Are Short Sellers Informed?
Evidence from the Short-selling Activities before Trading Halts

Ting Hu[a,*], Luofeng Zhou[a]

[a]*Economics and Management School, Wuhan University, China*

Abstract

The source and nature of the information on which short sellings is based is an important question to academics and regulatory authorities. This paper explores the sources of information of short-sellers in the Chinese stock market in the context of the trading suspensions of the listed firms from 2010 to 2017. We find that short-sellers establish a significant level of abnormal short-selling before trading suspensions due to significant matters that involve relatively more private information. In contrast, there is no such phenomenon before the trading halts with relatively little private information. Further investigations show that the abnormal short-selling before trading suspensions due to significant matters has a significant negative relationship with the cumulative return after trading resumptions, while the relation does not exist for the trading halts with relatively little private information. The above findings are robust to the considerations of market tranquility after the resumption of trading, the speculative risk-taking behavior of short sellers, their speculative voluntary liquidity incentives, and the impact of changes in short-selling regulatory policies. Finally, we examine the potential investment value of the short-selling activities before trading halts for other uninformed investors.

Keywords: Short-selling, Informed Trading, Private Information, Stock Trading Halts

1. Introduction

Short sellers' trading activities were found to have the ability to predict future returns on stocks (Boehmer et al., 2008; Diether et al., 2009; Chang et al., 2014, etc.), and they are often able to correctly short the stocks whose prices are overvalued to obtain excess returns while avoiding short stocks that are undervalued in the meantime (Au et al., 2009; Boehmer et al., 2010). However, the nature and source of the information on which short-sales are based has not yet been fully understood by scholars and investors. Some studies suggest that short-sellers can obtain private information related to future stock movements before the average investor, thus establishing a corresponding short-selling strategy in advance to obtain excess returns (Christophe et al., 2004, 2010; Chakrabarty and Shkilko, 2013; Berkman et al., 2016; Zhang et al., 2016; Yu et al., 2017); and another part of the studies found that short sellers are only more acute and have more powerful processing ability for public information such as company news and observable market

anomalies than average investors (Wu and Zhang, 2015; Blau and Wade, 2012; Engelberg et al., 2012; Curtis and Fargher, 2014).

Researches on whether short-sellers have private information related to the future return on stocks often need to use events that contain private information related to future corporate value, and then study the characteristics of short-selling activities prior to such events and pre-event sales and the relation between the short-selling activities and the stocks' return after the public disclosure of the information to infer whether the short sellers preserve private information related to the event. Under this research framework, this paper firstly uses trading halts, which has a great influence on stock prices, in Chinese A-share stock market to study whether short sellers in China have private information related to trading halts.

Trading halts usually contains important information related to the company's future value, and the stock price after the resumption of trading often shows large fluctuations due to the influx of new information (Liao et al., 2009; Hu et al., 2017). Therefore, the halts of listed companies has obvious investment value for investors (especially investors with information advantages). According to the relevant disclosure data of the administrative penalties on the website of the China Securities Regulatory Commission (CSRC), in Chinese stock markets, many transactions driven by private information before the suspension has been punished every year. By the end of 2017, the CSRC had issued a total of 1039 administrative penalty decisions, of which 235 were penalized for the use of private information related to suspension of major events[1]. It can be seen that the information related to the company's future stock price contained in trading halts has the possibility of inducing short-sellers to conduct informed trading, and also provides us with research opportunity for the sources and nature of short-sellers' information in Chinese stock market.

This paper combines the trading halts data and the short-selling data before the suspension from the start of the margin financing and trading mechanism in China to the end of 2017. The following two questions are studied: First, Is there a significant difference compared to other trading days that are not suspended in the level of short-selling activities before the suspension? If the level of short-selling activity before the suspension is significantly different from other trading days that are not suspended, then we will study the second question, whether the abnormal short-selling activity before the suspension can reflect the ability to predict in advance that information contained in the short-seller's suspension may have. If the short sellers obtain the private information related to the suspension in advance and conduct the corresponding informed transactions, they will establish higher-than-normal short positions before the suspended stock with high expected return rate after the resumption, while avoiding or reducing the short position for suspended stocks with low expected returns after the resumption of trading. In other words, if the short sellers have private information related to the suspension and conduct the corresponding informed transactions, we will find that the short-selling volume before the suspension is significantly negatively correlated with the rate of return after the resumption.

In order to answer the above questions, this paper first studies the distribution characteristics of short-selling trading activity indicators and the level of abnormal short-selling trading volume before different types of suspension events. We find that short-sellers' choices for the trading halts of stocks are characterized by specific objectives and high selectivity. At the same time, when we classify the suspension events according to the suspension reasons, we only find significant abnormal short-selling volume in trading halts driven by major events with high levels

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[1]This data is compiled through panalty data disclosed by CSRS.

of private information. And we did not find evidence of abnormal short-selling activity consistent with short-selling based on private information before the trading halts driven by the general meetings of non-halt periods and other reasons. In sum, we believe that the characteristics of short-selling transactions prior to suspension are consistent with the characteristics of short-selling traders' informed trading related to suspension.

Furthermore, based on the classification of trading halts according to the reasons for them, we follow the analysis framework of Christophe et al. (2004) which used multiple regression analysis on the short-selling volume before the trading halts and the stock return after the resumption. The results show that there is a significant negative correlation between the short-selling event of the major events driven trading halts with high private information content and the long-term trading halts of the halting period and the cumulative return rate of the 10 trading days after the resumption of trading. We did not find this relationship until the relatively low-informative routine halts (trading halts driven by the general meeting) and short trading halts. This shows that a considerable proportion of short-sellers in China have private information related to suspension and have conducted corresponding informed transactions. Further robustness tests show that after controlling the market situation after the resumption of trading, the speculative risk-taking behavior of short sellers, the speculative voluntary liquidity incentives of short sellers, and the changes in China's short-selling regulatory policies, the above results are still robust. Finally, from the perspective of constructing the corresponding investment strategy, this paper examines the possible investment value of the forecasting ability of the abnormal short-selling before the trading halts to the return rate after the resumption of trading for investors who do not have private information related to contents of the events.

The contributions of this paper are threefold: First, the existing literatures on the nature and source of the information on which the short-selling is based have studied earnings announcement (Christophe et al., 2004; Berkman and McKenzie, 2012), analysts' downgrade or recommendation (Christophe et al., 2010; Boehmer et al., 2018), private placement of stocks (Berkman et al., 2016), insider sales (Chakrabarty and Shkilko, 2013), etc. Based on the short-selling activities around the events, this paper first studies the short-selling activities around the trading halts of listed companies, and provides new empirical evidence for the sources and nature of short sellers' information advantages.

Second, current research on the nature and origin of information on short sellers is concentrated in developed markets (Christophe et al., 2004; Berkman et al., 2016; Boehmer et al., 2018, etc.) while research in emerging market countries with more frequent informed transactions is limited, and similar research on the sources and nature of information on short sellers in China is even more scarce. This paper fills this blank on the information nature of short sellers in emerging markets from the new research perspective of the trading halts of listed companies in Chinese listed stocks.

Third, most of the existing literature uses monthly short-selling transaction data (e.g. Singal and Xu, 2005; Karpoff and Lou, 2010) or short-term short-selling transaction data to conduct related research. We believe that monthly short-selling data is not consistent with the short-term trading strategies of short sellers and cannot effectively capture changes in short-selling transactions (Diether, 2008; Diether et al., 2009); and most of the existing research (e.g. Henry and Koski, 2010; Chakrabarty and Shkilko, 2013) used daily short-selling data from the short-selling data disclosed in the pilot experiments of the US SHO rules implemented between 2005 and 2007, and therefore limited to a quite short time interval [2]. Different from the above research,

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[2] The short-selling data disclosed in the pilot experiment of SHO rule began from January 1, 2005 to August 6, 2007.

this paper makes use of the daily short-selling data of about eight years from the launch of margin trading (March 31, 2010) to the end of 2017, and more comprehensively tested the short selling transactions about the nature of the information during this period. It is also more in line with the characteristics of the short-term trading strategy of short selling.

2. Literature Review on the Source and Nature of Short Sellers' Information

A large amount of research evidence shows that short-selling activities can effectively predict the future return of stocks. In this context, relevant scholars have begun to conduct more in-depth research on the specific source and nature of the information on which short-selling is based. Using events that contain private information related to the future value of firms, relevant studies found that short sellers can pre-interpret the contents of the listed company's earnings announcements, as they could therefore establish a higher-than-average short position before the negative earnings are disclosed to the public and perform predictive power for stock price declines after disclosure (Christophe et al., 2004; Berkman and McKenzie, 2012; Boehmer et al., 2018). Some scholars have also carried out important research based on the financial statement information of listed companies in China: Zhang et al. (2016) used the quarterly announcement of listed companies to study the relationship between margin trading and insider trading, but their measurement of short-selling only indicated whether the company allowed short-selling, but did not directly measure the target companies' short-selling[3]. Apart from the fact that the research events are completely different, compared with Zhang et al. (2016), this paper directly measures and tests the short-selling volume indicators before the trading halts, thus more directly studying whether the short sellers' activities are driven by private information related to trading halts. Xu et al. (2016) used the performance disclosed in the annual reports and the penalty announcement of major events from CSRC to study short sellers' informed trading behavior in China's stock market. The conclusions are in support of the assumption that the short sellers in China have obtained relevant private information in advance. Yu et al. (2017) conducted a separate study on the two types of margin trading (i.e. margin financing and short-selling) before the announcement of the earnings announcement of listed companies. They believed that the short-selling behavior before the event was informed while financing transaction behavior was more speculative.

Apart from studying the periodic disclosed events such as earnings announcements, subsequent research have extended the research perspective to a number of nonperiodic informative events. Time is not fixed and is therefore more difficult to predict for investors who do not preserve private information. Previous studies found that there was a significant increase in short sales before the public disclosure of insider sales; at the same time, the size of the short sales and the level of the insiders are positively correlated to the size of the insider sales (Chakrabarty and Shkilko, 2013; Khan and Lu, 2013), indicating that short sellers have prior private information related to insider trading. Similar events include analysts' downgrade or recommendation (Christophe et al., 2010; Meng et al., 2017), stock issuance of listed companies (Henry and Koski, 2010), private placement of stocks (Berkman et al., 2016) and the financial fraud of listed companies (Karpoff and Lou, 2010).

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[3]If short-selling is only used to determine whether the short-selling is likely to be caused by the fact that the stocks allowing the margin trading are different from the other stocks in terms of company-level characteristics, it may have a misleading impact on the conclusion.

Unlike the above studies, other scholars have linked public information to short-selling for analysis. Evidence is found that a large part of the information advantage of short-sellers compared to other investors actually comes from their public information (for example excellent processing ability for financial statements, indicators that reflect the company's fundamental and market capital ratios, company news reported by the media and so on. Dechow et al. (2001) argued that short sellers are good at finding stocks with low fundamental to market capitalization, and because such stocks often have lower expected returns, short sellers can profit from them. But he also stressed that such short sales are usually accompanied by high transaction costs. Similarly, Drake et al. (2011) used a combination of 11 indicators that reflected the companies' fundamental to compare short sellers with security analysts in dealing with the company's fundamentals, based on affirming the ability of short sellers to process public information. Differences in the information on the indicators indicate that short selling can promote the discovery process of stock prices, while securities analysts hinder this process. Engelberg et al. (2012) combined all company news information in the Dow Jones News Archive with short sales to analyze the characteristics of short-selling around the company's press release. They found that the information advantage of short sellers is largely due to their ability to analyze and process public information. Curtis and Fargher (2014) found that short sellers are good at discovering stocks whose stock prices are overvalued from the company's financial statements. In addition to using the fundamental information, they also extract useful information from accruals and asset growth indicators in the financial statements.

In summary, there is currently no uniform conclusion about the source and nature of the information on which short sellers conduct short sales. This paper explores whether the short sellers in China preserve private information related to the trading halts and conduct corresponding informed transactions by taking advantage of trading halts in Chinese stock market that contain private information and have a significant impact on stock prices and therefore provides new empirical evidence for explaining the source of the information advantage of short sellers.

3. Data Source and Variables

3.1. Data Source and the Sample

The sample period studied in this paper ranges from March 31, 2010 to December 31, 2017, of which March 31, 2010 is the initial launch time of margin trading in Chinese stock markets. Since we are studying short sales around trading halts, the sample in this article only includes stocks in the margin trading list. At the same time, we have dealt with the sample as follows: (1) Stocks are only suspended for one hour when the abnormal fluctuation is announced, and the suspension is rule-based trading halts, which is difficult for short sellers to utilize to form short positions, so we exclude these type of trading halts[4]. (2) We remove those sharing multiple trading halts within the inspected window. (3) In order to rule out the impact of events other than suspension, we also excluded those containing changes in analyst ratings, the publication of company periodic financial reports or the existence of dividend distribution announcements with in the inspected window. (4) In order to reduce the influence of outliers on the research results, the variables are trimmed according to the 1% and 99% standards. The short-selling data and the trading halts data in this paper are all from China Stock Market and Accounting Research database (CSMAR).

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[4]Related regulation requests an one-hour trading hal after abnormal volatility becomes public from 2002 in China.

3.2. Variable Definition

3.2.1. Independent Variables

The two independent variables in this research specify the abnormal short-selling activities before trading halts. We use the following two indicators to measure abnormal short-selling activities before trading halts: (1) Daily Average Abnormal Short-selling, $ABSS$. Related studies on the content of short sellers (Christophe et al., 2004; Christophe et al., 2010; Chakrabarty and Shkilko, 2013) usually examine unusual short-selling transactions within a short time window around events. We used the practice of the previous literature to calculate the average daily short selling of 10 trading days (-10,-1) before trading halts on the total window, i.e. 20 trading days before the halting date plus 20 trading days after the resumption. At the same time, we use the period between 20th and 11th trading day before the suspension, (-20, -11), plus the period between 11th and 20th trading day after the resumption, (+11, +20), to represent the normal period. Daily average short-selling in the comparison interval (20 trading days in total) is calculated. The abnormal short-selling volume ($ABSS$) of this paper measures the difference between the daily average short-selling volume of the 10 trading days before the suspension and the daily average short-selling volume of the comparison interval:

$$ABSS(-10, -1) = \frac{SS(-10, -1)}{NORMSS} - 1, \tag{1}$$

where $SS(-10, -1)$ represents the average daily short-selling volume for the ten days before the trading halts and $NORMSS$ represents the daily average short-selling volume for the comparison interval. (2) Daily Average Relative Short-selling, $RELSS$. In order to control the impact of trading volume on short-selling volume, we also calculated the daily average ratio of short-selling to total trade volume of 10 trading days (-10, -1) before trading halts:

$$RELSS(-10, -1) = \frac{SS(-10, -1)}{Trade\ Volume(-10, -1)} - 1, \tag{2}$$

where $SS(-10, -1)$ represents the average daily short-selling volume for the ten days before trading halts and $Trade\ Volume(-10, -1)$ represents the daily average trade volume for the same period.

3.2.2. Dependent Variable

The dependent variable is the cumulative return from the resumption date to ten trading days after that, $RET(0, +10)$. In order to check whether the short sellers utilize private information related to trading halts, we examine the relationship between the abnormal short-selling activity before the events and the cumulative return after the resumption. If the short sellers preserve relevant private information, a negative correlated cumulative return with the abnormal short-selling activity before the events should be observed. Since the reaction time of trading halts (especially for those driven by major events) is relative longer than periodic events like earnings announcements, we choose a bigger time window from the resumption date to 10 days after.

3.2.3. Controlled Variables

Other influencials in the regression include: (1) Cumulative return prior to trading halts, $RET(-10, -1)$. (2)Daily Average Abnormal trading volume prior to trading halts, $ABVOL(-10, -1)$, defined as:

$$ABVOL(-10, -1) = \frac{VOL(-10, -1)}{NORMVOL} - 1, \tag{3}$$

where $VOL(-10)$ represents the average daily trade volume of the 10 trading days prior to trading halts and $NORMVOL$ represents the average trading volume during the comparison interval. (3) The volatility during the prior period $\sigma(-10, -1)$. It is defined as the daily average volatility σ_t for the 10 trading days before trading halts, where σ_t denotes the difference between the highest and the lowest price within a trading day divided by the highest price. (4) Buy order imbalance $OIMB^+(-10, -1)$. We will segment the transactions into buyer and seller orders, and the order imbalance on day t is defined as:

$$OIMB_t = buy_t - sell_t. \tag{4}$$

When $OIMB_t \geq 0$, $OIMB_t^+ = OIMB_t$; otherwise $OIMB_t^+ = 0$. (5) A dummy variable ($POLICY$) representing the change of regulation on margin trading system in 2015. On July 1, 2015, CSRC introduced new regulation and imposed stricter supervision on margin trading. To control the impact on short selling activities, we construct the corresponding dummy variable $POLICY$. Samples after July 1, 2015 hold $POLICY = 1$, otherwise equals to zero.

The definitions of variables involved in the empirical analysis of this paper are concluded in Table 1:

Table 1: Variable Definition

Variable	Variable Name	Variable Definition
$ABSS(-10, -1)$	daily average abnormal short-selling for the ten trading days before trading halts	$ABSS(-10, 1) = \frac{SS(-10,-1)}{NORMSS} - 1$
$RELSS(-10, -1)$	daily average relative short-selling for the ten trading days before trading halts	$RELSS(-10, -1) = \frac{SS(-10,-1)}{Trade\ Volume(-10,-1)}$
$NORMRELSS$	daily average relative short-selling for non-halt period	$NORMSS = \frac{SS(-20,-11) \cup (+11,+20)}{NORMVOL}$
$ABVOL(-10, -1)$	daily average abnormal trade volume for the ten trading days before halts	$ABVOL(-10, -1) = \frac{VOL(-10,-1)}{NORMVOL} - 1$
$RET(0, +10)$	cumulative return from resumption to ten days after	$RET(0, +10) = \frac{CLOSE_{+10}}{CLOSE_{-1}} - 1$
$RET(-10, -1)$	cumulative return for the ten trading days before halts	$RET(-10, -1) = \frac{CLOSE_{-1}}{CLOSE_{-11}} - 1$
$\sigma(-10, -1)$	average volatility for the ten trading days before halts	$\sigma(-10, -1) = \frac{1}{10} \sum_{t=-10}^{-1} \frac{HIGH_t - LOW_t}{HIGH_t}$
$OMIB(-10, -1)$	buy-order imbalance for the ten trading days before halts	When $OIMB_t \geq 0$, $OIMB_t^+ = OIMB_t$; otherwise $OIMB_t^+ = 0$.
$POLICY$	policy dummy variable	Samples after July 1, 2015 hold $POLICY = 1$; otherwise zero

4. Methodology and Empirical Results

4.1. Descriptive Statistics

Table 2 reports descriptive statistics for the relevant variables. Among them, the average value of the abnormal short-selling $ABSS(-10, -1)$ indicates that the average daily short-selling

for the 10 trading days before the trading halts is 12.99% higher than the comparison period, which means that short positions are actively established prior to the trading halts. The average trading volume of the 10 trading days before the suspension was slightly higher than the non-suspension period, with an average of 2.61% higher. From the perspective of the cumulative return after the resumptions, the average is 2.86%.

Table 2: Descriptive Statistics for Main Variables

Variable	Mean	Median	Std. Dev.	25th per.	75th per.
$ABSS(-10,-1)$	0.1299	-0.0363	0.9606	-0.4447	0.4349
$ABVOL(-10,-1)$	0.0261	-0.0313	0.3693	-0.2413	0.2255
$RELSS(-10,-1)$	0.0064	0.0027	0.0086	0.0006	0.0083
$RET(-10,-1)$	-0.0182	0.0015	0.1627	-0.0565	0.0659
$RET(0,+10)$	0.0286	0.0079	0.1840	-0.0617	0.0951
$\sigma(-10,-1)$	0.0450	0.0354	0.0277	0.0262	0.0534
$OIMB^{+}(-10,-1)$	0.0202	0.0000	0.0423	0.0000	0.0229

Table 3 summarizes the descriptive statistics for the trading halts samples. After the abnormal fluctuations were excluded, the trading halts sample of this paper includes three types: general meetings driven trading halts, major events driven trading halts and other situation. Before 2013, Shenzhen and Shanghai Stock Exchanges required general meetings to halt throughout the happening day; after 2013, this regulation is cancelled in order to improve market effeciency and reduce unnecesary trading halts[5]. Therefore, the sample of general meetings driven trading halts only occurred before 2013. Major events driven trading halts oftern contains important information that is uncertain about the company including corporate reconstruction, acquisitions, changes in control and so on. This type of trading halts has a significant impacy on future stock price movements. Other types of trading halts are small in total number, such as non-public offerings, temporary trading halts and changes in company insiders' information.

Panel A of Table 3 counts the number of three types of trading halts by year, the cumulative return and market return after resumption. It can be seen that the number of trading halts in Chinese stock market began to increase significantly in 2013, and the number of major events driven ones reaches its peak in 2015. In the first three years when trading halts are driven most by general meeting, the post resumption cumulative return for each year is close to the market return rate of the same period. This indicates that this type of trading halts is often not informative. After 2013, the number of major events driven ones is dominant, and the difference between the cumulative return after the resumption and the market return during the same period increased, which may imply that major events driven trading halts include influencial information related to the subsequent stock return.

Panel B counts the total number of companies appearing in the trading halts sample and the frequency of each company. The total number of observations in our sample is 2,029, including 771 unique firms. As mentioned earlier, since this paper studies short-selling around trading halts, it means that only the stocks in the margin trading list will appear in our sample. This

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[5]See *Shenzhen Stock Exchange Listing Rules (revised in 2012)* and *Shanghai Stock Exchange Listing Rules (revised in 2012)* for more details.

number in Shanghai and Shenzhen stock markets is 950 in the end of 2016, so the number of 771 non-repetitive companies in this study contains most of the margin tradable stocks. Panel B also counts the frequency with which companies repeat in our sample. It can be seen that the majority of the 771 companies (73.6%) appear in the sample no more than three times; only a few (1.56%) was repeated more than 7 times in the sample. Panel C presents the main financial indicators of the sampled companies. The book value of the total assets was 227.1 billion yuan. The total sales and the book-to-market ratio were 31.1 billion yuan and 1.57 respectively.

Table 3: Descriptive Statistics for Trading Halts Sample

Panel A: Numbers of Each Types of Trading Halts and Cumulative Return after Resumption					
Year	General Meetings	Major Events	Others	RET(0,+10)	Market Return
2010.4-12	67	6	3	0.53%	0.70%
2011	147	14	3	-1.94%	-1.55%
2012	304	44	8	-0.60%	-0.11%
2013	0	133	35	-0.29%	0.22%
2014	0	292	32	8.12%	0.22%
2015	0	536	23	9.28%	2.74%
2016	0	204	8	0.22%	-0.02%
2017	0	156	13	-0.50%	0.38%

Panel B: Frequency of Sampled Companies	
Total Observations	2029
Distinct Companies	771
Times Apear in the Sample	
1	262
2	183
3	123
4	86
5	59
6	31
7	13
8	5
9	3
10	3
11	1

Panel C: Average Major Financial Indicators	
Total Assets (billion yuan)	227.1
Total Sales (billion yuan)	31.1
Stock Market Capitalization (billion yuan)	49.7
Book-to-Market Value	1.57

This study focuses on whether there is an abnormal short-selling before the trading halts and then studies the information content of short sellers. Table 4 therefore provides descriptive statistics for short-selling around the trading halts period and non-halts days for different types of halts. For the general meeting driven trading halts, we find that there is no significant difference in

the daily average short-selling before the suspension and the other non-halt days in the controlled interval. The average daily short-selling and the average daily short-selling volume divided by outstanding shares before major events driven halts are slightly higher than other non-halts days'. In addition, we find that the level of short-selling in China is much lower than that of other developed countries. For example, the average daily short-selling divided by trade volume in the US and Australian markets is 12.9% and 2.79% respectively (Boehmer et al., 2008; Diether et al., 2009; Saffi and Sigurdsson, 2011; Comerton-Forde et al., 2016).

Table 4: Short-selling Activities before Trading Halts and for Non-halt Period

Panel A: Trading Halts Driven by General Meeting

	Daily Average Short-selling (Share)		Daily Average Short-selling Divided by Tradables (%)		Daily Average Trade Volume (Share)	
	(-10,-1)	Non-halt Period	(-10,-1)	Non-halt Period	(-10,-1)	Non-halt Period
Mean	94326	106464	0.0043	0.0047	20766110	21717075
Median	39014	52386	0.0021	0.0024	12974666	15256435
Max.	1801509	1696963	0.0412	0.0489	153600000	208200000
Min.	0	10	0	0	693675	809647

Panel B: Trading Halts Driven by Major Events

	Daily Average Short-selling (Share)		Daily Average Short-selling Divided by Tradables (%)		Daily Average Trade Volume (Share)	
	(-10,-1)	Non-halt Period	(-10,-1)	Non-halt Period	(-10,-1)	Non-halt Period
Mean	351663	321333	0.0186	0.0151	34003314	32849025
Median	42418	43973	0.0054	0.0053	19618384	19984532
Max.	44892176	50626533	0.9048	0.6256	575400000	531400000
Min.	0	5	0	0	733584	500465

Panel C: Other Type of Trading Halts

	Daily Average Short-selling (Share)		Daily Average Short-selling Divided by Tradables (%)		Daily Average Trade Volume (Share)	
	(-10,-1)	Non-halt Period	(-10,-1)	Non-halt Period	(-10,-1)	Non-halt Period
Mean	499363	556297	0.0179	0.0202	33542890	31520407
Median	46409	48315	0.0065	0.0051	16185240	17012119
Max.	14546365	19281755	0.1838	0.2665	306300000	260700000
Min.	0	60	0	0	1348077	826303

4.2. Abnormal Short-selling Activities Prior to Trading Halts

Apart from general meeting driven trading halts, the other types of halts in this paper are mainly determined by the management of the company and these insiders actively request a halt to Shanghai or Shenzhen stock exchanges. At the same time, unlike regular financial statements and earnings announcements, trading halts are non-scheduled events, so only traders with private information can forecast the exact happening time and profit by establishing appropriate position in advance. Short traders with private information would establish an unusually high short position before trading halts expected to be bad news, and do not short before good news. To study short-seller's reaction to trading halts, we first examine the distribution of short-selling trading activities 10 trading days before (-10, -1) and non-halt trading period (controlled interval). To be more exactly, the non-halt date is from the 20th trading day to the 11th trading day before trading halts (-20, -11) and the 11th to the 20th trading day after resumption (+11, +20). Figures 1-a

Figure 1: Distribution of Short-selling Activities

Figure 1-a: Distribution of Shorted Shares per Thousand of Outstanding Shares
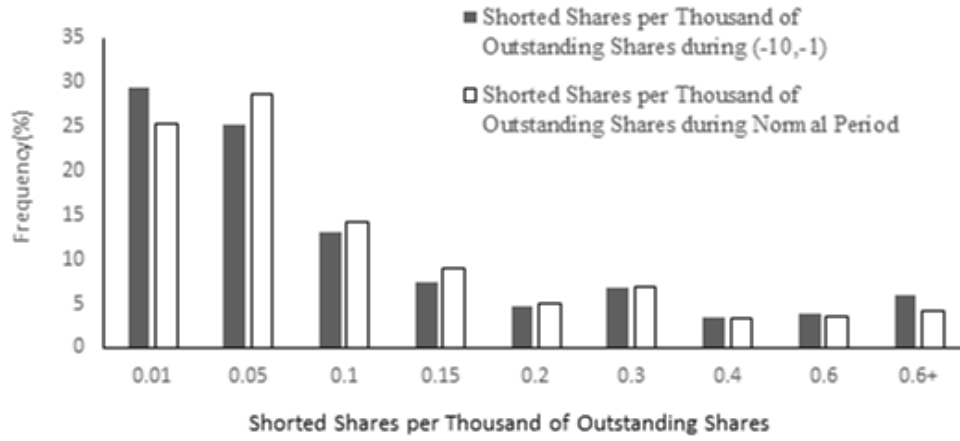
Figure 1-b: Distribution of Relative Short-selling
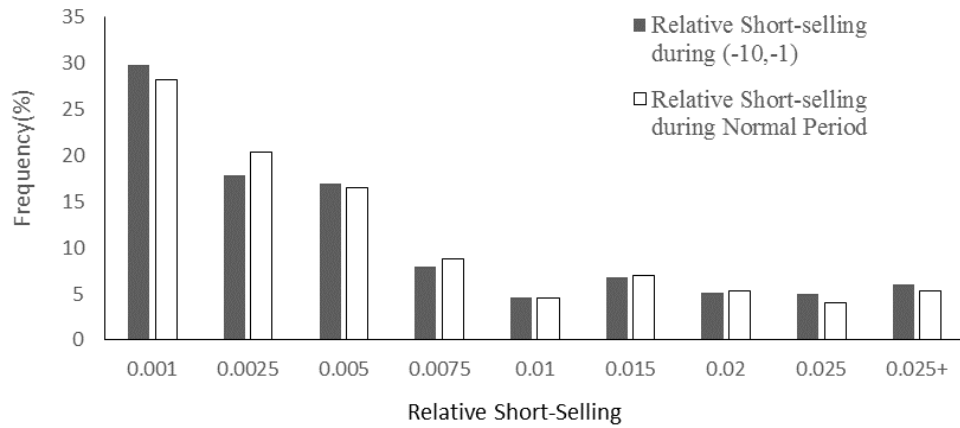
and 1-b show the distribution of daily average short-selling activity before and after the events. Among them, the short selling activity in Figure 1-a is expressed by the ratio of the short selling volume to the outstanding shares. Considering that the difference shown in Figure 1-a may be due to the abnormal trade volume, therefore, in Figure 1-b, we use the ratio of short sales to trade volume to represent the short-selling activity. Figure 1-a shows that compared with the normal period, the distribution of daily average short-selling trading activities in the 10 trading

11

days prior to trading halts shows a more obvious fat-tailed feature. The pre-halt observations were above the frequency of the control interval at the 0.01% and 0.6%+ level (both extremes), while the frequencies occurring at other levels were lower than or very close to the controlled period. Considering that the volume before the trading halts may be different from other non-halt periods, also resulting in abnormal short-selling, we use the relative short-selling to characterize short-sales in Figure 1-b. It can be seen that the distribution characteristics in Figure 1-b are very similar to those in Figure 1-a, i.e. the relative short-selling occurs at two extreme levels more frequently than the control interval.

The above analysis shows that for most halted stocks, the short-selling trading activity before the trading halts is not higher than (or even lower than) other normal non-halt periods; for a relatively small number of halted stocks, we find abnormal short selling prior to trading halts. It indicates that short sellers do not generally perform short-selling operations on suspended stocks, and their establishment of short positions exhibits characteristics for specific objects and with high selectivity, which are consistent with the characteristics of informed trading.

In addition to analyzing the differences between the distribution of short-selling activities around trading halts and that of non-halt period, a more straightforward approach is to construct a variable that reflects the difference in short-selling trades between the two ranges, namely the abnormal short-selling trade, $ABSS(-10, -1)$, and abnormal relative short-selling, ABRELSS(-10, -1). Following the practice of the existing literature (Christophe et al., 2004, 2010; Chakrabarty and Shkilko, 2013), we calculate the average short-selling of the first 10 trading days before trading halts and compare it with the average level in normal period. Details are shown in the variable definition section above. Since the trading strategies of informed short sellers depend on the nature of the trading halts' content, they will establish a higher-than-normal short position before the events expected to be bad news, and decrease their existing position or even do not short before events expected to be good news. Therefore we classify the trading halts into good news or bad news by using posterior information. Hopewell and Schwartz Jr (1978) ,Lee et al. (1994) and Hu et al. (2017) responded to the investor's reaction after the resumption of trading, i.e. the abnormal return of the trading halts by the open price of the resumption date divided by the close price prior to trading halts and minus the market return during the same period[6]. However, since the trading halts in the above literature usually does not exceed one trading day, it is feasible to calculate the abnormal return during trading halts to represent the sentiment of them. In this paper, the major events driven trading halts and other type of trading halts usually last long. So we use the abnormal return of the resumption date to classify. If the abnormal return excedes 0.5%, we believe that the event is good news; if the abnormal return is less than -0.5%, bad news is assumed.

Table 5 calculates the abnormal short-selling activities throughout the period (-10,-1) and the mean term by the halt types and the sentiment of contents. As for the full sample, abnormal short-selling and abnormal relative short-selling are not significant in bad news. Abnormal short-selling is significantly negative in good news while abnormal relative short-selling is insignificant. In sum, abnormal short-selling activities prior to trading halts are not detected. This might be ascribed to the lack of information in general meeting driven trading halts and other type of the trading halts. Motivations are inadequate for invetors to conduct short sales.

Next we classify the trading halts into three types and analyse them respectively. Consistent to

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[6]Hopewell and Schwartz Jr (1978) and Lee et al. (1994) researched on trading halts in US stock markets and most of these halts last short; Hu et al. (2017) researched on abnormal volatility trading halts and the duration is set to be only one hour.

Table 5: Abnormal Short-selling Activities: Classified by Halt Type

Panel A: Abnormal short-selling

	Full Sample		General Meeting		Major Events		Other Type	
	Good	Bad	Good	Bad	Good	Bad	Good	Bad
	(n=634)	(n=974)	(n=168)	(n=215)	(n=421)	(n=700)	(n=45)	(n=59)
(-10,-1)	−0.0567**	0.0107	−0.1521***	−0.1829***	-0.0279	0.0835***	0.0308	−0.1472*
-10	−0.0875**	-0.0301	-0.1431	−0.1874***	-0.0705	0.0373	-0.036	−0.2654**
-9	−0.0820**	0.0317	−0.2043***	-0.0717	-0.0161	0.0846**	−0.2279*	−0.2178*
-8	−0.0774*	-0.0197	−0.1712**	−0.1962***	-0.0639	0.0580	0.1513	−0.2980**
-7	-0.0556	0.0466	−0.2397***	−0.3225***	0.0228	0.1747***	-0.1063	-0.1202
-6	-0.0510	0.0929**	-0.0586	−0.1946***	-0.0553	0.1872***	0.0174	0.0253
-5	−0.1171***	0.0316	−0.2940***	−0.3258***	-0.0393	0.1592***	-0.1619	-0.1626
-4	0.0628	0.0412	-0.0558	−0.2044***	0.0977	0.1234***	0.1723	-0.0591
-3	-0.0257	0.0176	-0.1152	-0.1278	-0.0143	0.0731*	0.1969	-0.1265
-2	−0.1334***	−0.0980***	−0.1838**	−0.1766**	−0.1550***	-0.0658	0.2585	-0.199
-1	-0.0186	-0.0004	-0.0861	-0.0147	0.0034	0.0026	0.0288	0.0166

Panel B: Abnormal relative short-selling

	Full Sample		General Meeting		Major Events		Other Type	
	Good	Bad	Good	Bad	Good	Bad	Good	Bad
	(n=634)	(n=974)	(n=168)	(n=215)	(n=421)	(n=700)	(n=45)	(n=59)
(-10,-1)	0.0068	0.0331	−0.1230***	−0.1519***	0.0607	0.1050***	-0.0120	−0.1451*
-10	-0.0511	0.0601*	-0.1265	−0.1312*	-0.0194	0.1380***	-0.0634	-0.1700
-9	0.0171	0.1233***	−0.1471*	-0.0916	0.1045*	0.2122***	-0.1667	-0.1578
-8	0.0494	0.0456	-0.1292*	−0.1901***	0.1251*	0.1434***	0.0137	−0.2545*
-7	0.0382	0.0582	-0.1439	−0.2977***	0.1143*	0.1818***	0.0126	-0.0956
-6	-0.0293	0.0871**	-0.0779	−0.1324*	-0.0112	0.1696***	-0.0131	-0.0966
-5	0.0007	0.0378	−0.1874**	−0.2892***	0.0737	0.1615***	0.0385	−0.2291**
-4	0.1109**	0.0504	0.0075	-0.0973	0.1473**	0.1099**	0.1566	-0.1242
-3	0.0302	0.047	−0.1466*	-0.0490	0.0972	0.0938**	0.0614	-0.1667
-2	−0.0975**	−0.1373***	−0.1780***	−0.1403*	-0.0795	−0.1336***	0.0424	-0.1708
-1	-0.0683	−0.0865**	−0.1772**	-0.0515	-0.0032	−0.0998**	−0.2693**	-0.0567

our expectation, in low informative general meeting driven trading halts, no evidence is found in support of informed trading, i.e. significant and positive (negative) abnormal short-selling activities before bad (good) news. On the contrary, whenever the news is good or bad, the abnorml short-selling activities is significantly negative, which in the opposite direction we assumed before bad news. For informative major events driven trading halts, two indicators before bad news are both significantly positive. For most days the abnormal short-selling before good news is negative except the day -2. Another indicator shows no evidence for informed trading.

The analysis above shows that before major events driven bad trading halts, two indicators are significantly positive; no informed trading is found before good news. This indicates that in Chinese stock market, informed trading mainly manifested in major events driven bad trading halts. Similar to general meeting driven trading halts, evidence is not found in other type of trading halts with informed trading.

4.3. Regression Analysis

To further examine the level of abnormal short-selling activities prior to trading halts of different events more carefully, we conduct regression analysis to correlate abnormal short-selling activities to cumulative return after resumption. If the short-selling traders before trading halts

are informed, then we will not only observe that the short-selling is significantly higher or lower than the non-halt period. Also, it is expected that the abnormal short-selling before trading halts is significantly negatively correlated with the post-resumption cumulative return. That is, a higher abnormal short-selling implys a lower cumulative return after resumption. In order to explore the connection between the abnorml short-selling activity before trading halts and private information contained in them, this paper builds the following regression model based on the empirical model in Christophe et al. (2004):

$$ABSS_{it}(-10,-1) = \beta_0 + \beta_1 RET_{it}(0,+10) + \beta_2 RET_{it}(-10,-1)$$
$$+ \beta_3 ABVOL_{it}(-10,-1) + \varepsilon_{it}. \tag{5}$$

$ABSS(-10,-1)$ is the abnormal short-selling of the 10 days prior to trading halts. It measures the difference between the daily average short-selling prior to trading halts and that of the controlled interval. Since the raction time may be long, we use the cumulative return from the ressumption date to ten trading days after, $RET(0,+10)$, to measure the stock price change post to resumption. If the coeffecient β_1 is significantly negative, the short sellers may establish short positions before trading halts when the expected drift after resumption is positive and establish abnormally lower position when the expected drift after resumption is negative. In other words, short sellers are likely to be informed.

As short-selling activities are also affected by changes in stock prices over the same period, increasing stock prices will induce short-sellers to short the stocks whose stock prices are overvalued, resulting in an increase in short sales. To dissolve the impact of stock price changes over the short period on short-selling trading activities before trading halts, we control the cumulative return for 10 trading days prior to trading halts, $RET(-10,-1)$; in addition, the stocks with a sudden increase in trade volume have higher level of liquidity, making it easier to short, so we add the abnormal trading volume, $ABVOL(-10,-1)$, to the regression model to control the effect of the simultaneous change in trade volume on short-selling activities. All regression analysis in this study controlled the annual fixed effect and the company fixed effect, and the standard error in the regression include the clustering effect at the company level.

Plus, to rule out the impact of volume on short-selling volume, we also test another measure of short-selling activities' level, namely the relative short-selling, and constructed the following regression model:

$$RELSS_{it}(-10,-1) = \gamma_0 + \gamma_1 RET_{it}(0,+10) + \gamma_2 RET_{it}(-10,-1)$$
$$+ \gamma_3 NORMRELSS_{it} + \varepsilon_{it}. \tag{6}$$

Just like equation (5), $RET(0,+10)$ indicates the stock price movement after resumption. If γ_1 is significantly negative, it indicates that the short seller has a predictive ability for the stock price movement after resumption. The variable $RELSS(-10,-1)$ controls the impact of trade volume on short-selling activities. $NORMRELSS$ represents the average relative short-selling of the normal interval, which controls influence from the relative short-selling level during non-halt period.

Panel A of Table 6 reports OLS results based on equation (5) classified by the halt reason. The values in parentheses are t statistic based on the standard error of heteroscedastic robustness. The regression results for the full sample showed a coefficient β_1 approximately -0.7

Different types of suspension events contain different levels of information, major events driven trading halts, compared with other types, contain more information and have the greatest

14

impact on the stock price after resumption. Is the significantly negative β_1 based on the full sample mainly caused by major events driven trading halts? Based on the above considerations, we further carried out regression analysis of the samples according to different types. After the classified regression, $beta_1$ for the trading halts driven by general meeting type and other type of the trading halts were not significant, and only that of the major event driven halts is still significantly negative (t value was -2.54). This result confirms our prediction that the significant negatives found in the full sample regression are mainly due to the significant negative correlation between the abnormal short-selling before trading halts and the cumulative return after resumption. At the same time, since the short sellers only conduct informed trading before the major events driven halts with high private information content, and no empirical evidence of informed trading is found before other types of suspension with low private information content, the result is also in support of the assumption that short sellers in China are informed related to trading halts from another angle.

As for controlled variables, the regression coefficient of the cumulative return rate prior to trading halts $RET(-10, -1)$ is significantly negative in most cases, and the abnormal trade volume of the 10 trading days before the suspension $ABVOL(-10, -1)$ is significantly positive, indicating that when the stock price tends to decline before the trading halts and the trading volume level is higher during the same period, the short selling increases.

The regression results of another measure of short-selling activities (relative short-selling) is shown in Panel B of Table 6. The regression results are basically the same. γ_1 of the full sample and major events driven halts are significantly negative, while general meeting driven halts preserve a positive and statistically significant γ_1, and coefficient of the other type is not significant. These results imply that short sellers only conduct informed trading before trading halts driven by major events with high private information content, and before the halt type with low private information either in the opposite direction (general meeting type), or even little informed trading (the other type). It is worth noting that since the relative short-selling volume is the ratio of short-selling volume to trading volume, The proportion of Chinese short-selling is very low due to the high cost of securities trading and the insufficient supply of securities. So the relative short-selling volume is also much smaller than the abnormal short-selling[7]. For example, the average abnormal short-selling $ABSS(-10, -1)$ in Table 2 has an average of 12.99%, while the relative short-selling volume $RELSS(-10, -1)$ has a mean of only 0.64%. For this reason, the regression coefficients based on the relative short-selling volume in Table 6 are also numerically smaller than the regression coefficients based on the abnormal short-selling. Except for different driven events, the amount of information contained in different durations of halt period contains different amounts of information. In general, trading halts with a long period are more informative, and the amount of information is also larger. Therefore, we report the classification regression results of the two thresholds of halt duration (1 day and 5 days) in Table 7. It can be seen that regardless of the classification criteria, only the short-selling activities before the trading halts with a relatively long duration have a significant negative correlation with the stock return after resumption. For example, for trading halts lasting less than or equal to 5 trading days, the coefficients in equation (6) in equation (5) are not significant; and for those lasting more than 5 days, both are significantly negative. This means that informed short sellers will only use the information they obtain to conduct informed trading, and for those with small amount of information, the short sellers do not have significant predictive power to the post stock price trend.

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[7]As mentioned earlier, the current volume of short sales in China is much lower than that in developed markets.

Table 6: Abnormal Short-selling Activities Classified by Events

Panel A: Abnormal short-selling

Events	Intercept	$RET(0, +10)$	$RET(-10, -1)$	$ABVOL(-10, -1)$	$Adj.R^2$
Full Sample	-0.0142	-0.6923^{***}	-0.8405^{***}	0.6333^{***}	0.105
(n=1898)	(-0.07)	(-2.93)	(-4.19)	(6.46)	
General Meeting	0.1265	0.3425	1.4553	0.6505^{**}	0.079
(n=504)	(0.55)	(0.36)	(1.40)	(2.10)	
Major Events	-1.0555	-0.7983^{**}	-1.0854^{**}	0.5875^{***}	0.134
(n=1274)	(-0.93)	(-2.54)	(-4.71)	(4.50)	
Other Type	-0.5663	0.9619	0.5002	0.4038	0.664
(n=120)	(-0.65)	(0.49)	(0.23)	(0.77)	

Panel B: Relative short-selling

Events	Intercept	$RET(0, +10)$	$RET(-10, -1)$	$NORMRELSS$	$Adj.R^2$
Full Sample	-0.0005	-0.0013	-0.0053^{***}	0.8777^{***}	0.773
(n=1908)	(-0.71)	(-1.19)	(-3.68)	(24.92)	
General Meeting	-0.0003	0.0075^{***}	-0.0001	0.8600^{***}	0.784
(n=507)	(-0.49)	(2.41)	(-0.03)	(11.51)	
Major Events	0.001	-0.0017^{**}	-0.0063^{***}	0.8893^{***}	0.785
(n=1283)	(0.28)	(-1.98)	(-6.54)	(29.27)	
Other Type	0.0024	-0.0013	-0.0063	1.1647	0.800
(n=117)	(0.27)	(-0.06)	(-0.23)	(1.18)	

Note: Regressions control the fixed effect of the year and the fixed effect of the company. ***, **, and * indicate significant at the level of 1%, 5%, and 10%, respectively. The standard error controls the clustering effect at the company level (Clustering by Firm), in parentheses is the t value calculated based on the robust standard error.

4.4. Influence from Market Situation After Resumption

In the above regression analysis, we find that the short-selling trading activity before informative trading halts is significantly negatively correlated with the cumulative return after resumption, that is, the short sellers have the ability to forecast the stock price movement after resumption, thereby supporting the assumption that short sellers around trading halts in China are informed. However, it is necessary to point out that if the market situation after the resumption in the sample tends to decline as a whole, then that we have previously find a significant negative correlation between the short-selling trading activity before trading halts and the cumulative return after resumption of trading may comes from the overall decline of the market after resumption. Thus the previous conclusion may be only an illusion. To eliminate the impact of the bull market or the bear market on our results, we limit the absolute of market cumulative return to be smaller than 10% from the resumption date to 10 trading days after that (i.e. the absolute of average daily market return is less than about 1%) and regression analysis in Table 6 and 7 are done again[8].

Tables 8 and 9 respectively report the regression results classified according to the halt reason and the length of trading halts after limiting the market cumulative return after resumption. The

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[8]The market return is calculated as A-share market index return.

Table 7: Abnormal Short-selling Activities Classified by Duration

Panel A: Abnormal short-selling (Threshold = 1 day)

Duration	Intercept	$RET(0,+10)$	$RET(-10,-1)$	$ABVOL(-10,-1)$	$Adj.R^2$
Full Sample	-0.0142	-0.6923^{***}	-0.8405^{***}	0.6333^{***}	0.105
(n=1898)	(-0.07)	(-2.93)	(-4.19)	(6.46)	
$=1day$	-0.0408	0.4819	0.5627	0.7358^{***}	0.0147
(n=793)	(-0.19)	(0.74)	(0.97)	(3.49)	
$>1day$	-0.6627^{***}	-0.8663^{**}	-1.1598^{***}	0.5330^{***}	0.228
(n=1105)	(-5.25)	(-2.35)	(-4.04)	(3.53)	

Panel B: Relative short-selling (Threshold = 1 day)

Duration	Intercept	$RET(0,+10)$	$RET(-10,-1)$	$NORMRELSS$	$Adj.R^2$
Full Sample	-0.0005	-0.0013	-0.0053^{***}	0.8777^{***}	0.773
(n=1907)	(-0.71)	(-1.19)	(-3.68)	(24.92)	
$=1day$	-0.0004	0.0046^{*}	-0.0027	0.8498^{***}	0.811
(n=791)	(-0.47)	(1.96)	(-0.91)	(17.38)	
$>1day$	0.0028	-0.0018^{*}	-0.0057^{***}	0.9195^{***}	0.764
(n=1116)	(0.72)	(-1.87)	(-5.36)	-24.12	

Panel C: Abnormal short-selling (Threshold = 5 days)

Duration	Intercept	$RET(0,+10)$	$RET(-10,-1)$	$ABVOL(-10,-1)$	$Adj.R^2$
Full Sample	-0.0142	-0.6923^{***}	-0.8405^{***}	0.6330^{***}	0.105
(n=1898)	(-0.07)	(-2.93)	(-4.19)	(6.46)	
$\leq 5days$	-0.0589	0.0338	-0.4136	0.7714^{***}	0.0822
(n=1230)	(-0.26)	(0.07)	(-1.26)	(5.69)	
$>5days$	-0.4768	-0.8045^{**}	-1.5440^{***}	0.6751^{***}	0.208
(n=668)	(-0.34)	(-2.52)	(-3.62)	(3.43)	

Panel D: Relative short-selling (Threshold = 5 days)

Duration	Intercept	$RET(0,+10)$	$RET(-10,-1)$	$NORMRELSS$	$Adj.R^2$
Full Sample	-0.0005	-0.0013	-0.0053^{***}	0.8777^{***}	0.773
(n=1907)	(-0.71)	(-1.19)	(-3.68)	(24.92)	
$\leq 5days$	-0.0003	0.0011	-0.0034^{**}	0.8691^{***}	0.807
(n=1229)	(-0.43)	-0.66	(-2.31)	(22.07)	
$>5days$	-0.0002	-0.0022^{***}	-0.0074^{***}	1.0397^{***}	0.744
(n=678)	(-0.42)	(-3.22)	(-4.59)	(17.97)	

Note: Regressions control the fixed effect of the year and the fixed effect of the company. ***, **, and * indicate significant at the level of 1%, 5%, and 10%, respectively. The standard error controls the clustering effect at the company level (Clustering by Firm), in parentheses is the t value calculated based on the robust standard error.

results in Panel A of Table 8 are basically the same as those in Table 6. The full sample regression coefficient in this regression of abnormal short-selling is -0.4366 but is insignificant. Similar to the previous analysis, we believe that this characteristic of the coefficient may be caused by the fact that the full sample contains other less informative trading halts. When we regress according

Table 8: Abnormal Short-selling Activities Classified by Events Limiting Market Return

Panel A: Abnormal short-selling

Events	Intercept	$RET(0,+10)$	$RET(-10,-1)$	$ABVOL(-10,-1)$	$Adj.R^2$
Full Sample	0.0235	-0.4366	-0.7325^{***}	0.6327^{***}	0.0552
(n=1758)	(0.11)	(-1.60)	(-3.12)	(5.93)	
General Meeting	0.1050	0.4472	1.3541^{**}	0.7530^{***}	0.0998
(n=497)	(0.63)	(1.14)	(2.27)	(5.18)	
Major Event	-1.0709	-0.6290^{**}	-1.0115^{***}	0.5749^{***}	0.0753
(n=1153)	(-0.93)	(-2.00)	(-4.32)	(4.86)	
Other Type	-0.5955	1.1361	-0.1226	0.5266	0.560
(n=108)	(-0.64)	(-0.73)	(-0.05)	(0.70)	

Panel B: Relative short-selling

Events	Intercept	$RET(0,+10)$	$RET(-10,-1)$	$NORMRELSS$	$Adj.R^2$
Full Sample	-0.0002	-0.0003	-0.0047^{***}	0.8781^{***}	0.781
(n=1770)	(-0.30)	(-0.28)	(-3.34)	(24.40)	
General Meeting	-0.0003^{*}	0.0077^{**}	-0.0004	0.8605^{***}	0.784
(n=502)	(-0.96)	(-2.38)	(-0.11)	(11.5)	
Major Event	-0.0004	-0.0015^{**}	-0.0045^{***}	0.9590^{***}	0.811
(n=1161)	(-0.96)	(-2.52)	(-5.91)	(36.49)	
Other Type	0.0037	0.0024	-0.1590	1.1839	0.786
(n=107)	(0.45)	(0.08)	(-0.42)	(1.12)	

Note: Regressions control the fixed effect of the year and the fixed effect of the company. ***, **, and * indicate significant at the level of 1%, 5%, and 10%, respectively. The standard error controls the clustering effect at the company level (Clustering by Firm), in parentheses is the t value calculated based on the robust standard error.

to the classification of driven events, we find that β_1 of the major events driven halts which are highly informative is -0.6290 (significant at 5

According to Table 9, which is similar to Table 7, we find that relatively longer and thus more informative trading halts preserve a significantly negative β_1 and γ_1. For short trading halts, short sellers lose their ability to predict accurately the stock price after resumption or even go to the wrong direction (significantly positive β_1 and γ_1).

4.5. Other Possible Explanations

Although the empirical results above find that short sellers in Chinese stock markets are informed, that is, they will establish abnormal short positions before trading halts, showing the ability to predict stock price changes after resumption. However, there are still other possible explanations. Chances are investors preserve no private information but have a better usage of public information.

4.5.1. Volatility

One possible explanation comes from the speculative risk-taking behavior of short sellers. Diether et al. (2009) pointed out that when uncertainty in the market increases due to information asymmetry (Copeland and Galai, 1983; Glosten and Milgrom, 1985) or investors' disagreement

Table 9: Abnormal Short-selling Activities Classified by Duration Limiting Market Return

Panel A: Abnormal short-selling (Threshold =1 day)

Duration	Intercept	$RET(0, +10)$	$RET(-10, -1)$	$ABVOL(-10, -1)$	$Adj.R^2$
Full Sample	0.0235	-0.4366	-0.7325^{***}	0.6327^{***}	0.055
(n=1758)	(0.11)	(-1.60)	(-3.12)	(5.93)	
= 1day	0.0538	0.5376^{**}	0.1145	0.6986^{***}	0.092
(n=758)	(0.35)	(1.75)	(0.30)	(6.58)	
> 1day	-0.6814^{***}	-0.7315^{**}	-1.0197^{***}	0.5641^{***}	0.137
(n=1000)	(-4.33)	(-2.04)	(-3.65)	(4.04)	

Panel B: Relative short-selling (Threshold =1 day)

Duration	Intercept	$RET(0, +10)$	$RET(-10, -1)$	$NORMRELSS$	$Adj.R^2$
Full Sample	-0.0002	-0.0003	-0.0047^{***}	0.8781^{***}	0.781
(n=1770)	(-0.30)	(-0.28)	(-3.34)	(24.4)	
= 1day	-0.0004	0.0046^{*}	-0.0034	0.8410^{***}	0.809
(n=759)	(-0.51)	(1.84)	(-1.05)	(16.82)	
> 1day	0.0000	-0.0015^{**}	-0.0042^{***}	0.9672^{***}	0.792
(n=1011)	(-0.27)	(-2.58)	(-5.51)	(30.32)	

Panel C: Abnormal short-selling (Threshold =5 days)

Duration	Intercept	$RET(0, +10)$	$RET(-10, -1)$	$ABVOL(-10, -1)$	$Adj.R^2$
Full Sample	0.0235	-0.4366	-0.7325^{***}	0.6327^{***}	0.055
(n=1758)	(0.11	(-1.60)	(-3.12)	(5.93)	
$\leq$ 5$days$	-0.0428	0.5644	-0.3293	0.7787^{***}	0.017
(n=1154)	(-0.17)	(1.32)	(-0.99)	(5.35)	
> 5$days$	-0.4599	-0.6428^{*}	-1.3515^{***}	0.7924^{***}	0.151
(n=604)	(-0.32)	(-1.68)	(-2.75)	(3.48)	

Panel D: Relative short-selling (Threshold =5 days)

Duration	Intercept	$RET(0, +10)$	$RET(-10, -1)$	$NORMRELSS$	$Adj.R^2$
Full Sample	-0.0002	-0.0003	-0.0047^{***}	0.8781^{***}	0.781
(n=1770)	(-0.30)	(-0.28)	(-3.34)	(24.4)	
$\leq$ 5$days$	-0.0003	0.0022	-0.0036^{**}	0.8626^{***}	0.807
(n=1158)	(-0.42)	(1.41)	(-2.42)	(20.56)	
> 5$days$	-0.0001	-0.0015^{**}	-0.0064^{***}	1.0108^{***}	0.760
(n=612)	(-0.28)	(-2.36)	(-4.02)	(16.97)	

Note: Regressions control the fixed effect of the year and the fixed effect of the company. ***, **, and * indicate significant at the level of 1%, 5%, and 10%, respectively. The standard error controls the clustering effect at the company level (Clustering by Firm), in parentheses is the t value calculated based on the robust standard error.

(Harris and Raviv, 1993), speculative short sellers increase short sales, providing the market with additional risk-bearing capabilities. In this way, we will find that when the volatility increases during the day, the volume of short-selling transactions also increases; after the information is

released, it is accompanied by a decrease in volatility and a decrease in return. Following the practice of Diether et al. (2009), we use daily average price volatility $\sigma(-10, -1)$ to control the speculative risk-taking behavior of short sellers against existing conclusions. The intraday trading price fluctuation of day t is the difference between the highest price and the lowest price of the day divided by the highest price of the day, namely:

$$\sigma_t = \frac{HIGH_t - LOW_t}{HIGH_t}, \tag{7}$$

4.5.2. Buy-order Imbalance

Another possible explanation comes from the motivation of short sellers' role of voluntary liquidity provider (Diether et al., 2009; Chakrabarty and Shkilko, 2013). When short sellers observe a temporary unbalanced order from the buyer in the market, they will intensify short-selling activity and become voluntary liquidity providers. With the recovery of this temporary buyer's pressure, the stock price will return to the fundamental level, at which time short sellers can profit from it. Under this explanation, short-selling activities are also predictive for the future stock returns but this predictive ability is not related to private information, but rather to the timeliness provided by short-sellers (Grossman and Miller, 1988; Campbell et al., 1993, etc.). Consistent with Diether et al. (2009) and Chakrabarty and Shkilko (2013), we used the buy-order imbalance as the proxy of the buyer's pressure in the market, and constructed the daily average buy-order imbalance variable $OIMB^+(-10, -1)$. Before constructing the buyer order imbalance variable, we first calculate the order imbalanced on the trading day t, $OIMB_t$, which is the difference between the number of orders from the buyer side (*Daily Buys*) and the number of orders from the seller side (*Daily Sells*) within a day. Then buy-order imbalance is calculated as:

$$OIMB_t^+ = \begin{cases} OIMB_t & OIMB_t > 0 \\ 0 & Otherwise \end{cases} \tag{8}$$

4.5.3. Policy Change

On July 1, 2015, CSRC issued a trading rules definately regulating the qualification of the margin traders, the scale of margin trading of stock brokerage and supervision bottom line. This stricter supervision was designed to reduce negative effects on drop of the stock market caused by marging trading, resulting a drastic decline of short sales[9]. Since this policy was put forward when it was in a bear market, we construct a dummy variable *POLICY* to take into consideration the effect it brings.

4.5.4. Additional Regressions

As the previous empirical results show that only the short-selling before trading halts with higher information content has predictive ability to the cumulative return after resumption, therefore, in this section we only regress trading halts driven by major events and those lasting for more than 5 days. The specific regression equation is as follows:

$$\begin{aligned} ABSS_{it}(-10, -1) = {} & \beta_0 + \beta_1 RET_{it}(0, +10) + \beta_2 RET_{it}(-10, -1) + \beta_3 ABVOL_{it}(-10, -1) \\ & + \beta_4 \sigma_{it}(-10, -1) + \beta_5 OIMB_{it}^+ + \beta_6 POLICY_t + \varepsilon_{it} \end{aligned} \tag{9}$$

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[9]See the *Shenzhen Stock Exchange and the Shanghai Stock Exchange for the implementation of the Margin Trading (revised in 2015)*.

$$RELSS_{it}(-10, -1) = \gamma_0 + \gamma_1 RET_{it}(0, +10) + \gamma_2 RET_{it}(-10, -1) + \gamma_3 NORMRELSS_{it}$$
$$+\gamma_4 \sigma_{it}(-10, -1) + \gamma_5 OIMB_{it}^+ + \gamma_6 POLICY_t + \varepsilon_{it} \tag{10}$$

Table 10 reports the regression results. First, consistent with previous findings, short-selling before trading halts was significantly negatively correlated with the cumulative return after resumption. In the regression with $ABSS(-10, -1)$ as the explanatory variable, the estimated coefficient β_1 for the major events driven halts is -0.8158 (significant at 1% level), which means that if other conditions are similar, if the cumulative return rate of $RET(0, +10)$ decreases by 1%, the average daily short selling $ABSS(-10, -1)$ before trading halts is increased by 0.82%. The results about returns for trading halts lasting for more than 5 days are similar to the results of major events driven ones. Another short-selling indicator, $RELSS(-10, -1)$, is also significantly negatively correlated with the post cumulative rate. Take the major events driven trading halts as an example (column (3) of Table 10). After controlled other conditions, if the cumulative return rate $RET(0, +10)$ is reduced by 1%, $RELSS(-10, -1)$ is increased by about 0.002%. As mentioned above, since the short-selling volume of Chinese stock market has a low proportion in the volume, correspondingly, the regression coefficient of $RELSS(-10, -1)$ is also lower than that of $ABSS(-10, -1)$.

Second, the regression results in Table 10 partially support the explanation of the speculative risk-taking behavior of short sellers. In the regression using $RELSS(-10, -1)$ as the explanatory variable, the regression coefficient of $\sigma(-10, -1)$ is significantly positive at the level of 5%, indicating that when the uncertainty of the market increases, speculative short sales will increase for speculative risk-taking motives. But even if we control the impact of this possibility, abnormal short-selling activities still can significantly predict the rate of return after resumption. The regression coefficient of $OIMB^+(-10, -1)$ corresponding to the motivation of short-term traders' role of voluntary liquidity providers is not significant in all regressions, indicating that the data does not support this hypothesis.

Finally, the policy variable POLICY, which represents the effect of the changing margin trading system, is significantly negatively correlated with the short-selling indicators (except for the coefficients in the regression of columns (1) and (4), which are not significant), indicating that the system of strict supervision of margin trading implemented on July 1, 2015 significantly reduced the level of short-selling activity in Chinese stock market.

By considering the speculative risk-taking behavior of short sellers, the incentives for voluntary liquidity provides, and the impact of policy factor on the relationship between abnormal short-selling activity and the cumulative return after resumption, we find that although public information does explain part of the short sales, the ability that short sellers have to predict the future cumulative return seems not be totally explained. Based on these findings, we conclude that other than public information, short sellers also take advantage of private information.

4.6. Portfolio Strategy Analysis based on Abnormal Short-selling Before Trading Halts

In the analysis of this section, we focus on the portfolio strategy from the perspective of constructing a corresponding portfolio to investigate the possible investment value of the short-term high or low short-selling volume before trading halts for investors who do not have any private information about the content but know exactly or roughly the happening date. As shown in the previous results, if abnormal short-selling before trading halts with a high private information content can effectively predict the stock price movement after resumption, then other investors may establish a profitable short position.

Tables 11 and 12 analyze the investment value of possible portfolio strategies for short-selling transactions before major events driven trading halts those lasting for more than 5 days, and

Table 10: Excluded Other Possible Explanations

	$ABSS(-10,-1)$		$RELSS(-10,-1)$	
	(1) Major Events	(2) > 5 *days*	(3) Major Events	(4) > 5 *days*
Intercept	-1.1845	-0.6319	-0.0009^{**}	-0.0011^{*}
	(-1.03)	(-1.22)	(-2.11)	(-1.82)
$RET(0,+10)$	-0.8158^{***}	-0.8532^{*}	-0.0022^{***}	-0.0021^{***}
	(-3.19)	(-1.80)	(-3.54)	(-3.03)
$RET(-10,-1)$	-0.9170^{**}	-1.4889^{**}	-0.0055^{***}	-0.0071^{***}
	(-2.47)	(-2.55)	(-4.87)	(-3.95)
$ABVOL(-10,-1)$	0.5152^{***}	0.5654^{*}		
	(3.85)	(1.92)		
$NORMRELSS$			0.9616^{***}	1.0341^{***}
			(38.07)	(17.62)
$\sigma(-10,-1)$	3.6362	6.791	0.0194^{**}	0.0280^{**}
	(1.02)	(0.98)	(2.58)	(2.52)
$OIMB^{+}(-10,-1)$	0.5039	1.5054	-0.0002	0.0012
	(0.81)	(1.05)	(-0.08)	(0.31)
POLICY	-0.1413	-0.4262^{*}	-0.0017^{***}	-0.0014
	(-0.56)	(-1.12)	(-2.74)	(-1.61)
Fixed Effect (Year)	YES	YES	YES	YES
Fixed Effect (Company)	YES	YES	YES	YES
N	1274	668	1283	678
$Adj.R^2$	0.134	0.219	0.797	0.747

*Note: Regressions control the fixed effect of the year and the fixed effect of the company. ***, **, and * indicate significant at the level of 1%, 5%, and 10%, respectively. The standard error controls the clustering effect at the company level (Clustering by Firm), in parentheses is the t value calculated based on the robust standard error.*

explore the disclosure of short-selling activities for investors who do not have private information of the content but know exactly or roughly about the happening time. In Panel A of Table 11, we first divided the 1372 major event driven trading halts into five equal groups according to the average abnormal short-selling $ABSS(-10,-1)$ from high to low. We then inspect the difference in post-resumption cumulative return between highest quintile and the remaining 80%, the lowest quintile and the remaining 80%, and the highest quintile and the lowest quintile. Panel A shows that in the highest quintile of the major events driven trading halts of $ABSS(-10,-1)$, mean and median of the post-resumption cumulative return are -5.06% and -3.25%. The remaining 80% has the mean and median of 8.27% and 3.29%, respectively. The mean (median) of the difference is -13.33% (-6.54%) and significant at the 1% level.

Interestingly, we also found that the lowest quintile of $ABSS(-10,-1)$ has a mean (median) cumulative return of 5.82% (2.08%) and 5.56% (2.27%) for the remaining 80%. The difference between them is small and not statistically significant. This shows that the exceptionally high short-selling before the suspension is stronger than the unusually low short-selling volume and has a stronger predictive power after resumption. Nonetheless, similar to the findings

of Christophe et al. (2004), our results show that short-sellers' judgments are not correct at all times, and they sometimes trade in the wrong direction. For example, the cumulative return of the highest quintile of the $ABSS(-10, -1)$ group at the 75th percentile is positive (7.93%); similarly, the lowest quintile has a negative cumulative return (-7.43%) at the 25th percentile, which indicates that at least a quarter of abnormal high (low) short sales is accompanied by a positive (negative) cumulative return after resumption.

The last group in Panel A compares the difference between the cumulative return of the highest quintile and the lowest of the ABSS(-10,-1). If investors buy the lowest quintile and sell the highest before major events driven trading halts, they can get an abnormal return of 10% after resumption. The mean and median of the cumulative return are 10.88% and 5.33% and are significant at the 1

Panel B is based on the result of the abnormal relative short-selling $ABRELSS(-10, -1)$, where $ABRELSS(-10, -1)$ the difference between $RELSS(-10, -1)$ and $NORMSS$. Different from the results of Panel A based on $ABSS(-10, -1)$, the difference in cumulative return rate after resumption of the three groups is small and insignificant, indicating that for major events driven halts, portfolio constructed through ABRELSS may preserve little investment value. Table 12 reports the results of the trading halts whose duration is greater than 5 days. Different from the result major events driven halts, the trading strategies based on the two indicators of the short-selling activities have shown potential investment value, that is, investors can use the abnormal short-selling activities to establish the corresponding portfolio. Among them, the highest quintile of the $ABSS(-10, -1)$ group is 21.52% lower than the cumulative return of the other 80% (significant at 1% level), while the lowest quintile of the stock group is 5.38% higher than the other 80% (significant at 10% level). The difference of mean in cumulative return rates between the highest quintile and the lowest is -21.54% (significant at 1% level). The results based on $ABRELSS(-10, -1)$ (Panel B of Table 12) are similar to Panel A except that the difference is numerically lower than those in Panel A.

5. Conclusions

Based on the margin trading mechanism initiated by China in 2010 and the trading halts of listed companies, this paper studies the source and nature of short sellers' information by taking A-share listed companies from the start of the margin trading system in 2010 to the end of 2017. We find that short sellers do not generally trade on stocks in a short manner, and they are targeted and highly-selective when short stocks around trading halts. At the same time, we find abnormal high short-selling volume only before informative trading halts. Further research finds that the major events driven short-selling and the long-term trading halts are significantly negatively correlated with the cumulative return rate after resumption. The relationship is not found before the low informative trading halts. These results show that a significant proportion of short sales in China are consistent with the characteristics of informed trading.

Further robustness tests control the effect of market situation after the resumption, the speculative risk-taking behavior, the speculative voluntary liquidity providing incentives, and the changes in Chinese short-selling regulatory policies After the impact, the above results are still robust, which shows that short sellers take advantage of private information. Finally, from the perspective of constructing corresponding portfolio, this paper examines the possible investment value of the forecasting ability of the abnormal short selling activities before trading halts to the cumulative return after resumption for investors who do not have private information on the content but know exactly or roughly the happening time of trading halts.

Table 11: Portfolio Strategy Prior to Trading Halts Driven by Major Events

Panel A: Abnormal Short-Selling $ABSS(-10,-1)$

	Mean	Median	25th Percentile	75th Percentile	Minimum	Maximum
Highest quintile(n=274)	−0.0506***	−0.0325**	-0.2375	0.0793	-0.7744	0.7122
Other 80%(n=1098)	0.0827***	0.0329***	-0.0512	0.1702	-0.7076	1.8616
Difference	−0.1333***	−0.0654***				
Lowest quintile(n=274)	0.0582***	0.0208	-0.0743	0.1232	-0.593	1.8545
Other 80%(n=1098)	0.0556***	0.0227***	-0.0662	0.1629	-0.7744	1.8616
Difference	0.0026	-0.0019				
Highest quintile(n=274)	−0.0506***	−0.0325**				
Lowest quintile(n=274)	0.0582***	0.0208				
Difference	−0.1088***	−0.0533**				

Panel B: Abnormal Relative Short-Selling $ABRELSS(-10,-1)$

	Mean	Median	25th Percentile	75th Percentile	Minimum	Maximum
Highest quintile(n=274)	0.0428**	0.0271	-0.1124	0.1981	-0.7167	1.8586
Other 80%(n=1098)	0.0603***	0.0214***	-0.0653	0.1445	-0.7076	1.8616
Difference	-0.0175	0.0057				
Lowest quintile(n=274)	0.0374***	0.0151	-0.0717	0.1107	-0.4801	0.9525
Other 80%(n=1098)	0.0617***	0.0263***	-0.0665	0.168	-0.7167	1.8616
Difference	-0.0243	-0.0112				
Highest quintile(n=274)	0.0428**	0.0271				
Lowest quintile(n=274)	0.0374***	0.0151				
Difference	0.0054	0.012				

Table 12: Portfolio Strategy Prior to Trading Halts Lasting Over 5 Days

Panel A: Abnormal Short-Selling $ABSS(-10,-1)$

	Mean	Median	25th Percentile	75th Percentile	Minimum	Maximum
Highest quintile(n=135)	−0.1226***	−0.0667***	-0.3235	0.0438	-0.7744	0.7122
Other 80%(n=551)	0.0926***	0.0288*	-0.0817	0.1841	-0.7076	1.8616
Difference	−0.2152***	−0.0955***				
Lowest quintile(n=135)	0.0928***	0.0246	-0.1021	0.1937	-0.5930	1.8545
Other 80%(n=551)	0.0390***	0.012	-0.1116	0.1451	-0.7744	1.8616
Difference	0.0538*	0.0126				
Highest quintile(n=135)	−0.1226***	−0.0667***				
Lowest quintile(n=135)	0.0928***	0.0246				
Difference	−0.2154***	−0.0913**				

Panel B: Abnormal Relative Short-Selling $ABRELSS(-10,-1)$

	Mean	Median	25th Percentile	75th Percentile	Minimum	Maximum
Highest quintile(n=135)	-0.0152	-0.0299	-0.2771	0.147	-0.7167	1.8586
Other 80%(n=551)	0.0656***	0.0177	-0.0857	0.1502	-0.7076	1.8616
Difference	−0.0808**	-0.0476				
Lowest quintile(n=135)	0.0553***	0.0177	-0.0781	0.1585	-0.389	0.9524
Other 80%(n=551)	0.0480***	0.0093	-0.1255	0.147	-0.7167	1.8616
Difference	0.0073	0.0084				
Highest quintile(n=135)	-0.0152	-0.0299				
Lowest quintile(n=135)	0.0553***	0.0177				
Difference	−0.0705*	-0.0476				

In sum, this paper offers new empirical evidence and research perspectives for the short sellers to be informed traders by studying the characteristics of short sales around trading halts in Chinese stock markets, which may provide empirical evidence for the side-effect caused by the implementation of Chinese margin trading system. The conclusions give a reference for securities regulators to strengthen the supervision of Chinese margin trading, reduce the informed transactions related to short sales, and maintain the fairness of financial markets.

References

Au, A.S., Doukas, J.A., Onayev, Z., 2009. Daily short interest, idiosyncratic risk, and stock returns. Journal of Financial Markets 12, 290–316.

Berkman, H., McKenzie, M.D., 2012. Earnings announcements: Good news for institutional investors and short sellers. Financial Review 47, 91–113.

Berkman, H., McKenzie, M.D., Verwijmeren, P., 2016. Hole in the wall: Informed short selling ahead of private placements. Review of Finance 21, 1047–1091.

Blau, B.M., Wade, C., 2012. Informed or speculative: Short selling analyst recommendations. Journal of Banking & Finance 36, 14–25.

Boehmer, E., Huszar, Z.R., Jordan, B.D., 2010. The good news in short interest. Journal of Financial Economics 96, 80–97.

Boehmer, E., Jones, C., Zhang, X., 2018. What do short sellers know? .

Boehmer, E., Jones, C.M., Zhang, X., 2008. Which shorts are informed? The Journal of Finance 63, 491–527.

Campbell, J.Y., Grossman, S.J., Wang, J., 1993. Trading volume and serial correlation in stock returns. The Quarterly Journal of Economics 108, 905–939.

Chakrabarty, B., Shkilko, A., 2013. Information transfers and learning in financial markets: Evidence from short selling around insider sales. Journal of Banking & Finance 37, 1560–1572.

Chang, E.C., Luo, Y., Ren, J., 2014. Short-selling, margin-trading, and price efficiency: Evidence from the chinese market. Journal of Banking & Finance 48, 411–424.

Christophe, S.E., Ferri, M.G., Angel, J.J., 2004. Short-selling prior to earnings announcements. The Journal of Finance 59, 1845–1876.

Christophe, S.E., Ferri, M.G., Hsieh, J., 2010. Informed trading before analyst downgrades: Evidence from short sellers. Journal of Financial Economics 95, 85–106.

Comerton-Forde, C., Do, B.H., Gray, P., Manton, T., 2016. Assessing the information content of short-selling metrics using daily disclosures. Journal of Banking & Finance 64, 188–204.

Copeland, T.E., Galai, D., 1983. Information effects on the bid-ask spread. the Journal of Finance 38, 1457–1469.

Curtis, A., Fargher, N.L., 2014. Does short selling amplify price declines or align stocks with their fundamental values? Management Science 60, 2324–2340.

Dechow, P.M., Hutton, A.P., Meulbroek, L., Sloan, R.G., 2001. Short-sellers, fundamental analysis, and stock returns. Journal of Financial Economics 61, 77–106.

Diether, K., 2008. Short selling, timing, and profitability. Unpublished working paper, The Ohio State University .

Diether, K.B., Lee, K.H., Werner, I.M., 2009. Short-sale strategies and return predictability. The Review of Financial Studies 22, 575–607.

Drake, M.S., Rees, L., Swanson, E.P., 2011. Should investors follow the prophets or the bears? evidence on the use of public information by analysts and short sellers. The Accounting Review 86, 101–130.

Engelberg, J.E., Reed, A.V., Ringgenberg, M.C., 2012. How are shorts informed?: Short sellers, news, and information processing. Journal of Financial Economics 105, 260–278.

Glosten, L.R., Milgrom, P.R., 1985. Bid, ask and transaction prices in a specialist market with heterogeneously informed traders. Journal of financial economics 14, 71–100.

Grossman, S.J., Miller, M.H., 1988. Liquidity and market structure. the Journal of Finance 43, 617–633.

Harris, M., Raviv, A., 1993. Differences of opinion make a horse race. The Review of Financial Studies 6, 473–506.

Henry, T.R., Koski, J.L., 2010. Short selling around seasoned equity offerings. The Review of Financial Studies 23, 4389–4418.

Hopewell, M.H., Schwartz Jr, A.L., 1978. Temporary trading suspensions in individual nyse securities. The Journal of Finance 33, 1355–1373.

Hu, T., Hui, K., Peng, H., 2017. The effect of abnormal volatility trading halt on price volatility and liquidity: A natural experiment from the cancellation of abnormal volatility trading halt. Journal of Financial Research 447, 146–160.

Karpoff, J.M., Lou, X., 2010. Do short sellers detect overpriced firms? Evidence from SEC enforcement actions. Technical Report. Citeseer.

Khan, M., Lu, H., 2013. Do short sellers front-run insider sales? The Accounting Review 88, 1743–1768.

Lee, C.M., Ready, M.J., Seguin, P.J., 1994. Volume, volatility, and new york stock exchange trading halts. The Journal of Finance 49, 183–214.

Liao, J., Li, P., Zeng, Y., 2009. An empirical study on the implementation effect of trading halts system in chinese stock market. Management World 2, 36–48.

Meng, Q., Li, Y., Jiang, X., Chan, K.C., 2017. Informed or speculative trading? evidence from short selling before star and non-star analysts' downgrade announcements in an emerging market. Journal of Empirical Finance 42, 240–255.

Saffi, P.A., Sigurdsson, K., 2011. Price efficiency and short selling. The Review of Financial Studies 24, 821–852.

Singal, V., Xu, Z., 2005. Do short sellers know more? evidence from a natural experiment .

Wu, J., Zhang, A.J., 2015. Have short sellers become more sophisticated? evidence from market anomalies .

Xu, J., Wang, S., Xiong, Y., 2016. Informed short selling phenomenon in china's stock market. Chinese Journal of Management Science 24, 373–382.

Yu, H., Chen, B., Xu, J., Zhang, A., 2017. Are the motivations of margin purchasing and short selling the same? the research from the perspective of earings announcement. Journal of Finance and Economics 43, 121–135.

Zhang, J., Bai, X., Meng, X., 2016. Does margin trading and short selling promote insider trading? evidence from listed companies in china. Journal of Financial Research 432, 176–192.