Naked Short Selling and the Market Impact of Failures-to-Deliver: Evidence from the Trading of Real Estate Investment Trusts

Erik Devos[1]
The University of Texas at El Paso

Thomas McInish[2]
The University of Memphis

Michael McKenzie[3]
The University of Sydney

James Upson[4,*]
The University of Texas at El Paso

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[1] Erik Devos, Associate Professor of Finance, Department of Economics and Finance, College of Business Administration, El Paso, TX 79968 , 915.747.7770, hdevos@utep.edu

[2] Thomas McInish, Professor and Wunderlich Chair of Finance, Department of Finance, Insurance, and Real Estate, Fogelman College of Business and Economics, Memphis, TN 38152. 901.678. 4662, tmcinish@memphis.edu

[3] Michael McKenzie, Professor and Chair of Discipline of Finance, Faculty of Economics and Business, Sydney, NSW 2006 Australia, m.mckenzie@econ.usyd.edu.au

[4] James Upson, Assistant Professor of Finance, Department of Economics and Finance, College of Business Administration, El Paso, TX 79968, 915.747.7758, jeupson@utep.edu,
[*]Corresponding Author. We thank Tim McCormick and seminar participants at the University of Texas at El Paso for comments. We thank Jagadish Dandu for help in data collection. We retain responsibility for any remaining errors.

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Abstract

We investigate the impact of failures-to-deliver on the performance of 116 Real Estate Investment Trusts (REITs) during a period of substantial short selling (calendar years 2007 and 2008). REIT shares typically are easy to borrow, have high transparency (low information asymmetry), and are exposed to systematic risk during the sample period, making them short sale targets. We find that the majority of failure-to-deliver events are quickly resolved, with durations of less than three days. Our results support the conjecture that most failures-to-deliver result from short sellers covering their trades before the settlement date of the initial sale. Since the failure is resolved when the covering purchase settlement day arrives, traders forego borrowing which results in a failure-to-deliver. However, failures-to-deliver that are outstanding for many days have lower risk adjusted returns. Our results support the actions taken by the SEC in September of 2008 to tighten the delivery requirement of stock trades.

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The integrity of financial markets depends on the equal and equitable enforcement of trading rules and regulations. Securities and Exchange Commission (SEC) Regulation SHO, Rule 203, specifies a locate requirement mandating that brokers identify shares for borrowing prior to a short sale.[1] Shares are typically not borrowed until settlement day. A naked short sale occurs when a broker fails to deliver the shares sold short on settlement day. In both the popular press and through SEC comments, naked short sales are considered a contributing factor in the sudden share price drops during the fall of 2008.

Failures-to-deliver, resulting in naked short sales, can occur in several ways. First, despite having located the shares on the trade day, there may be no inventory of shares to borrow on the settlement day, forcing a fail.[2][3] Second, if a short position is covered after the day it is opened, but before the delivery date, and if no shares are borrowed, a fail will result. But this fail will automatically be resolved when the settlement date of the covering transaction arrives. In this circumstance, a trader chooses to allow the fail to occur. Third, shares may be available for borrowing, but the trader may consider the borrowing rate to be too expensive. We investigate these causes of fails.

We focus our investigation on Real Estate Investment Trusts (REITs) for several reasons. REIT shares are typically relatively easy to borrow. D'Avolio (2002) shows that the number of shares available for borrowing is higher for larger firms and for firms with high institutional ownership.[4] On average, the REITs in our sample have institutional ownership of 76.9% of outstanding shares and a mean market capitalization of 2.5 billion dollars.[5] In addition, the large institutional ownership levels of REIT shares implies that natural fails, those created by long sales where the shares are held in physical form, are less

[1]Specifically, Regulation SHO, Rule 203, adopted in January of 2005, placed specific constraints on short sale delivery and fail-to-deliver thresholds.
[2] We use the terms failure(s)-to-deliver and fail(s) interchangeably
[3]For example, if two traders 'locate' the same shares before the short sale is executed, then one of them may not be able to borrow shares on settlement day.
[4]Other studies have focused on the lending costs of equity loans including (e.g. Cohen, Diether, and Mallory (2007), Jones and Lamont (2002), Geczy, Musto, and Reed (2002), and Ofek, Richardson, and Whitelaw (2004), among others).
[5]Ciochetti, Craft, and Shilling (2002) also report high institutional ownership for REITs.

likely to occur. Only 59 of the 116 REITs included in our sample have options contract coverage, limiting the impact of naked short selling by option market makers. Naked short selling by stock market makers occurs when the market maker has a negative inventory position.[6]

In addition, REITs have large exposure to the credit crisis, the large drop in real estate prices, and the downturn in the economy that characterizes our sample period, making them excellent targets for short sales. For example, Mühlhofer (2008) shows that REIT returns are primarily affected by rental cash flows which, in an economic downturn, are likely to decrease. There is evidence to show that the impact of these events is more likely to be accurately priced for REITs. Devos, Ong, and Spieler (2007) find that REITs are more transparent and have lower levels of information asymmetry than other equities. This finding is further supported by the research of Blau, Hill, and Wang (2009) who find that short selling is lower in REITs compared to a matched sample of other equities. We believe that the high informational transparency of REITs coupled with the high exposure to systematic risk in the market makes REITs a superior vehicle for analyzing the impact of fails-to-deliver, compared to other equities.[7,8]

Our paper is not the first to look at the issue of fails-to-deliver in equity markets.[9] Boni (2006) investigates the fail-to-deliver issue using fails data for three settlement days prior to the implementation of Regulation SHO. She finds evidence that persistent fails-to-deliver, and, hence, persistent fails-to-receive, are strategic decisions of market participants to establish goodwill. Boni's analysis shows that most of the market participants with fail-to-deliver positions also have contemporaneous fail-to-receive positions. If a participant forces delivery from a fail-to-receive position, she will likely then be forced to deliver from a fail-to-deliver position that she also maintains. The result is a 'quid pro quo' equilibrium where market participants do not force delivery from counterparties, with the expectation that delivery

[6]Stock market makers can also naked short sell for hedging reasons. If they will be receiving a large placement of a particular equity, they are allowed to naked short the equity before placement as an inventory hedge.

[7]The impact of information asymmetry, as measured by deciles of standardized unexpected earnings, on short sales is studied by Christophe, Ferri, and Angel (2004). They focus their analysis on short sales prior to earnings announcements.

[8] The issue of informed trading and information asymmetry for REITs are examined in Gyourko and Nelling (1996), Downs and Güner (1999), McDonald, Nixon, and Slawson (2000), and Clayton and MacKinnon (2000), among others. The consensus is that asymmetric information is lower for REITs relative to other equities.

[9]Fail-to-deliver has been studied in other market contexts such as government bonds and currency. See for example, Johnson (1998), Kahn and Roberds (2001), and Fleming and Garbade (2002).

will not be forced from them. Boni also finds that persistent fails-to-deliver occur with a higher frequency when shares are expensive to borrow for short selling purposes. In addition, Evans, Geczy, Musto, and Reed (2009) use option market maker data from 1998-99 to analyze strategic fail-to-deliver trades by option market makers. They find the alternative to fail-to-deliver has a significant impact in the pricing of options, particularly when shares are expensive or impossible to borrow for short sales. Their explanation is that when shares are costly to borrow, short sellers turn to synthetic short trades by writing a call option and purchasing a put option, driving option prices from put-call parity. Option market makers can then arbitrage this mispricing by using their ability to naked short sell the underlying equity and fail-to-deliver when borrowing costs are high.

Our analysis extends previous research in several ways. First, our analysis is based on more recent fail-to-deliver data supplied by the SEC. We augment the fail-to-deliver data with daily equity loan inventory from the Data Explorer.[10] Using this Data Explorer data, we analyze, at the daily level, the number of shares available for borrowing and the cost of borrowing. We find that in only three occasions REITs have no equity loan inventory available when fails-to-deliver occur. In general, we find that fails-to-deliver occur much more frequently for REITs without option coverage and when borrowing costs are low. Therefore, we shed light on the fail-to-deliver mechanism during a period of high market wide volatility that is not included in the previous literature on fail-to-deliver. We find, consistent with prior expectations, the number of REITs in our sample having fail-to-deliver events increases significantly from 2007 through 2008. There is also a dramatic drop in fail-to-deliver events after the SEC initiated new share delivery constraints in September of 2008. However, we find that in general, fail-to-deliver events have relatively short durations. The median time for reportable fail-to-deliver events is only 1 day.[11] 75% of reportable fail-to-deliver events last less than or equal to 3 days. While some REITs in our sample have persistent reportable fails-to-deliver (i.e. reportable events lasting more than 5 days) most of

[10]More detail on the Data Explorer database is contained in the data section of this paper, however, the Data Explorer database represents only a subset of equity loan inventory. Additional equity loans may exist that are not included in the database.

[11]Fail-to-deliver reporting requires a minimum of 10,000 shares that fail-to-deliver to be recorded in the database.

these failure events are quickly resolved.[12] Our results are most consistent with the conclusion that the majority of fail-to-deliver events are the result of short sellers covering their short position before the required delivery date and allowing the obligation of delivery to resolve on its own, rather than borrowing stock to meet delivery requirements.

We also evaluate the impact that the revelation of a failure-to-deliver has on the market. The previously cited literature shows a correlation between borrowing costs and fails-to-deliver; however, it does not evaluate the announcement effect of the failure. We find that the revelation of fails-to-deliver to the market has a negligible impact on the market return of the underlying equity. However, if fails-to-deliver are sustained for many days, these sustained failures have a negative impact on stock returns. Our results indicate that the SEC decision to tighten delivery requirement of stock trades in September of 2008 was a reasonable response to potential market manipulation.

I. Hypothesis development

Under SEC Regulation SHO Rule 203 (called the locate rule), a short seller is obligated to affirm that shares that will be sold short are available to be borrowed. Stocks on the "easy-to-borrow" list satisfy the locate rule. For other stocks, specific arrangements must be made to assure that shares will be available for delivery. However, even if the locate rule is satisfied, it is possible that no shares can be borrowed on the settlement date. Suppose that perspective short sellers verify that a stock is on the easy-to-borrow list. Because all short sellers are using the same list, the aggregate number of shares that are sold short may exceed the number of shares than can be borrowed. Hence, one or more of the short sellers fails to deliver. This leads to our first null hypothesis:

> **Hypothesis 1:** Fails-to-deliver are the result of a lack of equity inventory available to borrow on the settlement date.

Hypothesis 1 is based on the premise that the short seller wishes to make delivery on the settlement date, but is prevented from doing so by a lack of stock to borrow. Hence, a showing of sufficient stock offered

[12]We use the same definition of 'persistent' fails as Boni (2006).

for lending on the settlement date is sufficient to refute the hypothesis. Since REITs typically have stock available for borrowing, we expect to reject this hypothesis.

Many trading strategies maintain short positions that are within the settlement time frame. Consider, for example, an institution that is implementing a contrarian trading strategy such as outlined by Lo and MacKinlay (1990). This strategy depends on market overreaction and can simply be implemented by shorting yesterday's winners and buying yesterday's losers to profit from price reversals. The portfolio of winners and losers is then rebalanced every day where, in many cases, yesterday's short position is today's long position. Related to our setting, assume that a short seller opens a short position of 100,000 shares on Monday for settlement on Thursday, and then closes out this position by purchasing 100,000 shares on Tuesday for settlement on Friday. There will be a recordable fail-to-deliver position opened on Thursday, if the short seller does not borrow shares for delivery. However, on the following day, Friday, assuming that the shares from the closing trade also do not fail-to-deliver, the fail-to-deliver position will be closed. Currently, the SEC allows broker-dealers to claim a 'pre-fail credit' for trades that fully cover a short position until the end of trading on day t+3. While a fail-to-deliver is recorded in the database, the covered trade is not a fail-to-borrow or a naked short sale.[13] To avoid the potential that the offsetting trade to the short sale fails-to-deliver, the short seller can initiate a loan contract on Friday such that the borrowed shares can be delivered to the counter party of the short sale, and then the loan terminated the same day with the delivery of the shares from the offsetting trade. In fact, consistent with our interpretation, Diether (2008) finds that a significant number of equity loan contracts are intraday.[14] During the majority of the period of our analysis however, a fail-to-deliver created by a locate, short, and cover transaction would not be considered either a naked short sale or a fail-to-borrow shares. Our second null hypothesis is:

[13] For more information on this issue see http://www.sec.gov/divisions/marketreg/204tfaq.htm

[14]These intraday loan contracts are not the result of short sales that are initiated and then covered on the same trading day. Such trades will be netted within a clearing firm and no delivery obligation will be sent to the National Securities Clearing Corporation.

Hypothesis 2: Fails-to-deliver are short in duration, covering after the trade date but before the short sale settlement date.

Although our motivation for Hypothesis 2 is based on the contrarian trading strategy, this is not the only trading strategy that would create short term short selling trade and cover transactions. Foster and Viswanathan (1996) propose a multi-period model where informed traders forecast the trades of others. If an informed trader forecasts that other traders will be selling into a market, competition for profits can lead to a 'rat race' of trading followed by the covering of positions. Brunnermeier and Pedersen (2005) model predatory trading events where one group of traders learn that liquidity needs will drive institutions to unwind long stock positions. This informed group of traders then sells into the market simultaneously with the unwind of the institution, further depressing prices. These positions are then covered, resulting in profits to the predatory group. In addition, Carlin, Lobo, and Viswanathan (2007) develop a cooperative model of trading where the cooperation breaks down during periodic liquidity crises. During these liquidity crises, traders race and fade the market to generate profits.

Naked short sellers may purposefully fail-to-borrow shares in order to destabilize a stock's price by increasing the amount of short selling that can be accomplished. Former SEC commissioner Roel Campos states: "the majority of these failures-to-deliver are <u>not</u> the result of honest mistakes or bad processing. Rather, these companies are instead targets of illegal and manipulative trading, with the intentional fails-to-deliver used by traders to extract profits as the share price plummets."[15]

An intentional fail-to-deliver can only result when there is in fact an intentional fail-to-borrow or when the short seller does not satisfy the locate requirement. Our data allow us to ascertain directly whether there is a fail-to-borrow. In addition, the actual accumulated position of shares that fail-to-deliver must negatively impact the returns of the targeted stock and not just the short sale. For example, Aitken, Frino, McCorry, and Swan (1998) show that news of a short sale negatively impacts the market. Consequently, it may also be true that the information content of the accumulation of fails-to-deliver may

[15]See http://www.sec.gov/comments/s7-30-08/s73008-108.pdf.

impact the stock price. In addition, the fail-to-borrow cannot be simply to avoid borrowing costs. To see this, consider two short sellers that short the same stock where one fails-to-deliver and the other borrows shares and meets his delivery obligation. Both short positions earn positive returns as the share price drops. However, the short seller that fails-to-borrow has a borrowing cost, known as the rebate rate in equity short sales, of 0%. On the other hand, the short seller that borrowed shares will have a rebate rate that can be positive or negative and can possibly change over the life of the short contract. The only difference in profits is the rebate rate of the short seller who borrowed shares, which in fact could be positive. The market can easily ascertain the rebate rate for shares and infer that fails-to-deliver are not informational based, but rather a transparent attempt to avoid high stock borrowing costs. In this case, outstanding fails-to-deliver should not affect stock prices. These considerations lead to the following hypothesis:

Hypothesis 3: Fails-to-deliver are the result of a fail-to-borrow available shares.

Evans et al., (2009) and Boni (2006) show that fails-to-deliver are linked to the cost of borrowing, with failures increasing in borrowing costs. Our analysis differs. A fail-to-deliver has two potential impacts on the market. The first is at the initiation of the fail, in other words on the day that the short sale occurs. The second potential impact is when the announcement to the market is made that a fail-to-deliver has occurred. Our analysis for hypothesis 3 focuses on the announcement to the market, after trading on day t+3, that a fail-to-deliver has occurred. If Hypothesis 3 is supported, then we will find that the announcement of fails has a negative impact on market returns. In addition, the duration of fails as measured by the number of days that reportable fails-to-deliver are outstanding, will have significant and negative explanatory power for abnormal returns.

II. Sample and data

The REIT equities used in our analysis are identified in the CRSP database using the share code identifier.[16] To limit the potential impact of bankruptcy and delisting effects, we require that REITs exist

[16]REIT's are identified in the CRSP database using the second digit of the share code. This digit is '8' for all REIT's in the database.

in the active CRSP database on the first and last day of the sample period. In addition, we drop REITs from the sample if the average price of the REIT for the full sample period is under 5 USD. The sample period is from the first trading day of 2007 through the last trading day of 2008.

Table 1 shows selected descriptive statistics for our 116 REITs. The sample REITs have an average daily market capitalization (labeled *CAP*) of about 2.5 billion USD with a median value of 1.2 billion USD (from CRSP). Our sample is actively traded with an average daily volume (labeled *VOLUME*) of 880,182 shares (from CRSP, also). On average, institutions own 76.9% (labeled *INSTOWN*).[17] 59 of the REITs in our sample have option contracts.[18] We also segment our descriptive statistics by REIT type. The sample consists of 99 equity REITs and 17 mortgage REITS (using a classification provided by NAREIT). Equity REITs are significantly larger in market capitalization and have higher institutional ownership, but smaller average daily trading volume. In addition, mortgage REITs tend to have a larger proportion of option coverage compared to equity type REITs. We also segment these statistics based on year. As expected, market capitalization decreases between 2007 and 2008, while trading volume increases. The average proportion of institutional ownership increases from 75.1% in 2007 to 78.7% in 2008 and average daily volume shows a substantial increase between 2007 and 2008.

[17] We use the monthly S&P security owner stock guide to obtain information on institutional ownership.
[18] Option contract listing data comes from the CBOE website http://www.cboe.com/data/mktstat.aspx.

A. Data Explorer equity loan dataset

Data Explorer is based in New York and London and according to its web site is the world's most comprehensive resource for data on short-selling. Data Explorer covers thousands of equities worldwide and receives more than 3 million transactions daily from over 100 top securities lending firms. Data are collected from institutions that borrow and lend securities and consolidated for dissemination to subscribers. For each security, the data includes information on the value and quantity of the demand and supply for stock borrowing, cost of borrowing on a scale of 0-5, the number of brokers and agents, and other variables. The Data Explorer dataset is extensive, covering 70% of the equity loan market. We obtain equity loan data for the period January 2007 through December 2008.

B. Fail-to-deliver data

The SEC fail-to-deliver database consists of the total number of fails-to-deliver on a particular settlement date. The data comes from the National Securities Clearing Corporation's (NSCC) Continuous Net Settlement system and is aggregated over all NSCC members. Fails data represents the net (balance level outstanding) for each stock; new fails + carry over fails - fails covered. If the net number of fails is less than 10,000 shares, no entry is recorded for that stock for that day.[19]

To facilitate the analysis, when appropriate, we match settlement day fails with the day on which the trade was made. Next, we address the continuous balance nature of the data. Consider a four day sequence: day one, no fails are reported; days two and three, 35,000 shares fail; day four, no fails are reported. On day two we can say that a minimum of 25,001 new fails were created. However, on day three there could be no new fails (the carry over value of the fails calculation is 35,000 shares), 35,000 new fails (35,000 new fails and 35,000 shares covered for a net of 35,000 fails), or some combination of new fails, covers, and carryovers. Finally on day four, a minimum of 25,001 shares are covered. We take the most conservative approach and assume that only the proportion of fails that increase from the

[19]As of July 1, 2009 the 10,000 share limit was dropped. Only stocks that have no fails on a particular settlement date are excluded from the fails data.

previous day represent new fails and the remaining fails represent carryovers from the previous day. However, we also set the number of fail-to-deliver shares equal to zero on days where no data is recorded in the fails dataset.[20] To allow comparison across REITs, we divide the adjusted fails data by CRSP trading volume for each day. Formally we define the failure rate (*Frate*) as

$$Frate_{i,t} = (Fails_{i,t} - Fails_{i,t-1}) / Vol_{i,t} . \quad (1)$$

where $Fails_{i,t}$ represents the fails data record for stock *i* on day *t* and $Vol_{i,t}$ represents the CRSP trading volume for stock *i* on day *t*. If $Frate_{i,t}$ is negative, the failure rate is set to zero.

Table 2 shows distribution statistics of the failure rate for the REITs included in our sample. For the full sample of 116 REITs there are 57,277 stock days, of which 7,659 days have fail-to-deliver rates (*Frate*) that are greater than zero. The *Frate* distributional properties are conditioned on the calculated *Frate* being greater than zero. There are 27 observed stock days in our dataset that produce fail rates in excess of 100%. These observations are dropped from the analysis. The average failure rate for the full sample is 6.15%. For any given day, 15.4 REITs, on average, have failure rates greater than zero. While the minimum failure rate is below 0.01% of CRSP volume, the maximum failure rate is 96.8%.

REITs are generally grouped into two main types--equity and mortgage. Mortgage REITs are required to invest at least 75% of assets in commercial property mortgages, residential mortgages, and short- or long-term construction loans. Equity REITs are required to invest 75% of assets in income producing properties. Equity REITs have an average fails rate of 5.61% compared to 7.81% for mortgage REITs. The maximum fail rates in our sample for equity REITs and mortgage REITs are 81.92% and 96.82%, respectively.

Each fails observation can contain long sale fails, standard short sale fails, fails due to technical system issues, and fails due to permissible naked short sales of option and stock market makers. In addition, the SEC does not guarantee the accuracy of the fails database. Since our focus is on the market

[20]The convention of setting fails equal to zero when data is not reported in the fails database is also followed by Kolasinksi, Reed, and Thornock (2009).

impact of fails-to-borrow, we drop 35 stock day observations where the fail rate is greater than 50% of CRSP volume as possible errors.

III. Results

A. Overview of fail-to-deliver market impact

Figure 1 shows a time series plot of the *Frate* and the number of stock days in each month when there are positive failure rates. From the beginning of our sample period until June of 2008, the *Frate* remains relatively stable at about 6% of trade volume. After June of 2008, the *Frate* continues to decline until by the end of the sample period when the average *Frate* is just over 3.5% of trade volume. Note that trade volumes increased during June-September, possibly explaining some of the drop in *Frate*, although the raw fails quantity also decreased from previous levels. While the *Frate* remains roughly constant during the January 2007-June 2008 period, the breadth of the *Frate*, measured as the number of stock trading days in a month with positive *Frate*, increases sharply. Starting in May of 2007, the number of stock days with positive *Frate* (labeled *Fsum*) is about 280 days out of a possible 2,320 stock days per month. The breadth measure peaks in July of 2008 at 522 stock days with positive *Frate*. After the SEC implementation of new rules restricting naked short sales in September of 2008, the breadth measure of *Frate* decreases sharply; although the breadth never drops below the levels seen at the beginning of our sample period. While this result clearly indicates that the *Frate* is increasing over the time frame of our analysis, it is not clear that there is a correlation between fails-to-deliver and a fail-to-borrow.

Next, we look at an estimate of the profitability of fail-to-deliver. Failure data are adjusted to align with the day the trades occur, rather than on the settlement date. Also, we assume that all fails are the result of short sales. Second, we only evaluate profits based on the net position of fails. Fails below the threshold rate are not available for the analysis. Also, the analysis assumes that a reduction in fails is based on the delivery of stock that is purchased and not the result of delivering borrowed shares. Finally, we assume that the closing price on the day of failure creation or covering is a good proxy for actual execution prices.

The results are shown in Table 3. We estimate the profit from fails-to-deliver based on the cash flow generated from the creation and covering of these positions. Cash flows are estimated based on the change in the number of shares that fail, multiplied by the closing stock price on the day the trade occurs. Specifically, cash flow for each REIT *i* is calculated as:

$$CshFlw_{i,t} = (FailQty_{i,t} - FailQty_{i,t-1}) * ClsPrc_{i,t} \quad (2)$$

where *FailQty* represents the number of shares that fail-to-deliver on day *t* and *ClsPrc* is the closing price on day *t*. Thus, an increase (decrease) in fails represents a cash inflow (outflow). If the quantity of fails is below the threshold reporting value of 10,000 shares, we set the fails quantity to 0. The reported value represents the sum of all cash flows over all sample REITs for each month. Total profit represents the carry over cash flow from month to month. For the 50% max fail rate filter, days where the quantity of fails is greater than 50% of CRSP volume are dropped from the analysis. Because of the similarity between the filtered and non-filtered evaluation, we restrict our discussion to the filtered results.

We find that the profit from fails-to-deliver is highly variable ranging from 159 million USD in May of 2007 to -134 million USD in June 2007. Through September of 2008, the profits from fail-to-deliver positions earned an estimated aggregate profit of 149 million USD, which is economically significant. However, over the same period, REITs lost 58.6 billion USD in market capitalization. While these results do not constitute a specific test of Hypothesis 2, the large losses absorbed by fail-to-deliver positions, in some months, indicate that as prices move against short positions, these positions are quickly closed out.

In September of 2008, the SEC initiated several rule changes for short selling and delivery of shares. In particular, on September 17, 2008 the SEC significantly tightened delivery requirements in emergency order 34-58572 and the next day restricted short selling in a list of financial stock with emergency order 34-58592.[21] However, assessing the impact of these rule changes is difficult because other emergency programs, such as the Troubled Asset Relief Program (TARP), were announced

[21] 10 REITs were included in the short sale ban of financial stocks.

contemporaneously. Boehmer, Jones, and Zhang (2009) find that financial stocks on the restricted short selling list have a positive price impact after the short sale ban was enacted, although, a similar price increase is found in a matched sample of stock that were not under the short sale ban. Our profit analysis indicates a similar positive price reaction. October of 2008 shows a loss of 94 million USD, followed by a small gain of 3 million USD in November and finishing the sample period with a loss of 28 million USD in December. Still, fail-to-deliver positions earned an estimated overall profit of 30 million USD by the end of December 2009.

While overall, fail-to-deliver selling generated an estimated net positive profit, the large monthly changes from positive to negative profits indicate that fail-to-deliver sellers are not simply waiting for prices to fall before closing out stock positions. If this were the case, while there would still be variability in the profit levels on a monthly basis, losses should be small or non-existent because failure positions would simply be maintained until prices are favorable to close out these positions.

B. Equity loan inventory analysis

One of the key assertions of our paper, justifying the selection of REITs as the focus of our analysis, is that REITs represent a target for short sellers over our sample period. Hence, in Figure 2 we examine the average inventory utilization and the average borrowing costs over our sample period. *Inventory Utilization* is the value of assets on loan divided by the total value of lendable assets expressed as a percentage. *Borrowing Costs* are provided on a scale of 0 (lowest) to 5 (highest). Both measures are calculated on a daily basis. Figure 2 clearly shows that there is a substantial increase in the quantity of equity loan inventory being used for short selling purposes. At the beginning of our sample, roughly 15% of the available loan inventory is used for short selling. The percentage quickly rises and peaks in March of 2008, at just under 35% of the available equity loan inventory. This represents over a 100% increase in the utilization value. After the peak utilization in March of 2008, the level of *Inventory Utilization* decreases, but remains substantially larger than the values found at the beginning of our sample period. As expected, simultaneously with the increase in *Inventory Utilization*, *Borrowing Costs* also rise. While

Inventory Utilization peaks in March of 2008, equity loan cost peak during the last week of September and the first week of October of 2008. This period coincides with the ban on short selling issued by the SEC. This large increase in loan costs during the period when short selling is banned is also found in the analysis of Kolasinksi et al. (2009). These results indicate that the REITs in our sample are active targets of short sellers during our sample period, consistent with our assertion.

Hypothesis 1 states that fails-to-deliver result from a lack of equity loan inventory available for borrowing. The implication is that the locate requirement of Regulation SHO has been met, but nevertheless, short sellers are forced to fail to deliver. Our results are shown in Table 4. We identify fails-to-deliver and variables from Data Explorer for January 1, 2007 to December 31, 2008. *Inventory Utilization and Borrowing Costs* are as previously defined. Excess Inventory is the difference between the number of shares available to be borrowed and the change in the number of shares from day *t-1* to day *t* of the quantity of shares that fail-to-deliver (in thousands of shares). Surplus (shortage) is the number of days on which excess inventory is positive (negative). Inventory position is the count of the number of days with shares that fail-to-deliver when there is a surplus or shortage of inventory to borrow. Short- and long-term costs are based on the value weighted average fee for all new trades on the most recent trading day and for all open trades, respectively.

Table 4, Panel A, shows the results for the full sample. One of the reasons we selected REITs for our study is because their shares are relatively easy to borrow. On average, only 40.12% of share inventory is consumed in short positions. In addition, on average there are 27 million shares available for loan with a maximum value of about 120 million shares. However, we do find that a negative equity loan position can occur, with the minimum number of available shares being negative 16,000. However, as indicated in the last column of the table, only 3 stock days out of 7,494 stock days that have increases in the outstanding reportable fail-to-deliver position, show insufficient equity inventory available to borrow based on the Data Explorer inventory levels. Overall there is little support for Hypothesis 1.

Evans et al. (2009) find that option market makers choose to fail-to-deliver when borrowing costs are high or shares are not available for borrowing. Therefore, we segment our equity loan analysis

between REITs that have option coverage and those that do not. Several REITs moved from the no option to option coverage during our study period and therefore can contribute to both the option and no option value. Table 4, Panel B, shows that REITs with option coverage have a slightly higher utilization of equity inventory for short sales, but also have a higher average number of shares available for loan, 30.5 million shares for those REITs with option coverage verses 24.6 million shares for REITs without option coverage. However, it is only the REITs without option coverage that ever have a negative loan inventory balance. All three stock days that have negative loan inventory balances occur of REITs lacking option coverage at the time of the fail-to-deliver. Also, the majority of stock days with fails-to-deliver occur for these non-option REITs. There are 4,122 stock days with increases in the number of shares that fail-to-deliver for non-option REITs, but only 3,372 days for option REITs. Hence, option market maker failures are not dominating our results.

Both Evans et al. (2009) and Boni (2006) find that share borrowing costs impact whether traders fail to deliver. Therefore, we segment our results based on both short- and long-term *Borrowing Costs* for REIT shares. It is possible that fails-to-deliver are a simple proxy for high stock *Borrowing Costs*. Table 4, Panel C, shows that the majority of failure to deliver events occur when *Borrowing Costs* are at their lowest, 4,310 out of 7,494 events. In fact, of the three stock days where we find a negative equity loan inventory, each day occurred when short term stock *Borrowing Costs* are at the lowest point. Even when short term stock *Borrowing Costs* are high, there remains a substantial inventory of shares to borrow, with an average of over 8 million shares ready for loan, with a minimum value of 246,000 shares. Our results are almost identical when we sort based on long term historic *Borrowing Costs*.

The results from our analysis of loan equity inventory for the REITs in our sample allow for several specific conclusions. First, our contention that REITs represent a type of equity that is easy to borrow is supported by the equity loan data. In general, there is a significant reserve quantity of shares for short sellers to borrow from over our sample period. Second, fails-to-deliver are not dominated by option market makers regulatory permissible ability to naked short sell shares for hedging purposes. The majority of fail-to-deliver events are found in REITs that lack option coverage. Third, fail-to-deliver

events are not just a proxy for high borrowing costs. While some events occur when borrowing costs are high, the majority occur when *Borrowing Costs* are low. Finally, we find little support for Hypothesis 1, that fails are the result of a lack of equity loan inventory. Although there are three events where loan inventory was insufficient to cover the increase in shares that fail-to-deliver, the majority of fail events occur when there is ample inventory to borrow.

C. Locate, short, and cover

1. Sustained reportable fails-to-deliver

Hypothesis 2 states that fails-to-deliver are the result of short sales that are covered before the delivery date. In general, the short seller locates the shares consistent with Regulation SHO, initiates a short sale, and then covers the short by purchasing back the stock before the required delivery date. A failure-to-deliver is recorded because the settlement date for the short sale is before the settlement date for the covering trade. One implication of the locate, short, and cover process of Hypothesis 2 is that the duration of reportable fails-to-deliver is less than 3 days. To test this implication, we evaluate the run duration of reportable fails-to-deliver.

We calculate the run duration of reportable fails-to-deliver by counting the number of consecutive days that fails are reported. The duration of the run is recorded for the month in which the run terminates. For example, if a run is three days long and starts in month t, but terminates in month t+1, the run duration is recorded for month t+1. The results of the run duration analysis are shown in Table 5. With the exception of two months (June and October of 2008), the average duration of outstanding reportable fails-to-deliver is below 3 days. We also report the maximum run duration for each month. For the full sample period, we find that one REIT has a run of 230 consecutive days. Several other REITs have persistent fails-to-deliver; however when we evaluate the run distribution based on the median, first, and third quartiles, these results indicate that the typical run duration is 3 days, or lower. In fact, when we transform the run duration values by taking the natural log to control for the outliers, the typical run of reportable fails-to-deliver is less than 3 days for both the full sample, and for each month.

Overall, our analysis of the run duration of reportable fails-to-deliver supports Hypothesis 2. In general, the average duration of consecutive days with reportable fails-to-deliver is below 3 days. If a short seller initiates a sale on day *t* and then covers the trade on day t+1, the difference in settlement days between the short sale and the covering trade creates a fail-to-deliver, with a duration of one day. Of course, longer durations of reportable fails-to-deliver can occur if the locate, short, and cover process is used by multiple short sellers for multiple days. Since the median duration of reportable fails-to-deliver is only a single day for 21 of the 24 months included in our sample, and is never over 2 days, the duration analysis indicates that fails-to-deliver are more likely associated with short term trading strategies. Note, however, that it is possible that the fails-to-deliver are closed out when the short seller actually borrows shares for deliver rather than by a covering purchase.

2. Clean event return analysis

Heretofore, we have assumed that decreases in the number of fail-to-deliver shares are caused by the delivery of shares purchased to cover a short position, rather than by borrowing shares. In this section, we offer support for this assumption. In addition, we recognize there is a temporal aspect to our analysis. The SEC implemented a number of emergency orders in September 2008, which can confound our analysis. Whether these rule changes caused the change in fails-to-deliver that are observed is not the focus of our analysis; however, the results clearly indicate that a structural break occurs in September 2008.[22] On the other hand, one of the focuses of our analysis is on the impact of fails-to-deliver under adverse market conditions. While there is considerable anecdotal information that a real estate boom occurred in the 2005-2006 time frame, exactly when the bubble began to burst is less clear. For the

[22]There are several other potential causes for the observed changes in the data, a few are which stated here. First, profitable trading opportunities could have been forgone in order to conserve cash positions. The developing credit crisis increased the desire to maintain cash. Second, firms may have desired to partake in the TARP program. However, continued aggressive short selling in the market might jeopardize TARP participation. Third, the SEC rule changes indicated that the SEC was highly focused on short sale activity. Even legal short sales might still precipitate legal action from the SEC, with legal defense costs consuming potential profits by short sellers. Finally, short sellers might have voluntarily curtailed short selling activity in order to reduce downward pressure on the market. This type of cooperative behavior is modeled in Carlin, et al. (2007).

purposes of our analysis, we set this date as May 1, 2007. We select this date for several reasons. First, there are a number of major financial announcements that occur in the second quarter of 2007. For example, in April of 2007, New Century Financial and SouthStar Funding, both subprime lenders, filed for bankruptcy. In June of 2007, Bear Stearns suspended redemptions in subprime hedge funds and the SEC opened several enforcement investigations into the formation techniques of collateralized debt obligations. Thereafter, the collapse of the housing market and the credit crisis both quickly developed. Figure 1 shows that in May 2007 the breadth of fails increased substantially and remained high until October 2008. Figure 2 indicates that equity loan utilization also increases sharply after May of 2007 along with borrowing costs. Our cash flow analysis, shown in Table 3, indicates that May 2007 is the single most profitable month for fails, and our run analysis indicates that the duration of consecutive days with outstanding fails-to-deliver increased after May and remains high through October 2008. Hence, hereafter, we restrict our analysis to the period 1 May 2007 through 15 September 2008 to better focus on the impact of failures-to-deliver on stock performance.

Hypothesis 2 implies a specific return pattern for the locate, short, and cover process. In particular, on days when fails are initiated (short positions are opened), the selling pressure and the fact that sales may be driven by short transactions, decreases stock prices and leads to negative returns. Then, when the shares are covered, the added buying pressure will result in positive returns. This return pattern is consistent with the theoretical work of Foster and Viswanathan (1996), Carlin, et al. (2007), and Brunnermeier and Pedersen (2005).[23] We match the failure data with the trade date. We use clean events to conduct our return analysis. A clean event is defined as a 3 day series for which day 1 has a decrease or no reported fail rate, day 2 has an increase in the fail rate, and day 3 has a decrease or no reported fail rate. The short time frame of this analysis is justified by our findings of the typical duration of outstanding fails-to-deliver.

[23]Our analysis is not constructed as a specific test of these models, rather, we highlight these models as a theoretical frame work to help structure our analysis.

We use abnormal returns for this analysis. However, as a robustness check, two estimates of abnormal returns are used. First, abnormal returns are estimated as the residual of a Fama and French 3 factor regression. The regression is based on a daily returns for the full two year period of the analysis. Peterson and Hsieh (1997) show that the Fama- French model performs well when applied to both equity and mortgage REITs. Second, REIT returns are adjusted based on the value weighted return of the market. The analysis is conditioned on the *Frate* rather than on the number of shares that fail-to-deliver. We denote the day that fails-to-deliver are initiated as the Fail Day, and the following day as the Cover Day for this analysis. Stock days are dropped from the analysis if the *Frate* is greater than 50% of traded volume as potential data errors. We test for the return pattern by evaluating the difference between the abnormal return on the fail and cover days. The results are shown in Table 6.

Table 6, Panel A, shows the results based on the 3 factor regression residual. There are 3,005 clean events in the sample period; however, we do not find evidence of the return signature under this level of conditioning. When the results are restricted to clean events with a minimum *Frate* of 10% of traded volume there are 575 events in the sample. We find that the return on the Fail Day is negative, with an average risk adjusted return of -0.119 and that the risk adjusted return for the cover day is positive, 0.068%, but these are not statistically different. As we increase the minimum threshold of the *Frate* considered, the returns on the Fail Day continue to become more negative and the subsequent returns on the Cover Day become more positive. Once the threshold fail rate reaches 14%, there is a significant return difference between the Fail and Cover Days. However, note that this analysis is only conditioned on the *Frate* of the Fail Day; if the *Frate* on day *t* is 15%, it does not mean that all of the fails are covered on the subsequent day. In general, this return pattern matches the theoretical return patterns identified in the race and fade and predatory trading literature, and supports the locate, short, and cover process of Hypothesis 2. Table 6, Panel B, shows the results when market adjusted returns are used, rather than the residual from a 3 factor regression. The results are the same when market adjusted returns are used, although statistical significance occurs at a minimum *Frate* of 15% rather than 14% for the regression residual.

There are several caveats to highlight before proceeding. First, the returns for the Fail and Cover Days are not meant to reflect the potential returns of short sellers. In general, short sellers are sophisticated traders that adopt complex strategies for trading. For example, Boehmer, Jones, and Zhang (2009) find that close to 75% of short sales are initiated by institutions. Diether (2008) finds that, after accounting for loan costs of short sales, most short sales must be paired with long counterparts to be profitable. Furthermore, we do not know the exact price at which a short sale is made or the price of the covering trade. Second, we emphasize that the *Frates* of our study are consistent with the findings of Diether, Lee, and Werner (2009) who find that short sales, on average, represent 24% of NYSE daily volume and 31% of NASDAQ volume for a sample of stocks in 2005. Our *Frates* are in line with their values, especially considering that the markets during our timeframe have significantly higher downward pressure than in 2005.

The results reported in Tables 5 and 6 support Hypothesis 2. We find that the median run duration is typically 1 day and never greater than 3 days. Our return analysis of clean events also offers support for the locate, short, and cover process. Returns on the day fails are initiated are increasingly negative as the *Frate* increases and these days are followed by positive risk adjusted returns. Our argument is that short selling pressure depresses the stock price on the day fails are initiated, and then buying pressure on the following day to cover increases the stock price resulting in the return pattern identified in the analysis. However, an alternate argument could be that a temporary increase in short selling decreased the stock price to below the fundamental value, buyers then enter the market on the following day to purchase the stock at a discounted price. While this argument might explain the return pattern identified, it does not explain why the duration of fails-to-deliver is so short, or why failures occur. If however, as noted earlier, the announcement of fails adversely affects the stock price, then short sellers might delay delivery of borrowed stock in order to further depress stock prices and extend profits.

D. A fail-to-borrow?

1. Failure announcement analysis.

A fail-to-deliver resulting from a sale of stock has two potential effects. First, there is a liquidity effect that occurs on the day of the sale. Microstructure models such as Kyle (1985) and Glosten and Milgrom (1985) indicate that the sale of stock depresses prices. In addition, Aiken et al. (1998) show that the announcement of a short sale has an added negative price impact beyond a standard equity sale. If fails-to-deliver are the result of short sale transactions, then on the day the fail is initiated (i.e. the day of the trade), there should be a negative liquidity impact on the price of the stock. There is also a potential announcement effect with a failure-to-deliver. After settlement on day t+3, there is an announcement to the market that fails-to-deliver have occurred. If the announcement of failures adversely impacts equity prices, then rational short sellers may purposely fail-to-borrow shares in order to increase profits from short positions. Any announcement impact from fails-to-deliver will, occur on day t+4.

According to Hypothesis 3, short sellers purposefully choose to fail with the expectation that the announcement of fails leads to a negative risk adjusted return on day t+4. In addition, we expect that the announcement effect will be increasing in the magnitude of the fails. We test this hypothesis in Table 7.

Our results indicate that there is limited, if any, announcement impact from fails-to-deliver. Again, Table 7, Panel A, shows the results based on the regression residual and Table 7, Panel B, shows the results for market adjusted returns. When all failure events with *Frate > 0* are included in the analysis, the risk adjusted return on the announcement day is negative and significant at the 5% level. However, the magnitude is quite low at -0.089%. As the *Frate* increases, the announcement affect becomes insignificant, though it tends to remain negative. On the other hand, the liquidity impact of fails is significantly different from zero when the *Frate* exceeds 10% of volume on the day of the trade. This result indicates that the liquidity impact of the initiation of fails dominates any possible improvement in short returns through the announcement to the market that a failure-to-deliver occurs. However, these results are not robust to the estimation method of abnormal returns. When market adjusted returns, shown in Table 7, Panel B, are used rather than the residual from the 3 factor model, abnormal returns are not

significantly different from zero for either Fail Days or announcement days. In addition, the returns for Fail Day and announcement days are not significantly different.

Why fail to borrow shares if it does not produce a gain? If the objective is to avoid borrowing costs, why then is the run duration of fails so short? How much is gained by avoiding delivery for a day or three? The lack of an announcement impact from fails-to-deliver weakens the support for Hypothesis 3, but strengthens the support for Hypothesis 2. However, it is possible that, although the announcement day of failures has limited market impact, sustained reportable fails-to-deliver have an impact on returns. We analyze this possibility next.

2. Sustained fail-to-borrow

The essence of the Roel Campos statement that forms the basis of our Hypothesis 3 is that fails-to-deliver, and, hence, fails-to-borrow are intentional efforts to manipulate stock prices. While we find no strong support that an announcement of fails impacts the market return, it is possible that sustained announcements of fails impact the market. We test hypothesis 3 by estimating the following regression:

$$AbRtrn_{i,t} = \alpha + \beta_1 RunLth_{i,t-1} + \beta_2 LagFr_{i,t-4} + \beta_3 Mcap_{i,t} + \beta_4 OPT_i + \beta_5 Mortgage_i + \beta_6 Util_{i,t} + \varepsilon_t \quad (3)$$

In this equation, $AbRtrn_{i,t}$ is the residual from a Fama and French 3 factor model regression on day *t* or the market adjusted return , $RunLth_{i,t-1}$ is the number of consecutive days reportable fails-to-deliver occur in the dataset, $LagFr_{i,t-4}$ is the lagged failure rate based on the volume traded on the day fails are initiated. *LagFr* differs from *Frate* in two respects. First, while *Frate* is truncated to 0 if there is a reduction in outstanding fails, *LagFr* can have both positive and negative values. Second, *LagFr* observations are dropped from the analysis if they are above 50% of volume, or below -50% of volume. In other words, if the reduction in outstanding fails on the trading day is greater than 50% of traded volume, then the observation is dropped. We also control for REIT specific characteristics including the market capitalization on day *t*, *Mcap*, a dummy to control for option coverage of the REIT, *OPT*, and a dummy to control for mortgage type REITs, *Mortgage*. *Mcap* is calculated at the number of shares outstanding on

day t multiplied by the closing price of the same day. *OPT* and *Mortgage* are 1 if they exist, and zero otherwise. Finally, $Util_{i,t}$ is the equity loan utilization for REIT *i* on day *t*. *Util* is included in the regression because there is a growing body of literature that indicates that short interest is correlated with negative future returns.[24] We estimate several specifications of this model cross sectionally for the restricted sample period of 1 May 2007 through 15 September 2008 based on the regression residual. Then as a robustness check, we re-estimate our strongest model using market adjusted returns rather than regression residuals as the dependent variable. All results are based on White's heteroscedasticity-consistent standard errors.

Table 8 shows the results of our regression analysis. In the first specification, we simply regress the abnormal return for each day against the one day lagged number of consecutive days with reportable fails-to-deliver from the fails dataset. The coefficient for run duration of -0.0027 is significant at the 1% level. The negative coefficient indicates that longer durations of fails are associated with negative daily abnormal returns, supporting the view that outstanding fails-to-deliver adversely impact stock prices. Consider a run of 20 consecutive days for which fails are reported. On the 20th day, the contribution to abnormal returns is 20 x -0.0027= -0.054 %. To get to the 20th day of continuous reportable fails, 19 previous days impact returns. The cumulative impact of 20 consecutive days is then $-0.0027\sum_{i=1}^{20} i$, or -0.0027 x 210= -0.567% for one calendar month of trading. Compare this return to a relatively generous rebate rate of 5% per year or 0.417% per month. Such a high rebate rate would reflect an easy to borrow security. Our results show that even when borrowing costs are low, sustained fails-to-deliver can be used to adversely impact market returns to such an extent, that forgoing even positive rebate rates can be profitable.

We test three additional model specifications. In specification two, we add the contemporaneous announcement effect and loan inventory utilization. Similar to our previous findings, the impact of the announcement of fails has no discernable impact on returns. In specification three, we use only REIT

[24] See for example Boehmer, Huszar, and Jordan (2010), Asquith, Pathak, and Ritter (2005), Boehmer, Jones, and Zhang (2008), and Diether, Lee, and Werner (2009).

specific variables. Of these, only the option dummy is significant. There are several possible reasons for this variable to be significant. First, as in Evans et al. (2009), option market makers may fail-to-borrow shares for delivery, using their regulatory permissible naked short sale exemption. Second, options can be used to create synthetic short positions, creating additional downward pressure on the REIT equity price. Finally, over our sample period, several REITs are added for option coverage and there is some evidence that the introduction of options leads to negative abnormal returns for the newly listed equity (Sorescu (2000), and Danielsen and Sorescu (2009)).[25] In our fourth specification, we include both the run duration measure and REIT specific effects. Under this specification both *RunLth* and *OPT* are significant and of the expected sign. The coefficient of *RunLth* remains quite stable even after controlling for REIT type, firm size, option listing and equity loan utilization, although the coefficient for *RunLth* in the fourth specification is only significant at the 10% level.

As a robustness check to examine the stability of the coefficient and the sensitivity of the analysis to the abnormal return estimation method, we rerun specification 4 using market adjusted returns for the dependent variable rather than the regression residual. The results are shown in the last column of Table 8. In this regression, the coefficient for *RunLth* is not statistically significant. In addition, several other variables that are not significant when using the regression residual as the estimate for abnormal returns become significant when abnormal returns are estimated using market adjusted returns. However, none of the explanatory variables show a statistically significant sign reversal between the two regressions. We also note that the explanatory power of all regressions estimated in this section is low. While there is some support that sustained failures-to-deliver adversely impact stock returns, consistent with our third hypothesis, this support is not robust to the estimation method for abnormal returns.

IV. Conclusion

The stock market collapse in the fall of 2008 represents the most significant economic event in recent times. In reaction to the high market volatility, the SEC enacted several emergency rules

[25] This evidence is still controversial. See for example Mayhew and Milhov (2005).

concerning naked short sales. First, even though the locate provision of Rule 203 has been met, on the day of delivery, no equity loan inventory may be available to borrow on settlement day, which is the day that most short sellers first attempt to borrow the stock. Second, short sellers may initiate and then cover the short position before the delivery date. In this case, knowing that the fail will be resolved on the settlement day of the covering transaction, the short seller may choose not to borrow the shares for earlier delivery. Finally, short sellers may fail to borrow available equity loan inventory in the effort to create a reportable fail-to-deliver, which they hope will negatively impact the stock price.

While Evans et al. (2009) and Boni (2006) find that fails-to-deliver are related to equity loan costs, the focus of our analysis is on the market impact of the fail-to-deliver announcement. Our analysis is conducted on a sample of 116 Real Estate Investment Trusts' (REIT) securities. We find that fails-to-deliver rarely result from a lack of equity inventory to borrow. In fact, for our sample, out of about 7,500 stock days having increases in failures-to-deliver only 3 are linked to insufficient equity loan inventory. In addition, the majority of fail-to-deliver events occur when equity loan costs are low. Our findings indicate that fails-to-deliver are not simply a proxy for high equity loan costs.

Our results also indicate that the majority of fail-to-deliver events are quite short in duration. The median number of consecutive days with reportable fails-to-deliver is only 1 day for our sample. While we find examples of significantly longer consecutive days with outstanding fails-to-deliver, including 1 of 230 days, 75% of outstanding fails-to-deliver are outstanding for 3 days or less, which is consistent with short sellers covering their short positions before the required delivery date; these are not conventional naked short sale.

Fails-to-deliver may have a market impact on the day of the transaction that leads to the fail or on the day the fail is announced. On the day of the transaction that results in the fail, we find a significantly risk adjusted return that is increasing in the level of fails-to-deliver. We find that the announcement of fails-to-deliver on the settlement day has no discernable market impact on the stock return, even when the level of fails is quite large. While we find no short term market effects of fails-to-deliver, we do find some evidence that sustained fails-to-deliver adversely impact stock performance. For example, if there

are fails-to-deliver outstanding for 20 days, we expect additional risk adjusted under performance of roughly -0.5%. In general, our results indicate that fail-to-deliver events have two primary aspects. The first is a short term short sale and cover trading strategy. The second represents a purposeful fail-to-borrow strategy, where sustained fails-to-deliver adversely impact the returns of the targeted stock. Our results indicate that the SEC's tightening of delivery requirement in September of 2008 was justified as an effort to reduce potential market manipulation.

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Figure 1. Failure-to-deliver Time Series by Month

We plot the time series for failure rates for the 116 REITs in our study. Frate is the ratio of fail-to-deliver shares divided by the CRSP volume. Fsum is the number of stock days in a month with increases in fail rates.

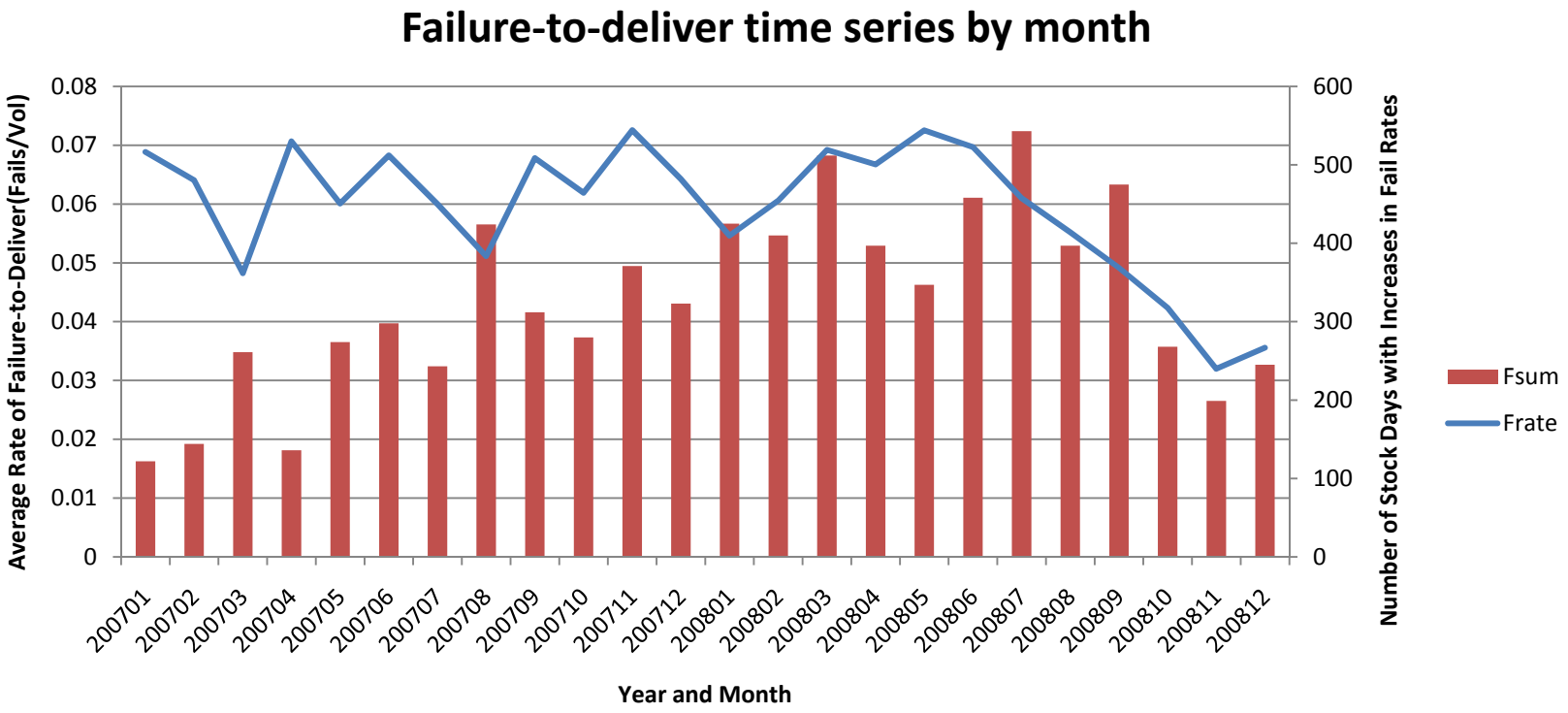

Figure 2. Equity Loan Utilization and Cost

We show the time series of the average utilization of the available equity loan inventory and the average equity loan costs over our sample period. Utilization is defined as the ratio of value of assets on loan to the total value of lendable assets. Borrowing costs are provided on a scale of 0 (lowest) to 5 (highest).

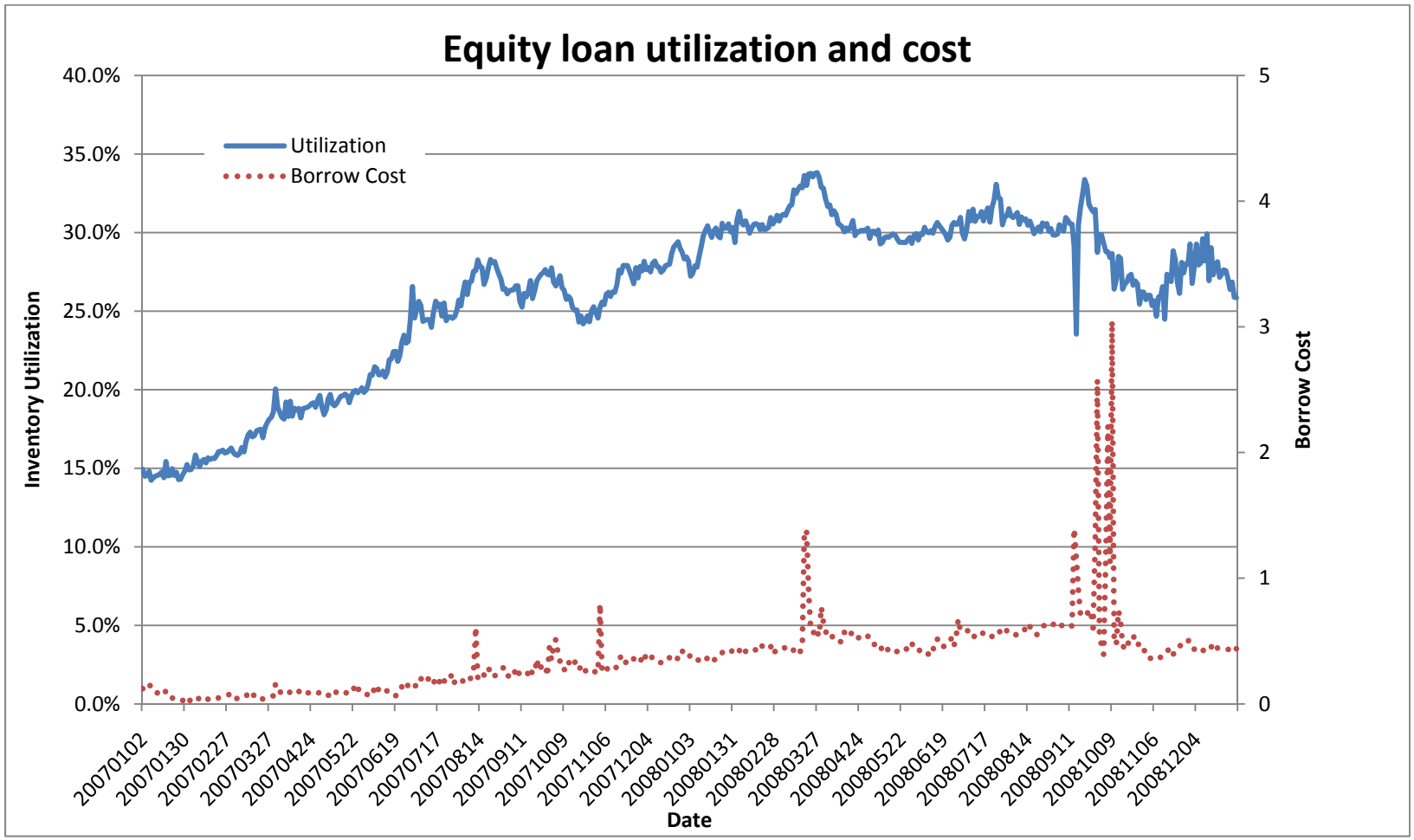

Table I. Descriptive Statistics

We present descriptive statistics for sample REITs beginning with the number of REITs (column 2) and the number of REITs with options (column 3). The remaining variables are: *CAP*, the market capitalization (shares outstanding X closing price) in millions of USD; *VOLUME*, the CRSP daily volume; *INSTOWN*, the percentage of shares outstanding owned by institutions; and *PRICE*, the average stock price. N is as of the end of 2008 in Panel A and as of the end of the indicated year in Panel B. *CAP* and *INSTOWN* are measured as of the beginning of 2007 in Panel A and as of the beginning of the indicated year in Panel B. *VOLUME* and *PRICE* are measured over the 2007-2008 sample period in Panel A and over the indicated year in Panel B.

	REITs	**Option**	***CAP* (Million USD)**		***VOLUME* (Shares)**		***INSTOWN*(%)**		**Price (USD)**
	N		**Mean**	**Median**	**Mean**	**Median**	**Mean**	**Median**	**Mean**
Panel A: 2007-2008 sample period									
Full Sample	116	59	2,500	1,219	880,182	462,800	76.9	81.8	35.83
By Type									
Equity	99	48	2,768	1,427	841,967	472,000	80.8	86.6	39.97
Mortgage	17	10	858	494	1,114,081	399,900	53.9	59.6	14.59
Panel B: Yearly sample period									
2007	116	31	2,822	1,440	595,802	368,600	75.1	80.1	41.70
2008	116	59	2,180	1,056	1,162,512	603,600	78.7	84.0	31.14

Table II. Statistics for REIT Failure-to-deliver

We present data for failure to deliver for REITs for 2007 and 2008. Only REITs in the active CRSP dataset on the first and last day of the sample period are included. Our failure to deliver data comes from the SEC and comprises the net number of shares that are not delivered on a particular settlement day: Existing fails + New fails - Shares covered. Only days with at least 10,000 failed to deliver shares for a given stock on a given day are included in the SEC dataset. When appropriate, we match settlement dates for fails with corresponding trade dates. The fail rate is $Frate_t = (FailQty_t - FailQty_{t-1}) / Vol_t$, where $Frate_t$ is the percentage of fail shares for a given trading volume, $FailQty_t$ is the number of failed shares associated with trading day t, and $VOLUME_t$ is the CRSP volume for trading day t.

	Fails (N)				Fails (%)			
	REITs	**Stock Days**	**Fail Days**	**REITs Per Day**	**Mean**	**Std**	**Min**	**Max**
Full sample	116	57,277	7,659	15.4	6.15	8.30	0.00	96.82
Equity	99	49,232	5,768	11.6	5.61	7.72	0.00	81.92
Mortgage	17	8,045	1,891	4.1	7.81	9.67	0.00	96.82

Table III. Estimate of Profit from Naked Short Sales

We estimate the profit from naked short sales based on the cash flow generated from the creation and covering of naked short positions. Cash flows (*CshFLw*) are estimated based on the change in the number of shares that fail to deliver multiplied by the closing CRSP price on the day the trade occurs. Specifically, $CshFlw = (FailQty_t - FailQty_{t-1}) * ClsPrc_t$, where *FailQty* is the number of shares that fail-to-deliver on day *t* and *ClsPrc* is the closing price on day *t*. Thus, an increase (decrease) in fails represents a cash inflow (outflow). Days on which no fail quantity is reported have *FailQty*= 0. The reported value represents the sum of all cash flows over all sample REITs for each month. Total profit represents the carry over cash flow from month to month. For the last 3 days of the sample period, all REITs have fewer than 10,000 fail to deliver shares, which is below the SEC threshold reporting level. For columns 5 and 6, we omit 35 cases for which *Frate* > 50%. All values are in USD.

		Full Sample		50% Max Fail Rate Filter	
Year	**Month**	**Profit**	**Total Profit**	**Profit**	**Total Profit**
2007	Jan	26,506,360		26,509,504	
	Feb	-14,343,156	12,163,204	-14,343,156	12,166,348
	Mar	-9,822,493	2,340,711	-10,215,836	1,950,512
	Apr	12,529,452	14,870,163	12,477,601	14,428,113
	May	159,446,060	174,316,224	159,465,820	173,893,933
	Jun	-134,010,578	40,305,646	-134,480,793	39,413,139
	Jul	19,317,810	59,623,456	19,304,329	58,717,468
	Aug	-21,018,464	38,604,991	-21,014,090	37,703,378
	Sep	3,530,198	42,135,190	3,536,437	41,239,815
	Oct	66,928,617	109,063,807	-10,142,127	31,097,688
	Nov	13,357,483	122,421,290	87,755,084	118,852,772
	Dec	-90,142,609	32,278,681	-89,620,699	29,232,073
2008	Jan	66,588,501	98,867,181	66,589,354	95,821,427
	Feb	40,365,410	139,232,592	40,222,300	136,043,727
	Mar	-17,361,406	121,871,186	-17,584,163	118,459,564
	Apr	6,996,514	128,867,700	6,801,261	125,260,825
	May	-24,927,603	103,940,097	-24,820,769	100,440,056
	Jun	63,201,481	167,141,578	63,195,505	163,635,561
	Jul	-14,386,605	152,754,973	-14,387,322	149,248,239
	Aug	-17,781,792	134,973,181	-18,185,449	131,062,790
	Sep	17,223,255	152,196,436	17,465,732	148,528,521
	Oct	-94,865,012	57,331,424	-93,606,569	54,921,952
	Nov	3,005,539	60,336,963	3,005,539	57,927,491
	Dec	-28,143,382	32,193,581	-28,143,382	29,784,109

Table IV. Analysis of Share Borrowing and Inventory on Fail-to-deliver Days

We collect data, including borrowing costs and borrowing inventory, from Data Explorer for January 1, 2007 to December 31, 2008 and corresponding data on fails from SEC fail-to-deliver dataset. Inventory Utilization is the value of assets on loan divided by the total value of lendable assets expressed as a percentage. Excess Inventory is the difference between the number of shares available to be borrowed and the change in the number of shares from day *t-1* to day *t* of the quantity of shares that fail-to-deliver (in thousands of shares). Surplus (shortage) is the number of days on which excess inventory is positive (negative). Inventory position is the count of the number of days with shares that fail-to-deliver when there is a surplus or shortage of inventory to borrow. Borrowing costs are provided on a scale of 0 (lowest) to 5 (highest). Short- and long-term costs are based on the value weighted average fee for all new trades on the most recent trading day and for all open trades, respectively. Panel A shows the results for the full sample. Panel B shows the results conditioned on option coverage of the REIT. Panels C and D show the results conditioned on the short- and long-term borrowing costs, respectively.

	Inventory Utilization (%)			Excess Inventory (shares, 000 omitted)			Inventory Position	
Sample	Mean	Min	Max	Mean	Min	Max	Surplus	Shortage
Panel A: Full sample								
Full	40.12	0.00	97.25	27,247	-16	120,351	7,494	3
Panel B: Option								
Yes	41.70	2.91	97.25	30,503	2,662	120,351	3,372	0
No	38.84	0.00	97.25	24,585	-16	120,351	4,122	3
Panel C: Short Term Borrowing Costs								
0	25.37	0.00	91.35	36,727	-16	120,351	4,310	3
1	40.44	6.66	86.34	20,645	1,139	111,370	849	0
2	49.93	5.69	86.92	16,729	1,620	102,494	487	0
3	58.58	3.15	95.44	16,028	244	104,533	425	0
4	67.92	5.95	95.50	12,726	1,669	104,067	357	0
5	78.39	11.01	97.25	8,290	246	20,886	1,066	0
Panel D: Long Term Borrowing Costs								
0	27.28	1.15	82.47	34,099	-16	120,351	4,891	2
1	42.90	0.97	86.00	23,296	161	115,871	820	0
2	61.52	11.56	87.72	14,475	857	101,627	345	0
3	70.94	5.95	89.52	13,677	4,433	80,795	306	0
4	77.68	0.00	95.63	10,362	-11	20,887	409	1
5	79.35	37.68	97.25	6,767	2,662	19,626	723	0

Table V. Sustained Fail-to-deliver

We report statistics for sustained fail-to-deliver, the number of consecutive days fails-to-deliver are above 10,000 shares. N = 116 REITs.

		Run Duration (in days)					
Year	**Month**	**Mean**	**Min**	**Max**	**Median**	**Q1**	**Q2**
2007	Jan	1.8	1	10	1	1	2
	Feb	1.7	1	13	1	1	2
	Mar	3.0	1	13	1	1	3
	Apr	1.6	1	13	1	1	2
	May	2.0	1	12	1	1	2
	Jun	1.9	1	17	1	1	2
	Jul	2.0	1	18	1	1	2
	Aug	2.9	1	20	2	1	3
	Sep	2.8	1	53	1	1	2.5
	Oct	2.9	1	63	1	1	2
	Nov	2.4	1	24	1	1	3
	Dec	2.3	1	22	1	1	2
2008	Jan	2.7	1	45	1	1	3
	Feb	3.0	1	72	1	1	2
	Mar	2.9	1	42	1	1	3
	Apr	2.8	1	54	1	1	2
	May	2.7	1	78	1	1	2
	Jun	3.4	1	152	1	1	3
	Jul	2.6	1	15	1.5	1	3
	Aug	2.8	1	116	1	1	2
	Sep	2.6	1	19	2	1	3
	Oct	10.3	1	230	1	1	2
	Nov	1.9	1	17	1	1	2
	Dec	2.1	1	17	1	1	2

Table VI. Abnormal Return Analysis on Fail and Cover Days

Abnormal returns are estimated as the residual from a Fama and French 3-factor model for 2007-2008 (Panel A) and by calculating the deviation from the average return of the market (Panel B). Our analysis of fail and cover days is limited to May 1, 2007 through September 15, 2008, inclusive. We examine 0 < *Frate* <= 50%, 10% < *Frate* <= 50%, 12% < *Frate* <= 50%, 13% < *Frate* <= 50%, 14% < *Frate* <= 50%, 15% < *Frate* <= 50%, 18% < *Frate* <= 50%, in turn. N indicates the number of 'Clean' events, defined as a three day series where day 1 has a decrease or no reported fail rate, day 2 has an increase in the fail rate, and day three has a decrease or no reported fail rate. Fail Day represents the day the fails rate increases and Cover Day is the following trading day in the 'Clean' event. Failure data is adjusted to align with the day of failure initiation, ie. the day the trades are initiated. We conduct a paired t-test comparing the difference in adjusted returns for the fail and cover days.

N	Low Filter	Fail Day	Cover Day	Difference	t-statistic	p-Value
Panel A: 3 Factor Residual Abnormal Returns						
3,005	>0%	0.001%	-0.048%	0.048%	0.70	0.484
575	10%	-0.119%	0.068%	-0.187%	-1.50	0.135
387	13%	-0.187%	0.072%	-0.258%	-1.72	0.086
344	14%	-0.243%	0.100%	-0.342%	-2.15	0.032
298	15%	-0.256%	0.178%	-0.434%	-2.51	0.013
201	18%	-0.415%	0.137%	-0.552%	-2.50	0.013
Panel B: Market Adjusted Abnormal Returns						
3,005	>0%	0.047%	0.057%	-0.010%	-0.14	0.320
575	10%	0.007%	0.116%	-0.108%	-0.80	0.424
387	13%	-0.003%	0.146%	-0.149%	-0.94	0.346
344	14%	-0.091%	0.158%	-0.249%	-1.50	0.134
298	15%	-0.136%	0.257%	-0.393%	-2.18	0.030
201	18%	-0.323%	0.195%	-0.518%	-2.23	0.027

Table VII. Abnormal Return Analysis of Fail Initiation and Announcement Days

We investigate the abnormal return impact of fails-to-deliver during the restricted sample period of May 1, 2007 through September 15, 2008. Failure initiation is the trade date (day t) associated with shares that fail to deliver on the settlement date. The Announcement day is day t+4, the first trading day after the fail-to-deliver quantity is announced on day t+3. Abnormal returns are estimated two with two methods. First, in Panel A, abnormal returns are the residuals from a Fama and French 3-factor model regression estimated over the full 2 year sample period. Second, in Panel B, abnormal returns are estimated as the deviation from the average return of the market. We test whether the values in columns 2 and 3 are significantly different from 0.0. We also test whether the means reported in column 3 are significantly different from those in column 4 and report the results in column 6.

		Failure			
		Initiation Day			t-
Low Filter	N	Returns	Announcement Day Returns	Difference	statistic
Panel A: 3 Factor Residual Abnormal Return					
>0%	6,027	-0.0496	-0.0888*	0.039	0.77
5%	2,399	-0.0820	-0.0780	-0.004	-0.05
10%	1,187	-0.2004**	0.0474	-0.248	-2.37*
13%	821	-0.1685*	-0.0324	-0.136	-1.13
14%	725	-0.1952*	-0.0269	-0.168	-1.30
15%	633	-0.1975*	-0.0419	-0.156	-1.11
18%	435	-0.2867*	-0.0950	-0.192	-1.12
Panel B: Market Adjusted Abnormal Return					
>0%	6,027	0.0472	-0.0001	0.047	0.87
5%	2,399	0.0501	-0.0665	0.117	1.38
10%	1,187	-0.0111	0.0892	-0.100	-0.91
13%	821	0.0667	0.0447	0.022	0.18
14%	725	0.0577	0.0713	-0.014	-0.10
15%	633	0.0672	0.0154	0.052	0.36
18%	435	0.0063	-0.0228	0.029	0.17

* Significantly different from zero at the 5% level.
** Significantly different from zero at the 1% level.

Table VIII. Regression Results of Outstanding Fails Impact

We test the impact of sustained failures to deliver by estimating the following regression:

$$AbRtrn_{i,t} = \alpha + \beta_1 RunLth_{i,t-1} + \beta_2 LagFr_{i,t-4} + \beta_3 Mcap_{i,t} + \beta_4 OPT_i + \beta_5 Mortgage_i + \beta_6 Util_{i,t} + \varepsilon_t$$

$AbRtrn_{i,t}$ represents the abnormal return for REIT *i* on day *t*. Abnormal returns are estimated with two methods. First, abnormal returns are the residuals from a Fama and French 3-factor model regression estimated over the full 2 year sample period. Second, abnormal returns are estimated as the deviation from the average return of the market. *RunLth* is the number of consecutive days that reportable fails-to-deliver are observed in the fails database. *LagFr* is the ratio of the change in outstanding fails divided by the CRSP volume on the day the fails are initiated. *Mcap* is the natural log of the market capitalization, calculated as shares outstanding multiplied by the closing stock price. *OPT* and *Mortgage* are dummy variables for option coverage of the REIT and if the REIT is a mortgage type. *Util* is the utilization rate of the available equity loan inventory defined as the value of assets on loan divided by the total value of lendable assets for REIT *i* on day *t*.

	Specification				Mkt Adjust
	1	2	3	4	Robust
Intercept	-0.0433***	-0.0071	-0.1459	-0.1555	-0.4765**
RunLth	-0.0027***	-0.0020**		-0.0018*	0.0003
LagFr		0.0745			
Mcap			0.0058	0.0074	0.0252**
OPT			-0.0831***	-0.0705**	-0.0214
Mortgage			-0.0613	-0.0269	-0.0135
Util		-0.1421*		-0.0900	-0.1461*
N	40,364	36,893	39,522	37,075	37,075
Adj R-sq	0.0594%	0.0717%	0.0369%	0.0835%	0.0237%

* Significantly different from zero at the 10% level.
** Significantly different from zero at the 5% level.
*** Significantly different from zero at the 1% level.