

# Why Investors Want to Know the Size of Your Shorts

By

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## *ABSTRACT*

There has been recent interest by financial market regulators in the potential information value of more extensive short selling disclosures. We use our unique short selling dataset to investigate the linkage between stock returns and the average daily size of short trades by speculators and dealers. We find that past and contemporaneous returns have a significant and positive impact on the size of dealer short trades, whereas speculators tend to decrease the size of their short trades when stock price is increasing. More importantly, we show that large speculative short trades tend to be followed by returns that are more negative, whereas the opposite holds for large dealer short trades. A portfolio formed by going short stocks where speculative short trade size is largest and long stocks where it is smallest generates five-day returns ranging from 0.40% to 1.34% depending upon whether speculative short selling is a high or low percentage of the stock's daily trading activity (and whether stock returns are measured on a raw, or market-adjusted basis). In contrast, for dealers an opposite trading strategy generates five-day returns ranging from 0.31% to 0.94%. Our results have important policy implications – particularly our finding of a differing linkage between subsequent return and the size of speculative versus dealer short trades. Requiring financial markets to provide a stock-by-stock daily report that discloses short selling by investor category (speculator versus dealer) could provide average investors with value-relevant information that could lead to financial markets that are more fair and efficient. Our results also have implications for academic research that focuses on short selling. Unless researchers control effectively for investor category when conducting empirical studies, they risk generating results that predominately reflect the short selling actions of dealers.

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## *ABSTRACT*

There has been recent interest by financial market regulators in the potential information value of more extensive short selling disclosures. We use our unique short selling dataset to investigate the linkage between stock returns and the average daily size of short trades by speculators and dealers. We find that past and contemporaneous returns have a significant and positive impact on the size of dealer short trades, whereas speculators tend to decrease the size of their short trades when stock price is increasing. More importantly, we show that large speculative short trades tend to be followed by returns that are more negative, whereas the opposite holds for large dealer short trades. A portfolio formed by going short stocks where speculative short trade size is largest and long stocks where it is smallest generates five-day returns ranging from 0.40% to 1.34% depending upon whether speculative short selling is a high or low percentage of the stock's daily trading activity (and whether stock returns are measured on a raw, or market-adjusted basis). In contrast, for dealers an opposite trading strategy generates five-day returns ranging from 0.31% to 0.94%. Our results have important policy implications – particularly our finding of a differing linkage between subsequent return and the size of speculative versus dealer short trades. Requiring financial markets to provide a stock-by-stock daily report that discloses short selling by investor category (speculator versus dealer) could provide average investors with value-relevant information that could lead to financial markets that are more fair and efficient. Our results also have implications for academic research that focuses on short selling. Unless researchers control effectively for investor category when conducting empirical studies, they risk generating results that predominately reflect the short selling actions of dealers.

## I. Introduction

Recent financial market reforms have led to increased focus on the potential informational value of more extensive short selling disclosures. For example, a May 2011 release by the Securities and Exchange Commission called for public comment on the feasibility and benefits of separately disclosing short positions by speculators and market makers.<sup>1</sup> A possible benefit of more detailed short selling data is that additional information could result in securities markets that are fairer and more informationally efficient.<sup>2</sup> For instance, trades by speculators could be established to exploit mispricing situations whereas trades by dealers could be primarily related to market making activities. If so, publicly disclosing short selling information broken out by short seller type could result in share prices converging more rapidly to their true fundamental values if average investors can effectively react to the information revealed in the disaggregated disclosure.

In this study, we examine the potential informational value of more extensive short selling disclosures from a trade size perspective. Using our unique dataset, which allows us to distinguish between short selling by speculators and dealers, we examine whether the average daily size of short trades by these two seller types has similar linkages to past, contemporaneous, and subsequent stock returns. Our results indicate that the linkages are different, and we conclude that requiring exchanges to provide a stock-by-stock daily report of this information would supply investors with value-relevant information for pricing securities.

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<sup>1</sup> See Securities and Exchange Commission Release No. 34-64383 dated May 3, 2011.

<sup>2</sup> This view is illustrated in several theoretical models (e.g., Miller (1977), Diamond and Verrecchia (1987), Duffie, Garleanu, and Pedersen (2002), and Hong, Scheinkman, and Xiong (2006)) and supported in empirical studies (e.g. Dechow, Hutton, Meulbroek, and Sloan (2001), Boehmer and Wu (2012)). The view that it could be beneficial to disclose shorting activity on a more timely basis and/or with additional details, however, is not universal. A particular potential cost of increased disclosure is share price manipulation by short sellers' predatory trading strategies, which to the extreme, arguably could destabilize the markets (see, e.g., Brunnermeier and Pedersen (2005) and Goldstein and Guembel (2008)).

Partitioning short trade size statistics by speculators versus dealers is a natural division given the (likely) differing motivations for trading by these two types of market participants. For example, if speculators possess negative private information, they will establish short positions in anticipation of earning abnormal profits from future price declines. The size of their short transactions may be driven by a tension between a wish to use smaller (or mid) sized trades to disguise their trading activities versus a need to employ larger trades to exploit information that may be ephemeral. In contrast, dealers are obligated to provide liquidity and to “make a market” in the stocks they follow. In situations where stock price is rising and inventory is low, dealers will sell shares short to meet abrupt buying pressure. Thus, although dealers’ short positions may sometimes be established to exploit negative private information, we expect they frequently arise directly from the dealers’ market making activities.

A wide number of studies have established that short sellers in general are informed investors (e.g., Desai, Ramesh, Thiagarajan, and Balachandran (2002), Christophe, Ferri, and Angel (2004), Asquith, Pathak, and Ritter (2005), Boehmer, Jones, and Zhang (2008), Diether, Lee, and Werner (2008), and Karpoff and Lou (2010)). These studies report that increased short sale activity is often followed by subsequent stock declines as the information that induced the short selling becomes revealed and impounded in stock price. We build upon this strand of research by exploring explicitly how the short trades of speculators versus dealers are linked to stock returns.

Other studies have examined whether the size of long buys and sales of long positions has implications for subsequent returns (e.g., Barclay and Warner (1993), Bhattacharya (2001), Chakravarty (2001), and Alexander and Peterson (2007)). Their findings generally indicate that, consistent with the theories of stealth trading by informed traders (Kyle (1985) and Admati and

Pfleiderer (1988)), medium-size trades are associated with the largest price changes. Our study builds upon this body of research by examining how the average daily size of speculative versus dealer short trades is linked to stock returns.

Using daily firm-level short selling data for NASDAQ firms, we first document significant variation in the shorting activities of speculators versus dealers.<sup>3</sup> For example, dealers engage in short trades on a very regular basis. In fact, short selling by dealers happens almost every day for every stock at every stock price level throughout our sample period of September 2000 to July 2001. Dealers' short trades also tend to be larger in size than the short trades of speculators. For example, for stocks priced above \$10 per share, the average daily size of dealer short trades is 973 shares whereas it is 854 shares for speculators. (The corresponding medians are 749 and 425 shares, respectively.)

The linkage between stock return and short trade size also differs significantly for speculators versus dealers. We find a significantly negative relationship between the average size of speculative short trades and past and contemporaneous returns whereas for dealers it is significantly positive. There is also a significantly negative linkage – that is quite monotonic – between the size of speculative short trades and subsequent five-day stock returns. This result provides strong support for the informed speculative trading hypothesis, and the monotonicity suggests that the stealth trading documented in previous studies applies only to long buys and sells, but not to short trades. In contrast, we find that larger short trades by dealers are followed by more positive (though not necessarily non-negative) future stock returns. This suggests that when dealers are engaged in a larger number of small short trades (as opposed to a smaller number of large short trades), subsequent returns are likely to reverse more sharply. Our

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<sup>3</sup> In this study, we focus on non-exempt short sales by speculators and dealers, i.e. those that were subject to the NASDAQ bid test which was in effect during our sample period. We describe in detail the difference between exempt and non-exempt short sales in Section III, below.

regression results also reveal that the relationship between the size of short trades (whether by speculators or dealers) and subsequent stock returns remains significant after controlling for market-wide returns and a stock's overall level of speculative and dealer short selling. Thus, the information content of short trade size is not a simple by-product of the level of short selling. Taken collectively, our findings indicate that requiring exchanges to report the average daily size of short trades by speculators and dealers would provide investors with value-relevant information for pricing securities.

The evidence presented in this research augments some findings reported in other studies. For example, Boehmer, Jones, and Zhang (2008) study short selling on the NYSE and find that when large short trades (i.e., separate trades of more than 5000 shares) dominate the previous five days' short selling, returns over the subsequent 20 days tend to be significantly more negative than when smaller short trades predominate. We find for NASDAQ firms that, although the average size of a day's speculative short trades is negatively correlated with subsequent five-day returns, an opposite result holds for dealers. In addition, our study differs from Boehmer et al. in several other ways. First, we separately examine the size of short trades of market participants (speculators versus dealers) who are likely to have distinctly different motivations for short selling whereas the proprietary dataset used by Boehmer et al. excludes short trades by specialists. Second, we investigate the linkage to returns of the average size of a day's short trades, while Boehmer et al. study the overall prevalence of a given order size in the previous five days. Lastly, we respond to the call for comment on the potential benefit of requiring exchanges to report the average daily size of short trades by speculators and dealers.

Our study also augments work by Comerton-Forde, Jones, and Putnins (2012). They match trade-level information with short sales executed on the NYSE and NASDAQ during the

first eight month of 2008 for a sample of 350 stocks and report that some short sellers demand liquidity while others supply liquidity. They show that liquidity-demanding short sellers are short-term momentum traders while liquidity-supplying short sellers tend to be contrarian, increasing their short positions after share price increases. Our study shows that speculators and dealers have distinctive roles in relation to liquidity, and that the sizes of their short trades have strong, but differing associations with stock returns.

Lastly, our study has potential implications for researchers using the REG SHO short selling database (which does not mark separately the short trades of speculators and dealers). Because our dataset reveals that short trades by NASDAQ dealers substantially outnumber short trades by speculators, failing to effectively partition the trades from these two distinctive groups into sub-samples when conducting empirical estimations may well lead to results that predominately reflect the short trading activities of dealers.

The remainder of this paper proceeds as follows: Section II provides a description of the distinction between speculative and dealer short selling and presents several testable hypotheses. Section III describes the characteristics of our short selling dataset, and the sample of NASDAQ stocks that are examined in our analysis. Section IV presents our empirical results, and the final section concludes.

## **II. Background and Testable Hypotheses**

### *II.1. Dealer short selling*

Dealers (market makers) and speculators can have very different motivations for selling short. The reason stems from the fact that dealers serve frequently as liquidity providers while speculators are liquidity demanders. Dealers engage in short trades as part of their obligation to

maintain a stable and orderly market, and when conducting market making activities, they accommodate buying or selling pressure by first utilizing their inventory capacity.<sup>4</sup> For example, when a stock price declines, dealers respond to excess investor selling by purchasing shares (hence, dealer inventory increases). Conversely, when a share price increases, dealers reduce inventory to respond to investor excess buying, and when inventory levels reach near zero, they short sell shares to satisfy any short-term abrupt buying demand (Hendershott and Seasholes (2007)). In addition, when investor demand for a company's shares is especially high (as indicated by a high stock return), we expect that dealer short trades will be large in size in order to swiftly meet the increased buying pressure. The above argument, denoted as the *Inventory Hypothesis*, asserts that the size of dealer short trades, along with their total short trade volume, will be positively associated with contemporaneous stock returns, and that the relationship is stronger when contemporaneous returns are more positive.<sup>5</sup>

The linkage between dealer short trade size and *subsequent* returns could be positive or negative depending upon whether larger dealer trades occur when stock momentum is high, or whether they occur in response to investor overreaction to news events and that over-reaction is followed by a price reversal in subsequent days. If the former occurs more often, we should observe a positive relationship between dealer short trade size and future (short-term) stock returns. If, instead, the latter is more dominant, the relationship should be negative.

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<sup>4</sup> Presently, NASDAQ market makers are obligated to quote prices at the best nationally available bid for at least 10% of the day.

<sup>5</sup> An additional point worth noting is that, when dealers are shorting into a rising market (to meet excess demand for a company's shares), they will likely not mark their trades as "short exempt" because those trades are not likely to violate the NASDAQ bid test (during our sample period, the NASDAQ bid test was in effect). Instead, those trades are likely to be marked as "non-exempt short" (as noted previously, the distinction between exempt and non-exempt short selling is discussed in detail in the next section of the paper).

## II.2. Speculative short selling from informed traders

Speculators establish short positions in stocks in anticipation of subsequent price declines or relative underperformance. While some studies suggest that private information is utilized by speculators when establishing profitable speculative short positions (e.g. Karpoff and Lou (2010)), other studies suggest that speculators are skilled at gleaning information from publicly available data (e.g. Englebert, Reed, and Ruggenberg (2010)).<sup>6</sup> Whatever the information source, speculators may engage in larger short trades when their trades are highly information-driven, the value of the information is ephemeral, and subsequent stock returns are expected to be more negative. This argument, which we refer to as the *Informed Speculative Trading Hypothesis*, suggests a significantly negative relationship between speculative short trade size and subsequent stock returns.

Of course, rather than risk disclosing their information advantage to dealers and other market participants by executing large short trades when subsequent returns are expected to be significantly negative, speculative short sellers may attempt to disguise their activities by engaging in mid-size or smaller trades (the *Stealth Trading Hypothesis*). Extant studies suggest that informed investors have an incentive to trade in a manner that does not quickly reveal their knowledge to others, and that the informativeness of stock trades varies by the size of the trade. For example, Barclay and Warner (1993) and Chakravarty (2001) report that medium-sized trades (defined as trades between 500 and 9,900 shares) are responsible for a disproportionately greater stock price impact than are other trades. Alexander and Peterson (2007) find that round lot trades that are medium in size are followed by a higher return than those that are larger-sized.

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<sup>6</sup> It is useful to note that these are not mutually exclusive alternatives.

They conclude that traders often attempt to hide their activities by transacting in medium-sized trades.

It is worth noting here that some portion of dealer short trades could also be information driven – whether informed from order flow, or via some other sources – and therefore also supportive of the Informed Speculative Trading Hypothesis or the Stealth Trading Hypothesis. Several studies argue that market participants can predict future returns using volume or current price movement (e.g., Blume, Easley, and O’Hara (1994), Llorente, Michaely, Saar and Wang (2002), and Lee and Swaminathan (2000) Thus, it is conceivable that in addition to market-making shorts, dealers also use information garnered from routing trades by informed traders (or, for that matter, valuable information garnered from other sources) as the basis (or bases) for establishing speculative short positions. Indeed, if this latter situation predominates in dealer shorts (the evidence that we report herein indicates that it does not), the returns associated with dealer and speculator short trades should be similar – and there would be no incremental value to requiring exchanges to report separately the average daily size of short trades by speculators and dealers.

Using our unique dataset which contains daily information on the short selling of NASDAQ firms, we investigate whether the average daily size of short trades by speculators and dealers conforms with the predications of the *Inventory Hypothesis*, the *Informed Speculative Trading Hypothesis*, and/or the *Stealth Trading Hypothesis*.

### **III. Data and Sample**

#### *A. Short Sale Data Source*

In this study, we utilize firm-level short sales data aggregated at the daily level, which we obtained from NASDAQ's Automated Confirmation Transaction Service (ACT). During our September 13, 2000 to July 10, 2001 sample period, ACT processed the vast majority of trades of NASDAQ-listed stocks.<sup>7</sup> To separate dealer (market maker) short trades from customer (speculative) short trades, we utilized ACT's trade reporting protocol along with NASDAQ's daily file of quotations.

ACT's protocol specified four rules for determining which party in a trade was responsible for reporting that trade. For example, (1) a market maker in a trade with a non-market maker was responsible for reporting the trade to ACT; (2) the seller in a trade between two market makers reports; (3) the NASD member in a trade with a non-member reports; or, (4) the seller in a trade between two NASD members reports. When reporting, if one side of the trade was selling short, that information was required to be reported as either an entry into the REPORT\_SHORT field, which indicated the reporting entity was shorting, or the CONTRA\_SHORT field, which meant the non-reporting party in the trade was selling short.

In addition, the record also includes an identifier for whether the trade was designated as "exempt" from the NASDAQ Short Sale Rule.<sup>8</sup> For customers, an exemption was allowed for certain specified arbitrage and hedging activities – all of which would be considered non-

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<sup>7</sup> We do not have access to ACT short selling data for any dates outside of our sample period. For additional description of these data, please see Christophe, Ferri and Hsieh (2010).

<sup>8</sup> NASDAQ's Short Sale Rule (Rule 3350) was, in our sample period, analogous to the "uptick" rule for NYSE-listed securities. The major difference was that Rule 3350 used a bid-test instead of the tick-test applied by the NYSE. Generally, the rule prohibited short-selling at the bid if it was lower than the preceding bid. See NASD's Notices to Members, 94-68 and 94-83, and interpretations (IMs) to the rule contained in IM-3350 of NASD Manual.

speculative. For dealers, an exemption was allowed, if necessary, for certain bona fide market making activities – subject to that dealer satisfying some specified criteria.<sup>9</sup>

To disaggregate the short sales in our ACT database into dealer short versus customer short, we utilized NASDAQ's daily file of quotations. That file allowed us to identify who, during each day of our sample period, was actively serving as a market maker (actively posting bid and ask quotes) in each stock. With this information, and the ACT trade reporting protocol, for every NASDAQ stock we are able to partition each day's short trades into four categories: dealer non-exempt, dealer exempt, customer non-exempt, and customer exempt (where customer short consists of non-exempt and exempt short trades that, according to the trade reporting rules and trade records, were *not* made by dealers acting as market makers on the day of the trade).

It is crucial to note that during the time of our sample NASD rules required market makers to flag *all* their short sales as such, and, not surprisingly, the REPORT\_SHORT field of our files reveals substantial shorting by dealers. In addition, the NASDAQ Trader Manual specified the circumstances that required a market maker short trade to be marked as non-exempt versus exempt:

Under revisions to NASD Rule 6130(d)(6) implemented in 1997, Market Makers that are exempt from the rule now must mark their ACT reports to denote when they have relied on a short-sale rule exemption, and thus must denote all short sales—both exempt and nonexempt—as short sales. Accordingly, if you effect a non-exempt short sale (e.g., a short sale during an up bid or a short sale at least 1/16 above a point on a down bid, assuming a spread of 1/16), you must mark your ACT report as a short sale. If you effect a short sale in reliance on an exemption to the rule, you must mark your ACT report as an exempt short sale.<sup>10</sup>

Consequently, in contrast to the notion that market making short selling should normally be reported as short exempt, the NASD rules show that short selling by market makers should

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<sup>9</sup> E.g., one criteria was that the market maker must be at the best bid or best offer for the stock no less than 35% of the time. See NASD's Notice to Members 94-68 for further details.

<sup>10</sup> See pages 3-4 of Chapter 9 of the NASDAQ Trader Manual (revised January 2000).

only be reported as exempt if the short sale violated the bid test.<sup>11</sup> Since dealer short selling is likely to occur in a rising market where potential buyers outnumber sellers, substantial non-exempt short trades are anticipated from market makers.<sup>12</sup> And, in fact, this is what we find in our database because most dealer short trades are coded as non-exempt (rather than exempt). We do recognize, however, that it is possible that some of a dealer's short non-exempt trades represent proprietary investing for either the dealer's desk or some other unit within the firm. If proprietary investment is the dominant motivation for dealer non-exempt short selling, the returns associated with dealer shorts should be similar to the returns associated with non-exempt customer short selling.

Customer non-exempt short trades likely represent speculative trades by sellers who were anticipating subsequent share price decline or relative underperformance. Any seller engaged in some non-speculative type of short selling who could have claimed exemption from the NASDAQ Short Sale Rule (i.e. have the right to trade "short exempt") would have done so, because the exemption would have allowed the sale to go forward when shorting would otherwise have been prohibited by the bid-test rule. Clearly, then, the customers (speculators) who did not claim the exempt status for their short sales were not authorized to do so and were not engaged in any of the few activities that earned exempt status. Therefore, we categorize all non-exempt customer short trades as speculative.

We focus this study on the linkage between daily stock returns and the average daily size of non-exempt dealer and non-exempt customer (speculative) short trades.<sup>13</sup> We choose this focus because non-exempt short trades represent the bulk of shorting activity by dealers and

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<sup>11</sup> Diether et al. (2008), pp. 8 suggest that the majority of market making shorts should be coded as exempt.

<sup>12</sup> Consistent with this argument, Hendershott and Seasholes (2007) find a negative correlation between specialist inventory and stock returns for NYSE stocks.

<sup>13</sup> Stock return data were obtained from CRSP.

speculators, and because many short selling-related studies either examine, or express an interest in examining, non-exempt short selling (e.g. Boehmer et al (2008), and Diether et al. (2008)).<sup>14</sup>

### *B. Formation of Sample*

The stocks we analyze are drawn from an initial sample of over 3,000 U.S.-domiciled companies whose common shares were listed on the NASDAQ and covered by ACT during the period September 13, 2000 to July 3, 2001. To minimize the potential for drawing improper inferences from thinly traded stocks, we deleted any stock that (a) did not trade every day and (b) had average daily volume of less than 50 trades per day in the sample period. These criteria result in a sample of 1,316 stocks, and a total of 272,412 (1,316 x 207) firm-trading day observations.

It is interesting to note that on 217,085 (79.69%) of the 272,412 firm-trading days there is at least one customer (speculative) short trade, whereas on 272,033 (99.85%) days there is at least one dealer short trade. In addition, as shown in Figure 1, dealer trades typically comprise approximately 14% of each day's total trades whereas speculative trades comprise approximately 4%. Consequently, almost one out of every five trades each day during this time period involved a situation where the seller was trading short.<sup>15</sup>

### *C. Sample Characteristics*

D'Avolio (2002) reports that low priced stocks tend to be difficult to short. To examine whether this characteristic exists in our sample, we partition stocks by \$2.50 stock price

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<sup>14</sup> Hereafter, for brevity, since the focus of our paper is on non-exempt short selling by dealers and customers (speculators), we refer to non-exempt short trades (and short selling) as short trades (or short selling).

<sup>15</sup> Hereafter, for brevity, since the focus of our paper is on non-exempt short selling by dealers and customer, we refer to non-exempt short trades (and short selling) as short trades (or short selling).

increments based upon each day's closing stock price (where the increments range from \$0 - \$2.50 per share, up to \$47.50 - \$50.00 per share, and then \$50.00 per share and above) and explore the likelihood that a stock experiences at least one speculative or dealer short trade in a trading day. The statistics from this partition are reported in Table 1.

As shown in the table (and consistent with D'Avolio's findings), speculators appear reluctant and/or unable to short low priced stocks. For example, when a stock's price is below \$2.50 per share, there is one (or more) customer short trade(s) on only 42.80% of trading days, and for a stock priced between \$2.50 and \$5.00, the percentage increases to only 55.41%. Interestingly, the likelihood of at least one speculative short trade increases almost monotonically as stock price rises, reaching 98.81% for stocks priced above \$50.00.

There does not, however, appear to be any relationship between stock price and the likelihood of one (or more) dealer short trade(s) in a day because on almost every day, every stock in our sample experienced at least one dealer short sales transaction. This finding is consistent with NASDAQ dealers engaging in market making activity and selling some shares short each day as they work to maintain a stable and orderly market for the stocks they follow. Lastly, as shown in the two far right columns in the table, both mean and median daily trading volume for sample stocks tend to rise as stock price increases.

Another way to look at the relationship between stock price and short selling is to examine, for those days when there was at least one speculative (or dealer) short trade, the percentage of overall trades that are speculative (or dealer) shorts. As shown in Table 2, when stock price is below \$10 per share, fewer than 3% of the day's trades, on average, involve speculative short sellers. And, when a stock is priced below \$5 per share, the median value for speculative short trades as a percentage of total trades is below 1%. However, the median

percentage rises (almost) monotonically as stock price increases, reaching a maximum of 3.93% for stocks priced above \$50.00. These results provide support for the use of stock price cutoffs when forming samples for speculative short selling studies because they show that speculative short sellers seem quite reluctant (or are unable) to short lower priced stocks.

The contrasting results for dealers, however, are striking. Both the mean and median values for dealer short trades as a percentage of daily trades *decline* (almost) monotonically as stock price increases. These results are consistent with dealers short selling to provide investors with execution immediacy – especially for lower priced stocks which, as shown in Table 1 above, generally experience trading volume that is lower than that of higher priced stocks. Another marked difference between speculative and dealer short trades is that in all price ranges, dealers sell shares short at least three times as often as do speculators.

The next issue we explore is the relationship between stock price and the typical size of short trades. Since the purpose of this study is to examine the linkage between short trade size and stock returns, if the size of typical short trades varies with stock price, including stock price as an independent variable in empirical specifications will be an appropriate control. As shown in Table 3, the average (mean) size of short trades for both customers and dealers declines almost monotonically as stock price increases. (Note that in the table, the results for speculators and dealers pertain to only those days where there was at least one speculative or dealer short trade, respectively). And, while the decline in the median trade size for speculators as stock price increases is somewhat irregular, for dealers the decline is quite steady. Further, the mean and median sizes of dealer short trades are larger than those of speculators, irrespective of price level. Thus, when considered along with the results presented in prior tables, it is evident that dealers short more often than speculators, and dealer short trades tend to be larger. Lastly, it is

interesting to observe that for stocks priced below \$5 per share, the median trade size for speculators is approximately 450 shares. This suggests that the maximum potential profit from those speculative short positions is only (approximately) \$2,250 -- which would occur if the stock price dropped \$5 to \$0.

Because the results presented in the tables above indicate that speculative short selling of lower priced stocks is constrained, the sample we utilize when examining whether and how short trade size is related to past, contemporaneous, and future stock returns is restricted to include only those days where a company's stock price is greater than or equal to \$10 per share. Imposing this restriction results in a final sample that consists of 178,353 firm-day observations.<sup>16</sup>

In Table 4 we present some summary statistics for this set of observations. As shown in Panel A, when the sample contains only those days when the firm's stock price is \$10 or above, the average short trade size of speculators and dealers is 853.66 and 972.86 shares, respectively; the corresponding median values are 425 and 749.33 shares. Presented in Panel B are trade size statistics associated with varying stock return ranges over preceding, contemporaneous and subsequent time intervals. Those statistics show that both speculators and dealers tend to increase the size of their short trades when stock return volatility (whether preceding, contemporaneous, or subsequent) increases. However, speculators engage typically in the largest short trades when stocks returns are more negative whereas the largest short trades by dealers are generally associated with positive returns. For example, speculative short sellers utilize an

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<sup>16</sup> Although our analysis is focused on short trade size, many other studies have examined the relationship between stock return and relative short selling, where relative short selling is defined as a stock's short volume divided by total share volume. Although not reported in a table, total (nonexempt speculative and dealer, combined) relative short selling for our sample of firms during our sample period has a mean (median) of 27.2% (26.3%). For comparison Diether et al (2008) report relative short selling of 31.33% (mean) and 31.72% (median) for NASDAQ stocks during their May 2, 2005 – April 28, 2006 time period.

average trade size of 822.06 shares when a firm's subsequent five-day returns are -5% or less but only 728.58 shares when those returns are between 0% and -5%.<sup>17</sup> And, dealers utilize an average trade size of 945.92 shares when a firm's contemporaneous (day 0) return is 5% or more, but only 889.09 shares when that return is -5% or less.

In Table 5, we present correlations between several key variables examined in our empirical specifications. As shown in the table, although speculative short trade size and dealer short trade size are positively correlated ( $\rho = 0.154$ ), they exhibit opposite correlations with stock returns.<sup>18</sup> In particular, the size of speculative short trades is negatively correlated with past, contemporaneous and future five-day returns, whereas the size of dealer short trades shows positive correlation with each of those returns. Consequently, dealers and speculators rely on at least somewhat different information when determining the size of their short trades.

Furthermore, the correlation between the percentage of a day's total trades made by speculators versus the percentage made by dealers is -0.115, indicating that speculators and dealers react to (at least somewhat) different events when determining the amount of their short trading activity.

In addition, we find that speculative trade size is positively correlated with speculative trade percentage whereas dealer trade size is negatively correlated with dealer trade percentage.

Lastly, since dealer short trades are approximately three to four times more common than speculative short trades (see Figure 1 and Table 2), these correlation results suggest that empirical studies that employ aggregated (across both speculators and dealers) short selling data may result in empirical findings that largely reflect the short selling actions of dealers (rather than speculators).

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<sup>17</sup> The 728.58 share amount is obtained by netting the average trade size results for days where subsequent returns are less than 0% against those where subsequent returns are less than or equal to -5%.

<sup>18</sup> Note that in this table, and throughout the rest of the paper, both speculative short trade size and dealer short trade size have been winsorized at their 99% values to control for the potential influence of extreme values on estimation results.

#### *IV. Empirical Specifications*

The principal objective of this study is to explore the relationship between stock returns and the size of short trades. We begin by examining how the average size of a day's short trades by dealers and speculators, respectively, is associated with past and contemporaneous returns. We then go on to explore whether and how the size of dealer and speculative short trades is linked to, and can be used to predict, subsequent returns.

##### *A. Past and Contemporaneous Returns, and the Size of Dealer Short Trades*

To explore the association between dealer short trade size and past and contemporaneous returns, we employ the following empirical specification:

$$\text{Dealer\_TS}(0) = \alpha + \beta_1 \text{Price}(0) + \beta_2 \text{Ret}(0) + \beta_3 \text{Ret}(-5,-1) + \beta_4 \text{Spec\_TS}(0) + \beta_5 \text{Spec\_Short\%} + \beta_6 \text{Dealer\_Short\%} + \varepsilon \quad (1)$$

Where, for each stock, *Dealer\_TS(0)* is the average dealer short trade size on day 0; *Price(0)* is the closing stock price on day 0; *Ret(0)* is the total return for day 0; *Ret(-5,-1)* is the total return from day -5 to day -1; *Spec\_TS(0)* is the average speculative short trade size on day 0; *Spec\_Short%* is the percentage of total trades on day 0 that are speculative short trades; and, *Dealer\_Short%* is the percentage of total trades on day 0 that are dealer short trades.

We include *Price(0)* in the specification to control for the negative relationship between dealer short trade size and stock price. The variables *Ret(0)*, and *Ret(-5,-1)*, are included to investigate whether and how dealer short trade size is associated with contemporaneous and past returns. Variables for speculative short trade size (*Spec\_TS(0)*) and the proportion of trades on day 0 that are speculative short trades (*Spec\_Short%*) are included to examine cross linkages between dealer and speculative short selling. Lastly, the proportion of total trades on day 0 that

are dealer short trades (Dealer\_Short%) is included in the specification to control for linkages between overall dealer shorting activity and dealer short trade size.

The results from estimating equation 1 for the sample of firm-days where there is at least one dealer short trade (178,186 firm-days) are presented in Table 6.<sup>19</sup> Robust standard errors (Petersen, 2007) that control for date and firm are listed in parentheses for the estimations presented in columns (i) through (v) of the table. Consistent and corroborating results using the Fama-Mac-Beth Method (over 207 days) are shown in columns (vi) through (x).

The results indicate that past and contemporaneous returns have a significant and positive impact on the size of dealer short trades. For example, as shown in column (v) of the table, the parameter estimates associated with Ret(0) and Ret(-5,-1) are 0.055 and 0.017, respectively, and the parameter estimates for these two variables are significant at 1% in every estimation in the table. Consequently, as predicted by the *Inventory Hypothesis*, positive (negative) past and contemporaneous returns spur on dealers to transact in larger (smaller) short trades. Moreover, consistent with the correlation results presented above, the regression estimates further indicate a significantly negative relationship between short trade size and dealer shorting as a percentage of total trading activity. However, even after for the overall level of short selling, the positive association between dealer trade size and past and contemporaneous returns remains robust. This demonstrates that trade size is an important tool for dealers to provide immediacy. Lastly, the significantly negative Price(0) parameter estimate indicates (as expected given the descriptive statistics presented above) that as stock price increases, dealers typically engage in short trades involving fewer shares.<sup>20</sup>

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<sup>19</sup> Note that for all the estimation results reported in this study, trade size variables are measured in 100's of shares, and Spec\_Short%, Dealer\_Short%, and all returns are measured in percentage terms.

<sup>20</sup> An alternative approach for examining the equation 1 specification is to measure the variables in abnormal terms. Results from this approach – where abnormal values for dealer (speculator) short trade size and short trade

### B. Past and Contemporaneous Returns, and Size of Speculative Short Trades

To examine whether past and contemporaneous returns have an association with the average size of speculative short trades that is similar to the association with the average size of dealer short trades, we employ the following empirical specification:

$$\text{Spec\_TS}(0) = \alpha + \beta_1 \text{Price}(0) + \beta_2 \text{Ret}(0) + \beta_3 \text{Ret}(-5,-1) + \beta_4 \text{Dealer\_TS}(0) + \beta_5 \text{Dealer\_Short\%} + \beta_6 \text{Spec\_Short\%} + \varepsilon \quad (2)$$

Equation 2 is similar to equation 1, except that  $\text{Spec\_TS}(0)$  trade size is employed as the dependent variable, and  $\text{Dealer\_TS}(0)$  and  $\text{Dealer\_Short\%}$  are included as independent variables. Each of the variables in the specification is as defined previously.

Results from estimating equation 2 for the sample of firm-days where there is at least one speculative short trade (160,130 firm-days) are presented in Table 7. Robust standard errors (Petersen, 2007) that control for date and firm are listed in parentheses for the estimations presented in columns (i) through (v) of the table. Consistent and corroborating results using the Fama-Mac-Beth Method (over 207 days) are shown in columns (vi) through (x).

In sharp contrast to the trade size results presented above for dealers, the parameter estimates in the table indicate that past and contemporaneous returns have a significantly *negative* impact on the size of speculative short trades. As shown in column (v), the  $\text{Ret}(0)$  and  $\text{Ret}(-5,-1)$  parameter estimates are -0.075 and -0.048, respectively, and both estimates are significant at 1% in the column (v) estimation and also in the other nine estimations reported in the table. Consequently, dealers and speculators react very differently to the information

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percentage are measured as the difference between the firm's value for the variable on the day minus the median value for the variable for the firm across all days of the sample period, and abnormal return for a firm on a day is measured relative to the NASDAQ Equally Weighted Index -- are similar to (and consistent with) those presented above, and are available from the authors upon request.

contained in past and contemporaneous returns when determining the size of their short trades. Furthermore, the results indicate a significantly negative relationship between speculative shorting as a percentage of total trading activity, and speculative short trade size which indicates that when more speculative short trading occurs, speculators tend to short a smaller number of shares per trade. In addition, and similar to the results presented above, there is a significant association between the size of speculative and dealer short trades.<sup>21</sup> There is also a significantly positive relationship between the proportion of trades in the day that are dealer short trades, and the size of speculative short trades. Consequently, when dealers are engaging in greater (lesser) short trading activity, there is a contemporaneous positive (negative) impact on the size of customer short trades.<sup>22</sup>

### *C. What Does the Size of Short Trades Imply about Future Returns?*

The results presented above demonstrate that past and contemporaneous stock returns have opposite impacts on the size of dealer and speculative short trades. A potentially more important issue for average investors, however, is whether and how the size of short trades by these two separate groups can be utilized to predict subsequent stock returns. If their short trades have differing implications for subsequent returns, requiring exchanges to provide a daily (stock-by-stock) report of the average size of dealer and speculative short trades could provide average

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<sup>21</sup> This result is consistent with the correlations presented in Table 5. Although the size of speculative and dealer short trades are positively correlated with each other, they exhibit opposite correlations with returns.

<sup>22</sup> We also estimate the equation 2 specification after measuring the variables in abnormal terms (where, each abnormal variable is as described in the footnote above). Results from this approach are similar to and consistent with the results presented above and are available from the authors upon request. The results reinforce the conclusion that dealers and speculators are reacting to different information sets when determining the size of their short trades. Dealer short trades tend to increase (decrease) in size when past and contemporaneous returns are more positive (negative) whereas speculators react in an opposite manner.

investors with valuable information, and could result in financial markets that are more orderly, fair and informationally efficient.

To examine the linkage between short trade size and subsequent returns, we apply this specification to our sample:

$$\begin{aligned} \text{Ret}(1,5) = & \alpha + \beta_1 \text{EWRET}(1,5) + \beta_2 \text{Spec\_TS}(0) + \beta_3 \text{Dealer\_TS}(0) + \beta_4 \text{Spec\_Short}\% \\ & + \beta_5 \text{Dealer\_Short}\% + \varepsilon \end{aligned} \quad (3)$$

Where,  $\text{Ret}(1,5)$  is the firm's total stock return from day 1 to day 5;  $\text{EWRET}(1,5)$  is the total return on the NASDAQ Equally Weighted Index from day 1 to day 5;  $\text{Spec\_TS}(0)$  is the average size of the firm's speculative short trades on day 0;  $\text{Dealer\_TS}(0)$  is the average size of the firm's dealer short trades on day 0;  $\text{Spec\_Short}\%$  is the percentage of the firm's total trades on day 0 that are speculative short trades; and  $\text{Dealer\_Short}\%$  is the percentage of the firm's trades on day 0 that are dealer short trades.

The return on the NASDAQ Equally Weighted Index is included in equation 3 to control for the systematic relationship between stock returns and market returns. Speculative short trade size,  $\text{Spec\_TS}(0)$ , is included to examine the link between the average size of speculative short trades and subsequent returns. Dealer short trade size,  $\text{Dealer\_TS}(0)$ , is included to explore how the average size of dealer short trades affects subsequent returns and to examine whether dealer short trade size and speculative short trade size have differing implications for subsequent returns. Lastly,  $\text{Spec\_Short}\%$  and  $\text{Dealer\_Short}\%$  are included in the specification to investigate whether and how the percentage of a day's trades that come from shorts by speculators and dealers affect future returns.

Results from estimating equation 3 using robust standard errors are presented in Table 8. The results in column (i), which pertain to all (final) sample days (the 178,353 firm-days where

stock price is \$10 per share, or above), indicate an expected positive and significant relationship between stock return and the contemporaneous return on the NASDAQ Equally Weighted Index. Most important, the results in the column show that the average size of short trades of speculators versus dealers have distinctly different implications for subsequent returns. Specifically, the parameter estimate associated with speculative trade size is -0.018 whereas the parameter estimate for dealer trade size is positive at 0.049. Both estimates are statistically significant at 1%. Though not reported in the table, a test of the equivalence of the Spec\_TS(0) and Dealer\_TS(0) parameters results in rejection of the null with a t-statistic of 5.75. The significantly negative relationship between the size of speculative short trades and subsequent returns indicates informed trading by speculative short sellers. On the other hand, the significantly positive relationship between the size of dealer short trades and subsequent returns suggests that dealer shorting activity is less likely to be information driven, and more likely driven by liquidity provision (market making). In addition, the estimation results show that although there is no significant link between speculative short trades as a percentage of total trades and subsequent stock returns, there is a significantly positive relationship between dealer short trades as a percentage of total trades and subsequent returns.

Next, we examine a variety of sub-samples to further explore the differing relationship between subsequent return and the size of short trades by speculators versus dealers. We first restrict the sample to days where the percentage of trades that are speculative short is at least 0.847%. That percentage represents the 10<sup>th</sup> percentile Spec\_Short% cutoff for sample days where there is at least one speculative short trade. As show in Table 1, depending upon the stock price range examined, on up to 18.73% of sample day observations there are no speculative short

sales.<sup>23</sup> Thus, utilizing this cutoff guards against finding a spurious relationship between speculative trade size and subsequent returns that is driven by days when there are few, if any, speculative short trades. Its imposition results in a sample size of 144,093 firm-day observations. As shown in column (ii), this restriction does not alter the finding that the average size of speculative and dealer short trades has significantly different implications for subsequent returns.

The estimation results presented in columns (iii) through (vi) of the table further restrict the sample based upon whether the return for the firm on day 0 is positive or negative. For example, to explore the future implications of short trade size when stock price is declining, the results in column (iii) and (vi) pertain to those days where Spec\_Short% is greater than or equal to 0.847%, and the stock's return on day 0 was less than, or equal to -2.5%, and -5.0%, respectively. The results presented in these columns are generally similar (though the estimations result in larger R<sup>2</sup>s) to those presented in column (i), and show that when speculators increase the size of their short trades on days when stock price is declining, subsequent returns are significantly more negative. In contrast, on those same days, as dealers increase the size of their short trades, subsequent returns tend to reverse and be less negative.

Finally, to explore the future implications of short trade size when stock price is increasing, the results in column (iv) and (vi) pertain to those days where Spec\_Short% is greater than or equal to 0.847%, and the stock's return on day 0 was greater than, or equal to +2.5% and +5.0%, respectively. The estimation results in these two columns are quite interesting because they reveal that when speculators increase the size of their short trades on days when stock price is increasing, there is no statistically significant implication for subsequent returns. In contrast,

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<sup>23</sup> For stocks priced between \$10 and \$12.50 per share, there was at least one speculative short trade on only 81.23% of sample days.

on those same days, as dealers increase the size of their short trades subsequent returns are significantly more positive.

A potential concern related to the approach utilized in the specification 3 estimations is the assumption that the relationship between short trade size and subsequent returns is strictly linear. Several empirical studies that examine the size of long buys and sales of long positions, however, indicate that this might not be an appropriate assumption because stealth traders are more likely to use mid-sized trades to disguise their information advantage. In addition, although we have winsorized the short trade size variables at their 99% value, it remains possible that our parameter estimates are unduly influenced by extreme observations. Therefore, to explicitly examine the stealth trading hypothesis and to ensure that any remaining outliers are not driving our results, in Table 9 we present estimation results that incorporate a dummy variable approach to examine the relationship between short trade size and subsequent returns. For this approach, we create dummy variables for speculative short trade size with breakpoints at 200, 350, 500 and 900 shares. For dealer short trade size, the dummy variable breakpoints are 500, 650, 850, and 1,250 shares.<sup>24</sup> Note that for identification, we suppress the middle category dummy variable for both speculative trade size (350 to 500 shares) and dealer trade size (650 to 850 shares) when conducting estimations.

The specification that we examine is:

$$\begin{aligned} \text{RET}(1,5) = & \alpha + \beta_1 \text{EWRET}(1,5) + \beta_4 \text{Spec\_Short\%} + \beta_5 \text{Dealer\_Short\%} + \sum_{i=1}^4 D_i \text{SpecDummy} + \\ & \sum_{j=1}^4 D_j \text{DealerDummy} + \varepsilon \end{aligned} \quad (4)$$

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<sup>24</sup> Each of these breakpoints corresponds approximately with the sample quintile value. The more precise quintile breakpoints for Spec\_TS(0) are 222.4, 350.0, 520.0, and 962.7 shares. For Dealer\_TS(0), the more precise breakpoints are 461.1, 645.2, 874.8, and 1,276.9 shares.

Where *SpecDummy* and *DealerDummy* are dummy variables for speculative and dealer short trade size based upon the breakpoints indicated above, respectively, and all other variables are as defined previously. The results from estimating equation 4 are presented in Table 9.

As shown in the table, and consistent with the findings above, the dummy variable parameter estimates for speculative short trade size decrease monotonically as the trade size category increases. In addition, as shown in columns (iii) and (v), when day 0 returns are more negative and speculative trade size is largest, subsequent returns are their most negative. This result is at odds with the stealth trading hypothesis. Rather, it is more in line with the proposition that speculators move aggressively by utilizing large short trades in advance of the most negative return performance, and suggests that they are able to anticipate that the firm will be subsequently experiencing additional bad (from a valuation perspective) news. Interestingly, as shown in columns (i), (ii), (iv) and (vi), when the average trade size of speculators is below 200 shares, subsequent stock returns are significantly more positive. This latter result suggests the possibility that speculators engage in smaller short trades when profit opportunities are more ephemeral (or, alternatively, that when speculators engage in short small trades, they are essentially uninformed).

The results in the table for dealer short trades are also consistent with the evidence presented above. Irrespective of day 0 returns, when dealers engage in large short trades, subsequent returns are more positive. In addition, as shown in column (vi), when day 0 returns are the most positive and dealer short trade size is largest, subsequent returns tend to be the most positive.

*D. Portfolio Returns From Sorting Stocks on the Basis of Speculative and Dealer Short Trade Size*

The evidence presented above demonstrates that dealers and speculators react to different information sets when determining the typical size of their short trades. The next issue we examine is the portfolio returns obtainable from strategies based upon these findings. More specifically, we calculate equally-weighted returns based on zero net investment strategies of going long stocks following a day where dealer or speculative short trades are large, and short stocks when their trades are small.

Table 10 reports raw returns, abnormal returns, and differences in returns over the five days following speculative short trades of different size groups after first sorting firm-days into quartiles based upon the percentage of a day's trades that are speculative short.<sup>25</sup> For these calculations, the abnormal return for a stock is measured as the difference between the stock's raw return over the five-day period less the return on the NASDAQ Equally Weighted Index over the same five-day period.

As shown in column (vi) of the table, the difference between the five-day return following a day of large versus small speculative short trades is significantly negative, irrespective of the proportion of day 0 trades that are speculative short, and irrespective of whether returns are measure in raw or abnormal terms. For example, on days where speculative short trades are more than 4.98% of total trades, a strategy based upon going long firms that experience average speculative short trades of at least 950 shares, and short firms that experience average speculative short trades of less than 200 shares results in a subsequent five-day raw return of -1.335% (or, 94.077% per year assuming 250 trading days per year – if trading costs are

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<sup>25</sup> The quartile breakpoints are based upon final sample days where there is at least one speculative short trade.

ignored), and an abnormal return of -1.199% (or, 81.473% per year – absent trading costs). Consequently, the recommended strategy based upon speculative short trade size is to go short stocks that experience large short trades and long those with small short trades.

Table 11 reports raw returns and abnormal returns for the five-day period following dealer short trades of different size groups after first sorting firm-days into quartiles based upon the percentage of a day's trades that are dealer short. As shown in column (vi) (and in sharp contrast to the Table 10 results), in every instance, the difference between the five-day return following a day of large versus small dealer short trades is *positive*, and in six of the eight cases, statistically significant at 5% or better. For the other two instances -- when dealer short trades as a percentage of total trades are relatively low (below 11.76% of the stock's trades) – the differences are statistically significant at 10%. For example, on days where dealer short trades are more than 20.71% of total trades, a strategy based upon going long firms that experience average speculative short trades of at least 1250 shares, and short firms that experience average dealer short trades of less than 250 shares results in a subsequent five-day raw return of 0.514% and an abnormal return of 0.943%. Interestingly, the return difference results for dealers are noticeably smaller in magnitude than those found above for speculators.

#### *E. What if Speculative and Dealer Short Trades are Left Combined?*

Our findings have shown clearly that the size of speculative and dealer short trades have contrasting linkages to stock return. In Table 12, however, we explore the empirical implications if our short selling data is not divided into speculative versus dealer trades. Following the methodology presented in the previous two tables, we present raw returns and abnormal returns

in the five days following short trades of different trade size categories.<sup>26</sup> Because dealer short trades are more common than those by speculators, it is not surprisingly that the results in the table are more similar to the dealer short trade findings presented above. As shown in column (vi), in all cases the difference in five-day returns for the largest versus smallest trade size categories is positive, and the difference is significantly positive in four of the eight sorts. What these results suggest is that empirical studies that utilize comingled (dealer and speculative) short data are likely to uncover findings that substantially reflect the shorting active of dealers rather than speculators.

## **V. Conclusion**

Dealers and speculators are likely to often have differing motivations for shorting stocks. In this study, we investigate the linkage between stock returns – past, contemporaneous and future – and the average daily size of dealer and speculative short trades. Consistent with the Inventory Hypothesis, we find that past and contemporaneous returns have a significant and positive impact of the size of dealer short trades. Consequently, as stock price increases, dealers tend to engage in larger short trades. In sharp contrast, however, speculators tend to decrease the size of their short trades when stock price is increasing, and increase their trade size as stock price declines. Therefore, these initial findings confirm that short selling by dealers and speculators is not a homogenous activity.

Our evidence on the predictive implications of dealer and speculative short trade size also indicate that these two categories of market participants react to different information sets when

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<sup>26</sup> The Total\_Short% quartile breakpoints are based upon final sample days where there is at least one non-exempt short trade. The TotalTS(0) breakpoints correspond approximately with the sample quintile value. The more precise quintile breakpoints are 454.37, 628.97, 844.16 and 1217.82 shares.

determining the size of their short trades. Irrespective of the daily percentage of short trading activity in a stock, when the average size of dealer short trades is large, the stock's subsequent returns are typically not as negative as when dealer short trades are small. A portfolio that consists of going *long* the stocks where average dealer short trade size is largest, and *short* the stocks where it is smallest, generates five-day returns that range from 0.31% to 0.94% depending upon whether dealer shorting represents a high or low percentage of the stock's overall daily trading activity (and whether stock returns are measured on a raw, or market-adjusted basis).

The predictive implication of speculative short selling is, however, quite different, and is consistent with the Informed Speculative Trading Hypothesis -- though not the Stealth Trading Hypothesis. For speculators, days of large short trades are followed by returns that are significantly more negative than days when their trades are small. A portfolio formed by going *short* the stocks where speculative short trade size is largest and *long* the stocks where it is smallest generates five-day returns ranging from 0.40% to 1.34% depending upon whether speculative short selling is a high or low percentage of the stock's daily trading activity (and whether stock returns are measured on a raw, or market-adjusted basis).

Our results have important policy implications – particularly our finding of a differing linkage between subsequent returns and the size of speculative versus dealer short trades. Requiring financial markets to provide a stock-by-stock daily report that discloses short selling by investor category (speculator versus dealer) could provide average investors with value-relevant information and could lead to financial markets that are more fair and efficient if average investors can react quickly to that new information. An intertwined issue concerns the level of disclosure detail that might best balance the potential value of increased disclosure of short selling data against the costs borne by financial markets and financial market participants to

provide the data.<sup>27</sup> One approach adopted recently by some European exchanges is a requirement that individuals disclose their short positions in a company whenever those positions exceed a threshold percentage of outstanding shares.<sup>28</sup> An individual-by-individual disclosure requirement, however, might be viewed as overly intrusive and burdensome for U.S. financial market participants. Our results show that simply requiring exchanges to report each stock's average short trade size – separately, each day, for speculators and dealers – could provide information that is value-relevant and therefore useful for average investors.

Our results also have implications for academic research that focuses on short selling of NASDAQ stocks. Because we find that dealer short selling is substantially more common than speculative short selling, unless researchers control effectively for investor category when conducting empirical studies, their results will likely be predominantly impacted by, and reflect, the short selling actions of dealers.

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<sup>27</sup> These costs include the direct cost to an exchange from requiring more frequent, disaggregated disclosure, and the cost of potential loss of information advantage for individual short sellers.

<sup>28</sup> For details on recent disclosure requirements in European financial markets, see Jones, Reed and Waller (2012),

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Table 1  
Short Trades and Stock Price

The number and percentage of trading day observations where there is at least one speculative (dealer) short trade, by stock price ranges. Stock price is the ending stock price of the day where the lower price in the range holds with a strong inequality. Total number of trading day observations represents the total number of trading day observations, out of a total sample of 272,412 trading day observations, where the ending stock price is in the indicated range. Speculative (%) represents the percentage of days within each stock price range where there is at least one speculative short trade. Dealer (%) represents the percentage of days within each stock price range where there is at least one dealer short trade. Trading volume represents the mean and median amount of daily shares traded for stocks within each price range.

| Stock Price       | Total Number of Trading Day Observations | Number of Trading Day Observations with at least one Speculative Short Trade | Speculative (%) | Number of Trading Day Observations with at least one Dealer Short Trade | Dealer (%) | Trading Volume |         |
|-------------------|--|--|-----------------|---|------------|----------------|---------|
|                   |  |  |                 |   |            | Mean           | Median  |
| \$0.00 - \$2.50   | 22,257                                   | 9,527  | 42.80%          | 22,181  | 99.66%     | 431,866        | 189,132 |
| \$2.50 - \$5.00   | 27,088                                   | 15,009   | 55.41%          | 27,013  | 99.72%     | 465,069        | 177,134 |
| \$5.00 - \$7.50   | 23,813                                   | 16,420   | 68.95%          | 23,758  | 99.77%     | 636,069        | 178,904 |
| \$7.50 - \$10.00  | 21,664                                   | 16,574   | 76.50%          | 21,625  | 99.82%     | 646,912        | 184,385 |
| \$10.00 - \$12.50 | 18,445                                   | 14,982   | 81.23%          | 18,411  | 99.82%     | 747,440        | 190,414 |
| \$12.50 - \$15.00 | 18,079                                   | 15,140   | 83.74%          | 18,046  | 99.82%     | 962,975        | 197,318 |
| \$15.00 - \$17.50 | 16,736                                   | 14,231   | 85.03%          | 16,717  | 99.89%     | 1,339,384      | 204,307 |
| \$17.50 - \$20.00 | 15,385                                   | 13,355   | 86.81%          | 15,361  | 99.84%     | 1,426,234      | 210,433 |
| \$20.00 - \$22.50 | 12,780                                   | 11,280   | 88.26%          | 12,764  | 99.87%     | 1,264,868      | 237,448 |
| \$22.50 - \$25.00 | 13,053                                   | 11,815   | 90.52%          | 13,046  | 99.95%     | 1,278,868      | 245,652 |
| \$25.00 - \$27.50 | 11,986                                   | 10,851   | 90.53%          | 11,979  | 99.94%     | 1,392,472      | 244,871 |
| \$27.50 - \$30.00 | 9,977                                    | 9,214  | 92.35%          | 9,966   | 99.89%     | 1,558,028      | 278,058 |
| \$30.00 - \$32.50 | 7,802                                    | 7,336  | 94.03%          | 7,798   | 99.95%     | 1,777,010      | 313,446 |
| \$32.50 - \$35.00 | 7,238                                    | 6,755  | 93.33%          | 7,234   | 99.94%     | 1,569,492      | 311,644 |
| \$35.00 - \$37.50 | 6,252                                    | 5,844  | 93.47%          | 6,251   | 99.98%     | 1,703,559      | 333,558 |
| \$37.50 - \$40.00 | 5,607                                    | 5,287  | 94.29%          | 5,607   | 100.00%    | 1,709,598      | 367,673 |
| \$40.00 - \$42.50 | 4,281                                    | 4,106  | 95.91%          | 4,281   | 100.00%    | 2,090,989      | 401,660 |
| \$42.50 - \$45.00 | 3,942                                    | 3,776  | 95.79%          | 3,940   | 99.95%     | 2,139,798      | 456,308 |
| \$45.00 - \$47.50 | 3,268                                    | 3,167  | 96.91%          | 3,267   | 99.97%     | 1,945,433      | 500,044 |
| \$47.50 - \$50.00 | 2,999                                    | 2,891  | 96.40%          | 2,999   | 100.00%    | 2,478,928      | 535,020 |
| \$50.00 - Total   | <u>19,760</u><br>272,412                 | 19,525   | 98.81%          | 19,759  | 99.99%     | 3,640,385      | 948,070 |

Table 2  
Percentage of Trades that are Short

Stock price is the ending stock price of the day where the lower price in the range holds with a strong inequality. Number of day observations is the number of day observations, out of a total of 272,412, where there is at least one speculative (dealer) short trade, by stock price ranges. Mean (median) represents the mean (median) percentage of trades that are speculative (dealer) short trades on those days where there is at least one speculative (dealer) short trade, by stock price ranges.

| Stock Price       | <u>Speculative Short Trades as a Percentage of Total Trades</u> |      |        | <u>Dealer Short Trades as a Percentage of Total Trades</u> |       |        |
|-------------------|---|------|--------|--|-------|--------|
|                   | Number of Day Observations                                      | Mean | Median | Number of Day Observations                                 | Mean  | Median |
| \$0.00 - \$2.50   | 9,527   | 1.84 | 0.85   | 22,181   | 18.86 | 17.73  |
| \$2.50 - \$5.00   | 15,009  | 2.39 | 0.98   | 27,013   | 18.44 | 17.29  |
| \$5.00 - \$7.50   | 16,420  | 2.38 | 1.35   | 23,758   | 18.84 | 17.69  |
| \$7.50 - \$10.00  | 16,574  | 2.88 | 1.89   | 21,625   | 18.24 | 17.05  |
| \$10.00 - \$12.50 | 14,982  | 3.12 | 2.02   | 18,411   | 18.00 | 16.74  |
| \$12.50 - \$15.00 | 15,140  | 3.27 | 2.22   | 18,046   | 17.85 | 16.67  |
| \$15.00 - \$17.50 | 14,231  | 3.36 | 2.39   | 16,717   | 17.82 | 16.67  |
| \$17.50 - \$20.00 | 13,355  | 3.58 | 2.57   | 15,361   | 17.59 | 16.32  |
| \$20.00 - \$22.50 | 11,280  | 3.77 | 2.75   | 12,764   | 17.39 | 16.16  |
| \$22.50 - \$25.00 | 11,815  | 3.97 | 3.09   | 13,046   | 17.49 | 16.36  |
| \$25.00 - \$27.50 | 10,851  | 4.02 | 3.11   | 11,979   | 17.52 | 16.28  |
| \$27.50 - \$30.00 | 9,214   | 4.17 | 3.26   | 9,966  | 17.24 | 16.09  |
| \$30.00 - \$32.50 | 7,336   | 4.12 | 3.29   | 7,798  | 16.64 | 15.55  |
| \$32.50 - \$35.00 | 6,755   | 4.07 | 3.35   | 7,234  | 16.50 | 15.51  |
| \$35.00 - \$37.50 | 5,844   | 4.10 | 3.37   | 6,251  | 16.36 | 15.28  |
| \$37.50 - \$40.00 | 5,287   | 4.06 | 3.37   | 5,607  | 16.29 | 15.12  |
| \$40.00 - \$42.50 | 4,106   | 4.04 | 3.40   | 4,281  | 15.95 | 14.84  |
| \$42.50 - \$45.00 | 3,776   | 4.18 | 3.58   | 3,940  | 15.58 | 14.55  |
| \$45.00 - \$47.50 | 3,167   | 4.04 | 3.51   | 3,267  | 15.74 | 14.78  |
| \$47.50 - \$50.00 | 2,891   | 4.15 | 3.66   | 2,999  | 15.55 | 14.46  |
| \$50.00 -         | <u>19,525</u>   | 4.31 | 3.93   | <u>19,759</u>  | 14.06 | 13.05  |
| Total             | 217,085   |      |        | 272,003  |       |        |

Table 3  
Size of Short Trades

Stock price is the ending stock price of the day where the lower price in the range holds with a strong inequality. Number of day observations is the number of day observations, out of a total of 272,412, where there is at least one speculative (dealer) short trade, by stock price ranges. Mean (median) represents the mean (median) size of short trades by speculators (dealers) on those days where there is at least one speculative (dealer) short trade, by stock price ranges.

| Stock Price |         | Number of<br>Day<br>Observations | Speculative<br>mean | Speculative<br>median | Number of Day<br>Observations | Dealer<br>mean | Dealer<br>median |
|-------------|---------|----------------------------------|---------------------|-----------------------|-------------------------------|----------------|------------------|
| \$0.00 -    | \$2.50  | 9,526                            | 1,335.01            | 466.67                | 22,180                        | 1,436.28       | 1,130.67         |
| \$2.50 -    | \$5.00  | 15,009                           | 1,214.01            | 445.00                | 27,013                        | 1,210.02       | 891.67           |
| \$5.00 -    | \$7.50  | 16,420                           | 1,026.81            | 500.00                | 23,758                        | 1,113.19       | 827.22           |
| \$7.50 -    | \$10.00 | 16,574                           | 984.81              | 467.78                | 21,625                        | 1,126.09       | 809.20           |
| \$10.00 -   | \$12.50 | 14,982                           | 937.50              | 439.00                | 18,411                        | 1,071.52       | 787.24           |
| \$12.50 -   | \$15.00 | 15,140                           | 968.19              | 450.00                | 18,046                        | 1,078.36       | 792.30           |
| \$15.00 -   | \$17.50 | 14,231                           | 938.40              | 442.11                | 16,717                        | 1,032.53       | 784.42           |
| \$17.50 -   | \$20.00 | 13,355                           | 938.74              | 425.00                | 15,361                        | 1,033.53       | 775.62           |
| \$20.00 -   | \$22.50 | 11,280                           | 861.64              | 423.08                | 12,764                        | 1,051.18       | 773.42           |
| \$22.50 -   | \$25.00 | 11,815                           | 644.44              | 411.11                | 13,046                        | 982.23         | 763.69           |
| \$25.00 -   | \$27.50 | 10,851                           | 900.46              | 409.09                | 11,979                        | 934.56         | 750.71           |
| \$27.50 -   | \$30.00 | 9,214                            | 868.52              | 425.81                | 9,966                         | 1,022.97       | 787.35           |
| \$30.00 -   | \$32.50 | 7,336                            | 862.91              | 417.79                | 7,798                         | 983.62         | 759.40           |
| \$32.50 -   | \$35.00 | 6,755                            | 835.99              | 440.54                | 7,234                         | 942.63         | 764.40           |
| \$35.00 -   | \$37.50 | 5,844                            | 847.71              | 430.83                | 6,251                         | 878.47         | 722.57           |
| \$37.50 -   | \$40.00 | 5,287                            | 794.83              | 435.90                | 5,607                         | 877.18         | 715.53           |
| \$40.00 -   | \$42.50 | 4,106                            | 777.80              | 419.55                | 4,281                         | 881.75         | 729.89           |
| \$42.50 -   | \$45.00 | 3,776                            | 802.65              | 440.42                | 3,940                         | 860.73         | 718.28           |
| \$45.00 -   | \$47.50 | 3,167                            | 745.10              | 423.10                | 3,267                         | 874.24         | 723.97           |
| \$47.50 -   | \$50.00 | 2,891                            | 740.43              | 435.32                | 2,999                         | 850.56         | 711.64           |
| \$50.00 -   |         | 19,525                           | 624.65              | 397.56                | 19,759                        | 762.25         | 650.51           |

Table 4  
Trade Size Distribution

N is the number of day observations, where there is at least one speculative (dealer) short trade. The 75<sup>th</sup> percentile, mean, median, and 25<sup>th</sup> percentile represents the indicated statistic for speculative (dealer) average short trade size within a day. The sample is restricted to stocks with a daily closing price greater than or equal to \$10 per share (178,353 firm days). RET(-5,-1), RET(0), and RET(1,5) is the return for the stock on the five days preceding, contemporaneous to, and five days after Day 0.

| <i>Panel A</i>              |  |   |
|-----------------------------|--|---|
|                             | Average Short Trade Size per day:<br>Speculative<br>(# shares) | Average Short Trade Size per day:<br>Dealer<br>(# shares) |
| N                           | 160,131  | 178,186   |
| 75 <sup>th</sup> percentile | 790.91   | 1142.90   |
| Mean                        | 853.66   | 972.86  |
| Median                      | 425.00   | 749.33  |
| 25 <sup>th</sup> percentile | 255.00   | 506.00  |

| <i>Panel B</i>   |   |        |        |        |        |  |                  |        |        |                  |
|------------------|---|--------|--------|--------|--------|--|------------------|--------|--------|------------------|
|                  | Average Speculative Short Trade Size on<br>Day 0 (# shares) |        |        |        |        | Average Dealer Short Trade Size on<br>Day 0 (# shares) |                  |        |        |                  |
|                  | N   | 25th   | Median | mean   | 75th   | N  | 25 <sup>th</sup> | median | mean   | 75 <sup>th</sup> |
| Ret(-5,-1) ≤ -5% | 51,622  | 285.44 | 475.00 | 887.44 | 920.90 | 56,753   | 517.76           | 749.48 | 933.04 | 1,123.98         |
| Ret(-5,-1) < 0%  | 82,112  | 263.30 | 448.16 | 844.27 | 864.17 | 92,228   | 503.33           | 739.12 | 932.48 | 1,127.77         |
| Ret(-5,-1) > 0%  | 78,019  | 250.00 | 401.15 | 714.23 | 722.22 | 85,958   | 508.96           | 759.38 | 951.18 | 1,160.35         |
| Ret(-5,-1) ≥ 5%  | 47,766  | 263.63 | 415.38 | 716.62 | 731.30 | 51,322   | 524.56           | 771.71 | 955.33 | 1,168.89         |
| Ret(0) ≤ -5%     | 26,110  | 300.43 | 500.00 | 881.60 | 959.65 | 27,745   | 506.11           | 720.27 | 889.09 | 1,068.12         |
| Ret(0) < 0%      | 81,806  | 261.33 | 436.69 | 810.64 | 833.88 | 90,644   | 497.26           | 734.62 | 933.41 | 1,129.32         |
| Ret(0) > 0%      | 74,858  | 250.00 | 413.33 | 747.06 | 745.18 | 83,097   | 517.26           | 762.75 | 942.72 | 1,148.98         |
| Ret(0) ≥ 5%      | 25,059  | 292.14 | 458.00 | 763.58 | 783.33 | 26,642   | 550.00           | 791.22 | 945.92 | 1,153.22         |
| Ret(1,5) ≤ -5%   | 55,640  | 278.26 | 453.69 | 822.06 | 850.00 | 60,740   | 516.16           | 749.18 | 936.26 | 1,124.14         |
| Ret(1,5) < 0%    | 86,863  | 261.45 | 433.33 | 788.46 | 805.06 | 96,177   | 507.45           | 746.70 | 938.53 | 1,134.18         |
| Ret(1,5) > 0%    | 73,268  | 250.00 | 415.11 | 771.97 | 768.57 | 82,009   | 504.17           | 752.06 | 944.98 | 1,153.70         |
| Ret(1,5) ≥ 5%    | 43,377  | 260.29 | 431.58 | 795.12 | 800.00 | 47,846   | 513.67           | 758.41 | 945.40 | 1,152.50         |

Table 5  
Correlations Between Key Variables

Speculative Trade Size represents the average size of a day's speculative short trades. Dealer Trade Size represents the average size of a day's dealer short trades. Speculative Trades % represents the percentage of a day's total trades that are speculative short trades. Dealer Trades % represents the percentage of a day's total trades that are dealer short trades. Ret(0) is the stock's return on day 0. Return(1,5) is the stock's five-day cumulative return over days 1 to 5. Return(-5,-1) is the stock's five-day cumulative return over days -5 to -1. Sample size consists of 178,353 firm-days. The sample is restricted on each day to firms with closing stock price of \$10 and above. Speculative Trade Size and Dealer Trade Size have both been winsorized at their 99% values.

|                        | Speculative Trade Size | Dealer Trade Size   | Speculative Trades % | Dealer Trades %      | Ret(0)               | Ret(1,5)             | Ret(-5,-1)           |
|------------------------|------------------------|---------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| Speculative Trade Size | 1.00                   | 0.154***<br>(0.000) | 0.027***<br>(0.000)  | 0.038***<br>(.000)   | -0.029***<br>(0.000) | -0.011***<br>(0.000) | -0.049***<br>(0.000) |
| Dealer Trade Size      |                        | 1.000               | 0.004<br>(0.108)     | -0.169***<br>(0.000) | 0.023***<br>(0.000)  | 0.010***<br>(0.003)  | 0.009***<br>(0.000)  |
| Speculative Trades %   |                        |                     | 1.000                | -0.115***<br>(0.000) | -0.023***<br>(0.000) | 0.009***<br>(0.000)  | 0.062***<br>(0.000)  |
| Dealer Trades %        |                        |                     |                      | 1.000                | 0.086***<br>(0.000)  | 0.029***<br>(0.000)  | 0.039***<br>(0.000)  |
| Ret(0)                 |                        |                     |                      |                      | 1.000                | -0.019***<br>(0.000) | -0.025***<br>(0.000) |
| Ret(1,5)               |                        |                     |                      |                      |                      | 1.000                | -0.058***<br>(0.000) |
| Ret(-5,-1)             |                        |                     |                      |                      |                      |                      | 1.000                |

\*\*\* significant at 1%, \*\* significant at 5%, \* significant at 10%

Table 6  
Estimation Results

$$\text{Dealer\_TS}(0) = \alpha + \beta_1 \text{Price}(0) + \beta_2 \text{Ret}(0) + \beta_3 \text{Ret}(-5,-1) + \beta_4 \text{Spec\_TS}(0) + \beta_5 \text{Spec\_Short\%} + \beta_6 \text{Dealer\_Short\%} + \varepsilon \quad (1)$$

Where, for each firm, Dealer\_TS(0) is the average dealer short trade size on day 0; Price(0) is the closing stock price on day 0; Ret(0) is the total stock return on day 0; Ret(-5,-1) is the total stock return from day -5 to day -1; Spec\_TS(0) is the average speculative short trade size on day 0; Spec\_Short% is the percentage of total trades on day 0 that are speculative short trades; and, Dealer\_Short% is the percentage of total trades on day 0 that are dealer short trades. Robust (date and firm) standard errors in parentheses. Dealer\_TS(0) and Spec\_TS(0) are both winsorized at their 99% value. The sample is restricted on each day to firms with closing stock price of \$10 and above. Spec\_Short%, Dealer\_Short%, and all returns are stated in percentage terms. All trade size variables are stated in terms of 100's of shares. Columns (i)-(v) present estimation results using 178,186 observations and robust standard errors (date and firm). Columns (vi) – (x) present estimation results using the Fama-MacBeth Method over 207 days and the average R<sup>2</sup> from those estimations.

|                | (i)                  | (ii)                 | (iii)                | (iv)                 | (v)                  | (vi)                 | (vii)                | (viii)               | (ix)                 | (x)                  |
|----------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| Intercept      | 14.125***<br>(0.226) | 14.073***<br>(0.222) | 14.158***<br>(0.227) | 14.147***<br>(0.233) | 13.518***<br>(0.220) | 14.383***<br>(0.130) | 14.290***<br>(0.124) | 14.535***<br>(0.135) | 14.446***<br>(0.132) | 13.853***<br>(0.129) |
| Price(0)       | -0.054***<br>(0.003) | -0.054***<br>(0.003) | -0.054***<br>(0.003) | -0.054***<br>(0.003) | -0.053***<br>(0.003) | -0.062***<br>(0.001) | -0.062***<br>(0.001) | -0.062***<br>(0.001) | -0.063***<br>(0.002) | -0.061***<br>(0.001) |
| Ret(0)         | 0.049***<br>(0.007)  |                      | 0.049***<br>(0.007)  | 0.049***<br>(0.007)  | 0.055***<br>(0.007)  | 0.087***<br>(0.007)  |                      | 0.088***<br>(0.006)  | 0.087***<br>(0.006)  | 0.096***<br>(0.006)  |
| Ret(-5,-1)     |                      | 0.012***<br>(0.003)  | 0.013***<br>(0.003)  | 0.013***<br>(0.003)  | 0.017***<br>(0.003)  |                      | 0.020***<br>(0.002)  | 0.019***<br>(0.002)  | 0.019***<br>(0.002)  | 0.024***<br>(0.002)  |
| Spec_TS(0)     |                      |                      |                      |                      | 0.103***<br>(0.005)  |                      |                      |                      |                      | 0.101***<br>(0.002)  |
| Spec_Short%    |                      |                      |                      | 0.003<br>(0.014)     | -0.009<br>(0.013)    |                      |                      |                      | 0.039***<br>(0.008)  | 0.023***<br>(0.008)  |
| Dealer_Short%  | -0.185***<br>(0.006) | -0.183***<br>(0.006) | -0.186***<br>(0.006) | -0.186***<br>(0.006) | -0.192***<br>(0.006) | -0.182***<br>(0.003) | -0.179***<br>(0.003) | -0.184***<br>(0.003) | -0.184***<br>(0.003) | -0.191***<br>(0.004) |
| R <sup>2</sup> | .056                 | .055                 | .057                 | .057                 | .082                 | .061                 | .056                 | .063                 | .065                 | .090                 |

\*\*\* significant at 1%; \*\* significant at 5%; significant at 10%

Table 7  
 Estimation Results with Robust Standard Errors

$$\text{Spec\_TS}(0) = \alpha + \beta_1 \text{Price}(0) + \beta_2 \text{Ret}(0) + \beta_3 \text{Ret}(-5,-1) + \beta_4 \text{Dealer\_TS}(0) + \beta_5 \text{Dealer\_Short}\% + \beta_6 \text{Spec\_Short}\% + \varepsilon \quad (2)$$

Where, for each firm, Spec\_TS(0) is the average speculative short trade size on day 0; Price(0) is the closing stock price on day 0; Ret(0) is the total stock return on day 0; Ret(-5,-1) is the total stock return from day -5 to day -1; Dealer\_TS(0) is the average dealer short trade size on day 0; Dealer\_Short% is the percentage of total trades on day 0 that are dealer short trades; and, Spec\_Short% is the percentage of total trades on day 0 that are customer short trades. Robust (date and firm) standard errors in parentheses. Dealer\_TS(0) and Spec\_TS(0) are both winsorized at the 99% value. The sample is restricted on each day to firms with closing stock price of \$10 and above. Spec\_Short%, Dealer\_Short%, and all returns are stated in percentage terms. All trade size variables are stated in terms of 100's of shares. Columns (i)-(v) present estimation results using 160,131 observations and robust standard errors (date and firm). Columns (vi) – (x) present estimation results using the Fama-MacBeth Method over 207 days and the average R<sup>2</sup> from those estimations.

|                | (i)                  | (ii)                 | (iii)                | (iv)                 | (v)                  | (vi)                 | (vii)                | (viii)               | (ix)                 | (x)                  |
|----------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| Intercept      | 9.530***<br>(0.212)  | 9.473***<br>(0.210)  | 9.469***<br>(0.210)  | 7.816***<br>(0.245)  | 3.551***<br>(0.258)  | 9.674***<br>(0.093)  | 9.581***<br>(0.091)  | 9.556***<br>(0.091)  | 7.646***<br>(0.124)  | 3.336***<br>(0.133)  |
| Price(0)       | -0.036***<br>(0.004) | -0.035***<br>(0.004) | -0.035***<br>(0.004) | -0.030***<br>(0.004) | -0.014***<br>(0.003) | -0.047***<br>(0.001) | -0.047***<br>(0.001) | -0.045***<br>(0.001) | -0.039***<br>(0.001) | -0.020***<br>(0.001) |
| Ret(0)         | -0.051***<br>(0.008) |                      | -0.053***<br>(0.008) | -0.061***<br>(0.008) | -0.075***<br>(0.008) | -0.075***<br>(0.006) |                      | -0.079***<br>(0.006) | -0.085***<br>(0.006) | -0.108***<br>(0.006) |
| Ret(-5,-1)     |                      | -0.041***<br>(0.004) | -0.041***<br>(0.004) | -0.044***<br>(0.004) | -0.048***<br>(0.004) |                      | -0.045***<br>(0.003) | -0.048***<br>(0.003) | -0.050***<br>(0.003) | -0.056***<br>(0.003) |
| Dealer_TS(0)   |                      |                      |                      |                      | 0.296***<br>(0.014)  |                      |                      |                      |                      | 0.291***<br>(0.006)  |
| Dealer_Short%  |                      |                      |                      | 0.087***<br>(0.009)  | 0.144***<br>(0.010)  |                      |                      |                      | 0.098***<br>(0.005)  | 0.154***<br>(0.006)  |
| Spec_Short%    | -0.166***<br>(0.017) | -0.154***<br>(0.017) | -0.157***<br>(0.017) | -0.140***<br>(0.017) | -0.135***<br>(0.015) | -0.121***<br>(0.009) | -0.110***<br>(0.009) | -0.109***<br>(0.009) | -0.091***<br>(0.009) | -0.095***<br>(0.008) |
| R <sup>2</sup> | .009                 | .011                 | .012                 | .015                 | .045                 | .010                 | .011                 | .013                 | .017                 | .047                 |

\*\*\* significant at 1%; \*\* significant at 5%; significant at 10%

Table 8  
 Estimation Results with Robust Standard Errors

$$\text{Ret}(1,5) = \alpha + \beta_1 \text{EWRET}(1,5) + \beta_2 \text{Spec\_TS}(0) + \beta_3 \text{Dealer\_TS}(0) + \beta_4 \text{Spec\_Short}\% + \beta_5 \text{Dealer\_Short}\% + \varepsilon \quad (3)$$

Where, Ret(1,5) is the firm's total stock return from day 1 to day 5; EWRET(1,5) is the total return on the NASDAQ Equally Weighted Index from day 1 to day 5; Spec\_TS(0) is the average size of the firm's speculative short trades on day 0; Dealer\_TS(0) is the average size of the firm's dealer short trades on day 0; Spec\_Short% is the percentage of the firm's total trades on day 0 that are speculative short trades; and, Dealer\_Short% is the percentage of the firm's trades on day 0 that are dealer short trades. Robust (date and firm) standard errors in parentheses. Spec\_TS(0) and Dealer\_TS(0) are both winsorized at their 99% value. The sample is restricted on each day to firms with closing stock price of \$10 and above. Spec\_Short%, Dealer\_Short%, and all returns are stated in percentage terms. All trade size variables are stated in terms of 100's of shares.

|                | (i)<br>All Days      | (ii)<br>Days where<br>Spec_Short% ≥ .847% | (iii)<br>Days where<br>Spec_Short% ≥ .847%<br>and Ret(0) ≤ -2.5% | (iv)<br>Days where<br>Spec_Short% ≥ .847%<br>and Ret(0) ≥ 2.5% | (v)<br>Days where<br>Spec_Short% ≥ .847%<br>and Ret(0) ≤ -5% | (vi)<br>Days where<br>Spec_Short% ≥ .847%<br>and Ret(0) ≥ 5% |
|----------------|----------------------|---|--|--|--|--|
| N              | 178,353              | 144,093                                   | 43,404   | 38,795   | 23,468   | 22,320   |
| Intercept      | -1.602***<br>(0.452) | -2.071***<br>(0.544)                      | -0.686<br>(0.754)  | -4.384***<br>(0.918)   | -0.259<br>(0.982)  | -4.789***<br>(1.213)   |
| EWRET(1,5)     | 1.163***<br>(0.071)  | 1.190***<br>(0.075)                       | 1.503***<br>(0.092)  | 1.185***<br>(0.112)  | 1.640***<br>(0.120)  | 1.293***<br>(0.142)  |
| Spec_TS(0)     | -0.018***<br>(0.006) | -0.012**<br>(0.006)                       | -0.018**<br>(0.009)  | -0.011<br>(0.010)  | -0.028***<br>(0.010)   | -0.013<br>(0.013)  |
| Dealer_TS(0)   | 0.049***<br>(0.010)  | 0.049***<br>(0.013)                       | 0.040**<br>(0.020)   | 0.092***<br>(0.025)  | 0.054*<br>(0.028)  | 0.103***<br>(0.035)  |
| Spec_Short%    | -0.020<br>(0.021)    | 0.033<br>(0.023)                          | -0.046<br>(0.034)  | 0.059<br>(0.039)   | -0.090*<br>(0.052)   | 0.004<br>(0.051)   |
| Dealer_Short%  | 0.032**<br>(0.013)   | 0.036**<br>(0.015)                        | 0.024<br>(0.021)   | 0.068***<br>(0.025)  | 0.022<br>(0.027)   | 0.072**<br>(0.035)   |
| R <sup>2</sup> | .180                 | .185                                      | .228   | .177   | .240   | .184   |

\*\*\* significant at 1%; \*\* significant at 5%; \* significant at 10%

Table 9  
Estimation Results with Robust Standard Errors

$$RET(1,5) = \alpha + \beta_1 EWRET(1,5) + \beta_4 Spec\_Short\% + \beta_5 Dealer\_Short\% + \sum_{i=1}^4 D_i SpecDummy + \sum_{j=1}^4 D_j DealerDummy + \varepsilon \quad (4)$$

Where, Ret(1,5) is the firm's total stock return from day 1 to day 5; EWRET(1,5) is the total return on the NASDAQ Equally Weighted Index from day 1 to day 5; Spec\_Short% is the percentage of the firm's total trades on day 0 that are speculative short trades; and, Dealer\_Short% is the percentage of the firm's trades on day 0 that are dealer short trades. SpecDummy is a binary variable equal to 1 if the average speculative short trade size for the day is in the indicated range, and 0 otherwise; DealerDummy is a binary variable equal to 1 if the average dealer short trade size for the day is in the indicated range, and 0 otherwise. Robust (date and firm) standard errors in parentheses. The sample is restricted on each day to firms with closing stock price of \$10 and above. Spec\_Short%, Dealer\_Short%, and all returns are stated in percentage terms. The restriction Spec\_Short% $\geq$ .847% is based upon the 10<sup>th</sup> percentile cutoff for Spec\_Short for firm sample days where there is at least one speculative short trade.

|   | (i)<br>All Days      | (ii)<br>Days where<br>Spec_Short% $\geq$ .847% | (iii)<br>Days where<br>Spec_Short% $\geq$ .847%<br>and Ret(0) $\leq$ -2.5% | (iv)<br>Days where<br>Spec_Short% $\geq$ .847%<br>and Ret(0) $\geq$ 2.5% | (v)<br>Days where<br>Spec_Short% $\geq$ .847%<br>and Ret(0) $\leq$ -5% | (vi)<br>Days where<br>Spec_Short% $\geq$ .847%<br>and Ret(0) $\geq$ 5% |
|---|----------------------|--|--|--|--|--|
| N   | 178,353              | 144,093  | 43,404   | 38,795   | 23,468   | 22,320   |
| Intercept   | -1.592***<br>(0.499) | -1.827***<br>(0.556)                           | -0.349<br>(0.777)  | -3.827***<br>(0.877)   | 0.267***<br>(0.980)  | -4.170***<br>(1.137)   |
| EWRET(i,t)  | 1.163***<br>(0.071)  | 1.190***<br>(0.075)                            | 1.502***<br>(0.091)  | 1.184***<br>(0.113)  | 1.639***<br>(0.120)  | 1.292***<br>(0.142)  |
| Spec_Short%   | 0.008<br>(0.022)     | 0.034<br>(0.023)                               | -0.043<br>(0.034)  | 0.058<br>(0.040)   | -0.083<br>(0.052)  | 0.006<br>(0.051)   |
| Dealer_Short%                                       | 0.027**<br>(0.012)   | 0.033**<br>(0.015)                             | 0.027<br>(0.021)   | 0.063***<br>(0.024)  | 0.027<br>(0.027)   | 0.069**<br>(0.034)   |
| <i>Dummy Variables for average short trade size</i> |                      |  |  |  |  |  |
| 950 $\leq$ SpecTS(0)                                | -0.304*<br>(0.171)   | -0.336*<br>(0.176)                             | -0.778***<br>(0.243)   | -0.321<br>(0.304)  | -1.263***<br>(0.329)   | -0.237<br>(0.376)  |
| 500 $\leq$ SpecTS(0)<950                            | -0.088<br>(0.125)    | -0.113<br>(0.131)                              | -0.527**<br>(0.240)  | 0.019<br>(0.244)   | -0.914***<br>(0.328)   | 0.124<br>(0.315)   |
| 200 $\leq$ SpecTS(0)<350                            | 0.162<br>(0.129)     | 0.128<br>(0.136)                               | -0.029<br>(0.246)  | 0.181<br>(0.239)   | -0.255<br>(0.328)  | 0.170<br>(0.353)   |
| SpecTS(0)<200                                       | 0.983***<br>(0.226)  | 0.724***<br>(0.226)                            | 0.159<br>(0.388)   | 0.993***<br>(0.363)  | 0.045<br>(0.509)   | 0.880*<br>(0.473)  |
| 1250 $\leq$ DealerTS(0)                             | 0.792***<br>(0.177)  | 0.802***<br>(0.207)                            | 0.792**<br>(0.334)   | 1.314***<br>(0.387)  | 1.027**<br>(0.432)   | 1.390***<br>(0.527)  |
| 850 $\leq$ DealerTS(0)<1250                         | 0.104<br>(0.113)     | 0.119<br>(0.128)                               | 0.329<br>(0.228)   | 0.171<br>(0.244)   | 0.614**<br>(0.280)   | 0.071<br>(0.350)   |
| 500 $\leq$ DealerTS(0)<650                          | -0.360***<br>(0.115) | -0.298**<br>(0.127)                            | -0.366<br>(0.239)  | -0.242<br>(0.236)  | -0.301<br>(0.347)  | -0.181<br>(0.322)  |
| DealerTS(0)<500                                     | -0.088<br>(0.143)    | -0.089<br>(0.161)                              | -0.101<br>(0.272)  | -0.271<br>(0.255)  | -0.195<br>(0.381)  | -0.533<br>(0.344)  |
| R <sup>2</sup>                                      | .181                 | .186   | .229   | .178   | .241   | .185   |

\*\*\* significant at 1%; \*\* significant at 5%; significant at 10%

Table 10  
Speculative Short Trade Size Sorts

Raw returns (panel a) and abnormal returns (panel b) over the five days following average daily short trades of different sizes for quartiles based upon speculative short trades as a percentage of total trades. Spec\_Short% is the percentage of the firm's total trades on day 0 that are speculative short trades. Spec\_TS(0) is the average size of the firm's speculative short trades on day 0. Ret(1,5) is the firm's total stock return from day 1 to day 5. AbRet(1,5) is the firm's abnormal total stock return from day 1 to 5 measured as Ret(1,-5) minus the total return on the NASDAQ Equally Weighted Index from day 1 to day 5. The five short trade size categories in columns (i) through (v) are based (approximately) on sample quintile breakpoints. Column (vi) contains the difference between the return in column (v) minus the return and column (i) as well as the corresponding t-statistic.

|                                   | Speculative Short Trade Size Categories |                       |                       |                       |                 |                |
|-----------------------------------|---|-----------------------|-----------------------|-----------------------|-----------------|----------------|
|                                   | (i)                                     | (ii)                  | (iii)                 | (iv)                  | (v)             | (vi)           |
| <i>Panel A – Raw Returns</i>      | SpecTS(0) ≤ 200                         | 200 < SpecTS(0) ≤ 350 | 350 < SpecTS(0) ≤ 500 | 500 < SpecTS(0) ≤ 950 | 950 < SpecTS(0) | Diff (v) – (i) |
| 4.98 < Spec_Short%                | n=5,426                                 | n=10,451              | N=7,980               | n=9,144               | n=7,033         |                |
| Ret(1,5)                          | 0.088                                   | -0.444                | -0.659                | -0.365                | -1.247          | -1.335         |
| t-statistic                       | 0.638                                   | -3.756                | -4.417                | -2.489                | 7.563           | -6.214         |
| 2.99 < Spec_Short% ≤ 4.98         | n=4,534                                 | n=9,276               | n=8,051               | n=9,546               | n=8,623         |                |
| Ret(1,5)                          | -0.475                                  | -1.158                | -1.446                | -1.418                | -1.395          | -0.919         |
| t-statistic                       | -2.921                                  | -8.443                | 9.613                 | -9.846                | -8.830          | -4.051         |
| 1.61 < Spec_Short% ≤ 2.99         | n=6,068                                 | n=8,702               | n=7,127               | n=8,834               | n=9,318         |                |
| Ret(1,5)                          | -0.466                                  | -1.203                | -1.335                | -1.673                | -1.630          | -1.164         |
| t-statistic                       | -3.215                                  | -8.549                | -8.135                | -11.304               | -10.887         | -5.588         |
| 0 < Spec_Short% ≤ 1.61            | n=12,205                                | n=7,784               | n=6,185               | n=6,348               | n=7496          |                |
| Ret(1,5)                          | -0.554                                  | -0.831                | -1.055                | -1.560                | -1.262          | -0.708         |
| t-statistic                       | -4.824                                  | -5.233                | -5.901                | -8.775                | -7.487          | -3.471         |
| <i>Panel B – Abnormal Returns</i> |   |                       |                       |                       |                 |                |
| 4.98 < Spec_Short%                |   |                       |                       |                       |                 |                |
| AbRet(1,5)                        | -0.114                                  | -0.770                | -0.857                | -0.514                | -1.313          | -1.199         |
| t-statistic                       | -0.887                                  | -7.181                | -6.435                | -3.941                | -8.770          | -6.088         |
| 2.99 < Spec_Short% ≤ 4.98         |   |                       |                       |                       |                 |                |
| AbRet(1,5)                        | -0.488                                  | -1.214                | -1.498                | -1.400                | -1.332          | -0.843         |
| t-statistic                       | -3.237                                  | -9.781                | -11.045               | -10.841               | -9.327          | -4.060         |
| 1.61 < Spec_Short% ≤ 2.99         |   |                       |                       |                       |                 |                |
| AbRet(1,5)                        | -0.425                                  | -1.075                | -1.076                | -1.449                | -1.352          | -0.927         |
| t-statistic                       | -3.165                                  | -8.365                | -7.193                | -10.791               | -10.016         | -4.871         |
| 0 < Spec_Short% ≤ 1.61            |   |                       |                       |                       |                 |                |
| AbRet(1,5)                        | -0.359                                  | -0.587                | -0.650                | -1.124                | -0.758          | -0.399         |
| t-statistic                       | -3.406                                  | -4.053                | -4.042                | -6.974                | -4.960          | -2.150         |

Table 11  
Dealer Short Trade Size Sorts

Raw returns (panel a) and abnormal returns (panel b) over the five days following average daily short trades of different sizes for quartiles based upon dealer short trades as a percentage of total trades. Dealer\_Short% is the percentage of the firm's trades on day 0 that are dealer short trades. Dealer\_TS(0) is the average size of the firm's dealer short trades on day 0. Ret(1,5) is the firm's total stock return from day 1 to day 5. AbRet(1,5) is the firm's abnormal total stock return from day 1 to 5 measured as Ret(1,-5) minus the total return on the NASDAQ Equally Weighted Index from day 1 to day 5. The five short trade size categories in columns (i) through (v) are based (approximately) on sample quintile breakpoints. Column (vi) contains the difference between the return in column (v) minus the return and column (i) as well as the corresponding t-statistic.

|                                   | Dealer Short Trade Size Categories |                                 |                                  |                                  |                           | (vi)<br>Diff (v) – (i) |
|-----------------------------------|------------------------------------|---------------------------------|----------------------------------|----------------------------------|---------------------------|------------------------|
|                                   | (i)<br>DealerTS(0) ≤ 500           | (ii)<br>500 < DealerTS(0) ≤ 650 | (iii)<br>650 < DealerTS(0) ≤ 850 | (iv)<br>850 < DealerTS(0) ≤ 1250 | (v)<br>1250 < DealerTS(0) |                        |
| <i>Panel A – Raw Returns</i>      |                                    |                                 |                                  |                                  |                           |                        |
| 20.71 < Dealer_Short%             | n=14,636                           | n=8,276                         | n=7,976                          | n=7,932                          | n=5,723                   |                        |
| Ret(1,5)                          | -0.294                             | -0.513                          | -0.327                           | -0.268                           | 0.220                     | 0.514                  |
| t-statistic                       | -3.074                             | -3.722                          | -2.339                           | -1.855                           | 1.342                     | 2.707                  |
| 15.68 < Dealer_Short% ≤ 20.71     | n=10,454                           | n=7,621                         | n=8,346                          | n=9,673                          | n=8,456                   |                        |
| Ret(1,5)                          | -1.115                             | -1.390                          | -1.156                           | -1.052                           | -0.539                    | 0.576                  |
| t-statistic                       | -9.029                             | -8.844                          | -7.932                           | -8.001                           | -3.900                    | 3.110                  |
| 11.76 < Dealer_Short% ≤ 15.68     | n=8,814                            | n=6,842                         | n=8,041                          | n=10,342                         | n=10,482                  |                        |
| Ret(1,5)                          | -1.509                             | -1.993                          | -1.119                           | -1.365                           | -0.777                    | 0.732                  |
| t-statistic                       | -10.621                            | -11.782                         | -7.161                           | -10.166                          | -6.221                    | 3.866                  |
| 0 < Dealer_Short% ≤ 11.76         | n=9,468                            | n=6,136                         | n=7,121                          | n=9,265                          | n=12,582                  |                        |
| Ret(1,5)                          | -1.172                             | -1.641                          | -1.286                           | -1.286                           | -0.860                    | 0.311                  |
| t-statistic                       | -8.360                             | -8.664                          | -7.277                           | -8.679                           | -7.203                    | 1.691                  |
| <i>Panel B – Abnormal Returns</i> |                                    |                                 |                                  |                                  |                           |                        |
| 20.71 < Dealer_Short%             |                                    |                                 |                                  |                                  |                           |                        |
| AbRet(1,5)                        | -0.522                             | -0.733                          | -0.419                           | -0.328                           | 0.421                     | 0.943                  |
| t-statistic                       | -5.940                             | -5.793                          | -3.256                           | -2.456                           | 2.762                     | 5.358                  |
| 15.68 < Dealer_Short% ≤ 20.71     |                                    |                                 |                                  |                                  |                           |                        |
| AbRet(1,5)                        | -0.943                             | -1.239                          | -1.037                           | -0.920                           | -0.208                    | 0.736                  |
| t-statistic                       | -8.462                             | -8.735                          | -7.821                           | -7.670                           | -1.636                    | 4.354                  |
| 11.76 < Dealer_Short% ≤ 15.68     |                                    |                                 |                                  |                                  |                           |                        |
| AbRet(1,5)                        | -1.198                             | -1.707                          | -1.153                           | -1.186                           | -0.533                    | 0.664                  |
| t-statistic                       | -9.321                             | -11.218                         | -8.216                           | -9.860                           | -4.677                    | 3.863                  |
| 0 < Dealer_Short% ≤ 11.76         |                                    |                                 |                                  |                                  |                           |                        |
| AbRet(1,5)                        | -0.781                             | -1.509                          | -1.182                           | -1.103                           | -0.471                    | 0.309                  |
| t-statistic                       | -6.215                             | -8.873                          | -7.426                           | -8.249                           | -4.326                    | 1.861                  |

Table 12  
Combined Speculative and Dealer Short Trade Size Sorts

Raw returns (panel a) and abnormal returns (panel b) over the five days following average daily short trades of different sizes for quartiles based upon combined speculative and dealer short trades as a percentage of total trades. Total\_Short% is the percentage of the firm's trades on day 0 that are short trades. TotalTS(0) is the average size of the firm's combined speculative and dealer short trades on day 0. Ret(1,5) is the firm's total stock return from day 1 to day 5. AbRet(1,5) is the firm's abnormal total stock return from day 1 to 5 measured as Ret(1,-5) minus the total return on the NASDAQ Equally Weighted Index from day 1 to day 5. The five short trade size categories in columns (i) through (v) are based (approximately) on sample quintile breakpoints. Column (vi) contains the difference between the return in column (v) minus the return and column (i) as well as the corresponding t-statistic.

|                                   | Short Trade Size Categories |                       |                       |                        |                   |                |
|-----------------------------------|-----------------------------|-----------------------|-----------------------|------------------------|-------------------|----------------|
|                                   | (i)                         | (ii)                  | (iii)                 | (iv)                   | (v)               | (vi)           |
| <i>Panel A – Raw Returns</i>      | TotalTS(0) ≤450             | 450 < TotalTS(0) ≤630 | 630 < TotalTS(0) ≤850 | 850 < TotalTS(0) ≤1200 | 1200 < TotalTS(0) | Diff (v) – (i) |
| 24.43 < Total_Short%              | n=11,663                    | n=10,015              | n=8,990               | n=7,385                | n=6,508           |                |
| Ret(1,5)                          | -0.101                      | -0.293                | -0.335                | -0.494                 | -0.074            | 0.027          |
| t-statistic                       | 0.998                       | 2.431                 | 2.584                 | 3.330                  | 0.470             | 0.146          |
| 19.20 < Total_Short% ≤ 24.43      | n=8,064                     | n=9,597               | n=9,667               | n=8,883                | n=8,348           |                |
| Ret(1,5)                          | -0.762                      | -1.006                | -1.132                | -0.706                 | -0.618            | 0.144          |
| t-statistic                       | 5.589                       | 7.338                 | 8.195                 | 5.037                  | 4.401             | 0.735          |
| 15.10 < Total_Short% ≤ 19.20      | n=7,167                     | n=9,122               | n=9,540               | n=9,049                | n=9,684           |                |
| Ret(1,5)                          | -1.494                      | -1.948                | -1.419                | -1.115                 | -0.819            | 0.675          |
| t-statistic                       | 9.765                       | 12.777                | 9.939                 | -7.511                 | -6.063            | 3.308          |
| 0 < Total_Short% ≤ 15.10          | n=7,818                     | n=7,972               | n=8,098               | n=8,408                | n=12,265          |                |
| Ret(1,5)                          | -1.116                      | -1.676                | 1.542                 | -1.663                 | -0.966            | 0.149          |
| t-statistic                       | 7.579                       | 10.354                | 9.536                 | 10.763                 | 7.960             | 0.782          |
| <hr/>                             |                             |                       |                       |                        |                   |                |
| <i>Panel B – Abnormal Returns</i> |                             |                       |                       |                        |                   |                |
| 24.43 < Total_Short%              |                             |                       |                       |                        |                   |                |
| AbRet(1,5)                        | -0.424                      | -0.603                | -0.588                | -0.554                 | 0.041             | 0.465          |
| t-statistic                       | 4.554                       | 5.450                 | 4.941                 | 4.054                  | 0.279             | 2.680          |
| 19.20 < Total_Short% ≤ 24.43      |                             |                       |                       |                        |                   |                |
| AbRet(1,5)                        | -0.699                      | -0.985                | -1.049                | -0.667                 | -0.302            | 0.397          |
| t-statistic                       | 5.659                       | 7.987                 | 8.376                 | 5.230                  | 2.351             | 2.226          |
| 15.10 < Total_Short% ≤ 19.20      |                             |                       |                       |                        |                   |                |
| AbRet(1,5)                        | -1.229                      | -1.748                | -1.360                | -0.945                 | -0.628            | 0.602          |
| t-statistic                       | 8.910                       | 12.738                | 10.618                | 7.095                  | 5.125             | 3.260          |
| 0 < Total_Short% ≤ 15.10          |                             |                       |                       |                        |                   |                |
| AbRet(1,5)                        | -0.602                      | -1.295                | -1.192                | -1.208                 | -0.436            | 0.166          |
| t-statistic                       | 4.522                       | 8.851                 | 8.152                 | 8.594                  | 3.929             | 0.957          |

Figure 1 Short Trades as Percentage of Total Trades



