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Short sales and the weekend effect—Evidence from a natural experiment ☆

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ABSTRACT

Price pressure induced by the short-seller's systematic unwinding and rewinding short positions around the weekend allegedly contributes to the weekend effect. On the Hong Kong Stock Exchange, short-selling was prohibited before 1994 and was allowed only for some stocks after 1994. Exploiting this natural experiment, we find a strong weekend effect during the pre-1994 period and during the post-1994 period for both stocks that are allowed to be sold short and those that are not. Moreover, the difference in the weekend effects between the two groups is economically and statistically indistinguishable. These results are inconsistent with the above-mentioned hypothesis.

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1. Introduction

There is ample research on the topic of calendar patterns in stock returns. Finance academicians and practitioners have for decades been interested in the implications of the day-of-the-week effects, one of which is the weekend effect. One of the explanations for the weekend effect is short positions (Fields, 1931, 1934; Chen and Singal, 2003a, 2003b). The intuition is straightforward—the inability to trade over the weekend causes short sellers to close their speculative positions on Fridays and re-establish new short positions on Mondays, causing stock prices to rise on Fridays and fall on the subsequent Mondays. However, the empirical evidence is inconclusive and still a matter of debate. Chen and Singal (2003a, 2003b) provide empirical evidence consistent with the above-mentioned hypothesis using U.S. data by investigating how the weekend effect varies with firms that have different levels of short interest. However, Angel, Christophe, and Ferri (2003), Blau, Van Ness, and Van Ness (2009), and Christophe, Ferri, and Angel (2009), using short-sale transactions on the NYSE and NASDAQ, provide evidence inconsistent with the hypothesis that short selling can be an explanation for the weekend effect.

We adopt a different approach to the question of whether short selling could be an explanation for the weekend effect. Instead of testing the implication of the hypothesis in levels, this paper focuses on changes in levels. It does so by examining a natural experiment. We take advantage of the fact that on the Hong Kong Stock Exchange (HKSE) short selling is allowed by regulators for stocks that meet certain requirements.[1] The HKSE is one of the largest and one of the most liquid equity markets in the world where short selling is practiced (Bris, Goetzmann, and Zhu, 2007).

Specifically, short selling was prohibited on the HKSE before January 1994. After January 1994, only some stocks were allowed for short selling, while others were not. The list of designated securities for short selling was revised on a quarterly basis—stocks that met the criteria of "eligible stocks" were added into the short-sale list, while those no longer eligible were removed from the list. In this case, we have a complete history of whether each individual stock is allowed for short selling on each day. We can therefore conduct both cross-sectional (stocks allowed for short selling vs. stocks not allowed for short selling) and time-series (before and after the regulation change) analysis of the relation between short selling and the weekend effect. The fact that stocks become eligible for short selling on different dates is an advantage in that it implies a reduced likelihood that comparisons will be affected by contemporaneous changes in market-wide factors affecting the inferences of the relationship between the variables we study (Bessembinder, 2000). The details of the regulation on the selection of stocks eligible for short selling is provided in the Appendix A. Generally, stocks eligible for short selling on the HKSE are to a great extent large and liquid stocks.

Our main empirical strategy is an event study of the lifting of the short-sale prohibition for stocks in the list of "eligible stocks."[2] We match the eligible stocks to a control group of stocks that were not allowed to be sold short to control for changes in overall market conditions. We then perform tests using a difference-in-difference approach, comparing the difference between the eligible stocks and the control group of stocks before and after an event change. As the regulation changes are not random and the choice of stocks to be allowed for short selling is not entirely exogenous, using a control sample and control covariates in the empirical methodology is critical. Such a methodology allows us to make more reliable inferences.

The results of our analysis are inconsistent with the claim that short selling contributes to the weekend effect, as suggested by Fields (1931, 1934) and further investigated by Chen and Singal (2003a, 2003b). First, we find a strong weekend effect for the pre-1994 period when short selling was prohibited. Second, for the post-1994 period, strong weekend effects are present for both the stocks that were allowed to sell short and those that were not. Moreover, the difference in the weekend

[1] According to the regulations of the Security and Futures Commission (SFC) of Hong Kong, breach of the short-sale constraint is a criminal offense punishable by fines and imprisonment according to the security laws in Hong Kong. The levels of fines and imprisonment were revised (from a maximum of HK$10,000 and six months) to HK$100,000 and two years imprisonment with the introduction of the Securities (Amendment) Ordinance 2000 on July 3, 2000.

[2] Bris, Goetzmann, and Zhu (2007) also perform an event study for the countries with regulatory changes in their sample. This methodology approach eliminates cross-sectional differences that might explain the results.

effects between the two groups of stocks is statistically insignificant. Third, as suggested by Chen and Singal (2003a), there is a greater probability that short sellers will close the more volatile positions over the weekend rather than less volatile ones. Therefore, the speculative short-sale hypothesis implies that the weekend effect should be stronger for more volatile stocks. We examine whether this relation between stock volatilities and the weekend effect exists in our sample but we do not find support for this hypothesis.

The remainder of the paper is organized as follows. In the next section, we review the related literature and develop our main hypotheses. Section 3 describes the data, the empirical design, the sample-selection process, and the variable construction. Section 4 presents the results and Section 5 concludes. We briefly describe the regulations and mechanism of short selling on the HKSE in the Appendix A.

2. Literature review and hypothesis development

Seventy years ago, Fields (1931, 1934) conducted perhaps the first academic investigation of the weekend effect, and found "an unmistakable tendency for industrial stock prices to advance on Saturday relative to Friday and Monday," (Fields, 1934). A lesser-known aspect of Fields' work is about the role played by the short sellers in forming the market prices. In his work he argues: "In the light of this investigation, is it not be concluded that the uncertainties of carrying short commitments over an exchange holiday in a bear market lead to replacements sufficiently heavy to turn the tide of price upward on Saturday? The evidence now appears to be strong enough to raise the previously expressed opinion at least above the level of pure conjecture" (Fields, 1931).[3] The weekend effect, consisting of negative equity returns on the first trading day of the week and abnormally high returns on the last one was subsequently analyzed in modern terms by Cross (1973).

Since then, many researchers have examined this phenomenon. In testing whether daily stock returns are generated by calendar or trading time hypotheses, French (1980) documents that the mean return for Monday was significantly negative. Gibbons and Hess (1981) and Keim and Stambaugh (1984) further examine asset returns for the day-of-the-week effect and investigate several explanations, but none prove satisfactory: neither settlement effects nor systematic errors in the data can adequately account for the Monday phenomenon (see also Lakonishok and Levi, 1982, 1985; Dyl and Martin, 1985; Chow, Hsiao, and Solt, 1997).

Lakonishok and Maberly (1990) suggest that there exists a day-of-the-week effect in the trading pattern of individual investors that is related to the day-of-the-week effect for stock prices. They find empirical evidence of strong selling pressure on Mondays, providing at least a partial explanation of the weekend effect. Abraham and Ikenberry (1994) also show that individual investors are more active sellers of stocks on Mondays, particularly following bad news in the market. Chan, Leung, and Wang (2004) also support the belief that the Monday seasonal effect may be related to the trading activities of less sophisticated individual investors.

Bessembinder and Hertzel (1993) indicate that the reason for the weekend effect is not outliers in the return series, the choice of sample period, firm size, the computation of returns of the indices examined, or the bid–ask spread (see also Lakonishok and Smidt, 1988). They further document a pattern in the serial dependence of security returns around non-trading days (see also Ariel, 1990 for the holiday effect). Damodaran (1989) shows that earnings and dividend reports released after Friday's market close explain only a small proportion of the negative Monday returns.[4] A further examination by Wang, Li, and Erickson (1997) shows that the Monday effect occurs primarily in the last two weeks of the month and that the mean Monday return of the first three weeks of the month

[3] See Thaler (1987) for a survey on the early literature of the weekend effect and other seasonal anomalies.

[4] One hypothesis for the weekend effect is that firms release bad news toward or after the close on Friday because they fear panic selling on financial markets. For this to cause the negative Monday returns, there has to be concurrent market inefficiency since rational investors should, over time, anticipate the bad news. Damodaran (1989) tests both. See also Dellavigna and Pollet (2009) for an interesting behavior-based (investor inattention) interpretation of firm strategic news release.

is not significantly different from zero. Kamstra, Kramer, and Levi (2000) add sleep desynchronosis to these "rational" explanations of the weekend effect.[5]

Chen and Singal (2003a, 2003b) revisit the original explanation for the weekend effect advanced by Fields (1931, 1934), which is essentially related to the short-term price pressure induced by the trading behavior of the short sellers. These authors contend that speculative short sales contribute to the weekend effect. They examine how short-selling activities may temporarily move the security price from its equilibrium value and induce strong day-of-the-week seasonal patterns in returns. Their hypothesis is based on the intuitive argument that speculative short sellers are unwilling to hold their positions over long non-trading periods, such as the weekends. Therefore, when they unwind their short positions on Fridays, there is temporary upward price pressure; similarly, when they re-establish their short positions on Mondays, there is temporary downward price pressure. Using a sample of U.S. firms, they find evidence that speculative short sales indeed contribute to the weekend effect, confirming the conjecture of Fields (1931, 1934). They also find that the weekend effect weakens significantly after 1977 when put options were introduced in the U.S.

On the other hand, Angel, Christophe, and Ferri (2003) question whether short sellers contribute to the weekend effect. They show that there is no discernible pattern in the daily percentages of short trades or short shares using data from the NASDAQ ACT-trade reporting system from September 13, 2000 to December 12, 2000, which is based on detailed trade-by-trade data with short-sell order identification. They conclude that their results are "consistent with either of two propositions: (1) the arbitrage opportunity available from a pattern of lower stock returns on certain days (e.g., Mondays) is not large enough to exceed the costs of short selling and, therefore, does not induce higher levels of short selling on the previous days; or (2) if a day-of-the-week effect exists, short selling is not one of several possible causes of the phenomenon." Blau, Van Ness, and Van Ness (2009) use short-sale transactions data for NYSE securities for 2005 and find evidence suggesting that there is more short selling during the middle of the week. Christophe, Ferri, and Angel (2009) examine daily short selling of NASDAQ stocks from September 13, 2000 to July 10, 2001 and find that short selling does not explain an economically meaningful portion of the weekend effect in returns, even among the firms that are most actively shorted. These results are inconsistent with the hypothesis that short selling explains the weekend effect.

We note that the weekend effect is not a U.S. phenomenon. The weekend effect exists in most of the major international equity markets (Jaffe and Westerfield, 1985a, 1985b; Kim, 1988; Aggarwal and Rivoli, 1989; Agrawal and Tandon, 1994; Kim and Park, 1994).[6] Therefore, the weekly seasonal effect is "a general, world-wide phenomenon rather than the result of a special type of institutional arrangement in the U.S." (Jaffe and Westerfield, 1985a, p. 433). Given this fact, it is important to examine whether Chen and Singal's (2003a) explanation applies to equity markets outside the U.S.

The short selling mechanism on the HKSE provides a unique opportunity to examine this issue. Before 1994, short-selling was prohibited, and after 1994 only some stocks were allowed for short-selling, with the short-selling list being updated quarterly over time. Obviously, for the stocks not allowed to short, the temporary price pressure argument does not apply. Note that the Hong Kong setting provides us with both time-series and cross-sectional identifications. First, we are able to examine any changes in the weekend effect before and after the regime change in 1994. Second, we are able to examine whether the weekend effect for stocks on and off the list are different for the post-1994 period.[7] Based on the temporary price pressure argument in Chen and Singal (2003a), we have two main testable hypotheses:

[5] Studies by Brusa, Liu, and Schulman (2000, 2003) indicate that the "traditional" weekend effect has been reversed lately.

[6] Jaffe and Westerfield (1985a) provide international evidence on the weekend effect from the U.K., Japan, Canada, and Australia; Jaffe and Westerfield (1985b) examine returns in the Japanese market; Kim (1988) examines six major markets including the U.S.; Aggarwal and Rivoli (1989) study four emerging markets; Agrawal and Tandon (1994) study eighteen countries; and Kim and Park (1994) examine the three major stock markets in the U.S., the U.K., and Japan.

[7] We note that, on September 8, 1995, the HKSE launched its Traded Stock Options Market. In our sample, we cannot identify which firms have traded options. Figlewski and Webb (1993) and Danielsen and Sorescu (2001) have argued that the introduction of traded options represents an economically important relaxation of the short-sale constraint. However, the fact that our sample contains firms with traded options strengthens our results because trading of stock options should alleviate the

Hypothesis 1. *Only shortable stocks exhibit a significant increase in the weekend effect from the period before to the period after they become eligible for short selling.*

Hypothesis 2. *There should be a significant increase in the difference between the weekend effects of shortable and nonshortable stocks from the pre-event to the post-event period.*

Besides these two main hypotheses, we also predict that the magnitude of the change in the weekend effect should be greater for more volatile stocks than for the less volatile stocks. The last conjecture is based on Chen and Singal's (2003a) intuition that speculative short sellers prefer high-volatility stocks because these stocks provide more profitable opportunities. Even more importantly, there is a greater probability that, over the weekend, short sellers will close the more-volatile positions rather than the less-volatile positions.

3. Data and methodology

In this section, we describe the data, the methodology for conducting our empirical tests, and the construction of the variables used.

3.1. Data

We rely on two data sources. The financial and accounting data are obtained from the Daily Stock Price and Returns File, Monthly Stock Price and Returns File, and Financial Statements File for Hong Kong from the Pacific-Basin Capital Markets Databases (PACAP). We use daily returns for all common and preferred stocks listed on the HKSE for the period January 1980–December 2003. Second, the complete list of stocks allowed for short selling from January 1994 to December 2002 were obtained directly from the HKSE, with the assistance of the Hong Kong Securities and Futures Commission (SFC). In line with the reform of the securities borrowing and lending regime, the HKSE introduced a pilot scheme for regulated short selling in January of 1994. Under the pilot scheme, on January 3, 1994 there are 17 securities that could be sold short. The scheme was revised on March 25, 1996 with the number of designated securities for short selling increased. The list of designated securities for short selling is revised on a quarterly basis since then. The stocks that meet the criteria of eligible stocks are added to the list, while those no longer eligible are removed from the list. The information is first disclosed on the website of the HKSE in the form of regular briefings. Table 1 reports statistics about these revisions and specifically the dates when the list changes, as well as the number of securities on the designated list from 1994 to 2002. The total number of distinct stocks that have been allowed for short selling during our sample period is 373. For readers' reference on the short-sell mechanism, and in particular how the stocks are selected and added to the short-sell list, we reproduce the relevant regulation in the Appendix A.

3.2. Methodology and variable construction

In our empirical analysis we first consider a simple time-series and cross-sectional comparison of means or medians of the weekend effect for the whole 1980–2003 period and across all common and preferred stocks with non-missing returns and non-missing market values for the previous month. We construct daily, equal-weighted or value-weighted market average returns with dividends reinvested using data from the Pacific-Basin Capital Markets Databases.[8]

(*footnote continued*)
weekend effect. However, a study by Mayhew and Mihov (2004) provides suggestive evidence that option initiation does not represent an economically important relaxation of the short-selling constraint.

[8] The database also provides the average returns excluding dividends. The results of using these average returns are qualitatively similar and hence are not reported.

Table 1
The lists of all stocks allowed for short selling.

This table gives the 20 lists of stocks that are allowed for short selling before the end of 2002. The table gives the number of stocks in each list and the dates of the lists. The first column reports the dates on which a new designated securities list was released, and the second column shows the day of the week. The last column reports the number of securities that each designated securities list contains.

Date	Day of Week	Number of Securities
January 3, 1994	Monday	17
March 25, 1996	Monday	113
May 1, 1997	Thursday	241
January 12, 1998	Monday	310
March 16, 1998	Monday	325
November 9, 1998	Monday	195
March 1, 1999	Monday	195
September 20, 1999	Monday	181
November 12, 1999	Friday	182
February 28, 2000	Monday	194
May 31, 2000	Wednesday	201
August 28, 2000	Monday	217
February 12, 2001	Monday	221
May 14, 2001	Monday	227
August 20, 2001	Monday	225
December 3, 2001	Monday	157
May 21, 2002	Tuesday	155
July 29, 2002	Monday	174
August 21, 2002	Wednesday	174
November 29, 2002	Friday	165
Total number of distinct stocks that have been allowed for short selling as of 2002		373

We then perform tests using a difference-in-difference approach, comparing the difference in weekend effects between shortable and nonshortable stocks before and after the regulation change. Our sample is essentially broken down into four groups of stocks: nonshortable-pre-period, nonshortable-post-period, shortable-pre-period, and shortable-post-period stocks. We create a matched sample of nonshortable stocks as follows. Using one-to-one matching without replacement, we determine a unique nonshortable match for each stock in our shortable sample based on market capitalization, closing price, and turnover ratio. We measure the matching criteria in the month preceding our pre-event window. We draw a nonshortable stock match from the sample of stocks that have never been shortable and we randomize the order of matching by sorting the shortable stocks alphabetically by symbol (Hendershott and Moulton, 2011). We then calculate the following matching error for each shortable stock i and each remaining nonshortabe stock j:

$$\frac{\left|\frac{Mcap_i}{Mcap_j}-1\right|+\left|\frac{Prc_i}{Prc_j}-1\right|+\left|\frac{Turn_i}{Turn_j}-1\right|}{3},$$

where *Mcap* is the stock's market capitalization, *Prc* is the stock's closing price, and *Turn* is the stock's turnover ratio. The nonshortable stock with the lowest matching error is selected as the match for that shortable stock and removed from the list of potential nonshortable matches for the remaining shortable stocks.

We use the following multivariate regression model to explore our main hypotheses developed in the previous section:

$$R_{i,t}^{Weekend} = \alpha+\gamma \times Period_{i,t}+\mu \times Shortable_{i,t} +\delta \times Period_{i,t} \times Shortable_{i,t}+\beta \times X_{i,t}+u_{i,t}, \quad (1)$$

where our dependent variable $R_{i,t}^{Weekend}$ is our measure for the weekend effect. To be consistent with Chen and Singal (2003a), we define the weekend return as Friday's return minus the following

Monday's return for the security. A Friday refers to the last trading day of the week, whether it is actually a Thursday or a Friday. Similarly, a Monday refers to the first trading day of the week, whether it is a Monday or a Tuesday. *Shortable* is a dummy variable that equals 1 for the shortable stocks and zero otherwise. *Period* is a dummy variable that equals 1 after the effective date when a certain security was allowed to be sold short and 0 otherwise. *Period* also equals one for the corresponding matched nonshortable security after the effective date and 0 otherwise.

We report the results of Model (1) in the next section by focusing on the instances in which a stock is allowed for short-selling for the first time. We require that each shortable stock has at least 20 available weekend returns before it becomes eligible for short selling and 20 available weekend returns after the event—i.e., we report results using a $[-6, +6]$-month event window.[9] Thus, our final sample for the difference-in-difference regressions consists of 283 shortable stocks.

Model (1) allows us to study the effect of the policy change (lifting the short-sale restriction) on the weekend effect for the shortable subsample and the nonshortable subsample. The intercept α is the average weekend effect for the nonshortable-pre-period group. The parameter γ captures changes in the weekend effect for all securities before and after the policy change (i.e., a time trend common to the nonshortable and shortable groups). The variable *Shortable* controls for shortable-group-specific effects to account for average permanent differences between the shortable and the nonshortable groups. The coefficient μ on the dummy variable *Shortable* measures the effect that is not due to the policy change. The coefficient δ measures the effect of the policy change. Therefore, rejecting Hypothesis 1 would require $\gamma+\delta=0$ and rejecting Hypothesis 2 requires $\delta=0$.

A major methodological concern is that Model (1) assumes random assignment of stocks to the shortable and the nonshortable subsamples. Nonrandom assignment causes bias in the estimates. Unfortunately, stocks must meet certain criteria to be included in the designated list of stocks eligible for short selling. In this case, additional explanatory variables can be added to the regression to control for differences across the shortable and nonshortable subsamples. We try to control for any source of difference between shortable and nonshortable subsamples that could be correlated with the event (lifting the short-sale restriction) but not due to the event. Further, even controlling for factors that do not correlate with the event could be helpful as these variables could shrink the standard error of the estimates. Therefore, we add a list of time-varying, firm-specific control variables, $X_{i,t}$, to Model (1). However, the fact that stocks come in and out of the designated list on different dates to some extent controls for the possibility of contemporaneous changes in economy-wide variables that potentially could affect the results.

The criteria for a stock to be included in the list of stocks eligible for short selling has been revised from time to time. However, generally the selection criteria of lifting the short-sale restrictions is correlated to some extent with large and liquid stocks. For each stock-weekend-return observation, the following variables were constructed[10,11]:

- *Size*—the natural logarithm of the market value of the equity of the stock as of the end of the most recent week.
- *BM*—the natural logarithm of the ratio of the book value of equity plus deferred taxes to the market value of equity, using the end of the previous quarter market and book values.
- *Volume*—the natural logarithm of the dollar volume of trading in the security in the most recent week.
- *Turnover*—the natural logarithm of the share turnover measured by the number of shares traded divided by the number of shares outstanding in the most recent week.

[9] All results are robust when we include in our sample the re-entering cases and to a $[-3,+3]$-month event-window. The shortable stocks are 308 if we include the cases when a stock re-enters the list of stocks eligible for short selling.

[10] We report the results when the control variables are not winsorized. However, to avoid giving extreme observations heavy weight in the regressions, we also performed the analysis when we set the smallest and largest 0.5% (1%) of the observations on each of the independent variables to its 0.005 (0.01) and 0.995 (0.99) fractile values. The inferences are the same in the case when the variables are winsorized and when they are not.

[11] We re-do our analysis when the control variables are measured before the pre-event window, and the results are essentially the same.

- *Volatility*—the standard deviation of the daily returns estimated from data over the most recent quarter.
- *InvPrc*—the natural logarithm of the inverse of the daily closing stock price in the most recent week.

4. Empirical results

In this section, we first compare the means and medians of the weekend return for the 1980–2003 period, and across all stocks by forming equal-weighted and value-weighted portfolios. Then we present our results from the difference-in-difference methodological approach for the 1994–2003 period when some stocks were allowed to be sold short and some were not. At the end of the section we provide further evidence of the weekend effect by focusing on volatile stocks.

4.1. Full-sample evidence, 1980–2003

Panel A of Table 2 reports the means and medians of daily equal-weighted and value-weighted average market returns on Mondays, Fridays, and the weekend effect for the 1980–1993 period, when no stock was allowed for short selling. The means and the medians for the Monday equal-weighted and value-weighted portfolio returns are not significantly different from zero. Conversely, the means

Table 2
Full sample evidence on the weekend effect.
The table reports means and medians for equal-weighted and value-weighted market returns. Panel A reports results for the period from January 1980 to December 1993 when short selling was prohibited on the HKSE. Panel B reports results for the period from January 1994 to June 2003 when only some stocks were allowed to be sold short. Monday refers to the first trading day of the week, and Friday refers to the last trading day of the week. The weekend effect refers to the difference between a Friday's return and the following Monday's return. In Panel B, a * denotes that the estimate in the panel differs significantly (p-value < 0.05) from the corresponding estimate reported in Panel A. The p-values (in parentheses) testing whether the mean (median) is different from zero are based on Student's t-test (the Wilcoxon signed rank test).

	(1) Equal-Weighted Market Returns		(2) Value-Weighted Market Returns		(3) Number of Days
	Mean	Median	Mean	Median	
Panel A: The Period when Short Selling was Prohibited (All Stocks, January 1980–December 1993)					
Monday	−0.1194 (0.2263)	0.1533 (0.1295)	−0.1490 (0.1123)	0.0502 (0.7107)	730
Friday	0.3848 (0.0000)	0.4448 (0.0000)	0.3161 (0.0000)	0.3422 (0.0000)	730
Weekend Effect	0.5042 (0.0000)	0.3682 (0.0000)	0.4650 (0.0000)	0.3499 (0.0000)	730
Panel B: The Period when Short Selling was Allowed for Some Stocks (All Stocks, January 1994–June 2003)					
Monday	−0.0326 (0.7332)	0.0076 (0.7536)	−0.0337 (0.7137)	0.0127 (0.9905)	495
Friday	0.3488 (0.0001)	0.3466 (0.0000)	0.2199* (0.0032)	0.1195* (0.0073)	495
Weekend Effect	0.3814 (0.0003)	0.3448 (0.0000)	0.2536 (0.0160)	0.1169 (0.0189)	495

and the medians for the Friday equal-weighted and value-weighted portfolio returns are always significantly positive. More importantly, the weekend effect is always positive and significant. Note that the weekend effect is in the range of 30 to 50 basis points, higher than in the U.S. markets, which are in the 20 to 35 basis point range as reported in Table I of Chen and Singal (2003a).[12] The fact that the weekend effect exists even when short selling is prohibited is consistent with the hypothesis that short sellers do not "cause" and are not responsible for the weekend effect per se. This fact by itself, however, does not contradict the argument that speculative short sales could partially explain the weekend effect.

In Table 2, Panel B reports the results for the 1994–2003 period when only some stocks were allowed for short selling. The weekend effect ranges from 0.12% (p-value of 0.02) for the median of the value-weighted returns to 0.38% (p-value of 0.00) for the mean of the equal-weighted returns. Even more importantly, all weekend-effect estimates reported in Panel B are not statistically different from the corresponding estimates reported in Panel A. This is to some extent inconsistent with the argument that short sellers contribute to the weekend effect, but we do not draw a strong conclusion because the sample used in Panel B includes both shortable and nonshortable stocks.

4.2. Difference-in-difference models, 1994–2003

In Table 3, Panel A presents the descriptive statistics for the shortable sample of stocks and the control sample of stocks; Panel B shows the preliminary results on the relationship between short selling and the weekend effect. Panel A shows that the shortable sample comprises larger, more liquid, and higher-priced stocks compared with the nonshortable sample. In Panel B we compare the equal-weighted means and medians for four subsamples: nonshortable-pre-period, nonshortable-post-period, shortable-pre-period, and shortable-post-period groups of stocks. We report results for the Monday, Friday, and weekend returns, but we focus on the weekend returns. The last two rows in Panel B report the estimates for the difference in the weekend effects between the pre-event and the post-event period and the associated p-value. This difference in terms of means and medians is not statistically different from zero for both the shortable and nonshortable group of stocks as the p-values range between 0.32 to 0.88 across columns (1), (2), (4), and (5). The fact that this difference is not statistically different from zero in all cases rejects Hypothesis 1. More importantly, the "difference-in-difference" estimates in columns (3) and (6) for the means and medians, respectively, are not significantly different from zero, rejecting Hypothesis 2. Our results so far do not support the idea the weekend effect could be partially explained by the activities of the short sellers, at least not on the HKSE.

We report the results associated with Model (1) with seven different sets of control variables in Table 4. Across all seven regression specifications, the coefficient associated with the interaction term, *Period* × *Shortable*, which measures the true effect of the policy change, is not significantly different from zero, thus rejecting Hypothesis 2. This indicates that the difference in the weekend effects between the shortable and the nonshortable groups is statistically insignificant in the post-event window, which is inconsistent with the hypothesis that short selling contributes significantly to the weekend effect. Rejecting Hypothesis 1 would require $\gamma+\delta=0$. We report the p-value associated with the F-test for this hypothesis. Hypothesis 1 is rejected in all regression specifications as the p-values are much higher than 0.10 and range between 0.76 and 0.94. The variables that have some explanatory power for the weekend effect are *Volume*, *Turnover*, and *Volatility*. The coefficients associated with these variables are all statistically significant in all regression specifications. In conclusion, our evidence does not support the hypothesis that short-selling activities contribute significantly to the weekend effect.

It is also worth noting that the weekend effect refers to the difference between the Friday return and the following Monday's return. Therefore, the concern that the difference in the riskiness of the

[12] Asparouhova, Bessembinder, and Kalcheva (2010, 2013) show that value-weighted portfolio returns are unbiased. The mean for the weekend effect in the case of the value-weighted portfolio is statistically different from zero. The difference between the mean weekend effect based on equally weighting the returns versus value weighting the returns is somewhat negligible. We conclude that the weekend effect is not due to bid–ask bounce. Bessembinder and Hertzel (1993) also indicate that the reason for the weekend effect is not the bid–ask spread.

Table 3
Characteristics of the shortable and nonshortable sample.

Panel A reports mean, median, and standard deviation, for different firm characteristics for the shortable and nonshortable groups after the matching procedure described in Section 3. There are 283 stocks in the shortable group and 283 stocks in the nonshortable group on average per quarter. *Firm Size* is the market value of the equity of the stock in millions of $HK as of the end of the most recent week, *Book-to-Market Ratio* is the ratio of the book value of equity plus deferred taxes to the market value of equity as of the end of the previous quarter, *Dollar Volume* is the dollar volume of trading in thousands of $HK in the most recent week, *Share Turnover* is the number of shares traded divided by the number of shares outstanding in the most recent week, *Daily Volatility* is estimated from daily data for the most recent quarter, and *Share price* is the closing price in $HK in the most recent week. Panel B reports the univariate evidence on the weekend effects for the shortable and nonshortable groups, respectively. Monday refers to the first trading day of the week, and Friday refers to the last trading day of the week. The weekend effect refers to the difference between a Friday's return and the following Monday's return. The *p*-value (in parentheses) is testing whether the mean (median) is different from zero and is based on the Student's Paired Samples *t*-test (the Wilcoxon signed rank test).

Panel A: Summary Statistics

	Shortable Group			Nonshortable Group		
	Mean	Median	St.Dev.	Mean	Median	St.Dev.
Firm Size	7,107	1,869	17,825	5,086	677	26,753
Book-to-Market Ratio	1.6060	1.0018	1.9654	1.4531	0.9847	1.4811
Dollar Volume	24,520	8,153	46,645	12,017	2,986	52,156
Share Turnover	7.6209	3.7131	16.7613	5.3906	3.0646	6.2592
Daily Volatility	3.8500	3.5556	1.8631	3.9480	3.5793	1.6334
Share Price	5.4140	1.9337	8.8539	2.1354	1.1285	3.3669

Panel B: Weekend Effect

		Mean				Median		
		(1)	(2)	(3)		(4)	(5)	(6)
		Shortable Group	Nonshortable Group	Difference (1)–(2)		Shortable Group	Nonshortable Group	Difference (4)–(5)
Monday	Pre-event	−0.0359	−0.0970	0.0611	Pre-event	0.0306	−0.0904	0.0394
		(0.5935)	(0.1353)	(0.3870)		(0.9440)	(0.1677)	(0.2550)
	Post-event	−0.2543	−0.1567	−0.0976	Post-event	−0.1448	−0.0733	−0.1752
		(0.0000)	(0.0071)	(0.2000)		(0.0002)	(0.0120)	(0.1303)
	Difference (Post–Pre)	−0.2184	−0.0598	−0.1586	Difference (Post–Pre)	−0.0822	0.0007	−0.2518
		(0.0209)	(0.4907)	(0.1287)		(0.0340)	(0.7872)	(0.0255)
Friday	Pre-event	0.4111	0.4279	−0.0168	Pre-event	0.3437	0.3160	−0.0132
		(0.0000)	(0.0000)	(0.7988)		(0.0000)	(0.0000)	(0.7310)
	Post-event	0.3159	0.3996	−0.0837	Post-event	0.1689	0.3121	−0.1434
		(0.0000)	(0.0000)	(0.3203)		(0.0000)	(0.0000)	(0.1082)
	Difference (Post–Pre)	−0.0952	−0.0283	−0.0669	Difference (Post–Pre)	−0.2212	−0.0760	0.0073
		(0.2058)	(0.7312)	(0.5150)		(0.0042)	(0.3734)	(0.4427)
Weekend Effect	Pre-event	0.4470	0.5249	−0.0779	Pre-event	0.2592	0.3998	−0.1927
		(0.0000)	(0.0000)	(0.4218)		(0.0000)	(0.0000)	(0.2875)
	Post-event	0.5702	0.5563	0.0138	Post-event	0.3674	0.3451	−0.0391
		(0.0000)	(0.0000)	(0.9020)		(0.0000)	(0.0000)	(0.6369)
	Difference (Post–Pre)	0.1232	0.0315	0.0917	Difference (Post–Pre)	−0.1658	−0.0629	0.0579
		(0.3223)	(0.8048)	(0.5341)		(0.8411)	(0.8838)	(0.5620)

Table 4
Weekend-effect evidence from difference-in-difference regressions.

This table reports the results of the difference-in-difference regression in Model (1). The dependent variable is the weekend return estimated as the difference between Friday return and the following Monday return. We report results using a [−6, +6]-month event window. *Shortable* equals one if the stock is eligible for short selling, and *Period* equals one if the observation lies in the post-event period. *Size* is the natural logarithm of the market value of the equity of the stock as of the end of the most recent week, *BM* is the natural logarithm of the ratio of the book value of equity plus deferred taxes to the market value of equity, using the end of the previous quarter market and book values, *Volume* is the natural logarithm of the dollar volume of trading in the security in the most recent week, *Turnover* is the natural logarithm of the share turnover measured by the number of shares traded divided by the number of shares outstanding in the most recent week, *Volatility* is the standard deviation of the daily returns estimated from data over the most recent quarter, and *InvPrc* is the natural logarithm of the inverse of the daily closing stock price in the most recent week. *N* is the number of shortable stocks. The *p*-values are shown in parentheses below the coefficients. The standard errors are clustered by event.

Independent Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Intercept	0.226	1.454	−0.828	−2.957	−1.603	−1.484	−2.989
	(0.88)	(0.40)	(0.65)	(0.09)	(0.37)	(0.42)	(0.13)
Period	0.029	0.036	0.038	−0.054	0.014	−0.033	−0.030
	(0.95)	(0.94)	(0.93)	(0.90)	(0.98)	(0.93)	(0.94)
Shortable	−0.116	−0.280	−0.291	−0.234	−0.123	−0.323	−0.333
	(0.13)	(0.00)	(0.00)	(0.00)	(0.08)	(0.00)	(0.00)
Period × *Shortable*	0.088	0.088	0.088	0.083	0.087	0.084	0.084
	(0.53)	(0.54)	(0.54)	(0.55)	(0.54)	(0.56)	(0.56)
Size	0.021	−0.235	0.089	0.177	0.159	−0.029	0.188
	(0.81)	(0.02)	(0.41)	(0.06)	(0.18)	(0.77)	(0.10)
BM	−0.176	−0.098	−0.093	−0.073	−0.188	−0.039	−0.0352
	(0.02)	(0.14)	(0.16)	(0.21)	(0.02)	(0.51)	(0.55)
Volume	–	0.320	–	–	–	0.215	–
		(0.00)				(0.00)	
Turnover	–	–	0.342	–	–	–	0.239
			(0.00)				(0.00)
Volatility	–	–	–	0.285	–	0.235	0.229
				(0.00)		(0.00)	(0.00)
InvPrc	–	–	–	–	0.197	−0.009	−0.008
					(0.02)	(0.90)	(0.91)
Prob(*F*) for $\gamma+\delta=0$	0.8107	0.7606	0.7560	0.9393	0.8367	0.8839	0.8766
N	283	283	283	283	283	283	283
Prob(*F*)	0.0346	0.0000	0.0000	0.0000	0.0022	0.0000	0.0000
R^2	0.0010	0.0078	0.0088	0.0112	0.0017	0.0139	0.0145

two groups of stocks may cause the differences in the weekend effects is not relevant. This is because the riskiness should affect both Monday returns and Friday returns in a similar manner, and hence it is unlikely to affect the difference between the two (the weekend effect). Specifically, under market efficiency and additional general assumptions, stock returns follow a general multi-factor linear model. Then a stock's return depends linearly on its betas, which are measures of the stock's riskiness. Assuming a stock's betas and that the coefficients on the betas do not change between two consecutive trading days, then the difference in the stock's returns between two consecutive trading days does not depend on the stock's riskiness. In any event, our empirical findings above are that the weekend effects between the two groups of stocks are not significantly different. Therefore, the fact that the stocks on the short list are likely to be larger, more liquid, and less risky, and hence should earn lower return, does not explain away our findings.

4.3. Weekend effect and volatile stocks

Chen and Singal (2003a,p. 702) argue that “highly volatile stocks are likely to provide more profitable opportunities.” Furthermore, high-volatility stocks pose higher holding risks for the short sellers during the weekend. Therefore, the weekend effect should be stronger for more volatile stocks.

In order to test this prediction, we split our shortable sample into high- and low-volatility subgroups based on their estimated daily return standard deviation over the quarter prior to a stock initially becoming eligible for short selling. When a stock initially becomes eligible for short selling, it is assigned to the high (low) volatility group if its volatility measure is above (below) the median volatility measures of all the shortable stocks at that time. We have 182 stocks in the high-volatility subgroup and 101 stocks in the low-volatility subgroup. The volatility rank of the matched nonshortable stock is based on its corresponding shortable stock volatility ranking.

In examining the relationship between the weekend effect, short-selling activities, and volatility, we start with our Model (1) and add a measure of volatility. Specifically, we employ the following model over the 1994–2002 period:

$$R_{i,t}^{Weekend} = \alpha + \gamma \times Period + \mu \times Shortable + \delta \times Period \times Shortable + \lambda_1 \times VolGroup + \lambda_2 \times Period \times VolGroup + \lambda_3 \times Shortable \times VolGroup + \lambda_4 \times Period \times Shortable \times VolGroup + \beta \times X_{i,t} + u, \quad (2)$$

where *VolGroup* is a dummy variable that equals one if a stock is assigned to the high-volatility subgroup and zero if it is assigned to the low-volatility subgroup. The coefficient of interest is now λ_4, and the null hypothesis is $\lambda_4 = 0$. This is a conditional version of the previous difference-in-difference regression model outlined in Model (1). Essentially, we are testing whether the set of shortable stocks with high volatilities experience any increase in the weekend effect, compared with the set of shortable stocks with low volatilities, after the stocks were allowed for shorting.

The regression results of Model (2) are presented in Table 5. Similar to Table 4, the coefficients associated with the control variables *Volume* and *Turnover* are statistically different from zero in regression specifications (3), (4), (6), and (7). Focusing on the coefficient of interest associated with the triple-variable interaction term, $Period \times Shortable \times VolGroup$, we observe that it is not statistically different from zero in all seven regression specifications, rejecting the above-mentioned hypothesis on the relationship between short-selling, volatility, and the weekend effect.

To allow the coefficients on the control variables to vary across high-volatility and low-volatility groups, we replicate Table 4 for each subsample of stocks. The results are report in Table 6. Panels A and B report the results for the high-volatility subsample of stocks and for the low-volatility subsample of stocks, respectively. The results in Panel A reject the hypothesis that over the post-1994 period there is a significant difference between the weekend effects of the shortable groups of stocks versus the nonshortable group of stocks for the high-volatility group as the coefficient on $Period \times Shortable$ is not statistically different from zero in all regression specifications. Further, we find that for the high-volatility group there is no significant change in the weekend effect for the list of shortable stocks from the pre-event to the post-event window as the *p*-value of the *F*-test for the hypothesis $\gamma + \delta = 0$ is between 0.69 and 0.86. Panel B presents similar results for the low-volatility group. Not surprisingly, the coefficient associated with $Period \times Shortable$ is not statistically different from zero across all regression specifications, and the *p*-value of the *F*-test for the hypothesis $\gamma + \delta = 0$ is between 0.68 and 0.76. Therefore, for the low-volatility group, over the post-1994 period there is no significant difference between the weekend effects of the shortable group of stocks versus the nonshortable group of stocks, and there is no significant change in the weekend effect for the list of shortable stocks from the pre-event to the post-event window (Table 6).

We also provide evidence on the relationship among the weekend effect, short selling, and volatility during the pre-1994 period when short-selling was prohibited. To accomplish this, we replicate Table VI in Chen and Singal (2003a). Specifically, for each year from 1980 to 1993, we calculate the standard deviation of returns for each stock with over 200 days of return data. As standard deviation is likely to vary by firm size, following Chen and Singal (2003a), we form size deciles based on firms' market capitalization as of the end of June of the current year. Within each size decile, the stocks are divided into quartiles by the daily return standard deviation. We then aggregate the 40 portfolios along the size dimension, resulting in four quartile portfolios based on daily return standard deviations. The daily mean standard deviation for each quartile is reported in the first row in Table 7. The weekend effect for the highest-standard-deviation quartile is 0.62%, which is similar to the magnitude and the statistical significance to the corresponding number reported in Chen and

Table 5
Weekend effect and volatility.

This table reports the results of the difference-in-difference regression in Model (2). The dependent variable is the weekend return estimated as the difference between Friday return and the following Monday return. We report results using a [−6, +6]-month event window. *Shortable* equals one if the stock is eligible for short selling, and *Period* equals one if the observation lies in the post-event period. *VolGroup* equals one if a stock is assigned to the high-volatility group and zero if it is assigned to the low-volatility group based on their estimated daily return standard deviation over the six months prior to a stock initially becoming eligible for short selling. *Size* is the natural logarithm of the market value of the equity of the stock as of the end of the most recent week, *BM* is the natural logarithm of the ratio of the book value of equity plus deferred taxes to the market value of equity, using the end of the previous quarter market and book values, *Volume* is the natural logarithm of the dollar volume of trading in the most recent week, *Turnover* is the natural logarithm of the share turnover measured by the number of shares traded divided by the number of shares outstanding in the most recent week, and *InvPrc* is the natural logarithm of the inverse of the daily closing stock price in the most recent week. *N* is the number of shortable stocks. The *p*-values are shown in parentheses below the coefficients. The standard errors are clustered by event.

Independent Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Intercept	0.491	−0.189	1.161	−1.050	−1.644	−0.070	−2.243
	(0.19)	(0.90)	(0.47)	(0.54)	(0.38)	(0.96)	(0.27)
Period	−0.138	−0.122	−0.107	−0.106	−0.133	−0.117	−0.115
	(0.80)	(0.82)	(0.82)	(0.82)	(0.80)	(0.80)	(0.80)
Shortable	−0.308	−0.362	−0.363	−0.363	−0.329	−0.335	−0.336
	(0.03)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Period × *Shortable*	0.219	0.221	0.207	0.207	0.217	0.212	0.211
	(0.52)	(0.53)	(0.50)	(0.50)	(0.52)	(0.49)	(0.49)
VolGroup	0.066	0.113	0.101	0.100	0.101	0.090	0.090
	(0.80)	(0.67)	(0.71)	(0.71)	(0.71)	(0.74)	(0.74)
VolGroup × *Shortable*	0.348	0.344	0.114	0.098	0.290	0.070	0.055
	(0.08)	(0.06)	(0.51)	(0.57)	(0.08)	(0.65)	(0.72)
VolGroup × *Period*	0.250	0.237	0.224	0.224	0.235	0.223	0.223
	(0.26)	(0.28)	(0.30)	(0.30)	(0.29)	(0.31)	(0.31)
VolGroup × *Period* × *Shortable*	−0.203	−0.193	−0.185	−0.185	−0.202	−0.193	−0.194
	(0.64)	(0.65)	(0.62)	(0.62)	(0.63)	(0.61)	(0.61)
Size	–	0.047	−0.213	0.101	0.156	−0.119	0.191
		(0.62)	(0.03)	(0.35)	(0.21)	(0.29)	(0.16)
BM	–	−0.172	−0.099	−0.093	−0.183	−0.108	−0.103
		(0.02)	(0.14)	(0.16)	(0.02)	(0.13)	(0.14)
Volume	–	–	0.311	–	–	0.308	–
			(0.00)			(0.00)	
Turnover	–	–	–	0.337	–	–	0.330
				(0.00)			(0.00)
InvPrc	–	–	–	–	−0.162	−0.136	−0.134
					(0.07)	(0.14)	(0.14)
N	283	283	283	283	283	283	283
Prob(F)	0.0010	0.0019	0.0000	0.0000	0.0033	0.0000	0.0000
R^2	0.0008	0.0021	0.0081	0.0091	0.0024	0.0084	0.0094

Singal (2003a). The weekend effect for the lowest-standard-deviation quartile is 0.32%, which is statistically different from zero and approximately 20 basis points higher than the corresponding number reported in Chen and Singal (2003a).

The difference between the extreme volatility quartile portfolios is 0.30%, and it is statistically significant. However, volatile returns might translate into a larger weekend effect without the impact of short sales. To further explore whether this is the case, we divide the weekend effect by the standard deviation and report the standardized weekend effect as the last row in Table 7. The difference of the standardized weekend effect between the highest- and lowest-volatility quartile portfolios turns out to be statistically insignificant (p-value=0.59). This evidence suggests that the trading pattern of short-sellers does not contribute significantly to the weekend effect, nor does it depend on the level of stock volatility.

Table 6
Weekend effect and volatility—subsample tests.

In this table, we replicate Table 4 for two subsamples: the "High-Volatility Group" and the "Low-Volatility Group." The dependent variable is the weekend return estimated as the difference between Friday return and the following Monday return. We report results using a [−6, +6]-month event window. *Shortable* equals one if the stock is eligible for short selling, and *Period* equals one if the observation lies in the post-event period. The rest of the variables are explained in Table 4. *N* is the number of shortable stocks. The *p*-values are shown in parentheses below the coefficients. The standard errors are clustered by event.

Panel A: High-Volatility Subsample

Independent Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Intercept	0.557	−0.471	0.890	−1.512	−2.415	−1.171	−3.595
	(0.29)	(0.80)	(0.66)	(0.49)	(0.31)	(0.62)	(0.18)
Period	0.111	0.116	0.118	0.120	0.100	0.102	0.103
	(0.85)	(0.84)	(0.81)	(0.81)	(0.86)	(0.84)	(0.83)
Shortable	0.039	−0.045	−0.300	−0.318	−0.083	−0.341	−0.360
	(0.75)	(0.69)	(0.02)	(0.01)	(0.45)	(0.01)	(0.01)
Period × *Shortable*	0.016	0.017	0.021	0.020	0.012	0.015	0.015
	(0.92)	(0.91)	(0.90)	(0.90)	(0.94)	(0.92)	(0.93)
Size	–	0.076	−0.199	0.142	0.221	−0.046	0.298
		(0.51)	(0.10)	(0.29)	(0.17)	(0.74)	(0.09)
BM	–	−0.201	−0.106	−0.100	−0.207	−0.112	−0.105
		(0.06)	(0.27)	(0.29)	(0.06)	(0.26)	(0.28)
Volume	–	–	0.337	–	–	0.339	–
			(0.00)			(0.00)	
Turnover	–	–	–	0.361	–	–	0.363
				(0.00)			(0.00)
InvPrc	–	–	–	–	−0.196	−0.209	−0.210
					(0.04)	(0.03)	(0.03)
Prob(*F*) for $\gamma+\delta=0$	0.8514	0.8324	0.7893	0.7851	0.8586	0.8227	0.8191
N	182	182	182	182	182	182	182
Prob(*F*)	0.9468	0.4021	0.0002	0.0001	0.1163	0.0002	0.0001
R^2	0.0001	0.0016	0.0084	0.0094	0.0022	0.0090	0.0101

Panel B: Low-Volatility Subsample

Independent Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Intercept	0.491	0.359	1.578	−0.251	−0.629	1.105	−0.652
	(0.19)	(0.79)	(0.28)	(0.85)	(0.68)	(0.47)	(0.67)
Period	−0.138	−0.128	−0.114	−0.112	−0.136	−0.118	−0.116
	(0.80)	(0.81)	(0.81)	(0.81)	(0.80)	(0.81)	(0.81)
Shortable	−0.308	−0.315	−0.306	−0.306	−0.274	−0.288	−0.289
	(0.03)	(0.00)	(0.01)	(0.01)	(0.00)	(0.01)	(0.01)
Period × *Shortable*	0.219	0.213	0.208	0.208	0.217	0.210	0.210
	(0.52)	(0.52)	(0.50)	(0.50)	(0.52)	(0.50)	(0.50)
Size	–	0.007	−0.216	0.045	0.083	−0.177	0.075
		(0.92)	(0.02)	(0.58)	(0.41)	(0.08)	(0.44)
BM	–	−0.122	−0.080	−0.077	−0.137	−0.088	−0.084
		(0.12)	(0.30)	(0.32)	(0.11)	(0.32)	(0.33)
Volume	–	–	0.258	–	–	0.254	–
			(0.00)			(0.00)	
Turnover	–	–	–	0.276	–	–	0.272
				(0.00)			(0.00)
InvPrc	–	–	–	–	−0.128	−0.058	−0.053
					(0.30)	(0.65)	(0.67)
Prob(*F*) for $\gamma+\delta=0$	0.7649	0.7489	0.6901	0.6849	0.7618	0.6974	0.6915
N	101	101	101	101	101	101	101

Table 6 (*continued*)

Panel B: Low-Volatility Subsample							
Independent Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Prob(F)	0.0240	0.0440	0.0000	0.0000	0.0627	0.0000	0.0000
R^2	0.0004	0.0010	0.0060	0.0068	0.0014	0.0061	0.0068

Table 7
Weekend effect by standard deviation quartiles—evidence from the period when short selling is prohibited.

This table replicates Table VI in Chen and Singal (2003a). For each year from 1980 to 1993, we divide all stocks into size deciles based on their market capitalization as of the end of June of the current year. Within each size decile, we subdivide stocks into quartiles based on their standard deviation for stocks with over 200 days of return data. Friday return, Monday return, and the weekend effect are reported below for each standard deviation quartile. Standardized weekend effect is calculated by dividing the weekend effect by the standard deviation. The *p*-values are in parentheses.

	Std.Qtl.1	Std.Qtl.2	Std.Qtl.3	Std.Qtl.4	Std.Qtl.4–Std.Qtl.1
Daily Standard Deviation	0.0192 (0.0000)	0.0249 (0.0000)	0.0302 (0.0000)	0.0387 (0.0000)	0.0196 (0.0000)
Monday	−0.0771 (0.0000)	−0.1231 (0.0000)	−0.1389 (0.0000)	−0.2039 (0.0000)	−0.1268 (0.0012)
Friday	0.2383 (0.0000)	0.2698 (0.0000)	0.3308 (0.0000)	0.4114 (0.0000)	0.1732 (0.0000)
Weekend Effect	0.3154 (0.0000)	0.3929 (0.0000)	0.4697 (0.0000)	0.6153 (0.0000)	0.2999 (0.0000)
Standardized Weekend Effect	0.1606 (0.0000)	0.1583 (0.0000)	0.1604 (0.0000)	0.1681 (0.0000)	0.0076 (0.5906)

4.4. Trading system changes in HKSE—robustness

In this subsection we discuss some changes in the trading system that took place on the HKSE and their possible effect, if any, on our reported results. First, in the pilot program, the HKSE also instituted the uptick rule, which mandated that a short-sale could not be made below the best current ask price. The uptick rule was abolished in March 1996 and reinstated on September 7, 1998, due to changes in market conditions during the East Asian financial crisis. Hence, from March 1996 to September 1998, short-sales were operated without the uptick rule. At other times in our sample, short-sales were operated with the uptick rule. To see whether the uptick rule change has any confounding effect on our results we add a dummy variable *NoUptickRulePeriod* that equals 1 if the period is during the period without the uptick rule in place and *UptickRulePeriod* that equals 1 if the period is during the period with the uptick rule in place in Model (1). Then, we use the set of dummy variables to create triple interaction terms. The coefficients on the triple interactions terms $Period_{i,t} \times Shortable_{i,t} \times NoUptickRulePeriod_{i,t}$ and $Period_{i,t} \times Shortable_{i,t} \times UptickRulePeriod_{i,t}$ are both insignificant (for brevity unreported in a table), which demonstrates that our results are not affected by the uptick rule change.

Second, the Chen and Singal (2003a) hypothesis is that the short sellers contribute to the weekend effect. They find that (1) the weekend effect is most pronounced in stocks with high levels of short interest and that (2) the weekend effect disappears only for those stocks on which options are traded. They argue that speculative short sellers are more likely to prefer put options because of the high risk associated with speculative short positions. Thus, migration of speculative short sellers to the options market should coincide with a reduction in the weekend effect. On September 8, 1995, the HKSE launched its Traded Stock Options Market. One of the criteria for a stock to be included in the short-sell list is to be an underlying stock of stock options traded on the HKSE (see Appendix A). That is, in

the extreme case all stocks eligible for short-selling have options traded on them and none of the stocks in our control group of stocks not eligible for short selling have options traded on them.[13] The fact that we still find strong weekend effect for both stocks that are allowed to sell short and those that are not and that the difference in the weekend effects between the two groups of stocks is statistically insignificant strengthens the conclusion that short sellers might not be the main driving force behind the weekend effect.

Further, generally, any empirical study in finance that uses closing prices at the end of the day should be concerned with whether or not these closing prices are reflective of the fundamental values on average. It has been shown that trading mechanism can affect the closing prices (Kandel, Rindi, and Bosetti, 2012). In particular, Kandel, Rindi, and Bosetti (2012) show that the prices of the very end of a continuous trading phase are greatly affected by the introduction of a call auction. They document that following the adoption of the call auction, a significant portion of daily volume moves to the call auction, associated with a significant decline in volume, spreads, and volatility in the last minutes of the continuous phase. At the same time, the authors document that trade size decreases, price discovery improves, and limit orders become more aggressive right before the close. The HKSE is a highly transparent market and operates as a pure order-driven market similar to the prototype public limit order book envisioned in Glosten (1994).[14] During our sample period, there was no closing call auction, which is important for the price formation at the end of the continuous trading phase, as discussed in details in Kandel, Rindi, and Bosetti (2012).[15] In any case, using the difference-in-difference approach and the fact that stocks become eligible for short selling on different dates reduces the probability that any market-wide change would significantly affect our results.

5. Conclusion

It is contended that short sellers may exert temporary price pressures, and contribute to the renowned weekend effect. Research has shown that the weekend effect exists in most major international equity markets. Therefore, it is important to examine whether this explanation applies to other equity markets besides the U.S. market. The short-selling mechanism in the HKSE provides a unique opportunity to investigate this issue. For the 1994 to 2002 period, some stocks were allowed for short selling while others were not. Nevertheless, we find strong weekend effects for both subsets of stocks, and the difference in weekend effects between the two subsets of stocks is statistically insignificant.

Appendix A. Selection of stocks on the short-sell list

We reproduce the relevant regulations on the selection of stocks eligible for short-sell in this section.[16]

The selection of stocks to the short-sell list is not aimed as catering to the short-sell demand. Stocks allowed for short selling are selected according to the criteria set out in Regulation Eighteen of the Eleventh Schedule in the Rules of the Stock Exchange of Hong Kong Limited, which are approved by the Securities and Futures Commission (Hong Kong's counterpart of the SEC in the U.S.). For ease of reference, the criteria are reproduced as follows. Note that stocks that do not meet the criteria are not eligible for short selling.

[13] Also based on our discussion with traders in Hong Kong, it is always the case that if the stock is not allowed to short, then there is no listed option for the underlying security.

[14] For a detailed description of the HKSE trading mechanism, refer to Ahn, Bae, and Chan (2001) and Gao, Hao, Kalcheva, and Ma (2011).

[15] According to the HKSE Fact Book (2008, 2009), the closing auction mechanism was adopted for a brief period from May 26, 2008 to March 22, 2009, which is after our sample period, but was eventually abandoned by the exchange.

[16] This section is based on the regulation memo for the SFC and private correspondence between SFC officials and the authors.

1. All constituent stocks of indices that are the underlying indices of equity index products traded on the HKSE.
2. All constituent stocks of indices that are the underlying indices of equity index products traded on the Hong Kong Futures Exchange (HKFE).
3. All underlying stocks of stock options traded on the HKSE.
4. All underlying stocks of Stock Futures Contracts (as defined in the rules, regulations and procedures of HKFE) traded on the HKFE.
5. All stocks that meet the minimum liquidity requirement for the issuance of basket derivative warrants (i.e., market capitalization of public float of no less than HK$1 billion being maintained for the 60 days' qualifying period).
6. Stocks with market capitalization of not less than HK$1 billion and an aggregate turnover during the preceding 12 months to market capitalization ratio of not less than 40%.
7. The Tracker Fund of Hong Kong and other ETFs approved by the HKSE's Board in consultation with the SFC.
8. All securities traded under the Pilot Program (these are securities listed on NASDAQ/Amex that are cross-traded on the HKSE).

The SFC does not select the stocks eligible for short selling. These securities are selected by the HKSE according to the eligibility criteria. The HKSE will review the list of designated securities (i.e., securities that can be sold short) and remove from the list the securities that no longer meet the criteria and add new securities that meet the criteria. The updated draft list is then sent to the SFC for comments. In general, stocks that meet the eligibility criteria but which have been identified by the SFC or the HKSE as "ramped" stock, stocks under investigation, or suspended stocks will not be included in the final list. The list of designated securities is publicly announced by the HKSE on its website. There is no official pre-announcement prior to that.

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