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DO SHORT SELLERS CAUSE THE WEEKEND EFFECT?

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We provide a new explanation for the weekend effect. Our hypothesis is based on the contention that speculative short sellers are unwilling or less likely to hold their positions over long non-trading periods, typically the weekend. Therefore, they buy to cover on Fridays and reopen their positions on Mondays causing Friday returns to be larger than Monday returns. We find evidence in support of this hypothesis based on a comparison of high short-interest stocks and low short-interest stocks, stocks with and without actively traded options, IPOs, zero short-interest stocks, and highly volatile stocks. We discuss trading implications of the finding.

1 Introduction

The weekend effect is best defined as a Friday's return minus the following Monday's return for a security or a portfolio of securities. This definition captures the pre-weekend positive returns and the post-weekend negative returns documented in the literature. Moreover, in the absence of a seasonality in returns, firms should, on average, earn the same return on all days of the week, especially on adjacent trading days. Thus, the weekend effect should be zero irrespective of the nature of the security.

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However, the weekend effect is positive. This has been known for several decades beginning with French (1980). Several researchers have provided additional evidence. Lakonishok and Smidt (1988) report the holiday effect for 90 years of Dow Jones stocks.[1] Keim and Stambaugh (1984) find that Friday returns are lower when there is Saturday trading. Instead of the weekend, Ariel (1990) studies returns before holidays. He finds that high stock returns occur before holidays (New Year's Day, Presidents' Day, Good Friday, Memorial Day, July Fourth, Labor Day, Thanksgiving, and Christmas Day). A significantly larger number of stocks rises pre-holiday than post-holiday. A rough calculation by Ariel (1990) shows that the bid–ask bounce could account for only 0.02% of the pre-holiday return in the actively traded stocks (30 randomly selected stocks from the S&P500). He finds that the pre-holiday return is in excess of the usual weekend effect. Further, the return is greater for an

equally weighted index than for a value weighted index.

The weekend effect seems to be weakening in the last few decades. Wang *et al.* (1997) find that the Monday return based on a value-weighted NYSE-AMEX index rises from −0.13% during 1962–1972, to −0.10% during 1973–1982, to an insignificant −0.00% during 1983–1993. For a value-weighted Nasdaq index, the Monday returns rise from −0.20% during 1973–1982 to −0.13% during 1983–1993.

Many potential explanations have been proposed and investigated: measurement errors (Keim and Stambaugh, 1984); delay between trading and settlement in stocks (Dyl and Martin, 1985; Jaffe and Westerfield, 1985; Lakonishok and Levi, 1982); specialist related biases (Keim and Stambaugh, 1984); timing of corporate releases after Friday's close (Damodaran, 1989; Penman, 1987); trading by institutional and/or individual investors on Mondays (Chan *et al.*, 2004; Lakonishok and Maberly, 1990; Sias and Starks, 1995); daylight savings for two weekends a year (Kamstra *et al.*, 2000); etc.[2] However, none of these explanations have been successful in explaining a significant part of the weekend effect. For example, Damodaran (1989) reports that the delay in announcement of earnings and dividend announcements on Friday can explain only a small proportion (3.4%) of the weekend effect. Further, he finds that the tendency to postpone release of this news is not restricted to firms in any particular size decile. Lakonishok and Levi (1982) find that the delay in settlement can only explain about 17% of the weekend effect. Keim (1989) confirms the presence of a bid–ask bounce by noting that Friday closing prices are at the ask and Monday's prices at the bid. However, the bid–ask bounce can account for as much as one-third of the observed weekend effect only for small stocks.

In this paper, we show that unhedged speculative short sellers (as distinct from hedged short sellers) are partly responsible for the weekend effect. Since stock returns for unhedged short positions are theoretically unbounded from below, speculative short sales are inherently much riskier than long positions. In addition, short sellers are subject to "short squeeze." Also, conditions relating to borrowed shares change on a daily basis: the shares may be recalled by the lenders forcing the short sellers to buy the stock to return it to the lender; the shares may be put on "special" meaning that the short seller has to pay greater compensation to the lender; and the collateral is revised daily to insure that the lender holds at least 102% of the value of shares lent. The inherent characteristics of a short position combined with institutional and market factors make the short position worthy of constant monitoring.

For that reason,

> Pros warn that speculative short-selling, in which an investor simply sells a stock short hoping the price will fall, is one of the riskiest strategies going. . . . it is not something a part-time investor should engage in.[3]

While close monitoring during trading hours can limit the potential loss of a short seller, non-trading hours introduce special risk as the short sellers are unable to trade and are, therefore, unable to control losses that may occur due to a positive stock price move. Thus, short sellers are averse to holding a short position during non-market hours, and would like to close their positions at the end of each day and reopen them the following day. However, the transaction costs of closing and opening a position, the uptick rule, and limited availability of shares to short sell makes it expensive for the short sellers to trade too often. Since the weekend is a long period (65.5 h for a regular weekend and 89.5 h for a long weekend) of non-trading compared to the normal interday period (17.5 h) of non-trading, short sellers may be less willing to hold open positions over

the weekend. Thus, we believe 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 causing the weekend effect, where stock prices rise on Fridays and fall on Mondays.

The results are consistent with the above contention. Overall, we find that stocks that have higher relative short interest (short interest divided by the number of shares outstanding) have a significantly larger weekend effect than other stocks. The introduction of put options in 1977 provides an interesting experiment for our hypothesis. Buying put options can be considered a substitute for short selling albeit at higher cost (due to the option premium) but at lower risk. Speculative short sellers are more likely to prefer put options because of the high risk associated with speculative short positions, compared to other short sellers whose positions are at least partially hedged. Thus, increasing use of options should coincide with a reduction in the weekend effect. We track the weekend effect for the 100 most actively traded stocks by stock volume and 100 less actively traded stocks assuming that stock volume is positively related to option volume. We find that the weekend effect weakens significantly after 1977 and disappears in the 1990s for the 100 most actively traded stocks. On the other hand, the weekend effect continues unabated for the 100 less actively traded stocks through the 1980s and 1990s. The time-trend in the weekend effect could be consistent with other explanations. Therefore, we conduct another test. We compare the weekend effect of stocks with low put volume with the weekend effect of stocks with high put volume. We find that low put volume stocks have a significantly higher weekend effect than the high put volume sample.

Though our hypothesis is based on speculative short selling, the short interest data pertains to both speculative and non-speculative short selling. To focus on speculative short selling, we choose initial public offerings (IPOs). IPOs are different because non-speculative short selling is less likely to occur: IPOs are usually not part of an index (no index arbitrage), not likely to be takeover candidates (no merger arbitrage), investors are unlikely to have accumulated capital gains (no shorting against the box), and IPOs tend to be volatile, reducing the possibility of other types of non-speculative short selling.[4] Further, options are unlikely to be available on IPOs meaning that short sellers cannot use put options instead of short selling. We find that high relative short-interest IPOs have a stronger weekend effect than low relative short-interest IPOs.

Similarly, when we compare the weekend effect for stocks that have zero short-interest with high short-interest stocks, we find that stocks with high relative short-interest have a significantly larger weekend effect than zero short-interest stocks. Finally, we find a larger weekend effect for the more volatile stocks. This is consistent with the expectation that speculative short sellers are more likely to close open positions over the weekend in more volatile stocks leading to a larger weekend effect for those stocks than for less volatile stocks. Thus, all the results herein support the notion that speculative short sellers contribute to the weekend effect.

2 Short sales and the effect on trading around weekends

Short selling is the act of selling shares that you do not own in the hope that you will be able to return the borrowed shares by buying them later at a lower price. Brokerage houses or securities lenders lend shares in return for a portion of interest earned on the cash collateral. The transaction is profitable for the brokerage house/securities lender, and the short seller is able to implement various strategies that we discuss later in this section.

2.1 Restrictions on short selling

There are many legal and institutional restrictions on short sales. For example, rule 10a-1 under the Securities and Exchange Act of 1934 allows short sales only on an uptick. The Investment Company Act of 1940 forbids short sales by investment companies (like mutual funds) except under special circumstances. ERISA, which governs pension funds, does not allow short sales. In addition to institutional restrictions, many private investors do not allow managers to short sell securities. For traders that short sell, the uptick rule, the limited availability or non-availability of shares, and the low interest on proceeds, all combine to make it costly to short sell. The SEC is contemplating even more restrictions on short sales though short selling is known to improve market liquidity and pricing efficiency.[5]

2.2 Motives for short selling

In spite of the relatively high cost of short selling, traders may like to short sell for several reasons. We divide the reasons into two categories: non-speculative short selling and speculative short selling.

2.2.1 Non-speculative short sales (or hedged short sales)

Non-speculative short selling consists of cases where the short sale is hedged with a long position in the same or related security. The first type of hedged short selling pertains to arbitrage activities. Though these transactions are popularly termed "arbitrage," they are not strictly arbitrage transactions; rather, they are low risk transactions. This arbitrage activity occurs from several perceived or real mispricings. Some examples are given below. Index arbitrage occurs when an index futures contract trades at a price different from that implied by the underlying cash index. Intra-industry stock price differences are arbitraged by taking opposite positions within an industry, called "pairs trading." Merger arbitrage takes place by short selling the acquiring firm and buying the target firm. Other types of arbitrage activity may also require short selling.

Second, short selling may occur for tax postponement, where an investor short sells the security that s/he owns towards the end of a taxable year so that capital gains are not realized during that taxable year. The Taxpayer Relief Act of 1997 reduced the incidence of this practice to a large extent.

Finally, short selling may take place because put writers need to hedge their positions by short selling the underlying stock. Figlewski and Webb (1993) reason that investors who are unable to short sell or who find it very costly to short sell turn to the options market when options are available. Put writers, in turn, hedge their position by short selling the underlying stock.[6]

2.2.2 Speculative short sales

When traders believe that a security is overpriced, they may wish to take advantage of the expected drop in price by short-selling that security. Since speculative short sales are costly and very risky,[7] market observers believe that these short sellers must have superior information. Market reaction to short interest announcements is consistent with this expectation (see Senchack and Starks, 1993). Further, DeChow *et al.* (2001) find that short sellers focus more heavily on stocks with poor fundamentals, suggesting that speculative short selling is common and profitable.

2.3 Effect of speculative short selling on weekend returns

It was explained in the previous section that speculative short sellers are especially concerned about

price changes over the weekend.[8] Thus, to minimize the chance of large losses due to price moves, they close their positions over the weekend. The process of closing positions on Fridays and reopening short positions on Mondays could be partly responsible for the weekend effect.

3 Data and sample characteristics

3.1 Characteristics of the weekend effect

As mentioned earlier, in the absence of seasonality in returns, firms should, on average, earn the same return on all trading days of the week when the previous calendar day is also a trading day. Since Mondays follow days that are closed for trading, the Monday return should reflect the return for more than one day and, therefore, should be greater than the return on other days. Thus, the weekend effect should be negative for all securities. To be conservative and bias the results against us, we assume that the weekend effect should be zero.

An examination of the weekend effect is presented in Table 1. Data for the table are obtained from the daily and monthly files maintained by the Center for Research in Security Prices (CRSP), and the period of analysis extends from July 1962 to December 2002. To focus in on the weekend effect, a Friday refers to the last trading day of the week whether it is actually a Thursday or a

Table 1 The weekend effect.

	Equally weighted index return		Value-weighted index return		Number of days
	Mean	Median	Mean	Median	
Panel A. July 1962–2002					
Overall weekend effect	0.341*	0.298*	0.154*	0.184*	2112
Regular weekend effect	0.324*	0.285*	0.136*	0.163*	1883
Long weekend effect	0.477*	0.498*	0.301*	0.380*	229
All weekends					
Monday	−0.095*	−0.029*	−0.059*	−0.017	2112
Friday	0.245*	0.285*	0.095*	0.119*	2112
Regular weekends					
Monday	−0.098*	−0.029*	−0.056~	−0.007	1883
Friday	0.226*	0.269*	0.091*	0.112*	1883
Long weekends					
Monday	−0.071	−0.044	−0.087	−0.083	229
Friday	0.406*	0.406*	0.214*	0.228*	229
Panel B. Sub-periods—Overall weekend effect					
July 1962–1972	0.310*	0.281*	0.255*	0.266*	548
1973–1989	0.388*	0.336*	0.209*	0.186*	887
1990–2002	0.303*	0.265*	−0.002	0.026	677

Statistical significance for testing whether the mean (median) is different from zero is based on the *t*-test (signed-rank test). Significance is indicated by ~at the 5% level, and by * for significance at the 1% level.

Friday. Similarly, a Monday refers to the first trading day of the week whether it is a Monday or a Tuesday.[9]

From panel A of Table 1, it can be observed that the mean weekend effect is a positive 0.341% and statistically significant for the equally weighted index. Similarly, the weekend effect of 0.154% for the value-weighted index is statistically significant. Contributing to the weekend effect, mean and median of Monday returns for both the equally weighted index and value-weighted index are negative, except that the median for the value-weighted index is not statistically different from zero, while those of Friday returns are significantly positive. We also find a larger weekend effect around long weekends compared with regular weekends. The equally weighted weekend effect is 0.477% for the 229 long weekends in the sample compared with a regular weekend effect of 0.324%. Similarly, the value-weighted weekend effect is 0.301% for the long weekends compared with an effect of 0.136% for regular weekends. The differences in the weekend effect between the long and regular weekends are statistically significant.

Researchers have documented some decrease in the weekend effect in more recent periods. To examine the time-trend in the weekend effect, we divide the entire period into three sub-periods: 1962–1972, which has only NYSE/AMEX stocks and no option activity, 1973–1989, which reflects the addition of NASDAQ and higher option activity after 1978, and 1990–2002, which corresponds to a significantly higher level of option activity. The weekend effects for different periods are reported in panel B of Table 1. While the weekend effect for the equally weighted index continues unaffected through the three sub-periods, the weekend effect for the value-weighted index weakens in the 1973–1989 period, and disappears completely in the 1990–2002 period.

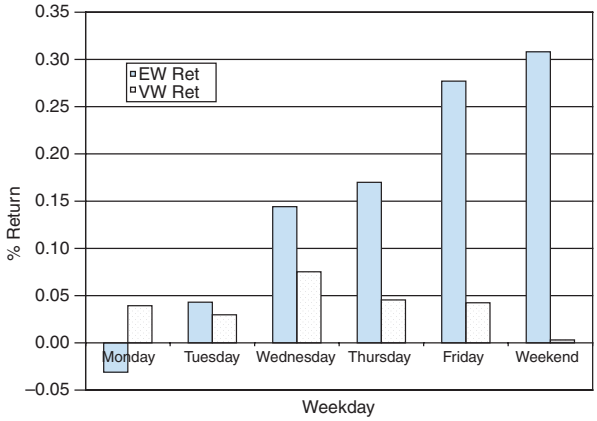

Figure 1 Weekend effect for CRSP EW and VW indexes 1990–2002.

The weekday returns for the 1990–2002 period are presented in Figure 1. It can be observed that the equally weighted returns are largest on Fridays and smallest on Mondays. The weekend effect based on equally weighted returns is a large 0.31%. On the other hand, the value-weighted returns for the 1990–2002 period are almost the same across different weekdays. Consequently, the weekend end effect based on a value-weighted index is close to zero for this period. We document later that the value-weighted weekend effect weakens in the last period because short sellers move from the stock market to the options market when actively traded options are available.

3.2 Sample characteristics—short interest

Monthly short interest data are obtained directly from NYSE and NASDAQ, and matched with CRSP. After various data screens, our final sample consists of 805,610 firm-months over the 1988–1999 period.[10]

To compare the level of short interest across different firms, it is necessary to standardize the absolute number of shares held short: a short interest of 1 million shares for General Electric is quite different from a short interest of 1 million shares

Table 2 Characteristics of short interest: Information relating to short interest as of mid-December each year is reported below only for NYSE and NASDAQ stocks. Mean daily volume for each stock is estimated over 66 trading days prior to but including the short sales date.

Year	Total number of firms	Shares outstanding (000)	Total daily volume (000)	Total shares short (000)	Firms with non-zero RSI	Mean RSI (%)	Median RSI (%)	10th percentile RSI	90th percentile RSI
1988	5246	100,212,374	204,602	614,051	3880	0.506	0.050	0.000	1.061
1989	5039	103,121,962	224,190	680,717	3979	0.634	0.074	0.000	1.400
1990	4983	108,242,434	217,834	1,060,752	3889	0.839	0.087	0.000	2.136
1991	4812	116,019,255	260,059	857,121	3913	0.811	0.100	0.000	2.124
1992	5043	127,438,139	303,789	1,305,302	4219	0.888	0.133	0.000	2.271
1993	5504	145,416,829	411,109	1,645,830	4676	1.026	0.163	0.000	2.660
1994	5942	162,109,956	430,498	2,287,563	5211	1.082	0.162	0.000	2.747
1995	6084	175,813,925	578,129	2,529,328	5554	1.113	0.213	0.000	2.970
1996	6591	207,346,695	708,209	3,708,636	6078	1.261	0.286	0.001	3.396
1997	6640	243,061,407	912,277	4,764,852	6239	1.478	0.306	0.002	4.029
1998	6302	281,368,386	1,157,630	5,132,970	5817	1.498	0.371	0.001	4.145
1999	5959	323,798,134	1,473,709	5,525,145	5491	1.619	0.384	0.001	4.391

for Black & Decker. We use "relative short interest" (RSI), the number of shares sold short divided by the number of common shares outstanding, as a measure of short interest. RSI is used in DeChow *et al.* (2001), Desai *et al.* (2002), and much of other recent research on short sales.

Sample characteristics relating to short interest as of December of each year are reported in Table 2. Short interest and the number of shares outstanding are as of the date of short interest. It can be observed that the number of shares outstanding and the total short interest (in shares) have increased significantly over the 1988–1999 period. In particular, the mean relative short interest has increased from 0.506% in 1988 to 1.619% in 1999—a threefold increase. Compared to the RSI mean of 1.619% for 1999, the median is only 0.384% suggesting the presence of a large number of firms with zero short interest. Not surprisingly, the tenth percentile relative short interest is close to zero in all years. At the same time, the fraction of firms with non-zero short interest has increased from 74% in 1988 to 92% in 1999. The increase in RSI and the increase in the fraction of firms with non-zero short interest underline the growing importance of short sales.[11]

Besides the time trend in RSI discussed above, we also present the relative short interest for RSI quartiles against size deciles in Table 3, which shows that relative short interest increases with an increase in firm size: the mean and median RSI are 0.231% and 0.009% for the smallest size decile and 1.575% and 0.822% for the largest size decile. We believe that higher RSI for larger firms could occur for at least two reasons. First, large sized firms are held by more institutional and individual investors, and this greater breadth of holding increases the shares available to short sell (see Chen *et al.*, 2001). Second, investors rely on large firms for various kinds of arbitrage activity increasing relative short interest in large stocks.

4 Evidence

4.1 Relation between relative short interest and the weekend effect

We first examine the direct relation between RSI and the weekend effect. If such a relation exists, we would expect firms with high speculative short interest to have a more pronounced weekend

Table 3 Short interest quartiles by size deciles. The RSI means (in percent) are reported in each cell. The medians (in percent) are in parentheses.

Size deciles	RSI quartile 1	RSI quartile 2	RSI quartile 3	RSI quartile 4	Overall
1	0.000	0.004	0.050	0.875	0.231
	(0.000)	(0.000)	(0.041)	(0.303)	(0.009)
2	0.000	0.015	0.077	1.109	0.300
	(0.000)	(0.011)	(0.065)	(0.474)	(0.027)
3	0.001	0.022	0.120	1.526	0.416
	(0.000)	(0.018)	(0.096)	(0.683)	(0.044)
4	0.002	0.033	0.179	2.121	0.583
	(0.000)	(0.028)	(0.140)	(1.010)	(0.065)
5	0.004	0.057	0.284	3.111	0.863
	(0.000)	(0.045)	(0.224)	(1.644)	(0.101)
6	0.010	0.106	0.479	4.173	1.191
	(0.002)	(0.078)	(0.395)	(2.550)	(0.176)
7	0.019	0.171	0.734	5.275	1.549
	(0.007)	(0.133)	(0.639)	(3.607)	(0.286)
8	0.047	0.307	1.048	6.009	1.852
	(0.015)	(0.220)	(0.946)	(4.351)	(0.452)
9	0.104	0.508	1.374	5.932	1.979
	(0.055)	(0.430)	(1.328)	(4.375)	(0.718)
10	0.285	0.686	1.267	4.062	1.575
	(0.239)	(0.637)	(1.160)	(3.132)	(0.822)
All	0.046	0.192	0.565	3.420	1.054
	(0.000)	(0.055)	(0.276)	(1.976)	(0.155)

effect. However, our data do not allow us to distinguish between speculative short interest and non-speculative short interest. Therefore, our initial tests are based on the assumption that firms with a high level of short interest also have a relatively high level of speculative short interest. To mitigate the differences in speculative short interest between large stocks and small stocks, we first form size deciles, and then form RSI quartiles within each size decile, which makes the assumption more reasonable. An added advantage of our methodology is that it ensures that our results are not driven by small sized firms. Since the lowest RSI quartile and the highest RSI quartile are drawn from each size decile, any size-related characteristics should not affect the two sub-samples differently. For example, the bid–ask bounce documented by Keim (1989) for small stocks should occur in both the low and high RSI samples within the same size decile.

To test the relationship between RSI and the weekend effect, we evaluate the difference between the weekend effect for the highest RSI quartile and the weekend effect for the lowest RSI quartile. The

Table 4 Regression results of high and low RSI quartiles.

M_D	Tu_D	W_D	Th_D	F_D	M_D × H	Tu_D × H	W_D × H	Th_D × H	F_D × H	Average adjusted R-square
−0.021	0.068	0.156*	0.129	0.246*	−0.080~	−0.077*	0.022	0.025	0.042	0.089

Statistical significance is indicated by ~ at the 5% level, and by * for significance at the 1% level.

following regression model is estimated.

$$\begin{aligned}\text{Ret}_{it} = {} & \beta_1 \text{M\_D}_{it} + \beta_2 \text{Tu\_D}_{it} + \beta_3 \text{W\_D}_{it} \\ & + \beta_4 \text{Th\_D}_{it} + \beta_5 \text{F\_D}_{it} \\ & + \beta_6 \text{M\_D}_{it} \times \beta H_{it} \\ & + \beta_7 \text{Tu\_D}_{it} \beta \times H_{it} \\ & + \beta_8 \text{W\_D}_{it} \beta \times H_{it} + \beta_9 \text{Th\_D}_{it} \times H_{it} \\ & + \beta_{10} \text{F\_D}_{it} \times H_{it} + \varepsilon_{itt} \qquad (1)\end{aligned}$$

where the dependent variable is the mean daily return for the high and low RSI quartile portfolios, M_D, Tu_D, W_D, Th_D, and F_D are dummies for weekdays, H_{it} is a dummy that is set to 1 for the high relative short interest quartile and zero otherwise for month t, and i refers to the high RSI or low RSI portfolio. RSI quartiles are constructed within each size decile on each short interest date. The returns are computed for the period following the construction of RSI quartiles. The coefficients β_1–β_5 represent the mean weekday returns for the low RSI sample, whereas the sum of same day coefficients ($\beta_1 + \beta_6$, $\beta_2 + \beta_7$, etc.) represent those for the high RSI sample. Our hypothesis predicts a negative β_6 (coefficient on M_D × H) and a positive β_{10} (coefficient on F_D × H).

To account for the increase in relative short interest over the period, we estimate regressions annually in a Fama–MacBeth framework (Fama and MacBeth, 1973), and then report the average coefficients for the July 1988 to December 1999 period in Table 4. Table 4 shows that, for both low RSI firms and high RSI firms, the Monday return is the smallest among all weekdays and the Friday return is the largest. Low RSI firms have a weekend effect of 0.27% (0.246 − (−0.021)) with a statistically insignificant return on Monday. The high RSI firms have a weekend effect of 0.39% (0.288 − (−0.101)) with statistically and economically significant returns on both Mondays and Fridays. As predicted, the joint regression shows that the coefficient of M_D × H is negative, suggesting that high RSI firms have a Monday return that is 0.08% smaller than the Monday return for low RSI firms. The difference in Monday returns is statistically significant. Though the coefficient of F_D × H is positive indicating that the Friday return is larger for high RSI firms than for low RSI firms, the difference is not statistically significant. Overall, the weekend effect for high RSI firms is significantly larger by 0.12% than for low RSI firms. The results suggest that approximately 30% (0.12/0.39) of the weekend effect is due to the difference in short interest, assuming all else constant.

4.2 Options as a substitute for short sales

After determining the effect of short interest on the weekend effect, we turn to examine the effect of options on the relation between short interest and the weekend effect, since an investor with negative information can either short sell or buy put options. The put options allow the speculative short sellers to reduce their risk (because their loss is limited to the put premium) and increase leverage. On the other hand, hedged short sellers have little risk and longer holding periods making options undesirable for such strategies. For example, the $1 billion Merger Fund typically has less than 5% of its deals

hedged using put options. Similarly, most market neutral funds do not rely on put options. Therefore, it appears that speculative short sellers are more likely to rely on put options than other short sellers.

The migration of speculative short sellers to the options market creates two types of new traders: put buyers (instead of short sellers) and put writers. Since the risk for put buyers, who would otherwise be speculative short sellers, is limited to put value and not unlimited, as with short sales, the need for constant monitoring is much reduced. At the same time, put writers usually hedge their position by short selling the underlying stock, possibly coupled with a call option. So, they are not exposed to as much risk and have less need to trade around the weekend. Since both put buyers and put writers have a reduced need to trade around the weekend than short sellers, we expect the weekend effect to weaken with the introduction of actively traded options.

We test the above argument by examining the impact of options on the weekend effect with both a time series test and a cross-sectional test. Put options were introduced in July 1977 at the Chicago Board of Options Exchange. Thus, 1978 was the first full year when put options were available. Options can have high bid–ask spreads, especially if they do not have high volume. Thus, migration to the options market is more likely to occur for stocks with actively traded options. Since we do not have option volume data by stock for the entire period 1962–1999, we use the stock trading volume as a proxy for option trading volume.

In our time series test, we pick the 100 most active stocks at the end of each year based on the average monthly volume among all stocks that have at least 7 months of non-missing trading volume. Similarly, we pick 100 stocks that rank from 1901 to 2000 by volume each year as the less actively traded. For the two samples, we obtain the Monday return, the Friday return, and the weekend effect in the following year, and report the results in Table 5. In the case of the 100 most active stocks, the weekend effect is significant and large during 1963–1977 when no put options existed. However, the effect

Table 5 Option activity and the weekend effect: stock volume as a proxy for option activity.

	100 Most active stocks			100 Least active stocks			
	Monday return	Friday return	Weekend effect	Monday return	Friday return	Weekend effect	No. weeks
1963–1977	−0.225*	0.182*	0.407*	−0.020	0.227*	0.247*	731
	−0.175*	0.155*	0.363*	−0.011	0.201*	0.231*	
1978–1987	−0.141~	0.122*	0.262*	−0.134*	0.283*	0.417*	522
	−0.034	0.034~	0.189*	−0.049*	0.276*	0.345*	
1988–1999	0.114~	0.079	−0.035	−0.127*	0.247*	0.374*	625
	0.134*	0.098*	−0.041	−0.085*	0.247*	0.364*	
Overall	−0.089*	0.131*	0.220*	−0.087*	0.249*	0.337*	1878
	−0.027*	0.099*	0.201*	−0.040*	0.233*	0.299*	

The first number in each cell is the mean, and the second number in each cell is the median. ~Significant at the 5% level; *Significant at the 1% level.

seems to drop off during 1978–1987 after the introduction of options and disappears altogether during 1988–1999. On the other hand, the weekend effect continues unabated for the less active stocks throughout the entire sample period: 0.247% during 1963–1977, 0.417% during 1978–1987, and 0.374% during 1988–1999. As the more active stocks are likely to have an active market for options, the result is consistent with the assertion that the replacement of short sales with put options by speculative short sellers caused the weekend effect to weaken or disappear. However, continuance of the weekend effect for the less active stocks suggests that the disappearance of the weekend effect for the more active stocks cannot be attributed to other reasons related to passage of time.

We also conduct a cross-sectional test for further examination of the effect of put options on the weekend effect (results not tabulated here). As argued earlier, put options are more likely to be used by speculative short sellers than by non-speculative short sellers. Therefore, stocks with a higher volume of put options relative to their daily stock trading volume (called put volume ratio) should have a less visible weekend effect than stocks with low put volume ratios. This hypothesis is supported by our test. On average, stocks with the most actively traded put options have a weekend effect that is 0.35% less than the average weekend effect of 0.48% for the sample.

The time-series and cross-sectional tests above lend additional support to our hypothesis that speculative short sellers contribute to the weekend effect, and that the weekend effect becomes 30–75% smaller once speculative short sellers migrate to the options market.

4.3 Zero short-interest stocks and initial public offerings

Now we use a different approach to test the impact of short sales on the weekend effect. We reason that if the weekend effect is at least partly caused by short sellers, stocks with zero short interest should experience a smaller weekend effect as the short sellers do not have to close their positions on Fridays or reopen them on Mondays. Therefore, we select stocks that are reported to have zero short interest. Since we only have monthly short sale data, we assume that a stock has zero short interest for all weekends during a month if it has zero short interest in the three months prior and three months following the relevant month. On each short interest date, we form portfolios of stocks with zero RSI. Meanwhile, we construct another portfolio consisting of firms in the same size decile as the zero RSI stock but with the highest RSI. Our sample consists of 41,737 firms with zero short interest and the same number of firms with the highest RSI but in the same size decile. The Fama–Macbeth regression of Eq. (1) is estimated (results not tabulated here).

The zero short-interest stocks exhibit no statistically significant Monday return but the Friday return is statistically and economically greater than zero. Overall, the weekend effect for the zero short-interest portfolio is 0.32%. For a size-matched sample of the highest RSI portfolio, we find that the Monday (Friday) return is significantly more negative (positive) than the zero short-interest sample. Overall, the highest RSI portfolio has a significantly larger weekend effect of 0.51%. The difference of 0.18% in the weekend effect indicates that short sales contribute more than one-third of the weekend effect in this sample.

Next, we use IPOs to separate speculative short sales from non-speculative short sales. IPOs are ideal for achieving this for several reasons. First, non-speculative short selling is less likely to occur in IPOs and thus the level of RSI in an IPO is a close approximation of speculative short interest.[12] Second, options are unlikely to be available on IPOs meaning that short sellers cannot use put options

instead of short selling. Third, IPOs are popular among short sellers according to Geczy *et al.* (2002).

Initial public offerings are identified from CRSP based on their day of listing. For every short interest date, we classify the IPOs into RSI quartiles depending on the reported short interest and the number of shares outstanding as of that date. Since most lending does not begin until the fourth trading day after the IPO date, and since syndicate members can begin to lend their shares 30 days after the IPO, we consider only weeks 2–4 (sixth trading day to twentieth trading day after listing) when it is most difficult to borrow shares of IPOs and all activity is presumably speculative in nature.

The Friday, Monday, and weekend returns for the low and high RSI quartiles are reported in Table 6. It can be observed that the mean weekend effect for the high RSI sample is 0.622% compared with 0.223% for the low RSI sample. The difference is statistically significant. Similarly, the medians are significantly different. These estimates suggest that short interest accounts for nearly two-thirds of the overall weekend effect.

5 Robustness check with volatile stocks

In this section, we present a robustness test that considers the implication of the hypothesized relation. More specifically, we expect that more volatile stocks will have a greater weekend effect than the less volatile stocks because volatility is related to speculative short sellers and the weekend effect in two ways. First, stocks with low volatility are unattractive to speculative short sellers because those stocks are likely to constantly earn the expected return, which is non-negative. In contrast, highly volatile stocks are likely to provide more profitable opportunities. Second, if speculative short sellers tend to close their positions over the weekend to reduce risk, it is more likely that they will close the more volatile positions than the less volatile positions, leading to a larger weekend effect.

We evaluate the relation between standard deviation and the weekend effect as follows. We form size deciles based on market capitalization at the middle of the year (i.e. as of June 30 each year), and group the stocks into quartiles by standard deviation within each size decile. Stocks in each standard deviation quartile are aggregated and reported as the first row in Table 7.

The weekend effect is computed for each stock for the same year for which the standard deviation is calculated as we expect the relation to be contemporaneous. The mean Friday return is greater for the highest standard deviation quartile by a significant 0.32% than for the lowest standard deviation quartile, while the mean Monday return is lower for the highest standard deviation quartile by a significant −0.18% than for the lowest standard deviation quartile. The mean weekend effect for the highest standard deviation quartile is a large 0.62%, significantly higher than 0.11% for the lowest standard deviation quartile. These results are consistent with the expectation that speculative short sellers are more likely to close open positions over the weekend in more volatile stocks leading to a larger weekend effect for those stocks than for less volatile stocks.

These results provide further evidence that is supportive of the assertion that trading patterns of speculative short sellers contribute to the weekend effect.

6 Trading implications of the weekend effect

Table 1 shows that the weekend effect for an equally weighted index is 0.34%, for the 1962–2002 period, and 0.30%, for the 1990–2002 period. The results are similar for the more recent 2 year and 5 year periods. On the other hand, the weekend

Table 6 Returns for high and low RSI IPOs. Initial Public Offerings are all new listings (excluding transfer listings) of ordinary common shares on NYSE, AMEX, and NASDAQ that are followed by CRSP during July 1962 to December 1999. Stock returns for these IPOs are considered from the 6th trading day to the 20th trading day after listing. We group IPOs into quartiles based on their relative short interest for the first month of reporting.

	Friday return		Monday return		Weekend effect		No. of
	High RSI	Low RSI	High RSI	Low RSI	High RSI	Low RSI	weeks
Mean	0.439*	0.117	−0.184	−0.107	0.622*	0.223	545
Median	0.238*	0.000	−0.128*	−0.001	0.599*	0.150~	545

~Significant at the 5% level; *significant at the 1% level.

Table 7 Weekend effect by standard deviation quartiles.

	Standard deviation quartile 1	Standard deviation quartile 2	Standard deviation quartile 3	Standard deviation quartile 4	Std Qtl 4 − Std Qtl 1
Daily standard	0.017*	0.026*	0.034*	0.051*	0.035*
deviation	0.016*	0.024*	0.033*	0.049*	0.033*
Friday return	0.107*	0.188*	0.262*	0.432*	0.324*
(in percent)	0.117*	0.193*	0.252*	0.430*	0.316*
Monday return	−0.006	−0.061~	−0.129*	−0.190*	−0.184*
(in percent)	0.004	−0.028~	−0.078*	−0.138*	−0.151*
Weekend effect	0.113*	0.249*	0.391*	0.622*	0.508*
(in percent)	0.113*	0.266*	0.393*	0.584*	0.508*

In each cell, the first number is the mean, and the second number is the median. ~Significant at 5% level; *significant at the 1% level.

effect for a value-weighted index has been close to zero in the recent periods.

Is the equally weighted weekend effect tradable? As the equally weighted index gives equal weight to all stocks in the universe, it means that an investor must short-sell all stocks on Fridays at the close and repurchase them on Mondays to capture the weekend effect. Obviously, the transaction costs to execute such a trading strategy are prohibitive and far in excess of the 0.30% that a trader would expect to earn.

Alternatives to trading individual stocks exist in terms of the Russell 2000 index and funds that track the Russell 2000. Other indexes that track a large number of stocks such as the Wilshire 5000 or the Russell 3000 are value-weighted indexes that include large-cap stocks resulting in too much weight being placed on the large-cap stocks. Indexes that exclude the large-cap stocks include the Russell 2000 index and the S&P 400 MidCap index. Among these mid-cap indexes, the Russell 2000 spans the largest number of stocks. On the negative side, the Russell 2000 is a value-weighted index but

the effect of value weighting is slightly mitigated because the large cap stocks are excluded.

The weekend effect for Russell 2000, as a proxy for the equally weighted index, is 0.20% for the 1990–2002 period instead of 0.30% for the equally weighted index. Though the Russell 2000 index is tradable in the futures market and as an exchange traded fund (AMEX: IWM), the bid–ask spread of both these instruments exceeds 0.20%. As a result, it is not possible to profitably use ETFs or futures to capture the weekend effect.

Mutual funds are another possible vehicle for capturing the weekend effect. However, a typical mutual fund company is unlikely to allow 100 trades a year. Fortunately, two mutual fund companies, Rydex and ProFunds, offer funds without restrictions on the frequency of trading. Rydex has one fund that tracks the Russell 2000, while ProFunds has three funds related to the Russell 2000 including one that is the inverse of Russell 2000. Unfortunately, the funds do not have a long enough history to suggest whether they accurately track the underlying index. Data for a few more years may provide sufficient trading history.

Though the weekend effect cannot be captured using available instruments, investors can change their trading patterns so that they can benefit from rather than being hurt by the weekend effect. Yale Hirsch's advice in his book "Don't Sell Stocks on Monday" is sound. In addition, investors should not buy stocks on a Friday. This advice pertains to all stocks other than the 100 most actively traded stocks. The weekend effect is especially pertinent for mid-cap stocks with high relative short-interest.

7 Summary and concluding remarks

In this paper, we provide a new explanation for the weekend effect. Our hypothesis is based on the contention that speculative short sellers are unwilling or less likely to hold their positions over long non-trading periods, typically the weekend. Therefore, they buy to cover on Fridays and reopen their positions on Mondays causing Friday returns to be larger than Monday returns.

Our evidence supports the hypothesis. This paper contributes to the literature by providing an explanation for the weekend effect that accounts for one-third to three-quarters of the weekend effect. Prior explanations have not been successful at explaining a significant part of the weekend effect. The weekend effect continues to be important: though it has weakened for large stocks with actively traded options, it persists, almost unabated, for stocks with less actively traded options. Investors can protect themselves against the weekend effect by not selling stocks on Mondays and not buying on Fridays, and even benefit from the weekend effect by selling on Fridays and buying on Mondays.

Notes

[1] Meeker (1932, p. 15) reports that short selling is legal in the United States from 1858. The New York Stock Exchange suspended trading for 10 days in 1873, four and a half months (all trading from August 1, 1914 to December 12, 1914) in 1914, and only short selling on September 21 and 22, 1931.

[2] See Dyl and Maberly (1988) and Ziemba (1993).

[3] Smith (1999).

[4] In the case of some IPOs, the underwriters sell (overallot) more shares than those available for sale. This overallotment of shares, if any, is neither considered to constitute nor recorded as short selling.

[5] See Opiela (2003) in *CFA Magazine*.

[6] In addition, the put writer may buy a call option to fully hedge his/her exposure. However, we ignore trading in call options as it is unlikely to affect the weekend effect.

[7] Stock returns for unhedged short positions are theoretically unbounded from below. Other researchers (DeChow *et al.*, 2001) have also noted the higher risk in unhedged short positions.

[8] French and Roll (1986) find that the price volatility over non-trading hours is much smaller than during trading hours. Therefore, it can be argued that non-trading hours are probably less important than trading hours in terms of volatility. However, note that as short sellers can monitor prices during trading hours and take action, the volatility during trading hours is inconsequential, even desirable. On the other hand, even a little volatility during non-trading hours can be devastating as the short sellers are unable to trade.

[9] The return for Monday, September 17, 2001, is excluded as the trading day immediately preceding that was Monday, September 10, 2001. The market was closed from September 11, 2001 to September 14, 2001 due to the terrorist attacks.

[10] See Chen and Singal (2003) for more details about processing of raw data.

[11] The increase in relative short interest with time seems inconsistent with the assertion that speculative short sellers would migrate to the options market. However, the substitution of short sales by put options does not lead to a reduction in short sales because put writers, in turn, use short sales to hedge their exposure. In essence, everything else being equal, put options change a portion of speculative short sales into non-speculative short sales.

[12] IPOs are usually not part of an index (no index arbitrage), not likely to be takeover candidates (no merger arbitrage), investors are unlikely to have accumulated capital gains (no shorting against the box), and other types of non-speculative short sellers will avoid IPOs due to their inherent volatility.

References

Ariel, R. (1990). "High Stock Returns Before Holidays: Existence and Evidence on Possible Causes." *Journal of Finance* **45**, 1611–1626.

Chan, S. H., Leung, W.-K., and Wang. K. (2004). "The Impact of Institutional Investors on the Monday Seasonal." *Journal of Business* (forthcoming).

Chen, H. and Singal, V. (2003). "Role of Speculative Short Sales in Price Formation: Case of the Weekend Effect." *Journal of Finance* **58**(2), 685–705.

Chen, J., Hong, H., and Stein, J. (2001). "Breadth of Ownership and Stock Returns." *NBER Working Paper* #8151.

Damodaran, A. (1989). "The Weekend Effect in Information Releases: A Study of Earnings and Dividend Announcements. *Review of Financial Studies* **2**, 607–623.

DeChow, P., Hutton, A., Meulbroek, L., and Sloan, R. (2001). "Short Sellers, Fundamental Analysis, and Stock Returns." *Journal of Financial Economics 61*, 77–106.

Desai, H., Thiagarajan, S. R., Ramesh, K., and Balachandran, B. V. (2002). "An Investigation of the Informational Role of Short Interest in the Nasdaq Market." *Journal of Finance* **57**(5) 2263–2287.

Dyl, E. A. and Maberly, E. D. (1988). "A Possible Explanation of The Weekend Effect." *Financial Analyst Journal* **44**(3), 83–84.

Dyl, E. A. and Martin, S. A. Jr. (1985). "Weekend Effects on Stock Returns: A Comment." *Journal of Finance* **40**, 347–350.

Fama, E. F. and MacBeth, J. D. (1973). "Risk, Return, and Equilibrium: Empirical Tests." *Journal of Political Economy* **81**, 607–636.

Figlewski, S. and Webb, G. P. (1993). "Options, Short Sales, and Market Completeness." *Journal of Finance* **48**, 761–777.

French, K. R. (1980). "Stock Returns and the Weekend effect." *Journal of Financial Economics* **8**, 55–69.

French, K. R. and Roll, R. (1986). "Stock Return Variances: The Arrival of Information and the Reaction of Traders. *Journal of Financial Economics* **17**, 5–26.

Geczy, C., Musto, D. and Reed, A. (2002). "Stocks are Special too: An Analysis of the Equity Lending Market." *Journal of Financial Economics* **66**(2–3) 241–269.

Jaffe, J. and Westerfield, R. (1985). "The Week-End Effect In Common Stock Returns: The International Evidence." *Journal of Finance* **40**(2), 433–454.

Kamstra, M. J., Kramer, L. A., and Levi, M. D. (2000). "Losing Sleep at the Market: The Daylight Saving Anomaly." *American Economic Review* **90**, 1005–1011.

Keim, D. B. (1989). "Trading Patterns, Bid-Ask Spreads, and Estimated Security Returns." *Journal of Financial Economics* **25**, 75–98.

Keim, D. B. and Stambaugh, R. F. (1984). "A Further Investigation of the Weekend Effect in Stock Returns." *Journal of Finance* **39**, 819–835.

Lakonishok, J. and Maberly, E. (1990). "The Weekend Effect: Trading Patterns of Individual and Institutional Investors." *Journal of Finance* **45**, 231–244.

Lakonishok, J. and Levi, M. (1982). "Weekend Effects on Stock Returns: A Note." *Journal of Finance* **37**, 883–889.

Lakonishok, J. and Smidt, S. (1988). "Are Seasonal Anomalies Real? A Ninety-Year Perspective." *Review of Financial Studies* **1**, 403–425.

Meeker, J. E. (1932). *Short Selling*. New York: Harper and Brothers Publishers.

Opiela, N. (2003). "Short Sellers in the Hot Seat." *CFA Magazine*. May–June, pp. 48–49.

Penman, S. H. (1987). "The Distribution Of Earnings News Over Time And Seasonalities In Aggregate Stock Returns." *Journal of Financial Economics* **18**(2), 199–228.

Senchack, A. J. and Starks, L. T. (1993). "Short-sale restrictions and market reaction to short-interest announcements." *Journal of Financial and Quantitative Analysis* **28**, 177–194.

Sias, R. W. and Starks, L. T. (1995). "The Day-Of-The-Week Anomaly: The Role Of Institutional Investors." *Financial Analyst Journal* **51**(3), 57–66.

Singal, V. (2003). *Beyond the Random Walk: A Guide to Stock Market Anomalies and Low Risk Investing*. New York: Oxford University Press.

Smith, G. (1999). "You too can short stocks." *Business Week*, March 22, p. 110.

Wang, K., Li, Y., and Erickson, J. (1997). "A new look at the Monday effect." *Journal of Finance* **52**, 2171–2186.

Ziemba, W. T. (1993). "Why A Weekend Effect?: Comment." *Journal of Portfolio Management* **19**(2), 93–99.

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