Short-selling and the Weekend Effect in Stock Returns

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Abstract

This study employs daily short-selling data for NASDAQ stocks to explore whether speculative short-selling causes a significant portion of the observed weekend effect in stock returns. We find that the weekend effect in returns persists during our sample period. We also identify a weekend effect in customer (speculative) short-selling, because this type of short-selling constitutes a larger percentage of trading volume on Monday than on the preceding Friday. And, our analysis reveals a weekend effect in dealer short-selling that is different from that of customers. The result for dealers conforms to the notion that dealers actively bring liquidity and stability through their market-making activities. Our main finding is that speculative short-selling does not explain an economically meaningful portion of the Monday-Friday difference in returns, even among the firms that are most actively shorted. This finding contradicts the results of some prior research.

Short-selling and the Weekend Effect in Stock Returns

I. Introduction

An intriguing phenomenon in financial markets is the weekend effect, which is the term for the fact that Monday's returns often are significantly lower than those of the immediately preceding Friday. French (1980) first called attention to this anomaly, and numerous researchers have sought an explanation in the years since. Keim and Stambaugh (1984) establish that the phenomenon has been a regular feature of the financial landscape for many years, but they uncover no evidence that it is specific to firm size, and they reject the possibility that it arises from measurement error. Lakonishok and Maberly (1990) attribute some of the Monday-Friday puzzle to the differential trading patterns of institutions and individuals. Sias and Starks (1995) document an association between the weekend effect and institutional ownership. Abraham and Ikenberry (1994) and Chan, Leung, and Wang (2004) relate Monday's return to a stock's holdings by institutions and individuals. Damodaran (1989) explores whether a tendency of corporations to release bad news on Friday after the markets close could account for depressed Monday share prices; he reports evidence of only a weak connection. Wang, Li, and Erickson (1997) find a Monday effect only in the final weeks of the month.

Chen and Singal (2003) propose that short-selling may explain a significant part of the weekend effect. They hypothesize that "the inability to trade over the weekend tends to make many short-sellers close their *speculative* positions at the end of the week and reopen them at the beginning of the following week leading to the weekend effect, where the stock prices rise on Fridays as short-sellers cover their positions and fall on Mondays as short-sellers reestablish new short positions" [page 2 – emphasis added]. They find support for the hypothesis in the positive

association between stocks' weekend effects and their monthly levels of short interest, which is the ratio of a stock's number of shorted shares, as reported monthly by the exchange where it is listed and traded, to its number of outstanding shares.[1] One strength of this monthly series of short interest, which Chen and Singal use as an indicator of the relative level of speculative short-selling, is the fact that it has been (historically) the only publicly available data on short-selling. Another strength is that it is an actual count of the number of a stock's shares that are in short positions.

The data series does, however, have several weaknesses. First, the monthly number of shorted shares is drawn from just one day in the middle of the month, and there is no guarantee that this day is representative of all days in the month or reflective of patterns in the short-selling of Mondays and Fridays. Second, short interest is an undifferentiated aggregation of several categories of shorted shares. It includes shares shorted by, among others, dealers in market-making, those shorted by arbitrageurs active in the options markets, and those shorted by investors who anticipate price decline or relative underperformance. Only the shares of the last category are likely to reflect the speculative activity that, according to Chen and Singal, might be partly responsible for the weekend effect in returns. Finally, the relative sizes of these categories that comprise short interest could change substantially over time, with the undetectable result that a stock's reported short interest could rise sharply in a month even if the speculative component of short interest actually declined.

Because of these considerations, the hypothesis that short-selling explains a significant part of the weekend effect deserves further examination when new and different data become available. Therefore, the purpose of this paper is to conduct that examination with the help of an extensive dataset of daily trades, including short sales, for a large number of stocks traded

[1] Chen and Singal measure the weekend effect as a stock's return on a Monday minus its return on the previous Friday. Consistent with prior studies, they find that Monday returns are significantly lower than Friday returns.

through NASDAQ's National Market System (NMS) between September 2000 and July 2001. This rich and precise dataset enables us to do several things Chen and Singal were unable to do. Thus, we can separate daily short-selling by NASAQ dealers from the short sales by their customers. This important distinction allows us to assess the different relationship that the weekend effect may have with customer (largely speculative) short sales versus shorting that primarily represents the dealer market-making. A final example of the superiority of our dataset is that it gives us the precise changes in short-selling in individual stocks between actual Mondays and Fridays and thus frees us from having to extrapolate possible relative short-selling across stocks on the basis of their monthly measures of short interest.

The paper proceeds in this way: the next section describes our data and sample and explains why the data provide a more reliable tool for empirical analysis than the short-selling data recently released under the SEC's Regulation SHO.[2] The third section presents our tests and statistical results, and a final section concludes.

We can summarize our findings this way. First, the weekend effect in returns, which Chen and Singal tracked up to 1999, persists for NASDAQ stocks through our sample period of 2000-2001. Second, customer short-selling displays a weekend effect of its own because customer-shorted shares on average constitute a larger percentage of share volume on Monday than on Friday. (This difference is more pronounced for firms of smaller market capitalization.) However, the raw number of shares shorted by customers tends to be greater on Fridays than on Mondays.

Third, short-selling by dealers also exhibits a weekend effect, but it is exactly opposite of the weekend effect in customer short-selling, because dealer-shorted shares constitute a *lower* percentage of trading volume on Monday than on Friday. This result for dealers is consistent

[2] For details regarding Regulation SHO, see Securities and Exchange Commission Release No. 50103; File No. S7-23-03, July 28, 2004.

with certain implications of Griffin, Harris, and Topalogu (2003) and conforms to the notion that dealers actively bringing liquidity and stability to the market by selling short when stock prices are rising. Our evidence of this key difference between short-selling by dealers and customers is new to the literature and has important implications for anyone engaged in short-selling research.

Our final conclusion is that speculative short-selling by customers does not explaion a meaningful portion of the observed weekend effect in stock returns. Consequently, the weekend effect in returns remains an unexplained anomaly.

II. Data and Sample

A. Structure of Records in Dataset

The source of our data is NASDAQ's Automated Confirmation Transaction Service (ACT), which processed the vast preponderance of transactions in NASDAQ-listed stocks during our study period. The ACT-based dataset includes all processed trades from the daily 9:30am-4:00pm sessions between September 13, 2000 and July 10, 2001.[3] We are unaware of any equally rich and detailed dataset dealing with the NASDAQ from this or any other period.[4] It is also important to note that, shortly after 2001, the ECNs (Electronic Communication Systems such as Archipelago and Island) starting reporting their trades through other Self-Regulatory Organizations. As a result, ACT files from later years cannot supply the almost comprehensive record of NASDAQ trading that our dataset provides for the 2000-2001 period.

A specific protocol is followed for reporting a trade to ACT: (1) a market-maker in a trade with a non-market-maker reports the trade; (2) the seller in a trade between two market-makers files the report; (3) the NASD member in a trade with a non-NASD member reports the

[3] Odd-lot trades are not included in our sample.
[4] Boehmer, Jones, and Zhang (2005) have a large and detailed but proprietary dataset that applies to short and other trades on the NYSE for the 2000-2004 interval.

trade; and (4) the seller in a trade between two members is responsible for reporting. As described below, this protocol for trade reporting helps us to separate dealer short-selling from customer short-selling.

In the ACT record, a short sale is indicated by an entry into either the REPORT_SHORT field, which means the reporting entity has flagged the trade as a short sale, or the CONTRA_SHORT field, which means the counterparty has indicated that the trade was short. In addition, the details in the ACT record of a trade include characteristics such as the stock's ticker, date, time, number of shares traded, trading price, and whether ACT has passed the record of the trade to the "tape" (i.e., the public record). This final item of information is particularly important in the cases of trades conducted through an ECN. Each of those trades generates (at least) two records – because the ECN is technically the counterparty for both the buy and sell sides of the trade – but ACT reports only one to the tape.[5] To avoid double-counting, we restrict our sample to only the transaction records that were reported to the tape, whether they were executed through an ECN or on another venue.

To distinguish between customer and dealer short sales, we make use of the daily file of quotations in order to identify who, during each day of our sample period, was serving as a market-maker (i.e., actively posting bid and ask quotes) in a stock.[6] With this information, and the trade reporting protocol described above, each day's short sales in a stock are broken into two major categories: dealer short-selling and customer short-selling. Dealer short-selling consists of the short-selling by NASD members who were functioning as dealers on the day.[7] It is crucial to note that, during the time of our sample, NASD rules required market-makers to

[5] An ECN-reported trade could include up to three records depending upon which side(s) of the trade reported.
[6] Any market-maker that did not offer competitive bid or ask quotes on a day was considered inactive and a customer rather than a dealer that day. Most of the larger market-makers actively quoted on their stocks every day.
[7] We excluded trades reported by ECNs from our measure of dealer short-selling.

identify all their short sales. Consistent with compliance with these rules, the REPORT_SHORT field of our files reveals substantial shorting activity.[8]

The second category, customer short-selling, contains all short sales 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. This example illustrates our procedure: If the reporting entity on a trade marked itself as buying and the counterparty as selling short, then we classified the trade as a customer's short sale. The reason is that, if the shorting party had been a dealer, then that dealer would have been required by ACT's protocol of reporting to file the trade report. And, when the reporting entity on a trade marked short was the seller in the transaction, and that seller was not an active market-maker on that day, the trade was also marked as a customer's short sale.

Within each category (dealer and customer), there is an additional distinction, based on whether the short sale was designated as "exempt" of the NASDAQ Short Sale Rule.[9] Regarding customers, NASDAQ allowed the exempt designation for short sales related to certain non-speculative activities including hedge transactions by qualified options market-makers, arbitrage of differences in a stock's price on U.S. versus foreign stock markets, convertible bond arbitrage, and the hedging of deliveries due in a few days. In these cases, the field labeled CONTRA_SHORT in the ACT record would contain an "X" rather than an "S".

For dealers, the designation of exempt was designed for short sales which were executed as part of bona fide market-making at the prevailing "inside" bid following a down tick. And dealers, when reporting their trades, were required to specifically distinguish between short and

[8] As page 3 of Chapter 9 in the NASDAQ Trader Manual (revised January 2000) states: "Under revisions to NASD Rule 6130(d)(6) implemented in 1997, Market-makers … must denote all short sales … as short sales."
[9] 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.

short-exempt transactions. For example, the instructions from pages 3-4 of Chapter 9 in the NASDAQ Trader Manual (revised 2000) state:

> 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.

An exempt trade by a market-maker would be signified by an "X" in the REPORT_SHORT field; if the dealer did not need to claim the exemption for the short sale (i.e. it did not violate the bid-test) the field would contain an "S". The reporting of both non-exempt (the majority of dealer trade reports) and exempt (the minority) short sales by active dealers makes our dataset quite different from the 2005 SHO-based data discussed in Diether et al. (2005a) who state that all dealer short trades in their sample are designated in the record as exempt short sales.

Thus, we are confident that a consistent review of the report fields, guided by the reporting rules and the quotations file, can accurately fit the sample's large set of daily short sales into a 2-by-2 matrix, for customers vs. dealers, and for non-exempt vs. exempt. For convenience, we will apply the following labels to the shares in these classes: "customer-shorted," "customer-shorted exempt," "dealer-shorted," and "dealer-shorted exempt." [10]

B. Specification of Key Measures of Short-selling

Customer-shorted shares were very likely sold in speculative trades by sellers who anticipated subsequent share price decline or relative underperformance. Therefore, they represent the speculative component of overall short-selling that Chen and Singal suggest may be

[10] Note: we could also have referred to "customer-short" as "customer-short non-exempt," and "dealer-short" as "dealer-short non-exempt." For brevity in exposition, we chose the nomenclature presented.

linked to the weekend effect in stock returns. Customer-shorted shares represent speculative trades because 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 likely 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.[11] We do, however, recognize the possibility that certain activity (e.g. convertible bond arbitrage) that could have qualified as "exempt" short-selling might have been executed and recorded in the ACT database as "non-exempt." This might occur if a customer did not want to be burdened with the special restrictions, paperwork, and potential audit that is associated with "exempt" short sale execution. In a later section of the paper, we explore the impact on our findings of the possible inclusion of cases of convertible bond arbitrage-related short-selling in our measure of speculative short-selling.

The majority of the dealer-shorted (non-exempt) trades, which is our largest category in both number of trades and of shares, were probably market-making moves (or, less likely for our sample period, brokering moves). It is possible, however, that some of a dealer's short non-exempt trades represented proprietary investing for either the dealer's desk or some other unit within the firm. Though we are not able to identify these trades directly, we are able to test whether a stock's total of dealer-shorted non-exempt shares tended to have a consistently substantial number of speculatively shorted shares. The details of the testing are in the Appendix and they lead us to conclude that dealer-shorted shares in our sample primarily resulted from market-making.

[11] Note that it is quite unlikely that any customer-shorted or dealer-shorted trades marked as exempt are speculative in nature. The exemption is only available for non-speculative activities, and trades marked as exempt could be subject to eventual audit for potential abuse.

C. Comparison of the ACT Dataset with the SHO Data

In 2004, the SEC adopted Regulation SHO which mandated a pilot examination of short sales in approximately 1,000 stocks of U.S. companies between 2005 and 2006. Also, SHO required that all Self- Regulatory Organizations (SROs) release to the public the trade data for short sales, beginning in January 2005. The data would include the ticker, price, volume, time, listing market, and whether the short sale was (or was not) exempt from short-sale rules. The SROs are the New York Stock Exchange and the NASDAQ Stock Market, among others. Several studies of the SHO data have appeared, including Diether, Lee, and Werner (2005a and 2005b) and Boni (2006).

Some key differences between the SHO data on NASDAQ stocks and our dataset deserve attention and suggest that our dataset is a more reliable tool of empirical analysis. For example, the SHO data do not distinguish between customer and dealer short-selling. As we mention above, during our sample period both types of participants submitted exempt and non-exempt short trades. And, as our tests detailed below reveal, short-selling by customers is distinctly different from short-selling by dealers. By reporting only the split between exempt versus non-exempt, the SHO data fail to separate short sales of customers from those of dealers, leaving the category of non-exempt an aggregate of trades made by diverse parties with quite different motivations. This weakness renders SHO data less useful than ACT data for testing hypotheses about the relationships of shorted shares to daily returns.

In addition, some trade reporting policies also potentially undermine the usefulness of SHO data. For example, the Securities Industry Association received a no-action letter in 2004 from the SEC regarding the distinction between short and short exempt trades on markets such as Archipelago that used masking procedures to implement the SHO pilot experiment.

> Where the market centers have automatic programming procedures in place to "mask" the application of the Price Test for the Pilot Securities, ***it is not necessary for market participants submitting orders in such securities to those market centers to distinguish between "short" and "short exempt" orders***, as such market centers will generally allow orders marked "short" in these Pilot Securities to be executed without regard to a Price Test. (italics and bold added) [12]

This blurring of the line between short and short exempt orders may make it difficult to draw firm conclusions from much of the SHO data currently being released to the public.

In sum, the ACT dataset used in this study is more precise and richer in detail and scope than the SHO data. The analysis contained here has, therefore, a foundation that is stronger than that supporting recent papers concerning short-selling and SHO-based information.[13]

D. 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 reduced the sample to 1,314 stocks. During this period, the value of numerous NASDAQ stocks changed dramatically, and the NASDAQ Value-Weighted Index fell by approximately 45%. By contrast, as Figure 1 illustrates, the NASDAQ Equally-Weighted Index during the period was almost unchanged. The movement of this latter index suggests that, because our tests do not weight returns by firm size, the sample period does not bias weekend returns in a negative direction. Nonetheless, to verify that our findings are not an artifact of a generally declining

[12] See www.sec.gov/divisions/marketreg/mr-noaction/sia041505.htm.

[13] Despite the obvious unique value of our dataset, we note two limitations. First, ACT files do not identify purchases that "cover" or reverse short sales. In this regard, it is exactly like SHO data. Second, ACT records do not indicate whether a seller transacting through the Small Order Execution System (SOES) is shorting. Because SOES handled only about 2% of all NASDAQ transactions in 2000-01, the number of missed short sales is probably not large. (See NASDAQ's website, www.marketdata.nasdaq.com, for more details.

market, we also conduct some tests for separate sub-samples of our time period. CRSP is the source for all data on returns of stocks and the indexes.

For our analyses, we define the week as Wednesday to the following Tuesday. For example, the first sample week runs from Wednesday, September 13 until Tuesday, September 19. Further, we consider only those weeks in which the NASDAQ market was open for each of the five trading days (Wednesday, Thursday, Friday, Monday and Tuesday). As a result, the final sample consists of 35 five-day trading weeks for the 1,314 stocks.[14]

We conduct tests on this full sample, as well as on two subsamples of stocks that were subjected to relatively high amounts of speculative short-selling. The two subsamples are the top half and the top quartile of the 1,314 stocks, as ranked by their daily median ratio of customer shorted shares to outstanding shares within the sample period. Testing with these subsamples is important because some of the 1,314 stocks experienced very little short-selling during the sample interval. Thus, a careful evaluation of the linkage which Chen and Singal proposed for short-selling and weekend effects in returns must include a direct exploration of the sub-samples of stocks that experienced the more active speculative shorting activity.

Table 1 presents, for each day of the week, the mean and median of the return, trading volume, and shorted shares in each of the four categories of short-selling. Return is defined in the customary way for NASDAQ stocks: the price from the last "print" on one day less the price from the previous day's last print, divided by the latter price.[15] Trading volume equals the total number of shares traded during the day, as recorded in NASDAQ's statements. For each

[14] This restriction led us to drop the weeks including Thanksgiving, Christmas, New Years, Martin Luther King Day, President's day, Easter, and Memorial Day. Keim and Stambaugh (1984, Table I, Note b) impose a similar control when they excluded cases of multiple-day returns for individual weekdays and Monday returns extending over three days. By contrast Chen and Singal defined a weekend as the time between the first trading day of the week less the last trading day of the preceding week.

[15] On the NASDAQ market, the last "print" is the last recorded transaction; in the vast majority of cases, the last print pertains to the last trade of the day or one of the very last trades. There is a slight chance, however, that the last print refers to a trade that occurred some seconds before the day's final trade, if the dealer was slow to report it. However, NASDAQ rules require, and audits monitor to insure, that a report is made within 90 seconds of the trade.

category of shorted shares (customer-shorted, dealer-shorted, and so on), the table contains both the number of shorted shares and its percentage of trading volume.

The method for normalizing the number of shorted shares (of whatever category) for inter-firm as well as inter-temporal comparisons, is an important choice, and we want to explain here why we normalize by trading volume. Asquith, Pathak, and Ritter (2005, p. 249) argue that the question being addressed determines whether shorted shares should be normalized by outstanding shares or by total shares traded. The central question of our paper is whether short-selling across weekends has a link to share price movements over those weekends. Thus, the question revolves around the establishment of prices by the interplay of buyers and sellers, and normalizing by *total shares traded* reflects the importance of short-selling to that interplay. Boehmer, Jones, and Zhang (2005) and Diether, Lee, and Werner (2005a) also take this approach.[16]

An example will illustrate our view. Two firms, X and Y, are alike in number of outstanding shares (10,000) and customer-shorted shares (100) and all other shorted shares (0) on a particular day. That day, Firm X's trading volume is 200 shares, while firm Y's volume is 1,000. Normalizing by volume captures the substantial difference in the role and impact of short-sellers relative to other market participants -- 50% of volume in X versus 10% in Y's. The alternative – normalizing by outstanding shares – would assign the same ratio to both firms (100/10,000 or 1%), and that single ratio fails to reflect the key fact that short-selling was a far bigger part of the trading in X than of the trading in Y.[17]

[16] By contrast, Desai, Ramesh, Thiagarajan, and Balachandran (2002), in their study of monthly returns, favor the ratio of shorted to outstanding shares. Dechow, Hutton, Meulbroek, and Sloan (2001) make the same choice.

[17] The use of this volume-based percentage to explore price movements is consistent with our prior decision to identify subsamples of actively shorted stocks by means of a ratio based on outstanding shares. In that case, we were looking at the long-term situation across the sample period, while our tests are directed towards price movements on individual Mondays and Fridays.

Panel A of Table 1 presents descriptive statistics for the entire sample of 45,990 observations (or 1,314 stocks over 35 weeks); Panel B pertains to the 22,995 observations on the 657 stocks in the upper half of the sample (657 stocks across 35 weeks); Panel C presents statistics for 11,515 observations, or the top quartile of stocks (329 over 35 weeks). Though we report and discuss our statistical tests below, some features of this table deserve special notice. First, in all Panels, returns on Mondays exhibit mean and median values that are lower than on any other weekday, including Friday. Thus, our dataset appears to be consistent with that of Chen and Singal, who uncover the traditional weekend effect in NASDAQ returns as late as 1999. Second, the table's computations regarding trading volume recall those of Lakonishok and Maberly (1990), because Monday's level of total shares traded is lower than that of any other day, in all three panels.

The third interesting feature, common to all panels, is that the customer-shorted shares present a very complex weekend effect. For example, Monday's customer-shorted shares are on-average fewer than those of Friday's. This finding is exactly opposite what is expected generally if the weekend effect is due (at least partially) to speculative short-selling activity. In contrast, however, customer-shorted shares as a percent of trading volume is higher on Mondays than on any other day of the week, which is quite consistent with a potential linkage between speculative short-selling and the weekend effect. These seemingly contradictory results arise because trading volume on Mondays tends to be so much lower than trading volume on other days of the week that customer shorting as a percentage of volume ends up being the highest on Mondays.

Fourth, the number of dealer-shorted shares and their percentage of volume are large, and both measures are lower on Mondays than on other days. Fifth, while the customer-shorted exempt category is very small, the dealer-shorted exempt shares amount to more than one-tenth of the number of dealers' non-exempt shares. The final interesting point is that, for the full

sample (Panel A), the percentage of trading volume that is attributable to the combined four categories of short-selling (customer, dealer, customer exempt, and dealer exempt) is approximately 25% on each weekday. This is very similar to the percentage of overall shorting to volume reported by Diether et al. (2005a) in their analysis of SHO data from early 2005.

III. Tests and Results

A. Weekend Effects in Returns

To explore whether the returns during our sample period exhibit the traditional weekend effect, it is not sufficient to simply compare average returns on Mondays to average returns on Fridays. Instead, it is necessary to compute the difference between each stock's return on Monday versus its return on the preceding Friday. Consequently, Table 2 reports the mean and median of this difference over the 35 sample weeks for the entire sample of stocks (Panel A), stocks in the upper half of the sample, based upon median ratio of shares shorted to outstanding shares (Panel B), and stocks in the top quartile of the sample, by median ratio of shares shorted to outstanding shares (Panel C). In every panel, the mean and median value for Return (%) is negative, and the corresponding p-values for the t-test (of the mean) and the Sign-test (of the median) support rejecting the hypothesis of no difference between the returns of Monday and the preceding Friday returns. In sum, these results strongly indicate the presence of a weekend effect *in returns* for our sample of NASDAQ stocks.

B. Weekend Effects in Short-selling

The second row of each panel in Table 2 reports the values for the mean and median of the difference between each stock's (speculative) customer-shorted shares as a percentage of trading volume on Monday versus the preceding Friday. These numbers reveal a weekend effect in *short-selling*, as customer-shorted shares constitute a higher percentage of Monday's trading

volume than of Friday's in the full sample and the two subsamples. Every mean is positive and statistically significant with low p-values; two of the medians are positive and also significant. Note that the median in Panel A requires some explanation: The reported value is zero yet the corresponding p-value is low and indicates that the population median is different from zero. The reason for this result is twofold: (1) 5,561 of the total of 45,990 observations had zero values, because some stocks in the full sample did not experience any short-selling before and after some weekends; (2) but 20,761 observations were positive, while 19,578 were negative. The Sign-test, as performed by the SAS statistical package, ignores all observations equal to the hypothesized median – here, zero – and performs calculations with the others. Because positive values outnumber negatives by 1,200, the Sign-test supports rejecting the hypothesis of a zero population median.[18] A complementary and important point is that, among stocks with some regular speculative short-selling (Panels B and C), Monday's value of customer shorted to total traded shares is above Friday's in the majority of observations.

The third and fourth rows of Table 2 present tests for a weekend effect in (a) dealer-shorted shares as a percentage of volume and (b) total dealer-shorted shares (equal to dealer-shorted non-exempt shares plus dealer-shorted exempt shares) as a percentage of volume. Both percentages exhibit a weekend pattern as both are *substantially and significantly higher on Friday than on Monday.* Therefore, both categories of short-selling appear to be positively linked to volume, because on Fridays when volume tends to be higher than on Mondays, total dealer-shorted exempt and non-exempt shares tend to be more common. Additionally, both categories of shorted shares move in the opposite direction from customer-shorted shares and they clearly represent, as we have stated, trading of a different type and motivation. For this reason, our separation of customer from dealer short-selling and the determination of their

[18] See Syntax for Proc Univariate in SAS 9.1 for Windows, SAS Institute, Cary, N.C.

individual relationships to the weekend effect provide insights that cannot be obtained from either the short interest data utilized by Chen and Singal or the more recent SHO-based data.

C. Tests of the Linkage between Weekend Effects in Returns and in Short-selling

We next investigate through OLS and panel regressions whether the Monday-Friday pattern in *returns* is associated with weekend effects in the types of *short-selling*. The model specification takes the following form:

$$R(M\text{-}F)_{it} = \beta_0 + \beta_1 CustSSVol(M\text{-}F)_{it} + \beta_2 TDeaSSVol(M\text{-}F)_{it} + e_{it}. \quad (1)$$

where (M-F) designates the Monday less the preceding Friday value, R refers to daily return, CustSSVol is the customer-shorted shares as a percentage of trading volume, TDeaSSVol is the total dealer-shorted shares (the sum of dealer exempt and non-exempt shorted shares) as a percentage of trading volume, i refers to the stock and t to the weekend, and e is the disturbance term.

If speculative short-selling is at least partly responsible for the weekend effect in stock returns, we expect to find a significantly negative parameter estimate for CustSSVol(M-F), because returns should move in the opposite direction of speculative short-selling's portion of trading volume. This hypothesis is consistent with the fact that short-selling represents a shift in the supply curve for shares, which does not necessarily cause or accompany an offsetting shift in demand. Thus, short sales at any time, *ceteris paribus*, should (a) prevent a stock's price from rising much above its current level or (b) force the price down from its current level. Several papers that focus on longer horizons provide evidence that at least indirectly supports this view. Asquith, Pathak, and Ritter (2004) report that abnormal monthly returns are negatively related to their previous month's short interest.[19] D'Avolio (2002), Geczy, Musto, and Reed (2002), and Jones and Lamont (2002) find that costly-to-short shares post low average returns over time.

[19] For additional evidence, see Desai, Ramesh, Thiagarajan, and Balachandran (2002) as well as Dechow, Hutton, Meulbroek, and Sloan (2001) and Boehmer, Jones, and Zhang (2005).

Similarly, Boehme, Danielsen, and Sorescu (2006) show overvaluation is likely in stocks that are difficult to short and are the subjects of widely dispersed opinions.

Equation (1) incorporates the variable TDeaSSVol(M-F) , which represents all dealer short-selling, rather than a variable based on only dealer-shorted non-exempt shares. The reason is that Exempt sales differ from non-exempt only because of the location of the bid price. When we ran regressions with only dealer-shorted non-exempt shares in place of TDeaSSVol(M-F), the results (available on request) were quantitatively very similar to those presented here. That is not surprising since, as Table 2 shows, dealer-shorted exempt is a small part of total dealer short-selling.

We expect to find a positive value for the coefficient of TDeaSSVol(M-F) if dealers' short-selling is fundamentally transactional and related to market-making. Such behavior provides liquidity and does not have the dampening impact on price that non-exempt short-selling by customers would have. This argument draws support from Griffin, Harris, and Topalogu (2003). Analyzing NASDAQ trades from May 2000 to February 2001 (an interval that is quite close to our September 2000-July 2001 sample period), they find that increases in a stock's price prompt institutions to surprisingly quick purchases of shares but individuals to equally quick sales. It is plausible that institutional volume is greater, which will create an imbalance in demand and supply. Dealers accommodating this imbalance as part of market-making activity would need to use a substantial number of shorted shares to provide liquidity and stability to the market. This shift in the supply curve of shorted shares therefore meets an unanticipated upward shift in demand, with the result that a stock's ratio of dealer-shorted shares to trading volume will be relatively high on days of rising prices and low when prices fall.[20] Because many stocks post a higher return on Friday than on Monday, Friday's ratio of dealer-

[20] Diether, Lee, and Werner (2005) also indicate that short-selling by dealers is likely to be contrarian because of their role as intermediaries.

shorted shares to trading volume should be higher than Monday's, which is consistent with the summary statistics reported in Table 2. Therefore, we would expect that our regression of the weekend difference in return on the weekend difference in dealer-shorted shares to trading volume to produce a positive coefficient.

Before turning to the results, we want to explain why short-selling by either customers or dealers is not an endogenous variable (i.e., influenced by the dependent variable of return) and why our regression equation is correctly specified. We recognize that *some* short sales occur in quick response during the trading day to upward as well as downward changes in prices. However, that fact regarding intra-day short-selling does not undermine our methodology because it analyzes *aggregated daily* data and not individual trades within a trading day. All our recorded short-selling and other transactions in a stock take place during the 9:30am - 4:00pm session, while the stock's daily return reflects the price in the day's last NASDAQ print and the previous day's last print. Therefore, the values of the variables for volume and shorted shares are "fixed" in the classic econometric sense: they are predetermined and hence independent of the value of daily return (Greene (1993), p. 581). The only way that the price of a stock's last print could be contemporaneous with the day's short-selling or volume is if all that short-selling and all that volume were to take place in the day's last recorded trade. None of the 45,990 observations in our sample is a day of a single trade.

Table 3 reports the results of regressions with OLS and techniques based on one-way fixed effects (for time, which is the weekend) and two-way fixed effects (for time and the individual firm). The first column for each technique in each of Table 3's panels is devoted to a regression where the only independent variable is customer-shorted shares, and the second column includes both customer-shorted shares and dealer-shorted shares as independent

variables. (Note that in the fixed effects regressions, the fixed effect parameter estimates are not reported.) Several aspects of these estimates merit special attention.

First, the coefficients for CustSSVol(M-F) are negative in every case and statistically significant in 16 of the 18 regressions. These results imply that customer-based short-selling varies inversely with daily returns across the weekend, and seems to support the notion that speculative short-selling is at least partially responsible for the weekend effect in stock returns. However the size of the coefficient is rather small; the maximum parameter estimate (across all 18 regression estimations) in absolute value, is only 0.078 (see Panel C, OLS regression). That coefficient implies that a firm with a 0.127 value for CustSSVol(M-F) would have an associated weekend effect in returns of only -0.010%.[21] Therefore, despite the statistical significance of many of the coefficients for CustSSVol(M-F), the economic connection between the two weekend effects (speculative short-selling and returns) is slight.[22] This means, of course, that if speculative short-selling is actually responsible for some part of the weekend effect, its causative impact during our sample period would be very, small.

Second, each of the nine estimates involving TDeaSSVol(M-F) is statistically significant and positive. The positive sign, which reflects the dealer's use of shorted shares in market-making, shows that dealer short-selling has the opposite link from that of customer shorting, which posts only negative coefficients in the regressions. Other researchers should be cognizant of this finding: non-exempt short-selling is clearly not a homogenous category. As illustrated by these results, there are very distinct differences between customer and dealer shorting activities.

The third important aspect of Table 3 is the quite low R-squared (less than 1%) of every OLS regression. Though the R-squared for the panel regressions is somewhat higher at 20-25%,

[21] As shown in Panel C of Table 2, the mean value for CustSSVol(M-F) is 0.127. The mean weekend effect, Return%, (as shown in the same panel) is 0.560%.

[22] We believe it is quite important to focus on the economic significance of parameter estimates given our large sample size, and Lindley's (1957) paradox.

the bulk of that increase is clearly due to the inclusion of the time (weekend) variable, because the two-way fixed-effects (both time and the firm) regressions have little additional explanatory power. This result indicates that much of the weekend effect in a stock's returns is systematic, or reflective of market-wide phenomena, and is not closely related to short-selling in the stock by either customers or dealers. Indeed, to further investigate the linkage between speculative (customer) short-selling and the weekend effect in returns, we examine the resulting R-squared from estimating the three one-way fixed effects specifications while only including TDeaSSVol(M-F) (i.e. we did not include CustSSVol(M-F)). In each of these estimations, the R-squared was equivalent to the R-squared shown in each panel of Table 3 (0.116, 0.182, and 0.222 in Panels A, B, and C, respectively). Consequently, during the time period we examine, customer short-selling adds essentially no additional explanatory power in the model estimations. In sum, the results of these estimations do not support the Chen and Singal hypothesis that short-selling by speculators can explain a meaningful portion of the observed weekend effect in stock returns.

D. Check for Robustness: Subsamples Based on Firm Size

To determine if our inability to find an economically meaningful link between the weekend effects in returns and speculative short-selling is due to sample aggregation issues, we next repeat the full array of tests on three subsamples based on the size of the firms, as measured by median market capitalization during the sample period. The approach we utilize conforms to the spirit of Chen and Singal who control for market capitalization by sorting stocks into size deciles. Our large-cap subsample consists of the 357 firms with median market capitalization above $1 billion; the medium-cap subsample consists of the 244 with median market capitalization between $500 million and $1 billion; and the small-cap subsample consists of the 713 firms with median market capitalization below $500 million.

This partitioning by firm size is methodologically useful because it recognizes two key features of the market for equity lending. First, as D'Avolio (2002) shows, shares of the large firms are more readily available (or cheaper or both) for borrowing by short-sellers, because institutional investors, who make shares available for lending, are more likely to hold the stocks of large firms than of small firms. Second, exchange-traded put options – a practical substitute for short-selling, as Diamond and Verrecchia (1987) note – are offered more for shares of large companies than of small ones, and the liquidity of put options rises with the size of the firm whose shares underlie the options.

Table 4 presents the descriptive statistics for the subsamples. Interestingly, the means and medians show the weekend effect in returns is generally lower in absolute amount for the large-cap stocks of Panel A but is pronounced for the stocks of the medium and small firms of Panels B and C. The table also records that the percentage of volume attributable to customer-shorted shares is larger on Monday than on Friday in each panel. Finally, in all three groups, the percentages of volume for both dealer-shorted (non-exempt) shares and total dealer-shorted shares move differently from the percentage based on customer-shorted shares, because they are higher on Friday than on Monday.

Table 5 presents results from estimating equation (1) for each subsample. The coefficient estimates reported in the table are mostly similar in size and sign to those of earlier tests. The R-squared values in every panel are once again low and show that, regardless of the size of the firm, the weekend effects in both types of short-selling have at most an economically small association with the weekend effect in returns. As before in Table 3, the inclusion of the dummy variables for the weekends (the one-way fixed effects regression) creates the most substantial improvement in explanatory power, and this is a further indication that the weekend effect in returns is market-wide, rather than a phenomenon induced by speculative short-selling.

E. Convertible Arbitrage and Non-Exempt Customer Short-selling

Convertible bond arbitrage consists of buying the (inefficiently priced) convertible bonds of a company, while simultaneously shorting the underlying stock. This strategy leads to a fully hedged position, and results in arbitrage profits irrespective of the movement of the future stock price. Subject to certain conditions, NASD rules exempt short-selling related to convertible bond arbitrage from the bid-test.[23] However, some arbitrageurs may be reluctant to utilize the exemption because of aggravations associated with (i) setting up special accounts and/or (ii) facing potential future audit of the legitimacy of the claimed exempt activity. Therefore, some portion of hedged customer short-selling activity that could have qualified as "exempt" may have been executed and recorded in the ACT database as "non-exempt" (what we have categorized as "speculative") short-selling

To the extent that this type of activity occurred, it could introduce noise into our tests of the relationship between speculative short-selling and the weekend effect in returns. We do not, however, anticipate that the impact of this potential mis-categorization on our finding is substantial because once initiated, both the short and long positions of convertible bond arbitrage would be held until conversion, and not closed over weekends.

Nonetheless, to investigate the potential impact of this arbitrage on our results and conclusions, we deleted the 255 sampled firms that reported convertible debt on a balance sheet at any year-end 1999-2001 and reestimated equation (1). Table 6 contains results of this reestimation with the remaining 1,059 stocks. They are quite similar to those presented in Table 3: The estimated coefficients for CustSSVol(M-F) are rather small, and the R-squared values are quite low. The greatest improvement in R-squared once again comes from the inclusion of the weekend dummy variable in the one-way fixed effects regressions.

[23] See NASD Notice to Members 94-68.

We also investigated the potential impact of merger arbitrage on our findings and conclusions. According to SDC, 80 sample stocks that announced acquisitions during our sample period. The results from estimating equation (1) (not reported herein, but available from the authors upon request) on data not including the observations of these 80 firms are also very similar to the results reported already in this study. We conclude that the lack of any evidence of an economically meaningful linkage between speculative short-selling and the weekend effect in stock returns is not due to short sales motivated by either arbitrage of convertible bonds or merger-arbitrage.

F. Partitioning the Sample Period into Sub-Periods

Figure 1 shows that during our September 13, 2000 to July 10, 2001 sample period the starting and ending values of the NASDAQ Equally-Weighted Index are essentially equal. In contrast, over the same period of time the NASDAQ Value-Weighted index declined. We have argued that because our tests do not weight returns by firm size, the fact that the Value-Weighted Index was generally in decline does not introduce bias into our tests and results. It must be noted, however, that since the Equally-Weighted NASDAQ Index contains all NASDAQ stocks, whereas our sample selection criterion limits our analysis to only those stocks with 50 or more trades on average during each sample months, we may have eliminated from our sample many small firms with high idiosyncratic risk. Those small firms with high idiosyncratic risk are likely to have contributed substantially to the flatness that characterized the Equally-Weighted Index at the start and end of our sample period.

Therefore, to verify that our findings are not an artifact of a generally declining market, we examine three sub-periods of our sample period. The first sub-period contains the first 12 (out of 35) sample weekends. The mean (median) return for our full sample of stocks over these 12 weeks is -0.244% (-0.285%). The second sub-period contains the middle 11 sample

weekends. The mean (median) return for our full sample of stocks over these 11 weeks is -0.207% (-0.229%). And, the third sub-period contains the final 12 weekends. The mean (median) return for our full sample of stocks over these final 12 weeks is 0.190% (0.141%).[24]

Table 7 presents results from estimating equation (1) for each sub-period for the full sample of stocks (Panel A), the sample restricted to the upper half of sample stocks based upon the median ratio of shares shorted by customers to outstanding shares during the entire sample period (Panel B), and the sample restricted to the top quartile of sample stocks based upon the median ratio of shares shorted by customers to outstanding shares during the entire sample period (Panel C). To facilitate presentation, we only include results from the OLS and One-Way Fixed Effects regressions for the variation of equation (1) that contains both independent variables (CustSSVol(M-F) and TDeasSSVol(M-F)).[25]

The results shown in each panel for each sub-period are consistent with the results shown above. For each estimation, there is a negative relationship between speculative (customer) and the weekend effect in stock returns, and a positive relationship between dealer short-selling and the weekend effect in returns. However, as above, the R-Squared from the OLS estimations are low – indicating low explanatory power, and the increase in R-squared for the one-way fixed effects (weekend) specifications indicates that the weekend effect in returns is mostly driven by market-wide factors rather than speculative short-selling. In sum, a generally declining market is not responsible for the results reported in this study.

[24] Our initial inclination was to split the 35 weekends into two sub-periods. However, this approach resulted in samples with on-average negative returns during each of the sub-periods.
[25] The full set of estimation results is available from the authors upon request.

G. Final Robustness Tests

Though we do not report the results here, we also conducted estimations on partitions of our sample by trading volume, forming groups of the highest, middle, and lowest third of sample stocks according to their average daily number of shares traded during the sample period.[26] The results, which are available from us on request, are very similar to those reported above. That is, the goodness-of-fit test detects very little connection between weekend effects in returns and the types of short-selling, and the coefficients for the variables of short-selling are statistically significant, though quite small in importance from an economic perspective.

Finally, as a last robustness check we focus on the sample observations that have the most pronounced weekend effects in either returns or customer short-selling. The reason is that a link between weekend effects in the two variables, which our earlier tests did not detect, could well emerge from an analysis of the observations containing their extreme values. Thus, we apply equation (1) to the lowest quartile of sample observations according to the Monday-Friday difference in returns and then to the highest quartile according to the Monday-Friday difference in customer-shorted shares as a percentage of volume. Each quartile contains 11,497 observations. Table 8 contains the results of the regressions which show a generally negative and small coefficient for customer short-selling, and a very low goodness-of-fit that argues against the existence of an economically significant link between speculative short sales and the weekend effect in returns.

IV. Conclusion

We utilize daily short-selling data to examine the purported linkage between the weekend effect in stock returns and speculative short-selling. Our analysis focuses on a large and detailed

[26] Chen and Singal (2003) use volume as a proxy for the availability of put options.

dataset of daily transactions in NASDAQ stocks between 2000 and 2001. The dataset is unique because it allows us to separate short sales by speculating customers from those by dealers, and short sales that are exempt from the NASDAQ bid-test from those that are not. During our sample period, the stocks display a substantial weekend effect in returns, with the effect being largest for the smallest firms.

We find that short-selling by customers (i.e., speculative short-selling) displays a weekend effect, because this type of short-selling constitutes a larger percentage of volume on Monday than on Friday; again, this difference is higher in the smaller firms. We also find that short-selling by dealers contains a weekend effect, but it is distinctly different from (and opposite to) the effect for customers because dealer-shorted shares consistently make up a larger portion of volume on Friday than on Monday. The use of short-selling by dealers to bring liquidity and stability to the market via their market-making activities is the reasonable explanation for this phenomenon. The distinct differences between customer and dealer short-selling behavior suggest that these two categories should not be treated as homogenous in academic research.

Finally, although we examine a variety of econometric specifications, and despite considering several different stratifications of the sampled stocks, our estimations indicate that speculative short-selling does not account for an economically meaningful portion of the weekend effect in returns, even among the firms that are most actively shorted. Instead, the weekend effect seems to be the result of other market-wide, systematic factors. Consequently, the weekend effect in stock returns remains an unresolved phenomenon.

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Figure 1

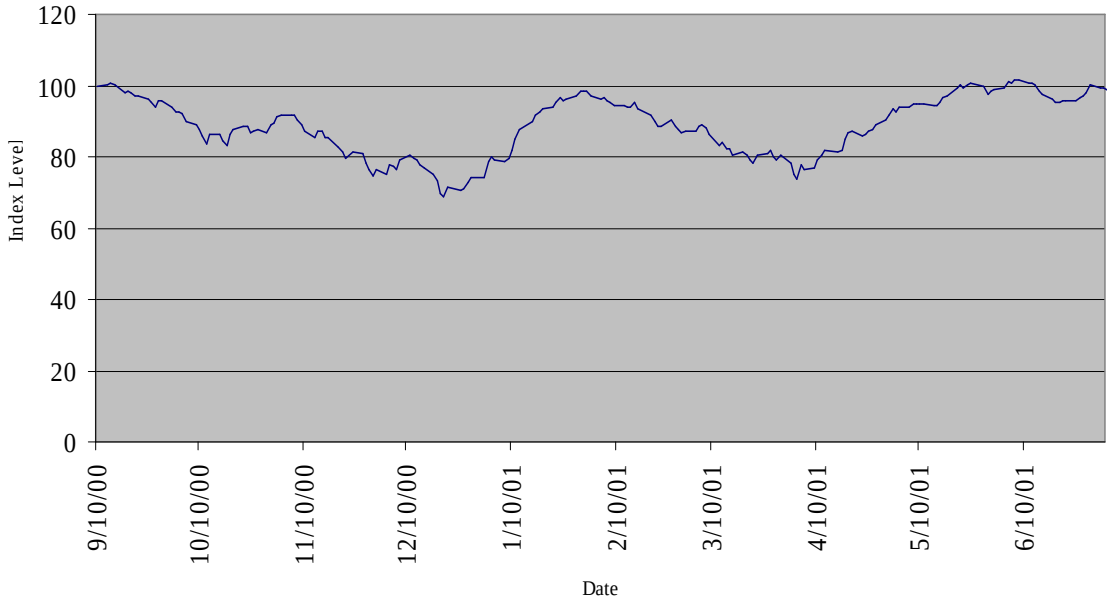
Nasdaq Equally Weighted Index
September 10, 2000 - July 3, 2001
Index Level
120
100
80
60
40
20
0
9/10/00
10/10/00
11/10/00
12/10/00
1/10/01
2/10/01
3/10/01
4/10/01
5/10/01
6/10/01
Date

Table 1

Day-of-the-Week Values for Returns, Trading Volume, and Short-selling by Customers and Dealers: NASDAQ Stocks from September 13, 2000 to July 10,2001

The cells labeled M, T, etc. contain the means and medians of daily returns, trading volume, and measures of short-selling. Panel A has 45,990 observations, or 35 five-day weeks x 1,314 stocks. Panels B and C have observations for 657 and 329 stocks, respectively.

Panel A: Full Sample (n=45,990)

	M	T	W	Th	F
Return (%)	-0.651	0.358	-0.395	0.034	-0.054
	-0.574	0.000	-0.544	-0.182	-0.400
Volume (000s of shares)	1,112	1,219	1,360	1,308	1,286
	224	236	248	241	239
Customer-Shorted Shares	40,907	44,224	48,907	47,905	44,169
	2,739	2,600	2,900	2,7000	2,700
Customer-Shorted Shares As %	3.15	3.02	3.02	3.01	3.01
of Volume	1.24	1.14	1.17	1.13	1.14
Dealer-Shorted Shares	217,598	240,888	265,505	256,807	257,191
	45,054	48,500	50,541	48,851	49,475
Dealer-Shorted Shares As % of	21.15	21.40	21.23	21.18	21.66
Volume	20.45	20.67	20.54	20.38	20.88
Customer-Shorted Exempt	948	1070	1,305	1321	1,938
Shares	0	0	0	0	0
Customer-Shorted Exempt	0.06	0.05	0.06	0.05	0.15
Shares As % of Volume	0.00	0.00	0.00	0.00	0.00
Dealer-Shorted Exempt Shares	25,156	27,496	30,364	29,251	31,754
	2,858	3,000	3200	3,100	3,125
Dealer-Shorted Exempt Shares	2.23	2.26	2.23	2.21	2.45
As % of Volume	1.21	1.19	1.20	1.18	1.24

Panel B: Stocks in the Upper Half of the Sample, by Median Ratio of Shares Shorted by Customers to Outstanding Shares (n=22,995)

	M	T	W	Th	F
Return (%)	-0.692	0.468	-0.239	0.135	-0.097
	-0.650	0.197	-0.532	-0.222	-0.498
Volume (000s of shares)	1,983	2,177	2,446	2,348	2,303
	449	477	508	500	489
Customer-Shorted Shares	77,846	84,177	93,353	91,493	83,889
	12,300	12,441	13,300	12,700	12,615
Customer-Shorted Shares As %	4.48	4.31	4.29	4.32	4.33
of Volume	2.70	2.55	2.58	2.53	2.52
Dealer-Shorted Shares	383,372	425,887	472,831	456,142	455,496
	93,710	100,980	105,951	103,301	102,294
Dealer-Shorted Shares As % of	20.95	21.16	21.05	20.99	21.35
Volume	20.32	20.50	20.46	20.25	20.63
Customer-Shorted Exempt	1,791	2,063	2,484	2,546	3,529
Shares	0	0	0	0	0
Customer-Shorted Exempt	0.08	0.07	0.08	0.07	0.14
Shares As % of Volume	0.00	0.00	0.00	0.00	0.00
Dealer-Shorted Exempt Shares	43,282	47,237	52,916	50,867	54,448
	5,700	6,000	6,700	6,300	6,388
Dealer-Shorted Exempt Shares	1.97	1.96	1.97	1.93	2.13
As % of Volume	1.25	1.22	1.25	1.23	1.27

Panel C: Stocks in the Top Quartile of the Sample, by Median Ratio of Shares Shorted by Customers to Outstanding Shares (n=11,515)					
	M	**T**	**W**	**Th**	**F**
Return (%)	-0.740	0.568	-0.194	0.097	-0.181
	-0.811	0.255	-0.589	-0.354	-0.548
Volume (000s of shares)	2,887	3,199	3,604	3,434	3,312
	842	908	988	960	915
Customer-Shorted Shares	126,843	137,606	152,974	149,050	136,739
	33,100	34,217	38,310	36,700	35,684
Customer-Shorted Shares As % of Volume	5.36	5.19	5.17	5.24	5.23
	3.71	3.58	3.63	3.63	3.54
Dealer-Shorted Shares	547,468	613,259	682,613	655,341	642,024
	174,410	186,963	203,773	194,011	193,598
Dealer-Shorted Shares As % of Volume	20.50	20.69	20.55	20.45	20.83
	19.89	20.09	19.99	19.75	20.19
Customer-Shorted Exempt Shares	2,426	2,829	3,525	3,545	4,653
	0	0	0	0	0
Customer-Shorted Exempt Shares As % of Volume	0.09	0.08	0.10	0.09	0.14
	0.00	0.00	0.00	0.00	0.00
Dealer-Shorted Exempt Shares	61,124	67,886	76,477	72,576	75,283
	11,800	12,800	13,800	12,800	13,290
Dealer-Shorted Exempt Shares As % of Volume	1.90	1.90	1.86	1.86	2.01
	1.34	1.33	1.32	1.32	1.35

Table 2

Weekend Effects in Returns and Short-selling by Customers and Dealers: NASDAQ Stocks from September 13, 2000 to July 10, 2001

Each variable is computed as Monday's value minus the previous Friday's value. The variable "Total Dealer-Shorted Shares" equals dealer-shorted exempt and non-exempt shares. A cell contains a mean with the p-value in parentheses corresponding to t-statistic or a median with the p-value in parentheses from a Sign-test. Panel A reports results for 1,314 stocks over 35 five-day weeks. Panels B and C have, for the same 35 weeks, observations for 657 and 329 stocks, respectively. Note: Every mean is significantly different from zero with a p-value of 1.6% or lower; every median is significantly different from zero with a p-value lower than 1%. See text for a discussion of the zero-valued median in Panel A.

	Mean	**Median**
Panel A: Full Sample (n=45,990)		
Return (%)	-0.597	-0.277
	(0.000)	(0.000)
Customer-Shorted Shares As % of Volume	0.133	0.000
	(0.000)	(0.000)
Dealer-Shorted Shares As % of Volume	-0.505	-0.412
	(0.000)	(0.000)
Total Dealer-Shorted Shares As % of Volume	-0.728	-0.537
	(0.000)	(0.000)
Panel B: Stocks in the Upper Half of the Sample, by Median Ratio of Shares Shorted by Customers to Outstanding Shares (n=22,995)		
Return (%)	-0.595	-0.313
	(0.000)	(0.000)
Customer-Shorted Shares As % of Volume	0.156	0.048
	(0.000)	(0.000)
Dealer-Shorted Shares As % of Volume	-0.393	-0.325
	(0.000)	(0.000)
Total Dealer-Shorted Shares As % of Volume	-0.553	-0.420
	(0.000)	(0.000)
Panel C: Stocks in the Top Quartile of the Sample, by Median Ratio of Shares Shorted by Customers to Outstanding Shares (n=11,515)		
Return (%)	-0.560	-0.384
	(0.000)	(0.000)
Customer-Shorted Shares As % of Volume	0.127	0.073
	(0.016)	(0.002)
Dealer-Shorted Shares As % of Volume	-0.325	-0.325
	(0.000)	(0.000)
Total Dealer-Shorted Shares As % of Volume	-0.442	-0.411
	(0.000)	(0.000)

Table 3

OLS and Panel Regressions of Weekend Returns on Weekend Short-selling by Customers and Dealers: NASDAQ Stocks from September 13, 2000 to July 10, 2001

The equation used in the regressions is this: $R(M\text{-}F)_{it} = \beta_0 + \beta_1 CustSSVol(M\text{-}F)_{it} + \beta_2 TDeaSSVol(M\text{-}F)_{it} + e_{it}$,, where (M-F) is the Monday-Friday difference, R is return, CustSSVol is the customer-shorted shares as % of trading volume, TDeaSSVol is the total dealer-shorted shares (exempt and non-exempt) as % of trading volume, i refers to the stock and t to the weekend, and e is the disturbance term. OLS, one-way (time) fixed-effects, and two-way (time and firm) fixed-effects regressions. Panel A reports results for 1,314 stocks over 35 five-day weeks. Panels B and C have, for the same 35 weeks, observations for 657 and 329 stocks, respectively. The dependent and independent variables are computed as the Monday value less the previous Friday's value. Standard errors are in parentheses. ***, **, and * indicate significance at 1%, 5%, and 10%.

Panel A: Full Sample (n=45,990)

	OLS		One-Way Fixed Effect		Two-Way Fixed Effect	
β_0	-0.590***	-0.554***	NA	NA	NA	NA
	(0.046)	(0.046)				
CustSSVol(M-F)	-0.049***	-0.042***	-0.031***	-0.029***	-0.035***	-0.031***
	(0.009)	(0.009)	(0.008)	(.008)	(0.008)	(0.008)
TDeaSSVol(M-F)		0.051***		0.041***		0.041***
		(0.004)		(0.003)		(0.003)
$\mathbf{R^2}$	0.001	0.005	0.113	0.116	0.144	0.150

Panel B: Stocks in the Upper Half of Sample, by Median Ratio of Shares Shorted by Customers to Outstanding Shares (n=22,995)

	OLS		One-Way Fixed Effect		Two-Way Fixed Effect	
β_0	-0.586***	-0.554***	NA	NA	NA	NA
	(0.059)	(0.059)				
CustSSVol(M-F)	-0.057***	-0.050***	-0.030**	-0.025***	-0.033***	-0.028***
	(0.010)	(0.010)	(0.009)	(0.009)	(0.010)	(0.010)
TDeaSSVol(M-F)		0.060***		0.045***		0.045***
		(0.006)		(0.005)		(0.005)
$\mathbf{R^2}$	0.001	0.006	0.179	0.182	0.207	0.210

Panel C: Stocks in the Top Quartile of the Sample, by Median Ratio of Shares Shorted by Customers to Outstanding Shares (n=11,515)

	OLS		One-Way Fixed Effect		Two-Way Fixed Effect	
β_0	-0.550***	-0.519***	NA	NA	NA	NA
	(0.084)	(0.084)				
CustSSVol(M-F)	-0.078***	-0.069***	-0.025*	-0.018	-0.026**	-0.020
	(0.015)	(0.015)	(0.013)	(0.013)	(0.013)	(0.013)
TDeaSSVol(M-F)		0.073**		0.058***		0.057***
		(0.006)		(0.013)		(0.008)
$\mathbf{R^2}$	0.002	0.008	0.218	0.222	0.249	0.252

Table 4

Weekend Returns and Short-selling by Customers and Dealers in NASDAQ Stocks Grouped by Market Capitalization: September 13, 2000 to July 10, 2001

Each variable is computed as Monday's value minus the previous Friday's value. The variable "Total Dealer-shorted Shares" equals dealer-shorted non-exempt plus dealer-shorted exempt shares. A cell contains a mean with the p-value in parentheses corresponding to t-statistic or a median with the p-value in parentheses from a Sign-test. Panel A reports results for the 357 stocks with median market capitalization greater than $1 billion during the 35-week sample period. Panels B and C have results for 244 stocks with median market capitalizations between $500 million and $1 billion and 713 stocks with median capitalization less than $500 million, respectively.

	Mean	Median
Panel A. Stocks with Median Market Capitalization greater than $1 Billion (n=12,495)		
Return (%)	-0.316	-0.142
	(0.000)	(0.002)
Customer-Shorted Shares As % of Volume	0.107	0.055
	(0.011)	(0.000)
Dealer-Shorted Shares As % of Volume	-0.461	-0.323
	(0.000)	(0.000)
Total Dealer-Shorted Shares As % of Volume	-0.660	-0.472
	(0.000)	(0.000)
Panel B. Stocks with Median Market Capitalization between $1 Billion and $500 Million (n=8,540)		
Return (%)	-0.703	-0.209
	(0.000)	(0.000)
Customer-Shorted Shares As % of Volume	0.059	0.000
	(0.363)	(0.391)
Dealer-Shorted Shares As % of Volume	-0.601	-0.462
	(0.000)	(0.001)
Total Dealer-Shorted Shares As % of Volume	-0.761	-0.542
	(0.000)	(0.000)
Panel C. Stocks with Median Market Capitalization below $500 Million (n=24,955)		
Return (%)	-0.701	-0.378
	(0.000)	(0.000)
Customer-Shorted Shares As % of Volume	0.172	0.000
	(0.000)	(0.000)
Dealer-Shorted Shares As % of Volume	-0.494	-0.466
	(0.000)	(0.000)
Total Dealer-Shorted Shares As % of Volume	-0.752	-0.578
	(0.000)	(0.000)

Table 5

OLS and Panel Regressions of Weekend Returns on Weekend Short-selling by Customers and Dealers: NASDAQ Stocks Grouped by Market Capitalization from September 13, 2000 to July 10, 2001

OLS, one-way (time) fixed-effects, and two-way (time and firm) fixed-effects regressions for this equation: $R(M\text{-}F)_{it} = \beta_0 + \beta_1 CustSSVol(M\text{-}F)_{it} + \beta_2 TDeaSSVol(M\text{-}F)_{it} + e_{it}$, where (M-F) is the Monday-Friday difference, R is return, CustSSVol is the customer-shorted shares as % of trading volume, TDeaSSVol is the total dealer-shorted shares (exempt and non-exempt) as % of trading volume, i refers to the stock and t to the weekend, and e is the disturbance term. The dependent and independent variables are computed as the Monday value less the previous Friday's value. Panel A reports results for the 357 stocks with median market capitalization greater than $1 billion during the 35-week sample period. Panels B and C have results for 244 stocks with median market capitalizations between $500 million and $1 billion and 713 stocks with median market capitalization less than $500 million, respectively. Standard errors are in parentheses. ***, **, and * indicate significance at 1%, 5%, and 10%.

Panel A. Stocks with Median Market Capitalization greater than $1 Billion (n=12,495)						
	OLS		**One-Way Fixed Effect**		**Two-Way Fixed Effect**	
B_0	-0.309***	-0.281***	NA	NA	NA	NA
	(0.073)	(0.073)				
CustSSVol(M-F)	-0.067***	-0.061***	-0.035**	-0.031**	-0.033**	-0.029**
	(0.016)	(0.016)	(0.014)	(0.014)	(0.014)	(0.014)
TDeaSSVol(M-F)		0.043***		0.035***		0.035***
		(0.007)		(0.007)		(0.007)
R^2	0.001	0.004	0.199	0.200	0.227	0.229
Panel B. Stocks with Median Market Capitalization between $1 Billion and $500 Million (n=8,540)						
	OLS		**One-Way Fixed Effect**		**Two-Way Fixed Effect**	
B_0	-0.701***	-0.667***	NA	NA	NA	NA
	(0.092)	(0.092)				
CustSSVol(M-F)	-0.034**	-0.030**	-0.023*	-0.020	-0.026*	-0.023*
	(0.015)	(0.015)	(0.014)	(0.014)	(0.014)	(0.014)
TDeaSSVol(M-F)		0.046***		0.031***		0.032***
		(0.007)		(0.007)		(0.007)
R^2	0.001	0.005	0.177	0.180	0.206	0.208
Panel C. Stocks with Median Market Capitalization below $500 Million (n=24,955)						
	OLS		**One-Way Fixed Effect**		**Two-Way Fixed Effect**	
B_0	-0.693***	-0.653***	NA	NA	NA	NA
	(0.069)	(0.069)				
CustSSVol(M-F)	-0.048***	-0.040***	-0.041***	-0.035***	-0.043***	-0.037***
	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)
TDeaSSVol(M-F)		0.055***		0.046***		0.044***
		(0.005)		(0.005)		(0.005)
R^2	0.001	0.006	0.085	0.088	0.117	0.120

Table 6
OLS and Panel Regressions of Weekend Returns on Weekend Short-selling by Customers and Dealers: NASDAQ Stocks from September 13, 2000 to July 10, 2001

Results After Dropping Firms with Convertible Debt in Either 1999, 2000, or 2001

The equation used in the regressions is this: $R(M\text{-}F)_{it} = \beta_0 + \beta_1 CustSSVol(M\text{-}F)_{it} + \beta_2 TDeaSSVol(M\text{-}F)_{it} + e_{it}$,, where (M-F) is the Monday-Friday difference, R is return, CustSSVol is the customer-shorted shares as % of trading volume, TDeaSSVol is the total dealer-shorted shares (exempt and non-exempt) as % of trading volume, i refers to the stock and t to the weekend, and e is the disturbance term. OLS, one-way (time) fixed-effects, and two-way (time and firm) fixed-effects regressions. Panel A reports results for 1,059 stocks over 35 five-day weeks. Panels B and C have, for the same 35 weeks, observations for 495 and 219 stocks, respectively. The dependent and independent variables are computed as the Monday value less the previous Friday's value. Standard errors are in parentheses. ***, **, and * indicate significance at 1%, 5%, and 10%.

Panel A: Full Sample (n=37,065)

	OLS		One-Way Fixed Effect		Two-Way Fixed Effect	
β_0	-0.578***	-0.542***	NA	NA	NA	NA
	(0.050)	(0.050)				
CustSSVol(M-F)	-0.049***	-0.044***	-0.038***	-0.033***	-0.039***	-0.035***
	(0.010)	(0.010)	(0.009)	(.009)	(0.009)	(0.009)
TDeaSSVol(M-F)		0.051***		0.041***		0.041***
		(0.004)		(0.004)		(0.004)
$\mathbf{R^2}$	0.001	0.006	0.109	0.112	0.139	0.142

Panel B: Stocks in the Upper Half of Sample, by Median Ratio of Shares Shorted by Customers to Outstanding Shares (n=17,325)

	OLS		One-Way Fixed Effect		Two-Way Fixed Effect	
β_0	-0.590***	-0.562***	NA	NA	NA	NA
	(0.068)	(0.068)				
CustSSVol(M-F)	-0.060***	-0.054***	-0.037***	-0.032***	-0.040***	-0.036***
	(0.012)	(0.012)	(0.011)	(0.011)	(0.011)	(0.011)
TDeaSSVol(M-F)		0.059***		0.045***		0.044***
		(0.006)		(0.006)		(0.006)
$\mathbf{R^2}$	0.002	0.007	0.170	0.173	0.198	0.201

Panel C: Stocks in the Top Quartile of the Sample, by Median Ratio of Shares Shorted by Customers to Outstanding Shares (n=7,665)

	OLS		One-Way Fixed Effect		Two-Way Fixed Effect	
β_0	-0.592***	-0.566***	NA	NA	NA	NA
	(0.103)	(0.103)				
CustSSVol(M-F)	-0.069***	-0.060***	-0.023	-0.017	-0.025	-0.019
	(0.017)	(0.017)	(0.015)	(0.015)	(0.016)	(0.016)
TDeaSSVol(M-F)		0.068***		0.056***		0.055***
		(0.011)		(0.010)		(0.010)
$\mathbf{R^2}$	0.002	0.007	0.202	0.205	0.232	0.236

Table 7

OLS and Panel Regressions of Weekend Returns on Weekend Short-selling by Customers and Dealers: Partitioning the Sample Period into Sub-Periods

Results from estimating $R(M\text{-}F)_{it} = \beta_0 + \beta_1 CustSSVol(M\text{-}F)_{it} + \beta_2 TDeaSSVol(M\text{-}F)_{it} + e_{it}$, where (M-F) is the Monday-Friday difference, R is return, CustSSVol is the customer-shorted shares as % of trading volume, TDeaSSVol is the total dealer-shorted shares (exempt and non-exempt) as % of trading volume, i refers to the stock and t to the weekend, and e is the disturbance term. OLS, and one-way (time) fixed-effects regressions. Panel A reports results for 1,314 stocks during each of the sample sub-periods. Panels B and C have, for the same sub-periods, observations for 657 and 329 stocks, respectively. The dependent and independent variables are computed as the Monday value less the previous Friday's value. Standard errors are in parentheses. ***, **, and * indicate significance at 1%, 5%, and 10%.

	First 12 Weeks (n=15,768)		Middle 11 Weeks (n=14,454)		Last 12 Weeks (n=15,768)	
Panel A: Full Sample						
	OLS	**One-Way Fixed Effect**	**OLS**	**One-Way Fixed Effect**	**OLS**	**One-Way Fixed Effect**
β_0	-1.866***	NA	1.399***	NA	-1.021***	NA
	(0.077)		(0.076)		(0.083)	
CustSSVol(M-F)	-0.034**	-0.026*	-0.028*	-0.025*	-0.054***	-0.037**
	(0.015)	(.014)	(0.015)	(.014)	(0.015)	(.015)
TDeaSSVol(M-F)	0.040***	0.044***	0.045***	0.054***	0.062***	0.031***
	(0.007)	(0.007)	(0.006)	(0.006)	(0.006)	(0.005)
R^2	0.003	0.075	0.004	0.091	0.009	0.125
Panel B: Stocks in the Upper Half of the Sample, by Median Ratio of Shares Shorted by Customers to Outstanding Shares						
	First 12 Weeks (n=7,884)		**Middle 11 Weeks (n=7,227)**		**Last 12 Weeks (n=7,884)**	
β_0	-2.038***	NA	1.788***	NA	-1.231***	NA
	(0.102)		(0.102)		(0.059)	
CustSSVol(M-F)	-0.041**	-0.026	-0.029	-0.012	-0.061***	-0.036**
	(0.018)	(0.017)	(0.018)	(0.017)	(0.017)	(0.015)
TDeaSSVol(M-F)	0.025**	0.032***	0.054***	0.062***	0.083***	0.038***
	(0.011)	(0.010)	(0.010)	(0.009)	(0.008)	(0.008)
R^2	0.002	0.113	0.005	0.142	0.014	0.208
Panel C: Stocks in the Top Quartile of the Sample, by Median Ratio of Shares Shorted by Customers to Outstanding Shares						
	First 12 Weeks (n=3,948)		**Middle 11 Weeks (n=3,619)**		**Last 12 Weeks (n=3,948)**	
	-2.189***	NA	2.059***	NA	-1.217***	NA
	(0.144)		(0.144)		(0.140)	
	-0.029	-0.007	-0.053**	-0.020	-0.081***	-0.033
	(0.024)	(0.023)	(0.027)	(0.025)	(0.022)	(0.020)
	0.041**	0.057***	0.077***	0.079***	0.082***	0.034***
	(0.017)	(0.016)	(0.017)	(0.016)	(0.014)	(0.012)
	0.001	0.149	0.007	0.165	0.013	0.221

Table 8

OLS and Panel Regressions for the Lowest Quartile by Weekend Effect in Returns and for the Highest Quartile by Customer-Shorted Shares as a Percentage of Volume: NASDAQ Stocks from September 13, 2000 to July 10, 2001

OLS, one-way (time) fixed-effects, and two-way (time and firm) fixed-effects regressions for this equation: $R(M\text{-}F)_{it} = \beta_0 + \beta_1\, CustSSVol(M\text{-}F)_{it} + \beta_2\, TDeaSSVol(M\text{-}F)_{it} + e_{it}$,, where (M-F) is the Monday-Friday difference, R is return, CustSSVol is the customer-shorted shares as % of trading volume, TDeaSSVol is the total dealer-shorted shares (exempt and non-exempt) as % of trading volume, i refers to the stock and t to the weekend, and e is the disturbance term. The dependent and independent variables are computed as the Monday value less the previous Friday's value. Panel A reports results for the 11,497 observations that comprise the lowest quartile of the sample in terms of R(M-F). Panel B presents results for the 11,497 observations that constitute the highest quartile in terms of CustSSVol(M-F). Standard errors are in parentheses. ***, **, and * indicate significance at 1%, 5%, and 10%.

Panel A. Quartile with Lowest Weekend Effect in Returns, R(M-F) (n=11,497)

	OLS		One-Way Fixed Effect		Two-Way Fixed Effect	
β_0	-11.891***	-11.843***	NA	NA	NA	NA
	(0.077)	(0.078)				
CustSSVol(M-F)	-0.015	-0.012	0.001	0.001	-0.001	-0.001
	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)
TDeaSSVol(M-F)		0.023***		0.008		0.013**
		(0.006)		(0.006)		(0.006)
$\mathbf{R^2}$	0.000	0.001	0.073	0.074	0.216	0.217

Panel B. Quartile with Highest Weekend Effect in Customer-Shorted Shares as a Percentage of Volume, CustSSVol(M-F) (n=11,497)

	OLS		One-Way Fixed Effect		Two-Way Fixed Effect	
β_0	-1.087***	-1.025***	NA	NA	NA	NA
	(0.123)	(0.121)				
CustSSVol(M-F)	-0.026	-0.020	-0.040***	-0.036**	-0.049***	-0.044***
	(0.017)	(0.017)	(0.016)	(0.016)	(0.017)	(0.017)
TDeaSSVol(M-F)		0.060***		0.044***		0.045***
		(0.007)		(0.007)		(0.007)
$\mathbf{R^2}$	0.000	0.006	0.141	0.144	0.259	0.262

Appendix

The reporting protocol of the ACT data does not allow us to state with confidence that speculative short sales account for none (or at most very few) of the recorded dealer-shorted non-exempt shares in a stock. We believe, however, that it is possible to craft a test that reveals the likelihood that market-making rather than speculation largely determines the number of dealer-shorted shares. That test measures the strength of the daily association between the number of dealer-shorted non-exempt shares and the number of customer-shorted non-exempt shares in a stock. The rationale for the test is that a stock's non-exempt customer-shorted shares result largely, if not exclusively, from speculative short-selling and that day-to-day changes in this variable reliably convey changes in investors' readiness to speculate on the stock. (See our discussion of the structure and interpretation of ACT data.) If speculative short-selling by dealers typically accounts for a substantial number of reported dealer-shorted shares, then the test should uncover at least some synchronicity in the daily movement of the two sets of non-exempt shorted shares.

Two facts support this presumption of a measurable amount of synchronicity. First, dealers monitor all their customers' orders and can exploit the information contained in them. A sudden increase in short-sell orders for a stock might prompt a dealer to take similar positions, while a dealer might well be reluctant to engage in short-selling when customers are placing few or no orders for short sales. Such behavior by dealers would resemble the "payment for order flow" that became a prominent feature of the stock market some years ago (Battalio, Jennings, and Selway (2001)). Second, dealers who want to profit from short-selling have the same means as their customers of finding attractive targets. There is no reason to believe that these dealers would be systematically faster or slower – or, even more absurdly, always either faster or slower – than customers in locating potentially over-priced stocks and selling the shares short. Given that dealers can readily augment their own research by surveying customer short-sell orders, the probability is high that speculation by dealers, if it occurs, has some correlation with speculation by customers.

The test, therefore, consists of finding – for each stock – the extent of the connection between the daily number of dealer-shorted shares and the daily number of customer-shorted shares. The equation used in the test is this:

$$DeaSSVol_{it} = \gamma_0 + \gamma_1 CustSSVol_{it} + \eta_{it.} \quad (A.1)$$

Here DeaSSVol is dealer-shorted non-exempt shares as a percentage of volume, CustSSVol is customer-shorted non-exempt shares similarly normalized, subscripts i and t refer to the stock and to the day, and η is the disturbance term. With OLS regression, we fit this equation to 207 days of data for each of the 1,314 stocks in our sample. If dealers in a stock do regularly engage in a meaningful amount of speculative short-selling, then γ_1 for that stock should be positive and significant and the regression should produce a convincing goodness-of-fit statistic. If, on the other hand, this regression for a stock generates a statistically insignificant coefficient for CustSSVol and a low R-squared, there would be little reason to believe that a substantial portion of dealer-shorted shares in that stock is regularly attributable to speculation.

Table A.1 reports the results of the test, which reveal very little similarity in the daily patterns of short-selling by customers and by dealers across the stocks in our sample. Most of the 1,314 estimates of γ_1 are quite small and only five percent of them are both statistically significant and positive.[27] Also, the values of R-squared are so low that customer short-selling seems almost completely divorced from dealers' decisions to sell short. In our view, the obvious conclusion to be drawn from the test is that there is only a limited probability that a meaningful number of the recorded dealer-shorted non-exempt shares regularly reflects speculation.

[27] Few of these regressions suffered from auto-correlation in the error terms.

Table A.1

Regression Tests of Daily Association between Customer-Shorted and Dealer-Shorted Shares in NASDAQ Stocks between September 13, 2000 and July 10, 2001

The table reports on key aspects of the regression of equation A.1: $DeaSSVol_{it} = \gamma_0 + \gamma_1 CustSSVol_{it} + \eta_{it}$. DeaSSVol is dealer-shorted shares as a percentage of volume, CustSSVol is customer-shorted shares as a percentage of volume, i refers to the stock, and t to the day. In all, 1,314 regressions were conducted, and each regression was based on 207 daily observations.

	Estimates of γ_0	**Estimates of γ_1**	**R-squared**
Mean / Standard Deviation	21.53 / 2.76	-0.06 / 0.32	0.01 / 0.02
Number Positive / Negative	1,314 / 0	489 / 825	--
Number Positive and Significant at 5% or lower	1,314	68	--