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

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ABSTRACT

Short-sales practices in the Hong Kong stock market are unique in that only stocks on a list of designated securities can be sold short. By analyzing the price effects following the addition of individual stocks to the list, we find that short-sales constraints tend to cause stock overvaluation and that the overvaluation effect is more dramatic for individual stocks for which wider dispersion of investor opinions exists. These findings are consistent with Miller's (1977) intuition and other optimism models. We also document higher volatility and less positive skewness of individual stock returns when short sales are allowed.

THE QUESTION OF HOW SHORT SALES IMPACT capital markets is highly controversial, with short-sale regulations varying widely across countries and capital markets.[1] Although 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 in the presence of short-sales constraints, security prices tend to reflect a more optimistic valuation than the average opinion of potential investors and thus tend to be upward biased. This overvaluation argument is based on two conditions: (1) A security's 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 not reflected in prices, enabling enthusiastic buyers to bid prices above the level that average investors perceive as fair. This argument has significant implications for market efficiency theories, since one of the major functions of capital markets is price discovery. Indeed, an efficient market should be "a market in which prices always 'fully reflect' available information" (Fama (1970 p. 383)).

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[1] Bris, Goetzmann, and Zhu (2007) provide a comprehensive review of the regulations of short sales in 46 equity markets around the world.

Jarrow (1980) and Figlewski (1981) are among the first to model Miller's (1977) idea rigorously in a static capital asset pricing model (CAPM) framework. In his general equilibrium analysis, Jarrow (1980) shows that the total effect of prohibiting short sales may be quite complex, owing to the substitution effect among stocks. When two equivalent markets that differ 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 than the price of the same asset in the other market. Figlewski (1981) adopts a standard one-period model to show that when investors with unfavorable information are constrained from selling short, excess demand exists and equilibrium prices exceed the market-clearing price that would obtain if short-sales constraints did not exist. Figlewski's (1981) conclusion is consistent with Miller's (1977) intuition. Chen, Hong, and Stein (2002) obtain a similar result in their model that allows for risk aversion—stocks with short-sales constraints reflect optimistic beliefs and thus realize lower future returns.[2]

Diamond and Verrecchia (1987) provide an alternative view by modeling the effects of short-sales constraints in a rational expectations framework. They show that the price of a stock constrained by short sales 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. In contrast to Miller (1977) and other optimism models, Diamond and Verrecchia's (1987) work is more in the efficient markets tradition. However, they make a strong assumption by introducing a risk-neutral market maker who has perfect 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 relative validity of the predictions of the foregoing models. 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 because finding two economies that are identical except for whether or not they have short-sales constraints is impossible. Thus, most existing tests focus on how to identify and measure the extent of short-sales constraints in major markets.

Figlewski (1981) tests the effect of short-sales constraints by looking at the relationship between the level of short interest and subsequent stock returns. His tests assume that short interest proxies for the level of shares that would be sold short if short-sales constraints were nonexistent, and therefore, the amount of adverse information that was excluded from the market price. He provides evidence that more heavily shorted firms underperform less heavily shorted firms.

[2] Other studies conclude that the price can be higher than the valuation of all investors owing to the opportunity to speculate that arises when short selling 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.

However, Chen et al. (2002) argue that Figlewski's (1981) short interest proxy may suffer from misspecification in that variations in short interest may reflect variations in the transactions costs of selling short rather than in suppressed negative information. Thus, a stock with a low or zero value of short interest may simply be difficult or costly to sell short, which could potentially translate into more, rather than less, negative information being held from the market. Chen et al. (2002) argue further that no clear-cut interpretation of the relationship between short interest and subsequent returns may exist.[3] Consequently, these authors proffer another proxy for short-sales constraints, namely, breadth of ownership. Chen et al. (2002) find that stocks experiencing a decline in breadth of ownership subsequently underperform those for which breadth has increased.

Danielsen and Sorescu (2001) focus on abnormal stock returns following option listings. Since traded put and call options arguably offer a low-cost way of establishing a short position, the listing of options can be viewed as the de facto alleviation of short-sales constraints. Danielsen and Sorescu (2001) find that post-1980 option introductions are associated with negative abnormal returns in underlying stocks. Similarly, Ofek and Richardson (2003) use data on DotComs and show that short-sales constraints, in the form of stock option lockups, have a considerable and persistent negative impact on subsequent stock returns. Jones and Lamont (2002) use early 20th century U.S. data to show that stocks that are expensive to sell short have high valuations and low subsequent returns. All these findings are consistent with the hypothesis that stocks that are difficult to sell short are overpriced.

A different approach to test Miller's (1977) hypothesis looks at the relationship between differences of investor opinions and cross-sectional stock returns. Diether, Malloy, and Scherbina (2002) use the dispersion of analysts' earnings forecasts to measure the degree of divergence in opinions and show that stocks with higher dispersion earn lower future returns than otherwise similar stocks. These authors argue that analysts' incentive structures represent additional frictions that prevent the revelation of negative opinions. Boehme, Danielsen, and Sorescu (2006) show that high dispersion of investor opinions and short-sales constraints are both required to induce overvaluation. The results of Diether et al. (2002) and Boehme et al. (2006) both support Miller's (1977) intuition.

Almost without exception, the indirect empirical tests discussed above encounter the 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.

[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 in the portfolio is monotonic in the actual short interest. This finding shows that short interest is not an effective measure of short-sales constraints.

[4] Geczy, Musto, and Reed (2002) and D'Avolio (2002) look at short-selling costs from a sample of security lending provided by certain institutions covering the months November 1998 to October 1999 and April 2000 to September 2001, respectively.

In this paper, we offer a direct examination of the hypothesized relationship between short-sales constraints and stock overvaluation. Our analysis is made possible by the unique regulatory feature of the Hong Kong market that allows short sales only of securities that are included in an official short-sales list that is revised over time. This unique market structure enables us to trace stock price movements before and after stocks are added to the official list, controlling for the other characteristics of the sampled stocks. Moreover, since short-sales restrictions for different stocks are released at different times, our cross-sectional analysis also suffers less from the potential confounding effects of other concurrent events.

A noteworthy related work is Bris et al.'s (2007) international study of the effects of short-sales constraints. They employ stock return data from 46 equity markets around the world and examine the effects of short-sales restrictions on market efficiency by comparing markets in which short sales are allowed and practiced to markets in which they are not. Whereas the measure of short-sales constraints is direct in the cross-country analysis, data limitations do not allow Bris et al. (2007) to carry out tests of overvaluation directly. Therefore, they 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 comovement. Our single-country analysis complements Bris et al. (2007) nicely in that we offer a direct examination of the effects of short-sales constraints.

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 (2004) develop a model illustrating that the fear of financial crises, rather than the fear of a real liquidity shock, is the true cause of financial crises. One implication of their model is that implementing constraints that preclude some market participants from front-running other investors can effectively prevent financial crises. 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, further aggravating market declines and leading ultimately to a crash. Therefore, their model predicts a higher frequency of extreme negative stock returns when short-sales constraints are binding. This argument leads to the testable implication that stock returns are more negatively (or less positively) skewed when short sales are constrained.

Bris et al. (2007) test whether short-sales constraints stabilize or destabilize financial markets by examining the frequency of extreme negative returns and the skewness of both individual stock returns and market returns. They find that in markets in which short selling is either prohibited or not practiced, stock returns at the market level tend to be less rather than more negative, which contradicts the prediction of Hong and Stein's (2003) model. However, Bris et al. (2007) fail to identify significant differences in skewness at the individual level or any significant relationship between the frequency of extreme negative returns and short-sales restrictions.

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 tests in the first group reveal significant negative cumulative mean abnormal returns after stocks are added to the list of designated securities for short selling. We regress these abnormal returns over variables that proxy for the dispersion of investor opinions and find that the decline increases with the divergence of investor opinions. These findings strongly support Miller's (1977) hypothesis that short-sale constraints lead to overvaluation and that overvaluation is more serious for individual stocks when ex ante opinions about those stocks are more diverse.

Our second group of tests fails to support the prediction of Hong and Stein's (2003) model of market crashes. Instead, we find that the returns of individual stocks exhibit less positive skewness, rather than the more positive skewness that Hong and Stein (2003) predict when short-sales constraints are removed. 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 I provides a detailed overview of short-sales practices in the Hong Kong stock market and describes our data. Section II tests the effects of short-sales constraints on the price discovery process. In Section III we examine some characteristics of stock return distributions before and after short-sales restriction changes. Section IV concludes.

I. Short Sales in 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 sold short, 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 1997 Asian financial crisis. However, exempt from the rule were short-selling transactions used by stock options market makers to hedge the portfolio risk resulting from their market-making activities. Finally, on December 3, 2001, the tick rule on short selling in the stock market for index arbitrageurs and market makers was also exempted to help improve market liquidity. The number of securities designated for short selling is revised on a quarterly basis, based on liquidity and market capitalization criteria. By January 27, 2003, there were 163 common stocks (out of 812 common stocks traded on the main board and 163 traded on the Growth Enterprises Market (GEM)[5]) that could be sold short.

[5] The Growth Enterprise Market is an alternative market in Hong Kong established in November 1999 and operated by the Hong Kong Stock Exchange. It is a market in which growth enterprises

Table I

Summary Statistics: List Changes and Addition Events

The table reports the occurrence of events in which individual stocks on the Hong Kong Stock Exchange 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 trackable, as some early records are in the format of paper copies carrying no announcement dates. Column 3 reports the number of stocks that each new version of the list contains. Column 4 reports the number of addition events that take place each time the list is revised. An addition event is defined as one in which an individual stock is added to the list and therefore can be sold short from the effective date. The last row of the table reports the cumulative number of stocks ever on the list and the cumulative number of addition events.

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

We obtain historical versions of the list of designated securities eligible for short selling (hereafter referred to as "the list") from the Hong Kong Stock Exchange. The original list, established in January 1994, was revised 20 times through January 27, 2003.[6] We report summary statistics about these revisions in Table I. We also obtain daily short-selling volume data around changes to the list from the Hong Kong Stock Exchange's Web pages. These data are available because the exchange requires all market participants to indicate whether their order is a short-selling order when inputting orders into the system. But since no particular indication is needed when participants buy stocks to cover their

with relatively small capitalization and high growth potential are listed and traded.

[6] Earlier versions of the list (up to August 2000) are available in the library of the Hong Kong Stock Exchange; later versions are obtained from the exchange's Web site (http://www.hkex.com.hk/).

short position, no short interest data are available. In later tests, we define daily short-sales turnover as the number of shares being sold short divided by the total number of shares traded on that day. Other data, including daily prices, trading volume, the market value of individual stocks, and the 3-month Hong Kong Interbank Offer Rate covering the period January 1992 to July 2003, come from the Datastream database.

Table I shows that the number of stocks to ever appear on the list is 448 over the sample period. Some stocks are deleted from the list, and others enter the list more than once. We define an "addition event" as one in which an individual stock is added to a revised version of the list and therefore can be sold short from the effective date of the revised version. Thus, when an individual stock re-enters the list, this is regarded as another addition event. Table I shows that we identify 519 additions over the sample period.

Stocks must meet certain criteria to be included in the list. The first expansion of the list in March 1996 covered all the 33 constituents of the Hang Seng Index, the Hang Sang MidCap 50 Index, and the balance of the 50 largest stocks not in those indices. Since then the criteria have been revised from time to time to reflect changing market conditions. As of January 2003, which is the end of our sample period, the criteria stipulate that stocks qualified for short selling should be among one or more of the following groups:

1. All constituent stocks of the underlying indices of equity index products traded on the exchange.
2. All constituent stocks of the underlying indices of equity index products traded on the Hong Kong Futures Exchange Limited.
3. All underlying stocks of stock options traded on the exchange.
4. All underlying stocks of stock futures contracts (as defined in the rules, regulations, and procedures of the Hong Kong Futures Exchange Limited) traded on the Hong Kong Futures Exchange Limited.
5. 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 over the 60-day qualifying period).
6. Stocks with market capitalization of not less than HK$1 billion and an annual turnover-to-market capitalization ratio of not less than 40%. ("Market capitalization" refers to the total number of issued shares times the latest stock price, and "annual turnover" refers to the aggregate Hong Kong dollar turnover during the preceding 12 months).
7. All securities traded under the pilot program (i.e., the first 17 securities that were approved for short selling in January 1994.)[7]

The decision to include in the list stocks that tend to be constituents of indices or that are relatively large and actively traded reflects the government's attempt to avoid the claimed adverse influence (intense volatility and

[7] The exchange also stipulates that the Tracker Fund of Hong Kong (the exchange-traded fund based on the Hang Seng stock index) and other exchange-traded funds approved by the board in consultation with the commission can be sold short.

potential manipulation of prices, for example) of short sales on smaller stocks. Importantly, this decision may result in a certain degree of endogeneity in our tests because inclusion in the list may result from excellent past performance and/or large market capitalization. Thus, caution needs to be exercised in attempting to differentiate the pure effect of changes in short-sales constraints on stock returns from other possible explanations.

Two methods are used to differentiate between possible explanations. First, we investigate the abnormal returns around two kinds of event dates. In our main test, we examine the abnormal returns around the effective dates (when the regulation changes take real effect) of addition events. Effective dates are also adopted by Danielsen and Sorescu (2001). In robustness tests, we also check the abnormal returns around announcement dates. If stocks' additions to the list provide additional signals about changes in the stocks' liquidity, future performance, and so forth, the effect of these additions on abnormal returns should be manifested on the announcement dates.[8] However, the effects of removing short-sale constraints should be evident after short sales are actually permitted, that is, after the effective dates.

Second, we examine cumulative abnormal returns over different event windows, covering a relatively long period both before and after the event dates. This careful analysis allows us to distinguish the maintained hypothesis from the possibility that the observed abnormal returns are just the reversal of previous changes in a stock's performance or from the possibility that the observed abnormal returns are due to temporary price pressures brought about by short-selling activities around the event dates.

The data set enables us to test the effect of short-sales constraints directly, and it also possesses several unique characteristics. First, stocks that can be sold short coexist with stocks that cannot be sold short. To the best of our knowledge, only Bris et al. (2007) bring forward similar data wherein securities are subject to different short-sales regulations. But Bris et al. (2006) introduce this difference by applying multimarket data in which case controlling for heterogeneous characteristics across economies becomes challenging. Second, short-sales constraints are lifted for individual stocks in our data set at different times, which enables us to better diversify away any concurrent effect owing to period- and/or market-specific events in the cross-sectional event tests. The following two sections elaborate on the empirical tests and subsequent results.

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

A. Hypotheses

From the above analysis, we summarize our two main hypotheses to be tested in this section. Our first hypothesis is as follows.

[8] Given the well-publicized criteria for list changes and observable changes in stocks' market performance, investors may not find it difficult to predict addition events. However, collecting and processing such information could be costly, and announcement dates are not standard. Therefore, abnormal returns may or may not be observed on announcement dates.

HYPOTHESIS 1: *Stock prices will decrease when short-sales restrictions are repealed.*

This hypothesis is based on Miller's (1977) overvaluation theory and relevant optimism models of short-sales constraints discussed previously. Specifically, this hypothesis suggests that, ceteris paribus, one would expect to observe negative abnormal returns around addition event dates.

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's (1977) 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 opinions are more divergent before addition events take place, the overvaluation will be more dramatic, and thus larger negative abnormal returns should be observed around the addition events. Therefore, if abnormal returns are regressed over variables that represent the dispersion of opinions, negative coefficients are expected.

B. Short-Sales Constraints and Overvaluation

B.1. Abnormal Return Measures

To test the overvaluation hypothesis, we compare stock prices before and after event dates. We apply the measures of abnormal returns (ARs) and cumulative abnormal returns (CARs) around events dates according to Brown and Warner (1985).

We use two measures to calculate ARs and CARs. The first measure is based on the ordinary least squares (OLS) market model, defined as

$$AR_i^m(t) = R_{it} - \hat{\alpha}_i - \hat{\beta}_i R_{Mt},$$

and

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

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 traded on the Hong Kong Stock Exchange on date t. The coefficients $\hat{\alpha}_i$ and $\hat{\beta}_i$ are estimates of the intercept and slope coefficients in the OLS market model when stock i's daily return, R_{it}, is regressed on the daily market return, R_{Mt}, in an estimation window before the event window. Therefore, $AR_i^m(t)$ is the abnormal return based on the market model (i.e., the difference between the actual return and the expected return based on the market model) on day t, and $CAR_i^m(t_1, t_2)$ is the cumulative abnormal return during event window (t_1, t_2).[9] Throughout the paper, we apply a 250-day estimation window unless otherwise specified. If a stock does not have a pre-event record of that length, a minimum length of 180 days is required.

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

$$AR_i^a(t) = R_{it} - R_{Mt},$$

and

$$CAR_i^a(t_1, t_2) = \sum_{t=t_1}^{t_2} (R_{it} - R_{Mt}), \tag{2}$$

where $AR_i^a(t)$ is the difference between the actual return on security i and the return on the market index on day t, and $CAR_i^a(t_1, t_2)$ is the cumulative abnormal return during event window (t_1, t_2).

B.2. Significance Testing: A Simulation Method

By excluding those stocks that fail to have long enough daily data to calculate ARs and CARs, we obtain a final sample consisting of 383 events clustered across 18 event dates. The stocks added to the short-sale list also tend to be large-cap, liquid stocks whose returns could have a common component that would not be taken into account under either the market model or the market-adjusted model. These conditions may induce cross-sectional correlations among the abnormal returns or cumulative abnormal returns of individual stocks. Thus, the usual event study t-tests that treat all ARs or CARs as independent observations might be overstated. Our preliminary results also indicate that some of the CAR distributions are positively skewed, which may limit the usefulness of traditional t-statistics. To ensure that our significance tests are not influenced by these potential misspecifications, we perform bootstrap tests with actual security returns data to generate the empirical distribution for various mean abnormal returns under the null hypothesis specific to our model. These empirical distributions are used to gauge the significance (to obtain the empirical p-values) of the respective mean abnormal returns. The bootstrap procedures are similar in spirit to those of Ikenberry, Lakonishok, and Vermaelen (1995) and Kothari and Warner (1997), but we make modifications to address the aforementioned concerns specifically.

We first identify the number of clusters in the original sample and the number of stocks in each cluster, respectively. Then, to form a simulated sample with similar correlation structure, we repeat three steps for each cluster. First, we assign a simulated event date to the cluster by randomly selecting a day (i.e., the simulated event date 0) between January 1, 1994 and January 31, 2003.

[9] In later tables and figures, when we report ARs and CARs together, they are calculated based on the same estimation windows.

Second, on this date, we form a "pool" of eligible stocks that are similar in size and turnover to actual firms in the cluster. Specifically, we use the largest and smallest size percentiles and the highest and lowest annual turnover of the actual firms in the cluster as the upper and lower bounds and then include all the listed stocks whose size and annual turnover at that time fall between the bounds in the pool.[10] Third, we randomly select from the pool—without replacement—the exact number of stocks as there are in the actual cluster. Because the chosen stocks for each cluster share a common event date, and because they are similar in terms of size and turnover to the stocks in the actual cluster, the abnormal returns, if any, of the chosen stocks would preserve the cross-sectional correlation as it exists in the actual cluster. Combining all the chosen stocks from the 18 clusters together, we obtain a simulated sample whose clustering structure resembles our actual sample. We then calculate the ARs and CARs of various horizons around the simulated event date for each stock in exactly the same way in which we compute them for the actual events, and obtain average values. Because of the random selections of "event dates" and stocks from eligible pools, on average, this simulated sample should not exhibit any abnormal returns, except for those induced by intragroup correlation.[11] The procedure is repeated 1,000 times, providing an empirical approximation of the distribution for each average AR and CAR drawn under the null model specific to our sample. Therefore, we are able to report one-tailed empirical p-values to test the significance of the AR or CAR values of the actual events by calculating the percentage of the average abnormal returns or cumulative abnormal returns observed in the empirical distribution based on 1,000 runs that is less than the average AR or CAR values observed for the actual sample.

B.3. Abnormal Return Results

In Table II, the cross-sectional means of ARs and CARs for different event windows surrounding addition events are reported.[12] Panel A reports the 21

[10] In one cluster, the smallest size percentile is only 3%. The next-smallest size percentile is 18%, and the next is about 35%. Since the majority of the clusters have a size percentile with a lower bound of 35% or more, we establish 35% as the lower bound for the size percentile of this cluster. For security turnover, we also impose the additional criterion that the annual turnover rate must be at least 10%.

[11] Even though we take into account potential cross-sectional dependence arising from size and turnover, in the actual event study industry concentration within each cluster can still result in correlated performance measures. Our bootstrap procedure would not necessarily account for such correlation. However, in closely examining the composition of firms within each actual calendar time cluster, we do not uncover any industry concentration.

[12] A winsorization procedure is applied to avoid potential bias caused by outliers. Any AR or CAR that is more than three standard deviations from the sample mean is set equal to the value that is (plus or minus) three standard deviations from the mean. Cowan and Sergeant (2001) find that limits of 3.0 standard deviations produce a better parametric test specification than 2.5, 3.5, or 4.0 standard deviations. Winsorization is also applied in Table III. Winsorized (at 5% and 95% percentiles) and unwinsorized abnormal returns are also examined; the results are qualitatively similar and thus are omitted here.

Table II

Abnormal Returns and Cumulative Abnormal Returns around Additions

The table reports abnormal returns and cumulative abnormal returns based on the market model and the market-adjusted model around additions. An addition event is defined as one in which an individual stock is added to the list and therefore can be sold short from the event day, denoted as day 0. For the market model, an estimation window of (−280, −31), with a minimum length of 180 days, is applied. The one-tailed p-value is obtained by calculating the percentage of the mean abnormal returns observed in the bootstrapped empirical distribution based on 1,000 runs that is less than the average AR and CAR values observed for the actual sample. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Daily Abnormal Returns (%) around Additions

	Market Model			Market-Adjusted Model		
Days	Mean	Median	One-Tailed p-Value	Mean	Median	One-Tailed p-Value
−10	−0.648*	−0.571	(0.06)	−0.255	−0.095	(0.26)
−9	−0.044	−0.090	(0.49)	−0.113	−0.178	(0.41)
−8	−0.258	−0.210	(0.25)	−0.087	−0.104	(0.41)
−7	0.270	−0.084	(0.78)	0.170	0.000	(0.66)
−6	0.312	0.141	(0.82)	0.268	0.135	(0.76)
−5	0.600	0.090	(0.94)	0.541	0.000	(0.92)
−4	0.375	−0.053	(0.85)	0.318	−0.190	(0.80)
−3	−0.053	−0.235	(0.48)	−0.087	−0.196	(0.45)
−2	−0.625*	−0.482	(0.07)	−0.721*	−0.766	(0.06)
−1	0.237	−0.023	(0.76)	0.059	−0.044	(0.47)
0	−0.555*	−0.292	(0.10)	−0.640*	−0.349	(0.08)
1	−0.492	−0.211	(0.13)	−0.409	−0.381	(0.18)
2	−0.660*	−0.593	(0.07)	−0.819**	−0.753	(0.05)
3	−0.102	−0.265	(0.40)	−0.270	−0.308	(0.25)
4	−0.518	−0.289	(0.12)	−0.385	−0.124	(0.20)
5	−0.357	−0.254	(0.21)	0.100	−0.210	(0.60)
6	−0.970**	−0.532	(0.03)	−1.169**	−0.974	(0.02)
7	0.495	−0.113	(0.91)	0.238	−0.247	(0.73)
8	−0.221	−0.046	(0.33)	−0.225	0.007	(0.32)
9	−0.352	−0.133	(0.25)	−0.494	0.000	(0.16)
10	−0.948**	−0.181	(0.03)	−0.720*	0.000	(0.07)

Panel B: Cumulative Daily Abnormal Returns (%) around Additions

	Market Model			Market-Adjusted Model		
Event Windows	Mean	Median	One-Tailed p-Value	Mean	Median	One-Tailed p-Value
(−10, −1)	0.035	−0.261	(0.59)	0.331	−0.328	(0.64)
(0, 10)	−4.523**	−2.188	(0.02)	−4.516**	−2.290	(0.01)
(0, 15)	−5.773**	−2.789	(0.01)	−5.578**	−3.056	(0.01)
(0, 30)	−5.437*	−4.964	(0.09)	−4.099	−4.067	(0.11)
(0, 60)	−5.638	−3.188	(0.28)	−3.782	−4.410	(0.34)

average daily ARs surrounding the effective dates of additions based on both the market model and the market-adjusted model. The average abnormal return based on the market model on the effective dates is −0.555%, with a p-value of slightly less than 0.10. Thus, the average abnormal return of actual events on day 0 ranks among the smallest 10% in the 1,000 simulated samples and the null hypothesis of no overvaluation effect can be rejected at the 10% level. The average abnormal return based on the market-adjusted model on the event day is −0.640%, with a p-value of 0.08, indicating again that the null hypothesis of zero abnormal returns can be rejected at the 10% level.

Panel A shows that at least eight of the mean daily ARs in the 10 trading days following the event date remain negative, based on both models. Three of the negative mean ARs are significant at the 10% level.

In Panel B, cumulative mean abnormal returns in the days surrounding the effective dates are reported. For the market model, the cumulative mean abnormal return from day −10 through day −1 (0.035%) is not significantly different from zero at the 10% level (p-value = 0.59). Thus, the pre-event period is not associated with significant cumulative abnormal returns. In contrast, the cumulative mean abnormal return from day 0 through day 10 (−4.523%) is significant at the 5% level (p-value = 0.02). The cumulative mean abnormal returns from day 0 through day 15 (−5.773%, p-value = 0.01) and from day 0 through day 30 (−5.437%, p-value = 0.09) are also significant. Although the p-value for the CAR over the period (0, 60) is not significant at the 10% level, the CAR (−5.638%) is very close to the CAR for days 0 through 30. Thus, results based on the market model strongly support Hypothesis 1. Results based on the market-adjusted model are only slightly weaker than the results based on the market model. Therefore, our evidence is consistent with the hypothesis that short-sales constraints result in overvaluation in the Hong Kong market.

Figure 1 provides a clearer view of the trend in cumulative mean abnormal returns by plotting mean ARs and CARs based on the market model from day −30 through day 60 relative to the event day. A clear postevent decreasing trend is evident. The mean CAR reaches its lowest value on day 44, when the CAR (0, 44) is −7.937% (p-value = 0.04).

Figure 1 is useful for differentiating alternative explanations of negative abnormal returns following additions. First, for an overreaction/reversal view to be valid, stocks would need to experience a positive change in market value, on average, before the addition event. The negative abnormal returns after the event dates could then be interpreted as a reversal of previous positive returns. However, if anything, Figure 1 shows negative returns in the pre-event period, which is not consistent with a reversal story.

Second, for a price pressure story to be valid, the negative CAR trend in the postevent period would have to be temporary and would be followed by a return reversal because short selling would temporarily increase the overall supply and exert downward pressure on prices as long as the short-run demand is not completely elastic. Mitchell, Pulvino, and Stafford (2004) document significant downward price pressure around mergers caused by merger arbitrage short

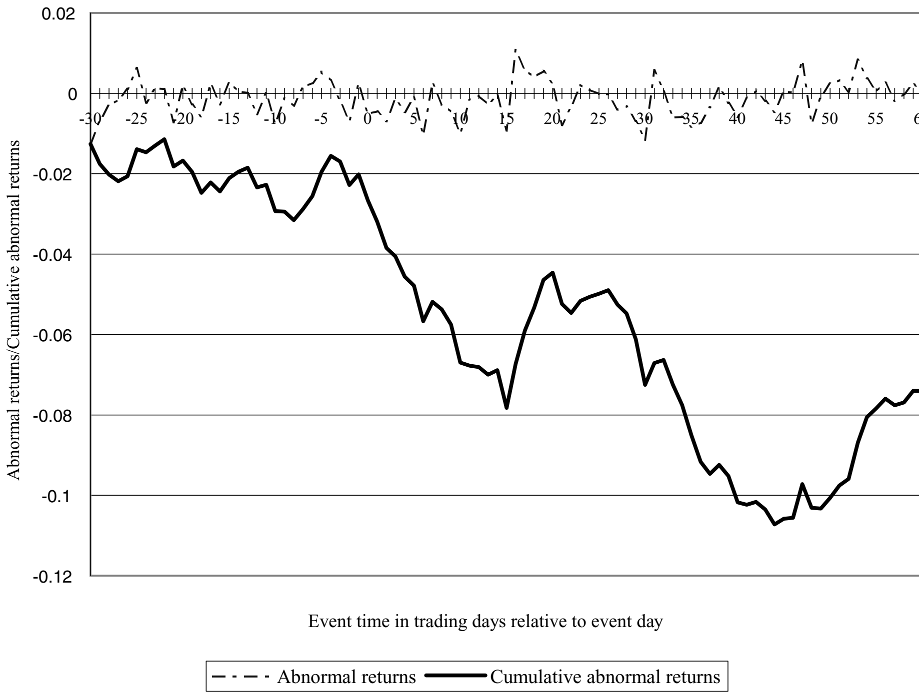

Figure 1. Abnormal returns and cumulative abnormal returns around additions. This figure reports abnormal returns and cumulative abnormal returns calculated based on the OLS market model around addition events. An addition event is defined as one in which an individual stock is added to the list and therefore can be sold short from the event date. The event day is denoted as day 0. For the market model, the estimation window is (−280, −31), with a minimum length of 180 days.

sales. Their evidence suggests that it takes less than 1 month (17 days, to be exact) for prices to revert back to fundamentals. But our Figure 1 indicates that mean CARs remain negative through day 60, supporting Hypothesis 1 and giving credence to the argument that much of the negative CARs can be attributed to the lifting of short-sales constraints.[13]

B.4. Announcement Dates Effect

One concern related to potential misspecification of our statistics has to do with the fact that the event date as defined in this study is the date on which a short-sales restriction was actually lifted, rather than the date on which the change was announced. Although announcement dates are widely used

[13] We check the cumulative abnormal returns over a longer window than Mitchell et al. (2004) do, due to the concern that stocks in the Hong Kong Stock Exchange might be less liquid than those in their study and might take longer to reverse.

Table III
Cumulative Daily Abnormal Returns (%) around Announcement Dates

The table reports abnormal returns and cumulative abnormal returns around announcement dates of additions (denoted as day 0) based on the market model and the market-adjusted model. An addition event is defined as one in which an individual stock is added to the list and therefore can be sold short from the effective day. For the market model, an estimation window of (−280, −31), with a minimum length of 180 days, is applied. The one-tailed p-value is obtained by calculating the percentage of the mean abnormal returns observed in the bootstrapped empirical distribution based on 1,000 runs that is less than the average AR and CAR values observed for the actual sample. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

	Market Model			Market-Adjusted Model		
	1	2	3	4	5	6
Event Windows	Mean	Median	One-Tailed p-Value	Mean	Median	One-Tailed p-Value
(−10, −1)	0.364	0.440	(0.65)	0.596	0.202	(0.68)
0	0.064	−0.062	(0.55)	0.275	0.244	(0.69)
(−1, 1)	−0.159	−0.073	(0.46)	−0.033	−0.099	(0.49)
(−2, 2)	−0.854	−1.263	(0.31)	−0.245	−1.061	(0.45)
(−3, 3)	−0.406	−1.027	(0.43)	0.059	−0.211	(0.54)

in event studies, we stick with effective dates in the main tests because we expect that most price changes associated with additions to the short-sale list will be triggered by the otherwise nonexistent trading caused by the suspension of short-sales restrictions, rather than by the news of the suspension itself. To ensure that we have clearly differentiated between these two types of effects, we examine CARs around announcement dates. Because we obtain information about announcement dates for only 12 revisions (out of all 21 versions of the list), there are 260 events included in this test, out of the 383 events in the total sample. (Refer to Table I for the correspondence of announcement dates and effective dates.)

Table III reports the average abnormal returns and cumulative abnormal returns around the announcement dates of additions. Columns 1 and 2 (columns 4 and 5) report the mean and median values for the actual events based on the market model (the market-adjusted model). Columns 3 and 6 report the one-tailed p-values for the actual events based on the empirical distributions generated similarly as in the Subsection B.2.

The average abnormal return on the announcement dates based on the market model (0.064%) is not significantly different from zero (p-value = 0.55). Neither are the mean CARs significant for the 3-, 5-, and 7-day windows around the announcement date. Similar results hold for the market-adjusted model. The lack of a price reaction around the announcements indicates that there is no additional informational content in being included in the list. This evidence suggests that price changes around additions stem from changes in short-sales restrictions themselves rather than from the news of such changes. This evidence also supports Hypothesis 1.

C. 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. We first identify proxies for the dispersion of investor opinions. We then run cross-sectional regressions of cumulative abnormal returns around addition events over these proxies to examine the coefficients. We also examine and control for potential effects related to the tick rule, daily short-selling turnover, and pre-event performance.

C.1. Measures of Dispersion of Investor Opinions

The variables that proxy for the dispersion of investor opinions are established as follows. The first measure of the dispersion of opinions, $SIGMA_{raw}$, is the standard deviation of the daily raw returns in the estimation window (i.e., from day $t-280$ to day $t-31$). The second measure, $SIGMA_{ab}$, is 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.[14] Trading volume is another widely agreed-upon proxy for belief dispersion.[15] Accordingly, *TURNOVER*, our third measure, represents the ex ante daily trading volume (scaled by outstanding shares) averaged over the estimation window. Panel A of Table IV provides descriptive statistics for these variables.

C.2. Other Stock Characteristics

Panel B of Table IV includes descriptive statistics of other characteristics of individual stocks around additions that we employ as independent variables in later cross-sectional regressions. The first variable, *ALPHA*, is the daily abnormal return averaged over the 3-month period before the event window based on the CAPM model. For consistency, we calculate *ALPHA* over the 250-day pre-event estimation window (−280, −31); we use the first 160-day period to estimate the CAPM model, and we use the next 90-day period to calculate *ALPHA*. We apply the 3-month Hong Kong Interbank Offer Rate as a risk-free rate. By examining the coefficient on *ALPHA*, we hope to find out whether the cumulative abnormal returns around additions are associated with past performance. More specifically, we hope to differentiate the optimism theory underlying Hypotheses 1 and 2 from the overreaction hypothesis based on return reversals. If some stocks were added to the list only because their prices had recently risen, the negative cumulative abnormal returns following list addition events may merely be reversals of the previous positive abnormal returns.

[14] See, for example, Harris and Raviv (1993) and Shalen (1993).

[15] See, for example, Shalen (1993) and Jones (2003). Standard deviation of daily returns and trading volume are also used by Danielsen and Sorescu (2001) and Boehme et al. (2006).

Table IV

Descriptive Statistics: Dispersion of Investor Opinions and Stock Characteristics

The table reports the descriptive statistics of variables that proxy for the dispersion of investor opinions and other stock characteristics around additions. An addition event is defined as one in which an individual stock is added to the list and therefore can be sold short from the effective day. $SIGMA_{raw}$ is the standard deviation of the daily raw returns in the estimation window of (−280, −31), with a minimum length of 180 days. $SIGMA_{ab}$ is the standard deviation of daily abnormal returns in the estimation window of (−280, −31) based on the market model. *TURNOVER* is the daily ex ante volume of trade, averaged over the period of (−280, −31) and scaled by outstanding shares. *ALPHA* is the CAPM alpha averaged over the period of (−120, −31). For the CAPM model, a 160-day estimation window of (−280, −121) is applied, and the risk-free rate is the 3-month Hong Kong Interbank Offer Rate. *SSTURNOVER* is the average daily short-selling turnover during the 11-day event window (0, 10). *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

	Number of Observations	Mean	Median	Std. Dev.	Min.	Max.
		Panel A: Proxies of Dispersion of Opinions				
$SIGMA_{raw}$	383	0.038***	0.031	0.033	0.006	0.412
t-stat		(22.54)				
$SIGMA_{ab}$	383	0.035***	0.030	0.032	0.005	0.410
t-stat		(21.51)				
TURNOVER (%)	383	0.655***	0.268	0.914	0.000	6.248
t-stat		(14.02)				
		Panel B: Other Stock Characteristics				
ALPHA (%)	383	0.002	−0.001	0.466	−2.286	1.468
t-stat		(0.10)				
SSTURNOVER (%)	383	0.175**	0.000	1.652	0.000	29.151
t-stat		(2.07)				

Although Figure 1 indicates no signs of such reversals, on average, additional cross-sectional regressions can provide evidence at the individual stock level. According to Table IV, the average *ALPHA* is only 0.002% and is not significantly different from zero at the 10% level. This evidence is inconsistent with the assertion that additions to the list are driven primarily by immediate past performance.

The second variable in Panel B, *SSTURNOVER*, is the average daily short-selling turnover over the event window (an event window of (0, 10) is applied here; we obtain qualitatively similar results when we apply event windows of different lengths). The daily short-selling turnover is defined as the number of shares being sold short divided by the total number of shares traded on that day. Because daily short interest data are not available, testing whether the abnormal returns around events are due to excess supply caused by short sales is difficult. Nevertheless, we do have access to daily short-selling volume data, and it may be interesting to see whether there is any relationship between short-selling turnover and abnormal returns. Table IV shows that the average

SSTURNOVER is 0.175%, which means that on average, less than 0.2% of the total shares traded each day in the 11-day window are sold short.

C.3. The Tick Rule

We also establish and include in later regressions the dummy variable *D_TICK*, which is equal to one if an addition took place when a tick rule was in effect (145 events) and to zero when no tick rule was in effect (238 events). As mentioned in Section I, when short sales were first introduced into the Hong Kong stock market in 1994, a tick rule also took effect. The rule stipulated that short sales could not be carried out below the best current asked price. This regulation can be viewed as another form of short-sales constraint that remains in effect for designated stocks, even though, literally, they can be sold short. The tick rule was repealed in March 1996 but reinstated in September 1998. Some market participants have been exempted from this rule during certain periods. However, it is still probable that the constraint weakens the realized effect of the lifting of short-sales restrictions. Therefore, it is interesting to examine the tick rule effect, and to further control for it in our regressions when it was in effect. Based on Hypothesis 1, we predict that the actual impact of lifting short-sales restrictions is less significant for additions that took place when the tick rule was in effect, compared with the impact on these events when the rule was not.

C.4. 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 additions, and the regressors are variables that proxy for the dispersion of investor opinions. Variables discussed in Subsections C.2 and C.3 are also examined and controlled for as needed. Table V provides the results of the cross-sectional regressions, where CAR^m (0, 10) around addition events is the dependent variable.[16]

Column 1 in Table V shows that the coefficient on the ex ante standard deviation of the stock's raw return is negative (−1.179) and significant at the 1% level, with a t-value of −4.51. Columns 2 and 3 report similarly strong results for the coefficients on the standard deviation of the stock's abnormal return and on ex ante turnover. These results are consistent with Hypothesis 2, suggesting that short-sales constraints result in more serious overvaluation of stocks when investors' opinions are more divergent.

In columns 4 to 6 we examine potential effects on cumulative abnormal returns of other variables. Column 4 reports an insignificant coefficient on *ALPHA*. This finding reinforces our earlier finding that postevent cumulative

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

Table V

Cross-Sectional Regressions of Cumulative Abnormal Returns during an 11-Day Window around Additions over Dispersion of Opinions

The table reports the cross-sectional regression results of the dependent variables CAR^m (0, 10) around additions over independent variables that proxy for dispersion of investor opinions and other individual stock characteristics. An addition event is defined as one in which an individual stock is added to the list and therefore can be sold short from the effective day. CAR^m (0, 10) is the cumulative abnormal return in the 11-day window (0, 10) around the addition event date based on the market model. For the market model, the estimation window is (−280, −31), with a minimum length of 180 days. $SIGMA_{raw}$ is the standard deviation of the daily raw returns in the estimation window of (−280, −31). $SIGMA_{ab}$ is the standard deviation of daily abnormal returns in the estimation window of (−280, −31) based on the market model. *TURNOVER* is the daily ex ante volume of trade, averaged over the period of (−280, −31) and scaled by outstanding shares. *ALPHA* is the CAPM alpha averaged over the period of (−121, −31). For the CAPM model, an estimation window of 160 days is applied, and the risk-free rate is the 3-month Hong Kong Interbank Offer Rate. *SSTURNOVER* is the average daily short-selling turnover during the 11-day event window (0, 10). *D_TICK* is a dummy variable set to one when the tick rule is in effect and to zero otherwise. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

	Dependent Variable: CAR^m (0, 10)										
	1	2	3	4	5	6	7	8	9	10	11
Intercept t-stat	−0.002	−0.008	−0.011	−0.047***	0.047***	−0.058***	−0.014	−0.021	−0.025**	−0.059***	−0.058***
t-stat	(−0.12)	(−0.61)	(−1.04)	(−5.26)	(−5.19)	(−5.19)	(−1.05)	(−1.52)	(−2.05)	(−5.20)	(−5.13)
$SIGMA_{raw}$	−1.179***						−1.419***				
t-stat	(−4.51)						(−5.27)				
$SIGMA_{ab}$		−1.102***						−1.332***			
t-stat		(−4.06)						(−4.76)			
TURNOVER			−5.474***						−5.659***		
t-stat			(−5.86)						(−6.07)		
ALPHA				0.340						0.753	
t-stat				(−0.18)						(0.39)	
SSTURNOVER					−0.182						−0.170
t-stat					(−0.34)						(−0.32)
D_TICK						0.031**	0.058***	0.055***	0.040**	0.032*	0.031*
t-stat						(1.99)	(3.15)	(2.97)	(2.28)	(1.71)	(1.67)
No. of obs.	383	383	383	383	383	383	383	383	383	383	383
Adjusted R^2	0.048	0.039	0.080	−0.003	−0.002	0.005	0.07	0.058	0.090	0.002	0.002

abnormal returns are not related to pre-event abnormal performance. The return reversal story therefore seems implausible. Column 5 reports an insignificant coefficient for *SSTURNOVER*, which stands for the average daily short-selling turnover during the 11-day event window for each individual stock. Because *SSTURNOVER* represents the daily short-selling volume rather than the daily short interest, as previously discussed, no conclusive evidence is obtained in this regard.

We regress the CARs on the dummy variable *D_TICK* and report the results in column 6. Consistent with our prediction, the coefficient on *D_TICK* is positive (0.031) and significant at the 5% level (t-value = 1.99). On average, therefore, the cumulative abnormal return when the tick rule is not in effect is 3.1% lower than the cumulative abnormal return when the rule is in effect (−5.8% vs. −2.7%). This finding is also consistent with Hypothesis 1 in that more thorough lifting of short-sales constraints leads to larger price decreases.

Based on the findings in columns 4 to 6 of Table V, we repeat the CAR regressions on proxies of dispersion of investor opinions while controlling for *D_TICK*. In columns 7 to 9, the coefficients on $SIGMA_{raw}$, $SIGMA_{ab,}$ and *TURNOVER* remain negative and statistically significant when *D_TICK* enters the model. Likewise, controlling for *D_TICK* does not change the signs or significance levels of the coefficients on *ALPHA* and *SSTURNOVER* in columns 10 to 11. Overall, our finding that increased diversity in ex ante investors' opinions leads to larger cumulative price declines when short-sales constraints are removed is quite robust. Thus, like Hypothesis 1, Hypothesis 2 is strongly supported by our tests.[17]

III. Short-Sales Constraints and the Distribution of Stock Returns

In this section, we examine the distribution characteristics of stock returns before and after addition events. Although short-sales restrictions are nearly as old as organized exchanges, whether short sales stabilize or destabilize the market (whether they prevent or facilitate market crashes) remains unclear. In Hong and Stein's (2003) model, disperse opinions and short-sales constraints prevent bad news from being released quickly, which potentially results in market crashes. A reasonable implication of their model is that when short-sales restrictions are removed, the frequency of extremely negative returns should decrease, and the skewness of stock returns should become less negative.

Bris et al. (2007) test this implication by examining the skewness and frequency of the extreme values of weekly stock returns across countries with and without short-sales constraints. They find that in markets in which short selling is either prohibited or not practiced, stock returns at the market level tend to be less rather than more negative. They document an insignificant difference

[17] We also carry out regressions controlling for abnormal trading volume, which represents the increase in daily turnover during the event window. Our results are not significantly changed and thus are omitted here.

in skewness at the individual level. They also find that short-sales restrictions are associated with less negatively skewed market returns and with a lower frequency of extreme negative returns around changes in short-sales regulations in several markets, including Hong Kong. These findings run counter to the implication of Hong and Stein's (2003) model.

Our data enable us to carry out a more detailed and arguably more persuasive test with respect to the Hong Kong market than Bris et al. (2007). For each addition event, we select a pre-event estimation window (−280, −31) and a postevent estimation window (31, 280). If a stock does not have the necessary 250-trading-day record before or after the event, a minimum record of 180 trading days is required for the stock to be included in the test. If a stock is deleted from the list within the post-event 180-day period, it is excluded from the test. We then estimate the coefficient of skewness, volatility, and frequency of extreme negative values of stock daily returns during the estimation windows. We report the cross-sectional mean and median values of these characteristics in Table VI. In the Significance of Difference columns, three statistics are reported. The first one is the paired t-statistic, which assumes that the underlying parameters follow a normal distribution. The next two p-values are based on two-tailed nonparametric tests. A signed rank test (or Wilcoxon test) assumes the underlying distribution is symmetric, while a sign test makes no such assumption.

A. 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,

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

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

One of the most significant and important results shown in Table VI is that when short sales of individual stocks are allowed, the coefficient of skewness of both raw returns and abnormal returns of these stocks is less positive. For example, the average skewness of raw returns prior to additions is 0.9375, but it falls to 0.5595 after additions. The t-statistic is 2.87, implying a decrease in skewness at the 1% level of significance when short-sales restrictions are lifted. The p-values of the sign test and of the signed rank test are both less than 0.01, also implying a decrease in skewness at the 1% significance level. This result is inconsistent with the implication of Hong and Stein's (2003) analysis.

Table VI

Difference in Distribution Characteristics of Daily Stock Returns before and after Additions

The table reports the distribution statistics of daily stock returns before and after additions to the list. An addition event is defined as one in which an individual stock is added to the list and therefore can be sold short from the effective day. Estimations are based on stock returns during estimation windows of (−280, −31) and (31, 280) around event dates, with a minimum length of 180 days for each window. Any stocks experiencing another addition or deletion event during the estimation windows are excluded. 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 before and after additions are significantly different from zero. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

		Before Additions		After Additions		Significance of Difference (before minus after additions)		
		Mean	Median	Mean	Median	t-stat	p-Value of Sign Test	p-Value of Signed Rank Test
Mean *(M)*	Raw returns	0.0014	0.0011	−0.0012	−0.0009	10.13***	0.00	0.00
Standard deviation *(SD)*	Raw returns	0.0365	0.0289	0.0413	0.0399	−2.68***	(0.02)	(0.00)
	Abnormal returns	0.0333	0.0275	0.0370	0.0368	−2.24**	(0.05)	(0.00)
Skewness	Raw returns	0.9375	0.8079	0.5595	0.4633	2.87***	0.00	0.00
	Abnormal returns	1.0026	0.8463	0.6407	0.5010	2.70***	0.00	0.00
Extreme values	Frequency [*Return* < *M*-(2)(*SD*)]	0.0200	0.0200	0.0214	0.0200	−2.19**	(0.12)	

B. Volatility of Returns

In Table VI, t-statistics show that the standard deviations of raw returns and abnormal returns are both significantly increased when stocks can be sold short. For example, the standard deviation of raw returns is 0.0365 before additions, but 0.0413 after additions. The difference is statistically significant with the t-test (t-value $= -2.68$) and with the signed rank and sign tests (p-values $=$ 0.02 and 0.01, respectively). This finding suggests that relaxing short-sales constraints increases the return volatility of individual stocks.

This finding need not imply that relaxing short-sale constraints destabilizes the entire market. Increasing the volatility of individual stocks is not tantamount to increasing the volatility of the market as a whole. For this reason and because of the overlapping attributes of our sample, we urge caution in inferring the effects of short sales on market stability. However, our results do provide interesting evidence that relaxing restrictions on short sales leads to higher return volatility for individual stocks.

C. Market Crashes

We also report the frequency of extreme negative daily returns in the pre- and post-event windows for each stock. A daily return is regarded as extremely negative if it is more than two standard deviations below its mean. For this test, extreme observations in the pre- (post-) event windows are measured relative to means and standard deviations measured over the corresponding periods. As shown in Table VI, the frequency of extreme negative daily returns is higher when short sales are allowed than when they are not. This finding is consistent with the reduction in positive skewness discussed above and with Bris et al.'s (2007) finding around changes in short-sales regulations in several markets, including Hong Kong.

IV. Conclusions

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 events on the Hong Kong market in which individual stocks are added to a designated short-sale list. We find that these additions are associated with statistically significant postevent declines in cumulative abnormal returns. This evidence supports Hypothesis 1 and is consistent with Miller's (1977) arguments 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 postevent cumulative abnormal returns over variables that proxy for the dispersion of investor opinions and find that the coefficients for these variables are consistent with the prediction of Hypothesis 2. Specifically, short-sales constraints tend to produce higher overvaluation if the dispersion in investor opinions is greater.

We also carry out tests to examine the implications suggested in the literature with respect to market crashes. Our results suggest that short sales make returns of individual stocks less positively skewed in Hong Kong, and that individual stocks become more volatile when short selling is practiced.

Our results complement existing literature and contribute to the understanding of the price impact that short-sales constraints may have on stocks, especially at the individual stock level. Suggestive evidence is also found on how short-sales constraints affect the distribution characteristics of individual stock returns. Although there are still open questions regarding how short-sale constraints influence the information infusion process or market liquidity, we expect our findings to provide useful insights for both policy makers and theory builders.

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