Short-Sales Constraints and Price Discovery: Evidence from the Hong Kong Market

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Abstract

The unique short-sales restrictions present in the Hong Kong stock market, where a list of designated securities that can be sold short is revised from time to time, provide valuable data for examining the effects of short-sales constraints on market efficiency, especially efficiency in price discovery. By analyzing the cumulative abnormal returns around the lifting and reinstatement of short-sales restrictions, we find that short-sales constraints tend to cause stock overvaluation and that the overvaluation effect is more dramatic for individual stocks where wider dispersion of investor opinions exist. The evidence suggests that eliminating short-sales restrictions helps improve the efficiency of price discovery, which is consistent with Miller (1977)'s intuition. We also find that when short sales are allowed, individual stock return exhibits higher volatility and less positive skewness.

Key words: Short-sales constraints, Price discovery, Hong Kong

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1. Introduction

The question of how short-sales practices impact capital markets is a highly controversial one, with short-sale regulations varying widely across countries and capital markets.[1] Whereas short selling has been carried out for years in major financial markets around the world, its effects on market efficiency, especially on pricing efficiency, remain of interest to financial researchers.

Miller (1977) theorizes that with short-sales constraints, security prices tend to reflect the most optimistic opinion and thus to be upward-biased. This overvaluation argument is based on two conditions: (1) security short sales are either prohibited or costly and (2) investors have heterogeneous beliefs or information about the security's value. The underlying intuition is quite straightforward. Pessimistic investors are forced to sit out of the market when short sales are not available, and thus some negative information is suppressed and not reflected in prices, enabling enthusiastic buyers to bid prices above the level that average investors perceive as fair. This argument has a significant impact on market efficiency theories, since one of the major functions of capital markets is price discovery, and an efficient market should be "a market in which prices always 'fully reflect' available information" (Fama (1970).

Jarrow (1980) and Figlewski (1981) are among those who initially attempted to model Miller (1977)'s idea rigorously in a static Capital Asset Pricing Model framework. By providing a general equilibrium analysis, Jarrow (1980) shows that the total effect of prohibiting short sales may be more complex, owing to substitution effect among stocks. When two equivalent markets differing only with respect to short-sales restrictions are compared, the price of an individual risky asset under short-sales restrictions can be either higher or lower. Figlewski (1981) adopts a standard one-period model to show that when investors with unfavorable information

[1] Bris, Goetzmann, and Zhu (2003) provide a comprehensive review of the regulations of short sales in 47 equity markets around the world.

are constrained from selling short, excess demand appears, and equilibrium prices are bid up and are thus higher than the market-clearing price when short-sales constraints do not exist. This is consistent with Miller (1977)'s intuition. Chen, Hong, and Stein (2002) obtain similar result by developing a model that allows for risk aversion, in that stocks with short constraints reflect optimistic beliefs and thus have lower future returns.[2]

Diamond and Verrecchia (1987) provide an alternative view by modeling the effects of short-sales constraints in a rational-expectation framework. They show that the price of a short-sales-constrained stock adjusts more slowly to unfavorable private information than it does to favorable private information. But they argue that in a rational market, traders will recognize the existence of short-sales constraints and will adjust their beliefs such that no overpricing of securities will exist, on average.

By contrast to Miller (1977) and other optimism models, Diamond and Verrecchia (1987)'s work is more in the efficient-markets tradition. They make a strong assumption by introducing a risk-neutral market maker who has prefect knowledge of the economic environment and can perform Bayesian updating in the short period between two consecutive trades. Careful empirical investigation is required to examine the validity of these model predictions.

The available empirical evidence largely supports the theoretical view that constraining short sales hinders price discovery. However, most tests are carried out in indirect ways. This is mainly because although short sales are not encouraged, they are permitted in major financial markets, especially in the U.S. markets, upon which most empirical tests focus. It is impossible to find two economies that are identical except that they do or do not have short-sales constraints. Thus, the focus of such tests has been on how to identify and measure the extent of the constraints. The earliest

[2] Some other studies conclude that the price can be higher than the valuation of all investors owing to the opportunity to speculate that arises when shorting is prohibited. See Harrison and Kreps (1978) and Morris (1996). Duffie, Garleanu, and Pedersen (2002) present a dynamic model to show that the prospect of lending fees may push the initial price of a stock above even the most optimistic buyer's valuation.

empirical efforts examining the effect of short-sales constraints on overvaluation date back to Figlewski (1981), who tests the theory by looking at the relationship between the level of short interest and subsequent stock returns. His test is based on the assumption that observed short interest could proxy for the level of shares that would be sold short if short-sales constraints were nonexistent. He provides evidence that more-heavily shorted firms underperform less-heavily shorted firms.

Chen, et al. (2002), however, argue that this short-interest proxy may suffer misspecification in that variations across stocks in short interest may instead reflect variations in the transactions costs of shorting. A stock with a low or zero value of short interest may simply be difficult or costly to short, which could potentially translate into more, rather than less, negative information being held off the market. Chen, et al. (2002) hold that there may be no clear-cut interpretation of the relationship between short interest and subsequent returns,[3] and they bring forward another proxy for short-sales constraints: the low breadth of ownership. They find that stocks experiencing decline in breadth of ownership—a proxy for short-sales constraints becoming more tightly binding—subsequently underperform those for which breadth has increased.

Danielsen and Sorescu (2001) adopt a different approach. They focus on abnormal stock returns following option listing. Since the introduction of traded put and call options arguably offers a lower-cost way of establishing a short position, the listing of options listing can be viewed as the de facto alleviation of short-sales constraints. Their empirical results indicate that post-1980 option introductions are associated with negative abnormal returns in underlying stocks, which support the overpricing hypothesis. Using data on DotComs, Ofek and Richardson (2003) show that short-sales constraints, in the form of stock option lockups, have a considerable and persistent negative impact on subsequent stock returns. This supports the

[3] Direct supporting evidence is found in D'Avolio (2002). For stock deciles sorted by short interest, neither the mean loan fee nor the percentage of stocks with high loan fees of the portfolio is monotonic in the actual short interest. This shows that short interest is not an effective measure of short-sales constraints.

argument that stock prices do not fully incorporate information under short-sales constraints. Jones and Lamont (2002) use early 20th century U.S. data to show that stocks that are expensive to short have high valuations and low subsequent returns. Their finding is consistent with the hypothesis that difficult-to-short stocks are overpriced.

Another attempt to test Miller (1977)'s hypothesis looks directly at the relationship between differences of investor opinion and cross-sectional stock returns. Diether, Malloy, and Scherbina (2002) use the dispersion of analysts' earnings forecasts as a measure of difference of opinion and show that stocks with higher dispersion earn lower future returns than otherwise similar stocks. They argue that analysts' incentive structure represents another form of friction that prevents the revelation of negative opinions. Their result thus supports Miller (1977)'s intuition. Boehme, Danielsen, and Sorescu (2002) design a test to show that both high dispersion of investor opinions and short-sales constraints are required to induce overvaluation.

These examples of indirect empirical research, almost without exception, face the unavoidable problem of using an imperfect proxy for short-sales constraints. Jones and Lamont (2002) arguably provide the most convincing evidence, since they look at the direct cost of short sales.[4] Yet, they have to go back to the 1930s to find relevant data. To test whether short-sales constraints indeed induce overvaluation calls for a more direct examination of the effects of such constraints.

In this paper, we carry out such a direct test of the effects of short-sales constraints on price discovery by tracing the evolution of short-sales regulation in the Hong Kong stock market, where a list of designated securities for short selling is revised from time to time. In January 1994, the Hong Kong Stock Exchange launched a pilot program to establish the so-called short-sale designation list. Initially, there

[4] Geczy, Musto, and Reed (2002) and D'Avolio (2002) look at shorting costs from a sample of security lending provided by certain institution covering months (11/1998–10/1999 and 4/2000–9/2001, respectively).

were 17 stocks on the list. Since 1994, the list has been frequently changed. Only stocks on the list can be short sold, and when an individual stock is deleted from the list, it cannot be short sold again. This market practice and the unique database enable us to directly compare stock price effects before and after the stock enters/exits the list, with the other characteristics of the sampled stocks naturally controlled. And since the restrictions for short sales are prohibited and/or reinstated for different stocks at different times, a subsequent cross-sectional analysis would suffer less from the potential confounding effects of other concurrent effects.

A noteworthy related work is Bris, et al. (2003)'s international study of the effects of short-sales constraints. They employ stock return data from 47 equity markets around the world to examine the effects of short-sales restrictions on market efficiency, comparing markets where short sales are allowed and practiced and those where they are not. Whereas the measure of short-sales constraints is direct in the cross-country analysis, data limitations do not allow for carrying out the overvaluation test directly. Correspondingly, Bris, et al. (2003) examine whether short sales are associated with more cross-sectional variation in equity returns, based on the assumption that more efficient price discovery results in higher idiosyncratic risk and less price co-movement. Our single-country analysis based on unique Hong Kong data complements their study well, in that we offer a direct examination of the hypothesized relationship between short-sales constraints and stock overvaluation.

Our data also enable us to examine another issue of interest: whether short sales are connected with market crashes. Existing theories offer mixed views. Bernardo and Welch (2002) develop a model describing how fear of financial crises, rather than fear of a real liquidity shock, is the true cause of financial crises. One implication of their model is that implementing constraints that hinder some market participants from front-running other investors can effectively prevent financial crises from occurring. This implication supports the finding of Franklin and Gale (1991) that short sales can potentially destabilize an economy. On the other hand, Hong and Stein (2003) develop a heterogeneous agent model and argue that if some investors are constrained from selling short, their accumulated unrevealed negative information will not be manifest until the market begins to drop, which further aggravates market declines and leads to a crash. Therefore, their model predicts a higher frequency of extreme negative stock returns when short-sales constraints are binding. This leads to a further testable implication that stock returns are more negatively (or less positively) skewed when short sales are constrained.

Bris, et al. (2003) test whether short-sales constraints stabilize or destabilize financial markets by examining the standard deviation of individual returns, the frequency of extreme negative returns, and the skewness of both individual returns and market returns. Their results are mixed. In markets where participants are allowed to short stocks, less return volatility and lower frequency of extremely negative returns are observed, which suggests that short sales help stabilize markets. However, they document that, in these markets, the skewness of stock returns at both the individual and the market level tends to be more rather than less negative, which contradicts Hong and Stein (2003)'s model's prediction and offers no evidence that short sales stabilize markets.

In this paper, we carry out two groups of empirical tests. The first group examines the role of short-sales constraints in price discovery, and the second examines their role in stabilizing or destabilizing the market. Our direct tests in the first group strongly support the hypothesis that in the presence of short-sales constraints, stocks tend to be overvalued. When a stock is added to the list of designated securities for short selling (i.e., the stock may be sold short), significant negative abnormal returns are observed. We document even more negative abnormal returns when we limit the sample to events in which no tick rule is in effect (which arguably represents a more thorough lifting of short-sales restrictions). Both findings suggest that stock prices are upward biased when short sales are restricted. More supporting evidence is found for off-the-list events, where the re-imposition of short-sales restrictions on certain stocks results in significantly positive abnormal returns.

By cross-sectionally regressing abnormal returns around on-the-list events over variables that proxy for the dispersion of investor opinions, we find evidence consistent with Miller (1977)'s intuition and relevant optimism models. The observed significant negative coefficients indicate that, when short-sales constraints are present, the more diverse ex ante opinions over an individual stock is associated with the more serious overvaluation of the stock. Additional evidence comes from off-the-list events, where the coefficients mostly turn positive**,** though not significant.

However, our second group of tests fails to support the prediction of Hong and Stein (2003)'s market crashes model. We find that when individual stocks can be sold short, their returns exhibit less-positive skewness, rather than the more-positive skewness that Hong and Stein (2003) predict. Our results are consistent with those in Bris, et al. (2003). We also find that individual stocks seem to be more volatile when short sales are allowed, which does not support the notion that short sales play a stabilizing role.

The rest of this paper is organized as follows. Section 2 provides a relatively detailed overview of short-sales practices on the Hong Kong stock market, along with a discussion of the uniqueness of the data from this market. Section 3 tests the effects of short-sales constraints on the price-discovery process. Abnormal returns (ARs) and cumulated abnormal returns (CARs) around on-the-list and off-the-list events are calculated and analyzed. Proxies standing for the dispersion of investor opinions are introduced, and our regression results—which strongly support Miller (1977)'s argument that overvaluation is more severe where investor opinions are more widely dispersed—are reported. Some robust tests are carried out, and other factors (including tick rule and announcement effects that may have influenced on our results) are analyzed and discussed. In Section 4, to test the market crashes hypothesis in Hong and Stein (2003), we further examine some characteristics of stock return distributions before and after short-sales restriction changes. Section 5 is a summary.

2. Short Sales on the Hong Kong Stock Market

In January 1994, in line with the reform of the securities borrowing and lending regime, the Hong Kong Stock Exchange introduced a pilot scheme for regulated short selling. Under the scheme, 17 securities could be short sold, but a short sale could not be made below the best current ask price (the so-called “tick rule”). The scheme was revised in March 1996, when the number of securities designated for short selling was increased and the tick rule was repealed. The rule was reinstated on September 7, 1998, following the October 1997 Asian financial crisis. However, short-selling transactions by stock options market makers to hedge the risk of the portfolio that results from their market-making activities are exempt from the rule. Finally, on December 3, 2001, an exemption from the tick rule on short selling in the stock market for index arbitrageurs and market makers took effect to help improve market liquidity, especially in a falling market. The number of designated securities for short selling is revised on a quarterly basis, based on liquidity and market capitalization criteria. By ~~the end of May~~ January 27 2003, there were ~~174~~ 163 common stocks (out of ~~818~~ 812 common stocks traded on the main board and ~~171~~ 163 traded on the Growth Enterprises Market) that could be short sold.

We obtained historical versions of the list of Designated Securities Eligible for Short Selling (hereafter referred to as the list) from the Hong Kong Stock Exchange, including 21 revisions to the list since its establishment, the last one effective since 27 January 2003[5]. Other data, including daily prices, trading volume, and market value of individual stocks covering the period January 1992 to July 2003 were downloaded from the Datastream database.[6] ~~There were 21 revisions to the list .~~Table 1 provides some summary statistics related to these revisions, including revision dates and the number of stocks listed. We find that the cumulative number of stocks that ever

[5] Earlier versions of the list (up to August 2000) are found in the library of the Hong Kong Stock Exchange; later versions can be downloaded from the exchange’s Web site (http://www.hkex.com.hk/).

[6] Although stocks could not be sold short until January 1994, we include market data beginning from January 1992 for the purpose of the OLS market model estimation.

appeared on the list is ~~454~~448. The sample contains ~~537~~ 519 events in which a stock is included on the list (short-sales restrictions lifted) and ~~362~~ 355 events in which a designated stock is eliminated from the list (short-sales restrictions reinstated). Correspondingly, our data contain these two types of distinct events, which we hereafter refer to as on-the-list events and off-the-list events, respectively. An on-the-list event occurs when an individual stock is added to a revised version of the list and can therefore be short sold from the effective date of that version.[7] An off-the-list event occurs when an individual stock originally on the list is deleted from the new version, which means that from the effective date of the new version, this stock can no longer be short sold.

(Insert Table 1 here)

We note that stocks must meet certain criteria to be included on the list. The fist expansion of the list in March 1996 covered all constituents of the Hang Seng Index, the Hang Sang MidCap 50 Index, and the balance of the 50 largest stocks that are not in those indices. The criteria are also revised from time to time owing to changing market conditions. For example, as a result of the reshuffling of indices on Hong Kong financial markets in November 2001, the Hong Kong Stock Exchange revised the criteria to stipulate that stocks qualified for short selling should be among one or more of the following groups:[8]

(a) All constituent stocks of indices that are the underlying indices of equity index products traded on the exchange

(b) All constituent stocks of indices that are the underlying indices of equity index products traded on Hong Kong Futures Exchange Limited

(c) All underlying stocks of stock options traded on the exchange

(d) All underlying stocks of Stock Futures Contracts (as defined in the rules,

[7] Note that when a new version of the list is published, if a stock included in the most recent version remains on the list, this is not counted as an on-the-list event. If a stock originally on the list was deleted but then later reinstated, the reinstatement is counted as another on-the-list event.

[8] This is also the latest criterion currently in effect.

regulations, and procedures of Hong Kong Futures Exchange Limited) traded on the Hong Kong Futures Exchange Limited

(e) Stocks that meet the minimum liquidity requirement for the issuance of basket derivative warrants (i.e., market capitalization of public float of not less than HK$1 billion, being maintained for the 60 days' qualifying period)

(f) Stocks with market capitalization of not less than HK$1 billion and an annual turnover-to-market capitalization ratio of not less than 40%

(g) Tracker Fund of Hong Kong and other Exchange Traded Funds approved by the Board in consultation with the commission

(h) All securities traded under the pilot program.

We also note that designated stocks are more likely to be value stocks. They are either constituents of indices or are relatively large and actively traded. (Our later statistics show that the market beta of the stocks in CAR tests averaged at about 0.6.) This reflects the government's attempt to avoid the claimed adverse influence (intense volatility and potential manipulation of prices, for example) aroused by short sales on smaller stocks. And although some stocks on the Growth Enterprises Market (GEM)[9] have been eligible to be short sold since February 12, 2001, most were soon eliminated from the list. As of May 2003, there were only four GEM stocks on the list.

It is important to note that these criteria-driven decisions for adding a stock to the list or for eliminating one from it may result in limited endogeneity on our sample formation and thus on the whole analysis. Inclusion in the list may well be a result of suggested excellent past performance and/or large market capitalization. Likewise, exclusion from the list may be a result of the stock's decreased market capitalization and/or liquidity, which is probably connected to the stock performing more poorly than before. Thus, in our later analysis, caution needs to be exercised in attempting to

[9] Growth Enterprise Market is an alternative market in Hong Kong established in November 1999 and operated by the Hong Kong Stock Exchanges, where growth enterprises with relatively small capitalization and high growth potentials are listed and traded.

precisely differentiate between the pure effect of changes in short-sales constraints over stock returns and the effects of changes in fundamentals and corresponding investors expectations.

However, we believe that this will not result in significant, if any, bias in our results. Our main methodology, as discussed later, is to examine the cumulative abnormal returns around the change in short-sales constraints. For two reasons, we expect to find a significant difference before and after the changes only if the existence of short-sales constraints affects the price-discovery process. First, given the well-publicized criteria and the easily observed changes in fundamentals and in the market performance of individual stocks, it is relatively easy for investors to predict the inclusion/exclusion decision well in advance. Unless the efficiency of price discovery has been affected, one probably would not expect to observe significant abnormal returns purely due to the announcement itself. Second, in our main test, we examine the abnormal returns around the *effective* dates of on-the-list and off-the-list events (when the regulation changes take real effect) rather than the announcement dates. The observed abnormal returns, if any, could be more confidently attributed to binding of short-sales restrictions, or the lack thereof. In robust tests, we also check the abnormal returns around announcement dates and compare them with the results from the main test. In general, significant cumulated abnormal returns are obtained around effective dates, but the cumulated abnormal returns around announcement dates are ~~insignificant~~less significant, and of opposite signs. The overall results support the validity of our reasoning above and suggest that the potential endogeneity bias is rather weak.

There exists some slight survival bias in our sample selection. After matching the ~~454~~ 448 stocks that ever appeared on the lists and the daily transaction records available in Datastream on July 23, 2003, our sample includes ~~409~~ 403 stocks (most unmatched cases are due to mergers and acquisitions of individual stocks and the subsequent deletion of their trade records from Datastream). For the purpose of comparative analysis before and after the short-sale constraint changes, we again eliminate from our sample 12 stocks whose daily price records begin exactly from the day when they were allowed to be short sold. So the final sample includes ~~397~~ 391 stocks, with ~~467~~ 450 on-the-list events (short-sales constraints lifted) and ~~314~~ 307 off-the-list events (short-sales constraints reinstated). And in a later analysis of abnormal returns and distribution characteristics of the returns, we confine our tests to stocks whose transaction records before and/or after the event dates are no shorter than a certain length,[10] so the performance of the stocks included in the final tests tend to be more stable than that of all the stocks ever entering the list, on average. We expect that this selection process will make our tests immune to possible compounding effects of other events, such as initial public offerings and highly volatile periods around stock listings and delistings.

The data set including on-the-list and off-the-list events enables us to test the short-sales constraints effect directly, and it also possesses several unique characteristics. First, there coexist both individual stocks that can be sold short and stocks that cannot, which is rare in other economies. To the best of our knowledge, only Bris, et al. (2003) bring forward similar data where securities are subject to different short-sales regulations. But they introduce this difference by applying multi-market data, under which situation controlling cross-sectional regressions across economies becomes a challenging task. Second, short-sales restrictions are lifted at different times for individual stocks in our data set, which enables us to better diversify away any concurrent effect due to period- and/or market-specific events in the cross-sectional event tests. And, most important, while most other empirical studies examine only the effects associated with the relaxation of short-sales constraints, our data contain unique off-the-list events in which individual stocks are re-prohibited from being short sold. This provides an excellent mirror-like test, and contrasting the empirical results between on-the-list and off-the-list events will be

[10] Typically, to include on-the-list and off-the-list events in the cumulative abnormal returns test, we require an individual stock to have at least a 180-day return record. This 180-to-250-day pre-event window is used to estimate the beta for individual stock based on the Capital Asset Pricing Model.

most persuasive.

The unique sample makes our empirical tests straightforward and credible. We calculate cumulative abnormal returns around the effective dates of on-the-list events for each individual stock, and, by examining whether it is significantly different from zero cross-sectionally, we are actually comparing stock price levels before and after the repeal of short-sale restrictions, thus revealing the effect of short-sales constraints on price discovery. The same tests can be performed symmetrically, over off-the-list events, and the results are deemed an important supplement to on-the-list events results. We are also able to compare the volatility, skewness, and frequency of extreme negative values of stock returns before and after on-the-list and off-the-list events; parameters are estimated based on an individual stock's returns during estimation windows of the same length before and after the event dates. The following two sections elaborate on the empirical tests and subsequent results.

3. Short-Sales Constraints, Overvaluation and Dispersion of Opinions

3.1 Hypotheses

From the above analysis, we summarize two main hypotheses to be tested in this section:

Hypothesis 1: Stock prices will decrease when short-sales restrictions are repealed; stock prices will increase when short-sales restrictions are reinstated.

This hypothesis is based on Miller (1977)'s overvaluation theory and relevant optimism models of short-sales constraints discussed previously. While there are differences in the basic assumptions of these theory and models, the underlying intuition is in fact the same. In an unconstrained efficient market, if some stocks are identified to be over-valued, the discernible market participants will short them, and their sale will bring the price back to its fair value. But when short sales are restricted, investors who have pessimistic opinions or negative information will simply leave the market, even though they believe the stocks are over-valued. Accordingly, stock prices in such an economy tend to reflect only enthusiastic investors' valuation and thus are upward biased.

Specifically, this hypothesis suggests that, ceteris paribus, one would expect to observe negative abnormal returns around on-the-list event dates. This is because when a stock is added to the list (on-the-list events), short-sales restrictions are repealed, which allows more pessimistic opinions to be manifested and makes stock prices decline. For off-the-list events, it is not quite intuitive that the market will bias prices upward again quickly, since negative information will probably not become available immediately or accumulate immediately following the event dates. But it seems reasonable to make a conjecture that, by recognizing that the short-sales restriction will prevent some negative information from being disclosed from now on, some investors (especially short-term investors who care more about immediate price movements than about long-term fundamentals), will adjust their valuation of stocks upwards. In other words, they now require a lower expected stock return. Thus, we expect to find positive abnormal returns around these events.

Hypothesis 2: The overvaluation effect of short-sales constraints is positively associated with the extent of dispersion of opinions; the more diverse the opinions, the more stock prices will decrease when short-sales restrictions are repealed.

This hypothesis stresses the second condition of Miller (1977)'s overvaluation theory and can be easily drawn from the reasoning explained above. When investors have more divergent opinions about a certain stock, the most optimistic investors' opinion will deviate more sharply from the average valuation of all investors (which is assumed to be the stock's fair value), so the overvaluation will be more dramatic. Specific to our sample, this hypothesis means that if the opinions are more divergent before on-the-list events take place, the overvaluation will be more dramatic, and thus more negative abnormal returns should be observed around on-the-list events. So, if abnormal returns are regressed over variables that stand for the dispersion of opinions, negative coefficients are expected. On the other hand, for off-the-list events, there is no solid theoretical prediction available. We make a bold conjecture that reinstating short-sales restrictions may have a greater impact on those stocks with more diverse opinions, thus resulting in more positive abnormal returns. So, in regressions of cumulated abnormal returns around off-the-list events over variables that stand for the dispersion of opinions, positive coefficients would add support to hypothesis 2.

3.2 Short-Sales Constraints and Overvaluation

3.2.1. Abnormal Return Measures

To test the overvaluation hypothesis, we need to compare stock prices before and after event dates. For the purpose of cross-sectional tests, we use the measures of abnormal returns (ARs) and cumulative abnormal returns (CARs) around events dates according to Brown and Warner (1985).

There are two measures for calculating CARs. The first measure is the cumulative abnormal return during event window (t_1, t_2) based on the OLS market model, defined as

$$CAR_m = \sum_{t=t_1}^{t_2} (R_{it} - \hat{\alpha}_i - \hat{\beta}_i R_{Mt}), \qquad (1)$$

where R_{it} is stock i's return on day t (we take the date when the change in short-sales restrictions goes into affect as event day 0) and R_{Mt} is the value-weighted average return of all the stocks on the market. $\hat{\alpha}_i$ and $\hat{\beta}_i$ are the estimations of intercept and coefficient of market return based on the OLS market model where stock i's daily return R_{it} is regressed on market daily return R_{Mt} in an estimation window before the event window.

The second measure is the cumulative abnormal return during event window (t_1, t_2) based on Brown and Warner (1985)'s market-adjusted model, defined as

$$CAR_a = \sum_{t=t_1}^{t_2} (R_{it} - R_{Mt}) \, . \qquad (2)$$

We use CAR measures to filter the price changes due to the market factor and to trace the abnormal return that occurs as the result of events. If the CAR measure around the event date is significantly positive, it suggests that the occurrence of events is associated with a positive price reaction, and vice versa.

3.2.2. Abnormal Return Results

In Table 2, the cross-sectionally averaged AR and CAR values of different lengths of event windows around on-the-list events are reported. For the market model, an estimation window of (-260, -11) with a minimum estimation window length of 180 days is applied. The first row of Table 2 reports the cumulated abnormal return in the 21-day (-10, 10) window around on-the-list events based on a market model. The second and third rows report the cumulated abnormal returns in the 2-day window and on event days. We can see that the average cumulated abnormal return in the (-10, +10) window amounts to -~~3.748~~4.198% with a t-value of ~~-3.32~~ -3.61, indicating a statistically significant difference from zero at the 1% level. The average abnormal return on the event day is ~~-0.499~~ -0.604% (t-value = ~~-1.98~~-2.37), which is significantly different from zero at the 5% level. The results reveal that when short-sales constraints are repealed, stock prices decrease. These results strongly support hypothesis 1, which states that short-sales constraints result in overvaluation.

(Insert Table 2 here)

The next three rows of Table 2 report the cross-sectionally averaged AR and

CARs based on market-adjusted value. The average cumulated abnormal return in the (-10, +10) window is ~~–3.787~~-4.216%, with a t-value of ~~–3.50~~-3.79, indicating a statistically significant difference from zero at the 1% level. The average abnormal return on the event day is – ~~0.620~~0.733% (t-value = ~~-2.26~~-2.60), which is significantly different from zero at the ~~5~~1% level. The results are quantitatively similar to the results based on the market model, and they also strongly support hypothesis 1. For brevity, our later discussion focuses mainly on results pertaining to CAR_ms, since the results from the two types of CARs are largely the same.

Next, we examine the cumulative abnormal returns around off-the-list events. Table 3 reports the cross-sectionally averaged AR and CAR values of different lengths of event windows around off-the-list events[11]. Consistent with our prediction under hypothesis 1, the CARs around off-the-list events are significantly positive: The average cumulated abnormal return in the (-10, +10) window based on the market model amounts to ~~8.047~~7.470%, with a t-value of ~~5.25~~4.93, which is statistically significantly different from zero at the 1% level; the average abnormal return on the event day is ~~0.543~~0.561%, which is statistically significantly different from zero at the 5% level. CAR values based on the market-adjusted model are qualitatively similar. The results suggest that when short-sales constraints are reinstated, prices increase. This may be due to investors' expectation that the reinstatement of short-sales restrictions will render it more difficult for negative information to be impounded into prices, and they therefore adjust their valuation of the stock upwards. The CARs on each day during the 21-day window around both on-the-list and off-the-list events are plotted in Figure 1. It appears that for off-the-list events, the CARs are even more statistically significantly non-zero.[12]

[11] Note that in Table 2, the number of on-the-list events included in the cross-sectional analysis shrinks to 403, down from the 467 events in the sample, while in Table 3, the number of off-the-list events shrinks from 314 to 312. This is because a 250-day estimation window, with a minimum of 180 days is required to estimate the market model for individual stocks. It is natural that this selecting criterion eliminates more on-the-list events than off-the-list ones.

[12] We also examine both measures of CAR for other event-window lengths for both types of events (e.g., CAR(-3,3), CAR(-30,30)). The results are qualitatively similar.

(Insert Table 3 here)

(Insert Figure 1 here)

3.2.3 Abnormal Returns Under Tick Rule

As mentioned in the preceding section, when short sales were first introduced into the Hong Kong stock market in 1994, a tick rule also took effect, stipulating that short sales could not be carried out below the best current ask price. This regulation is another form of a short-sales constraint that remains in effect for designated stocks, even though they can be sold short, literally. The tick rule was repealed in March 1996 but was reinstated in September 1998. Some market participants, namely stock options market makers, index arbitrageurs, and market makers of the stock market, have been exempted from this tick rule in different periods. However, it is still probable that this constraint weakens the factual effect of short-sales restrictions lifting. It is necessary, therefore, to control for this tick rule factor. Since all the off-the-list events took place during periods in which the tick rule was in effect, we focus on on-the-list events only. Based on hypothesis 1, we predict that the factual impact of lifting short-sales restrictions is less significant for on-the-list events that took place when the tick rule was in place, compared with the impact on these events when the rule was not in effect. Therefore less negative CARs would be observed when the tick rule was in place.

We divide on-the-list events into two groups, depending on whether an event took place when the tick rule was in effect. Specifically, the first group includes on-the-list events that took place on January 3, 1994, and after September 1998, during which periods the tick rule was in effect. The second group includes events that took place during periods when the tick rule was not in effect. We then calculate average AR and CAR values for each group. We report the results in Table 4.

(Insert Table 4 here)

Panel A of Table 4 reports the results for the first group (i.e., for events that occurred when the tick rule was in effect). We can see that the average cumulated abnormal return in the (-10, +10) window based on the market model is -2.159%, which is statistically marginally significant at the 10% level. This cumulated abnormal return has a positive sign which is consistent with the result reported in Table 1 based on all on-the-list events, yet is much less both in magnitude and in statistical significance. Furthermore, none of the other AR or CAR values based on the market model or the market-adjusted model are statistically significantly different from zero at conventional levels. This suggests that because of the existence of the tick rule, stocks are still quite difficult to short, even though the explicit restriction has been repealed. Therefore, the overvaluation caused by short-sales constraints is ~~not significantly~~ much less corrected by the occurrence of on-the-list events. This is consistent with our expectations based on hypothesis 1. Panel B shows that when there is no tick rule in effect, the cumulative abnormal returns are statistically significantly different from zero. For example, the average cumulative abnormal return in the (-10, +10) window based on the market model is –4.784%, which is significant at the 1% level. The average abnormal return on the event day based on the market model is – 0.937%, which is significant at the 5% level. This suggests that since short-sales constraints are alleviated more thoroughly when the tick rule is not in effect, overvaluation associated with short-sales constraints is corrected more thoroughly by the occurrence of on-the-list events. Overall, the results from Table 4 are consistent with our expectations based on hypothesis 1, and they further support our conclusion that short-sales constraints tend to result in overvaluation of individual stocks.

3.2.4 Announcement Dates Effect

One concern related to potential misspecification of our statistics is that the event date as defined in this study is the date on which a short-sales restriction change actually took effect, rather than date on which the change was announced. Although announcement dates are widely used in event studies, we stick with effective dates as event dates in the main tests because it is expected that most price changes associated with on-the-list events will be triggered by the otherwise nonexistent trading caused by the short-sales restriction change, rather than by the news of the change itself. A similar argument can be made for off-the-list events. To ensure that we have clearly differentiated between these two types of effects, we examine CAR values around announcement dates. As we obtain information about announcement dates for only 1~~3~~2 revisions (out of all the 21~~2~~ versions of the list), there are fewer events included in this test (refer to Table 1 for the correspondence of announcement dates and effective dates).

Table 5 reports the average abnormal returns and cumulative abnormal returns around announcement dates. Panel A shows that for on-the-list events, all the CAR values of different lengths of windows are positive, and most are not statistically significantly different from zero. Only the 21-day CAR based on market value, which is 2.126%, and the AR based on market-adjusted value, which is 0.433%, ~~is~~ are statistically marginally significant at the 10% level. This suggests that ~~no~~ not much significant abnormal return is related to the announcement of the news itself when a stock becomes eligible for short sale at a later date.

(Insert Table 5 here)

Panel B of Table 5 reports average abnormal returns and cumulative abnormal returns around announcement dates for off-the-list events. Basically ~~Only~~ only the abnormal returns on the announcement date (based on the market model and the market-adjusted model) are statistically significantly different from zero (at the ~~5~~1% level and the ~~10~~5% level, respectively), and they are negative, in contrast to the positive sign observed around effective dates. The opposite signs suggest that paying attention to the difference between the effect of the news of a change in short-sales restrictions and the effect of the changes themselves is important. The negative abnormal returns associated with announcement dates could imply that investors respond negatively to off-the-list news because the stocks do not meet the capitalization or liquidity requirement of the list any longer. Of course, this remains a conjecture. It is not clear why investor respond to the two types of announcements asymmetrically. But overall, tests of the announcement effect confirm that price changes around on-the-list and off-the-list events are related to the change in short-sales restrictions rather than to the news of the change. Thus far, our evidence strongly supports hypothesis 1.

3.3 Dispersion of Investor Opinions and Overvaluation

In this subsection we carry out tests on hypothesis 2, which states that the extent of overvaluation caused by short-sales constraints is positively associated with the extent of dispersion of opinions. First, we identify variables that are deemed to be good proxies for the dispersion of investor opinions; then we run cross-sectional regressions of cumulative abnormal returns around events over these dispersion proxies to examine the coefficients. The tick rule effect is also examined in robust tests.

3.3.1 Measures of Dispersion of Investor Opinions

The variables that can arguably proxy for the dispersion of investor opinions are established as follows. The first measure of the extent of dispersion of opinions, $SIGMA_{raw}$, is defined as the standard deviation of the daily raw returns in the estimation window (i.e., from day t-260 to day t-11). The second measure, $SIGMA_{ab}$, is defined as the standard deviation of the error terms based on the OLS market model estimated in the same window. We choose these two proxies because numerous studies agree on the correlation between dispersion of opinions and time-series volatility.[13] Trading volume is another widely agreed-upon proxy for belief dispersion.[14] TURNOVER, our third measure, represents the ex ante daily trading

[13] See, for example, Harris and Raviv (1993) and Shalen (1993).
[14] See, for example, Shalen (1993) and Jones (2002). These two variables are also used by Danielsen and Sorescu (2001) and Boehme, et al. (2002).

volume (scaled by outstanding shares) averaged over the estimation window.

We also take the ex ante beta over the estimation window (i.e., the β_i in equation (1)), denoted as BETA, as another independent variable in the following regressions. Miller (1977) suggests the concurrence of systematic risk and uncertainty, and Diether, et al. (2002) show that dispersion is positively related to market β. Danielsen and Sorescu (2001) argue that shorting higher beta stocks can provide more diversification for an otherwise long portfolio, so the restriction on short selling higher beta stocks results in a higher "shadow cost" of the short-sales constraint and thus in more severe overvaluation. Both explanations suggest a positive relationship between BETA and the extent of overvaluation, so we expect a negative coefficient for on-the-list events to be consistent with hypothesis 2. Table 6 provides descriptive statistics for both dispersion proxies and BETAs.

(Insert Table 6 here)

3.3.2 Cross-Sectional Regressions of Abnormal Returns over Dispersion Variables

We test hypothesis 2 by estimating several versions of a cross-sectional regression in which the dependent variable is an abnormal return measure around events, and the regressors are one or several of the variables proxied for the dispersion of investor opinions. Table 7 provides the results of the cross-sectional regressions, with the dependent variable of CAR_m (-10,10) around on-the-list events.[15]

(Insert Table 7 here)

In Table 7, column 1 shows that when regressing the cumulative abnormal returns over the ex ante standard deviation of the stock's raw return, a negative coefficient of ~~-2.0219~~ -1.9921 is obtained, and it is statistically significantly different from zero at

[15] We also examine CARs of different-length windows and CARs based on the market-adjusted model. The results are qualitatively similar and are thus omitted here.

the 1% level (t = ~~−4.85~~−4.71). Columns 2–4 show that when the cumulative abnormal returns are regressed over the standard deviation of the stock's abnormal return, ex ante turnover, or market beta, a negative coefficient is always obtained, and it is statistically significantly different from zero at the 1% level. These results are consistent with the prediction of hypothesis 2, suggesting that short-sales constraints tend to result in more serious overvaluation on stocks when investors' opinions are more divergent. Regressions of CAR based on the market-adjusted model produced very similar results and thus are omitted here. However, because the cumulative abnormal returns based on the market model are calculated using BETA, the coefficient on BETA in column 4 might be negatively biased. Thus, we also report the regression of CAR_a over BETA in column 5. We found that the coefficient remains statistically significantly negative. In summary, the regression results strongly support hypothesis 2.

In columns 6–8 of Table 7, we repeat the regressions using the combination of BETA and other proxies as independent variables. This is to follow Danielsen and Sorescu (2001), who take BETA as a control variable. The coefficients of $SIGMA_{raw}$, $SIGMA_{ab,}$ and TURNOVER remain negative and statistically significant. The coefficients of BETA, though less significant, remain negative. In the other columns we test the different combinations of independent variables, and the coefficients of both the standard deviation of raw return and turnover remain statistically significantly negative. Overall, we find that the more diverse the ex ante investors' opinions, the higher the cumulative magnitude of price downward adjustment on-the-list events cause. This suggests that when short sales are restricted, the more diverse the opinions, the more dramatically stocks are overvalued. The hypothesis is vigorously supported.

The same regressions are estimated for off-the-list events, and the results are reported in Table 8. The estimated coefficients of $SIGMA_{raw}$, $SIGMA_{ab}$, and BETA are positive but are statistically insignificantly different from zero. As previously explained, the process that causes positive abnormal returns around off-the-list events is not as intuitive or theoretically justified as the corresponding process around on-the-list events, and we do not want to construe the result too far. However, the positive signs of the coefficients favor hypothesis 2 as a mirror or control test. One exception is the coefficient of TURNOVER in column 3, which, contrary to our expectations, is even more statistically significantly negative for off-the-list events than for on-the-list events. And the phenomenon remains the same when we add abnormal volumes to the regression as a control variable. It may be that by applying turnover, we are actually capturing some other factors that we have not adequately controlled for, such as liquidity or just transactions costs. Further investigation is warranted here, and developing a more specific theory about the effect of imposing short-sales constraints would be helpful. But in general, the cross-sectional regression tests support hypothesis 2.

(Insert Table 8 here)

3.3.3 The Tick Rule

We again divide on-the-list events into two groups, depending on whether the tick rule is in effect, and we carry out regression tests for each group. As the CAR statistics in subsection 3.2.3 suggest, the tick rule acts as a kind of short-sales constraint even after short sales are allowed on paper, so we expect that the rule would help in constructing a robust test of the interplay between short-sales constraints and the dispersion of opinions in causing overvaluation. An intuitive approach is to repeat the cross-sectional regression of abnormal returns around on-the-list events over dispersion variables for each group. Imagine two on-the-list events that are identical except that one takes place when the tick rule is in effect, while the other takes place when it is not. If hypothesis 1 holds, events occurring when the tick rule is not in effect would result in more negative abnormal returns (since the lifting of short-sales constraints is more complete), which has been supported by tests described in subsection 3.2; if hypothesis 2 also holds, the coefficients of dispersion proxies should be more negative, provided that the two events have identical ex ante dispersions of investor opinions.

The regression results in Table 9 support our prediction. Panel A reports the coefficients when on-the-list events take place during periods in which the tick rule is in effect, and Panel B reports the coefficients during periods when it is not. Most coefficients from both panels are significantly negative, and the coefficients from Panel B display both more negative values and more significant t-statistics. For example, for tick-rule-in-effect events, the coefficient of $SIGMA_{raw}$ is ~~–1.272~~ –1.175 with a t-statistic of ~~–2.90~~ –2.57. For tick-rule-not-in-effect events, the coefficient of $SIGMA_{raw}$ is –5.173 with a t-statistic of –5.95. We further carry out a Chow test in Panel C, with the null hypothesis that the regression coefficient(s) estimated in Panel A is (are) equal to the coefficient(s) estimated in Panel B. Seven out of the eiht~~All the~~ p-values are smaller than 0.01, indicating that the null hypothesis is rejected at the 1% level. In other words, the estimated coefficients when the tick rule is in effect are significantly different from the estimated coefficients when it is not. The result from Table 9 supports both hypothesis 2 and the combination of hypothesis 1 and hypothesis 2.

3.3.4 Abnormal Volume

We have also carried out similar regressions including another control variable, which stands for the increase in daily turnover during the event window (-10, +10) compared to the average turnover during the estimation window (-260, -11)). In Danielsen and Sorescu (2001)'s test, this control variable is applied owing to its potential effect on CAR as a measure of improved market liquidity around option introductions. We also apply the control variable here, and we obtain a pattern in the coefficients of this abnormal turnover that is qualitatively similar to Danielsen and Sorescu (2001)'s results. Our results pertaining to the coefficients of proxy variables are not significantly changed and thus are omitted here.

To sum up, the tests described in Section 3 provide strong supportive evidence for hypotheses 1 and 2, suggesting that short-sales constraints are closely related to stock overvaluation and that the more diverse investors' opinions is, the more serious overvaluation short-sales constraints will cause.

4. Short-Sales Constraints and the Distributions of Stock Returns

In this section we examine the distribution characteristics of stock returns before and after short-sales restriction changes. Although short-sales restrictions are nearly as old as organized exchanges, it remains unclear whether short sales stabilize or destabilize the market, or, put another way, whether they prevent or facilitate market crashes. In Hong and Stein (2003)'s model, the presence of dispersion of opinions and short-sales constraints prevents bad news from being released quickly, which poses a potential danger of market crashes. A reasonable implication is that when short-sales restrictions are removed, the frequency of extremely negative returns should become lower, and the skewness of stock returns should become less negative. Bris, et al. (2003) check this implication by examining the skewness, volatility, and frequency of the extreme values of weekly stock returns across countries with and without short-sales constraints, but the results are mixed. When market participants are allowed to short sell individual stocks, the skewness of the market is more, not less, negative, which is contrary to Hong and Stein (2003)'s model's prediction. Their result for the Hong Kong market, where they assume that short-sales constraints were lifted in 1996, indicates that extreme negative returns are much more frequent after the constraints were lifted.

Our data enable us to carry out an even more detailed and arguably more persuasive test in the Hong Kong market than Bris, et al. (2003) on how short-sales restriction changes impact the distribution of stock returns. For each stock in each on-the-list event, a pre-event estimation window of (-260, -11) and a post-event estimation window of (+11, +260) are selected.[16] If a stock does not have the necessary 250-trading-days record before or after the event, a minimum record of 180 trading days is required for the stock to be included in the test. We then estimate the coefficient of skewness, the volatility, and the frequency of extreme negative values of stock daily returns during estimation windows and report the cross-sectional mean and median values of these characteristics in Table 10. In the Difference column, three statistics are applied to test whether these values are significantly different. The first one is the paired t-statistics, which assume that the underlying returns follow a normal distribution. The two p-values are based on two-tailed non-parametric tests. A signed rank test (or Wilcoxon test) assumes the underlying distribution is symmetric, while a sign test makes no such assumption.

(Insert Table 10 here)

4.1 Skewness

The coefficient of skewness is calculated by dividing (the sample analog to) the third moment of daily returns by (the sample analog to) the standard deviation of daily returns raised to the third power. Specifically,

$$\textit{Coefficient of Skewness} = \left(n(n-1)^{3/2}\sum R_{it}^{3}\right) \Big/ \left((n-1)(n-2)(\sum R_{it}^{2})^{3/2}\right), \qquad (3)$$

where R_{it} is the stock i's return on day *t,* and *n* is the size of the sample. This definition is similar to Chen, Hong, and Stein (2001)'s "negative coefficient of skewness," except that they put a negative sign before this coefficient of skewness for the empirical test, whereas we use the coefficient of skewness directly for analysis.

One of the most significant and important results of Table 10 is that when short sales of individual stocks are allowed, the coefficient of skewness of these stocks is

[16] We select the window length to be consistent with previous regression tests. The return during the event window of [-10, +10] is excluded to avoid the abnormal performance directly associated with event shock. However, additional tests reveal that including the event window days does not qualitatively change the results.

less positive. For on-the-list events, the skewness of both raw returns and abnormal returns becomes lower when short-sales restrictions are lifted. For example, the average skewness of raw return prior to on-the-list events is 0.8707, but it falls to 0.6966 after events. Since the return exhibits some skewness, we turn to p-values of the sign test, which does not need the underlying distribution to be symmetrical. The p-value of the sign test is 0.0027, implying a decrease in skewness at the 1% significant level when short-sales restrictions are lifted. For off-the-list events, all the statistics show that when short sales are prohibited again, there is a significant increase in the skewness at the 1% level. This result is inconsistent with the implication of Hong and Stein (2003)'s analysis. However, it is consistent with the empirical results of Bris, et al. (2003).

4.2. Volatility of Returns

In Table 10, for on-the-list events, t-statistics show that both the standard deviation of raw returns and that of abnormal returns are significantly increased when stocks can be sold short, and this is supported by the significant p-values. For example, the standard deviation of raw returns is 0.03687 before on-the-list events, but it rises to 0.04159 after the events. The difference between them has a t-statistic of 2.93, which is statistically significantly different from zero at the 1% level, and the two p-values (0.0875 and 0.0005) indicate the 10% and the 1% significant levels. This suggests that lifting the short-sales constraint is associated with a relatively high individual stock return volatility.

The result for off-the-list events is similar: There appears to be a decrease in the standard deviation of daily raw returns and abnormal returns when short-sales restrictions are reinstated (this can be inferred from the p-values signed rank test and sign test, although the t-statistics are not significant).

Because volatile individual stocks do not necessarily imply a volatile market as a whole, and because of the overlapping attributes of our sample, caution needs to be exercised in inferring the effects of short sales on market stabilization. However, our results do provide some evidence that less restriction on short sales is associated with higher return volatility for individual stocks.

4.3 Market Crashes

We also report the frequency of extreme negative daily returns in the pre-event window and the post-event window for each stock. An observation of daily return is regarded as extremely negative if it is lower than its mean minus two times its standard deviation estimated within the same window. As shown in Table 10, the difference of the frequency of extreme negative daily returns before and after events is not significant. The signs of t-statistics suggest that extreme negative returns may be more likely to occur when short sales are allowed. This is consistent with the less-positive skewness during the period.

Overall, the results of this section are to some extent similar to Bris, et al. (2003)'s results in that short-sales restrictions seem to be associated with more positive skewness. Our results also suggest less volatility at the individual level when short-sales restrictions apply, in contrast to Bris, et al. (2003)'s finding of insignificant changes of volatility around short-sales regulation changes in several markets, including Hong Kong.

5. Summary and Future Research

In this paper we examine the effect of short-sales restrictions on price discovery. We offer two hypotheses: (1) in the presence of different investor beliefs, short-sales constraints can cause stock prices to become upward biased and (2) the more diverse the beliefs, the more dramatic this overvaluation.

To test these two hypotheses, we identify certain events on the Hong Kong market in which individual stocks experienced short-sales restriction changes, and we test the cumulative abnormal return around these changes. We find that events in which stocks can be sold short from the event day are associated with statistically significant negative abnormal returns, while events in which an individual stock is prohibited to short sold beginning on the event day are associated with statistically significant positive abnormal returns. This supportive evidence to hypothesis 1 is consistent with Miller (1977)'s argument, in that short-sales constraints tend to prevent some negative information from being impounded into prices and that such constraints result in stock overvaluation. We regress abnormal returns over variables that proxy for the dispersion of investor opinions, and generally the coefficients for these variables are consistent with the prediction of hypothesis 2, in that short-sales constraints tend to produce higher overvaluation if the dispersion in investor opinions is greater.

We also carry out additional tests to examine the implication inferred from Hong and Stein (2003)'s market crashes model, but our results suggest the opposite: Short sales make returns of individual stocks less rather than more positively skewed. And individual stocks seem to be more volatile when short selling is practiced.

Another issue related to short-sales practice is the existence of stock options, which is widely accepted as an alternative way to make short positions and may arguably lower the cost of shorting. However, the options market is not so developed in Hong Kong, and at the end of May 2003 there were only 34 options traded. It is probable that the co-existence of traded options and individual stocks would not significantly influence our results.

Short-sales constraints may have an effect on market liquidity, including on the bid-ask spread and on the extent that trades can impact prices. We expect to apply high-frequency data for further investigation. Also, an earnings announcement study could provide insight into the effect of short-sales constraints on pricing efficiency. These are topics for future research.

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Table1

Summary Statistics: Changes in Short-Sales Restrictions

The table reports the occurrence of events in which individual stocks on the Hong Kong stock market experienced short-sales restriction changes. Column 1 reports the dates on which a new version of the list of designated securities for short selling took effect. Column 2 reports the dates on which a new version of the list was announced. For certain events, no announcement dates are tractable, as some early records are in the format of paper copies carrying no announcement dates. Column 3 and Column 4 reports the number of on-the-list and off-the-list events that take place each time the list is revised. An on-the-list event is defined as one in which an individual stock is added to the list and can thus be short sold from the effective date. An off-the-list event is defined as one in which an individual stock originally on the list is deleted from the new version of the list and therefore can no longer be short sold as of the effective date. Column 5 reports the number of stocks that each new version of the list contains, which basically equals the number of stocks in the last version plus the number of on-the-list events and minus the number of off-the-list events. The last row of the table reports the cumulated number of on-the-list events, off-the-list events, and stocks that were ever on the list.

* One stock was withdrawn from listing between March 25, 1996, and April 29, 1997, rendering the number of stocks that the list included as of March 25, 1996, to be 113-1+129=241.

Effective Date	Announcement Date	On-the-List Events	Off-the-List Events	Numbers of Stocks on the List
3-Jan-94	N/A	17	0	17
25-Mar-96	7-Mar-96	96	0	113
1-May-97	29-Apr-97	129	0	241*
12-Jan-98	N/A	69	0	310
16-Mar-98	N/A	15	0	325
9-Nov-98	N/A	19	149	195
1-Mar-99	N/A	7	7	195
20-Sep-99	N/A	3	17	181
12-Nov-99	N/A	1	0	182
28-Feb-00	23-Feb-00	24	12	194
31-May-00	N/A	7	0	201
28-Aug-00	N/A	32	16	217
12-Feb-01	31-Jan-01	15	11	221
14-May-01	3-May-01	6	0	227
20-Aug-01	7-Aug-01	9	11	225
3-Dec-01	27-Nov-01	17	85	157
25-Feb-02	5-Feb-02	7	14	150
21-May-02	8-May-02	11	6	155
29-Jul-02	17-Jul-02	24	5	174
29-Nov-02	21-Nov-02	6	15	165
27-Jan-03	21-Jan-03	5	7	163
Cumulated:		519~~537~~	355~~362~~	448~~454~~

Table 2

Cumulated Abnormal Returns Around on-the-List Events

The table reports abnormal returns and cumulated abnormal returns of different lengths of event windows around on-the-list events. An on-the-list event is defined as an event in which an individual stock is added to the list and can be short sold from the event day. The event day is denoted as day 0. CAR_m/AR_m is the cumulated abnormal return/abnormal return calculated based on the OLS market model:

$$CAR_m = \sum_{t=t_1}^{t_2} (R_{it} - \hat{\alpha}_i - \hat{\beta}_i R_{Mt})$$

$CAR_m(-10,10)$ is the cumulated abnormal return in the 21-day window (-10, +10) around on-the-list event date; $CAR_m(-1,0)$ and AR(0) are similarly defined. For the market model, the estimation window is (-260, -11), with a minimum length of 180 days. CAR_a/AR_a is the cumulated abnormal return/abnormal return calculated based on the market-adjusted model:

$$CAR_a = \sum_{t=t_1}^{t_2} (R_{it} - R_{Mt})$$

$CAR_a(-10,10)$ is the cumulated abnormal return in the 21-day window (-10, +10) around the on-the-list event date; $CAR_a(-1,0)$ and AR(0) are similarly defined.

*, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Variable Description	Number of Observations	Mean	Median	Std. Dev.	Min.	Max.
$CAR_m(-10,10)$	388	-0.04198 (t=-3.61)***	-0.02372	0.22884	-0.84825	1.71384
$CAR_m(-1,0)$	388	-0.00374 (t=-1.18)	-0.00375	0.06266	-0.26748	0.24138
$AR_m(0)$	388	-0.00604 (t= -2.37)**	-0.00340	0.05088	-0.23221	0.22988
$CAR_a(-10,10)$	388	-0.04216 (t=-3.79)***	-0.03139	0.21913	-0.93910	1.67945
$CAR_a(-1,0)$	388	-0.00670 (t=-1.97)**	-0.00536	0.06695	-0.33616	0.24310
$AR_a(0)$	388	-0.00733 (t=-2.60)***	-0.00459	0.05542	-0.26612	0.22532

Table 3

Cumulated Abnormal Returns Around off-the-List Events

The table reports abnormal returns and cumulated abnormal returns of different lengths of event windows around off-the-list events. An off-the-list event is defined as an event in which an individual stock originally on the list is deleted from the new version of the list and therefore cannot be short sold beginning on the event day. The event day is denoted as day 0. CAR_m/AR_m is the cumulated abnormal return/abnormal return calculated based on the OLS market model:

$$CAR_m = \sum_{t=t_1}^{t_2} (R_{it} - \hat{\alpha}_i - \hat{\beta}_i R_{Mt})$$

$CAR_m(-10,10)$ is the cumulated abnormal return in the 21-day window (-10, +10) around the off-the-list event date; $CAR_m(-1,0)$ and AR(0) are similarly defined. For the market model, the estimation window is (-260, -11), with a minimum length of 180 days. CAR_a/AR_a is the cumulated abnormal return/abnormal return calculated based on the market-adjusted model:

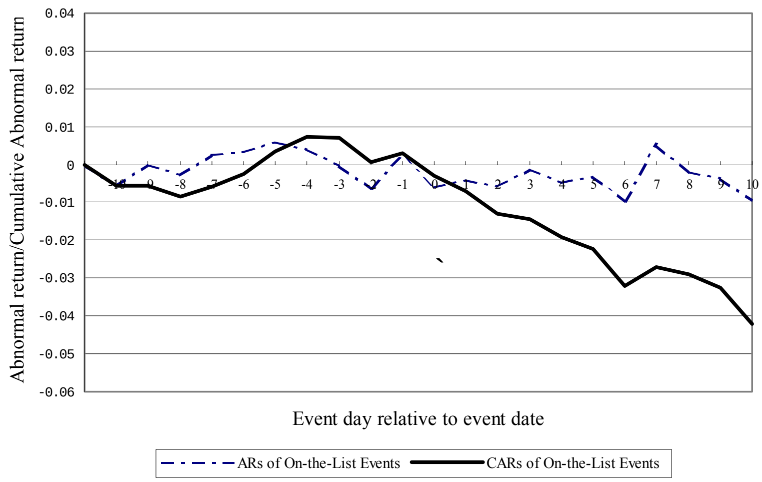
$$CAR_a = \sum_{t=t_1}^{t_2} (R_{it} - R_{Mt})$$

$CAR_a(-10,10)$ is the cumulated abnormal return in the 21-day window (-10, +10) around the off-the-list event date; $CAR_a(-1,0)$ and AR(0) are similarly defined.

*, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Variable Description	Number of Observations	Mean	Median	Std. Dev.	Min.	Max.
$CAR_m(-10,10)$	305/307	0.07470 (t=4.93)***	0.04152	0.26445	-0.59966	1.35156
$CAR_m(-1,0)$	305	0.00980 (t=2.00)**	0.00635	0.08569	-0.31227	0.97593
$AR_m(0)$	305	0.00561 (t=2.00)**	0.00360	0.04895	-0.20996	0.30660
$CAR_a(-10,10)$	305	0.02251 (t=1.77)*	-0.01418	0.22194	-0.51641	1.16469
$CAR_a(-1,0)$	305	0.01441 (t=2.90)***	0.01210	0.08681	-0.29054	0.98278
$AR_a(0)$	305	0.00989 (t=3.46)***	0.00862	0.04999	-0.19376	0.31880

Cumulative Abnormal Returns Around on-the-List Events



Cumulative Abnormal Returns Around off-the-List Events

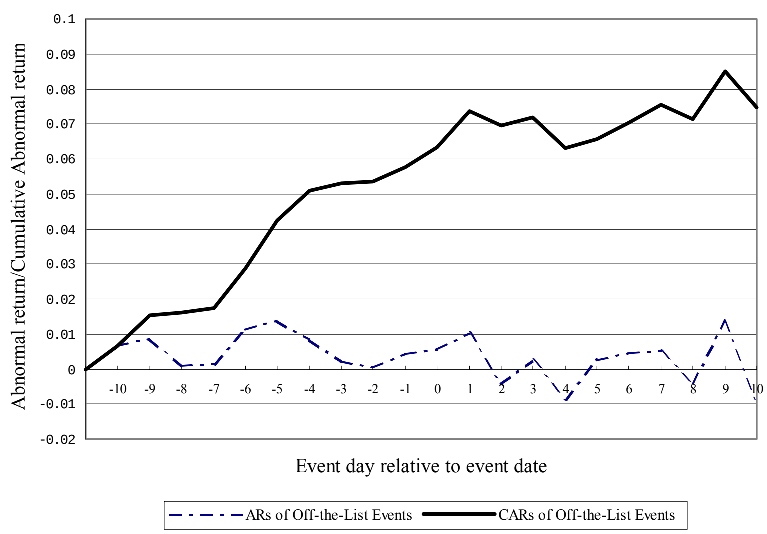


Fig. 1. Cumulated Abnormal Returns Around on-the-List and Off-the-List Events
The first graph reports abnormal returns and cumulated abnormal returns around on-the-list events calculated based on the OLS market model. An on-the-list event is defined as an event in which an individual stock is added to the list and can be short sold from the event date. The event day is denoted as day 0. For the market model, the estimation window is (-260, -11) with a minimum length of 180 days.

Table 4

Cumulated Abnormal Returns Around on-the-List Events Depending on Tick Rule

The table reports abnormal returns and cumulated abnormal returns of different lengths of event windows around on-the-list events depending on whether the tick rule is in effect. An on-the-list event is defined as an event in which an individual stock added to the list can be short sold from the event day. The event day is denoted as day 0. CAR_m/AR_m is the cumulated abnormal return/abnormal return calculated based on the OLS market model:

$$CAR_m = \sum_{t=t_1}^{t_2} (R_{it} - \hat{\alpha}_i - \hat{\beta}_i R_{Mt})$$

$CAR_m(-10,10)$ is the cumulated abnormal return in the 21-day window (-10, +10) around the on-the-list event date; $CAR_m(-1,0)$ and AR(0) are similarly defined. For the market model, the estimation window is (-260, -11) with a minimum length of 180 days. CAR_a/AR_a is the cumulated abnormal return/abnormal return calculated based on the market-adjusted model:

$$CAR_a = \sum_{t=t_1}^{t_2} (R_{it} - R_{Mt})$$

$CAR_a(-10,10)$ is the cumulated abnormal return in the 21-day window (-10, +10) around the on-the-list event date; $CAR_a(-1,0)$ and AR(0) are similarly defined.

*, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Tick Rule Effective (total 179 events)

Variable Description	Number of Observations	Mean	Median	Std. Dev.	Min.	Max.
$CAR_m(-10,10)$	147	-0.02159 (t=-1.96)*	-0.02159	0.20005	-0.76107	0.52462
$CAR_m(-1,0)$	147	-0.00080 (t=-0.18)	-0.00256	0.05349	-0.21810	0.10497
$AR_m(0)$	147	-0.00059 (t=-0.207)	-0.00224	0.03602	-0.15007	0.10838
$CAR_a(-10,10)$	147	-0.02044 (t=-1.43)	-0.03113	0.17312	-0.48740	0.51414
$CAR_a(-1,0)$	147	0.00084 (t=0.20)	0.00598	0.05061	-0.20777	0.11318
$AR_a(0)$	147	0.00053 (t=0.18)	0.00280	0.03550	-0.13937	0.10606

Panel B: Tick Rule Repealed (total 271 events)

Variable Description	Number of Observations	Mean	Median	Std. Dev.	Min.	Max.
$CAR_m(-10,10)$	241	-0.04784 (t=-3.03)***	-0.02456	0.24496	-0.84825	1.71384
$CAR_m(-1,0)$	241	-0.00553 (t=-1.26)	-0.00442	0.06770	-0.26579	0.24138
$AR_m(0)$	241	-0.00937 (t=-2.51)**	-0.00429	0.05793	-0.23221	0.22988
$CAR_a(-10,10)$	241	-0.05541 (t=-3.55)***	-0.03166	0.24235	-0.93910	1.67945
$CAR_a(-1,0)$	241	-0.01129 (t=-2.34)**	-0.00805	0.07492	-0.33616	0.24310
$AR_a(0)$	241	-0.01212 (t=-2.93)***	-0.00763	0.06423	-0.26612	0.22532

Table 5

Cumulated Abnormal Returns Around Announcement Dates

The table reports abnormal returns and cumulated abnormal returns of different lengths of event windows around announcement dates of on-the-list and off-the-list events. An on-the-list event is defined as an event in which an individual stock is added to the list and can be short sold from the effective day. An off-the-list event is defined as an event in which an individual stock originally on the list is deleted from the new version of the list and thus cannot be short-sold beginning on the effective day. The announcement day, denoted as day 0. CAR_m/AR_m, is the cumulated abnormal return/abnormal return calculated based on the OLS market model:

$$CAR_m = \sum_{t=t_1}^{t_2}(R_{it} - \hat{\alpha}_i - \hat{\beta}_i R_{Mt})$$

$CAR_m(-10,10)$ is the cumulated abnormal return in the 21-day window (-10, +10) around the announcement date; $CAR_m(-1,0)$ and AR(0) are similarly defined. For the market model, the estimation window is (-260, -11), with a minimum length of 180 days. CAR_a/AR_a is the cumulated abnormal return/abnormal return calculated based on the market-adjusted model:

$$CAR_a = \sum_{t=t_1}^{t_2}(R_{it} - R_{Mt})$$

$CAR_a(-10,10)$ is the cumulated abnormal return in the 21-day window (-10, +10) around the announcement date; $CAR_a(-1,0)$ and AR(0) are similarly defined.

*, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Panel A: On-the-List Events (total 309 events)

Variable Description	Number of Observations	Mean	Median	Std. Dev.	Min.	Max.
$CAR_m(-10,10)$	264	0.02166 (t=1.81)*	0.01180	0.19441	-0.87589	1.66885
$CAR_m(-1,0)$	264	0.00219 (t=0.53)	-0.00194	0.06707	-0.16676	0.59525
$AR_m(0)$	264	0.00243 (t=0.98)	-0.00052	0.04047	-0.07920	0.32429
$CAR_a(-10,10)$	264	0.01707 (t=1.53)	0.00382	0.18138	-0.56998	1.62880
$CAR_a(-1,0)$	264	0.00617 (t=1.50)	0.00181	0.06687	-0.16703	0.59861
$AR_a(0)$	264	0.00433 (t=1.75)*	0.00244	0.04021	-0.07937	0.31957

Panel B: Off-the-List Events (total 149 events)

Variable Description	Number of Observations	Mean	Median	Std. Dev.	Min.	Max.
$CAR_m(-10,10)$	147	-0.00296 (t=-0.19)	0.00322	0.18548	-0.66709	0.57472
$CAR_m(-1,0)$	147	-0.00851 (t=-1.69)*	-0.01501	0.06125	-0.16591	0.40232
$AR_m(0)$	147	-0.00813 (t=-3.03)***	-0.00788	0.03258	-0.12393	0.14806
$CAR_a(-10,10)$	147	-0.00768 (t=-0.57)	-0.01605	0.16326	-0.50400	0.50748
$CAR_a(-1,0)$	147	-0.00362 (t=-0.72)	-0.00748	0.06062	-0.16031	0.40851
$AR_a(0)$	147	-0.00614 (t=-2.31)**	-0.00589	0.03218	-0.12212	0.14748

Table 6

Descriptive Statistics: Dispersion of Investor Opinions

The table reports the descriptive statistics of variables that proxy for the dispersion of investor opinions. Panel A reports the descriptive statistics for on-the-list events, and Panel B reports the descriptive statistics for off-the-list events. An on-the-list event is defined as an event in which an individual stock is added to the list and can be short sold from the effective day. An off-the-list event is defined as an event in which an individual stock originally on the list is deleted from the new version of the list and thus cannot be short-sold beginning on the effective day. $SIGMA_{raw}$ is the standard deviation of the daily raw returns in the estimation window of (-260, -11), $SIGMA_{ab}$ is the standard deviation of abnormal returns in the estimation window of (-260, -11) based on the market model. TURNOVER is the ex ante volume of trade, averaged over the period of (-260, -11), scaled by outstanding shares. BETA is the beta value estimated in the estimation window of (-260, -11) based on the market model.

Proxies of Dispersion of Opinions	Number of Observations	Mean	Median	Std. Dev.	Min.	Max.
Panel A: On-the-List Events						
$SIGMA_{raw}$	388	0.03715	0.03094	0.02679	0.00541	0.34878
$SIGMA_{ab}$	388	0.03433	0.02946	0.02553	0.00534	0.34677
TURNOVER	388	0.00645	0.00289	0.00898	0.00000	0.06240
BETA	388	0.81205	0.73924	0.45680	-0.13382	2.40774
Panel B: Off-the-List Events						
$SIGMA_{raw}$	305	0.04607	0.04414	0.02072	0.00992	0.26771
$SIGMA_{ab}$	305	0.04425	0.04251	0.02048	0.00927	0.26737
TURNOVER	305	0.00445	0.00158	0.00717	0.00001	0.04974
BETA	305	0.56317	0.53241	0.34878	-0.76375	1.80315

Table 7

Cross-Sectional Regressions of Cumulative Abnormal Returns During 21-Day Window Around on-the-List Events over Dispersion of Opinions

The table reports the cross-sectional regression results of the dependent variables CAR_m and CAR_a around on-the-list events over independent variables that proxy for dispersion of investor opinions. An on-the-list event is defined as an event in which an individual stock is added to the list and can be short sold from the effective day. CAR_m is the cumulated abnormal return in the 21-day window (-10, +10) around on-the-list event date based on the OLS market model. For the market model, the estimation window is (-260, -11) with a minimum length of 180 days. CAR_a is the cumulated abnormal return in the 21-day window (-10, +10) around on-the-list event date based on the market-adjusted model. $SIGMA_{raw}$ is the standard deviation of the daily raw returns in the estimation window of (-260, -11). $SIGMA_{ab}$ is the standard deviation of abnormal returns in the estimation window of (-260, -11) based on the market model. TURNOVER is the ex ante volume of trade, averaged over the period of (-260, -11), scaled by outstanding shares. BETA is the beta value estimated in the estimation window of (-260, -11) based on the market model.

*, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Model Specification No.	1	2	3	4	5	6	7	8	9	10	11	12
Dependent Variable	CAR_m	CAR_m	CAR_m	CAR_m	CAR_a	CAR_m	CAR_m	CAR_m	CAR_m	CAR_m	CAR_m	CAR_m
Intercept	0.0320	0.0243	0.0023	0.0335	0.0231	0.0501	0.0519	0.0245	0.0364	0.0192	0.0325	0.0366
	(t=1.65)*	(t=1.28)	(t=0.16)	(t=1.44)	(t=1.03)	(t= 2.12)**	(t=2.16)**	(t=1.06)	(t=1.90)*	(t=0.75)	(t=1.70)	(t=1.54)
SIGMAraw	-1.9921					-1.6104			-6.1379	-9.6373	-1.1062	-1.0414
	(t= -4.71)***					(t=-3.15)***			(t=-1.84)*	(t=-2.02)**	(t=-2.28)**	(t=-1.95)*
SIGMAab		-1.9306					-1.4711		5.2129	8.5167		
		(t=-4.33)***					(t=-2.90)***		(t=1.52)**	(t=1.81)*		
TURNOVER			-6.8625					-5.9946	-4.5542	-4.7904	-5.1771	-5.0454
			(t= -5.49)***					(t=-4.16)***	(t=-3.04)***	(t=-3.16)***	(t=-3.58)***	(t=-3.33)***
BETA				-0.0929	-0.0804	-0.0397	-0.0534	-0.0342		0.0435		-0.0091
				(t=-3.71)***	(t=-3.34)***	(t=-1.32)	(t=-1.89)*	(t=-1.21)		(t=1.03)		(t=-0.29)
No. of Observations	388	388	388	388	388	388	388	388	388	388	388	388
Adjusted R-Square	0.0519	0.0439	0.0701	0.0319	0.0256	0.0538	0.0502	0.0712	0.0832	0.0834	0.0801	0.0779

Table 8

Cross-Sectional Regressions of Cumulative Abnormal Returns During a 21-Day Window Around off-the-List Events over Dispersion of Opinions

The table reports the cross-sectional regression results of the dependent variables CAR_m and CAR_a around off-the-list events over independent variables that proxy for dispersion of investor opinions. An off-the-list event is defined as an event in which an individual stock originally on the list is deleted from the new version of the list and thus cannot be short-sold beginning on the effective day. CAR_m is the cumulated abnormal return in the 21-day window (-10, +10) around the off-the-list event date based on the OLS market model. For the market model, the estimation window is (-260, -11) with a minimum length of 180 days. CAR_a is the cumulated abnormal return in the 21-day window (-10, +10) around the off-the-list event date based on the market-adjusted model. $SIGMA_{raw}$ is the standard deviation of the daily raw returns in the estimation window of (-260, -11). $SIGMA_{ab}$ is the standard deviation of abnormal returns in the estimation window of (-260, -11) based on the market model. TURNOVER is the ex ante volume of trade, averaged over the period of (-260, -11), scaled by outstanding shares. BETA is the beta value estimated in the estimation window of (-260, -11) based on the market model.

*, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Model Specification No.	1	2	3	4	5	6	7	8	9	10	11	12
Dependent Variable	CAR_m	CAR_m	CAR_m	CAR_m	CAR_a	CAR_m	CAR_m	CAR_m	CAR_m	CAR_m	CAR_m	CAR_m
Intercept	0.0397	0.0499	0.1335	0.0666	-0.0068	0.0371	0.0448	0.0955	0.0185	0.0459	0.0421	0.0183
	(t=1.08)	(t=1.38)	(t=8.00)***	(t=2.31)**	(t=-0.28)	(t=0.90)	(t=1.07)	(t=3.52)***	(t=0.53)	(t=1.18)	(t=1.23)	(t=0.48)
SIGMAraw	0.7590					0.7396			23.2796	39.4872	2.1459	2.0116
	(t=1.04)					(t=0.99)			(t=3.11)***	(t=3.07)***	(t=3.06)***	(t=2.84)***
SIGMAab		0.5600					0.5389		-21.5131	-37.7522		
		(t=0.76)					(t=0.72)		(t=-2.83)***	(t=-2.92)***		
TURNOVER			-13.1942					-13.9255	-14.4277	-13.2145	-14.8677	-15.3320
			(t=-6.67)***					(t=-6.91)***	(t=-7.18)***	(t=-6.14)***	(t=-7.33)***	(t=-7.47)***
BETA				0.0144	0.0521	0.0062	0.0107	0.0732		-0.1080		0.0569
				(t=0.33)	(t=1.43)	(t=0.14)	(t=0.24)	(t=1.77)*		(t=-1.55)		(t=1.38)
No. of Observations	305	305	305	305	305	305	305	305	305	305	305	305
Adjusted R-Square	0.0002	-0.0014	0.125	-0.0029	0.0034	-0.003	-0.0045	0.1311	0.1679	0.1717	0.1485	0.151

Table 9

Cross-Sectional Regressions of Cumulative Abnormal Returns During 21-Day Window Around on-the-List Events over Dispersion of Opinions Depending on Tick Rule

The table reports the cross-sectional regression results of the dependent variables CAR_m and CAR_a around on-the-list events over independent variables that proxy for dispersion of investor opinions depending on whether the tick rule is in effect, together with the results from Chow tests over the equality of regression coefficients. An on-the-list event is defined as an event in which an individual stock is added to the list and can be short sold from the effective day. CAR_m is the cumulated abnormal return in the 21-day window (-10, +10) around on-the-list event date based on the OLS market model. For the market model, the estimation window is (-260, -11) with a minimum length of 180 days. CAR_a is the cumulated abnormal return in the 21-day window (-10, +10) around on-the-list event date based on market-adjusted model. $SIGMA_{raw}$ is the standard deviation of the daily raw returns in the estimation window of (-260, -11). $SIGMA_{ab}$ is the standard deviation of abnormal returns in the estimation window of (-260, -11) based on the market model. TURNOVER is the ex ante volume of trade, averaged over the period of (-260, -11), scaled by outstanding shares. BETA is the beta value estimated in the estimation window of (-260, -11) based on the market model.

The null hypothesis of Chow tests in Panel C is H_0: b_1=b_2, where b_1 is (are) the regression coefficient(s) estimated by each regression model in Panel A, and b_2 is (are) the regression coefficient(s) estimated by the same model in Panel B.

*, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Tick Rule Effective (total 179 events)

Model Specification No.	1	2	3	4	5	6	7	8
Dependent Variable	CAR_m	CAR_m	CAR_m	CAR_m	CAR_a	CAR_m	CAR_m	CAR_m
Intercept	0.02303	0.02703	-0.00788	-0.02208	-0.03057	-0.00088	0.00204	-0.02660
	(t=0.85)	(t=1.04)	(t=0.39)	(t=-0.70)	(t=-1.12)	(t=-0.03)	(t=0.06)	(t=-0.85)
SIGMAraw	-1.17466					-1.65479		
	(t=-2.57)**					(t=-2.92)***		
SIGMAab		-1.34979					-1.74570	
		(t=-2.93)***					(t=-3.22)***	
TURNOVER			-3.36185					-4.13612
			(t=-2.05)**					(t=-2.16)**
BETA				-0.01198	0.01179	0.05418	0.04936	0.02835
				(t=-0.38)	(t=-0.43)	(t=1.42)	(t=1.38)	(t=0.78)
No. of Observations	147	147	147	147	147	147	147	147
Adjusted R-Square	0.03700	0.04930	0.02150	-0.00590	-0.00560	0.04370	0.05520	0.01890

Table 9 (Continued)

Panel B: Tick Rule Repealed (total 271 events)								
Model Specification No.	1	2	3	4	5	6	7	8
Dependent Variable	CAR_m	CAR_m	CAR_m	CAR_m	CAR_a	CAR_m	CAR_m	CAR_m
Intercept	0.11274	0.10121	0.01248	0.09401	0.08832	0.14493	0.15382	0.08102
	(t=3.67)***	(t=3.07)***	(t=0.68)	(t=2.86)***	(t=2.72)***	(t=4.19)***	4.16074	(t=2.52)**
SIGMAraw	-5.17311					-4.01973		
	(t=-5.95)***					(t=-3.86)***		
SIGMAab		-5.24267					-3.75080	
		(t=-5.08)***					(t=-3.31)***	
TURNOVER			-10.16324					-7.68366
			(t=-5.65)***					(t=-3.80)***
BETA				-0.18110	-0.18351	-0.08681	-0.12132	-0.10630
				(t=-4.85)***	(t=-4.98)***	(t=-1.98)**	(t=-2.97)***	(t=-2.57)**
No. of Observations	241	241	241	241	241	241	241	241
Adjusted R-Square	0.12540	0.09350	0.11410	0.08580	0.09020	0.13600	0.12230	0.13440

Panel C: Chow Test								
Model Specification No.	1	2	3	4	5	6	7	8
Dependent Variable	CAR_m	CAR_m	CAR_m	CAR_m	CAR_a	CAR_m	CAR_m	CAR_m
Degree of Freedom	(2, 384)	(2, 384)	(2, 384)	(2, 384)	(2, 384)	(2, 384)	(2, 384)	(2, 384)
F value	11.11	8.55	4.32	6.24	10.29	8.82	8.34	4.98
p-value	0.0000	0.0002	0.0139	0.0022	0.0000	0.0000	0.0000	0.0021

Table 10

Difference in Distribution Characteristics of Daily Stock Returns Depending on Short-Sale Constraints

The table reports the distribution statistics of daily stock returns before and after on-the-list events and off-the-list events. Panel A reports the values around on-the-list events, and Panel B reports the values around off-the-list events. An on-the-list event is defined as an event in which an individual stock is added to the list and can be short sold from the effective day. An off-the-list event is defined as an event in which an individual stock originally on the list is deleted from the new version of the list and thus cannot be short-sold beginning on the effective day. Estimations are based on stock returns during estimation windows of (-260, -11) and (+11, +260) around event dates, with a minimum length of 180 days. The coefficient of skewness is calculated by dividing (the sample analog to) the third moment of daily returns by (the sample analog to) the standard deviation of daily returns raised to the third power:

$$\textit{Coefficient of Skewness} = \left(n(n-1)^{3/2}\sum R_{it}^{3}\right) \Big/ \left((n-1)(n-2)(\sum R_{it}^{2})^{3/2}\right)$$

The frequency of days during which the firm return is lower than its mean minus two times its standard deviation is also reported. Abnormal returns are the residual of the regression based on the OLS market model. The t-statistics, p-value of sign test and p-value of signed rank test are reported to examine whether the differences between estimated values when short sales are prohibited and when they are allowed are significantly different from zero.

*, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

		Short Selling Prohibited		Short Selling Allowed		Difference			
		Mean	Median	Mean	Median	t-Statistics	p-Value of Sign Test	p-Value of Signed Rank Test	No. of Obs.
Panel A: On-the-List Events									351
Mean	Raw Returns	0.0012	0.0010	-0.0006	-0.0003	7.46***	0.0000	0.0000	
Standard Deviation	Raw Returns	0.0369	0.0299	0.0416	0.0398	-2.93***	(0.0875)	(0.0005)	
	Abnormal Returns	0.0339	0.0286	0.0375	0.0361	-2.39**	(0.0694)	(0.0004)	
Skewness	Raw Returns	0.8707	0.7800	0.6966	0.6306	1.44	0.0027	0.0058	
	Abnormal Returns	0.9397	0.8162	0.7689	0.6472	1.39	0.0075	0.0050	
Return<Mean-2*Stdev		0.0201	0.0200	0.0208	0.0200	-1.09	(0.1501)		
Panel B: Off-the-List Events									202
Mean	Raw Returns	0.0006	0.0002	-0.0006	-0.0010	2.63***	0.0059	0.0075	
Standard Deviation	Raw Returns	0.0436	0.0371	0.0467	0.0460	-0.76	(0.0000)	(0.0000)	
	Abnormal Returns	0.0424	0.0351	0.0449	0.0435	-0.60	(0.0000)	(0.0000)	
Skewness	Raw Returns	1.0819	0.6566	0.2290	0.4115	4.99***	0.0009	0.0000	
	Abnormal Returns	1.1171	0.6964	0.2172	0.4212	5.15***	0.0000	0.0000	
Return<Mean-2*Stdev		0.0206	0.0200	0.0217	0.0200	-1.49	(0.7527)		