rule to ban naked short selling for 19 financial stocks on July 15, 2008. This rule required the short sellers to borrow the stocks before initiating short selling in these stocks. This emergency rule expired on August 12, 2008. On September 17, 2008, the SEC approved a final rule (Rule 203) to eliminate the options market maker exception from the locate and close-out requirement. The locate requirement prohibits a broker-dealer from accepting a short sale order in any equity security from another person, or effecting a short sale order for 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 due date of delivery. The close-out requirement states that a participant of a clearing agency needs to take immediate action to close

out a fail to deliver position in a threshold security that has persisted for 13 consecutive settlement days by purchasing securities of like kind and quantity. In addition, if the FTD has persisted for 13 consecutive settlement days, any broker-dealer is prohibited from accepting any short sale order. The SEC staff obtained data from self-regulatory organizations, option market makers, and clearing agency that showed extensive use of option market maker exception to Regulation SHO's close-out requirement and the resulting FTD. Many market participants considered this exception as a well-known tool for manipulators according to SEC's release 34-58775. Rule 203 eliminated the exception for option market makers from the locate and close-out requirement.

At the same time, the SEC also implemented Rule 204 T ( $t+3$  closeout rule, later renamed to Rule 204) that required delivery of securities by the settlement day. The temporary rule imposed a penalty on any participant of a registered clearing agency, and any broker-dealer from which it receives trades for clearance and settlement, for having a FTD position at a registered clearing agency in any equity security. This interim rule became permanently effective on July 31, 2009. Since most FTD result from short sale trades, the approval of this rule was expected to reduce FTD. A study done by the SEC in 2011 (Release 34-61595) found that the FTD decreased significantly after the elimination of the option market maker exception and the implementation of the  $t+3$  close-out rule. Stratmann and Welborn (2013) compare fails to deliver during second and fourth quarters of 2008 for optionable stocks vs. non-optionable stocks, and find that eliminating the exception led to fewer FTD. However, they do not study the change in relationship between FTD and short selling. Our study focuses on the relationship between short selling and FTDs and the relationship between borrowing costs and FTD in light of the implementation of these rules.

We contribute to the literature of short selling and FTD by providing two main findings. First, we test the relationship between short selling activity and FTD using data over a long time horizon from year 2004 to year 2012. We use both short interest and short selling volume as a proxy for short selling activity. Overall, we find that FTD quantity increases as short interest and short volume increase. We test this relationship separately before and after the implementation of Rule 203 and Rule 204 by the SEC on September 18, 2008. These rules were aimed at reducing FTD caused by naked short selling and as a result, we find that the relationship between short selling and FTD weakens after the implementation of these rules.

Second, we test the change in relationship of FTD with borrowing cost as a result of implementation of Rule 203 and Rule 204. Previous literature establishes that borrowing cost is higher for stocks with low institutional ownership, small market capitalization, low book to market, and high turnover. We find FTD are higher for stocks with low institutional ownership, low book to market, small market capitalization, and high turnover. Also, availability of put options increases the FTD as short selling activity is used for hedging the option positions. As a result of option market maker exemption elimination (Rule 203), option market makers have to close their account before they can short the same security again. As a result, they are less likely to strategically fail to deliver and their trades will be less sensitive to borrowing costs. Also as a result of  $t+3$  delivery requirement (Rule 204), intentional failures due to high borrowing cost should reduce. We find that the relationship between FTD and borrowing cost becomes weaker after the implementation of Rule 203 and Rule 204.

## **2. Literature review and hypotheses development**

### *2.1. Naked short selling and fails-to-deliver*

The SEC defines naked short selling and FTD as follows.<sup>1</sup> In a "naked" short sale, the seller does not borrow or arrange to borrow the securities in time to make delivery to the buyer within the standard three-day settlement period. As a result, the seller fails to deliver securities to the buyer when delivery is due; this is known as a "failure to deliver" or "fail." One of the reasons Putniņš (2010) cites for naked short selling is when short sellers want to conduct manipulative "bear raids" on stocks. Evans, Geczy, Musto, and Reed (2009) show that the option to fail is significant to both the trading and pricing of equity options. They show that this option to fail is often in the money, and that when it is in the money, market makers and their customers profit from it. Boni (2006) uses FTD data from pre-Regulation SHO period (Before July 28, 2004) to show that equity and option market makers strategically fail to deliver when borrowing costs are high. Stratmann and Welborn (2013) find that removing the option market maker exception to Regulation SHO led to fewer FTD and higher borrowing costs for optionable stocks compared to non-optionable stocks. They also find that removing the exception reduced FTD for optionable stocks with high borrowing costs.

Though, naked short selling was blamed by the SEC for artificially exacerbating price declines during the financial crisis of 2008, there is mixed evidence in the literature on price manipulation by naked short sellers. Fotak, Raman, and Yadav (2013) do not find any evidence that short trades that result in FTD are causally related to the failure of financial firms in 2008. They also find that short trades that result in FTD and short sales that result in timely delivery have the same beneficial impact on market liquidity and price efficiency. Boulton and Braga-Alves (2012) study naked short sellers' trading strategies and their abilities to find overpriced stocks. Their findings suggest that naked short sellers do not systematically profit from short selling. Their results suggest that the restrictions placed on naked short sellers by the SEC may

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<sup>1</sup> <http://www.sec.gov/answers/nakedshortsale.htm>

have been misplaced. Liu, McGuire, and Swanson (2013) find that in contrast to the common belief that naked short selling is not based on company fundamentals, accounting fundamentals are highly significant in explaining naked short sales. They also find that naked short sales contain incremental information about future stock return. Kolasinski, Reed, and Thornock (2013) study the impact of emergency rule in 2008 to ban naked short selling in 19 financial firms. They find that short sale constraints make short selling more informed and after the ban, price reaction to announcements of unexpectedly high level of short interest became more negative.

Another strand of literature argues that FTD may have negative impact on equity markets. Lecce, Lepone, McKenzie, and Segara (2012) use data from Australian stock exchange and find slightly higher stock return volatility and a small reduction in liquidity when naked short sales are allowed. Autore, Boulton, and Braga-Alves (2011) find that stocks reaching threshold levels of failures become significantly overvalued, thus high level of fails-to-delivers may also be considered as a binding short sale constraint. Stratmann and Welborn (2014) find that stocks with high FTD experience abnormal negative returns, both in present and future periods. Boulton, and Braga-Alves (2010) find that threshold stocks are susceptible to short squeezes because fails is an attractive economic option for establishing short position in hard-to-borrow stocks, and thus these fails result in abnormal positive returns. These studies suggest that the restrictions imposed by the SEC on naked short selling may be beneficial for financial markets.

In our first hypothesis we test the relationship between FTD and short selling activity and the efficacy of the SEC's efforts to reduce FTD resulting from naked short selling. We study the relationship between short selling and FTD before and after the implementation of Rule 203 and

Rule 204. Prior to this rule, market participants complained that short sellers were taking advantage of “loopholes” to synthetically build short positions through the options market (Stratmann and Welborn (2013)). After the implementation of Rule 203, option market maker exception was eliminated from the locate and close-out requirement. At the same time, Rule 204 was implemented, which imposed a  $t+3$  delivery requirement. This rule imposed a penalty on any participant of a registered clearing agency, and any broker–dealer from which it receives trades for clearance and settlement, for having a FTD position at a registered clearing agency in any equity security. Since most FTD result from short sale trades, the approval of these rules should reduce FTD.

***Hypothesis 1:** Fails-to-deliver are higher for stocks with high short selling activity. This relationship between short selling and fails-to-deliver weakens after the implementation of Rule 203 and Rule 204.*

## 2.2. *Borrowing cost*

Short sellers borrow stocks from an equity lender and then deliver the stocks to the buyer. If the cost of borrowing is high, then the short sellers may fail to deliver. Failing to deliver creates the same short exposure for the short seller as delivery of the shares. Failing to deliver is equivalent to borrowing shares at a zero-fee zero-rebate equity loan plus the expected cost of being forced to buy back the stock and deliver it (Putniņš (2010)). The equity loans can be expensive as shown by prior research. D’Avolio (2002) uses eighteen months of loan supply and loan fees data from a large institutional lending intermediary and finds that annual loan fees can reach very high values in some rare cases. For example, it stood at 55 percent per annum for Krispy Kreme in their sample. One of the reasons Putniņš (2010) cites for naked short selling is



high borrowing costs. Boni (2006) finds evidence of positive correlation between FTD and borrowing costs indicative that some fails are strategic. Boni (2006) also finds that put option increases the probability of larger amount of persistent fails. Jones and Lamont (2002) study the cost of short selling equities from 1926 to 1933 and find that the stocks that are expensive to short have low book to market ratios and are small in size. Geczy, Musto, and Reed (2002) use a year of equity loans by a major lender and find that the equity loans of IPOs, DotCom, large-cap, growth, and low-momentum stocks are cheap relative to the profit of trading strategies that involve short selling. Using data on both short interest (a proxy for demand) and institutional ownership (a proxy for supply), Asquith, Pathak, and Ritter (2005) find that constrained stocks underperform during the period 1988–2002 by a significant 215 basis points per month on an equally weighted basis.

These studies suggest that short sellers failed to deliver as a result of high borrowing cost. Thus, FTD was considered a proxy for borrowing costs. With option market maker exemption elimination in Rule 203, option market makers have to close their account before they can short the same security again. As a result, they are less likely to strategically fail to deliver and less sensitive to borrowing costs. With the  $t+3$  delivery requirement in Rule 204, short sellers may not fail to deliver because of the high borrowing cost, but they may fail to deliver for other reasons (such as when they are not able to borrow the stock). The rules should curb the intentional delivery failures resulting from high borrowing costs. Thus, our second Hypothesis is about the relationship between FTD and borrowing cost, where low institutional ownership, small market capitalization, higher turnover, and low book-to-market value are used as a proxy for borrowing cost following the literature above. We also include availability of put option as

FTDs are higher for stocks with put option (Boni (2006)). We test this relationship before and after the implementations of the rules.

*Hypothesis 2: Fails-to-deliver are higher for stocks with low institutional ownership, small market capitalization, higher turnover, low book-to-market value, and stocks with put option availability. This relationship between fails-to-deliver and borrowing cost weakens after the implementation of Rule 203 and Rule 204.*

### **3. Data, Sample, and Descriptive Statistics**

We obtain the data on FTD from the SEC's website. We download this data for the period from October 2004 to December 2012. We use two datasets for short selling activity. One is the fortnightly/monthly short interest data from shortsqueeze.com website and other is daily short volume data from NYSE.<sup>2</sup> The details of these two samples are as follows.

We download the short interest data from shortsqueeze.com for the period from October 2004 to December 2012. Short interest data is available at different frequencies during this period. Part of the data is monthly and part of the data is fortnightly, for consistency we take the average of the fortnightly numbers in every month to calculate monthly number. This dataset also includes other variables such as average daily volume and percentage of institutional ownership. We remove the observations with listing exchange as Bulletin Board (BB) or National Bulletin Board (NBB). For this sample, we take the sum of FTD for each stock month across days to calculate monthly values of FTD. We obtain price, shares outstanding, and SIC codes from CRSP. We merge monthly FTD data, short interest data, and CRSP data and trim all the variables at 1<sup>st</sup> and 99<sup>th</sup> percentile. This sample of NYSE, AMEX, and NASDAQ stocks comprises of 657,079 stock-months for the period from October 2004 to December 2012 and

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<sup>2</sup> Fortnight is a period of two weeks.

10,910 unique stocks. We compute the following variables for this sample. *% Scaled fails*<sub>*i,m*</sub> is calculated as FTD divided by share outstanding times 100. *% Scaled short interest*<sub>*i,m*</sub> is calculated as total short interest<sub>*i,m*</sub> divided by shares outstanding times 100, where total short interest<sub>*i,m*</sub> is the number of outstanding shorted shares. *Market capitalization*<sub>*i,m*</sub> is calculated as shares outstanding times price. *% Turnover*<sub>*i,m*</sub> is calculated as average daily volume divided by shares outstanding times 100. *Return*<sub>*i,m*</sub> is calculated as  $(\text{price}_{i,m} - (\text{price}_{i,m-1})) / (\text{price}_{i,m-1})$ .

For our daily sample, we obtain the daily short volume data for NYSE listed stock from the exchange website for the period from January 2005 to June 2012. This dataset also includes total trading volume for the NYSE listed stocks. We merge FTD data, short volume data, and CRSP data and trim all the variables at 1<sup>st</sup> and 99<sup>th</sup> percentile. The daily sample of NYSE stocks comprises of 6,005,091 stock-days for the period from January 2005 to June 2012 and 4,321 unique stocks. We compute the following variables for this sample. Our measure of short selling, scaled short volume, is computed following Christophe, Ferri, and Hsieh (2010). *% scaled short volume*<sub>*i,d*</sub> is calculated as short volume<sub>*i,d*</sub> divided by shares outstanding times 100. *% scaled fails*<sub>*i,d*</sub>, *market capitalization*<sub>*i,d*</sub>, and *% turnover*<sub>*i,d*</sub>, are calculated in similar way as the monthly data, but using daily values. *Return*<sub>*i,d*</sub> is calculated as  $(\text{price}_{i,d} - (\text{price}_{i,d-1})) / (\text{price}_{i,d-1})$ . *Return*<sub>*i,d-3*</sub> is calculated as  $(\text{price}_{i,d-3} - (\text{price}_{i,d-4})) / (\text{price}_{i,d-4})$ .

We also use several other datasets to obtain control variables. We download book value per share for each stock year from Compustat. We calculate book to market value as book value per share divided by price. We download the list of stocks for which options are traded on the Chicago Board of Mercantile Exchange (CBOE). We use option<sub>*i*</sub> as a control variable which has a value of one for the stocks that are listed on the CBOE and zero otherwise.

We plot the monthly values of fails to deliver in millions and fails to deliver scaled by shares outstanding for our sample period in figure 1. We see a significant drop in both these numbers after the implementation of Rule 203 and Rule 204. Thus, these rules do serve the purpose of curbing FTD. We want to analyze further the relationship between FTD and short selling activity for the overall sample period and how it has changed after the implementation of these rules.

[Insert Figure 1 near here]

We report the descriptive statistics of both monthly and daily samples in Table 1. For our monthly sample,  $\% \text{ scaled fails}_{i,m}$  ranges from 0 percent to 43.12 percent with a mean value of 1.08 percent.  $\% \text{ scaled short interest}_{i,m}$  ranges from 0 percent to 29.91 percent with a mean value of 3.40 percent. For our daily sample,  $\% \text{ scaled fails}_{i,d}$  ranges from 0 percent to 1.14 percent with a mean value of 0.02 percent.  $\% \text{ scaled short volume}_{i,d}$  ranges from 0 percent to 0.86 percent with a mean value of 0.09 percent. We also report the descriptive statistics separately for the period before and after the implementation of Rule 203 and Rule 204, the differences between these numbers, and the t-statistics associated with these differences. For both monthly and daily samples, we find that FTD reduces after the implementation of Rule 203 and Rule 204.

[Insert Table 1 near here]

Next, we perform correlation analysis between fails to deliver, short selling activity, and other control variables and report the results in Table 2. In Panel A, we report the results for monthly short interest data sample. We find that  $\% \text{ scaled fails}_{i,m}$  is positively related with  $\% \text{ scaled short interest}_{i,m}$ . In Panel B, we report the results for daily short volume data sample. We find that  $\% \text{ scaled fails}_{i,d}$  is positively related with  $\% \text{ scaled short volume}_{i,d,3}$ . For both panels A and B, we find that fails to deliver is negatively related with institutional ownership, market

capitalization, book to market value, and contemporaneous return and positively related with turnover. The results for short selling activity, market capitalization, institutional ownership, book to market value, and turnover are consistent with our Hypotheses 1 and 2 related to these variables. For the daily sample, fails to deliver is positively related with past return. We do not find the correlation between *% scaled fails* and *option<sub>i</sub>* to be consistent across the two panels. In Panel C, we report the correlation of fails to deliver with all other variables for the period before and after the implementation of Rule 203 and Rule 204. We find that even though fails to deliver is positively related with short interest or short volume both before and after the implementation of these rules, the correlation coefficients reduces for the after period consistent with Hypothesis 1. Sign and significance of all other variables also stays the same as Panel A and Panel B for this sub-sample analysis except that the correlation between FTD and book to market value is not significant for our daily sample after the implementation of Rule 203 and Rule 204.

[Insert Table 2 near here]

## 4. Results

### 4.1. Portfolio Approach

In this section, we present the result of our empirical analysis. First we report the characteristics of stocks that have high *% scaled fails* and stocks that have low *% scaled fails*. For the monthly (daily) sample, we divide each month (day) into deciles based on *% scaled fails*. We take the mean of *% scaled short interest* (*% scaled short volume*) across stocks for each month (day) within each *% scaled fails* decile. Then, we take the mean across months (days) within each *% scaled fails* decile. We calculate the mean for all other variables in a similar way. We report the mean values for the lowest decile of *% scaled fails* and highest decile of *% scaled*

*fails* in Table 3. We also report the differences between these two deciles and the t-statistics associated with those differences. Apart from overall results, we also report difference between the lowest and highest decile and the t-statistics associated with those differences separately for the period before and after the implementation of Rule 203 and Rule 204. In Panel A, we report these numbers for our monthly short interest data sample. In Panel B, we report these numbers for our daily short volume data sample.

We find that *% scaled short interest* is higher for highest decile of *% scaled fails*. The difference between the *% scaled short interest* for highest decile of *% scaled fails* and *% scaled short interest* for lowest decile of *% scaled fails* is 4.09 percent and it is statistically significant. For the period before (after) the implementation of Rule 203 and Rule 204, this difference is 4.60 percent (3.63 percent). This indicates that FTD are higher for stocks with higher short selling activity, but the difference is smaller for the period after the implementation of Rule 203 and Rule 204. *% turnover, price, and proportion of optionable stocks* are also higher for highest decile of *% scaled fails*. We calculate *proportion of optionable stocks* as the percentage of stocks with listed put options in each decile. *Market capitalization, % of institutional ownership, and book to market value* are higher for lowest decile of *% scaled fails*. All these differences are statistically significant except for institutional ownership before the implementation of Rule 203 and Rule 204. We do not find the difference for return to be significant. For our daily sample of short volume data we find the similar results except for price variable. In addition, we find that  $\text{return}_{d-3}$  is higher for stocks with high FTD for the overall sample period and for the period after the implementation of Rule 203 and Rule 204. This indicates that short sales on days of positive stock returns results in higher FTD. Collectively, these results are consistent with our Hypotheses 1 and 2.

[Insert Table 3 near here]

Next, we look at the *% scaled fails* for different levels of *% scaled short interest* and report the results in Table 4. We divide each month in deciles based on *% scaled short interest*. We take the mean of *% scaled fails* across stocks for each month within each *% scaled short interest* decile. Then we take the mean across months within each *% scaled short interest* decile. We report mean values of both *% scaled short interest* itself and the *% scaled fails* for each decile in Table 4, Panel A. The difference between *% scaled fails* for high *% scaled short interest* group and *% scaled fails* for low *% scaled short interest* group is 1.42 percent. However, we do not find any monotonous pattern for this Panel. For the period before (after) the implementation of the rules the difference between *% scaled fails* for high and low groups of *% scaled short interest* is 1.52 percent (1.28 percent). In Panel B, we use the double sort method. We divide our sample into two groups; stock-months with high borrowing cost and stock-months with low borrowing cost, using institutional ownership as a proxy for borrowing cost. Then, we divide each group of institutional ownership into deciles based on *% scaled short interest*. We report the mean value of *% scaled fails* for these 20 groups. These means are calculated in two stages in the similar way as Panel A. We find that for low institutional ownership *% scaled fails* increases monotonously with increase in *% scaled short interest*. For high institutional ownership *% scaled fails* increase with increase in *% scaled short interest* from decile 3 to decile 10. Even for the sub-samples with period before and after the implementation of Rule 203 and Rule 204 for low institutional ownership *% scaled fails* increases monotonously with increase in *% scaled short interest*. For high institutional ownership also the *% scaled fails* is higher for higher deciles of *% scaled short interest* with few exceptions. For the overall group, the difference between *% scaled fails* for highest decile of *% scaled short interest* group and *%*

*scaled fails* for lowest decile of *% scaled short interest* group is 2.75 percent (1.51 percent) for low (high) institutional ownership group. For the period before the implementation of the rules, these numbers are 4.58 percent for low institutional ownership group (2.67 percent for high institutional ownership group). For the period after the implementation of the rules, these numbers are 1.02 percent for low institutional ownership group (0.38 percent for high institutional ownership group). These results provide additional evidence that there is positive relationship between FTD and short interest. This relationship is somewhat stronger for the low institutional ownership (i.e. high borrowing cost) stocks and weaker for the period after the implementation of Rule 203 and Rule 204, consistent with Hypotheses 1 and 2.

[Insert Table 4 near hear]

We perform the similar test as Table 4 with daily sample of NYSE stocks and report the results in Table 5. In Panel A, we find that *% scaled fails* is higher for the highest decile of *% scaled short volume* compared to *% scaled fails* for lowest decile of *% scaled short volume* for the overall sample as well as for the sub-sample before the implementation of the rules. However, we do not find any monotonous pattern for this Panel. In Panel B, we find that for both groups of institutional ownership, *% scaled fails* increase with increase in *% scaled short volume* with few exceptions. The difference between *% scaled fails* for high *% scaled short volume* group and *% scaled fails* for low *% scaled short volume* group is positive and significant for all six subsamples. Similar to the results of Table 4, the numbers in this table also indicate that the relationship between fails to deliver and short volume is somewhat stronger for the low institutional ownership (i.e. high borrowing cost) stocks and weaker for the period after the implementation of Rule 203 and Rule 204, consistent with Hypotheses 1 and 2.

[Insert Table 5 near here]



#### 4.2. Regression Analysis

Next, we perform regression analysis to test the relationship between FTD and short selling activity after controlling for other confounding factors. We estimate the following equation and report the results in Table 6:

$$\begin{aligned} \% \text{ scaled fails}_{i,m} &= \alpha_0 + \alpha_1 \% \text{ scaled short interest}_{i,m} + \alpha_2 \% \text{ of institutional ownership}_{i,m} \\ &+ \alpha_3 \log \text{ market capitalization}_{i,m} + \alpha_4 \text{ book to market value}_{i,m} \\ &+ \alpha_5 \% \text{ turnover}_{i,m} + \alpha_6 \text{ return}_{i,m} + \alpha_7 \text{ option}_i + \varepsilon_{i,m} \end{aligned} \quad (1)$$

where  $\alpha_0$  to  $\alpha_7$  are parameters to be estimated and  $\varepsilon$  is random error term. Subscripts  $i$  and  $m$  stand for stock and month, respectively. All the variables are previously defined in section 3. We report the results of this regression estimate for the overall sample period and separately for the period before and after the implementation of Rule 203 and Rule 204. We find that the coefficient on  $\% \text{ scaled short interest}_{i,m}$  is positive and significant for the overall sample as well as for the two sub-samples. However, the coefficient for the period after the implementation of the rules is lower than the coefficient for the period before the implementation of the rules. For the overall sample, a one percent increase in scaled short interest increases monthly scaled fails by 0.1194 percent (11.06 percent higher than their average level of 1.08). A one percent increase in scaled short interest increases monthly scaled fails by 0.1904 percent (14.86 percent higher than their average level of 1.28) before the implementation of the rules, but only by 0.0264 percent after the implementation of the rules (only 2.97 percent higher than their average level of 0.89). We test for the equality of coefficient for  $\% \text{ scaled short interest}_{i,m}$  for the two sub-samples and find that the difference of 0.1640 is statistically significant at 0.01 level. To test the impact of implementation of the rules on the relationship between short interest and fails-to-

deliver, we also include 1) a dummy variable *before*, which take the value of 1 before the implementation of the rules and 2) the interaction term *% scaled short interest*  $\times$  *before* in the full sample regression.<sup>3</sup> We find that the coefficient on *% scaled short interest*  $\times$  *before* is positive and significant for the short interest sample. These results are consistent with Hypothesis 1 that fails to deliver are higher for higher level of short selling activity and that the relationship between fails to deliver and short selling activity weakens after the implementation of the rules. The coefficient on *% of institutional ownership<sub>i,m</sub>*, is negative and significant for the overall sample as well as for the two sub-samples. For the overall sample, a one percent increase in institutional ownership decreases monthly scaled fails by 0.009 percent. The coefficients on *log market capitalization<sub>i,m</sub>*, and *book to market value<sub>i,m</sub>* are negative and significant and the coefficient on *% turnover<sub>i,m</sub>* is positive and significant for the overall sample as well as for the two sub-samples. We do not find coefficient on return to be significant for this monthly level regression. The coefficient on *option<sub>i</sub>* is significant only for the sub-sample period before the implementation of Rule 203 and Rule 204; having a put option caused the monthly scaled FTD to be higher by 0.1755 percent (13.71 percent higher than their average levels of 1.28). When we test for the equality of coefficients, we find that the differences for coefficients of *% institutional ownership<sub>i,m</sub>*, *log market capitalization<sub>i,m</sub>*, *book to market value<sub>i,m</sub>*, and *option<sub>i</sub>* for the two sub-samples are statistically significant. These results are consistent with our Hypothesis 2. We do not find the differences for coefficients on *% turnover<sub>i,m</sub>* and *return<sub>i,m</sub>* to be significant for the two sub-samples.

[Insert Table 6 near here]

Next, we perform a multivariate regression analysis using the daily short volume data.

We estimate the following equation and report the results in Table 7:

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<sup>3</sup> The results of this particular specification are not tabulated for space limitations.

$$\begin{aligned}
\% \text{ scaled fails}_{i,d} &= \alpha_0 + \alpha_1 \% \text{ scaled short volume}_{i,d-3} \\
&+ \alpha_2 \% \text{ of institutional ownership}_{i,ft} + \alpha_3 \log \text{ market capitalization}_{i,d} \\
&+ \alpha_4 \text{ book to market value}_{i,d} + \alpha_5 \% \text{ turnover}_{i,d} + \alpha_6 \text{ return}_{i,d} \\
&+ \alpha_7 \text{ return}_{i,d-3} + \alpha_8 \text{ option}_i + \varepsilon_{i,ft} \tag{2}
\end{aligned}$$

where  $\alpha_0$  to  $\alpha_8$  are parameters to be estimated and  $\varepsilon$  is random error term. Subscripts  $i$  and  $d$  stand for stock and day, respectively. All the variables are previously defined in section 3. The coefficient on  $\% \text{ scaled short volume}_{i,d-3}$  is positive and significant for the overall sample as well as for the two sub-samples. A one percent increase in scaled short volume increases scaled fails by 0.0536 percent (225 percent higher than their average level of 0.0238) for the overall sample. A one percent increase in scaled short volume increases daily scaled fails by 0.0805 percent (245 percent higher than their average level of 0.0329) before the implementation of the rules, but only by 0.0314 (215 percent higher than their average level of 0.0146) percent after the implementation of the rules.<sup>4</sup> We test for the equality of coefficient on  $\% \text{ scaled short volume}_{i,d-3}$  for the two sub-samples and find that the difference of 0.0491 is statistically significant at 0.01 level. To test the impact of implementation of the rules on the relationship between short volume and fails-to-deliver, we also include 1) a dummy variable *before*, which take the value of 1 before the implementation of the rules and 2) the interaction term  $\% \text{ scaled short volume} \times \text{before}$  in the full sample regression. We find that the coefficient on  $\% \text{ scaled short volume} \times \text{before}$  is positive and significant for the short interest sample. These results are also consistent with Hypothesis 1 that fails to deliver are higher for higher level of short selling activity and that

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<sup>4</sup> The average level of scaled short volume is 0.09 percent for the overall sample. The average level of scaled short volume is 0.09 percent before the implementations of the rules and 0.08 percent after the implementation of the rules. Fails-to-deliver numbers are rounded off to two decimal points in the table for space limitation.

the relationship between fails to deliver and short selling activity weakens after the implementation of the rules. The coefficient on *% of institutional ownership*<sub>*i,ft*</sub>, is negative and significant for the overall sample as well as for the two sub-samples. For the overall sample, a one percent increase in institutional ownership decreases monthly scaled fails by 0.0003 percent. The coefficient on *log market capitalization*<sub>*i,d*</sub> is negative and significant and the coefficient on *% turnover*<sub>*i,d*</sub> is positive and significant for the overall sample as well as for the two sub-samples. These results in Table 7 are consistent with those reported in Table 6. Apart from that, we find that the coefficient for book to market value is negative and significant for the overall sample and for sub-sample after the implementation of Rule 203 and Rule 204. The coefficient on *return*<sub>*i,d*</sub> is negative and significant for the overall sample period. The coefficient on *option*<sub>*i*</sub> is positive and significant for the overall sample as well as for the two sub-samples, but the effect was much larger before the implementation of Rule 203 and Rule 204. Before the implementation of the rules, put option availability caused the daily scaled fails to be higher by 0.0146 percent (44.38 percent higher than their average level of 0.0329). After the implementation of the rules, put option availability caused the daily scaled fails to be higher by 0.0017 percent (11.64 percent higher than their average level of 0.0146). When we test for the equality of coefficients, we find that the differences for coefficients on *% institutional ownership*<sub>*i,ft*</sub>, *log market capitalization*<sub>*i,d*</sub>, and *option*<sub>*i*</sub> for the two sub-samples are also statistically significant. We do not find the differences for coefficients on *book to market value*<sub>*i,d*</sub>, *% turnover*<sub>*i,m*</sub>, *return*<sub>*i,d*</sub>, and *return*<sub>*i,d-3*</sub> to be significant for the two sub-samples. These results provide evidence in support of our Hypothesis 1 and 2. The relationship between FTD and short selling and the relationship between FTD and borrowing costs weaken after the implementation of Rule 203 and Rule 204.

[Insert Table 7 near here]

## 5. Conclusion

Naked short selling was blamed by the SEC for the steep decline of stock prices in the financial crisis of 2008. As a result, the SEC implemented emergency rule to ban naked short selling for 19 financial stocks on July 15, 2008. This rule required the short sellers to borrow the stocks before initiating short selling in these stocks. This emergency rule expired on August 12, 2008. Later, in September of 2008, the SEC implemented Rule 203 (to eliminate option market maker exception) and Rule 204 ( $t+3$  close-out rule). The FTD quantity decreased significantly after the elimination of the option market maker exception and the implementation of the  $t+3$  close-out rule.

We study the determinants of FTD in the period before and after the implementation of Rule 203 and Rule 204 in September of 2008. For our sample period of October 2004 to December 2012, we find a positive relationship between FTD and short selling, which weakens after the implementation of Rule 203 and Rule 204.

Next, we establish a relationship between FTD and borrowing cost using a multivariate regression framework. We find that FTD are higher for stocks with low institutional ownership, small market capitalization, low book-to-market value, high turnover, and put option availability. This relationship also weakens after the implementation of Rule 203 and Rule 204.

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## Appendix A:

### Sample, variable definitions, and data sources

#### Sample:

The monthly sample of NYSE, AMEX, and NASDAQ stocks comprises of 657,079 stock-fortnights for the period from October 2004 to December 2012 and 10,910 unique stocks. Part of the short interest data is monthly and part of the data is fortnightly, for consistency we take the average of the fortnightly numbers to calculate monthly number.

The daily sample of NYSE stocks comprises of 6,005,091 stock-days for the period from January 2005 to June 2012 and 4,321 unique stocks.

The Rule 203 and Rule 204 were implemented in September 2008. We present all the results for the overall period, for the period before the implementation of these rules, and for the period after the implementation of these rules.

#### Variable Definitions:

% Scaled fails $_{i,m}$  = total number of fails to deliver during the month divided by shares outstanding times 100;

% Scaled short interest $_{i,m}$  = total short interest $_{i,m}$  divided by shares outstanding times 100, where total short interest $_{i,m}$  is the number of outstanding shorted shares for each security during month m;

Institutional ownership $_{i,m}$  = percentage of shares owned by institutional owners;

Market capitalization $_{i,m}$  = shares outstanding times price at the end of the month;

Book to market value $_{i,m}$  = book value per share divided by price per share at the end of the month;

% Turnover $_{i,m}$  = average daily volume divided by shares outstanding times 100;

Return $_{i,m}$  =  $(\text{price}_{i,m} - (\text{price}_{i,m-1})) / (\text{price}_{i,m-1})$ ;

Price $_{i,m}$  = price at the end of the month;

% Scaled fails $_{i,d}$  = number of fails to deliver shares divided by shares outstanding times 100;

% Scaled short volume $_{i,d}$  = number of shares sold short divided by shares outstanding times 100;

Market capitalization $_{i,d}$  = shares outstanding times price;

Book to market value $_{i,d}$  = book value per share divided by price per share;



$\% \text{ Turnover}_{i,d} = \text{daily volume divided by shares outstanding time } 100;$

$\text{Return}_{i,d} = (\text{price}_{i,d} - (\text{price}_{i,d-1})) / (\text{price}_{i,d-1});$

$\text{Return}_{i,d-3} = (\text{price}_{i,d-3} - (\text{price}_{i,d-4})) / (\text{price}_{i,d-4});$

$\text{Price}_{i,d} = \text{daily price};$

$\text{Option}_i = \text{dummy variables equals one for the stocks which are traded on Chicago Board of Mercantile Exchange, and zero otherwise};$

Table 1

**Descriptive Statistics**

This table provides descriptive statistics of short interest, short volume, fails to deliver, and the control variables used in our paper. Apart from overall results, we report these numbers separately for the period before and after the implementation of Rule 203 and Rule 204. We also report the difference between numbers for these two sub-samples. In Panel A, we report the descriptive statistics of our monthly short interest data sample. In Panel B, we report the descriptive statistics of our daily short volume data sample. Please see Appendix for sample coverage and variable definitions.

Panel A: Monthly sample of short interest data for NYSE, AMEX, and NASDAQ listed stocks								
Variable	Overall		Before Rule 203 and Rule 204		After Rule 203 and Rule 204		Difference (After - Before)	
	Number of observations	Mean	Number of observations	Mean	Number of observations	Mean	Difference	t-statistics
% scaled fails <sub>i,m</sub>	657,079	1.08%	315,408	1.28%	334,913	0.89%	-0.39%***	(-41.1)
% scaled short interest <sub>i,m</sub>	657,079	3.40%	315,981	3.41%	334,379	3.37%	-0.04%***	(-3.43)
% turnover <sub>i,m</sub>	611,590	0.90%	278,071	0.82%	326,932	0.98%	0.15%***	(48.55)
Market capitalization <sub>i,m</sub> (in millions)	632,256	1,773.46	305,420	1,774.88	320,301	1,779.07	4.19	(0.36)
% of institutional ownership <sub>i,m</sub>	448,688	33.33%	222,174	21.60%	221,719	44.94%	23.35%***	(255.96)
Return <sub>i,m</sub>	610,109	0.21%	292,054	0.00%	312,601	0.01%	0.01%***	(25.72)
Book to market value <sub>i,m</sub>	407,936	0.63	192,785	0.50	210,932	0.74	0.24***	(162.76)

Panel B: Daily sample of short volume data for NYSE listed stocks								
Variable	Overall		Before Rule 203 and Rule 204		After Rule 203 and Rule 204		Difference (After - Before)	
	Number of observations	Mean	Number of observations	Mean	Number of observations	Mean	Difference	t-statistics
% scaled fails <sub>i,d</sub>	6,005,091	0.02%	3,011,909	0.03%	2,993,182	0.01%	-0.02%***	(-234.47)
% scaled short volume <sub>i,d-3</sub>	5,991,388	0.09%	3,008,750	0.09%	2,982,638	0.08%	-0.01%***	(-86.78)
% turnover <sub>i,d</sub>	4,676,151	0.36%	2,407,652	0.44%	2,268,499	0.28%	-0.16%***	(-461.87)
Market capitalization <sub>i,d</sub> (in millions)	5,871,905	3,248.94	2,962,917	3,378.99	2,908,988	3,116.48	-262.51***	(-43.42)
% of institutional ownership <sub>i,ft</sub>	2,513,735	46.40%	562,605	39.13%	1,951,130	48.49%	9.36%***	(188.9)
Return <sub>i,d</sub>	5,822,137	0.01%	2,957,130	0.00%	2,865,007	0.00%	0.00%***	(13.26)
Book to market value <sub>i,d</sub>	3,520,573	0.60	1,678,664	0.48	1,841,909	0.70	0.22***	(494.72)

\*\*\*, \*\*, \* indicate statistical significance at the 0.01, 0.05 and 0.10 level, respectively.

Table 2

**Correlation matrix**

This table provides correlation matrix for short interest, short volume, fails to deliver, and the control variables used in our paper. In Panel A, we report the correlation coefficients for our monthly short interest data sample. In Panel B, we report the correlation coefficients for our daily short volume data sample. In Panel C, we also report the correlation of fails to deliver with other variables used our paper separately for the period before and after the implementation of Rule 203 and Rule 204. Please see Appendix for sample coverage and variable definitions.

<i>Panel A: Monthly sample of short interest data for NYSE, AMEX, and NASDAQ listed stocks</i>								
Variable	% scaled fails <sub>i,m</sub>	% scaled short interest <sub>i,m</sub>	% of institutional ownership <sub>i,m</sub>	Log market capitalization <sub>i,m</sub>	Book to market value <sub>i,m</sub>	% turnover <sub>i,m</sub>	Return <sub>i,m</sub>	
% scaled short interest <sub>i,m</sub>	0.1550***							
% of institutional ownership <sub>i,m</sub>	-0.0960***	0.3108***						
Log market capitalization <sub>i,m</sub>	-0.1217***	0.2413***	0.4062***					
Book to market value <sub>i,m</sub>	-0.0637***	-0.1318***	0.0043**	-0.3035***				
% turnover <sub>i,m</sub>	0.2877***	0.4378***	0.2149***	0.1311***	-0.1051***			
Return <sub>i,m</sub>	-0.0141***	-0.0105***	0.0265***	0.0844***	-0.0907***	-0.0111***		
Option <sub>i</sub>	0.0116***	0.2607***	0.3342***	0.4815***	-0.1813***	0.2119***	0.0339***	

<i>Panel B: Daily sample of short volume data for NYSE listed stocks</i>								
Variable	% scaled fails <sub>i,d</sub>	% scaled short volume <sub>i,d-3</sub>	% of institutional ownership <sub>i,ft</sub>	Log market capitalization <sub>i,d</sub>	Book to market value <sub>i,d</sub>	% turnover <sub>i,d</sub>	Return <sub>i,d</sub>	Return <sub>i,d-3</sub>
% scaled short volume <sub>i,d-3</sub>	0.0541***							
% of institutional ownership <sub>i,ft</sub>	-0.0964***	0.3914***						
Log market capitalization <sub>i,d</sub>	-0.0750***	0.3073***	0.5659***					
Book to market value <sub>i,d</sub>	-0.0284***	-0.0229***	-0.0536***	-0.2610***				
% turnover <sub>i,d</sub>	0.1127***	0.5623***	0.2320***	0.1471***	-0.0575***			
Return <sub>i,d</sub>	-0.0081***	0.0013***	0.0107***	0.0195***	-0.0206***	0.0084***		
Return <sub>i,d-3</sub>	0.0024***	0.0133***	0.0118***	0.0185***	-0.0189***	-0.0116***	-0.0250***	
Option <sub>i</sub>	-0.0072***	0.2788***	0.4731***	0.5167***	-0.1106***	0.1864***	0.0088***	0.0083***

*Panel C: Correlation of scaled fails with other variables by sample periods*

Variable	% scaled fails			
	Monthly sample		Daily sample	
	Before Rule 203 and Rule 204	After Rule 203 and Rule 204	Before Rule 203 and Rule 204	After Rule 203 and Rule 204
% scaled short interest/ % scaled short volume	0.2018***	0.0977***	0.0709***	0.0150***
% of institutional ownership	-0.0328***	-0.1055***	-0.0845***	-0.0926***
Log market capitalization	-0.0990***	-0.1549***	-0.0862***	-0.0775***
Book to market value	-0.0516***	-0.0235***	-0.0033***	-0.0005
% turnover	0.2854***	0.3110***	0.0852***	0.1243***
Return	-0.0079***	-0.0136***	-0.0088***	-0.0075***
Option	0.0305***	0.0028	-0.0014**	0.0046***

\*\*\*, \*\*, \* indicate statistical significance at the 0.01, 0.05 and 0.10 level, respectively.

Table 3

**Descriptive Statistics by fails to deliver**

In this table we report the mean values of short interest, short volume, and other stock characteristics by fails to deliver. We divide our sample into 10 groups of fails to deliver and report the descriptive for the lowest and highest decile. We also report the difference between the mean values of the lowest and the highest decile and the t-statistics associated with those differences. Apart from overall results, we also report difference between the mean values of the lowest and the highest decile and the t-statistics associated with those differences separately for the period before and after the implementation of Rule 203 and Rule 204. In Panel A, we report these numbers for our monthly short interest data sample. In Panel B, we report these numbers for our daily short volume data sample. Please see Appendix for sample coverage and variable definitions.

Panel A: Monthly sample of short interest data for NYSE, AMEX, and NASDAQ listed stocks									
Variable	Overall				Before Rule 203 and Rule 204		After Rule 203 and Rule 204		
	Lowest decile 0	Highest decile 9	Difference (High - Low) 0-9	t-statistics 0-9	Difference (High - Low) 0-9	t-statistics 0-9	Difference (High - Low) 0-9	t-statistics 0-9	
% scaled fails <sub>i,m</sub>	0.00%	10.49%	10.49%***	(29.35)	13.67%***	(40.21)	7.56%***	(53.32)	
% scaled short interest <sub>i,m</sub>	1.52%	5.61%	4.09%***	(27.36)	4.60%***	(19.26)	3.63%***	(40.62)	
% turnover <sub>i,m</sub>	0.46%	2.13%	1.67%***	(42.88)	1.32%***	(44.78)	1.99%***	(71.04)	
Market capitalization <sub>i,m</sub> (in millions)	1,831.75	529.53	-1,302.23***	(-9.39)	-156.91***	(-6.86)	-2,357.71***	(-15.22)	
% of institutional ownership <sub>i,m</sub>	30.90%	21.74%	-9.66%***	(-4.20)	-2.97%	(-0.86)	-14.87%***	(-12.89)	
Price <sub>i,ft</sub>	22.44	28.21	5.77***	(8.24)	1.50**	(2.18)	9.71***	(10.06)	
Return <sub>i,m</sub>	-0.01%	0.07%	0.08%	(0.12)	0.11%	(0.12)	0.05%	(0.05)	
Book to market value <sub>i,m</sub>	0.72	0.54	-0.18***	(-7.61)	-0.16***	(-11.69)	-0.20***	(-7.67)	
Proportion of optionable stock <sub>m</sub>	0.26	0.39	0.13***	(12.21)	0.15***	(15.61)	0.11***	(10.69)	

Panel B: Daily sample of short volume data for NYSE listed stocks								
Variable	Overall				Before Rule 203 and Rule 204	After Rule 203 and Rule 204		
	Lowest decile	Highest decile	Difference (High - Low)	t-statistics	Difference (High - Low)	t-statistics	Difference (High - Low)	t-statistics
	0	9	0-9	0-9	0-9	0-9	0-9	0-9
% scaled fails <sub>i,d</sub>	0.00%	0.41%	0.41%***	(67.12)	0.66%***	(293.1)	0.15%***	(103.18)
% scaled short volume <sub>i,d-3</sub>	0.07%	0.11%	0.03%***	(34.89)	0.04%***	(26.32)	0.03%***	(32.46)
% turnover <sub>i,d</sub>	0.33%	0.52%	0.20%***	(42.97)	0.22%***	(45)	0.18%***	(44.79)
Market capitalization <sub>i,d</sub> (in millions)	2,700	1,104	-1,596***	(-77.26)	-2,267***	(-163.92)	-939***	(-30.41)
% of institutional ownership <sub>i,ft</sub>	44.64%	32.62%	-12.02%***	(-34.21)	-7.00%***	(-7.92)	-13.29%***	(-35.75)
Price <sub>i,d</sub>	28.12	27.15	-0.97***	(-5.58)	-3.80***	(-20.07)	1.80***	(8.34)
Return <sub>i,d</sub>	0.01%	-0.04%	-0.05%	(-1.48)	-0.05%	(-1.16)	-0.06%	(-1.01)
Return <sub>i,d-3</sub>	-0.08%	0.10%	0.18%***	(4.83)	0.06%	(1.56)	0.29%***	(4.76)
Book to market value <sub>i,d</sub>	0.62	0.58	-0.04***	(-7.49)	-0.03***	(-8.13)	-0.05***	(-8.92)
Proportion of optionable stock <sub>i</sub>	0.40	0.44	0.04***	(18.94)	0.02***	(7.03)	0.06***	(19.17)

\*\*\*, \*\*, \* indicate statistical significance at the 0.01, 0.05 and 0.10 level, respectively.

Table 4

**Fails to deliver ranked by scaled short interest and institutional ownership**

In Panel A, we report the average fails to deliver for the deciles based on scaled short interest. In Panel B, we report average fails to deliver for double sorted groups by institutional ownership and scaled short volume. We divide our sample in two groups of high and low institutional ownership. Within each group, we divide the sample into 10 groups based on scaled short interest. We report the average fails to deliver for these 20 groups. Apart from overall results, we also report these numbers separately for the period before and after the implementation of Rule 203 and Rule 204. For this table we use the monthly short interest data sample. Please see Appendix for sample coverage and variable definitions.

<i>Panel A: Fails to deliver by scaled short interest</i>					
Overall		Before Rule 203 and Rule 204		After Rule 203 and Rule 204	
% scaled short interest <sub>i,m</sub>	% scaled fails <sub>i,m</sub>	% scaled short interest <sub>i,m</sub>	% scaled fails <sub>i,m</sub>	% scaled short interest <sub>i,m</sub>	% scaled fails <sub>i,m</sub>
0.013% (Low)	0.978%	0.001% (Low)	1.643%	0.025% (Low)	0.376%
0.056%	0.347%	0.023%	0.340%	0.086%	0.352%
0.184%	0.587%	0.116%	0.488%	0.246%	0.675%
0.543%	0.998%	0.428%	0.844%	0.646%	1.133%
1.210%	1.001%	1.086%	0.990%	1.317%	0.997%
2.135%	0.880%	2.058%	0.982%	2.189%	0.769%
3.275%	0.847%	3.385%	1.042%	3.141%	0.653%
4.791%	0.872%	5.052%	0.964%	4.503%	0.772%
7.240%	1.101%	7.396%	1.251%	7.034%	0.939%
14.492% (High)	2.401%	14.434% (High)	3.168%	14.467% (High)	1.655%
Difference (High-Low)	1.42%***		1.52%***		1.28%***
t-statistics	(10.75)		(8.85)		(25.76)

<i>Panel B: Fails to deliver by institutional ownership and scaled short interest</i>											
Overall				Before Rule 203 and Rule 204				After Rule 203 and Rule 204			
% of institutional ownership <sub>i,m</sub> (Low)		% of institutional ownership <sub>i,m</sub> (High)		% of institutional ownership <sub>i,m</sub> (Low)		% of institutional ownership <sub>i,m</sub> (High)		% of institutional ownership <sub>i,m</sub> (Low)		% of institutional ownership <sub>i,m</sub> (High)	
% scaled short interest <sub>i,m</sub> (Low)	% scaled fails <sub>i,m</sub>	% scaled short interest <sub>i,m</sub> (Low)	% scaled fails <sub>i,m</sub>	% scaled short interest <sub>i,m</sub> (Low)	% scaled fails <sub>i,m</sub>	% scaled short interest <sub>i,m</sub> (Low)	% scaled fails <sub>i,m</sub>	% scaled short interest <sub>i,m</sub> (Low)	% scaled fails <sub>i,m</sub>	% scaled short interest <sub>i,m</sub> (Low)	% scaled fails <sub>i,m</sub>
0.014%	0.188%	0.314%	0.173%	0.010%	0.260%	0.246%	0.249%	0.019%	0.121%	0.380%	0.097%
0.038%	0.222%	1.040%	0.152%	0.034%	0.309%	0.900%	0.232%	0.042%	0.140%	1.176%	0.074%
0.077%	0.283%	1.732%	0.151%	0.080%	0.376%	1.582%	0.233%	0.075%	0.199%	1.874%	0.070%
0.155%	0.396%	2.406%	0.151%	0.169%	0.546%	2.347%	0.226%	0.143%	0.258%	2.458%	0.075%
0.330%	0.497%	3.114%	0.190%	0.353%	0.772%	3.242%	0.293%	0.313%	0.247%	2.984%	0.086%
0.689%	0.652%	3.906%	0.194%	0.702%	1.034%	4.229%	0.304%	0.683%	0.302%	3.588%	0.083%
1.300%	0.799%	4.842%	0.229%	1.300%	1.324%	5.254%	0.356%	1.311%	0.312%	4.436%	0.100%
2.220%	0.915%	6.103%	0.298%	2.222%	1.535%	6.498%	0.476%	2.233%	0.335%	5.706%	0.123%
3.826%	1.206%	8.163%	0.516%	3.819%	2.013%	8.493%	0.884%	3.846%	0.457%	7.814%	0.156%
9.539%	2.934%	14.413%	1.681%	9.381%	4.839%	14.659%	2.923%	9.697%	1.144%	14.121%	0.480%
(High)		(High)		(High)		(High)		(High)		(High)	
Difference (High-Low)	2.75%***		1.51%***		4.58%***		2.67%***		1.02%***		0.38%***
t-statistics	(13.78)		(9.26)		(33.66)		(12.41)		(18.6)		(14.58)

\*\*\*, \*\*, \* indicate statistical significance at the 0.01, 0.05 and 0.10 level, respectively.



Table 5

**Fails to deliver ranked by scaled short volume and institutional ownership**

In Panel A, we report the average fails to deliver for the deciles based on scaled short volume. In Panel B, we report average fails to deliver for double sorted groups by institutional ownership and scaled short volume. We divide our sample in two groups of high and low institutional ownership. Within each group, we divide the sample into 10 groups based on scaled short volume. We report the average fails to deliver for these 20 groups. Apart from overall results, we also report these numbers separately for the period before and after the implementation of Rule 203 and Rule 204. For this table we use the daily short volume data sample. Please see Appendix for sample coverage and variable definitions.

Overall		Before Rule 203 and Rule 204		After Rule 203 and Rule 204	
% scaled short volume <sub>i,d-3</sub>	% scaled fails <sub>i,d</sub>	% scaled short volume <sub>i,d-3</sub>	% scaled fails <sub>i,d</sub>	% scaled short volume <sub>i,d-3</sub>	% scaled fails <sub>i,d</sub>
(Low)		(Low)		(Low)	
0.0000%	0.0348%	0.0000%	0.0409%	0.0000%	0.0288%
0.0059%	0.0153%	0.0052%	0.0239%	0.0065%	0.0069%
0.0183%	0.0162%	0.0175%	0.0249%	0.0190%	0.0076%
0.0344%	0.0154%	0.0342%	0.0229%	0.0347%	0.0081%
0.0548%	0.0145%	0.0550%	0.0216%	0.0546%	0.0076%
0.0781%	0.0143%	0.0792%	0.0216%	0.0769%	0.0072%
0.1062%	0.0153%	0.1098%	0.0233%	0.1027%	0.0075%
0.1445%	0.0173%	0.1525%	0.0266%	0.1367%	0.0083%
0.2076%	0.0224%	0.2243%	0.0344%	0.1912%	0.0108%
0.3995%	0.0406%	0.4351%	0.0594%	0.3647%	0.0222%
(High)		(High)		(High)	
Difference (High-Low)	0.006%***		0.019%***		-0.007%***
t-statistics	(9.33)		(24.24)		(-15.84)

<i>Panel B: Fails to deliver by institutional ownership and scaled short volume</i>											
Overall				Before Rule 203 and Rule 204				After Rule 203 and Rule 204			
% of institutional ownership <sub>i,m</sub> (Low)		% of institutional ownership <sub>i,m</sub> (High)		% of institutional ownership <sub>i,m</sub> (Low)		% of institutional ownership <sub>i,m</sub> (High)		% of institutional ownership <sub>i,m</sub> (Low)		% of institutional ownership <sub>i,m</sub> (High)	
% scaled short volume <sub>i,d-3</sub>	% scaled fails <sub>i,d</sub>	% scaled short volume <sub>i,d-3</sub>	% scaled fails <sub>i,d</sub>	% scaled short volume <sub>i,d-3</sub>	% scaled fails <sub>i,d</sub>	% scaled short volume <sub>i,d-3</sub>	% scaled fails <sub>i,d</sub>	% scaled short volume <sub>i,d-3</sub>	% scaled fails <sub>i,d</sub>	% scaled short volume <sub>i,d-3</sub>	% scaled fails <sub>i,d</sub>
(Low)		(Low)		(Low)		(Low)		(Low)		(Low)	
0.0019%	0.0071%	0.0133%	0.0138%	0.0000%	0.0387%	0.0000%	0.0486%	0.0000%	0.0140%	0.0000%	0.0094%
0.0001%	0.0160%	0.0401%	0.0063%	0.0039%	0.0244%	0.0259%	0.0166%	0.0039%	0.0063%	0.0262%	0.0042%
0.0010%	0.0190%	0.0614%	0.0068%	0.0110%	0.0278%	0.0607%	0.0185%	0.0109%	0.0064%	0.0522%	0.0039%
0.0042%	0.0070%	0.0795%	0.0067%	0.0182%	0.0304%	0.0858%	0.0183%	0.0179%	0.0070%	0.0704%	0.0037%
0.0107%	0.0103%	0.0976%	0.0073%	0.0267%	0.0324%	0.1102%	0.0207%	0.0260%	0.0072%	0.0876%	0.0037%
0.0207%	0.0116%	0.1179%	0.0081%	0.0377%	0.0360%	0.1373%	0.0234%	0.0361%	0.0080%	0.1065%	0.0040%
0.0333%	0.0130%	0.1425%	0.0088%	0.0541%	0.0412%	0.1696%	0.0259%	0.0500%	0.0090%	0.1292%	0.0044%
0.0524%	0.0153%	0.1757%	0.0104%	0.0828%	0.0528%	0.2125%	0.0304%	0.0713%	0.0105%	0.1598%	0.0050%
0.0894%	0.0213%	0.2290%	0.0128%	0.1451%	0.0708%	0.2795%	0.0361%	0.1119%	0.0150%	0.2091%	0.0065%
0.2519%	0.0411%	0.3906%	0.0218%	0.3745%	0.1115%	0.4606%	0.0566%	0.2760%	0.0294%	0.3643%	0.0125%
(High)		(High)		(High)		(High)		(High)		(High)	
Difference (High-Low)	0.0340%***		0.0079%***		0.0728%***		0.0079%***		0.0154%***		0.0032%***
t-statistics	(19.57)		(9.55)		(33.66)		(4.25)		(28.06)		(6.3)

\*\*\*, \*\*, \* indicate statistical significance at the 0.01, 0.05 and 0.10 level, respectively.

Table 6

**Stock level regression using short interest panel data**

We run the following regression of monthly fails to deliver on monthly scaled short interest and other control variables:

$$\begin{aligned} \% \text{ scaled fails}_{i,m} &= \alpha_0 + \alpha_1 \% \text{ scaled short interest}_{i,m} + \alpha_2 \% \text{ of institutional ownership}_{i,m} \\ &+ \alpha_3 \log \text{ market capitalization}_{i,m} + \alpha_4 \text{ book to market value}_{i,m} \\ &+ \alpha_5 \% \text{ turnover}_{i,m} + \alpha_6 \text{ return}_{i,m} + \alpha_7 \text{ option}_i + \varepsilon_{i,m} \end{aligned} \quad (1)$$

We report the results of the overall sample period, and for the periods before and after the implementation of Rule 203 and Rule 204 in this table. Please see Appendix for sample coverage and variable definitions. Statistical significance is based on double clustered standard errors along the firm and year dimensions following Petersen (2009).

Variable	% scaled fails <sub>i,m</sub>		
	Overall	Before Rule 203 and Rule 204	After Rule 203 and Rule 204
Intercept	3.2516*** (7.48)	6.8739*** (10.82)	1.1227*** (11.20)
% scaled short interest <sub>i,m</sub>	0.1194*** (9.17)	0.1904*** (13.23)	0.0264*** (9.67)
% of institutional ownership <sub>i,m</sub>	-0.0090*** (-12.75)	-0.0083*** (-6.62)	-0.0045*** (-14.05)
Log Market capitalization <sub>i,m</sub>	-0.1337*** (-7.58)	-0.3032*** (-16.13)	-0.0433*** (-9.63)
Book to market value <sub>i,m</sub>	-0.2593*** (-8.71)	-0.4668*** (-7.17)	-0.0569*** (-6.25)
% turnover <sub>i,m</sub>	0.2796*** (-0.35)	0.4540*** (0.68)	0.1661*** (-0.24)
Return <sub>i,m</sub>	-0.0536 (-0.35)	0.1422 (0.68)	-0.0090 (-0.24)
Option <sub>i</sub>	-0.0081 (-0.29)	0.1755*** (3.39)	0.0170 (1.44)
Sector fixed effects	Yes	Yes	Yes
Adjusted R Square	0.1094	0.1478	0.0784
Number of observations	300,132	140,723	156,885

\*\*\*, \*\*, \* indicate statistical significance at the 0.01, 0.05 and 0.10 level, respectively.

Table 7

**Stock level regression using short volume panel data**

We run the following regression of daily fails to deliver on daily scaled short volume and other control variables:

$$\begin{aligned} \% \text{ scaled fails}_{i,d} &= \alpha_0 + \alpha_1 \% \text{ scaled short volume}_{i,d-3} \\ &+ \alpha_2 \% \text{ of institutional ownership}_{i,ft} + \alpha_3 \log \text{ market capitalization}_{i,d} \\ &+ \alpha_4 \text{ book to market value}_{i,d} + \alpha_5 \% \text{ turnover}_{i,d} + \alpha_6 \text{ return}_{i,d} \\ &+ \alpha_7 \text{ return}_{i,d-3} + \alpha_8 \text{ option}_i + \varepsilon_{i,ft} \end{aligned} \quad (2)$$

We report the results of the overall sample period, and for the periods before and after the implementation of Rule 203 and Rule 204 in this table. Please see Appendix for sample coverage and variable definitions. Statistical significance is based on double clustered standard errors along the firm and year dimensions following Petersen (2009).

Variable	% scaled fails <sub>i,d</sub>		
	Overall	Before Rule 203 and Rule 204	After Rule 203 and Rule 204
Intercept	0.0783*** (6.97)	0.2054*** (7.52)	0.0464*** (7.64)
% scaled short volume <sub>i,d-3</sub>	0.0536*** (8.73)	0.0805*** (11.09)	0.0314*** (16.15)
% of institutional ownership <sub>i,ft</sub>	-0.0003*** (-7.41)	-0.0005*** (-7.48)	-0.0001*** (-11.09)
Log Market capitalization <sub>i,d</sub>	-0.0030*** (-6.10)	-0.0102*** (-7.10)	-0.0016*** (-12.74)
Book to market value <sub>i,d</sub>	-0.0049*** (-3.88)	0.0018 (0.23)	-0.0012*** (-2.64)
% turnover <sub>i,d</sub>	0.0126*** (-1.84)	0.0128*** (0.04)	0.0062*** (-1.56)
Return <sub>i,d</sub>	-0.0112* (-1.84)	0.0005 (0.04)	-0.0069 (-1.56)
Return <sub>i,d-3</sub>	0.0044 (0.94)	0.0168 (1.51)	0.0091** (2.38)
Option <sub>i</sub>	0.0027** (2.36)	0.0146*** (3.29)	0.0017*** (4.00)
Sector fixed effects	Yes	Yes	Yes
Adjusted R Square	0.0464	0.064	0.0363
Number of observations	1,357,303	270,567	1,086,736

\*\*\*, \*\*, \* indicate statistical significance at the 0.01, 0.05 and 0.10 level, respectively.

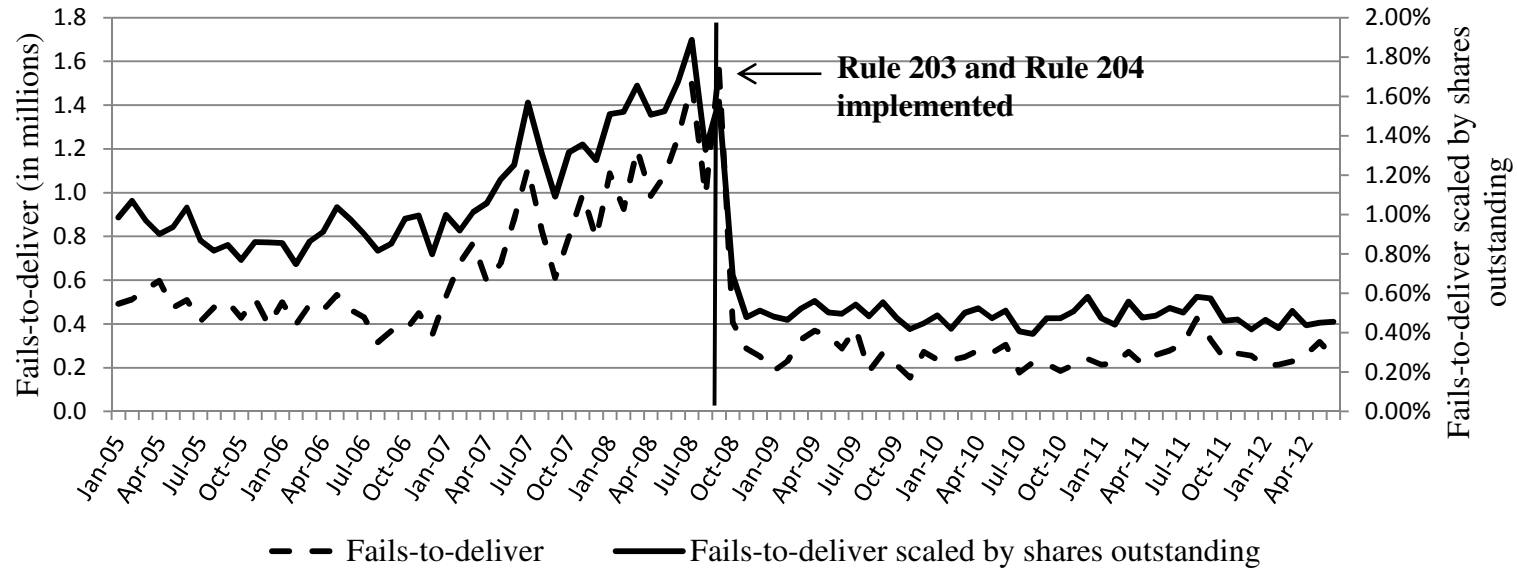


Figure 1: Fails to deliver over time. In this figure we present the monthly fails to deliver in millions and monthly fails to deliver scaled by shares outstanding for our sample period. We take the sum of daily fails to deliver during the month across stocks to calculate the monthly numbers.