Short Selling and the Weekend Effect for NYSE Securities

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Abstract:

We examine the relation between short selling and the weekend effect using short sale transactions data. We test the Chen and Singal (2003) hypothesis that speculative short sellers close out their position on Friday and reopen their position on the following Monday, hence, adding to the weekend effect. We do not find evidence of this hypothesis for our sample. We do not find that short selling is more abundant on Monday than on Friday, even for stocks that have higher Friday returns. Instead, we find that short sellers execute more short sale volume during the middle of the week. Our evidence is consistent with other research [Diether, Lee, and Werner (2007)] that shows short sellers are contrarian in contemporaneous returns. We find that the positive correlation between short selling and returns on Monday is greater, on average, than the correlation on the other days of the week. The results are robust to subsamples of stocks with larger weekend effects and stocks that do not have listed options.

I. Introduction

Chen and Singal (2003) hypothesize that the behavior of speculative short sellers adds to the weekend effect because of added selling pressure on Monday. Chen and Singal argue that speculative short sellers face risk in holding positions over the weekend and will, therefore, close their positions on Friday and reopen their positions on the following Monday. The closing of short positions on Friday and the reopening of these positions on the following Monday may partially explain of the weekend effect. We test the Chen and Singal hypothesis in a different time period using short sale transactions data. We do not find evidence supporting the Chen and Singal hypothesis for our sample time period. Rather, we find evidence suggesting that short selling is more abundant during the middle of the week. Further, we find that daily returns are positively correlated with daily short selling activity, supporting the notion that short sellers are contrarian in contemporaneous returns [e.g. Diether, Lee, and Werner (2007)]. We find that the positive correlation between returns and short selling activity is greater, on average, on Monday than on other days, which is contrary to the prediction of the Chen and Singal hypothesis.

A number of studies examine the weekend effect. Lakonishok and Maberly (1990) and Dyl and Maberly (1992) suggest that individual investors may be responsible for trading pattern anomalies that lead to the weekend effect. Specifically, Lakonishok and Maberly (1990) find evidence that individuals increase the selling of stocks relative to buying on Monday, thereby, adding to the weekend effect. Miller (1988) also finds that lower Monday returns are caused by individual investors. Although individual investors may partially explain the weekend effect, Rogalski (1984) finds that a portion of the weekend effect can be attributed to the non-trading weekend. He finds that most of the negative Friday close-to-Monday close returns occur during the non-trading weekend and are apparent by negative Friday close to Monday open returns. Harris (1986), while looking at open-to-close returns, finds that the weekend effect occurs in the first 45 minutes of Monday's trading. The literature suggests that the weekend effect depends on the amount of information entering the market during non-trading hours. The intuition of the Chen and Singal (2003) hypothesis is that information entering during non-trading hours (weekend) presents risk to speculative short sellers. Potential information arriving during the weekend motivates speculative short sellers to close positions on Friday and reopen positions on the following Monday, thus lowering Monday's returns relative to Friday's returns.

Keim and Stambaugh (1984) show that the weekend effect varies across firm size and that Friday's returns and the following Monday's returns are positively correlated. Abraham and Ikenberry (1994) also present evidence that suggests that Monday's return has a strong relationship to Friday's return. Specifically, when Friday's return is negative, Monday's return is negative nearly 80% of the time. In Wang, Li, and Erickson's (1997) investigation of the weekend effect, the authors find that negative Monday returns are significantly greater in the last two weeks of the month. That is, they find that the weekend effect is much larger during the last two weeks of the month than during the first of the month.

Our initial investigation into the weekend effect is to understand the role of short-selling in explaining differences between Friday's return and Monday's return. Diamond and Verrecchia (1987) posit that a significant portion of short sales are executed by investors with information regarding a certain security. The recent consensus in the literature is that short sellers are informed about the true value of stocks. Using intraday short sale data from the Australian Stock Exchange, Aitken, Frino, McCorry, and Swan (1998) examine the price reaction to short sales and find that abnormal returns decrease almost immediately after a short sale.[1] Their findings are consistent with Diamond and Verrecchia, who hypothesize that informed short interest leads to an adjustment in prices. Senchalk and Starks (1993) also find evidence for the Diamond and Verrecchia hypothesis. The authors find that unexpected increases in short interest yield significantly negative, although relatively small, abnormal returns. Desai, Ramesh, Thiagarajan, and Balachandran (2002) examine the relation between the level of short interest and returns. They find that the increases in the level of short interest significantly decrease returns for NASDAQ stocks. Further, they find that heavily shorted stocks experience negative returns. Kadiyala and Vetsuypens (2002) find that monthly short interest declines around positive signals for a sample of favorably performing stocks, suggesting that short sales can measure investor sentiment.

Boehmer, Jones, and Zhang (2007), using short sale transaction data, find evidence of the Diamond and Verrecchia (1987) hypothesis as stocks that are lightly shorted outperform stocks that are heavily shorted. The authors find that a large portion of short volume is made up from institutional traders who are likely more informed than individual traders [Lo and MacKinnley (1990), Chakravarty and McConnell (1997), and Binay (2005)]. Christophe, Ferri, and Angel (2004) find a negative relation between short selling and future abnormal returns on NASDAQ. Further, they find that informed

[1] The Australian Stock Exchange makes short sales transparent to the market upon execution.

traders abnormally increase the level of short sales for stocks with negative earnings announcements during their pre-announcement periods.

Examining the behavior of short sellers, Diether et al. (2007) find that short sellers are contrarian rather than momentum traders. That is, they find that short selling increases after a period of high returns. They also find that short sellers are contrarian in contemporaneous returns suggesting that daily short selling and daily returns are positively correlated. Consistent with the Diamond and Verrecchia (1987) hypothesis, they find that short sellers are able to predict future returns, at times up to five days out, suggesting that short sellers are indeed informed.

While theoretical and empirical research shows that short sellers are able to predict negative returns, the findings of a positive contemporaneous correlation between daily short selling and daily returns warrants further investigation of the Chen and Singal (2003) hypothesis. Chen and Singal find evidence that the behavior of the speculative short sellers adds to the weekend effect using monthly short interest data. Using return data from July 1962 to December 1999, they find a significant weekend effect. In a Fama-MacBeth (1973) framework, they find that the correlation between monthly short interest and returns is significantly negative on Mondays. They also find that the weekend effect is less for stocks with tradable options because speculators are more likely to use options than short sales because of less risk. They interpret their results to be consistent with the hypothesis that speculative short sellers add to the weekend effect by closing out their positions on Friday and increasing selling pressure on Monday as they reopen their positions.

Christophe, Ferri, and Angel (2006) test the Chen and Singal (2003) hypothesis and find a weekend effect in mean returns for NASDAQ stocks. Using a proprietary dataset, which allows them to distinguish between dealer and customer short sales, Christophe et al. find that customer short sales as a percentage of trading volume is higher on Monday than on Friday. Although the weekend effect is apparent in their data, they conclude that customer (speculative) short selling only slightly contributes to the weekend effect. Their results provide weak evidence in support of the Chen and Singal hypothesis.

An interesting aspect of the Christophe et al. (2006) study is that they find that dealer short sales make up the largest percentage of executed short sales and they assume that dealer shorts are a primary result of market making and not individual speculative trading.

Gao, Kalcheva, and Ma (2006) also test the Chen and Singal (2003) hypothesis by looking at short selling on the Stock Exchange of Hong Kong. They find a significant weekend effect before 1993-- a period when short selling is not allowed. In 1994, after short selling is introduced for some stocks, the weekend effect exists for both subsets of stocks that are shortable and non-shortable. The authors find that Monday returns are less for shortable stocks than for non-shortable stocks though the difference is insignificant, which weakly supports the Chen and Singal hypothesis. Further, the authors report that the difference in the size of the weekend effect between the subset of stocks is not significant.

The current research testing the Chen and Singal (2003) hypothesis has yet to provide substantial evidence for or against the notion that speculative short sellers are adding to the weekend effect. We use publicly available short sale transaction data for NYSE stocks and find evidence contradictory to the Chen and Singal hypothesis. We subdivide our sample into stocks that exhibit a positive weekend effect and stocks that do not exhibit a positive weekend effect. That is, we create subsamples of stocks based on the size of the difference between Friday's returns and the following Monday's returns. For the sample of stocks that exhibit a positive weekend effect, we find that Monday's returns are significantly less than Friday's returns. However, we find that Friday's short selling activity (the percentage of short sale volume relative to trading volume) is significantly higher than Monday's short selling activity. We create a subsample of stocks that do not have tradable options, following the intuition of Chen and Singal who suggest that stocks with options are likely to have less speculative short selling. We find that Monday's short selling activity is significantly less than Friday's short selling activity for stocks that do not have tradable options, which contradicts the notion that speculative short sellers will reopen positions on Monday after closing them on Friday. Similar to other papers that test the Chen and Singal (2003) hypothesis, we use finer short sale data that gives researchers information about the short sale transaction. However, it is important to note that as in the other papers, we do not have information about the closing of short positions, which is important in testing the Chen and Singal hypothesis because the closing of the short positions on Friday adds to the buying pressure and increases prices relative to Monday, where the opening of short positions decreases prices.

After sorting stocks into deciles based on Monday's short selling activity, we do not find evidence that the weekend effect increases across short selling deciles. We find that the weekend effect increases across the bottom five deciles, but is mixed across the top five deciles.

Consistent with Diether et al. (2007), we find that short sellers are contrarian in contemporaneous returns. That is, we find that daily short selling activity and daily returns are positively correlated for each day of the week. Interestingly, we find that the correlation is greatest on Monday, which contradicts the notion that short selling pressure decreases returns on Monday, thus causing a weekend effect. The results of our analysis are robust to subsamples of stocks that exhibit larger weekend effects and stocks without tradable options. Because our sample time period differs from Chen and Singal's (2003) time period, it is possible that short selling activity has increased, which may affect the behavior of short sellers over time. Therefore, we argue that the evidence we find regarding the Chen and Singal hypothesis is specifically robust for our sample time period. In order to test whether the use of finer data is the driving force behind our contradictory results, we obtain monthly short interest data and replicate portions of Chen and Singal. We find that using monthly short interest data produces different results than the our results when using short sale transactions data suggesting that the use of finer data produces more reliable results.

The rest of the paper follows: Section II describes the data. Section III presents the methods we use to formally test the Chen and Singal (2003) hypothesis, as well as the empirical findings of the tests. Section IV concludes.

II. Data

The short sale data is obtained from the NYSE in response to the SHO regulation. The trade data is taken from TAQ, while the daily return, price, capitalization, and volatility data are from CRSP. We limit our sample to NYSE-listed common stocks and exclude stocks with prices less than $5 and stocks that do not trade every day of the sample time period, which is January 1, 2005, to December 31, 2005. These limitations leave 2,151 stocks, from which we calculate the weekend effect following Chen and Singal (2003). We subtract Monday's return from the previous Friday's return. If trading does not occur on Monday, then the weekend effect is calculated as the Friday's return less the following Tuesday's return. In order to isolate the contribution of short selling in explaining the weekend effect, we distinguish between stocks that *do not* exhibit a positive weekend effect and stocks that *do* exhibit a positive weekend effect. The total number of stocks that (do not) exhibit a positive weekend effect is 1,502 (649).

We note an important limitation in using the short sale transactions data from Regulation SHO to test the Chen and Singal (2003) hypothesis. As Chen and Singal argue, the added selling pressure from speculative short sellers on Monday will likely decrease Monday's returns, however, the closing of the short positions on the previous Friday will add buying pressure and increase Friday's returns, thus increasing the weekend effect. The SHO data does not contain information on the covering of short positions. However, our transactions data allows us to observe the short selling activity for each day of the week, something monthly short interest data is unable to do.

Our variables follow. Our price is the CRSP daily ending price. Market capitalization is the daily ending capitalization reported by CRSP. Volume is the average daily volume and volatility is measured as the standard deviation of returns from day t_{-10} to day t, where day t is the current trading day. Table 1 presents descriptive statistics of the stocks used in the analysis. The average stock in our sample has a price of $33.07

with a daily capitalization and daily volume of $5,892,049 and 783,512 shares, respectively. The volatility (defined above) of the average stock in our sample is 0.0429. We create several subsamples. The first subsample consists of the 649 stocks with a non-positive weekend effect (that is, Friday's return minus the following Monday's return is negative) while the second subsample consists of the 1,502 stocks with a positive weekend effect (Friday's return minus the following Monday's return is positive). We also create subsamples of stocks with the largest weekend effects. We include subsamples of the 1,000 stocks with the largest weekend effects as well as the 500 stocks with the largest weekend effects. From the stocks that exhibit a positive weekend effect, we also create a subsample of stocks that do not have tradable options (602 stocks).[2] Panels B and C report the different statistics for the stocks with a non-positive and positive weekend effect while panels D and E report the descriptive statistics for the top 1,000 stocks and top 500 stocks with the largest weekend effects. Consistent with Keim and Stanbaugh (1984), we find that size, in terms of market capitalization, is less for stocks with the highest weekend effects. Further, we find that volume (volatility) is smaller (greater) for stocks with the largest weekend effect. Panel F reports the characteristics of the 602 stocks that do not have tradable options. We find that these stocks are generally smaller (low market cap) and have lower volume than stocks in the other subsamples.

Table 2 reports descriptive statistics for CRSP returns, by day, with each stock equally-weighted. Panel A also shows the number of days. We find that Monday's

[2] We also create a subsample of stocks that are in the Reg SHO pilot that is not tabulated. Because these stocks experience regulatory changes during our sample time period, we test to see if the results of our tests hold in this subsample. We perform our entire analysis for this subsample of stocks and find that results are qualitatively similar. The results from the tests on SHO pilot stocks are available upon request.

returns and Friday's returns are similar, in the aggregate. Panels B and C of table 2 show the mean returns, by day, for the subsamples of stocks with a non-positive and a positive weekend effect. We find that, in panel B (panel C), Monday's returns are significantly larger (smaller) than the Friday's returns, which is a product of subdividing the sample into positive and non-positive weekend effect subsamples. In panels D and E, we report the average returns, by day, for stocks with the largest weekend effects. We also find that Friday's returns are significantly larger than Monday's returns for stocks that do not have tradable options (panel F) and the difference is similar to that in panel C. An interesting pattern is that the size of the weekend effect largely depends on the size of Friday's return as opposed to the size of Monday's returns. We find that Friday's returns are the largest for stocks with the largest weekend effects, which is consistent with literature regarding seasonalities in weekday returns [Lakonishok and Smidt (1988)].

III. Results

Our first test of the Chen and Singal (2003) hypothesis is to determine if there is more short selling activity on Monday. If speculative short sellers are closing out positions on Friday and reopening positions on the following Monday, then more short selling activity should occur on Mondays than on Fridays. Table 3 presents descriptive statistics for the short activity ratio — defined as the daily short volume divided by the daily total trade volume. The overall average short activity ratio is almost 20%. While this value may appear high when compared to the monthly short interest data, Boehmer et al. (2007) find that nearly 13% of NYSE Superdot volume is short volume. For NASDAQ-listed securities, Diether et al. (2007) find that short volume makes up about

32% of volume, while NASDAQ reports only 3% in monthly short interest. Further, Diether et al. find that nearly 24% of volume on the NYSE is made up from short sale volume.

Panel A shows the descriptive statistics for short activity for the entire sample, equally-weighted by stock, for each day of the week. We find that Monday's short activity ratio is significantly less than Friday's short activity ratio, which is contrary to the initial prediction that short selling will be higher on Monday than on Friday due to speculators reopening positions on Monday. Panels B and C report the results for the subsamples of stocks with non-positive and positive weekend effects while panels D and E report the results for the subsamples of stocks with the largest weekend effects. If short selling is a partial explanation for the weekend effect, then we expect to see Monday's short activity ratio to increase relative to Friday's short activity ratio across subsamples with the larger weekend effects. Surprisingly, we find that the difference between Friday's short activity ratio and Monday's short activity ratio increases (rather than decreases) from panels B to E. That is, we find more short selling activity on Friday than on Monday, and the difference is increasing as the weekend effect increases.[3]

Panel F reports the results for stocks that do not have tradable options. Chen and Singal (2003) argue that stocks without tradable options should have more speculative short sellers because speculators are not able to substitute short sales with tradable options. That is, the number of speculating short sellers relative to non-speculating short

[3] While we find that the differences between Friday's and Monday's short selling activity is increasing from panels C to E, which contradicts the expectation of the Chen and Singal (2003) hypothesis, the differences between panels are not statistically significant. The t-statistic testing whether or not panel D's difference is larger than panel C's is 1.13 while the t-statistic testing the differences between panels D and E is 0.34.

sellers will be greater for stocks that do not have tradable options. First, we find that our short activity ratio is smallest in this subsample. Figlewski and Webb (1993) and Danielsen and Sorescu (2001) find that stocks with tradable options are sold short more than stocks that do not have tradable options. They argue that short selling of stocks with listed options is greater than stocks without listed options because option market makers use short sales to hedge their positions. Our finding of relatively less short activity for stocks without tradable options is consistent with the findings of Figlewski and Webb and Danielsen and Sorescu.

We also see that Monday's short activity is significantly less than Friday's. We perform a t-test to determine if the difference in panel F is significantly larger than the difference in panel A. We find that the difference is significant at the 5% level with a t-statistic of 2.17, showing that, in our "no option" subsample, which should consist of more speculative short sellers, Monday's short activity is significantly less than Friday's short activity and the difference is greater than the difference for the entire sample.[4] This finding contradicts the prediction of the Chen and Singal (2003) hypothesis.

The difference between Friday's short activity and Monday's short activity does not depend on whether the stocks exhibit a positive or non-positive weekend effect. We do not find a significant difference between Monday's short activity for stocks without a weekend effect and Monday's short activity for stocks with a weekend effect (t-statistic = 1.13). The difference in Friday's short activity and Monday's short activity between stocks that exhibit positive and non-positive weekend effects is not significant (t-statistic

[4] We also test to see if the difference between Monday's and Friday's short activity is significantly larger for stocks that do not have tradable options (panel F) and stocks with a positive weekend effect (panel C). We find that the difference is statistically significant at the 10% level with a t-statistic of 1.84.

= 1.42). We argue that daily short activity is independent of the size and magnitude of the weekend effect.

In response to these findings, we want to note the difference between our time period and Chen and Singal's (2003). It is possible that the results from our tests differ from Chen and Singal's because of different time periods used in the analyses. For instance, if short activity has increased between the study periods and short sellers are informed, as found in the literature, then the effect of speculative short sellers may be deflated by the presence of informed short sellers.

Because there may be other factors influencing the level of short activity, we run a pooled regression of a standardized measure of short volume on several stock characteristics and day of the week dummy variables.

$$SASV_{i,t} = \beta_0 + \beta_1 ln(return_{i,t}) + \beta_2 ln(volume_{i,t}) + \beta_3 ln(volatility_{i,t}) + \delta_1 MON_{i,t} + \delta_2 TUES_{i,t} + \delta_3 THUR_{i,t} + \delta_4 FRI_{i,t} + \varepsilon_{i,t} \quad (1)$$

The dependent variable, $SASV_{i,t}$ is the standardized abnormal short volume for stock i on day t.[5] Following Lakonishok and Vermaelen (1986) and Koski and Scruggs (1998) we define the abnormal short volume as:

$$ASV_{i,t} = SV_{i,t} - \overline{SV}_i.$$

$SV_{i,t}$ is the average daily short volume for stock i on day t and $\overline{SV}_i$ is the mean for average daily short volume for each stock. $ASV_{i,t}$ is the abnormal short volume. We define SASV, the standardized abnormal short volume, as:

[5] We specify equation (1) several different ways. We use year end values for market cap, trading volume, volatility, and prices and find that the results are qualitatively similar. We use the natural log of daily changes in prices and daily changes in market capitalization and find the results to be similar. We choose to report the results for equation (1) in order to confirm the positive relation between short selling activity and daily returns. In each case, the results regarding abnormal short volume for day of the week dummy variables is the same.

$$SASV_{i,t} = \frac{ASV_{i,t}}{\sigma(SV_i)}$$

where $\sigma(SV_i)$ is the standard deviation of short volume for each stock. This standardization allows each dependent variable in the panel data sample to have a zero mean and a unit variance.

The explanatory variables include the natural log of the daily return, ln(*return);* the natural log of the daily volume, ln*(volume);* and the natural log of the standard deviation of returns for day t_{-10} to day t, ln(*volatility),* where day t is the current trading day. We also use day of the week dummy variables. We test for fixed effects, by stock, and find observed differences across stocks. We perform both a one-way fixed effects (by stock) regression and a two-way fixed effects (by stock and date) regression and find the results to be qualitatively similar. We report the one-way fixed effects results for equation (1) in table 4. We find a contemporaneous positive relation between returns and abnormal short volume thus, supporting Diether et al. (2007). We also find that daily volume is positively related to abnormal short sale volume, while the results for the estimates of volatility are mixed.

We find that abnormal short volume is highest during the middle of the week in our sample (panel A). Particularly, we find that Monday's and Friday's short volume is significantly less than Wednesday's short volume, while Tuesday's and Thursday's short volume is less than Wednesday's short volume, although the difference is not significant in each panel. The estimate for the Monday dummy variable is the most negative, which, again, contradicts the hypothesis that short sellers close out their positions on Friday and reopen on the following Monday. Rather, it supports the notion that short sellers are more abundant during the middle of the week. A possible explanation is that short sellers face risk that information from the weekend may work against their established short positions, so they tend to execute more short sales during the middle of the week. Panels B through F also show that short sellers execute the least short volume on Mondays and in general, execute more short volume during the middle of the week. In each of the panels, we find that Monday's and Friday's short selling activity appears to be lowest when compared to the other days of the week. The intraweek pattern of standardized abnormal short volume appears to be robust for stocks that exhibit positive and non-positive weekend effects, stocks with the largest weekend effects, and stocks that do not have tradable options.

III.A Weekend effect

We define the weekend effect similar to Chen and Singal (2003) - the last day of the week's return minus the following first day of the week's return. Table 5 presents the mean of the weekend effect, equally-weighted by stock. We sort stocks into deciles by Monday's short activity ratios. If short selling contributes to the weekend effect, then as Monday's short selling increases, the weekend effect should also increase. We present the mean of the weekend effect for each decile. In panel A, we find that the weekend effect is increasing in the bottom five deciles but becomes mixed in the top deciles. As expected, panel B reports a negative weekend effect and no specific pattern across increasing short selling deciles. Panel C reports the results for stocks with a positive weekend effect and shows that the weekend effect is significantly greater than zero with a t-statistic (unreported) greater than 20. In the remaining panels, we find that the mean weekend effect generally increases in the bottom five deciles but the relation is mixed in the top five deciles. Since panels D and E contain stocks with the largest weekend effect, we expect a stronger increasing relation between the weekend effect and Monday's short activity ratio. We do not find substantial evidence that the calculated weekend effect is positively related to Monday's short activity ratio. We also find that the relation between the weekend effect and Monday's short activity ratio is weak for stocks that do not have listed options (panel F).

In summary, tables 3 through 5 do not support the hypothesis of Chen and Singal (2003). We find that short selling is significantly less on Monday than on Friday, and that short volume is greatest during the middle of the week. Further, after sorting stocks into deciles according to Monday's short activity ratio, we do not find that the magnitude of the weekend effect increases as short activity on Monday increases.

To further investigate the Chen and Singal (2003) hypothesis, we estimate correlation coefficients between returns and short activity, by day of the week. Chen and Singal posit that, when speculative short sellers reopen their short positions on Monday after closing the positions on the previous Friday, the selling pressure will decrease Monday's returns. In other words, short activity and returns should be negatively correlated on Mondays. Recent literature regarding the informativeness of short sellers suggest that short sellers are able to predict future negative returns [Senchalk and Starks (1993), Desai et al. (2002), Christophe et al. (2004), and Boehmer et al (2007)]. As mentioned earlier, Diether et al. (2007) find that short sellers are contrarian in contemporaneous returns and lagged returns. Contrarian behavior suggests that daily short activity and daily returns are positively correlated.

Table 6 reports the correlation coefficients between short activity and returns, by day. Panel A presents the coefficients with the corresponding p-values for the entire sample. Consistent with Diether et al. (2007), we find that short selling and returns are positively correlated, suggesting that short sellers are contrarian in contemporaneous returns. Comparing the coefficients, we find that Monday's coefficient is larger than any other day of the week, suggesting that short selling on Mondays does not decrease returns, but rather, the relation is exactly the opposite and stronger than any other day.

The Chen and Singal (2003) hypothesis predicts that Monday's contemporaneous correlation between short selling activity and returns should become more negative as the weekend effect becomes more prevalent. We find that the correlation between Monday's returns and Monday's short activity ratio increases from panels B to E, which is contrary to the hypothesis. Finally, we find in panel F that the correlation coefficient is largest on Monday for stocks that are likely to have more speculative short sellers, that is, stocks that do not have tradable options. Further, Monday's correlation coefficient in panel F is larger than any other coefficient in the table, thus adding to earlier evidence that speculative short selling does not explain the weekend effect in our sample time period. We test whether or not the relation between short activity and returns is significantly greater on Monday than on the other days in the next subsection.

III.B Regression Results

Chen and Singal (2003) perform Fama and MacBeth (1973) regressions for returns on five day of the week dummy variables and five interaction dummy variables, where they interact day dummy variables with a dummy variable that equals one if the relative monthly short interest is high. Since we have access to transaction data, we estimate a pooled model similar to Chen and Singal.[6] That is, we regress daily returns on day dummy variables and interaction variables, where we interact the day of the week with the amount of short activity on that day. The pooled model is specified in equation (2).

$$Ret_{i,t} = \delta_1 MON_{i,t} + \delta_2 TUES_{i,t} + \delta_3 WED_{i,t} + \delta_4 THUR_{i,t} + \delta_5 FRI_{i,t} + \delta_6 MON_{i,t} \times SA_{i,t} + \delta_7 TUES_{i,t} \times SA_{i,t} + \delta 8 WED_{i,t} \times SA_{i,t} + \delta_9 THUR_{i,t} \times SA_{i,t} + \delta_{10} FRI_{i,t} \times SA_{i,t} + \varepsilon_{i,t}. \qquad (2)$$

The dependent variable is the return for stock i on day t. The independent variables include day of the week dummy variables, where $MON_{i,t}$ is equal to one if Monday, zero otherwise. The other day of the week dummy variables are similarly specified. Further, $MON_{i,t} \times SA_{i,t}$ is equal to the short activity ratio on day t, if day t is a Monday. Likewise, the other interaction variables are defined. We exclude the intercept in order to obtain full rank of the coefficient matrix.

Chen and Singal (2003) find a negative interaction estimate for δ_6, supporting the hypothesis that speculative short sellers add to the weekend effect by reopening short positions on Monday. Monthly short interest data and daily return data for the time period of July 1988 to December 1999 is used in their estimation. We estimate (2) using daily short sale data available in compliance with Regulation SHO (January 3, 2005), which provides a more robust test. If the Chen and Singal hypothesis holds, the estimated coefficient, δ_6, from equation (2) will be significantly negative.

Table 7 reports the results from estimating equation (2). We estimate equation (2) for the entire sample of stocks in panel A and find that the estimate of δ_6 is significantly

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[6] We do not use the estimation technique of Fama and MacBeth (1973). That is, we do not estimate the time series by stock and then estimate the cross-sectional mean. Because we only use one year of short sale data, we use panel data models to estimate the relation between returns and short selling activity.

positive, which is contrary to the results of Chen and Singal (2003). We perform a t-test to determine if the estimate of δ_6 is greater than the average of the estimates from the other interaction variables. That is, we test whether δ_6 is greater than $\frac{1}{4}\sum_{j=7}^{10}\delta_j$ where j = {7, 8, 9, and 10}. We find that the estimate of δ_6 is greater than the average of the other interaction estimates with a t-static of 5.37 for the entire sample. The results of this test add to the comparison of the correlation coefficients in table 6 and show the correlation between returns and short activity ratios is, on average, greatest on Mondays.

Panels B and C report the results from estimating equation (2) for stocks with a non-positive weekend effect and stocks with a positive weekend effect, respectively. In panel B (panel C), we find that the estimated coefficient, δ_6, is significantly positive and greater than the average of the estimates for δ_7, δ_8, δ_9, and δ_{10} with a t-statistic of 3.04 (4.57). Likewise, we perform a similar examination for panels D through F. We find that t-statistic testing the difference between δ_6 and the average of δ_7, δ_8, δ_9, and δ_{10} is significant at the 5% level for the 1,000 stocks with the largest weekend effect (t-statistic = 2.45). We find that the difference between the estimate for δ_6 and the average estimate of δ_7, δ_8, δ_9, and δ_{10} is positive but not significant for the 500 stocks with the largest weekend effect (panel E). In panel F, we find that a similar test yields a t-statistic of 5.34, suggesting that the contemporaneous relation between returns and short selling activity is higher on Monday than on the other days of the week. The results from our regressions, which use finer short sale data, do not support the Chen and Singal (2003) hypothesis that short selling partially causes the weekend effect.

To further test the Chen and Singal (2003) hypothesis, we obtain monthly short interest data for some of the stocks in our sample and replicate a portion of the their analyses to see if the differences in our findings are a result of using finer data.[7] We are able to obtain short interest for 1,806 of the 2,151 stocks in our sample. Following Chen and Singal, we sort the short interest sample into size deciles, according to market capitalization at the beginning of the month and then, within each size decile, we subdivide the observations into quartiles based on the relative short interest (RSI), which is defined as the number of shares that are shorted, but uncovered, relative to the number of shares outstanding. Using the highest and the lowest quartiles, we estimate the following model:

$$Ret_{i,t} = \delta_1 MON_{i,t} + \delta_2 TUES_{i,t} + \delta_3 WED_{i,t} + \delta_4 THUR_{i,t} + \delta_5 FRI_{i,t} + \delta_6 MON_{i,t} \times H_{i,t} + \delta_7 TUES_{i,t} \times H_{i,t} + \delta 8 WED_{i,t} \times H_{i,t} + \delta_9 THUR_{i,t} \times H_{i,t} + \delta_{10} FRI_{i,t} \times H_{i,t} + \varepsilon_{i,t}. \qquad (3)$$

Following Chen and Singal, we set dummy variable H equal to unity if stock i is in the highest quartile on day t, zero if stock i is in the lowest quartile on day t. We perform the regression for the entire sample and each of the subsamples as before.

Table 8 reports the results from estimating equation (3). We find that the interaction variable MON×H is only significant in two of the six panels. We find that Tuesdays, which have negative returns in our sample, have a greater impact when interacting with the high RSI quartile in panels A, C, D, and E (Tuesday's interaction results in panel B are significantly negative at the 10% level). Comparing the results in table 8 to the results in table 7, we see that the contemporaneous contrarian behavior of short sellers (the positive relation between daily short volume and daily returns) on each day of the week is not shown when using the monthly short interest data. In general, we do not find that using monthly short interest provides the same results as we find in

[7] We are able to obtain monthly short interest for only 1,806 of the 2,151 stocks for total sample. We have monthly short interest data for 552 of the 649 stocks with a non-positive weekend effect; 1,254 of the 1,502 stocks with a positive weekend effect; 897 of the 1,000 stocks with the largest weekend effect; 471 of the 500 stocks with the largest weekend effect; and 381 of the 602 stocks that do not have tradable options.

table 7.[8]

Wang, Li, and Erickson (1997) find evidence that the weekend effect is greater during the last two weeks of the month. As a measure of robustness, we calculate the weekend effect for the last two weeks of the month. For stocks that exhibit a positive weekend effect, we find an average weekend effect of 0.0033, which is significantly greater than zero at the 1% level and larger, in comparison, than the weekend effect for the entire sample of stocks for the entire time period. Similar to previous analysis, we include day of the week dummy variables and three-way interaction variables that interacts the short activity ratio with day dummy variables and month-end dummy variables (M_E). We use the three-way interaction to control for the possibility that the Chen and Singal (2003) results are being driven by the larger weekend effect in the last two weeks of the month. The pooled model is shown below.

$$Ret_{i,t} = \delta_1 MON_{i,t} + \delta_2 TUES_{i,t} + \delta_3 WED_{i,t} + \delta_4 THUR_{i,t} + \delta_5 FRI_{i,t} + \delta_6 M\_E_{i,t} + \delta_7 MON_{i,t} \times SA_{i,t} \times M\_E_{i,t} + \delta_8 TUES_{i,t} \times SA_{i,t} \times M\_E_{i,t} + \delta_9 WED_{i,t} \times SA_{i,t} \times M\_E_{i,t} + \delta_{10} THUR_{i,t} SA_{i,t} \times M\_E_{i,t} + \delta_{11} FRI_{i,t} \times SA_{i,t} \times M\_E_{i,t} + \varepsilon_{i,t} \quad (4)$$

In equation (4), our attention is focused on the estimate of δ_7. If the Chen and Singal results are driven by the larger weekend effect during the last two weeks of the month, then the estimate of δ_7 should be negative and significant. The results from estimating equation (4) are reported in Table 9.

Ariel (1987) documents a monthly pattern in daily returns and suggests that monthly returns are explained by large positive daily returns in the ten consecutive

[8] As a measure of robustness, we replicate our table 7 using the monthly short interest data. We interact day of the week dummy variables with RSI. We find that the interaction variables are rarely significant and positive as opposed to our results in table 7, which show the interaction variables (using daily short volume divided by trade volume) are significant. Although the results from performing such an analysis lead us to believe that the findings of Chen and Singal may be biased by the use of monthly data, we are unable to conclude that the differences in our results and the results of Chen and Singal are entirely due to use of finer short sale data.

trading days beginning with the last day of the month. He finds that returns become negative during the end of the month. Consistent with Ariel's results, we find a negative estimate for δ_6 which suggests that returns in the last two weeks of the month are significantly less than returns in the first two weeks of the month. We find that the estimates of δ_7 are significantly positive for the entire sample and each of the subsamples. Performing similar t-tests as before reveals that the estimate of δ_7 is significantly larger than the average of the other interaction estimates ($\delta_{8.}$ $\delta_{9,}$ $\delta_{10,}$ and δ_{11}) at the 1% level for the entire sample of stocks and each subsample, thus adding to the strong evidence against the Chen and Singal (2003) hypothesis for our sample time period.[9]

IV. Conclusion

One explanation of the weekend effect is that short sellers increase selling pressure on Monday, which leads to negative returns and the presence of the weekend effect. Specifically, Chen and Singal (2003) propose the hypothesis that speculative short sellers, because they face a greater risk in holding short positions over the weekend, will close out their short positions on Friday, which increases buying pressure before the weekend. By reopening their positions on the following Monday, increased selling pressure will drive prices down, thus adding to the weekend effect. We test the Chen and Singal hypothesis using a different time period and finer short sale data. In light of their hypothesis, we expect to see more short activity (daily short volume divided by daily total trade volume) on Monday than on Friday. Using short sale transaction data for a sample of NYSE-listed stocks, we find contradictory evidence. Although the short sale transactions data does not contain information about the covering of short sales, we are

[9] The t-statistics testing the difference between the estimate of δ_7 and the average of the other interaction estimates are 9.79 in column 1, 8.78 in column 2, 8.51 in column 3, 6.18 in column 4, 3.60 in column 5, and 3.96 in column 6.

able to test whether or not short selling differs between the days of the week. We find that the level of short activity is lowest on Monday and significantly less than short selling activity on Friday. We find that the difference between Monday's short activity ratio and Friday's short activity ratio is increasing across stocks with larger weekend effects and is largest for stocks that do not have tradable options, which Chen and Singal argue have more speculative short sellers. We also find that short volume is highest during the middle of the week.

According to the Chen and Singal (2003) hypothesis, we also expect to see the weekend effect become larger as the level of Monday's short selling increases. We do not find evidence that supports the above proposition. After sorting stocks into deciles according to Monday's short activity ratios, we show that the weekend effect is generally increasing in the bottom deciles, but does not increase in the top deciles. The results are robust to stocks with larger weekend effects and stocks without listed options.

We estimate correlation coefficients between returns and short activity ratios for each day of the week and find that returns are positively correlated with short selling activity for each day. This is consistent with the notion that short sellers are contrarian in contemporaneous returns [Diether et al. (2007)]. We find, in our sample, that the correlation is greatest on Monday. Interestingly, we find that the size of the positive correlation increases across stocks with larger weekend effects and is largest for stocks that do not have tradable options.

Our regression analysis generates some surprising results. When returns are regressed on day of the week dummy variables and interaction variables that interact day dummy variables with daily short activity ratios, we find that returns are increasing in short activity ratios on Monday. Further, we find that the increasing relation between Monday's returns and Monday's short activity ratios is significantly larger than the average relation between returns and short activity ratios on other days.

Using monthly short interest data, we replicate a portion of Chen and Singal's (2003) analysis for our sample time period. We find that the use of finer short sale data helps explain the role short sellers play in determining the weekend effect. However, we are unable to conclude that the difference in our findings and the findings of Chen and Singal are entirely due to the use of finer short sale data. When controlling for the results of Wang, Li, and Erickson (1997), we find, during the last two weeks of the months, that the relation between returns and short activity is positive and significant on Mondays. Similarly, we find that Monday's relation is significantly greater than the average relation between short activity and returns on other days. Using finer and more recent short sale data, our results do not support the hypothesis of Chen and Singal, that speculative short sellers add to the weekend effect.

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Table 1

Descriptive Statistics of Stocks

The table presents descriptive statistics for the stocks in our sample. The sample includes NYSE stocks that have an average price greater than $5 and are traded every day of the sample time period (January 1, 2005 to December 31, 2005). The number of stocks in the entire sample is 2,151. We subdivided the sample by stocks that exhibit a positive and negative weekend effect, which is defined as Friday's return minus the following Monday's return. We also create subsamples for the 1,000 and the 500 stocks that have the largest weekend effect. Further, from the stocks that exhibit a positive weekend effect, we create a subsample for non-optionable stocks which likely contains more speculative trades than optionable stocks. The statistics are presented for price, market capitalization, average volume, and volatility. Price is the closing price for each stock, Mkt Cap is daily market capitalization, Volume is the average volume, and Volatility is measured as the standard deviation of returns for the time period [t_{-10} to t] where t is the current trading day. The table gives the equally weighted (by stock) average daily statistics.

	Price	Mkt Cap	Volume	Volatility
Panel A. General statistics for entire sample (2,151 stocks)				
Mean	33.07	5,892,049	783,512	0.0429
St dev	31.58	19,373,217	1,732,327	0.0176
Min	5.59	25,822	3,990	0.0063
Max	836.30	373,034,463	29,339,069	0.1094
Panel B. General statistics for stocks with a *non*-positive weekend effect (649 stocks)				
Mean	33.81	7,417,187	944,635	0.0425
St dev	40.60	22,967,830	1,869,979	0.0172
Min	5.74	28,488	3,990	0.0103
Max	836.30	370,078,836	19,961,272	0.1090
Panel C. General statistics for stocks with a positive weekend effect (1,502 stocks)				
Mean	31.91	5,233,050	713,893	0.0430
St dev	26.24	17,562,027	1,665,176	0.0178
Min	5.59	25,822	4,150	0.0063
Max	629.62	373,034,463	29,339,069	0.1094
Panel D. General statistics for the 1,000 stocks with the largest weekend effect				
Mean	32.22	4,377,169	669,189	0.0468
St dev	26.67	15,220,521	1,433,724	0.0169
Min	5.85	30,928	5,604	0.0133
Max	626.62	373,034,463	20,032,298	0.1094
Panel E. General statistics for the 500 stocks with the largest weekend effect				
Mean	30.69	3,007,276	637,378	0.0533
St dev	17.08	5,951,462	1,186,936	0.0163
Min	5.95	30,928	6,015	0.0205
Max	107.74	80,369,853	13,568,481	0.1094
Panel F. General statistics for the 602 stocks with no tradable option				
Mean	25.92	857,586	103,022	0.0368
St dev	31.48	2,110,093	129,908	0.0174
Min	5.59	25,822	5,604	0.0063
Max	626.62	34,259,019	1,638,410	0.0914

Table 2

Descriptive Statistics of Returns

The table presents descriptive statistics for returns for each day of the week and the difference between Friday's mean return and the mean return of each day. Panel A shows the descriptive statistics of returns for the sample stocks, the number of days in the sample, and the difference from Friday's mean return for the entire sample. Panels B – F report the results from the subsamples. The t-statistics test for the significance of the difference between Friday's mean return and the mean return for each day.

	Monday	Tuesday	Wednesday	Thursday	Friday
Panel A. Mean Returns for entire sample, by day					
Mean	0.0013	-0.0006	0.0002	0.0002	0.0013
Stand. Dev.	0.0024	0.0022	0.0022	0.0020	0.0022
Min	-0.0073	-0.0128	-0.0110	-0.0110	-0.0090
Max	0.0174	0.0129	0.0148	0.0098	0.0114
Number of Days	46	52	52	51	51
Difference	-0.0000	0.0020*	0.0012*	0.0012*	n/a
t statistic	(-0.01)	(28.34)	(18.17)	(17.67)	n/a
Panel B. Mean Returns for stocks with a non-positive weekend effect, by day					
Mean	0.0012	-0.0006	-0.0000	0.0016	-0.0004
Stand. Dev.	0.0023	0.0023	0.0022	0.0018	0.0017
Min	-0.0073	-0.0128	-0.0080	-0.0054	-0.0090
Max	0.0099	0.0092	0.0148	0.0098	0.0058
Difference	-0.0016*	0.0002	-0.0003*	-0.0020*	n/a
t statistic	(-12.99)	(1.78)	(-3.17)	(-26.65)	n/a
Panel C. Mean Returns for stocks with a positive weekend effect, by day					
Mean	0.0014	-0.0007	0.0002	-0.0005	0.0020
Stand. Dev.	0.0025	0.0022	0.0022	0.0018	0.0020
Min	-0.0066	-0.0122	-0.0110	-0.0110	-0.0045
Max	0.0174	0.0129	0.0105	0.0064	0.0114
Difference	0.0006*	0.0027*	0.0018*	0.0025*	n/a
t statistic	(8.57)	(34.20)	(24.99)	(40.40)	n/a
Panel D. Mean Returns for the 1,000 stocks with the largest weekend effect, by day					
Mean	0.0016	-0.0007	0.0003	-0.0008	0.0027
Stand. Dev.	0.0026	0.0023	0.0023	0.0019	0.0020
Min	-0.0054	-0.0122	-0.0096	-0.0110	-0.0028
Max	0.0174	0.0106	0.0098	0.0064	0.0114
Difference	0.0011*	0.0034*	0.0024*	0.0035*	n/a
t statistic	(11.32)	(34.91)	(25.86)	(48.11)	n/a
Panel E. Mean Returns for the 500 stocks with the largest weekend effect, by day					
Mean	0.0019	-0.0008	0.0005	-0.0015	0.0036
Stand. Dev.	0.0028	0.0026	0.0025	0.0021	0.0022
Min	-0.0054	-0.0122	-0.0085	-0.0110	-0.0026
Max	0.0150	0.0106	0.0098	0.0064	0.0114
Difference	0.0017*	0.0044*	0.0031*	0.0051*	n/a
t statistic	(11.56)	(28.75)	(21.02)	(49.55)	n/a
Panel F. Mean Returns for the 602 stocks with no tradable option, by day					
Mean	0.0009	-0.0003	0.0000	-0.0005	0.0017
Stand. Dev.	0.0024	0.0019	0.0018	0.0015	0.0019
Min	-0.0041	-0.0098	-0.0096	-0.0068	-0.0045
Max	0.0174	0.0064	0.0105	0.0034	0.0113
Difference	0.0008*	0.0020*	0.0017*	0.0022*	n/a
t statistic	(7.01)	(18.06)	(16.59)	(23.79)	n/a

*Statistically significant at the 1% level
**Statistically significant at the 5% level

Table 3

Descriptive statistics of Short Activity

The table presents descriptive statistics for short activity for each day of the week and the difference between Friday's short activity and the short activity of each day where short activity is defined as the daily short volume divided by the daily total trade volume. Panel A shows the descriptive statistics of short activity for the sample stocks and the difference from Friday's short activity for the entire sample. Panels B – F report the results for the subsamples. The t-statistics test for the significance of the difference between Friday's short activity and the short activity for each day.

	Monday	Tuesday	Wednesday	Thursday	Friday
Panel A. Short activity for the entire sample, by day					
Mean	0.1954	0.1937	0.1941	0.1962	0.1976
St. dev	0.0743	0.0726	0.0723	0.0736	0.0728
Min	0.0304	0.0348	0.0344	0.0283	0.0315
Max	0.6148	0.6080	0.6157	0.6165	0.6169
Difference	0.0022*	0.0039*	0.0035*	0.0014*	n/a
t statistic	(5.34)	(9.97)	(8.90)	(3.72)	n/a
Panel B. Short activity for stocks with a non-positive weekend effect, by day					
Mean	0.1914	0.1896	0.1906	0.1958	0.1929
St. dev	0.0714	0.0697	0.0706	0.0717	0.0713
Min	0.0304	0.0365	0.0425	0.0318	0.0315
Max	0.6041	0.6080	0.6157	0.6165	0.6169
Difference	0.0015**	0.0033*	0.0023*	-0.0030*	n/a
t statistic	(2.13)	(4.78)	(3.18)	(-4.83)	n/a
Panel C. Short activity for stocks with a positive weekend effect, by day					
Mean	0.1971	0.1954	0.1956	0.1963	0.1996
St. dev	0.0754	0.0737	0.0730	0.0744	0.0734
Min	0.0328	0.0348	0.0344	0.0283	0.0355
Max	0.6148	0.5882	0.6105	0.6073	0.6056
Difference	0.0025*	0.0042*	0.0040*	0.0033*	n/a
t statistic	(4.96)	(8.76)	(8.58)	(7.04)	n/a
Panel D. Short activity for the 1,000 stocks with the largest weekend effect, by day					
Mean	0.2047	0.2032	0.2031	0.2032	0.2079
St. dev	0.0713	0.0699	0.0690	0.0708	0.0695
Min	0.0343	0.0362	0.0422	0.0283	0.0355
Max	0.6148	0.5881	0.6105	0.6073	0.6056
Difference	0.0032*	0.0047*	0.0048*	0.0047*	n/a
t statistic	(5.19)	(7.81)	(8.43)	(8.19)	n/a
Panel E. Short activity for the 500 stocks with the largest weekend effect, by day					
Mean	0.2084	0.2067	0.2061	0.2054	0.2119
St. dev	0.0626	0.0607	0.0600	0.0631	0.0601
Min	0.0343	0.0486	0.0521	0.0283	0.0355
Max	0.5651	0.5230	0.4878	0.5754	0.4956
Difference	0.0035*	0.0052*	0.0057*	0.0065*	n/a
t statistic	(3.91)	(5.90)	(6.65)	(7.54)	n/a
Panel F. Short activity for the 602 stocks with no tradable option, by day					
Mean	0.1757	0.1750	0.1742	0.1758	0.1799
St. dev	0.0911	0.0892	0.0876	0.0897	0.0893
Min	0.0328	0.0348	0.0344	0.0290	0.0355
Max	0.5651	0.5230	0.4878	05754	0.4977
Difference	0.0042*	0.0049*	0.0057*	0.0041*	n/a
t statistic	(4.55)	(5.45)	(6.82)	(4.53)	n/a

*Statistically significant at the 1% level
** Statistically significant at the 5% level

Table 4

Regression Results from Short Sale Volume on Stock Characteristics and Day-of-the-Week

The table presents the results from estimating the following model.

$$SASV_{i,t} = \beta_0 + \beta_1 ln(return_{i,t}) + \beta_2 ln(volume_{i,t}) + \beta_3 volatility_{i,t} + \delta_1 MON_{i,t} + \delta_2 TUES_{i,t} + \delta_3 THUR_{i,t} + \delta_4 FRI_{i,t} + \varepsilon_{i,t}$$

The dependent variable, $SASV_{i,t}$ is the standardized abnormal short volume for day t and stock i where the mean of the short volume for stock i is subtracted from the average daily short volume for stock i and then divided by the standard deviation of the short volume for stock i. $Ln(return_{i,t})$ is the natural log of the daily return of stock i on day t. $Ln(volume_{i,t})$ is the natural log of the average daily volume for stock i on day t. The $ln(volatility_{i,t})$ is the natural log of the standard deviation of the daily high price less the daily low price for day-of-the-week t and stock i. The day-of-the-week dummy variables for stock i are also specified. The p-values are reported in parentheses below.

	Intercept	ln(return)	ln(volume)	ln(volatility)	MON	TUES	THUR	FRI	R^2	Fixed Effects
Panel A. Regression results for the entire sample of stocks										
FE Estimate	0.0267	0.2345*	0.0939*	-0.0418*	-0.0841*	-0.0025	-0.0050	-0.0643*	0.0961	Yes
p-value	(0.2159)	(<.0001)	(<.0001)	(<.0001)	(<.0001)	(0.6803)	(0.4129)	(<.0001)		
Panel B. Regression results for stocks with a non-positive weekend effect										
FE Estimate	0.3250*	0.2512*	0.0812*	-0.0243*	-0.1053*	-0.0178	0.0382*	-0.0864*	0.1068	Yes
p-value	(<.0001)	(<.0001)	(<.0001)	(0.0003)	(<.0001)	(0.1077)	(0.0004)	(<.0001)		
Panel C. Regression results for stocks with a positive weekend effect										
FE Estimate	-0.1152*	0.2269*	0.1004*	-0.0494*	-0.0750*	0.0042	-0.0256*	-0.0551*	0.0923	Yes
p-value	(<.0001)	(<.0001)	(<.0001)	(<.0001)	(<.0001)	(0.5668)	(0.0004)	(<.0001)		
Panel D. Regression results for the 1,000 stocks with the largest weekend effect										
FE Estimate	-0.0748**	0.2279*	0.1143*	0.0246*	-0.0667*	0.0118	-0.0304*	-0.0427*	0.1063	Yes
p-value	(0.0204)	(<.0001)	(<.0001)	(<.0001)	(<.0001)	(0.1848)	(0.0006)	(<.0001)		
Panel E. Regression results for the 500 stocks with the largest weekend effect										
FE Estimate	0.0194*	0.2295*	0.1216*	0.0971*	-0.0521*	0.0135	-0.0374*	-0.0331*	0.1203	Yes
p-value	(0.6753)	(<.0001)	(<.0001)	(<.0001)	(<.0001)	(0.2813)	(0.0028)	(0.0057)		
Panel F. Regression results for stocks without a tradable option										
FE Estimate	-1.5186*	0.1858*	0.2054*	-0.1064*	-0.0268**	0.0217	-0.0169	-0.0271**	0.0950	Yes
p-value	(<.0001)	(<.0001)	(<.0001)	(<.0001)	(0.0234)	(0.0619)	(0.1485)	(0.0169)		

*Statistically significant at the 1% level
** Statistically significant at the 5% level

Table 5

Weekend Effect

The table presents the calculated value of the weekend effect. The weekend effect is defined as Friday's return less the following Monday's return. Further, if there is no trading on Monday, the weekend effect is Friday's return less the following Tuesday's return. The weekend effect is sorted by Monday's short activity deciles. Panel A reports the weekend effect across Monday's short activity deciles for the entire sample. Panels B – F report the results for the subsamples.

Panel A. Weekend effect by short activity deciles for the entire sample

	All	SA Low	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	SA High
Mean	0.0014	0.0008	0.0012	0.0013	0.0015	0.0018	0.0012	0.0013	0.0017	0.0019	0.0014
St. Dev	0.0031	0.0018	0.0028	0.0033	0.0034	0.0035	0.0032	0.0035	0.0031	0.0033	0.0027
Min	-0.0125	-0.0052	-0.0058	-0.0077	-0.0074	-0.0091	-0.0083	-0.0125	-0.0078	-0.0071	-0.0095
Max	0.0140	0.0103	0.0125	0.0135	0.0140	0.0132	0.0120	0.0119	0.0118	0.0130	0.0101
Panel B. Weekend effect by short activity deciles for stocks with a non-positive weekend effect											
Mean	-0.0019	-0.0011	-0.0014	-0.0018	-0.0021	-0.0021	-0.0019	-0.0023	-0.0019	-0.0023	-0.0017
St. Dev	0.0018	0.0011	0.0012	0.0016	0.0017	0.0019	0.0020	0.0023	0.0019	0.0016	0.0018
Min	-0.0125	-0.0052	-0.0058	-0.0078	-0.0074	-0.0091	-0.0083	-0.0125	-0.0084	-0.0071	-0.0095
Max	-0.0000	-0.0000	-0.0000	-0.0000	-0.0001	-0.0000	-0.0000	-0.0001	-0.0000	-0.0000	-0.0000
Panel C. Weekend effect by short activity deciles for stocks with a positive weekend effect											
Mean	0.0028	0.0016	0.0025	0.0030	0.0031	0.0034	0.0027	0.0033	0.0030	0.0032	0.0026
St. Dev	0.0024	0.0014	0.0024	0.0027	0.0025	0.0028	0.0023	0.0026	0.0024	0.0023	0.0019
Min	0.0000	0.0000	0.0001	0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Max	0.0140	0.0103	0.0125	0.0135	0.0140	0.0132	0.0120	0.0119	0.0130	0.0103	0.0101
Panel D. Weekend effect by short activity deciles for the 1,000 stocks with the largest weekend effect											
Mean	0.0039	0.0029	0.0042	0.0041	0.0045	0.0039	0.0041	0.0040	0.0039	0.0040	0.0034
St. Dev	0.0023	0.0018	0.0027	0.0021	0.0027	0.0022	0.0024	0.0024	0.0023	0.0022	0.0016
Min	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015
Max	0.0140	0.0104	0.0135	0.0125	0.0140	0.0132	0.0120	0.0119	0.0130	0.0102	0.0083
Panel E. Weekend effect by short activity deciles for the 500 stocks with the largest weekend effect											
Mean	0.0055	0.0057	0.0059	0.0054	0.0058	0.0053	0.0058	0.0056	0.0054	0.0055	0.0048
St. Dev	0.0022	0.0022	0.0026	0.0018	0.0026	0.0021	0.0024	0.0024	0.0024	0.0019	0.0015
Min	0.0032	0.0034	0.0032	0.0032	0.0032	0.0032	0.0032	0.0032	0.0032	0.0032	0.0033
Max	0.0140	0.0125	0.0135	0.0107	0.0140	0.0132	0.0120	0.0119	0.0130	0.0102	0.0101
Panel F. Weekend effect by short activity deciles for the 602 stocks with no tradable options											
Mean	0.0026	0.0012	0.0016	0.0022	0.0028	0.0031	0.0034	0.0031	0.0027	0.00280	0.0031
St. Dev	0.0022	0.0009	0.0012	0.0019	0.0027	0.0027	0.0031	0.0025	0.0015	0.0020	0.0021
Min	0.0000	0.0000	0.0001	0.0002	0.0001	0.0001	0.0001	0.0000	0.0000	0.0000	0.0001
Max	0.0128	0.0038	0.0057	0.0104	0.0125	0.0128	0.0125	0.0104	0.0080	0.0089	0.0083

Table 6

Spearman Correlation Tests

This table reports the Spearman correlation coefficients for our measure of short selling activity and returns, by day of the week. Short Act is the short activity ratio, defined as the daily short volume divided by the daily total trade volume. The correlation coefficients between the short activity ratio and returns are reported for each day of the week. Panel A reports the correlation coefficients, with the corresponding p-values, for the entire sample while panels B – F report the results for the subsamples.

Panel A. Correlation tests between shorting activity and returns for entire sample, by day

	Monday	Tuesday	Wednesday	Thursday	Friday
Short Act._returns	0.14337*	0.10900*	0.12625*	0.11601*	0.11581*
p-value	(<.0001)	(<.0001)	(<.0001)	(<.0001)	(<.0001)

Panel B. Correlation tests between shorting activity and returns for stocks with a non-positive weekend effect, by day

	Monday	Tuesday	Wednesday	Thursday	Friday
Short Act._returns	0.13964*	0.11424*	0.11776*	0.11651*	0.10438*
p-value	(<.0001)	(<.0001)	(<.0001)	(<.0001)	(<.0001)

Panel C. Correlation tests between shorting activity and returns for stocks with a positive weekend effect, by day

	Monday	Tuesday	Wednesday	Thursday	Friday
Short Act._returns	0.14488*	0.10689*	0.12984*	0.11594*	0.11923*
p-value	(<.0001)	(<.0001)	(<.0001)	(<.0001)	(<.0001)

Panel D. Correlation tests between shorting activity and returns for the 1,000 stocks with the largest weekend effect, by day

	Monday	Tuesday	Wednesday	Thursday	Friday
Short Act._returns	0.14498*	0.11593*	0.13639*	0.12405*	0.11581*
p-value	(<.0001)	(<.0001)	(<.0001)	(<.0001)	(<.0001)

Panel E. Correlation tests between shorting activity and returns for the 500 stocks with the largest weekend effect, by day

	Monday	Tuesday	Wednesday	Thursday	Friday
Short Act._returns	0.14931*	0.13288*	0.15060*	0.14275*	0.11830*
p-value	(<.0001)	(<.0001)	(<.0001)	(<.0001)	(<.0001)

Panel F. Correlation tests between shorting activity and returns for the 602 stocks with no tradable option, by day

	Monday	Tuesday	Wednesday	Thursday	Friday
Short Act._returns	0.15029*	0.10135*	0.12430*	0.10796*	0.12052*
p-value	(<.0001)	(<.0001)	(<.0001)	(<.0001)	(<.0001)

*Statistically significant at the 1% level
**Statistically significant at the 5% level

Table 7

Regression Results

The table reports the results from a regression of returns on day-of-the-week dummy variables and five interaction variables. We interact the short activity ratio for stock i on day t, $SA_{i,t}$, with the day dummy variables. We use both one-way and two-way fixed effects (by stock and by day) and find the results are similar, so we only report the one-way fixed effects results. The model is specified below:

$$Ret_{i,t} = \delta_1 MON_{i,t} + \delta_2 TUES_{i,t} + \delta_3 WED_{i,t} + \delta_4 THUR_{i,t} + \delta_5 FRI_{i,t} + \delta_6 MON_{i,t} \times SA_{i,t} + \delta_7 TUES_{i,t} \times SA_{i,t} + \delta_8 WED_{i,t} \times SA_{i,t} + \delta_9 THUR_{i,t} \times SA_{i,t} + \delta_{10} FRI_{i,t} \times SA_{i,t} + \varepsilon_{i,t}.$$

Panel A reports the results from the fixed effects regression for the entire sample while panels B - F report the results for the subsamples, respectively. The t-statistics are reported in parentheses.

	MON	TUES	WED	THUR	FRI	MON×SA	TUES×SA	WED×SA	THUR×SA	FRI×SA	R^2	Fixed Effects
Panel A. Regression Results for the entire sample												
Estimate	-0.0020*	-0.0033*	-0.0030*	-0.0029*	-0.0014*	0.0168*	0.0137*	0.0163*	0.0152*	0.0136*	0.0175	Yes
t-statistic	(-21.27)	(-37.61)	(-34.35)	(-32.06)	(-15.70)	(43.03)	(36.88)	(43.96)	(41.00)	(37.08)		
Panel B. Regression Results for stocks with a non-positive weekend effect												
Estimate	-0.0020*	-0.0033*	-0.0029*	-0.0014*	-0.0027*	0.0165**	0.0144*	0.0153*	0.0154*	0.0122*	0.0170	Yes
t-statistic	(-11.83)	(-20.80)	(-18.64)	(-8.94)	(-17.17)	(23.03)	(21.08)	(22.64)	(22.92)	(18.23)		
Panel C. Regression Results for the stocks with a positive weekend effect												
Estimate	-0.0020*	-0.0033*	-0.0030*	-0.0346*	-0.0007*	0.0169*	0.0134*	0.0166*	0.0151*	0.0140*	0.0179	Yes
t-statistic	(-17.68)	(-31.40)	(-28.87)	(-32.51)	(-7.20)	(36.37)	(30.35)	(37.73)	(34.00)	(31.92)		
Panel D. Regression Results for the 1,000 stocks with the largest weekend effect												
Estimate	-0.0022*	-0.0039*	-0.0036*	-0.0044*	-0.0004*	0.0183*	0.0156*	0.0190*	0.0177*	0.0148*	0.0229	Yes
t-statistic	(-14.38)	(-27.37)	(-24.97)	(-30.87)	(-2.72)	(29.54)	(26.57)	(32.35)	(29.98)	(25.42)		
Panel E. Regression Results for the 500 stocks with the largest weekend effect												
Estimate	-0.0029*	-0.0053*	-0.0047*	-0.0066*	-0.0003	0.0228*	0.0215*	0.0251*	0.0248*	0.0183*	0.0286	Yes
t-statistic	(-11.23)	(-21.82)	(-19.29)	(-27.28)	(-1.19)	(21.49)	(21.37)	(24.91)	(24.75)	(18.52)		
Panel F. Regression Results for the 602 stocks with no tradable option												
Estimate	-0.0015*	-0.0019*	-0.0021*	-0.0023*	-0.0002	0.0136*	0.0093*	0.0121*	0.0104*	0.0108*	0.0184	Yes
t-statistic	(-11.53)	(-15.38)	(-17.03)	(-18.51)	(-1.67)	(24.64)	(17.65)	(23.03)	(19.76)	(20.71)		

*Statistically significant at the 1% level
**Statistically significant at the 5% level

Table 8

Regression Results of High and Low Relative Short Interest Quartiles

The table reports the results from replicating Chen and Singal (2003). We divide the short interest sample (1,806 stocks) into size deciles at the beginning of the month and then subdivide stocks into quartiles based on relative short interest. We regress returns on day-of-the-week dummy variables and five interaction dummy variables for the highest and lowest quartiles. We define H to equal unity if the stock i on day t is in the highest RSI quartile. We interact the dummy variable H with the day dummy variables following Chen and Singal (2003).

$$Ret_{i,t} = \delta_1 MON_{i,t} + \delta_2 TUES_{i,t} + \delta_3 WED_{i,t} + \delta_4 THUR_{i,t} + \delta_5 FRI_{i,t} + \delta_6 MON_{i,t}\times H_{i,t} + \delta_7 TUES_{i,t}\times H_{i,t} + \delta_8 WED_{i,t}\times H_{i,t} + \delta_9 THUR_{i,t}\times H_{i,t} + \delta_{10} FRI_{i,t}\times H_{i,t} + \varepsilon_{i,t.}$$

Panel A reports the results from the regression for the entire short interest sample while panels B - F report the results for the subsamples, respectively. The t-statistics are reported in parentheses.

	MON	TUES	WED	THUR	FRI	MON×H	TUES×H	WED×H	THUR×H	FRI×H	R^2	F-Value (p-value)
Panel A. Regression Results for the entire short interest sample (1,806 stocks)												
Estimate	0.0014*	-0.0004*	0.0003*	0.0001	0.0016*	0.0005*	-0.0007*	-0.0000	0.0002	-0.0004**	0.0031	69.61
t-statistic	(10.68)	(-3.42)	(2.67)	(0.038)	(12.69)	(2.92)	(-3.92)	(-0.12)	(1.24)	(-2.04)		(<.0001)
Panel B. Regression Results for stocks with a non-positive weekend effect (552 stocks)												
Estimate	0.0011*	-0.0003	0.0002	0.0017*	-0.0002	0.0005	-0.0006	-0.0003	0.0000	-0.0004	0.0031	23.12
t-statistic	(4.49)	(-1.33)	(0.92)	(7.39)	(-0.86)	(1.65)	(-1.94)	(-0.83)	(0.14)	(-1.31)		(<.0001)
Panel C. Regression Results for the stocks with a positive weekend effect (1,254 stocks)												
Estimate	0.0015*	-0.0005*	0.0004*	-0.0006*	0.0023*	0.0006*	-0.0007*	0.0001	0.0001	-0.0001	0.0054	83.21
t-statistic	(9.81)	(-3.22)	(2.58)	(-4.28)	(15.63)	(2.58)	(-3.52)	(0.60)	(0.31)	(-0.31)		(<.0001)
Panel D. Regression Results for the 1,000 stocks with the largest weekend effect (897 stocks)												
Estimate	0.0016*	-0.0005*	0.0003**	-0.0010*	0.0029*	0.0005	-0.0005**	0.0002	-0.0000	-0.0001	0.0072	78.25
t-statistic	(8.70)	(-2.93)	(1.96)	(-5.40)	(16.39)	(1.69)	(-2.28)	(0.92)	(-0.14)	(-0.54)		(<.0001)
Panel E. Regression Results for the 500 stocks with the largest weekend effect (471 stocks)												
Estimate	0.0017*	-0.0007**	0.0008*	-0.0015*	0.0037*	0.0007	-0.0008**	-0.0001	-0.0003	-0.0001	0.0095	56.71
t-statistic	(6.13)	(-2.51)	(2.91)	(-5.78)	(13.82)	(1.61)	(-2.01)	(-0.24)	(-0.86)	(-0.29)		(<.0001)
Panel F. Regression Results for the 602 stocks with no tradable option (381 stocks)												
Estimate	0.0014*	-0.0005**	0.0003	-0.0008*	0.0020*	0.0005	-0.0000	-0.0004	0.0002	0.0000	0.0052	23.86
t-statistic	(6.66)	(-2.36)	(1.70)	(-4.10)	(10.25)	(1.17)	(-0.08)	(-1.00)	(0.56)	(0.07)		(<.0001)

*Statistically significant at the 1% level
**Statistically significant at the 5% level

Table 9

Regression Results

The table presents the results from a one-way fixed effects regression of returns on day of the week dummy variables, a dummy variable capturing returns at the end of the month, and five three-way interaction variables. M_E is a dummy variable equal to one if the day is in the last two weeks of the month while SA is the short activity ratio for stock i on day t. We use a three-way interaction to control for the potential of the month-end driving the results of the weekend effect following Wang, Li, and Erikson (1997). The model is specified below:

$$Ret_{i,t} = \delta_1 MON + \delta_2 TUES + \delta_3 WED + \delta_4 THUR + \delta_5 FRI + \delta_6 M\_E + \delta_7 MON{\times}SA{\times}M\_E + \delta 8_7 TUES{\times}SA{\times}M\_E + \delta_9 WED{\times}SA{\times}M\_E + \delta_{10} THUR{\times}SA{\times}M\_E + \delta_{11} FRI{\times}SA{\times}M\_E + \varepsilon_{i,t}.$$

We perform a one-way (by stock) and a two-way (by stock and date) and find the results to be similar so we only report the one-way results. We perform the analysis for the entire sample as well as the subsamples, respectively. The t-statistics are reported in parentheses.

	All Stocks	Non-Positive Weekend Effect Stocks	Positive Weekend Effect Stocks	1000 Stocks with Largest Weekend Effect	500 Stocks with Largest Weekend Effect	Non-Optionable Stocks
MON	0.0007*	0.0008*	0.0007*	0.0009*	0.0010*	0.0005*
	(10.96)	(6.32)	(8.95)	(8.28)	(6.05)	(4.41)
TUES	-0.0002*	-0.0001	-0.0003*	-0.0004*	-0.0006*	0.0001
	(-3.45)	(-0.96)	(-3.55)	(-3.37)	(-3.71)	(0.85)
WED	-0.0008*	-0.0009*	-0.0008*	-0.0009*	-0.0009*	-0.0008*
	(-12.54)	(-7.81)	(-9.92)	(-8.28)	(-5.49)	(-7.31)
THUR	-0.0001	0.0015*	-0.0007*	-0.0012*	-0.0019*	-0.0007*
	(-0.85)	(12.48)	(-9.29)	(-11.27)	(-11.84)	(-6.52)
FRI	0.0015*	0.0001	0.0021*	0.0028*	0.0038*	0.0016*
	(22.63)	(0.73)	(26.76)	(27.00)	(22.83)	(15.51)
M_E	-0.0025*	-0.0027*	-0.0024*	-0.0028*	-0.0036*	-0.0015*
	(-39.24)	(-23.62)	(-31.33)	(-26.69)	(-20.92)	(-15.43)
MON×SA×M_E	0.0186*	0.0185*	0.0186*	0.0200*	0.0249*	0.0130*
	(44.19)	(23.79)	(37.20)	(30.62)	(22.98)	(20.21)
TUES×SA×M_E	0.0091*	0.0102*	0.0086*	0.0101*	0.0156*	0.0046*
	(22.68)	(13.74)	(18.08)	(16.28)	(15.01)	(7.48)
WED×SA×M_E	0.0224*	0.0232*	0.0221*	0.0244*	0.0307*	0.0169*
	(56.45)	(31.99)	(46.51)	(39.30)	(29.68)	(27.61)
THUR×SA×M_E	0.0148*	0.0151*	0.0147*	0.0166*	0.0220*	0.0106*
	(37.24)	(20.98)	(30.74)	(26.65)	(21.22)	(17.33)
FRI×SA×M_E	0.0113*	0.0099*	0.0117*	0.0126*	0.0155*	0.0096*
	(28.41)	(13.58)	(24.77)	(20.41)	(15.16)	(15.82)
R-squared	0.0122	0.0127	0.0142	0.0167	0.0206	0.0127
Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes

*Statistically significant at the 1% level
**Statistically significant at the 5% level