Short Sale Constraints, Disperse Pessimistic Beliefs and Market Efficiency
- Evidence from the Chinese Stock Market

ZHONGKUANG ZHAO, SHUQI LI and HEPING XIONG[1]

Abstract

In the Chinese stock market, the regulatory agency lists qualified stocks on announcement date and permits investors to sell short on the effective date, a practice that allows us to directly study the impact of short sale constraints. Applying an event study to 511 additions, between February 2010 and August 2013, of individual stocks to the list of securities qualified for short sale, we find that short sale constraints cause individual stocks to be overpriced and that such overvaluation is exclusively related to distortions associated with pessimistic beliefs. In addition, we observe lower volatility, skewness and extreme value frequency of stock returns after short sale constraints are lifted. This implies the emergence of a more appropriate distribution of returns and improved market efficiency at the individual stock level as the range of securities qualified for short selling expands.

Keywords: Short Sale Constraint, Overvaluation, Disperse Beliefs, Market Efficiency
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I. Introduction

In a stock market with short sale constraints, pessimistic investors are forced out of the market through sales of in-hand stocks or are prevented from entering it, rather than allowed to fully incorporate their expectations into current prices through short selling, which impedes the discovery function of financial markets. The asymmetric impact that short sale constraints exert on optimistic and pessimistic investors together with investors' heterogeneous information and opinions (Miller, 1977) lead to stock overvaluation. However, scholars haven't reached a consensus regarding the overvaluation effect, especially theory builders. Short sale constraints have at least four effects that could theoretically result in undervaluation: substitution between stocks (Jarrow, 1980), investors' intertemporal substitution (Gallmeyer and Hollifield, 2008), dynamic adjustment of rational expectations (Diamond and Verrecchia, 1987) and limited information (Bai, Chang and Wang, 2006).

Most empirical findings are consistent with Miller's intuition, with a few exceptions,

[1] ZHAO is at School of Economics, The Peking University, Email: deniszzk@163.com. Lee is at School of Management, Wuhan University of Technology, Email: fantasticlsq@163.com. XIONG is corresponding author at Economics and Management School of Wuhan University, Email: hepingxiong@126.com. All errors are our own.

especially the subprime mortgage crisis in 2008. During the Crisis, the Securities and Exchange Commission(SEC) imposed stringent constraints on short selling, the result of which is highly controversial. Comparatively, the Chinese capital market have gradually loosened the short sale constraints imposed on stock trading since 2010. In this paper, we utilize the samples provided by the practice in Chinese stock market, to study the impact of short sale constraints and disperse beliefs on overvaluation and market efficiency.

The sample of Chinese stock market provide many advantages, for studies focused on mature stock markets such as the U.S. stock market often have technical difficulties in empirical testing. As short-sale constraints differ only marginally among different stocks in these countries, previous scholars (Figlewski, 1981; Danielsen, and Sorescu, 2001; Chen, Hong, and Stain, 2002; Jones, and Lamont, 2002; Ofek and Richardson, 2003; Phillips, 2011) have had to find indicators that proxy for short sale constraints. Four indicators commonly used in the existing literature are Relative Short Interest (RSI), Short-Stock-Rebate Rates (SSRR), Breadth of Ownership (BO) and Option Status (OS)[2].

However, almost without exception, these indirect indicators encounter problems of endogeneity or data non-availability. SSPR can well represent the degree of constraints, but the relevant data are not easily accessible - that is why Jones and Lamont (2002) go back to the Great Depression to conduct an empirical test. Figlewski (1981) believes, as observed RSIs increase, the unrealized demand for short sales also increases; therefore, a higher RSI represents a higher degree of short sale constraints; however, this higher RSI could result from smaller short sale constraints, which generate an endogeneity problem. Although lower Breadth of Ownership may correlate with lower liquidity (Grullon, Kanatas, and Weston, 2004), may signal that there are fewer long-position investors and a higher level of short sale constraints (Chen, Hong, and Stain, 2002), and can proxy for a lower supply of shares to sell short (Asquith, Pathak, and Ritter, 2005), as an intermediate variable determined by and affecting many other factors, BO is merely weakly correlated with short sale constraints and thus an inaccurate indicator. Many studies link short sales with the option market. Put–call parity is most powerfully violated under high constraints (Lamont, and Thaler, 2003, Ofek, Richardson, and Whitelaw, 2004), and 76% of the disparity in price efficiency between stocks with high and low constraints is eliminated after the introduction of stock options (Phillips, 2011). However, options still cannot fully eliminate the effects of short sale constraints. In sum, it is difficult to find two stocks that are identical in all respects except whether they can be sold short in a mature market.

Researchers have sought to mitigate the endogeneity problem in two ways: by examining temporary suspensions of short sales during financial crises, for example, the subprime mortgage crisis of 2008; and by focusing primarily on emerging markets, which have relatively short

[2] RSI is defined as the proportion of daily short trading volume compared with the total stock shares outstanding. SSRR refers to the rebate fee of the security that brokers require from investors who sell short. Breadth of Ownership refers to the diversification of shareholders and ownership, usually measured by the shareholding proportion of institutional investors. Option Status (OS) measures the existence and quantity of stock options, which are believed to be alternatives to short sales.

histories of short sale execution, for example, the Hong Kong stock market.

Some scholars (Grundy, Lim, and Verwijmeren, 2012; Marsh, and Payne, 2012; Beber, and Pagano, 2013; Boehmer, Jones, and Zhang, 2013) use data of stocks that are temporarily banned from short sales during the crisis and discover unanimously an insignificant overvaluation effect - i.e., the ban regulation fails to support the stock price, as supposed. However, as this method focuses on extremely bearish markets, it gives rise to the problem of external validity and generalization to other market circumstances. The normally significant overvaluations of stocks caused by short sale constraints in normal market conditions may just be moderated by behavioral or psychological factors, notably, panic of investors in extreme crisis situations.

Compared with the U.S., the Chinese stock market has unique advantages. In the Chinese stock market, regulatory agency bulletins the list of qualified securities on announcement date and allow them to sell short on the effective date. Given this administrative feature, the only fundamental difference between the same stock before and after removal of short sale constraints lies in whether permission to short is granted, yielding a good sample with which to directly assess the impact of short sale constraints. In addition, as short sale constraints have been gradually relaxed over a relatively long period in China, the stock market has experienced many different situations, not just market crises and crashes.

Others utilize stock data in emerging markets like Hong Kong, where the regulatory agency has gradually liberalized short sale constraints. Significantly negative returns following the relaxation of constraints (Chang, Cheng and Yu, 2007) and differences in H-share premia[3] between shortable and non-shortable stocks that go public in both the mainland and Hong Kong markets (Chan, Kot and Yang, 2011) empirically support Miller's intuition. However, studies that focus on the Hong Kong market encounter other endogeneity problems. The authority in Hong Kong often designates stocks that can be sold short by a series of positive characteristics, for example, high ex-ante returns, large market capitalization and (typically) inclusion in the Hang Seng Index to minimize the interim destabilizing impact of the removal of short-sale constraints. Such a set of criteria leads to similarity in sample characteristics and could undermine the credibility of the analysis, as one can explain the empirical results on the basis of these common qualities rather than as resulting from the relaxation of constraints. In fact, such selection bias is embedded in any standard-meeting policy, as in the permission of stocks going public in both the mainland and Hong Kong markets studied by Chan, Kot and Yang(2011).

Compared with the Hong Kong stock market, the Chinese stock market has advantages with respect to sample diversification. Although the Hong Kong stock market has undergone several major revisions in the criteria of stock qualification, the list of less than 200 qualified stocks continues to be characterized by large-scale stocks and relatively minimal diversity. Correspondingly, the Chinese stock market, though with a shorter history of short sales, has seen substantial additions of eligible stocks with each criteria revision. Up until the present, the

3 A-H Premiums of stocks that go public in both mainland and Hong Kong markets, are equal to the mainland yield minus the Hong Kong yield on the same stock on the same day.

qualification list has covered stocks from four main sub-markets in China: Shanghai A-shares, Shenzhen A-shares, the small and medium-sized enterprise board (SME Board) and the growth enterprise market (GEM). Thus, the wider coverage and more diverse sample of the Chinese market tend to reduce endogeneity problems caused by sample convergence in empirical analysis.

Another problem arouses when considering the impact of disperse beliefs on overvaluation. While above-mentioned theoretical researches have clarified that short sale constraints will exclusively distort beliefs of pessimistic investors, empirical studies have not yet clearly distinguish heterogeneity of pessimistic and optimistic beliefs. Studies that have addressed the impact of disperse beliefs on overvaluation have only employed such indicators as the standard errors of raw (Harris and Raviv, 1993; Shalen, 1993) and abnormal returns (Jones, 2003), which do not represent asymmetries of daily return distribution, and do not reflect the asymmetric effect of short sale constraints on pessimistic and optimistic beliefs neither, albeit only pessimistic investors' expectations are distorted. Intuitively, two stocks with identical belief distributions with respect to downward movements and different belief distributions with respect to upward movements may have significantly different standard deviations, although the degrees of price distortion and overvaluation may be equal. In sum, although standard deviations are indeed highly correlated with dispersion of beliefs, they do not proxy well for the dispersion of only pessimistic beliefs in our context.

Because negative daily returns naturally suggest that beliefs are more pessimistic than optimistic on that day, we increase the weights on negative returns rather than evenly distribute weights when establishing indicators of the dispersion of pessimistic beliefs, as in a second-order moment indexes standard deviation of returns. We therefore introduce pessimism level indicators that identify the proportion and degree of negative daily returns and demonstrate that overvaluation is exclusively influenced by dispersed pessimistic beliefs.

Finally, short sale constraints should influence the market efficiency. As the overvaluation represents a bias from the fair value and a distortion of investors' beliefs, the constraints will necessarily undermine the price discovery function and the efficiency of the stock market. Scholars try to find the impact of short The relaxation of short sale constraints improves market investment channels and the price discovery function, reduces the volatility of the stock market, and thus enhances market efficiency on the country level (Bris et al., 2007; Saffi and Sigurdsson, 2011; Lee et al., 2013). At the same time, some scholars argue that a sudden increase in short sales following additions of stocks that can be sold short could increase stock market volatility in the short run (Allen and Gale, 1991; Bernardo and Welch, 2004). Based on our stock data of Chinese stock market, we analyze the improvement of market efficiency on individual stock level.

Our work is related to Chang, Cheng and Yu (2007), with two main differences. First, we use the stock sample of Chinese stock market for aforementioned reasons. Second, we focus on the effect of distortion of pessimistic beliefs on overvaluation while they mainly try to mitigate the endogenous problem of previous studies on short sale constraints. Another related work is Chang,

Luo and Ren (2013), which as well focused on Chinese stock market. However, they only study the pilot practice of short selling in China, that is, in all 285 addition events before December 31, 2012. While we cover the both the pilot period and formal implementation period, that is, in all 511 addition events up to August 20, 2013. The longer time interval tends to provide more market conditions and thus strengthen the external validity and generalization of the conclusion. And more importantly, since the formal implementation period, many stocks from the SME Board and the GEM have been granted the qualifications of selling short. Consequently, our samples are much more diversified in the stock properties, and enhance the reliability of the empirical result. Still, we clarify the effect of distortion of pessimistic beliefs while they do not.

In this paper, we firstly examine the impact of short sale constraints on overvaluation in China directly. The above-noted administrative features allows us to directly trace returns on stocks before and after they are added to the permission list and thus control for other characteristics of the sample. We find significant negative abnormal returns after stocks are added to the list. Thus, consistent with Miller's conclusion, we find that short sale constraints cause overvaluation, which disappears after constraints are lifted. Additionally, to exclude or reduce the impact of other endogenous factors, we conduct a series of robustness tests. We include a long sample interval to lower the confounding impact of other market events and employ a non-parametric test to overcome the problem of asymmetric distribution of daily returns and a bootstrap simulation method to further reduce the above-noted selection bias problem. Moreover, we simultaneously study the effects of announcement dates and effective dates and consider the possible roles of return contrarian and momentum effects.

After verifying significant overvaluation, we probe into the effect of belief dispersion. As noted above, only pessimistic beliefs are distorted, and thus we introduce pessimism level indexes. Our empirical results show that only pessimism indicators that reflect the asymmetric influence of short sale constraints on optimistic and pessimistic briefs significantly affect the degree of overvaluation. To our knowledge, we are among the first to clearly discern the dispersion of only pessimistic beliefs when conducting empirical sturdies in this field.

Finally, we study variations in the efficiency of the Chinese stock market by comparing the distribution characteristics of both raw and abnormal returns around the event date. Our findings demonstrate sharp declines in mean value, standard deviation, skewness and negative extreme value frequency of stock returns after addition to the permission list, which implies abnormal returns of less significance, volatility, asymmetry and potential to provoke market crashes after short sale constraints are repealed.

The remainder of the paper is organized as follows. Section II provides a brief introduction to short sale practices in China and describes our data. Section III tests the overvaluation effect of short sale constraints. Section IV examines the relationship between dispersion of beliefs and overvaluation. Section V examines the impact of short sale constraints on market efficiency. Part VI concludes.

II. The Short Sale Practice in China and the Data

In China, stocks that satisfy the requirements of the China Securities Regulatory Commission (CSRC) are permitted to sell short.The CSRC announced a pilot version of short sale regulations in Feb 2010, and began to formally implement the practices of short selling in Dec 2011. In the pilot scheme, 90 stocks were designated as qualified for short selling. Since then, the qualification list has altered with changes in stock quotations. From October 2010 to November 2011, a total of six stocks were swapped out of and added to the list, maintaining a total number of 90 stocks. In November 2011, the CSRC substantially lowered the qualification standard, resulting in 191 additions to the list. Subsequently, two stocks are admitted into the list, with one eliminated. In January 2013, there was another round of standards loosening, and 218 stocks were added to the list. Since then, the CSRC has dynamically adjusted the list according to new qualification standards, removing nine stocks and adding four. As of August 20, 2013, a total of 495 stocks could be sold short in China.

Another notable policy change, in place since August 13, 2012, concerns refinancing practices. The new policy allows brokers to borrow securities for short sale from other financial institutions (such as banks, insurance companies, etc.) instead of relying on their own stocks. Intuitively, the refinancing policy should expand sources of securities to borrow, further relaxing short sale constraints.

In China, the main requirements for short-selling stocks include scale, liquidity and volatility. The latest version of the CSRC regulation stipulates that qualified stocks must satisfy the following 8 main requirements:

1. Qualified stocks have been traded on an exchange for more than three months;

2. Shares outstanding are not less than 200 million, or the market value of outstanding shares is not less than 800 million RMB;

3. The number of shareholders are not less than 4,000 individuals;

4. The average daily turnover rate over the last three months is no more than 15% below that of the market index, or the average daily trading volume is not less than 50 million yuan;

5. The average daily return over the last three months has not deviated from the market return by 4% or more;

6. The volatility of the stock over the last three months has not reached 5 times the volatility of the market;

7. The company has completed nontradable shares reform[4], i.e., all shares are tradable;

8. The stock is not investigated currently by the CSRC, i.e., the company is not undergoing a reorganization, merger, buyout or investigation of possible illegal activities.

[4] Prior to the reform, some shares held by the government could not be traded in the market.

Table 1 Summary of changes in qualification list

Announcement Date	Effective Date	Summation	Addition
2010-02-12	N/A	90	90
10-06-21	10-07-01	90	4
10-07-01	N/A	90	1
10-07-16	10-07-29	90	1
11-11-25	11-12-05	281	191
12-06-01	12-06-04	281	1
12-10-26	12-10-29	282	1
13-01-25	13-01-31	500	218
13-03-05	13-03-06	499	0
13-03-07	13-03-07	498	0
13-03-28	13-03-29	496	1
13-04-19	13-04-24	497	1
13-04-26	13-05-02	496	0
13-05-24	13-05-27	496	1
13-07-24	13-07-25	497	1
13-08-02	13-08-05	495	0
Cumulated:		495	511

This table summarizes changes in the qualification list from the initial implementation of short sales (February 12, 2010) to August 20, 2013 in China. “Announcement date” in the first column refers to the date on which the CSRC announces a change in the list of qualified securities. “Effective date” in the second column refers to the date on which a designated stocks can be sold short. Generally, the effective date is later than the announcement date; N/A implies that the two dates are the same. The date format is year - month - day, with the first two digits omitted from the year specification (except in the case of the first event). “Summation” in the third column refers to the total number of shortable stocks after adjustment of qualification list. “Addition” in the fourth column refers to the number of additions of new stocks to the list. The final row indicates the total number of summations and additions.

We treat an addition[5] of a stock to the list of shortable securities as an event, and apply the event study to compare abnormal returns before and after an addition. As shown in Table 1, we select as our sample interval the period from February 12, 2010, when short sales began in China, to August 20, 2013. During this period, a total of 511 stocks were added to the designated list. By treating the same stocks before and after the event date as two stocks that have exactly the same features except that one can be sold short, we can control for the influence of other factors.

We collect information of qualification lists, announcement dates and effective dates of shortable stocks from websites of the Shanghai Stock Exchange and Shenzhen Stock Exchange. Data retrieved from the CSMAR database include: the stock trading codes (Stkcd), closing prices (Clsprc), daily trading shares (Trd), daily transaction volume (Trv), daily circulation market value (Cmv), daily total market value (Tmv), daily return (Yield) and market returns (Mr). Information

[5] An addition is defined as a stock that is added to the qualification list for the first time.

about cash dividends, equity dividends, allotments and share splits come from the annual reports of listed companies.

In calculating rates of return, we choose daily yields with dividends and other adjustments on the grounds that a rational investor would make his investment decisions on the basis of overall returns rather than merely the fluctuations of stock prices. Nevertheless, in addition to cash and equity dividends, we should also adjust raw rates of return for other activities such as allotment and equity splits to make them comparable to base period returns. The daily yield in this paper is calculated as follows:

$$Yield_{i,t} \quad \frac{P_{i,t}(1 \quad F_{i,t} \quad S_{i,t}) \; C_{i,t} \quad D_{i,t}}{P_{i,t-1} \quad C_{i,t} \quad S_{i,t} \quad K_{i,t}} \quad 1$$

Where i and t denote the stock and time period, respectively, P is the closing price, and D, F, S, C and K are the cash dividend, equity dividend, the number of allotments, the number of split shares outstanding and the allotment price per share on ex-dividend date, respectively.

Table 2 Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max	skewness
Clsprc	559005	18.31	18.95	1.56	294.17	4.33
Trd()	559005	1.84E+07	3.33E+07	601.00	2.74E+09	10.14
Trv	559005	2.35E+08	3.94E+08	2055.00	7.00E+10	16.98
Cmv	559005	2.46E+07	8.58E+07	1.10E+05	2.06E+09	12.39
Tmv	559005	4.18E+07	1.48E+08	2.25E+05	7.12E+09	13.25
Yield	559005	0.00	0.05	-0.14	0.13	169.15
Mr	559005	0.00	0.02	-0.09	0.09	-0.20

In China, on the first day of an initial public offering (IPO), the price of a stock can fluctuate without limit, while the subsequent fluctuation range is 10%, and in different years, the number and amount of IPOs differ significantly[6]. To avoid the impact of IPOs, we exclude transaction data from the first day of an IPO. In addition, we remove data on stocks whose estimation and event windows are too short and stocks with too much missing data. Our final sample includes stocks from the Shanghai and Shenzhen Stock Exchanges, the SME board and the GEM and contains 378 stocks if the announcement date is chosen as the event date and 381 stocks if the effective date is chosen as the event date.

Descriptive statistics are presented in Table 2, where we observe that the skewness of daily yields and of stocks' closing prices reach positive values of 169.15 and 4.32, respectively, so that their distributions are significantly shifted to the right. These results are consistent with overvaluation caused by short sale constraints. However, the above analysis does not adjust the

[6] For instance, in China, the number and amount of IPOs was significantly higher in 2010, when many stocks were first sold short, than in other years. One may explain the result by the extreme values of returns on the first day of an IPO.

return for idiosyncratic risk of individual stocks, nor does it compare the situation before and after an addition. We will discuss the impact of short sale constraints on overvaluation in detail below.

III. Short Sale Constraints and Overvaluation

To study the relationship between short sale constraints and overvaluation, we treat the addition of a stock as an event and compare daily and cumulative abnormal returns before and after the event date. If short sale constraints cause overvaluation, the predicted return, calculated on the basis of market structure in the estimation window prior to the event date, should exceed the actual return. In other words, we should observe significant negative abnormal returns after the relaxation of short sale constraints.

3.1 Abnormal Return

Heterogeneity of individual stocks makes direct comparisons of raw returns unconvicing. To assess abnormal returns in the event window, we must first obtain predicted returns[7].. We utilize the market model to adjust for the heterogeneous risk of different stocks. We first select the announcement date as the event date ($t \quad 0$), specify the estimation window as the interval between 280 and 31 days prior to the event date and specify the event window as the interval between 30 days prior to the event date and 60 days after the event date. The daily and cumulative abnormal returns are defined, respectively, as follows:

$$AR_i(t) \quad R_{it}^{\sim} \quad \widehat{\sim}_i \quad \widehat{\ }_i R_{Mt}$$

$$CAR_i(t_1,t_2) \quad \sum_{t=t_1}^{t_2} R_{it}^{\sim} \quad \widehat{\sim}_i \quad \widehat{\ }_i R_{Mt}$$

where R_{it} is the daily return of stock *i* on day *t*, R_{Mt} is the daily value-weighted average market return on day *t*, and $\widehat{\ }_i, \widehat{\ }_i$ are the intercept and coefficient parameters, respectively, estimated by an OLS regression of R_{it} on R_{Mt} in the estimation window. $AR_i(t)$ represents the daily abnormal return of stock *i* on day *t*, and $CAR_i(t_1,t_2)$ represents the cumulative abnormal return of stock *i* between day t_1 and day t_2, obtained by summing the daily abnormal returns during the period.

3.2 Empirical Results of Overvaluation

Table 3 shows the daily and cumulative abnormal returns around the event date. Panels A and B demonstrate the empirical results for daily and cumulative abnormal returns. We first use the

[7] Calculation methods for predicted returns include the constant mean model, the market model, the economic model, etc. (Browm and Warner, 1985; Campbel et al, 1997; Mackinlay, 1997).

announcement date and then the effective date as the event date, and report corresponding results on the left and right sides of Table 3, respectively.

3.2.1 Announcement Date Effect

The left part of Panel A reports daily abnormal returns between 10 days before the announcement date and 10 days after the announcement date. The mean, standard deviation, t values and p values of the t test of abnormal returns are reported in Columns 2 to 5. We observe that the mean of daily abnormal returns over the 21 days is -0.09%, with p values close to 0, indicating that we cannot reject the hypothesis that abnormal returns over the 21 day period are significantly different from 0 at the 1% level.

The daily results show a majority of days with negative daily returns, with significant abnormal negative returns on 9 out of 14 days. In addition, the results are more notable for the days following the announcement date, with 6 out of 8 days showing significantly negative returns. These results illustrate that most days within the event window are characterized by negative abnormal returns, although the relevant information has been delivered to the market before the announcement date, exerting a partial forward influence.

The left part of Panel B reports the mean cumulative abnormal returns (CAR) within the event window: (-10, -1), (0, 5), (0, 10), (0, 20), (0, 30) and (0, 60), as seen in rows 1 to 6. The mean, standard deviation, t values and p values of the t test for the cumulative abnormal returns are reported in Columns 2 to 5.

The cumulative abnormal returns exhibit a sharp decline after the announcement date, while the CARs before the announcement date are not statistically significantly different from zero, with a p-value of 0.119. In contrast, in the period after the announcement date, the CARs are significantly negative, with a p-value close to 0. Since 30 days after announcement, the cumulative abnormal returns gradually disappear, and are no longer significant after 60 days[8]. The dramatic decrease in CARs after the event date verifies the overvaluation caused by short sale constraints.

Figure 1 directly shows the changes in daily and cumulative abnormal returns from 30 days before the announcement date to 30 days after the announcement date. As seen in the figure, the cumulative abnormal returns fluctuate between -2% and 0 before the announcement date. Following the announcement date, the CARs decline until they reach their lowest point after 27 days. Daily abnormal returns show similar results: positive and negative returns balance each other before the announcement date, and the frequency of negative returns increases significantly after the announcement date. Nevertheless, we do not observe significant abnormal returns before

[8] The negative cumulative abnormal returns should ultimately disappear over a period of time following the event date. The increase in short-term supply caused by accumulated pessimistic expectations, together with an inelastic short-term demand curve, cause the stock price to decline. However, the non-sustainability of the surge in supply and the elastic long-term demand curve will move the stock price back to the original equilibrium level. Thus, the cumulative abnormal returns disappear after demand and supply achieve equilibrium again .

the announcement date, which suggests that the subsequent negative CARs do not originate from contrarian or momentum effects.

Table 3 Empirical results of abnormal return

Panel A: Daily Abnormal Return										
	Announcement date						Effective date			
Day	Mean	SD	t value	p/z value			mean	SD	t	p
				t-test	ST	BS				
-10	-0.0014*	0.0008	-1.70	0.09	0.003	0.087	0.0026***	0.0009	3.05	0.00
-9	-0.0007	0.0009	-0.74	0.46	0.481	0.461	-0.0004	0.0009	-0.40	0.69
-8	0.0052***	0.0010	5.33	0.00	0.000	0.000	-0.0009	0.0009	-1.01	0.32
-7	0.0037***	0.0010	3.62	0.00	0.011	0.001	-0.0029***	0.0009	-3.32	0.00
-6	-0.0007	0.0009	-0.82	0.41	0.352	0.402	-0.0058***	0.0008	-6.83	0.00
-5	-0.0021**	0.0010	-2.06	0.04	0.000	0.034	-0.0063***	0.0010	-6.64	0.00
-4	0.0005	0.0008	0.55	0.58	0.461	0.564	0.0019**	0.0010	1.79	0.07
-3	-0.0027***	0.0008	-3.53	0.00	0.000	0.000	-0.0005	0.0009	-0.49	0.63
-2	-0.0008	0.0008	-1.01	0.31	0.152	0.308	-0.0015	0.0009	-1.63	0.10
-1	-0.0050***	0.0009	-5.38	0.00	0.000	0.000	-0.0030***	0.0009	-3.24	0.00
0	0.0005	0.0009	0.57	0.57	0.923	0.561	-0.0052***	0.0011	-4.98	0.00
1	-0.0016*	0.0009	-1.73	0.09	0.034	0.079	-0.0031***	0.0009	-3.25	0.00
2	-0.0001	0.0009	-0.12	0.91	0.147	0.909	-0.0069***	0.0011	-6.45	0.00
3	-0.0049***	0.0010	-5.11	0.00	0.001	0.000	0.0029***	0.0009	3.27	0.00
4	-0.0045***	0.0010	-4.52	0.00	0.000	0.000	0.0015**	0.0009	1.74	0.08
5	-0.0076***	0.0010	-7.98	0.00	0.000	0.000	0.0028**	0.0010	2.67	0.01
6	-0.0086***	0.0012	-7.03	0.00	0.000	0.000	0.0027**	0.0010	2.85	0.01
7	0.0045***	0.0010	4.71	0.00	0.000	0.000	-0.0027**	0.0011	-2.41	0.02
8	0.0006	0.0009	0.69	0.49	0.062	0.494	-0.0001	0.0010	-0.07	0.95
9	0.0049***	0.0010	5.02	0.00	0.000	0.000	0.0043***	0.0010	4.39	0.00
10	0.0018**	0.0009	2.06	0.04	0.021	0.036	0.0058***	0.0010	6.01	0.00
Panel B: Cumulative Abnormal Return										
	Announcement day						Effective day			
Event	Mean	SD	t value	p/z value			mean	SD	t	p
Window				t-test	ST	BS				
(-10, -1)	-0.004	0.003	-1.600	0.119	0.171	0.109	-0.0167***	0.0029	-5.86	0.00
(0, 5)	-0.018***	0.002	-7.590	0.000	0.000	0.000	-0.0080***	0.0024	-3.32	0.00
(0, 10)	-0.015***	0.004	-4.050	0.000	0.000	0.000	0.0021	0.0038	0.54	0.59
(0, 20)	-0.020***	0.006	-3.460	0.001	0.001	0.001	-0.0099**	0.0054	-1.83	0.07
(0, 30)	-0.027***	0.007	-4.040	0.000	0.000	0.000	-0.0074	0.0064	-1.14	0.26
(0, 60)	-0.008	0.009	-0.840	0.403	0.162	0.398	0.0074	0.0094	0.79	0.43

The table shows the empirical results of abnormal returns based on CAPM. To calculate the abnormal returns, the paper chooses (-280, -31) as the estimation window, and (-30, 60) as the event window. All stocks with estimation window less than 200 days or event window less than 90 days are excluded out of sample. Three columns t-test, ST and BS report the p or z values of t test, Sign rank test and bootstrap test respectively. In bootstrap test, we resample 1000 times from the original sample to examine the significance of abnormal returns. *, ** and *** denote significance at 10%, 5% and 1% level, respectively.

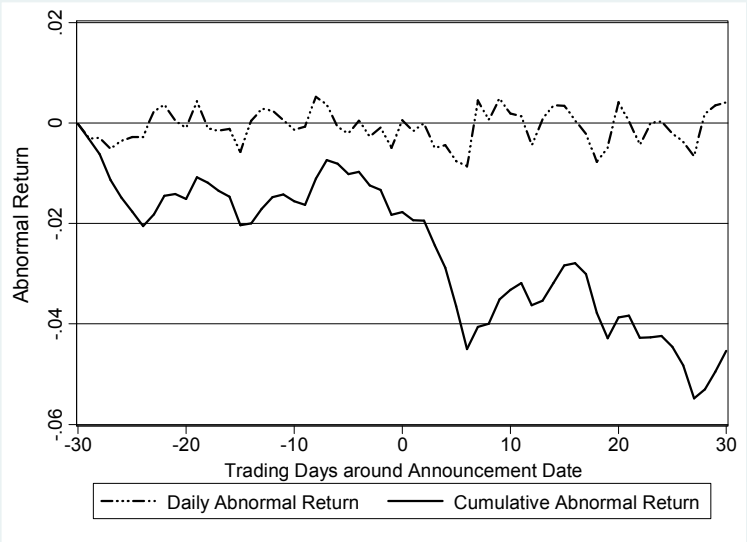

Figure 1 Daily and cumulative abnormal returns around announcement day

The figure displays daily and cumulative abnormal returns within the event window (-30, 30). The calculation method for abnormal returns is the same as before.

3.2.2 Non-parametric Test and Bootstrap

Two factors reduce the credibility of the t-tests. First, the distribution of abnormal returns is highly asymmetric, with skewness significantly greater than 0, which contradicts the assumption of t-tests of a symmetric normal distribution. Second, although the sample of stocks is relatively diverse in China, the stocks still share some common characteristics, such as large market capitalization and strong performance, which to some extent causes selection bias and endogeneity problems. We carry out two robustness tests[9] to address these problems.

To address the first problem, we conduct a signed-rank test and report the z values in the ST column in table 1. As a non-parametric test, a signed-rank test can effectively solve the problem of asymmetric distribution (Carrado, 1989). The z-values of our signed-rank tests are consistent with the p-values of our t-tests, which implies that the asymmetric distribution of abnormal returns does not affect our results.

As for the second problem, we implement a bootstrap simulation method proposed by Chang et al. (2007) to correct for the selection bias caused by the standard-meeting policy. Without loss of generality, we re-sample 1,000 times to obtain a more diversified sample. The z-value, shown in the BS column of table 3, implies significant negative cumulative abnormal returns following the announcement date.

3.2.3 Effective Date Effect

[9] Another general robust test to avoid the influence of extreme values is winsorization. Cowan and Sergeant (2001) determine that the standard of winsorization should be three standard deviations around the mean. This paper conducts the same operation by replacing extreme values with the mean plus or minus three standard deviations. As our results do not differ from those of the original t-test, we omit these results here.

Danielsen and Sorescu (2001) and Chang et al. (2007) suggest that, as short sale constraints are lifted substantially on effective date, overvaluation of designated stocks can be eliminated only afterwards. This conclusion, however, does not take into account the expectation effect. If an investor expects a sharp drop in a stock price after the relaxation of short sale constraints, his behavior and the stock price will be affected immediately upon reception of this information.

The right section of Table 3 indicates that the effect of the relaxation of constraints on the effective date is not significant in China. Specifically, the daily abnormal returns show little differences around the effective date. In addition, cumulative abnormal returns from day -10 to day -1 before the effective date reach -1.67% (p-value=0.00), while CARs from day 0 to day 5 are less negative, with a mean of approximately -0.8% (p-value=0.00). Nevertheless, after day 5， the CARs become even less negative or insignificant. Neither the daily nor the cumulative abnormal returns decline significantly after effective date. We find that the announcement date effect is stronger than the effective date effect. The reason for this finding may be that most price changes associated with removal of short sale constraints should be triggered by immediate distortions in investors' expectations and behavior upon receipt of news rather than by the otherwise nonexistent trading following the relaxation of constraints. In China's immature market, such an expectations effect appears likely to dominate.

IV. Heterogeneous Beliefs and Overvaluation

Short sale constraints will lead to overvaluation, given that investors have heterogeneous beliefs. The increase in the dispersion of heterogeneous beliefs should exacerbate the distortion of pessimistic beliefs and thus increase overvaluation (Boehme et al., 2006). However one essential principle is that with short sale constraints, only pessimistic beliefs are distorted, which are not clearly distinguished in empirical researches. Indicators of heterogeneous beliefs, with equal weights on upwards and downwards daily returns, cannot reflect the asymmetric effect of short sale constraints on optimistic and pessimistic beliefs. By using cumulative abnormal returns after announcement date as a proxy for overvaluation and introducing pessimism level indicators that can represent the asymmetric influence of short sale constraints, we analyze the impact of disperse pessimistic beliefs on overvaluation.

4.1 Measurement of Disperse Beliefs

Previous studies have proposed various proxies for investors' heterogeneous beliefs. Danielsen and Sorescu (2001) and Boehme et al. (2006) show a significant positive correlation between heterogeneous beliefs and the volatility of time-series returns. Thus, volatility are generally used as a proxy for heterogeneous beliefs. Harris and Raviv (1993) and Shalen (1993)

employ the volatility of raw returns (*Sdall*) as an indicator of heterogeneous beliefs, and Jones (2003) employs the volatility of abnormal returns (*Sdab*). However, as second-order moment index, volatility cannot fully reflect the fact that only pessimistic beliefs are distorted by short-sale constraints. In other words, while volatility can proxy for disperse beliefs, it cannot well proxy for the dispersion of merely pessimistic beliefs, which is needed exactly in studies of short sale constraints.

Thus we introduce indicators that can represent the asymmetric property of the return distribution. Thus, we utilize two pessimism level indicators. The frequency of negative abnormal returns (*Frnab*) is defined as the frequency of negative abnormal returns before the announcement date, which is positively correlated with investors' pessimism level. And the skewness of abnormal returns (*Skabb*) is defined as the skewness of the distribution of abnormal returns before the announcement date. Third-moment skewness is a natural measure of distribution asymmetry. The more negative *Skabb* is, the more strongly abnormal returns are distributed to the left and thus the greater is the pessimism level. *Frnab* and *Skabb* represent the frequency and degree of the pessimist belief respectively.

The other way to measure disperse beliefs is turnover[10] index based on trading volume proposed by Chang et al. (2007). Following them, we also constructs two turnover index, namely, the average daily circulation turnover (*Avtc*) and average daily total turnover (*Avturn*), with the presence of both circulation shares and total shares in Chinese stock market.

Nevertheless, we introduce two additional indicators, specifically, refinancing dummy variables (*Tdummy*) and ex ante average abnormal returns (*Alpha*), to reflect the impact of the implementation of refinancing policy and contrarian effects. *Tdummy* splits the sample based on the implementation date of the refinancing policy (13 August 2012), setting the 271 addition events before that date to 0 and the 107 events after that date to 1. *Tdummy* is defined as follows:

$$Tdummy \quad \begin{matrix} 0, & Before\ Refinancing \\ 1, & After\ Refinancing \end{matrix}$$

Alpha, which we employ to detect contrarian and momentum effects, is defined as average abnormal returns from day -30 to day 0. If *Alpha* is negatively correlated with cumulative abnormal returns after the announcement date, then there exists a significant contrarian effect, while a positive correlation implies a significant momentum effect. If no correlation is found, neither effect is significant. Table 4, which presents descriptive statistics, divides the above indicators into three categories: heterogeneous belief indicators (*Dispersion*), pessimism level indicators (*Pessimism*) and other stock property indicators (*Property*).

[10] Turnover is defined as the proportion of trading volume per day compared with total shares outstanding. In this paper, turnover is calculated by dividing *Trv* by *Mv*, where *Trv* is the daily transaction volume and *Mv* is the total market value (*Tmv*) or circulation market value (*Cmv*). *Trv*, *Tmv* and *Cmv* are calculated by multiplying trading volume, total shares outstanding and circulation shares outstanding, respectively, by the closing stock price.

Table 4 Descriptive statistics

Variables	Obs	Mean	Std. Dev.	Min	Max	Skewness	t-value
			Dispersion				
Sdab	378	0.04	0.04	0.01	0.7	9.75	14.56
Sdall	378	0.04	0.04	0.01	0.7	9.95	17.51
Avtc	378	18.73	12.91	1.28	102.77	1.76	27.01
Avturn	378	12.57	7.7	0.34	40.59	0.79	30.92
			Pessimism				
Frnab	378	0.54	0.03	0.45	0.64	0.26	368.25
Skabb	378	3.81	7.37	-0.48	36.42		10.88
			Property				
Tdummy	378	0.26	0.44	0	1	1.12	12.2
Alpha	378	-0.0006	0.0032	-0.0092	0.0084	0.16	-3.68

4.2 Empirical Model

To study the impact of investors' heterogeneous beliefs on overvaluation, we regress overvaluation on these three types of indicator as follows:

$$Overvaluation = c_1\ Dispersion + c_2\ Pessimism + c_3\ Property$$

We choose cumulative abnormal returns from day 0 to day 20, *CAR(0,20)*, as a proxy for overvaluation. The more negative *CAR(0,20)* is, the greater is the overvaluation associated with short sale constraints. Thus, *CAR(0,20)* is negatively correlated with overvaluation. Four diversification indexes, *Sdab*, *Sdall*, *Avtc* and *Avturn*, are all positively correlated with belief heterogeneity. If increased difference of investor beliefs increases overvaluation, then all four dispersion indicators should be negatively correlated with *CAR(0,20)*.

As noted above, *Frnab* is positively and *Skabb* negatively correlated with pessimism level indicators. A higher *Frnab* and a more negative *Skabb* imply, ex ante, a higher probability and a greater degree of pessimistic beliefs, which should significantly intensify overvaluation and generate a more negative *CAR(0,20)*. Thus, *Frnab* and *Skabb* should be negatively and positively correlated with *CAR(0,20)*, respectively.

Finally, if implementation of refinancing policy leads to a further relaxation of short sale constraints, then following the implementation date, *CAR(0,20)* should be more negative; thus, we should observe a negative coefficient for *Tdummy*. At the same time, we do not expect negative cumulative abnormal returns to originate from contrarian or momentum effects - hence, the significance of the coefficient for *Alpha*.

4.3 Empirical Results for Three Types of Indicators

Table 5 shows the results of a cross-sectional regression of overvaluation on three types of indicators. We first conduct a single variable regression on the eight indicators and report the results in models (1) to (8).

Consistent with our expectations, turnover indexes, as diversification indicators derived from trading volume, are significantly negatively correlated with cumulative abnormal returns from day 0 to day 20. With a 1% increase in *avtc* or *avturn*, cumulative abnormal returns drop by approximately 0.002%, as models (5) and (6) suggest.

By contrast, volatility indexes, as dispersion indicators derived from the distribution of raw or abnormal returns, are not significantly correlated with *CAR(0,20)*, as shown in models (1) and (2). Compared with trading volume, return distributions can directly represent investor expectations. Thus, when daily return distributions are used to construct dispersion indicators, the asymmetric influence of short sale constraints on overvaluation should be stressed. If most differences in volatility between stocks result from diverse optimistic beliefs, which will not be distorted by short sale constraints, volatility cannot provide a good proxy for diversity of pessimistic beliefs.

Furthermore, models (3) and (4) confirm the significant relationship between overvaluation and pessimism level indicators, as predicted, which verifies the necessity of using these indexes. A 1% increase in *Frnab* and a 1 unit decrease in *Skabb* lead to a more negative *CAR(0,20)* by 0.9% and 0.2%, respectively. To summarize models (1) to (6), the dispersion indicators drawn from trading volume can effectively represent the dispersion of investors' beliefs, while the indicators derived from the return distribution require different weights for optimistic and pessimistic beliefs, as average-weighted indexes cannot reflect the asymmetric effects of short sale constraints.

As for the influence of other property indexes, models (7) and (8) indicate an insignificant coefficient for *Alpha* and a positive coefficient for *Tdummy*. The insignificance of *Alpha* suggests that cumulative abnormal returns after the event date are independent of abnormal returns preceding the event date, so that contrarian and momentum effects are not present. However, in contrast with expectations, a significant and positive *Tdummy* indicates that cumulative abnormal returns following implementation of the refinancing policy are 9.7% less negative on average, while the mean value for *CAR(0,20)* is merely -2%.

To verify our conclusions, we construct models (9) through (12) by simultaneously employing two types of indicators. The results are stable: average turnover and *Frabb* significantly affect overvaluation, while the influence of *Alpha* is not significant. In addition, the coefficient for *Tdummy* is consistently close to 9% in all models.

However, do these results necessarily suggest that refinancing further reinforces short sale constraints? Figure 2 and Table 6 illustrate the real variations in abnormal returns after refinancing. Figure 2 divides all samples into two subsets based on the implementation date of the refinancing policy, visually presenting cumulative abnormal returns around the announcement date. Following refinancing, abnormal returns adjust much more quickly than before, reaching their nadir on day 7, while CARs remain substantial even on day 60 before refinancing.

Table 5 Empirical Results of Overvaluation

Independent Variables	Dependent Variables: *CAR*(0, 20)														
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Sdab	-0.005														
	(0.118)														
Sdall		-0.012													
		(0.120)													
Frnab			-0.890***						-0.643***	-0.686***			-0.820***	-0.632***	-0.626***
			(0.203)						(0.210)	(0.192)			(0.203)	(0.192)	(0.208)
Skabb				0.002**											
				(0.001)											
Avtc					-0.002***						-0.002**				
					(0.000)						(0.000)				
Avturn						-0.002***						-0.002***	-0.002***	-0.002**	-0.002**
						(0.001)						(0.001)	(0.001)	(0.001)	(0.001)
Tdummy							0.097***		0.091***	0.091***	0.094***	0.094***		0.089***	0.089***
							(0.0120)		(0.012)	(0.012)	(0.012)	(0.012)		(0.012)	(0.012)
Alpha								2.801	0.940						0.144
								(1.836)	(1.83)						(1.850)
Constant	-0.020***	-0.020**	0.459***	-0.028***	0.002	0.010	-0.031***	-0.019***	0.300***	0.323***	-0.031***		0.448***	0.317***	0.313***
	(0.007)	(0.008)	(0.110)	(0.007)	(0.010)	(0.011)	(0.010)	(0.006)	(0.113)	(0.104)	(0.010)		(0.109)	(0.103)	(0.113)
Obs	378	378	378	378	378	378	378	378	378	378	378	378	378	378	378
R-squared	0.001	0.001	0.048	0.012	0.021	0.028	0.145	0.008	0.174	0.173	0.155	0.164	0.069	0.187	0.187

The table reports the empirical results of overvaluation. Standard deviations of corresponding parameters are reported in parentheses. All results are reported to three significant digits. *, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.

Table 6 Effect of Refinancing on Overvaluation

Cumulative Abnormal returns								
Event window		Mean	S.D.	t-value	p-value / z-value			
					t-test	ST	BS	
(-10, -1)		-0.009	0.006	-1.43	0.157	0.148	0.159	
(0, 5)		- 0.028***	0.004	-6.68	0.000	0.000	0.000	
(0, 10)		-0.002	0.007	-0.29	0.773	0.320	0.764	
(0, 20)		0.049***	0.009	5.18	0.000	0.001	0.000	
(0, 30)		0.040***	0.014	2.81	0.006	0.009	0.004	
(0, 60)		0.076***	0.021	3.56	0.001	0.003	0.398	
Independent Variables		Tdummy	Frnab	Avturn	Alpha	Constant	Obs	R-squared
$CAR(0, 5)$	(1)	-0.014***				-0.014***	378	0.018
		(0.005)				(0.003)		
	(2)	-0.017***	-0.213**	-0.001**	-0.137	0.107**	378	0.043
		(0.005)	(0.0915)	(0.000)	(0.812)	(0.05)		

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

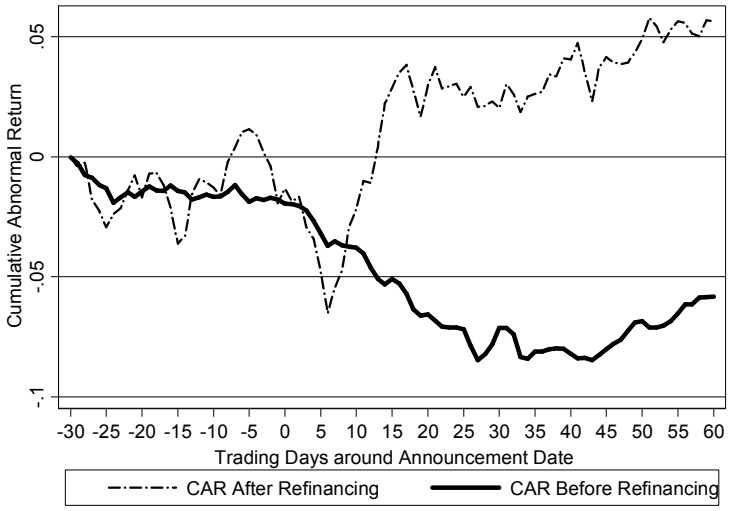

Figure 2 Cumulative Abnormal Returns before and after Refinancing

The upper part of table 6 shows cumulative abnormal returns following refinancing. Cumulative abnormal returns on day 5 are negatively significant, and on day 10, they are insignificant. Given the quicker adjustment of stock prices following refinancing, we should use a shorter interval to study the impact of refinancing. Applying regression analysis to cumulative abnormal return from day 0 to day 5, we find that, compared with events before the implementation of refinancing, subsequent CARs are 1.7% more negative, indicating that refinancing significantly relaxes short sale constraints.

Finally, we regress overvaluation on the three types of indicators simultaneously. As models (13) to (15) suggest, each 1% increase in Frnab and Avturn decrease *CAR(0,20)* by approximately 0.6% and 0.002%, respectively, while the impact of Alpha is insignificant. Consistent with the results of the aforementioned regressions, these findings indicate that the dispersion and

pessimism indicators significantly impact overvaluation, while contrarian and momentum effects do not.

In this section, we reach the stable conclusion that dispersion of heterogeneous beliefs are positively correlated with overvaluation and suggest options for constructing proxies for pessimistic beliefs in the presence of short sale constraints. We find, however, that negative cumulative abnormal returns do not result from contrarian and momentum effects, which solidifies our findings. Finally, we observe a more flexible price discovery function following refinancing.

V. Short Sales Constraints and Market Efficiency

Scholars have studied the relationship between short sale constraints and market efficiency but have not reached a consensus regarding this relationship. Hong and Stain (2003) build a theoretical model and show that short sale constraints impede the dissemination of bad news and that the accumulation of bad news should ultimately lead to a market crash. The implication of their model is that short sale constraints increase the frequency of extreme negative returns and decrease the skewness of stock returns. However, the empirical study of Birs et al. (2007) finds no difference in skewness or frequency of extreme returns with different degrees of short sale constraints. Finally, Saffi and Sigurdsson (2011) find that low volatility is significantly related to reduced short sale constraints.

For each addition to the list of stocks qualified for short selling, we select a pre-event windows (-300,-30) and a post-event window (30,300) and thus divide our trading data into two subsamples. As shown in Table 7, for robustness, the paper compares four indexes of stock return distributions before and after the relaxation of short sale constraints by applying t-tests, a signed-rank test and a sign test to both raw and abnormal returns simultaneously.

First, we find significant drops in the mean of stock returns after additions. The means of abnormal returns is a significant 0.1% prior to additions and an insignificant 0.02% after additions, which suggest an significant nonnegative alpha with short sale constraints and an almost insignificant one without. As for differences in means and standard deviations, t-tests (t-value=-13.57), the signed-rank test (p-value=0.00) and the sign test (p-value=0.00) unanimously indicate that mean stock returns fall significantly after stocks are admitted to the list. The sharp decline in the significance of abnormal returns suggests that the abnormity of individual stock returns decreases.

In addition, the ex-ante standard deviations of raw and abnormal returns are 0.0444 and 0.0376, while ex-post, they are 0.0241 and 0.0187, respectively. The difference between the standard deviations of raw and abnormal returns is significant, with t-values of -8.03 and -7.33, respectively, and p-values for the signed-rank test and the sign test equal to 0.00 in all cases. Although these results do not necessarily imply a decrease in volatility or an increase in efficiency at the market level, for individual stock volatility will be diversified in market portfolio, they do

provide intriguing evidence at the individual stock level.

Table 7 Difference in Distribution Characteristics of Returns before and after Additions

		Before event		After event		Significance of Difference		
		Mean	Median	Mean	Median	t-value	SR	ST
Mean	Ab	0.001***	0.001	0.0002*	0.0001	-6.47***	0.00	0.00
		(9.17)		(1.58)				
S.D.	Raw	0.044***	0.0362	0.024***	0.024	-8.03***	0.00	0.00
		(17.51)		(87.48)				
	Ab	0.038***	0.028	0.019***	0.018	-7.33***	0.00	0.00
		(14.56)		(63.99)				
Skewness	Raw	3.16***	0.093	0.197***	0.203	-8.20***	0.00	0.00
		(8.76)		(12.25)				
	Ab	4.28***	0.718	0.677***	0.630	-9.11***	0.00	0.00
		(10.88)		(22.83)				
Extreme Values	Raw	0.027***	0.0318	0.009***	0.012	-24.87***	0.00	0.00
		(44.08)		(17.16)				
	Ab	0.023***	0.022	0.009***	0.010	-20.78***	0.00	0.00
		(45.37)		(15.36)				

The table reports the statistics of daily stock returns before and after additions. The t-value of corresponding parameters is reported in parenthesis. Mean, S.D., Skewness and Extreme Values refers to the average returns, standard deviation of returns, skewness of returns, and the frequency of negative extreme values. Negative extreme Values are defined as the daily return that is less than average return minus two standard deviation. The t-value, p value of Signed Rank Test and p value of the Sign Test are reported in Column "t-value", "SR" and "ST". *, ** and *** denote significance at the 10%, 5% and 1% level, respectively.

More importantly, we observe less positive skewness, which implies a much more symmetric distribution of returns. After the additions, average skewness of raw returns decreases from 3.16 to 0.20, and that of abnormal returns decreases from 4.28 to 0.63, with t-values for these difference equal to -8.20 and -9.11, respectively, and p-values for the signed-rank test and sign test equal to 0.00 in all cases. In contrast with Hong and Stain (2003), whose theoretical model emphasizes the dramatic decline in skewness caused by increasing negative extreme returns in a market crash scenario, we argue that if the frequency of market crashes is low, overvaluation should cause the distribution of stock returns to shift rightward, increasing the skewness of the distribution. In recent years, the frequency of market crashes in China[11] has not been sufficiently high to counter the overvaluation effect, and skewness turns out to be less positive after additions.

Finally, the frequency of extreme returns shows a sharp decline after additions, which suggests the daily stock returns are much less fat-tailed. The average frequency of extreme values of raw returns decreases from 2.7% to 0.9%, and that of abnormal returns decreases from 2.3% to 0.9%, with t-values of -24.87 and -20.78, respectively, and p-values for the signed-rank test and sign test equal to 0.00 in all cases. Theoretically, the weakened impact of market crashes after the short sale constraints are repealed, should lead to a lower frequency of extreme negative values.

[11] The limits on fluctuation of daily returns (No more than 10% for individual stock) in the Chinese stock market may further reduce the probability of market crashes.

At the individual stock level, we find significantly smaller means, standard deviations, skewness values and frequencies of negative extreme values after stocks are added to the qualification list, indicating that the degree of abnormity, volatility, asymmetry of returns, probability of extreme values and market crashes all decrease. These findings provide strong evidence of an improvement in market efficiency at individual stock level after short sale constraints are lifted.

VI Conclusion

By applying an event study to 511 additions of stocks to the list of securities qualified for short selling, we find that (1) significant negative cumulative abnormal returns after additions confirm that short sale constraints cause overvaluation of stocks; (2) standard deviations do not effectively represent the dispersion of pessimistic beliefs, and empirical results for pessimism level indicators show that the degree of overvaluation is exclusively influenced by distortions caused by pessimistic beliefs; (3) the implementation of short sales in China has significantly reduced ex post volatility, asymmetry and extreme value frequencies of daily stock returns and effectively improved market efficiency.

Our research complements existing literature by more effectively addressing endogeneity issues. In addition, our research contributes to our understanding of the influence of short sale constraints on investors' beliefs by proposing investor pessimism indicators that overcome the disadvantages of current indicators that place equal weight on pessimistic and optimistic beliefs. Nevertheless, we provide substantial evidence of improvement in market efficiency after stocks are added to the list of shortable securities. We believe our findings have useful implications for both researchers and policy makers.

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