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Short-sale prohibitions, firm characteristics and stock returns: evidence from Chinese market

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Short-sale prohibitions, firm characteristics and stock returns: evidence from Chinese market

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Abstract

Purpose – The purpose of this paper is to empirically analyze the impacts of short prohibitions on stock prices.
Design/methodology/approach – The authors adopt event study in this paper. First, the authors match each shortable stocks with one unshortable stocks by the propensity score matching method. Second, the authors check the performance difference between treatment group and control group after the event date. Third, the authors check the performance difference among sub-groups sorted by other factors associated with stock returns.
Findings – The authors find that stocks do not decline necessarily after removal of short prohibitions; only those heavily overpriced stocks, such as small stocks, lower B/M or P/E stocks and higher turnover stocks, decline significantly.
Research limitations/implications – The media falsely stated that short selling lead to market crash; otherwise, short selling is beneficial for improving market efficiency as it is helpful for keeping overpriced stocks in line with the fundamental value.
Originality/value – This is the first paper showing that removal of short prohibitions only impacts heavily overpriced stocks significantly, which is valuable for policy making.

Keywords Firm characteristics, Future stock returns, Margin-buying constraints, Short-sale prohibitions
Paper type Research paper

1. Introduction

Whether short sellers benefit or harm market efficiency remains highly debated. Many argue that short sellers may destabilize the market, as indicated by a large number of studies demonstrating a decline in stocks after short-sale prohibitions are removed (Chang *et al.*, 2007; Chang *et al.*, 2014; Sharif *et al.*, 2014). In this paper, we present new evidence relevant to the issue. Contrary to previous studies, we document, relative to matched stocks (based on propensity score matching method), that only those heavily overpriced stocks decline after the removal of short-sale prohibitions. This finding elucidates the relationship between the removal of short-sale prohibitions and stock decline. It also implies that short selling would improve the price efficiency of the Chinese stock market.

Our first objective is to examine whether stocks necessarily decline after the removal of short-sale prohibitions. In the Chinese stock market, short-sale prohibitions are removed from seven different batches, and the stocks of the first three batches show no significant decline. During the first 60 trading days after the removal of short-sale prohibitions, the

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average cumulative abnormal returns (CARs) of shortable stocks are 0.94 percent with a *t*-value of 1.24, slightly greater than zero. Shortable stocks only underperform the matched ones by 0.47 percent with a *t*-value of 0.43, which contradicts the traditional view that stocks decline if short selling is permitted. By contrast, the stocks of the last four batches decline after the removal of short-sale prohibitions. The average CAR of the shortable stocks during the first 60 trading days is −6.39 percent (about −26.63 percent annually) with a *t*-value of −7.48, and the median CAR is −9.18 percent (−38.25 percent annually). During the same period, the average CAR of the matched stocks is −0.32 percent with a *t*-value of −0.49, and the median CAR is −4.21 percent. These results indicate that, on the average, shortable stocks underperform the matched ones by 6.07 percent with a *t*-value of 4.96. Therefore, stocks do not necessarily decline after the removal of short-sale prohibitions.

Our second objective is to exploit what causes the variation in return patterns. We hypothesize that only heavily overpriced stocks decline after the removal of short-sale prohibitions. Blue-chip stocks, such as large stocks and value stocks, are typically less overpriced in the Chinese market. First, we show that the stocks of the first three batches (showing no significant decline) are constituent stocks of the CSI 300 Index[1], which accounts for almost 60 percent of the market value in the Chinese A-shares market. The average size of the first three batches is RMB39.1504 billion, which is significantly larger than that of the last four batches by RMB31.3941 billion with a *t*-value of 7.43. The average E/P of the first three batches is 0.0442, which is significantly higher than that of the last four batches by 0.0122 with a *t*-value of 6.19. Second, we demonstrate that the degree of decline is negatively correlated with size, B/M, or E/P, which implies that overpriced stocks tend to decline more. Third, we find that stocks with the largest size, largest B/M, or largest E/P exhibit no significant decline relative to their matched stocks after the removal of short-sale prohibitions.

Our findings elucidate the relationship between short selling and stock returns, which is valuable for policymakers in the emerging markets[2]. Our results indicate that removal of short-sale prohibitions does not necessarily lead to stock decline and can help pull overpriced stocks back to their fundamentals, which contributes to market efficiency.

The remainder of this paper is organized as follows: Section 2 introduces the background, including short selling in the Chinese market and the related literature. Section 3 describes our research design and data resources. Section 4 presents our main results, and Section 5 provides further discussions. Section 6 concludes the paper.

2. Background

2.1 Short selling in the Chinese market

It took about five years for the Chinese Government to introduce short selling since the newly revised Securities Act was approved on October 27, 2005, permitting security companies to provide stock lending for investors. On February 12, 2010, Shanghai Stock Exchange (SSE) and Shenzhen Stock Exchange (SZSE) released the pilot list, including 90 designated stocks, which could be sold short or bought on margin. On March 30, 2010, SSE and SZSE noticed that short selling and margin buying in the Chinese stock market would start on March 31, 2010. Since then, the list of designated stocks has been expanded from 90 stocks to 900 stocks, which included five major and two minor adjustments.

Chinese regulators practice prudence in introducing short selling because of its potentially undesirable impact on the stock market. Thus, stocks that can be sold short are selected with caution. Specifically, "Detailed Implementation Rules" issued by SSE and SZSE stipulate a number of requirements for the designated stocks:

(1) the stock should have been listed for more than three months;

(2) total outstanding shares should not be less than 100,000,000 or the circulation market value should not be less than RMB500,000,000;

(3) the number of shareholders should not be less than 4,000;

(4) during the last three months, the average daily turnover of individual stocks should not be less than 15 percent of the average daily turnover of index;

(5) during the last three months, the deviation between the average daily returns of individual stocks and average daily return of index should not be more than 4 percent; and

(6) during the last three months, the stock volatility of individual stocks should not be more than five times of index volatility.

To avoid a potentially undesirable impact on the stock market, regulators only allow blue-chip stocks to be sold short in the first several batches, adding more stocks to the list subsequently. To illustrate, the pilot list only consists of constituent stocks for the SSE 50 Index and the SZSE Component Index[3], which are the largest stocks in the Chinese A-share market; the third batch of stocks mainly consists of constituent stocks for HS300 Index, which can be regarded as blue-chip stocks in the Chinese A-share market. However, even four ST stocks and six GEM stocks are included in the fourth designated list; the seventh batch of stocks includes 57 GEM stocks[4]. To conclude, shortable stocks in the first three batches mainly consist of blue-chip stocks, which are less overpriced, while the last four batches of shortable stocks always include small and growth stocks; thus, the effect of short-sale prohibitions needs to be investigated separately.

A more notable characteristic of the Chinese stock market is that small stocks are more overpriced, whereas large stocks are less overpriced. For instance, with the price-earnings ratio as a proxy of overvaluation, the average ratio of SZSE-listed stocks is 41.25, and that of the SSE-listed stocks is only 15.05; the average price-earnings ratio of GEM stocks is 77.66, and the average price-earnings ratio of stocks in the SZSE main board market is only 24.78[5]. As short sellers are professional investors, they tend to focus on small-value stocks or stocks with a low earnings-price ratio, prompting us to explore different return patterns among different stocks sorted by firm fundamentals.

2.2 Related literature

Many studies argue that short-sales constraints lead to overvaluation. One reason is that short-sales constraints force pessimistic investors to sit out of the market so that the stock would have a higher bid price than its fair value (Miller, 1977; Figlewski, 1981; Chen *et al.*, 2002). Scheinkman and Xiong (2003) cited another reason – that is, the stock buyer also gains an option, which would be valuable for investors if short-sales constraints are set to sell the asset in the future; thus, the stock price could be higher than the fair value. The overvaluation hypothesis is supported by numerous empirical studies (Aitken *et al.*, 1998; Desai *et al.*, 2002; Ofek *et al.*, 2004; Ashiq and Trombley, 2006; Engelberg *et al.*, 2012; Andrikopoulos *et al.*, 2012).

Whether stock price decreases or increases after removal of short-sale prohibitions remains inconclusive. Chang *et al.* (2007) indicate that stocks in Hong Kong markets decline 60 trading days after they are allowed to be sold short; Chang *et al.* (2014) as well as Sharif *et al.* (2014) demonstrate that Chinese A-share stocks decline after the removal of short-sale prohibitions. However, Lamba and Ariff (2006) demonstrate that stocks in the Malaysian market increase in the value after the removal of short-sale restrictions. On the basis of these studies, we emphasize that stocks do not necessarily decrease after the removal of short-sale prohibitions; in addition, to expect less-overpriced stocks to decline is unreasonable.

Another set of related literature identifies which types of stocks are heavily overpriced. Miller (1977) argues that an increase in the divergence of opinion can increase the market clearing price. Previous research indicates that stocks with higher divergence of opinion earn lower future returns (Danielsen and Sorescu, 2001; Diether *et al.*, 2002; Boehme *et al.*, 2006; Berkman *et al.*, 2009; Keskek *et al.*, 2013). In these studies, frequently

used proxies for divergence of opinion include turnover, idiosyncratic volatility, and standard deviation of analyst forecasts. On the contrary, the present study shows that divergence of opinion shows no significant correlation with future underperformance.

Many researchers argue that firm fundamentals can help short sellers identify which stocks are overpriced[6]. Dechow *et al.* (2001) demonstrate that short sellers always short-sell stocks with a lower book-to-market ratio or earnings-price ratio and cover their positions as these ratios mean revert. According to Asquith *et al.* (2005), only equally weighted portfolios of constrained stocks underperform by a significant 215 basis points per month, which implies that firm size influences the short-constrained effects. Geczy *et al.* (2002) and Jones and Lamont (2002) demonstrate that smaller stocks are more expensive to short sell; thus, smaller stocks would be more overpriced by short-sales constraints[7]. For Boehmer *et al.* (2008), short-constrained effects are strongest for the small quintile stocks, where lightly shorted stocks outperform heavily shorted stocks by 2.20 to 3.33 percent per month. Meanwhile, the present study combines these arguments with an event study, which has not been previously explored. Consistent with the previous findings, we show that stocks with the largest firm size, highest B/M, or highest E/P do not decrease after the removal of short-sale prohibitions.

3. Research design and data selection

3.1 Research design

This study aims to examine whether stocks decline after the removal of short-sale prohibitions and which stocks decline. In the Chinese market, the stocks that can be included in the list are determined by regulators who tend to select large-value stocks. Such decision procedures may cause endogeneity problems. Therefore, we should be more cautious in identifying the effects purely driven by short-sale prohibitions.

Two methods are adopted in this study. First, we examine the CAR of shortable stocks after they are allowed to be sold short. As shortable stocks in the Chinese market tend to be relatively large-value stocks, the CAR based on the Fama-French three-factor model is used, which can partly address fundamentals-related bias.

Second, we consider matched stocks as risk factors in the Fama-French three factors model cannot address all the potential endogeneity problems. As discussed in Subsection 2.1, regulators set six necessary requirements for the designated stocks, and the most binding conditions involve turnover, daily return, and volatility (most Chinese A-share stocks can meet the first three requirements), which are not considered in the FF model. Thus, we match each eligible stock with an ineligible one by the average turnover, average daily return, and volatility during the past three months (about 60 trading days). Our matching window ranges from −90 to −31 (denote the event date as 0). The matching procedures are listed as follows:

(1) on each event date, denote shortable stocks as 1 and unshortable stocks (never been on the list) as 0;

(2) calculate the average turnover, average daily return, and average idiosyncratic volatility[8] during (−90, −31) for each stock;

(3) estimate the propensity score for each stock by employing the logit model, based on the average turnover, average daily return, and idiosyncratic volatility during the matching window; and

(4) match one unshortable stock to each shortable stock by nearest-neighbor matching.

We compare the CARs of eligible stocks with the matched ones around the event date. If the average CAR of stocks on the designated list is significantly lower than that of matched ones, the assertion that stocks decline after the removal of short-sale prohibitions is appropriate; otherwise, such a conclusion cannot be drawn.

3.2 Data

Our data are retrieved from the Chinese Stock Market and Accounting Research database provided by GuoTaiAn Company. Our data consist of three parts: stock-specific data, including daily stock return, daily turnover, daily idiosyncratic volatility, book-to-market equity, earning-price ratio, and firm size; market-level data, including the daily Fama-French three-factor model; and margin-buying balance (the uncovered margin buying position). Our study covers all events, including seven adjustments (five major and two minor adjustments) from March 31, 2010 to September 22, 2014.

Our sample is from January 5, 2009 to April 30, 2015 because we need daily data during (−280, −31) to estimate the risk factor loadings and data during (0, 60) in order to evaluate short-sale prohibition effects (as Chang *et al.*, 2007). A total of 989 stocks are added to the designated lists, and 62 stocks are excluded from our sample for one of the following reasons:

(1) Stocks not trading on event dates are excluded from our analysis because other important events may occur on those days, which could induce changes in the CAR around certain event dates.

(2) Following Chang *et al.*, 2007, stocks trading less than 180 days during (−280, −31) are excluded from our analysis as estimation of factor loadings would not be reliable.

(3) Stocks missing matching variables (mainly idiosyncratic volatility observations) during their matching windows are excluded from our analysis.

(4) Stocks off support during propensity score matching are excluded from our analysis because no appropriate matched stocks are present. Detailed descriptions are provided in Table I.

Panel A of Table II presents the goodness of match. No significant difference in matching variables is indicated between the treatment group and the control group. The average daily return of the treatment group is 0.0381 percent, which is 0.33 base points higher than that of the control group; regardless, no significant difference is found. The average turnover of the treatment group is 2.04 percent, which is 0.14 percent lower than that of the control group; however, the difference is not considered significant. The average IVOL of the treatment group is 0.0601, whereas that of the control group is 0.0607; nevertheless, no significant difference is detected. These observations indicate that our matching procedures are reliable.

Panel B of Table II presents a comparison of stock characteristics during our estimation window. Typically, stocks in the treatment group are large stocks and value stocks, which supports our discussion in Subsection 2.1. The average size of the treatment group is RMB13.1958 billion, and that of the control group is only RMB3.0941 billion. Thus, a typical shortable stock is approximately four times as large as an unshortable stock. The average earnings-price ratio of the treatment group is 0.0358, which is significantly higher than that of the control group by 0.0070; a significant difference is indicated. On the basis of these observations, we argue that the Fama-French three-factor model is more appropriate for calculating abnormal returns (AR) as CAPM does not eliminate the effects of size and value.

Finally, we present the margin-buying balance and short-selling balance during the first 60 trading days in Figure 1. Short-selling balance approximately increases to 900 million yuan by the 60th trading date, and margin-buying balance approximately increases to 200 billion yuan by the 60th trading date. In the first 20 trading days, the margin-buying balance increases faster than the short-selling balance, which means that investors are more optimistic about the removal of short-sale prohibitions; subsequently, the short-selling balance increases faster than the margin-buying balance, indicating that investors become less optimistic about the event. These findings imply that the effects of the event would vary during the first 20 trading days and should be analyzed separately during this period.

Batch	Effective date	Number of stocks on the list	Number of new added stocks	Effective new additions	Reasons for excluding stocks
1	March 31, 2010	90	90	85	3 stocks do not trade on the effective date 2 stocks trade less than 180 days during estimation window
2	July 1, 2010	90	5	3	2 stocks trade less than 180 days during estimation window
3	December 5, 2011	278	193	183	5 stocks do not trade on the effective date 3 stocks are off support during matching procedures 2 stocks have no IVOL data during matching window
4	January 31, 2013	500	276	260	4 stocks do not trade on the effective date 6 stocks trade less than 180 days during estimation window 1 stock is off support during matching procedures 5 stocks have no IVOL data during matching window
5	April 10, 2013	500	1	1	No stock is deleted
6	September 16, 2013	700	206	196	8 stocks do not trade on the effective date 2 stocks are off support during matching procedures
7	September 22, 2014	900	218	199	15 stocks do not trade on the effective date 3 stocks trade less than 180 days during estimation window 1 stock has no IVOL data during matching windows
Accumulated			989	927	

Table I. Summary statistics of list changes of short selling and margin buying stocks

Notes: This table detailedly reports the list changes of short selling and margin buying stocks. Our data covers all designated stocks in Chinese market. The second column reports the date on which each batch of stocks was allowed to be sold short. The third column reports how many stocks are included on the list, and the fourth column reports the number of new additions. Because of the reasons detailedly listed in the sixth column, some new added stocks are excluded from our analysis, and the number of stocks remained in our analysis are reported in the fifth column

4. Empirical results

Following Chang *et al.* (2007) and Chang *et al.* (2014), this study examines the difference in CAR between the treatment group and the control group around the event date. We calculate the CAR of each stock by the following steps:

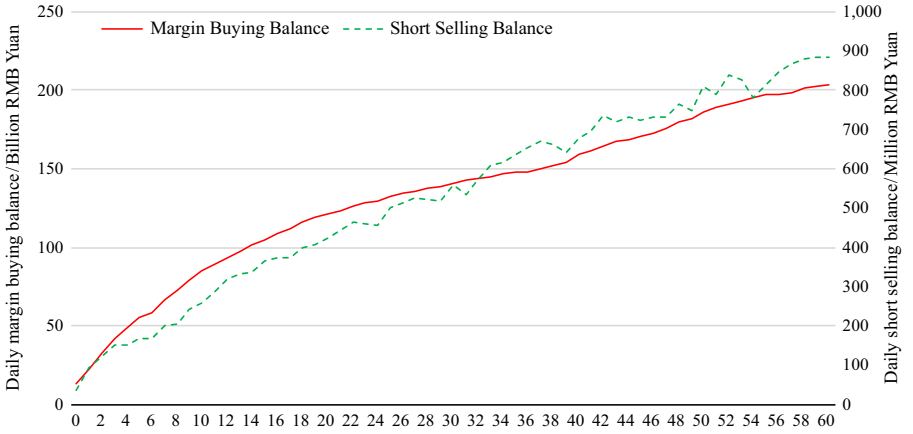
(1) Estimate loadings on three risk factors. We estimate regression (1) by the OLS method for each stock, using data from −280 to −31 (the event date is denoted as 0). If the trading period of a stock during the estimation window is shorter than 180 days, this observation is excluded:

$$r_{it} - r_{ft} = \gamma_{0i} + \gamma_{1i} \times \left(r_{Mt} - r_{ft}\right) + \gamma_{2i} \times \mathrm{SMB}_t + \gamma_{3i} \times \mathrm{HML}_t + \varepsilon_{it} \quad (1)$$

	Treatment group			Control group			Treatment – control		
	Obs.	Mean	Median	Obs.	Mean	Median	Mean(diff)	*t*-value	*p*-value
Panel A: goodness of match: data during (−90, −31)									
Matching variables									
Dret/%	927	0.0381	0.0298	927	0.0347	0.0229	0.0033	0.18	0.8603
Tov	927	0.0204	0.0142	927	0.0218	0.0154	−0.0014	−1.39	0.1653
IVOL	927	0.0601	0.0533	927	0.0607	0.0539	−0.0006	−0.38	0.7035
Panel B: comparison of stock characteristics during estimation window (−280, −31)									
Stock characteristics									
Size/10^9	927	13.1958	6.3517	927	3.0941	1.9877	10.1016	10.06	0.0000
B/M	927	0.3900	0.3293	927	0.4067	0.3618	−0.0167	−1.45	0.1460
E/P	927	0.0358	0.0299	927	0.0288	0.0252	0.0070	6.10	0.0000

Notes: This table reports the comparison of matching variables and stock characteristics. Columns 3-5 report the summary statistics of shortable stocks, columns 6-8 report the summary statistics of matched stocks, and columns 9-11 report summary statistics of difference between treatment group and control group. To test the goodness of matching procedures, we compare the three matching variables during marching period (−90, −31), which is reported in panel A. To illustrate Fama-French three factors model is more appropriate for our analysis, we compare stock characteristics between the two groups during estimation window (−280, −31), which is reported in panel B. Dret means daily return, Tov means turnover and IVOL means idiosyncratic volatility. Dret is reported in percentage, e.g. 0.0381 means 0.0381 percent. Size is reported in billion RMB

Table II. Comparison of matching variables and stock characteristics



Notes: This figure plots aggregate margin buying balance and short selling balance during period (0, 60). The green dashed curve denotes short selling balance and the red solid curve denotes margin buying balance

Figure 1. Margin buying balance and short selling balance during period (0, 60)

where r_{it} is the return of stock i on day t; r_{ft} is the risk-free interest rate on day t; r_{Mt} is the market return of A-shares stocks on day t (which is calculated by value weights); SMB_t is the size factor on day t; and HML_t is the book-to-market factor on day t; and γ_{0i}, γ_{1i}, γ_{2i}, γ_{3i} denote the loadings for each risk factor.

(2) Calculate AR. On the basis of the risk factor loadings, the AR of each stock are obtained using the following equation:

$$\mathrm{AR}_{it} = \left(r_{it} - r_{ft}\right) - \gamma_{0i} - \gamma_{1i} \times \left(r_{Mt} - r_{ft}\right) - \gamma_{2i} \times \mathrm{SMB}_t - \gamma_{3i} \times \mathrm{HML}_t \quad (2)$$

(3) Calculate the CARs by the following equation:

$$\mathrm{CAR}_i(t_1, t_2) = \prod_{t=t_1}^{t=t_2} (1 + \mathrm{AR}_{it}) - 1 \tag{3}$$

where t_1 and t_2 denote the cumulative intervals for the CARs. As the buy-and-hold strategy is more reasonable for our study, we calculate the CARs by Equation (3) rather than by average ARs.

4.1 Return patterns around event dates

As discussed in Subsection 2.1, a significant difference with respect to firm characteristics is indicated between the stocks of the first three batches and the last four batches. Thus, we treat them separately in this subsection.

Panel A of Table III presents the empirical results for the first three batches. The stocks of the first three batches do not significantly decrease after the removal of short-sale prohibitions, whereas the CARs before the event date are negative. Shortable stocks do not underperform matched ones in any subperiod. These two findings indicate that removal of short-sale prohibitions does not necessarily lead to stock decline. Specifically, during the subperiod (−30, −21) about one calendar month before the event date, shortable stocks even significantly outperform the matched ones by 1.06 percent with a *t*-value of 2.39. The CAR (−20, −1) of the treatment group, with a mean of −1.88 percent and a median of −2.14 percent, is lower than that of the control group (mean difference is −0.73 percent); however, unshortable stocks cannot significantly outperform shortable ones during this period, as the *t*-value of the difference is −1.23. Even after the removal of short-sale prohibitions, stocks in the control group also cannot significantly outperform those in the treatment group. During the first 20 trading days (about one calendar month), the average CAR of the treatment group is −0.52 percent, underperforming the matched ones by 0.73 percent with a *t*-value of 0.75; during the first 40 trading days (about two calendar months),

		Treatment group			Control group					
	Obs.	Mean	Median	*t*-value	Mean	Median	*t*-value	Mean (diff)	*t*-value	*p*-value
Panel A: the first three batches of stocks										
CAR (−30, −21)	271	−0.0048	−0.0115	−1.48	−0.0154	−0.0236	−5.12	0.0106	2.39	0.0176
CAR (−20, −1)	271	−0.0188	−0.0214	−4.99	−0.0114	−0.0201	−2.52	−0.0073	−1.23	0.2193
CAR (0, 20)	271	−0.0052	−0.0151	−0.87	0.0021	−0.0053	0.28	−0.0073	−0.75	0.4528
CAR (0, 40)	271	0.0007	−0.0123	0.11	0.0101	0.0114	1.25	−0.0094	−0.91	0.3641
CAR (0, 60)	271	0.0094	−0.0051	1.24	0.0141	0.0027	1.52	−0.0047	−0.43	0.6703
Panel B: the last four batches of stocks										
CAR (−30, −21)	656	−0.0148	−0.0222	−4.40	−0.013	−0.0200	−4.46	−0.0018	−0.40	0.6875
CAR (−20, −1)	656	−0.0222	−0.0431	−3.70	0.0103	−0.0151	1.52	−0.0325	−3.88	0.0001
CAR (0, 20)	656	−0.0168	−0.0309	−3.05	−0.0096	−0.0195	−2.17	−0.0071	−1.03	0.3022
CAR (0, 40)	655	−0.0439	−0.0574	−6.53	−0.0051	−0.0339	−0.73	−0.0389	−4.03	0.0001
CAR (0, 60)	651	−0.0639	−0.0918	−7.28	−0.0032	−0.0421	−0.49	−0.0607	−4.96	0.0000

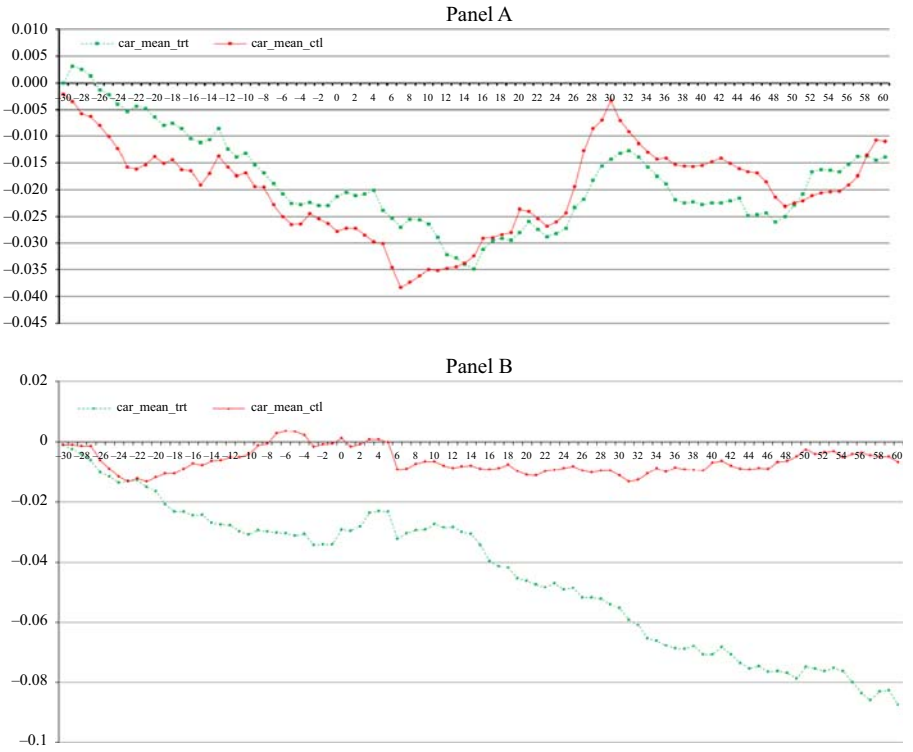
Notes: This table reports the comparison of CAR between treatment group and control group around event dates. CAR is cumulative abnormal returns based on Fama-French three factors model. Columns 3-5 report the CAR summary statistics of treatment group, columns 6-8 report the CAR summary statistics of control group, and columns 9-11 report the summary statistics of CAR difference between the two groups. Panel A reports the summary statistics of the first three batches of stocks, and panel B reports the summary statistics of the last four batches of stocks

Table III.
CAR comparison among different batches of stocks

the treatment group underperforms the matched ones by 0.94 percent, on the average, with a *t*-value of 0.91; during the first 60 trading days (about three calendar months), the treatment group also underperforms the matched ones by 0.47 percent, with a *t*-value of 0.43; however, no significant difference is indicated.

Panel A of Figure 2 presents a plot of the cross-sectional average CAR only for the first three batches. Intuitively, the stocks of the control group cannot significantly outperform those of the treatment group. Approximately on the 28th day after the removal of short-sale prohibitions, the stock price even exceeds its initial level on the event date. The plot depicts that the major trend in the CAR curve for shortable stocks is almost horizontal during (0, 60) and the CAR (0, 60) is even slightly larger than 0 and that shortable stocks do not significantly underperform unshortable stocks during any subperiod. Therefore, the first three batches show no decline in stocks after the removal of short-sale prohibitions.

Panel B of Table III shows the empirical results for the last four batches. Unlike the results in panel A, our findings reveal that the stocks of the treatment group decline significantly during any subperiod around the event date and that shortable stocks of the last four batches significantly underperform their matched ones. We indicate that the



Notes: Panel A: CARs for the first three batches of stocks; Panel B: CARs for the last four batches of stocks. This figure plots cumulative abnormal returns calculated based on the OLS FF three factors model around addition events. The event date is denoted as date 0 from which the added stocks can be sold short. Our estimation window is (−280, −31), with a minimum length of 180 days. The green dashed curve denotes average CAR of treatment group and the red solid curve denote the average CAR of control group

Figure 2.
CARs of different batches of stocks during period (−30, 60)

average CAR (−20, −1) of the treatment group is significantly lower than that of the control group by 3.25 percent with a *t*-value of 3.88, implying that investors view the removal of short-sale prohibitions as negative information. During the first 20 trading days after the removal of the short-sale prohibitions, the CAR of the shortable stocks is −1.68 percent, insignificantly underperforming the matched ones by 0.71 percent, with a *t*-value of 1.03. We attribute this result to margin buying being introduced and margin-buying power pushing up the stock price in the first 20 trading days, which will be discussed in greater detail in Subsection 4.4. During (0, 40), the stocks of the treatment group significantly underperform those of the control group by 3.89 percent, with a *t*-value of 4.03; the underperformance extends to 6.07 percent, with a *t*-value of 4.96 percent, during (0, 60). In addition, either the average CAR or the median CAR of shortable stocks during any subperiod around the event date is negative. We thus conclude that the stocks of the last four batches decline after the removal of short-sale prohibitions.

Panel B of Figure 2 illustrates these observations more intuitively. As shown, the CAR curve of the control group remains almost horizontal during our sample period, whereas the CAR curve of the treatment group slopes apparently downward during our sample period, which strongly supports the aforementioned conclusion.

In short, in the Chinese stock market, the first three batches show no significant decline in stocks, while the last four batches exhibit a significant decline in stocks after the removal of the short-sale prohibitions, indicating that stocks do not necessarily decline even when short-selling is permitted.

4.2 Causation inquiry

In this subsection, we explore why stocks of different batches exhibit different return patterns. We argue that the decline in stocks after the removal of short-sale prohibitions depends on whether the stocks have been overpriced and that less-overpriced stocks would not show a significant decline even if short selling is permitted.

Table IV presents a comparison of stock characteristics between the first three batches and the last four batches during (−30, −1). As discussed in Subsection 2.1, we hypothesize that the stocks of the first three batches tend to be large stocks and value stocks, which are less overpriced. The cross-sectional average size of the first three batches is RMB39.1504 billion (median is 16.3930), whereas that of the last four batches is only RMB7.7564 billion (median is 6.2736), indicating that the stocks of the first three batches are, on the average, about five times as large as the stocks of the last four batches. The average earnings-price ratio of the first three batches is 0.0442 (median is 0.0320), which is significantly higher than that of the last four batches by 0.0122, with a *t*-value of 6.19. In addition, we show that the average turnover of the first three batches is 1.02 percent, which is significantly less than

		Batches I			Batches II			Batches I-II		
Periods	Variables	Obs.	Mean	Median	Obs.	Mean	Median	Mean(diff)	*t*-value	*p*-value
(−30, −1)	Size/billion RMB	271	39.1504	16.3930	656	7.7564	6.2736	31.3941	7.43	0.0000
	B/M	271	0.3862	0.3499	656	0.3773	0.3080	0.0089	0.47	0.6364
	E/P	271	0.0442	0.0399	656	0.0320	0.0258	0.0122	6.19	0.0000
	TOV	271	0.0102	0.0083	656	0.0289	0.0222	−0.0186	−11.71	0.0000

Table IV. Differences of stock characteristics between the first three batches and the last four batches

Notes: This table reports the comparison of stock characteristics between stocks of batches I (the first three batches) and stocks of batches II (the last four batches). This table is requisite preparation for the following analysis on what caused the different performance after removal of short prohibitions between stocks of batches I and batches II, so we only compare the four variables during (−30, −1). Columns 3-5 report the summary statistics of first three batches of stocks, columns 6-8 report the last four batches of stocks, and columns 9-11 report the summary statistics of difference between batches I and batches II

that of the last four batches by 1.86 percent, with a *t*-value of 11.71. This result indicates that the stocks of the last four batches are more speculative and could be easily bid for at a higher price. All these findings support our argument that the stocks of the last four batches tend to be more overpriced before the removal of short-sale prohibitions.

Based on the analysis above, we intend to scrutinize the factors that influence the underperformance of shortable stocks after short selling is permitted. We measure underperformance of shortable stocks as difference in CARs (0, 60) between the control group and the treatment group. Table V summarizes the outcome of the regression analysis. Univariate regression demonstrates that a significant negative correlation exists between size (B/M, E/P) and the difference in CARs (0, 60), implying that the larger the size (B/M, E/P), the lower the underperformance. These findings show that stock characteristics influence the effect of the short-sale prohibitions. These results also support our argument that more overpriced stocks tend to decline more after the removal of short-sale prohibitions.

Previous studies show that the divergence of opinion, commonly measured by the turnover and IVOL, may influence the effects of short-sale constraints[9]; however, the data presented in Table V are not consistent with these findings: the coefficient of turnover is −0.4486 with a *t*-value of −0.60, and the coefficient of IVOL is 0.1281 with a *t*-value of 0.46. We hypothesize that in the Chinese market, turnover and IVOL influence overpricing of stocks; in addition, they are not the main basis for the decision of the short sellers. These three characteristics (size, B/M, and E/P) exhibit a more significant negative correlation with underperformance after the turnover and IVOL are controlled, which confirms their influence on the effects of short-sale prohibitions. Furthermore, we demonstrate that the interpretation power of E/P disappears if the size, B/M, and E/P are regressed together, which is similar to the result provided by Fama and French (1992). The last empirical result shows that the turnover exhibits a significant negative correlation with underperformance if regressed together with the three characteristics; this observation, indicates that the turnover is indeed a measure for divergence of opinion. In short, the empirical results in Table V reveal that stock characteristics (size, B/M, and E/P) significantly influence the effect of short-sale prohibitions.

To conclude, different stock characteristics between the stocks of the first three batches and the last four batches are the potential factors affecting their different performances after the removal of short-sale prohibitions.

4.3 Return patterns conditional on stock characteristics

In this subsection, we examine which kinds of stocks decline after the removal of short-sale prohibitions. Based on the findings in Subsection 4.2, we hypothesize that relative to their matched stocks, the stocks with a small size (low B/M, low E/P) decline after the removal of short-sale prohibitions, whereas the stocks with a large size (high B/M, high E/P) do not decline. We test our hypothesis by the following steps: sort stocks into three groups according to the average size (B/M, E/P) during (−31, −1); in each subgroup, check whether the shortable stocks decline relative to their matched ones. For brevity, we only check CARs (0, 20), (0, 40), and (0, 60).

Table VI reports the results for different groups sorted by firm size. Panel A reports the comparison among small size stocks. The average CAR (0, 20) of the treatment group (−2.05 percent) is lower than that of the control group (−0.61 percent), with a *t*-value of −1.26; the median CAR (0, 20) of the treatment group (−4.34 percent) is also lower than that of the control group (−1.73 percent). The stocks of the treatment group significantly underperform the control group by 6.06 percent with a *t*-value of 3.72 during (0, 40); the stocks of the treatment group also significantly underperform the matched ones by 7.90 percent with a *t*-value of 4.15 during (0, 60). These findings indicate that shortable stocks significantly decline relative to their matched ones after the removal of short-sale prohibitions. Panel B reports the results for the median size group. The control group outperforms the treatment group after

Table V.
What determines the short sales constraints effects?

Dep. Var.	Size	B/M	E/P	IVOL	TOV	Constant	R^2_Adj/%
CARctl (0, 60)-CARtrt (0, 60)	−0.0309 (−3.34)					0.7519 (3.51)	0.91
CARctl (0, 60)-CARtrt (0, 60)		−0.2093 (−6.12)				0.1235 (7.43)	3.72
CARctl (0, 60)-CARtrt (0, 60)			−1.2897 (−3.93)			0.0901 (5.72)	1.58
CARctl (0, 60)-CARtrt (0, 60)				0.1281 (0.46)		0.0375 (1.90)	0.02
CARctl (0, 60)-CARtrt (0, 60)					−0.4486 (−0.60)	0.0535 (0.05)	0.08
CARctl (0, 60)-CARtrt (0, 60)	−0.0483 (−4.59)			0.3468 (1.21)	−1.5345 (−1.85)	1.1623 (4.71)	1.75
CARctl (0, 60)-CARtrt (0, 60)		−0.2183 (−6.55)		0.1066 (0.39)	−0.8971 (−1.23)	0.1399 (5.67)	4.06
CARctl (0, 60)-CARtrt (0, 60)			−1.4534 (−4.35)	0.1836 (0.63)	−0.9357 (−1.24)	0.1055 (4.34)	1.95
CARctl (0, 60)-CARtrt (0, 60)	−0.0289 (−3.21)	−0.1863 (−5.07)	−0.3069 (−0.92)			0.7871 (3.76)	4.57
CARctl (0, 60)-CARtrt (0, 60)	−0.0503 (−4.96)	−0.1947 (−5.48)	−0.4814 (−1.47)	0.3351 (1.15)	−2.1252 (−2.62)	1.3125 (5.49)	6.02

Notes: This table reports cross-sectional regression results of underperformance of shortable stocks on stocks characteristics. We measure underperformance of shortable stocks as the difference of CAR (0, 60) between matched stocks and shortable stocks. The explanatory variables include average size, average B/M and average E/P during (−30, −1); to control the potential influence of divergent opinion during (0, 60), we control average IVOL and average TOV during (0, 60). Size is measured as log (market capitalization), IVOL denotes idiosyncratic volatility, and TOV denotes turnover. CARctl (0, 60) denotes CAR (0, 60) of control group stocks, and CARtrt (0, 60) denotes CAR (0, 60) of treatment group stocks

	Obs.	Treatment group Mean	Median	*t*-value	Control group Mean	Median	*t*-value	Treatment – control Mean	*t*-value	*p*-value
Panel A: small group of size										
CAR (0, 20)	278	−0.0205	−0.0434	−2.14	−0.0061	−0.0173	−0.82	−0.0145	−1.26	0.2094
CAR (0, 40)	278	−0.0489	−0.0714	−4.57	0.0117	−0.0355	0.91	−0.0606	−3.72	0.0002
CAR (0, 60)	278	−0.0703	−0.1068	−5.06	0.0087	−0.0335	0.59	−0.0790	−4.15	0.0000
Panel B: median group of size										
CAR (0, 20)	370	−0.0111	−0.0207	−1.82	−0.0008	−0.0157	−0.13	−0.0103	−1.17	0.2421
CAR (0, 40)	370	−0.0298	−0.0367	−3.59	−0.0032	−0.0128	−0.41	−0.0267	−2.41	0.0166
CAR (0, 60)	370	−0.0374	−0.0499	−3.46	0.0026	−0.0302	0.23	−0.0399	−2.67	0.0080
Panel C: large group of size										
CAR (0, 20)	279	−0.0092	−0.0186	−1.39	−0.0135	−0.0187	−2.14	0.0042	0.46	0.6454
CAR (0, 40)	279	−0.0141	−0.0197	−1.86	−0.0096	−0.0173	−1.13	−0.0046	−0.40	0.6920
CAR (0, 60)	279	−0.0210	−0.0229	−2.21	−0.0057	−0.0135	−0.58	−0.0153	−1.12	0.2643

Notes: This table reports the CAR comparison after effective date among different size groups. First, we sort stocks into three sub-groups by average size during (−30, −1); second, we compare CARs between treatment group and control group among each sub-group. Columns 3-5 report the CAR summary statistics of treatment group, columns 6-8 report the CAR summary statistics of control group, and columns 9-11 report the summary statistics of CAR difference between the two groups. For brevity, we only report CAR (0, 20), CAR (0, 40) and CAR (0, 60)

Table VI.
CAR comparison after effective date among different size groups

the removal of the short-sale prohibitions; however, both magnitude and statistical significance are mitigated relative to the results in panel A. Panel C shows the results for the large-size group. The average CAR (0, 20) of the shortable stocks is −0.92 percent, whereas that of the unshortable stocks is −1.35 percent, indicating that the shortable stocks even outperform their matched ones by 0.42 percent in the first 20 trading days after the removal of short-sale prohibitions; however, the difference is not significant. Over an extended period, stocks in the control group cannot significantly outperform those in the treatment group. The CAR (0, 40) of the treatment group is −1.41 percent, whereas that of the control group is −0.96 percent, and the *t*-value of the difference is only −0.40. The CAR (0, 60) of the treatment group is −2.10 percent, while that of the control group is −0.57 percent, and the *t*-value of the difference is only −1.12, insignificant at the 10 percent level. The results in Table VI support our argument that large stocks do not decline even if short-sale prohibitions are removed. The difference in CAR between the two groups increases monotonically with an increase in firm size, and the *t*-value of the difference also increases monotonically.

Table VII reports the results for different groups according to B/M. Consistent with our regression analysis, the underperformance of shortable stocks decreases with an increase in B/M. In panel A, we show that the stocks of the control group significantly outperforms those of the treatment group in any subperiod after the removal of short-sale prohibitions. Contrary to the results in Table VI, the results we obtained show that the underperformance of shortable stocks emerges even in the first 20 days after the event date by 3.11 percent, with a *t*-value of 3.10. The underperformance extends to 7.41 percent during (0, 40), with a *t*-value of 4.86, and reaches 9.58 percent during (0, 60), with a *t*-value of 5.44. Panel B shows that the shortable stocks in the median B/M group also underperform the unshortable stocks, although the magnitude of underperformance decreases. The stocks of the control group significantly outperform those of the treatment group by 4.88 percent during (0, 60), with a *t*-value of 3.47. Panel C summarizes the results for the high B/M group, indicating that these findings can be reversed. The stocks of the treatment group even outperform those of the control group in any subperiod after the event dates; nevertheless, the difference is not significant. In the first 20 trading days, the stocks of the treatment group earn 0.87 percent on the average, while those of

	Obs.	Treatment group Mean	Median	*t*-value	Control group Mean	Median	*t*-value	Treatment – control Mean	*t*-value	*p*-value
Panel A: low group of B/M										
CAR (0, 20)	278	−0.0496	−0.0525	−6.70	−0.0185	−0.0199	−2.85	−0.0311	−3.10	0.0021
CAR (0, 40)	278	−0.0785	−0.0874	−7.93	−0.0044	−0.0241	−0.38	−0.0741	−4.86	0.0000
CAR (0, 60)	278	−0.0985	−0.0983	−7.64	−0.0027	−0.0139	−0.20	−0.0958	−5.44	0.0000
Panel B: median group of B/M										
CAR (0, 20)	370	−0.0029	−0.0211	−0.41	0.0009	−0.0128	0.15	−0.0038	−0.41	0.6807
CAR (0, 40)	370	−0.0247	−0.0360	−3.09	0.0015	−0.0148	0.17	−0.0262	−2.31	0.0213
CAR (0, 60)	370	−0.0422	−0.0487	−4.14	0.0066	−0.0185	0.62	−0.0488	−3.47	0.0006
Panel C: high group of B/M										
CAR (0, 20)	279	0.0087	−0.0020	1.23	−0.0034	−0.0196	−0.47	0.0121	1.21	0.2280
CAR (0, 40)	279	0.0086	−0.0063	1.02	0.0003	−0.0159	0.03	0.0084	0.69	0.4911
CAR (0, 60)	279	0.0141	−0.0008	1.28	0.0003	−0.0303	0.02	0.0138	0.84	0.4034

Notes: This table reports the CAR comparison after effective date among different B/M groups. First, we sort stocks into three sub-groups by average B/M during (−30, −1); second, we compare CARs between treatment group and control group among each sub-group. Columns 3-5 report the CAR summary statistics of treatment group, columns 6-8 report the CAR summary statistics of control group, and columns 9-11 report the summary statistics of CAR difference between the two groups. For brevity, we only report CAR (0, 20), CAR (0, 40) and CAR (0, 60)

Table VII.
CAR comparison after effective date among different B/M groups

the control group earn −0.34 percent. The average CAR (0, 40) of the treatment group is 0.86 percent, while that of the control group is 0.03 percent. The average CAR (0, 60) of the treatment group is 1.41 percent, while that of the control group is 0.03 percent. Evidence in Table VII support our arguments and indicate that the higher the stocks are overpriced, the more they decline after the removal of short-sale prohibitions.

Table VIII reports the results in different groups based on E/P. Panel A shows the empirical results of low E/P stocks. We find that shortable stocks insignificantly

	Obs.	Treatment group Mean	Median	*t*-value	Control group Mean	Median	*t*-value	Treatment – control Mean	*T*-value	*P*-value
Panel A: low group of E/P										
CAR (0, 20)	278	−0.0259	−0.0401	−2.94	−0.0185	−0.0280	−2.76	−0.0074	−0.68	0.4998
CAR (0, 40)	278	−0.0516	−0.0688	−4.87	−0.0194	−0.0423	−1.64	−0.0323	−2.04	0.0418
CAR (0, 60)	278	−0.0742	−0.0928	−5.46	−0.0212	−0.0550	−1.59	−0.0529	−2.92	0.0038
Panel B: median group of E/P										
CAR (0, 20)	370	−0.0157	−0.0253	−2.42	0.0053	−0.0039	0.88	−0.021	−2.47	0.0141
CAR (0, 40)	370	−0.0372	−0.0432	−4.77	0.0159	0.0003	1.99	−0.0531	−4.98	0.0000
CAR (0, 60)	370	−0.0501	−0.0550	−4.86	0.0203	−0.0017	1.88	−0.0704	−4.93	0.0000
Panel C: high group of E/P										
CAR (0, 20)	279	0.0021	−0.0039	0.30	−0.0093	−0.0241	−1.27	0.0114	1.12	0.2624
CAR (0, 40)	279	−0.0017	−0.0158	−0.20	−0.0039	−0.0231	−0.41	0.0022	0.18	0.8612
CAR (0, 60)	279	−0.0001	−0.0135	−0.01	0.0004	−0.0184	0.03	−0.0005	−0.03	0.9746

Notes: This table reports the CAR comparison after effective date among different E/P groups. First, we sort stocks into three sub-groups by average E/P during (−30, −1); second, we compare CARs between treatment group and control group among each sub-group. Columns 3-5 report the CAR summary statistics of treatment group, columns 6-8 report the CAR summary statistics of control group, and columns 9-11 report the summary statistics of CAR difference between the two groups. For brevity, we only report CAR (0, 20), CAR (0, 40) and CAR (0, 60)

Table VIII.
CAR comparison after effective date among different E/P groups

underperform unshortable stocks in the first 20 trading days, with an average difference of −0.74 percent and a *t*-value of −0.68. The CAR (0, 40) is significantly lower than that in the control group at the 5 percent level, with an average difference of −3.23 percent and a *t*-value of −2.04; the difference extends to −5.29 percent with a *t*-value of −2.92 during (0, 60). The results in Panel A support our hypothesis that stocks with higher E/P decline after the removal of short-sale prohibitions. Contrary to the results in Tables VI and VII, the effects of short-sale prohibitions seem to be most significant among the median E/P group. As shown in panel B, the shortable stocks underperform the matched ones in any subperiod after the removal of short-sale prohibitions. For instance, the stocks of the control group significantly outperform those of the treatment group by 7.04 percent, with a *t*-value of 4.93 during (0, 60). Panel C shows the empirical results for the stocks with high E/P. Consistent with our findings above, shortable stocks do not significantly underperform unshortable stocks in this subgroup. They even outperform their matched counterparts by 1.14 percent during the first 20 trading days, with a *t*-value of 1.12. In short, the empirical evidence in Table VIII also completely supports our hypothesis and confirms that less-overpriced stocks do not decline relative to the matched ones after the event date.

In conclusion, the analysis in this subsection firmly supports our argument that only heavily overpriced stocks (e.g. stocks with a larger size, higher B/M, or higher E/P) decline after they are permitted to be sold short. Based on these observations, we argue that short selling may be beneficial for pulling overpriced stocks back to their fundamentals, which differs from the viewpoint that short sellers are predatory investors and destabilize the market (Brunnermeier and Pedersen, 2005; Takahashi and Xu, 2015).

5. Further discussions

5.1 More discussions on CAR (0, 20)

The reason remains inconclusive as to why the stocks of the treatment group do not significantly underperform those of the treatment group in the first 20 trading days (about one calendar month) after the event date. We attribute such to the margin buying power, which pushes up the price of shortable stocks. As mentioned earlier, Chinese regulators introduce short selling and margin buying simultaneously. In the first 20 trading days, the effects of short selling would be neutralized by the margin buying power. To test our argument, we check the correlation between the margin-buying ratio, margin balance (uncovered margin buying position) relative to the circulation market value, and underperformance of shortable stocks during (0, 20). The results are summarized in Table IX.

Table IX indicates that the margin-buying ratio (MBR) exhibits a significant negative correlation with the underperformance of shortable stocks, measured as the difference in CAR between the control group and the treatment group during (0, 20). The MBR coefficient is −1.0569, with a *t*-value of −2.45 when we control no other variables, and adjusted R^2 is 0.80 percent. As we have mentioned, the stock characteristics, including the size, B/M, and E/P, significantly affect underperformance; thus, we control these variables gradually. The MBR coefficient increases to −1.7827 with a *t*-value of −3.82, given that the firm size is controlled; the MBR coefficient increases to −1.2023 with a *t*-value of −2.81, given that the B/M is controlled; the MBR coefficient is −1.2641, with a *t*-value of −2.81, given that E/P is controlled. Finally, when we control all of these three variables, the coefficient increases to −1.9473 with a *t*-value of −4.17, and the adjusted R^2 extends to 3.88 percent. These findings support our argument that the margin buying power may be the reason for the insignificant underperformance of shortable stocks during the first 20 trading days.

5.2 Results based on the Fama-French five-factor model

As Jiang *et al.* (2016) provide strong evidence of the effect of profitability on the Chinese stock market, we check our main results through CARs based on the Fama-French five-factors model.

Dep. Var.	MBR	Size	B/M	E/P	Constant	R^2_Adj/%
CAR_ctl (0, 20)-CAR_trt (0, 20)	−1.0569 (−2.45)				0.0198 (2.91)	0.80
CAR_ctl (0, 20)-CAR_trt (0, 20)	−1.7827 (−3.82)	−0.0269 (−3.83)			0.6445 (3.93)	2.26
CAR_ctl (0, 20)-CAR_trt (0, 20)	−1.2023 (−2.81)		−0.0799 (−4.16)		0.0518 (4.97)	2.23
CAR_ctl (0, 20)-CAR_trt (0, 20)	−1.2641 (−2.81)			−0.6237 (−2.82)	0.045 (3.98)	1.67
CAR_ctl (0, 20)-CAR_trt (0, 20)	−1.9473 (−4.17)	−0.0279 (−4.19)	−0.0631 (−2.72)	−0.2464 (−0.99)	0.7014 (4.55)	3.88

Notes: In this table, we regress underperformance of shortable stocks during (0, 20) on average MBR during (0, 20), controlling for average size, average B/M and average E/P during (−30, −1). We measure underperformance of shortable stocks as the difference of CAR (0, 20) between matched stocks and shortable stocks. MBR is abbreviation for margin buying ratio, calculated as uncovered margin buying position relative to circulation market value. Size is measured as log (market capitalization). CARctl (0, 20) denotes CAR (0,20) of control group, and CARtrt (0, 20) denotes CAR (0, 20) of treatment group

Table IX.
The impacts of margin buying on CAR difference during period (0, 20)

First, we demonstrate that the treated stocks in the first three batches do not significantly underperform their matched ones after the removal of short-sale prohibitions, whereas those in the last four batches underperform significantly. The results are presented in detail in Table X.

Second, we confirm that the stocks with a large size, high B/M, or high E/P do not decrease significantly after the removal of short-sale prohibitions. Return patterns conditional on size, B/M, and E/P are reported in Tables XI-XIII, respectively. All results are consistent with our findings in Subsection 4.3, supporting our argument that only heavily overpriced stocks significantly decrease after the event date.

5.3 Return patterns conditional on turnover

Whether size and B/M (E/P) measure mispricing or risk remains controversial. In this subsection, we employ the turnover as a measure of mispricing. Xiong and Yu (2011)

		Treatment group			Control group					
	Obs.	Mean	Median	*t*-value	Mean	Median	*t*-value	Mean (diff)	*t*-value	*p*-value
Panel A: the first three batches of stocks										
CAR (0, 20)	271	−0.0001	−0.0139	−0.02	0.0152	0.0105	2.05	−0.0153	−1.55	0.1216
CAR (0, 40)	271	0.0018	−0.0099	0.26	0.0158	0.0201	2.02	−0.0140	−1.38	0.1683
CAR (0, 60)	271	0.0120	0.0010	1.48	0.0269	0.0258	2.91	−0.0150	−1.34	0.1824
Panel B: the last four batches of stocks										
CAR (0, 20)	656	−0.0047	−0.0098	−0.83	−0.0042	−0.0202	−0.95	−0.0004	−0.06	0.9525
CAR (0, 40)	655	−0.0358	−0.0549	−5.29	−0.0072	−0.0364	−1.01	−0.0287	−2.98	0.003
CAR (0, 60)	651	−0.0411	−0.0711	−4.68	−0.0110	−0.0543	−1.23	−0.0308	−2.53	0.0117

Notes: This table reports the comparison of CAR between treatment group and control group around event dates. CAR is cumulative abnormal returns based on Fama-French five-factors model. Columns 3-5 report the CAR summary statistics of treatment group, columns 6-8 report the CAR summary statistics of control group, and columns 9-11 report the summary statistics of CAR difference between the two groups. Panel A reports the summary statistics of the first three batches of stocks, and panel B reports the summary statistics of the last four batches of stocks

Table X.
CAR comparison among different batches of stocks-based on Fama-French five-factors model

	Obs.	Treatment group Mean	Median	*t*-value	Control group Mean	Median	*t*-value	Treatment – control Mean	*t*-value	*p*-value
Panel A: small group of size										
CAR (0, 20)	278	−0.0121	−0.0364	−1.25	0.0009	−0.0149	0.12	−0.0129	−1.13	0.2605
CAR (0, 40)	278	−0.0436	−0.0649	−3.96	0.0084	−0.0392	0.66	−0.0519	−3.15	0.0018
CAR (0, 60)	278	−0.0430	−0.0936	−2.92	0.0058	−0.0343	0.40	−0.0489	−2.49	0.0134
Panel B: median group of size										
CAR (0, 20)	370	−0.0012	−0.0050	−0.19	0.0055	−0.0146	0.88	−0.0067	−0.74	0.4590
CAR (0, 40)	370	−0.0239	−0.0354	−2.92	0.0003	−0.0151	0.04	−0.0243	−2.21	0.0277
CAR (0, 60)	370	−0.0251	−0.0455	−2.41	0.0012	−0.0315	0.11	−0.0263	−1.80	0.0731
Panel C: large group of size										
CAR (0, 20)	278	0.0026	−0.0098	0.39	−0.0033	−0.0159	−0.52	0.0059	0.64	0.5256
CAR (0, 40)	278	−0.0070	−0.0131	−0.91	−0.0100	−0.0166	−1.24	0.0030	0.27	0.7852
CAR (0, 60)	278	−0.0083	−0.0174	−0.90	−0.0052	−0.0174	−0.51	−0.0031	0.01	−0.2382

Notes: This table reports the CAR comparison after effective date among different size groups. First, we sort stocks into three sub-groups by average size during (−30, −1); second, we compare CARs between treatment group and control group among each sub-group. Columns 3-5 report the CAR summary statistics of treatment group, columns 6-8 report the CAR summary statistics of control group, and columns 9-11 report the summary statistics of CAR difference between the two groups. For brevity, we only report CAR (0, 20), CAR (0, 40) and CAR (0, 60)

Table XI.
CAR comparison after effective date among different size groups based on Fama-French five-factors model

	Obs.	Treatment group Mean	Median	*t*-value	Control group Mean	Median	*t*-value	Treatment – control Mean	*t*-value	*p*-value
Panel A: low group of B/M										
CAR (0, 20)	278	−0.0235	−0.0263	−3.02	−0.0087	−0.0192	−1.21	−0.0148	−1.40	0.1603
CAR (0, 40)	278	−0.0602	−0.0796	−5.79	−0.0028	−0.0285	−0.24	−0.0575	−3.70	0.0003
CAR (0, 60)	278	−0.0531	−0.0736	−3.77	−0.0068	−0.0308	−0.50	−0.0464	−2.45	0.0151
Panel B: median group of B/M										
CAR (0, 20)	370	0.0011	−0.0109	0.15	0.0060	−0.0130	1.04	−0.0050	−0.55	0.5816
CAR (0, 40)	370	−0.0252	−0.0427	−3.07	0.0003	−0.0188	0.04	−0.0255	−2.26	0.0241
CAR (0, 60)	370	−0.0305	−0.0487	−2.95	0.0084	−0.0159	0.77	−0.0389	−2.77	0.006
Panel C: high group of B/M										
CAR (0, 20)	278	0.0110	−0.0031	1.46	0.0055	−0.0158	0.77	0.0055	0.52	0.6027
CAR (0, 40)	278	0.0114	−0.0003	1.43	0.0012	−0.0188	0.13	0.0102	0.87	0.3867
CAR (0, 60)	278	0.0092	−0.0042	0.91	−0.0022	−0.0300	−0.19	0.0114	0.76	0.4493

Notes: This table reports the CAR comparison after effective date among different B/M groups. First, we sort stocks into three sub-groups by average B/M during (−30, −1); second, we compare CARs between treatment group and control group among each sub-group. Columns 3-5 report the CAR summary statistics of treatment group, columns 6-8 report the CAR summary statistics of control group, and columns 9-11 report the summary statistics of CAR difference between the two groups. For brevity, we only report CAR (0, 20), CAR (0, 40) and CAR (0, 60)

Table XII.
CAR comparison after effective date among different B/M groups based on Fama-French five-factors model

confirm that the turnover and size of price bubble are positively correlated in the Chinese market; Chou *et al.* (2013) also show that stocks with higher turnover earn lower future returns. If our argument that heavily overpriced stocks decrease significantly holds, we should find that stocks with a lower turnover do not significantly underperform the matched ones.

	Obs.	Treatment group Mean	Median	*t*-value	Control group Mean	Median	*t*-value	Treatment – control Mean	*T*-value	*P*-value
Panel A: low group of E/P										
CAR (0, 20)	278	−0.0135	−0.0244	−1.56	−0.0100	−0.0250	−1.47	−0.0035	−0.33	0.7452
CAR (0, 40)	278	−0.0488	−0.0694	−4.41	−0.0159	−0.0463	−1.37	−0.0328	−2.05	0.0410
CAR (0, 60)	278	−0.0611	−0.0823	−4.43	−0.0253	−0.0624	−1.93	−0.0358	−1.93	0.0543
Panel B: median group of E/P										
CAR (0, 20)	370	0.0002	−0.0088	0.03	0.0125	−0.0073	2.00	−0.0123	−1.33	0.1854
CAR (0, 40)	370	−0.0267	−0.0432	−3.43	0.0160	−0.0048	1.95	−0.0427	−4.00	0.0001
CAR (0, 60)	370	−0.0245	−0.0387	−2.33	0.0191	−0.0044	1.75	−0.0436	−3.02	0.0027
Panel C: high group of E/P										
CAR (0, 20)	279	0.0021	−0.0073	0.30	−0.0018	−0.0206	−0.26	0.0039	0.39	0.6955
CAR (0, 40)	279	0.0018	−0.0148	0.23	−0.0066	−0.0255	−0.73	0.0085	0.69	0.4898
CAR (0, 60)	279	0.0090	−0.0097	0.90	0.0021	−0.0195	0.17	0.0070	0.46	0.6434

Table XIII.
CAR comparison after effective date among different E/P groups based on Fama-French five-factors model

Notes: This table reports the CAR comparison after effective date among different E/P groups. First, we sort stocks into three sub-groups by average E/P during (−30, −1); second, we compare CARs between treatment group and control group among each sub-group. Columns 3-5 report the CAR summary statistics of treatment group, columns 6-8 report the CAR summary statistics of control group, and columns 9-11 report the summary statistics of CAR difference between the two groups. For brevity, we only report CAR (0, 20), CAR (0, 40) and CAR (0, 60)

The results are reported in Table XIV. For stocks with a low turnover, no significant difference in CARs is indicated between the treatment group and the control group; however, for stocks with either medium or high turnover, the CARs of the treatment group are significantly smaller than those of the control group. These findings strongly support our argument that heavily overpriced stocks decline significantly.

	Obs.	Treatment group Mean	Median	*t*-value	Control group Mean	Median	*t*-value	Treatment – control Mean	*t*-value	*P*-value
Panel A: low group of TOV										
CAR (0, 20)	278	0.0074	−0.0035	1.21	0.0098	−0.0070	1.35	−0.0023	−0.25	0.8037
CAR (0, 40)	278	0.0048	−0.0053	0.68	−0.0032	−0.0113	−0.37	0.0080	0.76	0.4450
CAR (0, 60)	278	0.0197	0.0059	2.27	0.0053	−0.0143	0.46	0.0144	1.09	0.2779
Panel B: median group of TOV										
CAR (0, 20)	370	0.0014	−0.0094	0.19	0.0040	−0.0140	0.69	−0.0026	−0.27	0.7876
CAR (0, 40)	370	−0.0217	−0.0443	−2.44	0.0102	−0.0147	1.09	−0.0319	−2.41	0.0166
CAR (0, 60)	370	−0.0209	−0.0464	−1.79	0.0104	−0.0193	0.95	−0.0313	−1.99	0.0477
Panel C: high group of TOV										
CAR (0, 20)	279	−0.0204	−0.0331	−2.34	−0.0102	−0.0218	−1.41	−0.0102	−0.94	0.3479
CAR (0, 40)	279	−0.0583	−0.0694	−5.69	−0.0115	−0.0439	−1.10	−0.0468	−3.42	0.0007
CAR (0, 60)	279	−0.0767	−0.1058	−5.98	−0.0168	−0.0595	−1.23	−0.0599	−3.37	0.0009

Table XIV.
CAR comparison after effective date among different turnover groups based on Fama-French five-factors model

Notes: This table reports the CAR comparison after effective date among different E/P groups. First, we sort stocks into three sub-groups by average turnover during (−30, −1); second, we compare CARs between treatment group and control group among each sub-group. Columns 3-5 report the CAR summary statistics of treatment group, columns 6-8 report the CAR summary statistics of control group, and columns 9-11 report the summary statistics of CAR difference between the two groups. For brevity, we only report CAR (0, 20), CAR (0, 40) and CAR (0, 60)

5.4 Impacts on higher moments

Table XV reports the effects on higher return moments, such as market volatility, skewness, and kurtosis. The standard deviation significantly increases from 0.0246 to 0.0274, with a *t*-value of 7.90, skewness significantly decreases by 0.1061, with a *t*-value of 3.85, and kurtosis significantly increases by 0.4370.

6. Conclusion

In this paper, we mainly explore two questions. The first is whether stocks decline after short selling is permitted. The second question is which kind of shortable stocks significantly decline relative to their matched ones. We demonstrate, in Chinese market, that shortable stocks do not necessarily decline but only those heavily overpriced stock decline after the removal of short-sale prohibitions.

Our first finding is that the shortable stocks in the first three batches mainly consist of blue-chip stocks, which are widely acknowledged as less-overpriced stocks and do not perform poorly relative to their matched stocks around the event date (−30, 60). This finding indicates that short sellers are not necessarily harmful for the Chinese market. However, for the stocks of the last four batches, the unshortable stocks significantly outperform shortable stocks around the removal of short-sale prohibitions. The different return patterns exhibited in the two batches of stocks elucidate the effects of the short-sale prohibitions.

Furthermore, stock characteristics, including firm size, book market ratio, and earnings-price ratio, affect the underperformance of the shortable stocks. For one thing, these three characteristics are significantly different between the stocks of the first three batches and the last four batches. For another, regression analysis shows that these three characteristics are negatively correlated with the underperformance of the shortable stocks during (0, 60).

Third, more-overpriced stocks would decline, on the average, relative to their matched ones after the removal of the short-sale prohibition, whereas less-overpriced stocks would remain constant relative to the matched stocks. Stocks with larger size, higher B/M, or higher E/P, which are widely acknowledged as less-overpriced stocks, are not significantly outperformed by their matched stocks; meanwhile, stocks with smaller size, lower B/M, or

	Mean	SD	Min	p25	p50	p75	Max
Std							
Pre	0.0246	0.0079	0.0074	0.0190	0.0236	0.0291	0.0597
Post	0.0274	0.0072	0.0099	0.0224	0.0265	0.0316	0.0564
Mean (pre-post)	−0.0028						
t-value (pre-post)	−7.90						
Skewness							
Pre	0.2152	0.6327	−2.4800	−0.1783	0.1788	0.6058	2.3302
Post	0.1091	0.5518	−1.9097	−0.2388	0.1150	0.4535	1.9944
Mean (pre-post)	0.1061						
t-value (pre-post)	3.85						
Kurtosis							
Pre	3.6268	1.4239	1.6001	2.6722	3.2465	4.1367	11.4640
Post	4.0638	1.3139	2.1275	3.1463	3.7661	4.5851	11.6721
Mean (pre-post)	−0.4370						
t-value (pre-post)	−6.87						

Notes: We report summary statistics of standard deviation, skewness and kurtosis in this table. Pre denotes period (−30, −1), post denotes period (0, 60)

Table XV. Summary statistics on higher moments of stock return

lower E/P significantly underperform their matched ones. These findings tend to agree that short sellers are value explorers rather than bloodsuckers for the Chinese market.

Finally, we show that the margin buying power would mitigate the underperformance of the shortable stocks over a short period (e.g. 20 trading days). The margin-buying ratio exhibits a significant negative correlation with underperformance during (0, 20), indicating that margin buying would be a potential reason for insignificant underperformance of shortable stocks during (0, 20).

Notes

1. www.csindex.com.cn/sseportal_en/csiportal/zs/jbxx/report.do?code=000300&&subdir=1: CSI 300 is abbreviation for "China Security Index 300." As the first equity index launched by two exchanges (Shanghai Stock Exchange and Shenzhen Stock Exchange), CSI 300 aims to reflect the price fluctuation and performance of the Chinese A-shares market.
2. For example, after the crash of the Chinese stock market, the authorities suspended all short sales. We admit that such regulation is necessary for boosting the investors' sentiment and stabilizing the market under such extreme circumstances; however, our findings imply that prohibiting short selling is irrational in the long run. Furthermore, our results suggest that regulators should permit more stocks, particularly small stocks and growth stocks, to be sold short.
3. Shenzhen component index consists of 40 stocks before May 20, 2015 (http://business.sohu.com/20150520/n413411994.shtml).
4. In China, firms with two consecutive annual losses are subject to special treatment (i.e. ST stocks). If their financial status continues to deteriorate, they will be suspended from trading or be delisted. "GEM stocks" means growth enterprises market stocks, which may be listed under a relaxed set of requirements.
5. Data from www.sse.com.cn/ and www.szse.cn/. SSE-listed stocks are typically larger than SZSE-listed stocks, and stocks in SZSE Main Board are typically larger than GEM stocks.
6. More studies find that firm fundamentals are associated with stock future returns. For example, Banz (1981) as well as Fama and French (1992) show that firm size is correlated with stock return; Stattman (1980), Rosenberg *et al.* (1985) as well as Fama and French (1992) indicate that the book market ratio positively predict future returns; Ball (1978), Basu (1983), and Fama and French (1992) demonstrate that earnings-price ratio is positively correlated with future returns.
7. We should clarify that "short sales constraints" here refers to short cost rather than short-sale prohibitions imposed by regulators.
8. The reason for using idiosyncratic volatility rather than other volatility measures is that IVOL may influence short constraints effects. For example, Au *et al.* (2009) show that heavily shorted stocks significantly underperform lightly shorted stocks only in the highest idiosyncratic-risk stock group.
9. These measures have been supported by many theoretical models, such as Shalen (1993), Harris and Raviv (1993), Hong and Stein (2003), etc. They are also widely used by empirical research works, such as Jones *et al.* (1994), Chang *et al.* (2007), Diether *et al.* (2002), etc. Au *et al.* (2009) show that heavily shorted stocks significantly underperform lightly shorted stocks only in highest idiosyncratic-risk stock group.

References

Aitken, M.J., Frino, A., McCorry, M.S. and Swan, P.L. (1998), "Short sales are almost instantaneously bad news: evidence from the Australian Stock Exchange", *The Journal of Finance*, Vol. 53 No. 6, pp. 2205-2223.

Andrikopoulos, P., Clunie, J. and Siganos, A. (2012), "UK short selling activity and firm performance", *Journal of Business Finance & Accounting*, Vol. 39 Nos 9-10, pp. 1403-1417.

Ashiq, A. and Trombley, M.A. (2006), "Short sales constraints and momentum in stock returns", *Journal of Business Finance & Accounting*, Vol. 33 Nos 3-4, pp. 587-615.

Asquith, P., Pathak, P.A. and Ritter, J.R. (2005), "Short interest, institutional ownership, and stock returns", *Journal of Financial Economics*, Vol. 78 No. 2, pp. 243-276.

Au, A.S., Doukas, J.A. and Onayev, Z. (2009), "Daily short interest, idiosyncratic risk, and stock returns", *Journal of Financial Markets*, Vol. 12 No. 2, pp. 290-316.

Ball, R. (1978), "Anomalies in relationships between securities' yields and yield-surrogates", *Journal of Financial Economics*, Vol. 6 Nos 2-3, pp. 103-126.

Banz, R.W. (1981), "The relationship between return and market value of common stocks", *Journal of Financial Economics*, Vol. 9 No. 1, pp. 3-18.

Basu, S. (1983), "The relationship between earnings yield, market value, and return for NYSE common stocks: further evidence", *Journal of Financial Economics*, Vol. 12 No. 1, pp. 129-156.

Berkman, H., Dimitrov, V., Jain, P., Doch, P. and Tice, S. (2009), "Sell on the news: differences of opinion, short-sales constraints, and returns around earnings announcements", *Journal of Financial Economics*, Vol. 92 No. 3, pp. 376-399.

Boehme, R., Danielsen, B. and Sorescu, S. (2006), "Short-sale constraints, differences of opinion, and overvaluation", *Journal of Financial and Quantitative Analysis*, Vol. 4 No. 2, pp. 455-487.

Boehmer, E., Jones, C.M. and Zhang, X. (2008), "Which shorts are informed?", *The Journal of Finance*, Vol. 63 No. 2, pp. 491-527.

Brunnermeier, M.K. and Pedersen, L.H. (2005), "Predatory trading", *The Journal of Finance*, Vol. 60 No. 4, pp. 1825-1863.

Chang, E.C., Cheng, J.W. and Yu, Y. (2007), "Short-sales constraints and price discovery: evidence from the Hong Kong market", *The Journal of Finance*, Vol. 62 No. 5, pp. 2097-2121.

Chang, E.C., Luo, Y. and Ren, J. (2014), "Short-selling, margin-trading, and price efficiency: evidence from the Chinese market", *Journal of Banking & Finance*, Vol. 48 No. 11, pp. 411-424.

Chen, J., Hong, H. and Stein, J.C. (2002), "Breadth of ownership and stock returns", *Journal of Financial Economics*, Vol. 66 No. 2, pp. 171-205.

Chou, P.H., Huang, T.Y. and Yang, H.J. (2013), "Arbitrage risk and the turnover anomaly", *Journal of Banking & Finance*, Vol. 37 No. 11, pp. 4172-4182.

Danielsen, B.R. and Sorescu, S.M. (2001), "Why do option introductions depress stock prices? A study of diminishing short sale constraints", *Journal of Financial & Quantitative Analysis*, Vol. 36 No. 4, pp. 451-484.

Dechow, P.M., Hutton, A.P., Meulbroek, L. and Sloan, R.G. (2001), "Short-sellers, fundamental analysis, and stock returns", *Journal of Financial Economics*, Vol. 61 No. 1, pp. 77-106.

Desai, H., Ramesh, K., Thiagarajan, S.R. and Balachandran, B.V. (2002), "An investigation of the informational role of short interest in the Nasdaq market", *The Journal of Finance*, Vol. 57 No. 5, pp. 2263-2287.

Diether, K.B., Malloy, C.J. and Scherbina, A. (2002), "Differences of opinion and the cross-section of stock returns", *The Journal of Finance*, Vol. 57 No. 5, pp. 2113-2141.

Engelberg, J.E., Reed, A.V. and Ringgenberg, M.C. (2012), "How are shorts informed? Short sellers, news, and information processing", *Journal of Financial Economics*, Vol. 105 No. 2, pp. 260-278.

Fama, E. and French, K. (1992), "The cross-section of expected stock returns", *Journal of Finance*, Vol. 46 No. 2, pp. 427-466.

Figlewski, S. (1981), "The informational effects of restrictions on short sales: some empirical evidence", *Journal of Financial and Quantitative Analysis*, Vol. 16 No. 04, pp. 463-476.

Geczy, C.C., Musto, D.K. and Reed, A.V. (2002), "Stocks are special too: an analysis of the equity lending market", *Journal of Financial Economics*, Vol. 66 No. 2, pp. 241-269.

Harris, M. and Raviv, A. (1993), "Differences of opinion make a horse race", *Review of Financial studies*, Vol. 6 No. 3, pp. 473-506.

Hong, H. and Stein, J.C. (2003), "Differences of opinion, short-sales constraints, and market crashes", *Review of Financial Studies*, Vol. 16 No. 2, pp. 487-525.

Jiang, F., Qi, X. and Tang, G. (2016), "Q-theory, mispricing, and profitability premium: evidence from China", SSRN working paper.

Jones, C.M. and Lamont, O.A. (2002), "Short-sale constraints and stock returns", *Journal of Financial Economics*, Vol. 66 No. 2, pp. 207-239.

Jones, C.M., Kaul, G. and Lipson, M.L. (1994), "Transactions, volume, and volatility", *Review of Financial Studies*, Vol. 7 No. 4, pp. 631-651.

Keskek, S., Rees, L. and Thomas, W.B. (2013), "Earnings announcements, differences of opinion and management guidance", *Journal of Business Finance & Accounting*, Vol. 40 Nos 7-8, pp. 769-795.

Lamba, A. and Ariff, M. (2006), "Short selling restrictions and market completeness: the Malaysian experience", *Applied Financial Economics*, Vol. 16 No. 15, pp. 385-393.

Miller, E.M. (1977), "Risk, uncertainty, and divergence of opinion", *The Journal of Finance*, Vol. 32 No. 4, pp. 1151-1168.

Ofek, E., Richardson, M. and Whitelaw, R.F. (2004), "Limited arbitrage and short sales restrictions: evidence from the options markets", *Journal of Financial Economics*, Vol. 74 No. 2, pp. 305-342.

Rosenberg, B., Kenneth, R. and Lanstein, R. (1985), "Persuasive evidence of market inefficiency", *Journal of Portfolio Management*, Vol. 11 No. 3, pp. 9-17.

Scheinkman, J.A. and Xiong, W. (2003), "Overconfidence and speculative bubbles", *Journal of Political Economy*, Vol. 111 No. 6, pp. 1183-1220.

Shalen, C.T. (1993), "Volume, volatility, and the dispersion of beliefs", *Review of Financial Studies*, Vol. 6 No. 2, pp. 405-434.

Sharif, S., Anderson, H.D. and Marshall, B.R. (2014), "Against the tide: the commencement of short selling and margin trading in mainland China", *Accounting & Finance*, Vol. 54 No. 4, pp. 1319-1355.

Stattman, D. (1980), "Book values and stock returns", *The Chicago MBA: A Journal of Selected Papers*, Vol. 4 No. 1, pp. 25-45.

Takahashi, H. and Xu, P. (2015), "Trading activities of short-sellers around index deletions: evidence from the Nikkei 225", *Journal of Financial Markets*, Vol. 27 No. 1, pp. 132-146.

Xiong, W. and Yu, J. (2011), "The Chinese warrants bubble", *The American Economic Review*, Vol. 101 No. 6, pp. 2723-2753.

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