Do short sale transactions precede bad news events?*

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ABSTRACT: Do short sale transactions precede bad news events? Not recently. This paper examines short sale transactions around significant news events. Using a novel and comprehensive dataset covering daily short sale transactions for 4,193 securities on the New York Stock Exchange for the period April 1, 2004 through March 31, 2005, we find no evidence that short sale transactions are concentrated prior to bad news events. This challenges prior research that has found short sale transactions have tended to precede stock price declines. Additional analysis reveals that there is no reliable evidence of daily changes in short sales transactions leading daily stock returns, inconsistent with the notion that short sale transactions (at least in the aggregate) are based on private information.

Data Availability: *The data used in this study are available from the sources identified in the study.*

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Keywords: *short selling; earnings announcements; management forecasts.*

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I. INTRODUCTION

Sophisticated investors with access to private information about impending bad news in a company can trade profitably by way of short selling. It has long been argued that short sellers represent a sophisticated subset of investors given the relative costs of short selling (e.g., Diamond and Verrecchia, 1987). Prior research suggests that short sellers are, on average, able to predict lower future performance (e.g., Asquith and Muelbroek, 1996, Aitken et al. 1998, Desai, et al. 2002, Christophe, Ferri and Angel, 2004). However, current research has highlighted the fragility of these relations in that the negative relation between short seller activity and future firm performance is driven by a few, small firms (e.g., Asquith, Pathak and Ritter, 2005 and Cohen, Diether, and Malloy 2005). In this paper, we revisit this mixed evidence by examining daily short sale transaction data from the NYSE for 4,193 securities for the period April 1, 2004 through to March 31, 2005. This data has only recently become available for a large set of firms (all NYSE securities). Analysis of this high frequency data allows us to generate some powerful tests of short seller's ability to time their trades around significant bad news events.

Using a variety of corporate announcements (earnings announcements and management forecast announcements), we find no evidence that short sale transactions precede bad news announcements. Furthermore, examining the link between daily stock returns and daily changes in short sale transactions, we find no evidence that increases in short sale transactions precede stock price declines. In fact, we find that short sale transactions increase at the announcement of significant news events, irrespective of the nature of the news (i.e., whether it is a good or bad news event).

Our findings have significant implications for claims about the information content in short seller activity. At least in 2004, it appears that short sellers (in the aggregate) have lost their ability to predict significant bad news events and more generally their ability to predict stock price declines. We conjecture two reasons as to why short sale transactions no longer precede bad news events.

First, the magnitude of short trading activity has exploded in recent years, so we are likely witnessing a new regime for short sellers. In the 1980s short sales averaged about 15 million shares traded a year (source NYSE web site). By the early 2000s that volume had increased to over 200 million shares per year. In addition, a substantial amount of buying to cover transactions is generated through this growth in short sale transactions. Consequently, short related volume has almost doubled as a percentage of total NYSE volume since the mid 1990s. In 2003, short related volume (both newly initiated short sales and covering trades) accounted for over 28 percent of total NYSE volume. Given the substantial increase in short sale transactions in recent years, it is possible that short sales by uninformed speculators and parties interested in hedging positions dominate the short sale market, thereby watering down the potential informativeness of aggregate short sale transactions. Our results speak to the lack of information content in aggregate (daily) short sale transactions. One interpretation of this result is the effect of an informational cascade. To the extent that equity investors are utilizing monthly short interest or daily short sale transaction data in their investment decisions, short sales (in the aggregate) will no longer carry the same information content it did in earlier periods.

Second, recent regulatory requirements (e.g., Regulation FD) have changed the manner in which private information gets disseminated to investors. This could be another potential reason for the striking difference between our results and the analysis in Christophe, Ferri and Angel (2004). This broadening of information flow to the capital markets generally may have removed the informational advantage of subsets of investors, thereby limiting the informativeness of their trades. Indeed, recent research has shown that Regulation FD has been effective in curtailing selective disclosure (Gintschel and Markov, 2004).

The remainder of the paper is divided into four sections. Section II provides a review of the prior literature on short selling. Section III describes our sample and methodological approach. Our results are presented in Section IV. Finally, the conclusions and some limitations of our study are summarized in Section V.

II. LITERATURE REVIEW

There has been an extensive examination of short selling behavior in the prior literature. Diamond and Verrecchia (1987) suggest that the costs associated with short selling are high enough that liquidity traders would find it too costly to short-sell. As a result, short selling is expected to be done by informed traders.

Prior empirical research has examined the link between short selling activity and future firm performance over a variety of time horizons. In this section, we review this literature by the type of short selling data examined.

Monthly short interest reports

The majority of prior empirical work is based on monthly short interest reports compiled by US stock exchanges in the 1990s, and the findings from these studies provide some evidence that short sellers represent a sophisticated subset of the investment community. For example, Dechow, et al. (2001) find that short-sellers are able to identify overvalued stocks relative to fundamentals. They find evidence that short sellers tilt their positions toward mispriced securities as suggested by several fundamental ratios. For NYSE, AMEX and NASDAQ securities, firms with heavy short selling tend to experience negative future stock returns (Asquith and Meulbroek, 1996, Desai, et al., 2002). In addition, Pownall and Simko (2005) find evidence that for a sample of NYSE firms over the 1989-1998 period, the stock price reaction to short interest increases is more negative when the analyst following is low, consistent with short sellers being more informative when there are fewer alternative information sources.

Several studies have taken a more focused approach by examining changes in monthly short interest around significant corporate announcements. For example, Dechow, Sloan, and Sweeney (1996), Griffin (2003), Efendi, Kinney, and Swanson (2005) and Desai, et al. (2005) find that monthly short interest increases prior to events such as SEC actions, class action lawsuits, and earnings restatements.

More recently, Asquith, Pathak and Ritter (2005) find that a portfolio of short sale constrained stocks (defined as those securities in the highest percentile of monthly short interest and the lowest tercile of institutional ownership) under-performed by 215 (39) basis points per month during 1988-2002 on an equal (value) weighted basis. They found that short sale constraints are not common (only 21 securities per month met their

definition of constrained securities), and for the majority of stocks, monthly short interest information has only a modest ability to predict future abnormal returns.

Equity lending market data

Several authors have been able to obtain detailed data from the equity lending market to examine the demand and supply forces that impact short selling behavior. For example, Gezcy, Musto, and Reed (2002) find that trading strategies that involve short-selling growth stocks and buying value stocks, short-selling large stocks and buying small stocks, and short-selling low momentum stocks and buying high momentum stocks generate profits after considering the borrowing costs in the equity lending market. Reed (2003) finds a larger negative stock price reaction to bad news earnings announcement of those firms whose stock is costly to short-sell, consistent with short-selling constraints impeding the information to be impounded in price.

Cohen, Diether and Malloy (2005) utilize data from one large financial institution active in the equity lending market for small NASDAQ securities. Using proprietary data on equity loan fees and loan quantity information they are able to identify a subset of securities which experience a demand increase (as measured by an increase in the equity loan fee *and* an increase in the number of shares loaned in a given month). Cohen et al. find that this portfolio of securities (about 20 securities in a given month) experience negative abnormal returns of about 2.5 percent in the following month. However, similar to the results in Asquith, Pathak and Ritter (2005), this negative relation is driven by a few, small securities. More generally, the relation between short selling and future firm performance is less clear.

Daily short selling data

Using daily short selling data, Angel, Christophe, and Ferri (2003) find that abnormally high short-selling tends to occur before abnormally low returns, consistent with sophisticated short-sellers' possessing information that enables them to predict stock price movements. Similarly, Christophe, Ferri, and Angel (2004) provide evidence that for a sample of 913 Nasdaq firms between September and December of 2000, abnormal short-selling in the five days leading up to the earnings announcement is negatively associated with stock returns over the two day window that consists of the day of and the day after the earnings announcement. Using intra-day data from Australia, Aitken, et al. (1998) find that short sales are negatively associated with stock returns. They provide evidence that short sales near information events and those that are made through market orders are associated with a larger stock price reaction.

Most closely related to our analysis are recent papers by Boehmer, Jones and Zhang (2005) and Diether, Lee and Werner (2005). Boehmer et al. (2005) examine the relation between daily short sale activity and future stock returns for NYSE securities from January 2000 through to April 2004. They group NYSE securities into five portfolios each day based on the prior five days short sale activity and then examine the future returns (over the following 20 trading days) for these five portfolios and find that the portfolio with the greatest short sale activity in the prior five days underperforms the portfolio with the least short sale activity by about 8.7 percent annualized. Diether et al. (2005) undertake a similar exercise using new disclosures for NASDAQ securities for the first quarter of 2005. While both papers find a statistical relation between daily short selling activity and future stock returns, it is not necessarily evidence in support of short

sellers targeting "problem" firms. If short sellers are successful in identifying "problem" firms, we should see increased short selling activity prior to events that trigger *substantial* declines in security prices.

The current short selling landscape

Collectively, prior research has found some evidence consistent with short seller activity increasing prior to poor firm performance. However, some recent research has questioned the robustness of these relations (Asquith, Pathak and Ritter, 2005). Furthermore, there has been considerable growth in short selling in recent years. NYSE notes that in the 1980s short sales averaged about 15 million shares traded a year. However, by the early 2000s that volume had increased to over 200 million shares per year. Short related volume (both originating short sales and purchases to cover) has almost doubled as a percentage of total NYSE volume since the mid 1990s. In 2003, short related volume accounted for over 28 percent of total NYSE volume. Given this recent growth in short selling activity coupled with new regulatory requirements that has changed the manner in which companies communicate with the investment community (e.g., Regulation FD), our paper contributes to the short selling literature by examining recent daily short sale transactions with an aim to identify whether short-sellers are indeed sophisticated investors who are able to predict bad news events. If short-sellers are sophisticated investors that are better informed, we expect to see short selling to increase in the days leading up to the announcement of bad news.

III. METHODOLOGICAL APPROACH

Sample

We obtain our short sale transaction data directly from NYSE (NYSE Volume Summary File).[1] The data files are summaries of daily transactions executed on the electronic trading platform SuperDOT (Super Designated Order Turnaround System). This order-routing system is fully electronic and is used to place orders for securities that are listed on NYSE. The system facilitates the transmission of market and limit orders directly to the trading post for each particular security allowing for a quicker and more efficient execution of order flow. The SuperDOT system can be used for all trades under 100,000 shares and priority is given to smaller orders (2,100 shares or less). While the SuperDOT system started out as an order routing mechanism for small orders, it is increasingly becoming the predominant order routing mechanism for NYSE. Of the total order flow on NYSE, the SuperDOT system accounts for about 99 percent of total order flow (NYSE web site). It is an enormous system capturing 6 million quotes and 13 million orders. However, it is important to note that the SuperDOT system only accounts for about 74 percent of total NYSE volume (for our primary sample described below). That is, large orders are still processed through brokers or are phoned down to the floor by-passing the SuperDOT system. Very large orders are often placed in "upstairs" trading locations. These large orders require substantial search costs to find a willing party to minimize market impact costs from trading. Such large trades are absent from the SuperDOT system. In our later empirical analysis, we address this issue by looking at a subset of securities where the ratio of volume of executed order flow on the SuperDOT

[1] Details of the file are described at: http://www.nysedata.com/info/productDetail.asp?dpbID=37&dptID=0.

system is very high relative to total NYSE volume (i.e., there are relatively fewer upstairs trades) and we find that our results are not due to missing large trades.

Table 1 describes the short sale data we examine. Panel A of table 1 reports descriptive information for the full sample and panel B reports descriptive information for a reduced sample (described below). The full sample contains 1,052,443 security-day observations. This represents 4,193 NYSE securities for which we have SuperDOT trading data for the period from April 1, 2004 through to March 31, 2005. For our descriptive information reported in table 1, we first average the variables over the 251 trading days for each security and then report distributional information for these security averages. Average (median) total volume for NYSE securities is 387,736 (57,285) shares per day over our sample period. Average (median) Super DOT total volume is 301,698 (70,978) shares per day over our sample period. As noted above, SuperDOT does not capture all of the volume for a given security. For the median security on NYSE, SuperDOT captures about 83.5 percent of total NYSE volume (for the full sample untabulated statistic). The average (median) security has 476 (97) trades per day on the SuperDOT system.

For our empirical analysis reported in section IV, we use three short sale metrics. The first measure, *SHORT*, is the number of executed short sell orders on a given day for a security (a non-deflated measure). For the full sample of NYSE securities, the average (median) security has 62,599 (5,168) shares sold short on a given day in our sample period. Alternatively, originating short sale transactions account for about 10.3 (14.9) percent of SuperDOT volume for the average (median) firm (statistic untabulated). Relative to earlier sample periods examined in prior research (e.g., Christophe, Ferri and

Angel 2004), there has been significant growth in short sale related transactions in recent years. Christophe, Ferri and Angel (2004) report that short sale transactions account for only 3 percent of daily volume for their sample of 913 Nasdaq securities for the period September 13, 2000 to December 12, 2000. This likely reflects the increased use of short strategies and long-short market neutral fund strategies by large institutional investors as well as retail investors in recent years.

Our two remaining short sale measures are deflated. *SHORT/SHARES*, is the number of short sale trades scaled by the number of shares outstanding that day (data on shares outstanding are obtained from the CRSP daily files). *SHORT/VOLUME*, is the number of short sale trades scaled by total SuperDOT volume. For the full sample, 0.09 (0.06) percent of outstanding shares for the average (median) security are traded short on a given day, and 14.34 (13.65) percent of total SuperDOT volume reflects originating short sale transactions.

We impose additional constraints to obtain our final sample. First, we require the security to be traded every day for our sample period (i.e., a non-zero NYSE and SuperDOT volume every day). Second, we keep only those securities with average security price greater than $10 over the sample period. Third, we require each security to have an average number of daily trades greater than 100. Our constraints are designed to remove thinly traded securities for which it is difficult to interpret daily returns and daily changes on short sale transactions (these are the same sample selection criteria used by Christophe, Ferri and Angel 2004). In section IV, we briefly discuss our analysis when we use the full sample of NYSE securities. These constraints reduce the final sample to 1,772 securities.

The descriptive information for this reduced sample is reported in panel B of table 1. The reduced sample is characterized by more actively traded securities. The average (median) security has 741,405 (315,253) shares traded daily on NYSE and 549,276 (255,920) shares traded daily on SuperDOT. SuperDOT accounts for about 83 (84.6) percent of total NYSE volume for the average (median) security (statistic untabulated). In the reduced sample, for the average (median) security, about 0.11 (0.08) percent of outstanding shares are traded short on a given day, and 22.50 (22.49) percent of total SuperDOT volume reflects originating short sale transactions. Of note is the greater volume of SuperDOT trades that are from originating short sale transactions for the reduced sample relative to the full sample. Short sellers are more active in larger, more heavily traded securities (e.g., Dechow et al., 2001). Finally, panel B of table 1 also reports descriptive information on the daily percentage change in our short sale measures and daily returns. The average (median) security experiences increases in all three short sale measures over the sample period.

Daily Short Sales Transactions and Identification of News Events

Discussion of Short Sales

The focus in our analysis is on daily short sale transactions. This relatively high frequency data allows us to generate some powerful tests examining changes in short sale transactions around significant news events. Most prior research has only had access to the monthly short interest reports prepared by the various exchanges (Aitken, et al. 1998 and Christophe, Ferri and Angel, 2004 are notable exceptions). These reports give one number a month that represent the total number of shares that are held short on a given

day. Our daily data suffers from a limitation similar to the monthly short interest data in that all short sale transactions (informed, speculative and hedging) are aggregated. Ideally, one would like to disaggregate hedging related trades and focus on (alpha) information based positions. One major difference between the daily data that we examine and the monthly data used previously is that the daily data does not have the net short position at the end of the day (we only know the number of shares sold short in a given day).

Monthly data is likely to be too coarse to use in order to assess whether short sellers are unusually active immediately prior to significant bad news events. We examine daily changes in short sale transactions surrounding significant news events to test the claim that short sellers are sophisticated traders who are able to identify significant price changes. A significant portion of the prior research in accounting that documents the stock return predictability from financial statement analysis suggests that these returns are concentrated around subsequent earnings announcements (e.g., Bernard and Thomas 1990; Sloan, 1996; Skinner and Sloan, 2002). Given that short selling is a relatively costly trade (margin requirements), sophisticated short sellers should time their trades to coincide with subsequent earnings announcements when the price reversals are most likely to occur.

Testing daily changes in short sale transactions is tantamount to testing the ability of short sellers (in the aggregate) to time the market. This is a difficult null hypothesis to reject, as not only must short sellers identify mispriced securities but they must also identify (very accurately) when those security prices will be corrected. Thus, our focus

on daily sort sale transactions may be unduly restrictive in identifying the informativeness of short sales.

It is very difficult to obtain accurate data on the time a round-trip short sale transaction takes (i.e., the time between the originating short sale and the closing covering position). Prime brokers keep track of this flow internally but do not release reports externally. Prior research has suggested that the average loan length for a short sale is about 10 days (Reed, 2003) which is consistent with our narrow window to examine short sale transactions. However, a 10 day round-trip trade for the average short seller seems too short when viewed in context of the average turnover of large institutional funds. Bushee (2001) reports that the quarterly turnover percentage (using sales transactions only to abstract from fund flow distortions on purchase transactions) for dedicated, quasi-indexer and transient institutional investor groups is 23.1, 22.9 and 55.7 percent respectively. If we assume that transient institutional investors are more likely to reflect long-short or market neutral funds, then this turnover suggests that the average round-trip trade is about five to six months. Indeed, conversations with several hedge fund managers revealed that turnover of funds utilizing short strategies are often around 200 percent or more annually (consistent with a round trip trade of at least several months).

To estimate the round trip trade for our reduced sample of 1,772 securities, we obtained the average short interest for a given month from NYSE for our sample period. This can be viewed as a "stock" of short interest. The "inflow" of new short interest is measured as the sum of aggregate daily short sale transactions during the month (from SuperDOT). We then compute a turnover ratio expressed in number of trading days. For

our sample of securities, the average (median) short interest turnover translates to 33 (42) trading days. This estimate tends to be more consistent with a holding period of several months as suggested by the analysis of institutional fund turnover. Of course, this measure is a noisy estimate (and most likely an upper bound) due to SuperDOT not capturing all short selling activity.

In summary, while our focus on daily short sale transactions allows us to track whether short sales precede bad news events, our analysis may be too restrictive if we limit the analysis to only several days either side of our selected news events. To help mitigate this problem, we examine short sale transactions up to thirty days prior to our selected news events (results below concentrate only on the immediate 20 days prior to a given event).[2]

Defining a News Event

There are many potential news events to examine. We choose both quarterly earnings announcements and voluntary management forecasts of quarterly and annual earnings. There is a long literature noting the informational content of earnings announcements (e.g., Ball and Brown 1968 and Beaver 1968). There is also extensive literature suggesting that management forecasts are news events. Lev and Penman (1990), Baginski, Hassell, and Waymire (1994) and Soffer, Thiagarajan, and Walther (2000) all document that firms that issue management forecasts experience significant abnormal returns at the announcement date.

[2] The problem in lengthening the window of analysis is two-fold. First, there will more likely be confounding events in the longer window, and second, we only have 251 days of data to examine.

We utilize two measures to capture the news contained in these events. For the earnings announcements, we first use the seasonal difference in quarterly earnings scaled by the market value of equity from four quarters earlier as an earnings based measure of the news in the earnings announcement. Our second measure is the compounded stock return for the day of and the day after the earnings announcement. In recent years, earnings announcements have been accompanied by conference calls and detailed announcements that contain information not only about the quarter just finished but significant information about the future. This may render an earnings based measure of the news in an earnings announcement as low quality. For the empirical analysis discussed in section IV, we only briefly discuss the results for the earnings based measure and instead focus on the returns based news measure (results are very similar using both measures). We use similar measures for management forecasts. The equivalent earnings based measure for our management forecasts is the difference between the management forecast and the most recent mean analyst consensus estimate scaled by the absolute value of that analyst consensus estimate. Data for earnings announcements are obtained from Compustat and data for management forecasts are from Thomson Financial.[3]

We could examine other news events such as earnings restatements, class action law suits and drug denials (e.g., Vioxx), etc. However, a more efficient mechanism to identify these announcements is to look directly at price movements. We incorporate stock returns into our analysis two ways. First, we select a sample of security-days where

[3] It is important to note that the announcement dates from both data sources are not very precise. This is a limitation of our analysis because Compustat and Thomson Financial list an earnings or management forecast announcement date on the day that it is released irrespective of whether it was during or after trading hours. This makes it difficult to infer the first trading day when the stock price could reflect the new information contained in that announcement. When we examine daily changes of short sale transactions around these announcements, the contemporaneous change may reflect short sale transactions prior to the announcement (given that many of the announcements are made after hours). We note this issue when discussing the results below.

stock returns were extreme based on the top percentile of the absolute daily return (|RET|) distribution within our sample period. Within the top percentile of |RET|, we identify firms with positive and negative returns. Security-days within the top percentile of |RET| and negative RET are classified as "drop" securities (1,410 security-days satisfy this criterion, with an average daily return of -8.17 percent). Security-days within the top percentile of |RET| and positive RET are classified as "leap" securities (1,794 security-days satisfy this criterion, with an average daily return of 8.24 percent). We look at extreme positive returns in addition to extreme negative returns as a natural benchmark for significant news events.[4] If short sellers are able to identify price declines, we expect to see short sale transactions concentrated prior to the "drop" securities, but not the "leap" securities. Our selection criteria will capture events such as the announcement of earnings restatements and class action lawsuits as the stock return for such announcements is on average negative ten percent (Wu, 2002).

Finally, we conduct a more formal regression analysis of the lead and lag structure of daily changes in short sale transactions and daily returns. An added advantage of looking at daily returns is that we no longer have an issue with announcement dates.

IV. RESULTS

In this section, we present the results of our empirical analyses. First, we describe the analysis related to earnings announcements and management forecasts. Second, we

[4] By focusing on extreme daily returns we limit the amount of overlap between event windows for a given firm. However, it is still possible for volatile firms to have "drops" and "leaps" (as we define them) in close to consecutive trading days. To address the issue of overlapping windows, we require at least 20 days between extreme returns for a given security.

report our analysis linking changes in short sale transactions directly to daily stock returns. Finally, we discuss some additional analyses to address several limitations of our sample.

Earnings Announcements

Table 2 reports our empirical analysis for earnings announcements. For the 1,772 securities in our reduced sample we have earnings announcement data for 4,729 security-quarters. Panel A of table 2 gives the breakdown of earnings announcements by month for our sample period. There is a fairly even distribution of earnings announcement across fiscal quarters with a concentration of announcements in certain months reflecting the preponderance of December fiscal year end firms.

Panel B of table 2 gives descriptive information for our two measures of the "news" in the earnings announcements. The first measure, $(E_t-E_{t-4})/P_{t-4}$, is the seasonal difference in quarterly earnings (where E_t is income before extraordinary items) scaled by the market value of equity from four quarters ago. We do not winsorize or trim this variable so the means (and extremes) reflect small denominators. The median firm in our sample reports a small increase in quarterly earnings. Our second measure, *RET(0,+1)*, is the 2-day return compounded over the day of and day after the earnings announcement. The average (median) firm experiences a positive return of 68 (60) basis points.

We use both of the "news" measures to partition the sample into good and bad news sub-samples. For the sake of brevity, we only report the results for the returns based measure (results are very similar using the earnings based measure). Figure 1 documents the pattern in short sale transactions surrounding earnings announcements.

Panel A shows the general pattern in the number of executed short sell orders in the 40 day period straddling the earnings announcement (in all figures the vertical line corresponds to day 0 – the event day). There is a slight increase in short sales prior to the earnings announcement. However, the large increase is contemporaneous with the earnings announcement. The average firm experiences an increase in short sales of 125,000 shares to about 225,000 at the time of the announcement (not conditioning on the news of the announcement). As discussed earlier, the announcement date recorded on Compustat may be an after hours announcement so the contemporaneous short sales (day 0) may relate to the day prior to the actual announcement. The increase in short sales continues to the day after the announcement before quickly returning to a normal level a few days after the announcement. Results for the *SHORT/SHARES* variable look similar to those for the unscaled *SHORTS* measure (not shown in figure1 for sake of brevity). Panel B of figure 1 examines the pattern in *SHORTS/VOLUME* for the 40-day period around the earnings announcement. There is only a muted change in the volume deflated measure of short sale transactions around the earnings announcement. This is attributable to the large increase in overall volume around the earnings announcement which is concurrent with the increase in short selling. Panels C and D partition the sample based on the extreme deciles of announcement period stock returns. For *SHORTS* (and *SHORTS/SHARES* unreported figure) the pattern of an increase in short sale transactions at the earnings announcement is evident for both extreme good and bad news earnings announcements. For *SHORTS/VOLUME* (Panel D) the pattern is again very muted. It is interesting to note that the analysis in Christophe, Ferri and Angel (2004) which focuses solely on short sales transactions in the 5 day period leading up to the earnings

announcements ignores the short selling activity that occurs concurrently with the earnings announcement.

To assess the statistical significance of the patterns reported in figure 1, we report regression analysis similar to that used in Christophe, Ferri and Angel (2004). We regress a measure of abnormal *SHORT/SHARES* [*AB_SHORT/SHARES*] on announcement date returns [*RET(0, +1)*], returns in the 5 day period leading up to the earnings announcements [*RET(-5, -1)*] and a measure of abnormal trading volume in the pre-announcement period [*ABVOL(-5,-1)*]. Our dependent variable, *AB_SHORT/SHARES(-5,-1)*, is the average daily abnormal short-selling for the stock in the pre-announcement period, measured as the average daily *SHORT/SHARES* in the pre-announcement period divided by the average daily *SHORT/SHARES* in the non-announcement period, all minus 1. The independent variable of interest is [*RET(0, +1)*] which will identify whether short sale transactions precede announcement returns. We control for pre-announcement returns, [*RET(-5, -1)*], to capture the effect of temporary price movements on short sale transactions in the pre-announcement period. Finally, we control for abnormal pre-announcement volume, [*ABVOL(-5,-1)*], measured as the average daily volume in the pre-announcement period divided by the average daily volume in the non-announcement period, all minus 1. This variable captures the possibility that stocks with high volume are easier (or less costly) to short. The regression specification is as follows:

$$AB\_SHORT/SHARES(-5, -1) = \beta_0 + \beta_1 RET(0, +1) + \beta_2 RET(-5, -1) + \beta_3 ABVOL(-5, -1) + \varepsilon$$

If short sales transactions precede bad news events, we would expect to see a negative and significant β_1 as found in Christophe, Ferri and Angel (2004). Instead, the

results in panel C of table 2 suggest that the β_1 coefficient is not statistically different from zero (all of our test statistics are based on Huber-White robust standard errors). This confirms what we see in figure 1 – there is no reliable evidence that short sale transactions precede bad news events.[5]

Management Forecasts

As an alternative news event, we examine the 2,288 management earnings forecasts released during our sample period (853 quarterly forecasts and 1,435 annual forecasts) in table 3.[6] The forecasts are reasonably evenly spread throughout the sample period, with some concentration in July, October and January/February as expected as the majority of firms have December fiscal year-ends. Similar to the analysis with earnings announcements, we use both an earnings and a price based measure to identify good and bad news management forecasts. The earnings-based measure, $(M_t-A_t)/|A_t|$, is the difference in the management forecast of earnings relative to the most recent mean consensus analyst forecast deflated by the absolute value of the most recent mean consensus analyst forecast. We do not winsorize or trim this variable so the extremes reflect small denominators. The median firm in our sample reports a management forecast that is slightly below the prevailing consensus analyst forecast. Our second measure, *RET(0,+1)*, is the 2-day return computed for the day of and the day after the management forecast issue date as reported by Thomson Financial. As with the earnings announcement analysis the average return is slightly positive.

[5] In unreported analyses we also examine an abnormal measure of *SHORT/VOLUME* and find very similar results.
[6] If on a given day, there are multiple management earnings forecasts, e.g. annual and quarterly, we keep the annual forecast.

Figure 2 examines the pattern in short sale transactions for our sample of 2,288 management forecasts. The figures are very similar to those for the earnings announcements. There is a noticeable increase in short sale transactions at the announcement date (with the SHORT variable) for both good and bad news events. Our reported analyses of "good" and "bad" news in panels C and D of figure 2 are based on the extreme deciles of stock returns at the time of the management forecast. The pattern for the volume deflated measure is muted.

Panel D of table 3 reports regression analysis examining the link between short sale transactions in the pre-announcement period and announcement returns. Again we fail to find a statistically negative β_1 coefficient for the announcement returns, inconsistent with the notion that short sale transactions precede bad news events.

Daily Stock Returns and Short Sale Transactions

As an alternative to specifying a news event, we can infer news from changes in stock prices. To do this, we choose a sample of firms that experienced extreme decreases ("drops") and increases ("leaps") in daily prices (these security-days were identified based on the top percentile of the daily |RET| distribution for our sample period). Figure 3 reports the pattern in short sales transactions (*SHORT* and *SHORT/VOLUME*) for these sub-samples. For both price increases and decreases there is a significant increase in the number of short sales contemporaneous with the significant price change. For example, for both the "drop" and "leap" sub-samples, the mean number of shares sold short on a given day is about 125,000 in the period leading up to the price change rising to around 350,000 on the day of the price change and quickly returning to a normal level. Panel C

of table 3 reports regression results where we examine the link between our extreme return security-days and short selling activity. While we find a negative β_1 coefficient, it is not significant at conventional levels. Similar to the analysis with earnings announcements and management forecasts, there is no evidence of short sale transactions preceding significant stock price declines.

Collectively, the evidence from earnings announcements, management forecasts and extreme price movements fails to support the claim that short sale transactions precede bad news events. To investigate this issue further, we undertake a more general analysis of the relation between daily percentage changes in short sales transactions (*%ΔSHORT*) and daily stock returns (*RET*). Specifically, we run the following regression specifications (once for daily and once for weekly):

$$RET_t = \alpha + \beta_1 \%\Delta SHORT_{t-1} + \ldots + \beta_{10} \%\Delta SHORT_{t-10} + \lambda_1 RET_{t-1} + \ldots + \lambda_{10} RET_{t-10} + \varepsilon$$

We run these regressions for each of the short sale transaction measures, but for the sake of brevity, we only tabulate and discuss the results for *%ΔSHORT*. We estimate the regression by security and then report statistics about the distributional properties of the coefficient estimates. If short sale transactions precede bad news events, we would expect to see negative β coefficients in the regression of daily (weekly) returns on lagged daily (weekly) changes in short sale transactions and lagged daily (weekly) returns. Table 5 reports the results from the regressions (panel A reports the results using daily returns and short activity and panel B reports results using weekly measures of returns and short activity). In both panels, we do not see a statistically negative average β coefficient for any of the lagged *%ΔSHORT* variables. The absence of significantly negative β coefficients is robust to various lags (between five and twenty daily lags) as

well as to including or excluding lagged daily returns. Of note is the absence of significantly negative β coefficients, even at the lower quartile, suggesting that for the vast majority of firms, short sale transactions do not precede stock price declines in our sample. The t-statistics on the β_1 coefficient are less than -1.96 for only 151 firms (about 8.5 percent of our reduced sample of 1,772 securities). Furthermore, the remaining coefficients (β_2 through β_{10}) are significantly negative for less than five percent of our sample.

In unreported tests, we examine firm characteristics for the small subset that exhibit a statistically negative β_t coefficient ($\forall$ t=1,10 in the daily return analysis and $\forall$ t=1,5 in the weekly return analysis). For the sample of 257 (193) firms which exhibit a negative β_t coefficient in panel A (B), we find that these firms are similar to other firms based on market capitalization, institutional ownership and analyst following (the only exception is with the weekly return analysis where we find a difference in institutional ownership, t-statistic of 2.98). Thus, this subset can not be characterized as a portfolio of neglected securities. In summary, there is no consistent evidence of short sale transactions leading negative stock returns in our sample period.

Additional Analyses

In this section, we outline various additional analyses we have undertaken to address potential alternative explanations for the lack of a relation between daily short sale activity and bad news events.

Full sample versus reduced sample

The bulk of our empirical analysis is based on the reduced sample of relatively liquid NYSE securities. This sample was selected to (i) minimize issues with non-synchronous trading on computing daily changes in short sale transactions and daily returns data, (ii) ensure that short selling was relatively costless, and (iii) allow comparability with prior research (Christophe, Ferri and Angel 2004). To check that our results are generalizable to all NYSE securities for our sample period, we re-estimated all of our empirical analysis using the full sample of 4,193 securities. In cases where SuperDOT volume was unavailable in the data files or was zero, we code our daily percentage in short sale transactions as missing for those days. Results for this analysis are very similar to the reduced sample results presented in the tables. The key inference of no pattern of short sale transactions preceding bad news events is robust to the use of the full sample.

Effect of exchange traded options

Our focus on daily short sale transactions has thus far ignored the possibility of alternative investment vehicles for a sophisticated investor to trade on bearish fundamentals. If a security has exchange traded options, it is possible for an investor to synthetically create a short equity position from a short position in a call option contract and a long position in a put option with identical strike prices and expiration dates across the contracts. Indeed, this synthetic short may be preferable for certain traders given relative transaction costs across equity and option markets. Thus, the absence of a relation between daily short sale transactions and bad news events may reflect greater use

of synthetic short positions by sophisticated investors in our sample period. To assess the impact of exchange traded options on our analysis, we obtained from the Options Clearing Corporation a list of securities that had exchange traded options during our sample period. Of the 1,772 securities in our reduced sample, 1,146 had exchange traded options. For the 626 securities that did not have exchange traded options we still found no evidence of daily short sale transactions preceding bad news events.[7]

Transaction costs

Another alternative explanation for our lack of finding a pattern of short selling prior to bad news events is that short selling is particularly costly for some of the securities in our sample. This is not likely to be the case given our reduced sample focused on the relatively liquid NYSE securities. However, it is still possible for short sale constraints to impede the ability of short sellers to take positions. To address this issue, we obtained a list of hard to borrow securities from one of the prime brokers. These lists are compiled weekly for clients. We only had access to one report each month, so we restricted our sample to exclude all NYSE securities that were on these lists for any month in our sample period. This reduced our sample from 1,772 securities to 1,621 securities. Results are almost identical for this smaller sample, suggesting that short sale constraints are not likely to explain our failure to find that short sellers time their trades prior to bad news events.

[7] Of the 626 securities for which we could not locate exchange traded options many of them have CUSIP designated issuer codes greater than "10" reflecting preferred issues or multiple classes of common stock. Removing these issues from our sample of non-optionable NYSE securities reduces the sample from 626 to 519 securities. With this smaller sample we still find no evidence of daily short sale transactions preceding bad news events.

SuperDOT does not capture all NYSE trades

In other unreported tests, we partitioned our sample based on the fraction of NYSE volume that is reflected by SuperDOT. For our reduced (full) sample the median security has 84.6 (83.5) percent of total NYSE volume captured on SuperDOT. It is possible that more informed short sale transactions are marked for execution directly with the broker to avoid the SuperDOT system.[8] Splitting the sample (full or reduced) at the median of the fraction of SuperDOT volume relative to NYSE total volume, and examining those securities where SuperDOT captures the lion's share of NYSE volume produced similar results – short sale transactions do not appear to precede bad news events.

Related to the issue of SuperDOT not capturing all of NYSE volume is the possibility that sophisticated short sellers move their trades off the SuperDOT system to "upstairs" trading locations to avoid being identified on the SuperDOT system. We examined the ratio of non-SuperDOT volume to SuperDOT volume (where non-SuperDOT volume is calculated as total NYSE volume less SuperDOT volume) around our various bad news events (earnings announcements, management forecasts and significant stock price declines). We found no reliable statistical evidence of an increase in this ratio in the week prior to our bad news events. This suggests that, on average, sophisticated short sellers are not moving their trades to alternate trading platform and as such this is not a valid alternative explanation for our results.

[8] Discussions with several hedge fund managers suggested that this is not likely to be the case.

Convertible debt arbitrage trades

Another possibility for observing no increase in daily short selling activity prior to bad news events is that for some of our firms there is a significant amount of short selling that is not based on a bearish view of the firm. For example, traders engage in statistical arbitrage trades to exploit *relative* value differences across different claims on a given firm's assets. One common such trade relates to convertible debt. We excluded firms from our sample that have reported convertible debt on their balance sheets (408 out of 4,193 securities have no convertible debt for the underlying firm). With the sub-sample of firms with no convertible debt we find virtually identical results to those tabulated.

Neglected NYSE securities

Much of the prior research documenting a relation between short selling activity and future firm performance has found the relation to be concentrated in the relative small, less liquid securities (e.g., Asquith, Pathak and Ritter 2005; Cohen, Diether and Malloy 2005). Our sample of NYSE securities tends to be larger, more liquid securities - so our tests could suffer from low power. To address this issue, we identify the relatively neglected securities within our NYSE universe. We calculated the average institutional ownership, analyst following and market capitalization for all NYSE securities in our sample period and ran all of our empirical analyses on the bottom quartile (or decile) of the full sample of 4,139 securities across each of these three measures. For these various sub-samples, we find virtually identical results to those tabulated.

Securities with earnings quality issues

The results discussed in section IV and in the various sub-sections above relate to average relations between short selling and bad news events. It is likely that professional short sellers who base their trades on firm fundamentals will focus their attention on subsets of securities (and these are the short sellers whose information based trades we want to identify). For example, professional short sellers may focus their trading activity on securities that are experiencing financial reporting (earnings) quality issues. There are many information intermediaries that cater to this market (Gradient Analytics, The Center for Financial Research and Analysis, Assay Research and Criterion Research). To examine this possibility, we examine the top quartile (or decile) of NYSE securities based on measures of operating and total accruals (Richardson, Sloan, Soliman and Tuna 2005). For this sub-sample, we also cannot find evidence of increases in daily short sale activity prior to our bad news events.

Portfolio return analysis

Our null hypothesis can be characterized as a test of inside trading (i.e., the extent to which aggregate short sale transactions are concentrated in the short period leading up to significant bad news events is tantamount to these short sellers trading on material private information). This null hypothesis is strict and may be difficult to reject as it requires short sellers to not only know of impending problems at the firm but also exactly when that information will be released to the market triggering a significant stock price reaction.

More generally our null hypothesis can be stated as: are short sellers able to trade prior to *any* negative news? Our regression analysis in table 5 suggests that for our sample of NYSE securities, there is no reliable evidence that this is true. However, we have also replicated the portfolio analysis of Boehmer, Jones and Zhang (2005) for our sample. Specifically, we sort firms into quintiles every day based on the average of SHORT/SHARES for the previous five trading days. We then track the returns of these portfolios over the next twenty trading days. This creates a sample of 247 twenty-day portfolio returns. We find that the portfolio with the highest (lowest) level of daily shorting activity over the previous five days experiences average returns of 114 (110) basis points over the next twenty trading days (this difference is not statistically significant at conventional levels). In addition, we ran the standard three factor Fama-French portfolio analysis for this sample. We find that the alpha for the portfolio with the highest (lowest) level of daily shorting activity over the previous five days is 40 (75) basis points over the next twenty trading days. After correcting for over-lapping return intervals (we have up to 20 lags of dependence in this data analysis) using standard Newey-West corrections, we find that the hedge return of 35 basis per month is significant at the nine percent level (t-statistic of 1.73). We repeated this analysis for the SHORT/VOLUME measure and found very similar results.

Given that our sample size consists of only 251 trading days these portfolio tests suffer from low power. However, the return difference of 35 basis points per month is equivalent to only 4.3 percent annualized. These returns are of a similar order of magnitude to Boehmer, Jones and Zhang (2005) who found 8.7 percent annualized for their sample. Together, these portfolio returns are dwarfed by the large negative returns

we examine in table 4 (-8 percent was the average *daily* return examined in table 4). A reconciliation of the two approaches is that short sellers (at least in the aggregate) do not appear to be able to time their trades prior to *significant* bad news events, but appear to be able (at the margin) to generate some small profits from downward information.

Miscellaneous

Finally, the data we obtain from NYSE for the SuperDOT system comes from daily files they compile. This data is not prepared for back-testing purposes, so transactions that alter shares outstanding, such as splits and reverse splits, may confound time series analysis of this data set. Specifically, our unscaled measures (*SHORT* and *%*Δ*SHORT*) could be influenced by such transactions. We delete split securities from our sample using the CRSP daily event file, and our results are unaffected. In any event, splits do not affect our volume deflated measure as this information comes from the same daily file.

V. SUMMARY AND CONCLUSIONS

In this paper, we examine daily short sale transactions for a sample of 4,193 NYSE securities for the period April 1, 2004 through to March 31, 2005. We find no evidence that short sale transactions precede bad news events in this time period. We examine a variety of news events including earnings announcements and management forecasts along with a detailed time series analysis of whether daily changes in short sale transactions lead negative future returns. Our findings stand in contrast to prior research that has documented a negative association between short sales and future returns.

Our results are consistent with several interpretations. First, the absence of a relation could be a consequence of the large increase in short sale transactions in recent years that has led to a watering down in the information content of such trades. Second, it could be due, in part, to the effects of Regulation FD that has removed the selective disclosure that may have been an essential support to the informed trading that was captured in the short trades examined in earlier time periods. Third, the results are consistent with the notion that as a group short sellers are not trading on the basis of inside information. Alternatively stated, the SEC and other regulatory bodies are, on average, effective in mitigating insider trading activity (or at least the footprint of such trading activity is not readily observable in market data).

Our study has a number of limitations. First, we use only one year of data for one exchange in our analysis and this restricts our ability to generalize to other periods and markets. Second, we examine short sale transactions using daily data. While this is consistent with the relatively short holding period for the typical short position (Reed, 2003), it is possible that we are missing some of the information content of short sale transactions by looking at relatively high frequency data. For example, if "informed" short sellers (as opposed to speculators or hedgers) hold their positions for extended periods then looking at daily data may miss the price reversals those trades are designed to capture. However, even extending our analysis of daily short sale transactions out to 20 days, or performing weekly analysis, we are still unable to find a relation between short sale transactions and returns.

Third, we only examine the impact of short selling on a selection of news events: earnings announcements and voluntary management forecasts. There may be other

events (e.g., earnings restatements, class action law suits, and drug denials) for which we can also detect the ability of short sellers to trade on the basis of rich information sets. These analyses would be an interesting extension for future research. However, it is worth re-iterating that our analysis of daily returns and daily changes in short sales transactions reveal no evidence of a leading relation between short sale transactions and returns. To the extent that short sale transactions are based on private information, it is not information that is revealed in prices, at least over relatively short horizons.

Fourth, our analysis reports that *on average* short sale transactions do not precede bad news events between April 1, 2004 and March 31, 2005 for NYSE securities. Future work could examine subsets of data to see if short sale transactions do precede bad news events, at least for some short sellers. This analysis would require disaggregated data for daily short sale transactions. The researcher could then partition firms ex ante based on observable information such as size of trade (assuming that larger trades are from more sophisticated short sellers).

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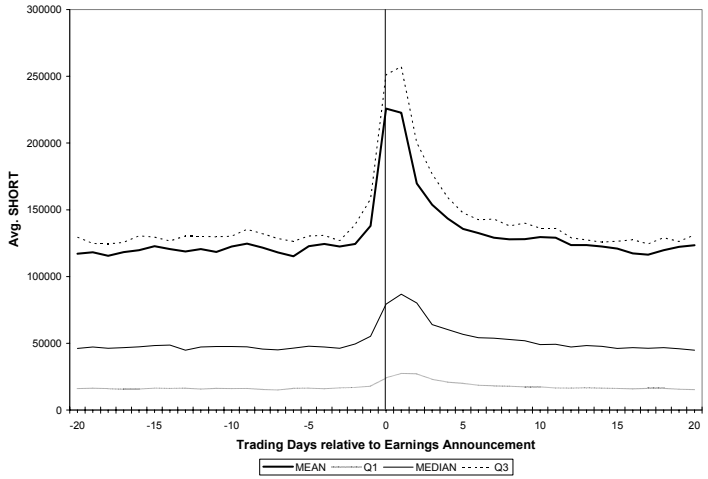
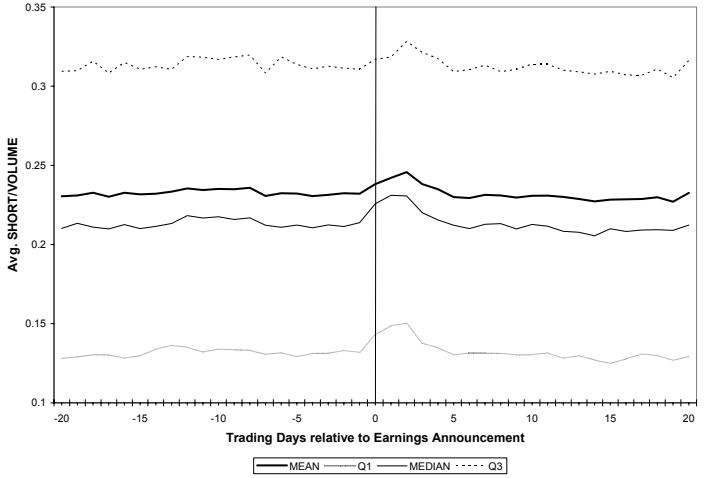
Figure 1
Short selling behavior around earnings announcements

The sample includes 4,729 firm-quarter earnings announcements for NYSE firms from April 1, 2004 to March 31, 2005

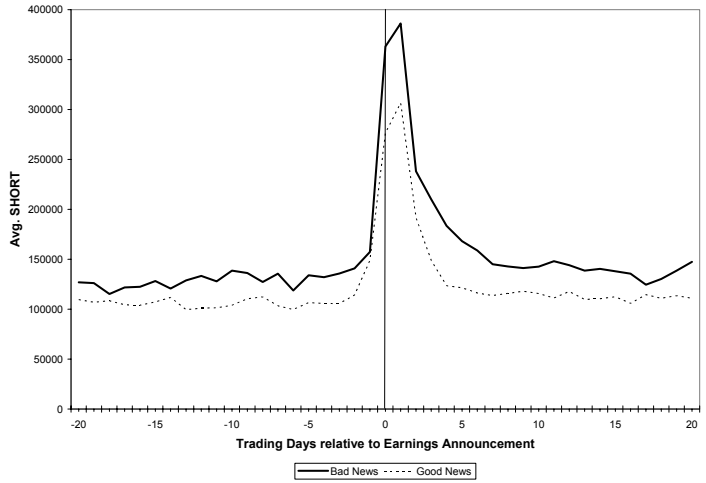
Panel A: *SHORT* All Securities



Panel B: *SHORT/VOLUME* All Securities



Panel C: *SHORT* Good v Bad News Securities



Panel D: *SHORT/VOLUME* Good v Bad News Securities

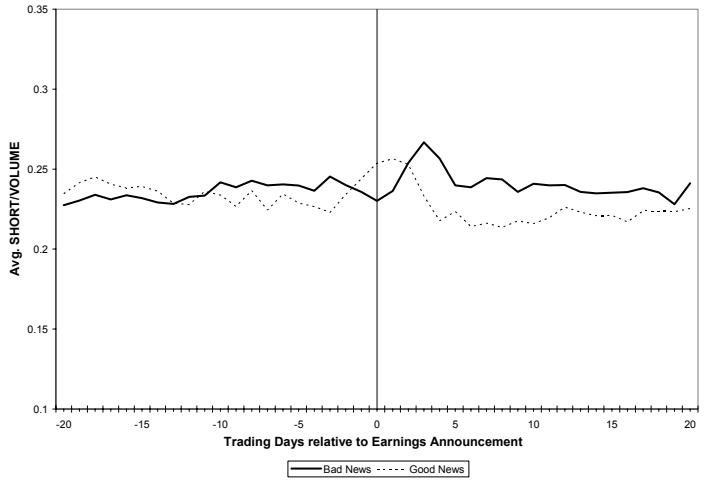
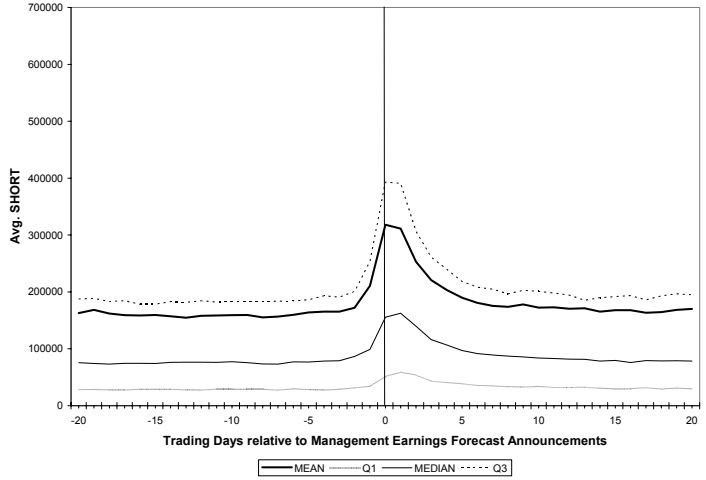


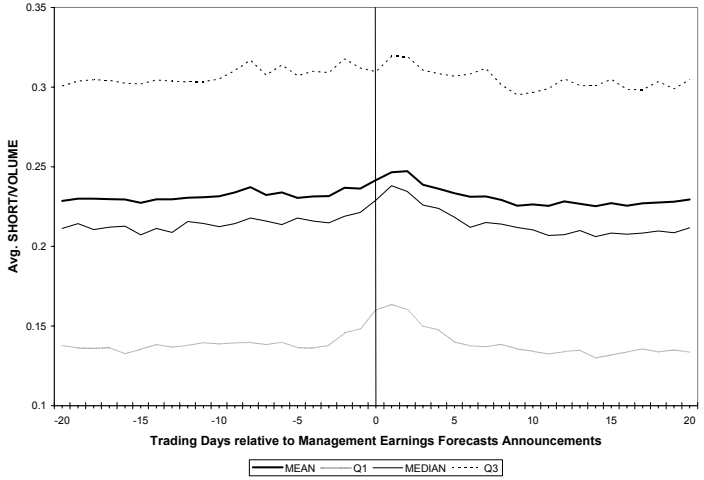
Figure 2
Short selling behavior around management earnings forecasts

The sample includes 2,288 management earnings forecasts for NYSE firms from April 1, 2004 to March 31, 2005

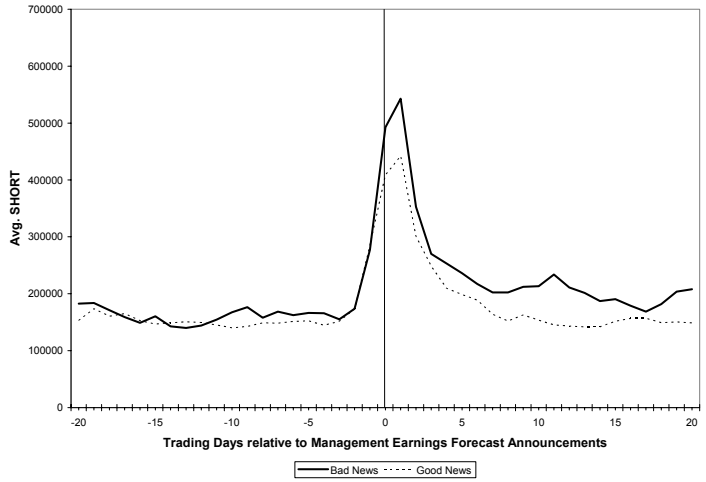
Panel A: *SHORT* All Securities



Panel B: *SHORT/VOLUME* All Securities



Panel C: *SHORT* Good v Bad News Securities



Panel D: *SHORT/VOLUME* Good v Bad News Securities

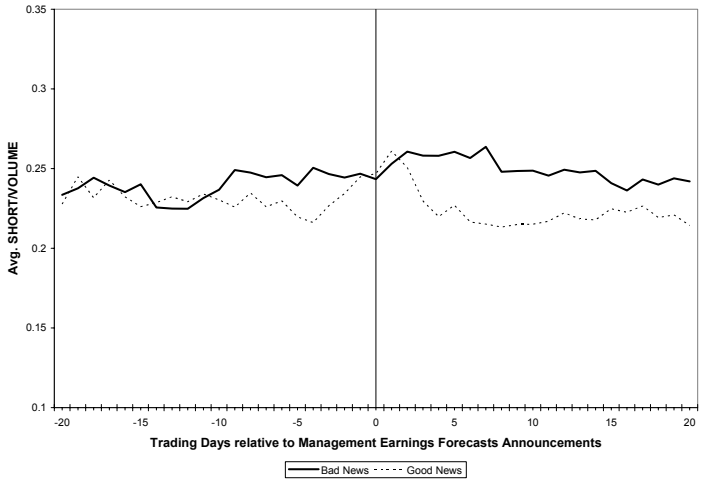
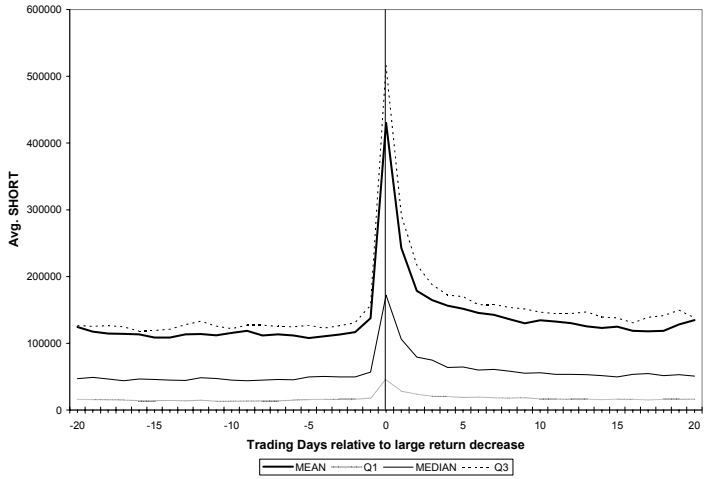


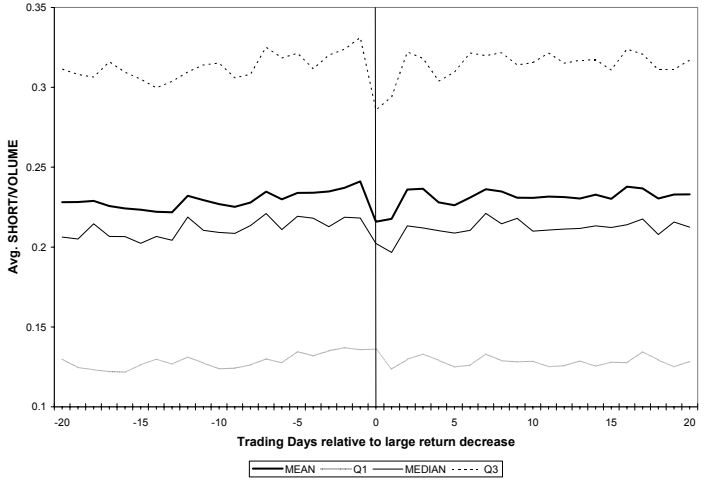
Figure 3
Short selling behavior around extreme stock price movements

Sample is 1,410 (1,794) firm-days with extreme price drops (leaps) for NYSE firms from April 1, 2004 to March 31, 2005

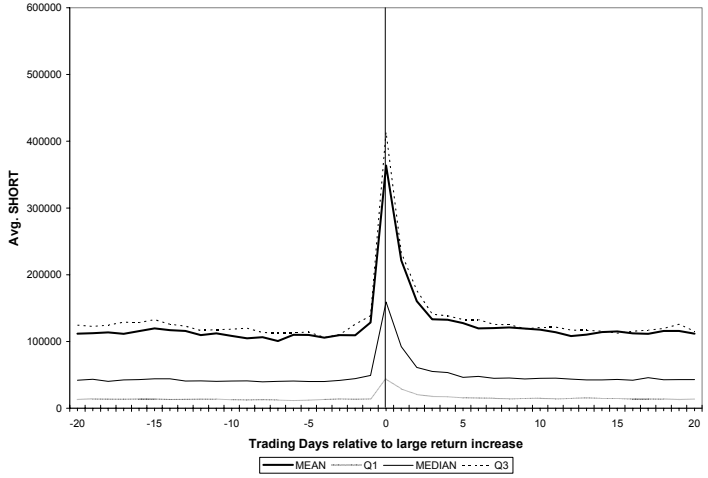
Panel A: *SHORT* - Return drops



Panel B: *SHORT/VOLUME* - Return drops



Panel C: *SHORT* - Return leaps



Panel D: *SHORT/VOLUME* - Return leaps

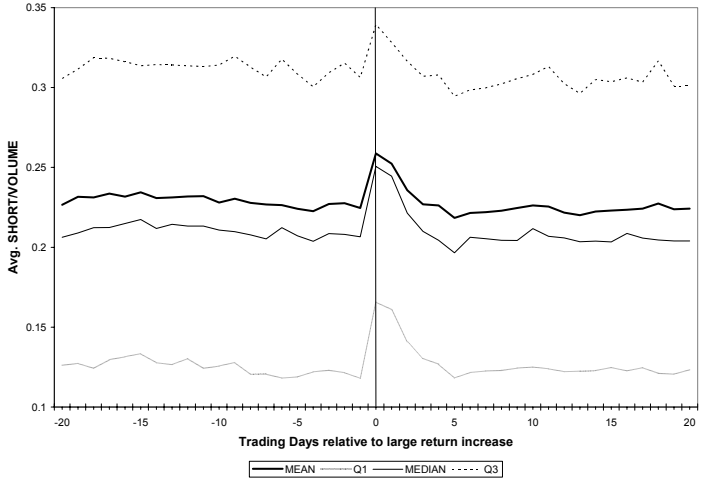


Table 1
Daily NYSE Trading, SuperDOT Trading and SuperDOT Short Sale Volume

Panel A: All Data from NYSE Volume Summary

	Mean	Std Dev	Min	Q1	Median	Q3	Max
NYSE Volume	387,736	1,058,574	0	7,137	57,285	309,764	19,818,000
SuperDOT Volume	301,698	722,591	112	15,925	70,978	269,065	14,192,152
# Trades	476	772	0	11	97	646	6,093
SHORT	62,599	152,397	0	234	5,168	57,686	3,059,871
SHORT/SHARES	0.09%	0.14%	0.00%	0.01%	0.06%	0.11%	5.03%
SHORT/VOLUME	14.34%	11.09%	0.00%	3.96%	13.65%	22.94%	91.53%

Panel B: Data after Sample Selection

	Mean	Std Dev	Min	Q1	Median	Q3	Max
NYSE Volume	741,405	1,321,280	11,192	133,921	315,253	801,274	19,188,762
SuperDOT Volume	549,276	895,904	14,384	107,412	255,920	626,625	12,379,957
# Trades	991	914	101	338	705	1,317	6,093
SHORT	122,184	185,106	0	21,867	60,386	144,166	1,676,185
SHORT/SHARES	0.11%	0.10%	0.00%	0.05%	0.08%	0.14%	1.20%
SHORT/VOLUME	22.50%	7.46%	0.00%	18.21%	22.49%	26.81%	72.80%
%ΔSHORT	24.87%	10.64%	-83.06%	19.89%	23.75%	28.82%	249.25%
%ΔSHORT/SHARES	15.62%	7.72%	-71.25%	11.66%	14.83%	18.93%	152.60%
%ΔSHORT/VOLUME	25.26%	11.03%	-83.06%	20.08%	24.05%	29.24%	249.25%
RET	0.07%	0.18%	-1.55%	0.00%	0.06%	0.12%	1.90%

The sample covers observations with available data on *NYSE Volume Summary* and *CRSP* for the period April 1, 2004 to March 31, 2005. The initial sample size in panel A is 1,052,443 security-days from April, 1 2004 to March 31, 2005. There are 4,193 securities for 251 trading days. We require securities to be traded every day, to have an average daily trading volume of greater than 100 trades per day and an average stock price above $10 to be included in the final sample. After imposing these criteria (panel B), there are 444,772 security-day observations, with 1,772 securities and 251 trading days. Numbers reported in the table reflect the distribution of security averages. Q1 (Q3) is the lower (upper) quartile of the respective distribution. *NYSE Volume* is total daily volume of shares traded as from *NYSE Volume Summary* daily files. *SuperDOT Volume* is the total daily volume of shares traded through the SuperDOT Trading System as from *NYSE Volume Summary* daily files. *# Trades* is the total daily number of trades as from the *NYSE Volume Summary* daily files. *SHORT* is the daily (gross) volume of stocks shorted through the SuperDOT Trading System as from *NYSE Volume Summary*. *SHORT/SHARES* is *SHORT* divided by the number of shares outstanding as from *CRSP* daily files. *SHORT/VOLUME* is *SHORT* divided by the total SDOT trading volume. *%ΔSHORT* is the percentage daily change in *SHORT*. *%Δ SHORT/SHARES* is the percentage daily change in *SHORT/SHARES*. *%ΔSHORT/VOLUME* is the percentage daily change in *SHORT/VOLUME*. *RET* is the daily return as from *CRSP*.

Table 2
Short Sale Transactions Around Earnings Announcements

Panel A: Earnings Announcements

	April	May	June	July	August	September
N	39	383	100	943	424	97
%	0.82%	8.10%	2.11%	19.94%	8.97%	2.05%

	October	November	December	January	February	March	Total
N	902	453	86	504	700	98	4,729
%	19.07%	9.58%	1.82%	10.66%	14.80%	2.07%	100.00%

	Q1	Q2	Q3	Q4	Total
N	616	1,379	1,391	1,343	4,729
%	13.03%	29.16%	29.41%	28.40%	100.00%

Panel B: Earnings Announcement News Variables

	Mean	Std Dev	Min	Q1	Median	Q3	Max
$(E_t-E_{t-4})/P_{t-4}$	-2.46%	244.57%	-16138.53%	-0.04%	0.33%	0.99%	876.67%
RET(0,+1)	0.68%	5.31%	-35.38%	-2.11%	0.60%	3.21%	33.29%

Panel C: Regression Analysis (4,729 earnings announcements)

$$AB\_SHORT/SHARES(-5, -1) = \beta_0 + \beta_1 RET(0, +1) + \beta_2 RET(-5, -1) + \beta_3 ABVOL(-5, -1) + \varepsilon$$

	β_0		β_1	β_2		β_3		Adj. R^2
Coefficient	0.019	***	0.011	2.604	***	0.876	***	41.11%
Robust t	3.12		0.07	10.44		20.37		

$(E_t-E_{t-4})/P_{t-4}$ is our earnings based measure of the news content of the earnings announcement. It is computed as the difference in quarterly income before extraordinary items (relative to the same quarter of the prior year) deflated by the market value of equity from four quarters earlier. *RET(0,+1)* is the stock's 2 day percentage return following the earnings announcement and measured from the close of day -1 to the end of day +1. *AB_SHORT/SHARES(-5,-1)* is the average daily abnormal short-selling for the stock in the pre-announcement period, measured as the average daily *SHORT/SHARES* in the pre-announcement period divided by the average daily *SHORT/SHARES* in the non-announcement period, all minus 1. *SHORT* is the daily (gross) volume of stocks shorted through the SuperDOT Trading System as from *NYSE Volume Summary* daily files. *SHORT/SHARES* is *SHORT* divided by the number of shares outstanding as from *CRSP* daily files. *RET(-5,-1)* is the stock's percentage return measured from the closing price on day -6 through to the end of day -1. *ABVOL(-5,-1)* is the stock's abnormal volume in pre-announcement period, measured as the average daily volume in the pre-announcement period divided by the average daily volume in the non-announcement period, all minus 1. . *** (**) significant at the 1% (5%) level.

Table 3
Short Sale Transactions Around Management Earnings Forecasts

Panel A: Management Earnings Forecasts

	April	May	June	July	August	September
N	55	145	119	354	155	167
%	2.40%	6.34%	5.20%	15.47%	6.77%	7.30%

	October	November	December	January	February	March	Total
N	424	196	138	245	262	28	2,288
%	18.53%	8.57%	6.03%	10.71%	11.45%	1.22%	100%

	Quarterly	Annual	Total
N	853	1,435	2,288
%	37.28%	62.72%	100.00%

Panel B: Management Earnings Forecasts News Variables

Variable	Mean	Std Dev	Min	Q1	Median	Q3	Max
$(M_t-A_t)/\|A_t\|$	5.99%	99.23%	-3157.14%	-3.41%	-0.44%	3.56%	824.24%
RET(0,+1)	0.42%	7.20%	-39.10%	-2.76%	0.36%	3.50%	63.36%

Panel C: Regression Analysis (2,288 management forecasts)

$$AB\_SHORT/SHARES(-5, -1) = \beta_0 + \beta_1 RET(0, +1) + \beta_2 RET(-5, -1) + \beta_3 ABVOL(-5, -1) + \varepsilon$$

	β_0		β_1	β_2		β_3		Adj. R^2
Coefficient	0.014	*	0.027	2.159	***	0.912	***	42.62%
Robust t	1.65		0.18	6.03		12.62		

$(M_t-A_t)/|A_t|$ is our earnings based measure of the news content of the management forecast. It is computed as the difference in the management forecast of earnings (M) relative to the most recent mean consensus analyst forecast (A) deflated by the absolute value of the most recent consensus analyst forecast. *RET(0,+1)* is the stock's 2 day percentage return following the earnings announcement and measured from the close of day -1 to the end of day +1. *AB_SHORT/SHARES(-5,-1)* is the average daily abnormal short-selling for the stock in the pre-announcement period, measured as the average daily *SHORT/SHARES* in the pre-announcement period divided by the average daily *SHORT/SHARES* in the non-announcement period, all minus 1. *SHORT* is the daily (gross) volume of stocks shorted through the SuperDOT Trading System as from *NYSE Volume Summary* daily files. *SHORT/SHARES* is *SHORT* divided by the number of shares outstanding as from *CRSP* daily files. *RET(-5,-1)* is the stock's percentage return measured from the closing price on day -6 through to the end of day -1. *ABVOL(-5,-1)* is the stock's abnormal volume in pre-announcement period, measured as the average daily volume in the pre-announcement period divided by the average daily volume in the non-announcement period, all minus 1. *** (**) significant at the 1% (5%) level.

Table 4
Short Sale Transactions Around Return Spikes

Panel A: Extreme News Events inferred from |RET|

	April	May	June	July	August	September
N	388	315	197	338	226	201
%	12.11%	9.83%	6.15%	10.55%	7.05%	6.27%
# Leaps	178	178	121	177	118	132
% Leaps	9.92%	9.92%	6.74%	9.87%	6.58%	7.36%
# Drops	210	137	76	161	108	69
% Drops	14.89%	9.72%	5.39%	11.42%	7.66%	4.89%

	October	November	December	January	February	March	Total
N	350	221	198	271	256	243	3,204
%	10.92%	6.90%	6.18%	8.46%	7.99%	7.58%	100%
# Leaps	180	157	106	152	180	115	1,794
% Leaps	10.03%	8.75%	5.91%	8.47%	10.03%	6.41%	100%
# Drops	170	64	92	119	76	128	1,410
% Drops	12.06%	4.54%	6.52%	8.44%	5.39%	9.08%	100%

Panel B: Price Based News Variable

Variable	Mean	Std Dev	Min	Q1	Median	Q3	Max
RET Drops	-8.17%	3.45%	-34.12%	-8.72%	-7.00%	-6.16%	-5.67%
RET Leaps	8.24%	3.45%	5.67%	6.20%	7.11%	8.82%	45.48%
|RET(0)|	8.21%	3.45%	5.67%	6.18%	7.04%	8.78%	45.48%

Panel C: Regression Analysis (3,204 extreme return days)

$$AB\_SHORT/SHARES(-5, -1) = \beta_0 + \beta_1 RET(0) + \beta_2 RET(-5, -1) + \beta_3 ABVOL(-5, -1) + \varepsilon$$

	β_0		β_1	β_2		β_3		Adj. R^2
Coefficient	0.052	***	-0.262	0.658	***	0.426	***	25.51%
Robust t	3.55		-1.57	1.31		3.72		

Return "drops" refer to the 1,410 security-days for which daily stock returns were lower than negative of the ninety-ninth percentile of the absolute daily return distribution for our sample period. Return "leaps" refer to the 1,794 security-days for which daily stock returns were greater than the ninety-ninth percentile of the absolute daily return distribution for our sample period. *SHORT* is the daily (gross) volume of stocks shorted through the SuperDOT Trading System as from *NYSE Volume Summary* daily files. *SHORT/SHARES* is *SHORT* divided by the number of shares outstanding as from *CRSP* daily files. Other variables are as defined in table 3. *** (**) significant at the 1% (5%) level.

Table 5
Regression Analysis of Daily Changes in Short Sale Transactions and Daily Returns

Panel A: Daily returns on lagged daily %ΔSHORT and lagged daily returns

$RET_t = \alpha + \beta_1 \%\Delta SHORT_{t-1} + \ldots + \beta_{10} \%\Delta SHORT_{t-10} + \lambda_1 RET_{t-1} + \ldots + \lambda_{10} RET_{t-10} + \varepsilon$

Variable	Mean	Median	Q1	Q3	t-Mean	t-Median	t-Q1	t-Q3
Alpha	0.0007	0.0006	-0.0006	0.0019	0.37	0.37	-0.31	1.05
$\%\Delta SHORT_{t-1}$	-0.0001	-0.0001	-0.0010	0.0008	-0.09	-0.07	-0.80	0.64
$\%\Delta SHORT_{t-2}$	0.0000	0.0000	-0.0009	0.0009	0.02	0.01	-0.68	0.68
$\%\Delta SHORT_{t-3}$	0.0000	0.0000	-0.0009	0.0009	0.00	0.01	-0.69	0.66
$\%\Delta SHORT_{t-4}$	-0.0001	0.0000	-0.0010	0.0009	-0.07	-0.04	-0.73	0.62
$\%\Delta SHORT_{t-5}$	0.0000	0.0000	-0.0009	0.0009	-0.03	-0.03	-0.69	0.62
$\%\Delta SHORT_{t-6}$	-0.0002	-0.0002	-0.0011	0.0007	-0.16	-0.17	-0.86	0.52
$\%\Delta SHORT_{t-7}$	0.0001	0.0001	-0.0008	0.0010	0.06	0.04	-0.61	0.70
$\%\Delta SHORT_{t-8}$	0.0001	0.0000	-0.0008	0.0009	0.04	-0.01	-0.62	0.70
$\%\Delta SHORT_{t-9}$	0.0003	0.0003	-0.0005	0.0012	0.25	0.24	-0.40	0.95
$\%\Delta SHORT_{t-10}$	0.0004	0.0003	-0.0005	0.0012	0.27	0.26	-0.39	0.98
RET_{t-1}	-0.0123	-0.0116	-0.0707	0.0482	-0.19	-0.16	-1.00	0.67
RET_{t-2}	-0.0197	-0.0177	-0.0663	0.0346	-0.22	-0.24	-0.94	0.49
RET_{t-3}	-0.0258	-0.0241	-0.0690	0.0207	-0.34	-0.33	-0.94	0.29
RET_{t-4}	-0.0163	-0.0133	-0.0624	0.0350	-0.20	-0.19	-0.84	0.47
RET_{t-5}	0.0007	0.0001	-0.0494	0.0475	0.01	0.00	-0.68	0.68
RET_{t-6}	-0.0003	0.0025	-0.0474	0.0471	0.01	0.03	-0.67	0.65
RET_{t-7}	-0.0059	-0.0048	-0.0493	0.0411	-0.06	-0.07	-0.67	0.58
RET_{t-8}	-0.0180	-0.0213	-0.0658	0.0198	-0.29	-0.30	-0.92	0.29
RET_{t-9}	-0.0213	-0.0206	-0.0657	0.0249	-0.29	-0.29	-0.91	0.36
RET_{t-10}	-0.0117	-0.0151	-0.0607	0.0365	-0.18	-0.21	-0.85	0.51

Panel B: Weekly returns on lagged weekly %ΔSHORT and lagged weekly returns

$RET_t = \alpha + \beta_1 \%\Delta SHORT_{t-1} + \ldots + \beta_5 \%\Delta SHORT_{t-5} + \lambda_1 RET_{t-5} + \ldots + \lambda_{10} RET_{t-5} + \varepsilon$

Variable	Mean	Median	Q1	Q3	t-Mean	t-Median	t-Q1	t-Q3
Alpha	0.0058	0.0052	0.0009	0.0098	0.80	0.84	0.16	1.41
$\%\Delta SHORT_{t-1}$	-0.0005	0.0000	-0.0046	0.0052	0.00	-0.02	-0.68	0.70
$\%\Delta SHORT_{t-2}$	-0.0021	-0.0001	-0.0051	0.0041	-0.05	-0.02	-0.65	0.56
$\%\Delta SHORT_{t-3}$	-0.0021	-0.0004	-0.0055	0.0041	-0.11	-0.08	-0.80	0.55
$\%\Delta SHORT_{t-4}$	0.0013	0.0012	-0.0032	0.0067	0.22	0.20	-0.47	0.90
$\%\Delta SHORT_{t-5}$	-0.0014	-0.0005	-0.0057	0.0038	-0.14	-0.12	-0.82	0.55
RET_{t-1}	-0.0326	-0.0373	-0.1498	0.0741	-0.20	-0.23	-0.87	0.42
RET_{t-2}	-0.0427	-0.0454	-0.1481	0.0487	-0.29	-0.29	-0.87	0.28
RET_{t-3}	-0.0277	-0.0307	-0.1359	0.0703	-0.20	-0.21	-0.82	0.40
RET_{t-4}	-0.0490	-0.0521	-0.1458	0.0437	-0.32	-0.33	-0.89	0.27
RET_{t-5}	-0.0432	-0.0417	-0.1436	0.0500	-0.28	-0.28	-0.87	0.31

All regression coefficients are estimated first for each security. Distributional information across securities is reported in the table. The t-statistics are the mean, median, Q1 and Q3 t-statistics for our sample. *RET* is daily stock return. *SHORT* is the daily (gross) volume of stocks shorted through the SuperDOT Trading System as from *NYSE Volume Summary* daily files. Panel A (B) reports regression analysis using daily (weekly) returns and daily (weekly) changes in *SHORT*.