International Review of Business Research Papers
Vol. 12. No. 1. March 2016 Issue. Pp. 29 – 42

The Information Roles of Short Sales in Chinese Stock Markets

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This paper investigates whether short sales have increased the market efficiency since short sales were allowed in 2010. Evidence from regression R-squared method and from Dimson beta method shows that short sales do increase the revealing of firm specific information, and individual stock prices react to their own information quicker than before. This paper also checks whether short sales contain information in the earnings announcement events. Results confirm that short sellers are able to make profit through increasing their short positions at pre-announcement period.

JEL Codes: G12, G14, G15

1. Introduction

Chinese equity markets began in 1991 but short selling was not allowed until March 31st 2010. At the beginning, only 90 stocks that are blue chips in Chinese equity market can be shorted through 6 named securities companies. From Dec 5th 2011, additional 189 stocks can be shorted, implying that the short sales had not caused problems to the Chinese Regulatory of Securities Commission (CSRC) during March 31st 2010 to Dec 5th 2011.

It is easily understood that the short sales in Chinese equity markets exclude "naked short selling" completely. Avoiding dramatic volatility is always the primary objective of the CSRC. In addition, unlike that in the U.S. market where securities lending is conducted by the stock brokerage houses at their discretion, Chinese securities companies cannot borrow/lend securities from other companies. All the short sales can be conducted only if the securities company has sufficient shares to lend to clients. Therefore, this regulation compressed the short sale volume dramatically. From Oct 28th 2011 when Chinese Securities Finance Ltd. Co. was founded, borrowing and lending securities among securities companies can go through this centralized firm.

The Chinese stock market around March 31st 2010 provides a perfect setting to study whether short sale plays a role in improving market efficiency. It was claimed that emerging of short sales would increase the market efficiency by revealing the negative information promptly. However, there has not been verified by empirical studies so far. This paper compares the same market without short sale and with short sale, and we answer two questions: Frist, Is firm specific information, especially the negative information reflected in price faster? Second, Do short sales contain negative information about the stocks? As this study is the first in this field, we contribute to the short sale literature with two conclusions: First, after short sales ban

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is lifted, the market efficiency is improved, especially for the days when market goes down. Second, the speed of individual stock price adjustment to its own information becomes quicker.

The remaining of the paper is organized as follows: Section 2 reviews the literature. Section 3 describes data and explains background information about short sales in Chinese equity market, and study whether speed of price adjustment to information becomes faster after the market starts to incorporate short sale. Section 4 studies whether short sale before earnings announcement contain important information. Section 5 discusses the results and concludes.

2. Literature Review

In current literature, studies on the short selling can be grouped into the following six research threads. First, How short selling affects market volatility? Second, Whether market crash and market bubbles are related to the short selling or short selling constraints? Third, Do short sellers have private information that helps predict stock price? Fourth, How the short selling cost/constraints shape different equity markets (market efficiency) around the world? Fifth, The effectiveness of new regulations on short sales. Sixth, The short sale endogeneity, that is, how the short sales are conducted? Our current study belongs to above mentioned third and fourth research thread.

Regarding whether short sellers have private information that helps predict stock price, there are basically two research approaches. One is calendar approach. Researches prior to 2000 on short sales often take this approach. Basically researchers try to find if the high short sale stocks have negative Jensen's alpha using Fama-French three factor model, or even including momentum factor. For example, Dechow et al. (2001) find investors short firms with low earnings and book to market ratio, and cover their positions as the ratios mean-revert. Desain et al. (2002) exam the relation between short interest and stock return in Nasdaq market and find heavily shorted firms associated with significant negative abnormal return. Boehmer, Huszar & Jordan, (2009) study short interest related information content and show that stocks with relatively high short interest subsequently experience negative abnormal returns. Diether, Lee & Werner (2009) study SEC temporary suspension of short-selling and conclude that effect of the price tests on market quality are uncertain and are dependent upon order flow distortion. Au, Doukas & Onayev (2008) study UK short selling data, finds a negative relation between short interest and stock return among stocks with high idiosyncratic risk. For stocks with low idiosyncratic risk, short selling activities are mostly concentrated where arbitrage cost is less. Boehmer, Jones & Zhang (2008) find short sellers are well informed. The heavily shorted stocks underperform lightly shorted stocks, and institutional investors are more informed. They conclude short sellers make important contribution to efficient stock prices.

Another approach is event study method. Researchers try to find whether short selling volume increase before some negative events. Senchack & Starks (1993) find stocks with increased open short interest generate negative abnormal return around open short interest announcement date. Safieddine & Wilhelm (1996) study short-selling activities around seasoned equity offerings (SEO). They find high level of short selling associated with SEOs, and such activity are attributed to lower proceeds from issuing new shares. Henry & Koski (2010) study price and short selling behavior around SEO announcements. While they find no evidence of informed short selling, however they do find higher levels of short selling around issue dates which is consistent with manipulative trading. Christophe, Ferri & Angel (2004) perform event study of short-sales transactions prior to earnings announcements of 913 Nasdaq-listed firms. They find the abnormal short selling is linked to post-announcement

returns. Daske, Richardson & Tuna (2005) use NYSE database for the period from April 1, 2004 through March 31, 2005, and they find no evidence that short sale transactions are associated with before bad news events. Desai, Krishnamurthy & Venkataraman (2005) document that several months before earnings announcement, short sellers accumulated positions, and unwind these positions after the drop in share price induced by the announcement. Christophe, Ferri & Angel (2010) study short-selling prior to analyst downgrades announcement in a sample of 670 Nasdaq downgrade stocks between 2000 and 2001. They find abnormal levels of short-selling before pubic release of the downgrades. They also find significant relation between abnormal pre-announcement short selling activities and the subsequent downgrades. Karpoff & Lou (2010) examine the relation between short selling and the investigation and enforcement of the financial statement misrepresentation by SEC. They find abnormal short increase before the misconduct, indicating discovery of these events eventually.

Regarding how the short sale constraints affect market efficiency, there are some theoretical papers such as Miller (1977), Diamond & Verrechia (1987), and Hong & Stein (2003). All of these three papers point out that short sale is necessary for the negative information/opinions to reflect in the stock prices. Empirical studies also focus on efficiency improving after the short sale constraints are lifted in the market. Aitken et al. (1998) find connection between constraint lifting and the following negative stock performance. Bekaert & Harvey (2003) find that the cost of capital is lower when the constraints are lifted in some emerging market, indicating higher market efficiency. Jones & Lamont (2002) find that there is negative return if the short selling cost (one type of constraint) is higher. Ofek & Richardson (2003) find that the temporary short sale forbidding (new equity's lock period) leads to high stock price and low following returns. Chang & Yu (2007) study the short sale in Hong Kong market where stocks that meet some criteria are allowed to short sell. They prove that stocks that are not allowed to short sell have higher price. Bris, Goetzmann & Zhu (2007) look at 46 equity markets and find the market efficiency is improved after short sale constraints lifted.

Even though all above research find relation between price behavior and short-selling activities, none of the research clarifies the relation between short sales and market efficiency. All prior researches find there is link between the increased short selling prior to the negative announcement and the subsequent negative stock return. However, there has been no study examines whether short selling improves market efficiency. Our current research fills the gap. We study stock price before and after March 31st, 2010, when short sale started to be allowed in Chinese stock market. We find after the short sale ban was lifted, market efficiency improved, and the speed that stock price reflects the stock information becomes faster after short sale is in the market.

3. Methodology for Market Efficiency

3.1. Data

90 stocks initially were allowed to short sell from March 31st 2010 and additional 189 stocks were added to the short-sellable list on Dec 5th 2011. In order to investigate the roles of short sales, this paper focuses on the initial 90 stocks.[1] The sample period ends March 7th, 2012. Daily and weekly stocks' returns and market performance, which is proxied by HuShen300 index, are obtained from WIND database.

The short selling data are also obtained from WIND database, there are two types of short selling data. One is daily short selling volume, which is a flow variable; another is open interest,

which is a stock variable. Because securities companies are not required to disclose short positions related information, these two types of variables are complementary.

Following charts give us an idea how the short selling was done. Figure 1 is daily average open interest during the sample period. It is clear that short selling volume is almost zero in the first year and has increased sharply in the second year. Figure 2 is the stock movements during this two year sample period. We see majority of the stocks have negative returns. The total market return during the sample period is -15.5%.

Figure 1: Daily open interest in Chinese market

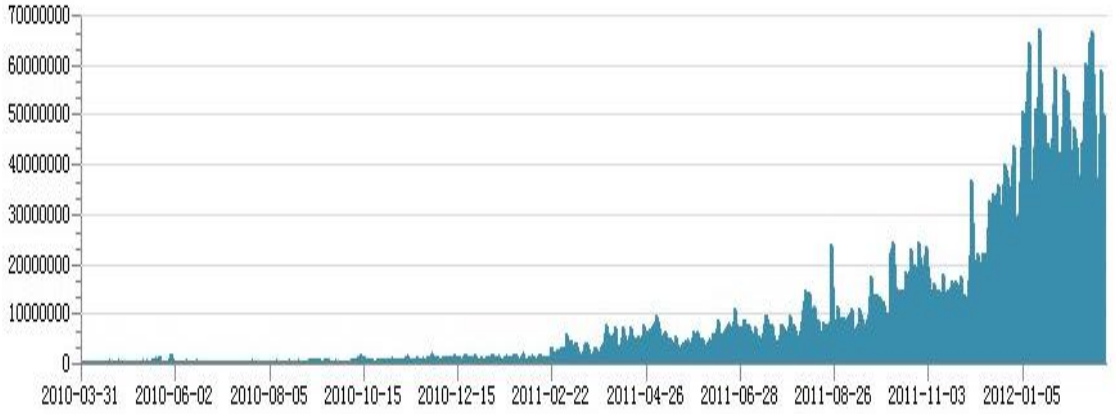
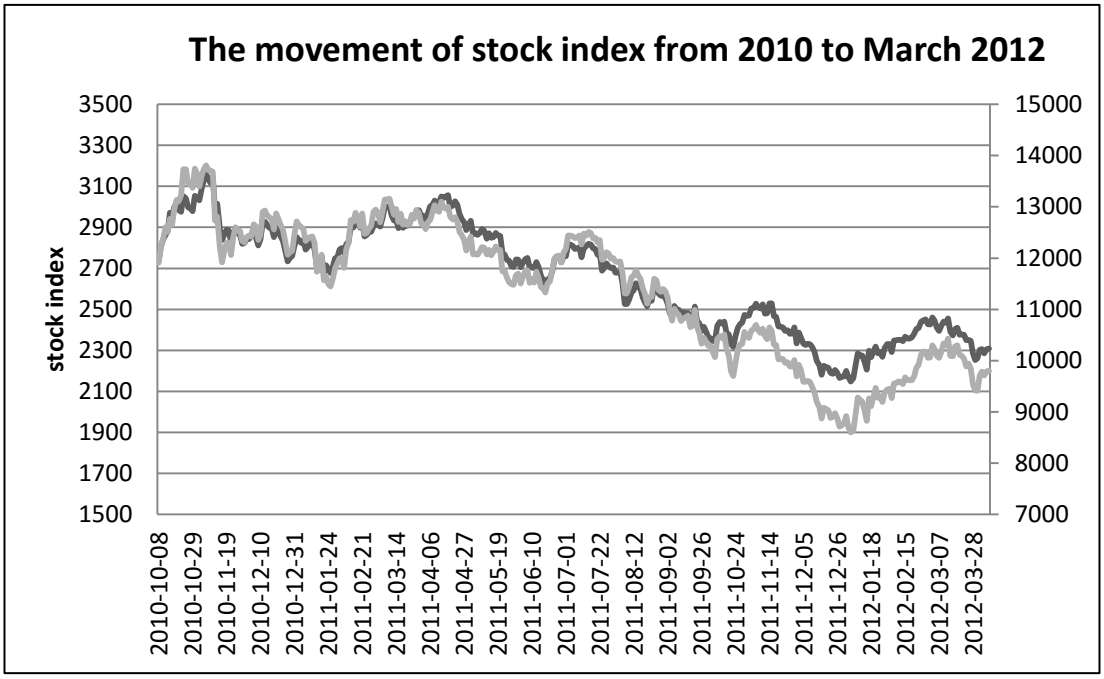


Figure 2: stocks returns' average in the two year sample period (weekly data)



Market Efficiency Models

In order to test whether short selling improves market efficiency, we need to give a measurable variable to depict market efficiency. This paper takes two approaches.

Mørck, Yeung & Yu (2000) state that the more efficient of the market, the more firm-specific information is revealed. Hou & Moskowitz (2004), Bris, Goetzmann & Zhu (2007) follow this idea and use regression R-squared method to test if short selling increases market efficiency. That is, the R-squared from the individual stock regressed on market portfolio should be lower when the market becomes more efficient. Moreover, Bris, Goetzmann & Zhu (2007) distinguish market up condition and market down conditions[2]. When short sell is forbidden, negative information cannot be reflected in the stock price, at least not promptly reflected in the stock market directly. Therefore, the R-squared would be higher if regression is using only down market conditions.[3]

Specifically, the R-squared is obtained from following regression model:

$$r_{it} = \alpha_{it} + \beta^{M} r_{Mt} + \varepsilon_{it} \quad (1)$$

Where r_{it} is individual stock's return, r_{Mt} is market portfolio's return. To distinguish market conditions, following regression models are used.

$$r_{it} = \alpha_{it} + \beta^{M} r_{Mt}^{+} + \varepsilon_{it} \quad (2)$$

$$r_{it} = \alpha_{it} + \beta^{M} r_{Mt}^{-} + \varepsilon_{it} \quad (3)$$

Where r_{Mt}^{+}, r_{Mt}^{-} are market return when it is positive and negative respectively. The R-squared from above two equations are denoted as R_i^{2+} and R_i^{2-}. The difference is denoted as $R_i^{2Diff} = R_i^{2-} - R_i^{2+}$.

Table 1: R-squared method

		R^2	R_i^{2+}	R_i^{2-}	$R_i^{2Diff} = R_i^{2-} - R_i^{2+}$
Short sales NOT allowed	# of observations	83	83	83	83
	Average	**50.10%**	**34.19%**	**30.55%**	**-3.63%**
	Median	54.88%	36.43%	30.48%	-1.18%
Short sales allowed	# of observations	83	83	83	83
	Average	**43.12%**	**35.45%**	**23.57%**	**-11.87%**
	Median	45.71%	40.22%	23.20%	-14.44%
P-value of mean difference		0.0000	0.2453	0.0003	0.0000

Note: R^2 is obtained from following regression model: $r_{it} = \alpha_{it} + \beta^{M} \times r_{Mt} + \varepsilon_{it}$ (1),

Where r_{it} is individual stock's return, r_{Mt} is market portfolio's return. R_i^{2+} and R_i^{2-} are obtained from following regression models respectively: $r_{it} = \alpha_{it} + \beta^{M} \times r_{Mt}^{+} + \varepsilon_{it}$, $r_{it} = \alpha_{it} + \beta^{M} \times r_{Mt}^{-} + \varepsilon_{it}$, where r_{Mt}^{+}, r_{Mt}^{-} are market return when it is positive and negative respectively. The difference is denoted as $R_i^{2Diff} = R_i^{2-} - R_i^{2+}$.

Table 1 gives the results of the R-squared, in which "short sales are NOT allowed" means period of March 7th 2008 through March 31st 2010, "short sales are allowed" means period of April 1st 2010 through April 1st 2012.

We can extract following findings from Table 1. First, the R-squared of the market model decrease from 50.10% without short sale to 43.12% with short sale, with great significance. This means after allowing short sales of these stocks, stock price contains more firm specific information. Individual stocks are not as much as before to follow the market movements. In other words, short sales do improve market efficiency. Still about one half individual stock

returns can be attributed to market movement. Second, R_i^{2+} doesn't change significantly, implying that individual stocks move with the market indifferently with or without short sale when market goes up. Third, R_i^{2-} gets lower, from 30.55% without short sale to 23.57% with short sale which indicates that R-squared decreasing is mainly due to observations when market goes down. Short sales already let negative information be embodied in the price so that individual stocks don't go with market movement as much as before. Fourth, R^{2Diff} gets lower as well. The difference of R-squared between up and down conditions indicate that investors are more likely to "be herding" in buying. But investors don't herd in selling. All the results indicate that short sales do improve market efficiency. As an application of this study, the CSRC ought to go ahead to allow more stocks to short sell.

Besides how much information is reflected in the stock price, the efficiency can also be measured by the speed of information adjusted by the stock price. Refer to Chordia & Swaminathan (2000), Hou & Moskowitz (2004), Chiang et al. (2008), we apply Dimson beta regression method to tell if the speed of price adjusting increased after short sales constraint lifted. The model is following:

$$r_{it} = \alpha_{it} + \sum_{k=1}^{5} \beta_k^i r_{t-k}^M + \beta_0^i r_t^M + \varepsilon_{it} \quad (4)$$

Where dependent variable is individual stocks' return. The explanatory variables are market return and its lags up to 5. If individual stock price adjust speed is quick, then we would expect to see a greater β_0^i. Otherwise, slow adjusting speed would lead to greater $\sum_{k=1}^{5} \beta_k^i$. Chordia & Swaminathan (2000) compare these two coefficients and propose a speed variable:

$$x^i = |\sum_{k=1}^{5} \beta_k^i| / |\beta_0^i| \quad (5)$$

$$\text{Delay} = 1/(1 + e^{-x^i}) \quad (6)$$

Where "Delay" measures the slowness of adjusting speed. *e* is the natural exponential. where x^i is the speed of adjustment ratio for stock i. A logit transformation is applied to obtain the DELAY as a measure for individual stock i's speed of adjustment. "Delay" has a value between 0.5 and 1. The greater the "Delay", the slower of the adjusting speed. The less the "Delay", the faster of the adjusting speed. Considering that the comovements with the market portfolio are different at up/down conditions, we also distinguish the market performance to calculate Delay_i^+ and Delay_i^- by markets moving directions.

$$r_{it} = \alpha_{it} + \sum_{k=1}^{5} \beta_k^i r_{t-k}^M + \beta_0^i r_t^{M+} + \varepsilon_{it} \quad (7)$$

$$r_{it} = \alpha_{it} + \sum_{k=1}^{5} \beta_k^i r_{t-k}^M + \beta_0^i r_t^{M-} + \varepsilon_{it} \quad (8)$$

We calculate the "Delay" for two periods: before and after short sales were allowed. Results are shown in Table 2. We find that "Delay" doesn't change at two periods, both are close to 0.5, which indicates that individual stocks react market information quickly. Lifting the short sales constraints hasn't changed the adjusting speed. Without considering significance, the adjusting speed to market risk is even decreased.

The principle of Dimson Beta approach is to decompose the individual stocks return into two parts: one spontaneous part and one delayed part. We take this approach but using individual stock's information rather market information. Model is as below:

$$r_{it} = \alpha_{it} + \sum_{k=1}^{5} \beta_k^i Re_{t-k}^i + \beta_0^i Re_t^i + \varepsilon_{it} \quad (9)$$

$$r_{it} = \alpha_{it} + \sum_{k=1}^{5} \beta_k^i Re_{t-k}^i + \beta_0^i Re_t^{i+} + \varepsilon_{it} \quad (10)$$

$$r_{it} = \alpha_{it} + \sum_{k=1}^{5} \beta_k^i Re_{t-k}^i + \beta_0^i Re_t^{i-} + \varepsilon_{it} \quad (11)$$

Among these equations, *Re* is the residual of equation (1). As the residual of the equation, Re is called idiosyncratic risk. Equation (9) gives us an idea how the individual stock price reacts to the idiosyncratic risk and its lags.

3.3 Empirical Results – Speed of Price Adjustment

Model 4-11 results are shown in the Panel B of Table 2. We find that the "Delay" gets smaller after the short sales are allowed for idiosyncratic risk. Remarkably, "Delay" changes from 0.5708 to 0.5471 with a p-value of 0.0011. When just considering the negative idiosyncratic risk, "Delay" drops from 0.5397 to 0.5331 with a p-value of 0.0986. This indicates that stock price adjusts to the idiosyncratic risk more quickly.

Table 2: the results of "Delay" computation

Panel A: react to market risk					
		Delay	$Delay_i^+$	$Delay_i^-$	$Delay_i^- - Delay_i^+$
Short sales NOT allowed	# of observations	83	83	83	83
	Average	**0.5453**	**0.6166**	**0.6172**	**0.00067**
	Median	0.5336	0.5813	0.5910	0.00745
Short sales allowed	# of observations	83	83	83	83
	Average	**0.5577**	**0.6326**	**0.6590**	**0.02643**
	Median	0.5408	0.5957	0.6013	0.0131
	P-value	0.1445	0.3321	0.3627	0.2839
Panel B: react to idiosyncratic risk					
		Delay	$Delay_i^+$	$Delay_i^-$	$Delay_i^- - Delay_i^+$
Short sales NOT allowed	# of observations	83	83	83	83
	Average	**0.5708**	**0.5725**	**0.5397**	**-0.03278**
	Median	0.5551	0.5655	0.5245	-0.02316
Short sales allowed	# of observations	83	83	83	83
	Average	**0.5471**	**0.5592**	**0.5331**	**-0.02613**
	Median	0.5316	0.5359	0.5258	-0.01675
	P-value	0.0011	0.0624	0.0986	0.2373

Note: the "Delay" variable depicts the slowness of stock price adjusting to new information. Greater "Delay" indicates slower adjusting speed.

4. Methodology for Information Content of Short Sales

Previous section shows that after the short sales constraints were removed, these short sellable stocks don't co-move with market portfolio as much as before. There is a greater percentage of the individual stock price change due to idiosyncratic risk than before. In addition, the adjusting speed to the idiosyncratic risk is quicker. This section investigates what kind of information there is in the short sales. Are we are able to make use of short sales information to predict stock returns?

We test the predictability of short sales information in two ways. One is general short sale information; another is the short sale information just before the earnings announcement events.

4.1 Models for Short Sales Earnings Announcement

The short sale is measured by Relative Short Sale (RSS), which is computed as short selling volume divided by trading volume. Using short sale day as day zero, Rss(-5,-1) is the average of previous 5 days' RSS. The question is whether Rss(-5,-1) can predict present stock abnormal return. The abnormal return is benchmarked on one index model, as indicated in the Equation (1) using previous 30 days trading data, and under the assumption that beta keeps constant in our regression period. R(1)=r(1)- $\beta^{M} * r_{M}(1)$ is next day's abnormal return; R(1,2)=R(1)+R(2), is cumulative abnormal return (CAR) for next day and the following day. R(1,3), R(1,4), R(1,5) are similar. These different CAR are used because the database doesn't provide information when the short positions are closed. We have to rely on these CARs to consider the short term predictability.

The data are in panel format. Besides the key variables of short sale and stock abnormal returns, we also have some control variables such as previous days' returns, turnover, and volatility. The volatility is computed as (price high – price low)/previous day's closing price. The data are summarized in Table 3. The model is as following:

$$R(1)_{it} = \beta_1 Rss_{it} + \beta_2 r(-5,-1)_{it} + \beta_3 tv(-5,-1)_{it} + \beta_4 vlt_{it} + a_i + e_{it} \quad (12)$$

$$R(1,2)_{it} = \beta_1 Rss_{it} + \beta_2 r(-5,-1)_{it} + \beta_3 tv(-5,-1)_{it} + \beta_4 vlt_{it} + a_i + e_{it} \quad (13)$$

$$R(1,3)_{it} = \beta_1 Rss_{it} + \beta_2 r(-5,-1)_{it} + \beta_3 tv(-5,-1)_{it} + \beta_4 vlt_{it} + a_i + e_{it} \quad (14)$$

$$R(1,4)_{it} = \beta_1 Rss_{it} + \beta_2 r(-5,-1)_{it} + \beta_3 tv(-5,-1)_{it} + \beta_4 vlt_{it} + a_i + e_{it} \quad (15)$$

$$R(1,5)_{it} = \beta_1 Rss_{it} + \beta_2 r(-5,-1)_{it} + \beta_3 tv(-5,-1)_{it} + \beta_4 vlt_{it} + a_i + e_{it} \quad (16)$$

Where a_i is fixed effect for different stocks, e_{it} is the error term. The results are summarized in Table 4.

4.2 Empirical Results of Event Study

After controlling previous 5 days' returns, trading volume, and intraday volatility, we find that RSS still show positive significances for R(1), R(1,2), through R(1,5) for stocks listed on Shanghai Stock Exchange and that RSS variable is insignificance for stocks listed on

Shenzhen Stock Exchange. For example, one unit of RSS increasing will cause 0.026% daily abnormal return averagely. These results reveal that short sellers won't be able to predict stock returns in the short run and lose money.

Table 3: descriptive of variables (daily)

	Stocks in Shanghai Exchange				Stock in Shenzhen Exchange			
	Mean	**Std**	**Min**	**Max**	**Mean**	**Std**	**Min**	**Max**
Rss	0.6119	0.8877	0.00005	10.5503	0.8330	1.0512	0.00008	14.8364
Rss(-5,-1)	0.5758	0.7227	0	7.0154	0.7839	0.8281	0	6.3868
r(0)	0.0133	2.0393	-10	10.101	-0.0262	2.3069	-10	10.1099
r(-1)	-0.0470	2.0078	-10	10.101	-0.0824	2.2748	-10	10.1099
r(-5,-1)	-0.1595	4.3265	-21.5872	37.5965	-0.3299	4.9373	-25.8593	31.2020
R(1)	-0.0020	1.3322	-8.9460	10.7947	0.0022	1.6261	-12.4478	10.2973
R(1,2)	0.0070	1.9338	-12.0798	16.3821	-0.0077	2.3751	-19.6780	12.4182
R(1,3)	0.0130	2.3783	-13.8416	25.5583	-0.0084	2.9161	-21.2484	19.9476
R(1,4)	0.0185	2.7310	-14.3776	26.7811	-0.0155	3.3354	-26.3154	17.7142
R(1,5)	0.0281	3.0411	-15.1101	22.1364	-0.0266	3.7102	-26.4957	17.3019
tv(-5,-1)	0.6391	0.8334	0.0038	12.8643	0.9802	0.8489	0.0793	11.3025
vlt	2.8325	1.5899	0.3676	13.4100	3.2995	1.6716	0.6246	15.2099
vlt(-5,-1)	2.7640	1.1010	0.7397	10.5178	3.2475	1.0670	1.1061	9.68002

Note: the definitions of variables are: RSS=(short volume)/trading volume; r, raw return R, abnormal return; tv(-5,-1), the previous 5 days' average turnover; vlt=(high-low)/previous closing price.

Table 4: regression results of abnormal returns on short sales

	Shanghai Exchange					Shenzhen Exchange				
	R(1)	R(1,2)	R(1,3)	R(1,4)	R(1,5)	R(1)	R(1,2)	R(1,3)	R(1,4)	R(1,5)
Rss	0.0262 *					0.0256				
Rss		0.0509 **					0.0081			
Rss			0.0614 **					-0.0001		
Rss				0.0762 **					0.0272	
Rss					0.0917 ***					0.0449
r(-5,-1)	-0.0087 ***	-0.0101 **	-0.0034	0.0027	0.0012	-0.0113 ***	-0.0148 ***	-0.0098	-0.0126 *	-0.0201 ***
tv(-5,-1)	-0.057 ***	-0.0896 ***	-0.1521 ***	-0.2425 ***	-0.3129 ***	-0.062 ***	-0.1588 ***	-0.2701 ***	-0.4006 ***	-0.5058 ***
vlt	-0.0396 ***	-0.0452 ***	-0.0462 ***	-0.0481 ***	-0.0591 ***	-0.0149	-0.0362 **	-0.0106	-0.0157	-0.014 ***
R2	0.0053	0.0046	0.0046	0.0065	0.0085	0.0036	0.0057	0.006	0.0104	0.014

Note: the regression is conducted with fixed effects. *** indicates significance at 1% level, ** at 5% level and * 10% level. Without asterisk indicates insignificance at conventional levels.

It is necessary to explain why we put short sale variable to the right side of the equation. Selling, no matter how it is initiated, will give pressure on price. If selling variable is negatively significant, it is possible that selling action itself, instead of the information about the short sales has caused the price to go down. Table 4 shows the selling variables have positive signs. Therefore, we are able to make conclusion that short sales cannot predict short term stock returns in general. In fact, for the stocks listed on Shanghai Stock Exchange, the short sellers have lost on their books within one week after short positions were built.

Given that the short sales cannot predict stock returns in general, we turn to some specific events and explore whether short sales before these events have some private information. We follow Christophe, Ferri & Angel (2004) to investigate the earnings announcement events. We investigate the abnormal short sales before earning announcements in this paper to see whether short sellers are aiming special events to build up their positions and what the outcomes are. We consider the earnings announcement event because it is a scheduled event in corporate finance and it is one of the most important information revealing for the stock price changing. Investors with private information might establish short positions for those firms with expected negative earnings surprise, or reduce short positions for those firms with positive surprise.

Christophe, Ferri & Angel (2004) examine five days prior to earning announcements of 913 Nasdaq-listed firms in the fall of 2000, and provide evidence of informed trading in pre-announcements. In our sample, we have 4 earnings announcement events. They are 10Q4, 11Q1, 11Q2, and 11Q3. We obtain the earnings announcement information from GTA-CSMAR database.

We judge if the announcement is a negative surprise by computing the sum of the announcement day and following day's returns $RET(0,1)$. If RET(0,1) is negative, then it means the market label the earnings announcement a type of negative news; if non-negative, then positive news. A profitable earnings announcement (accounting number) is possible to be negative news (market reaction) if the earning is less than expected. For positive news, the short sellers have to endure loss in the book.

To examine the relation between short sales and stock returns, we have to compute the abnormal short sales. We have measurement which is $RELSS(-N,-1)$. $RELSS(-N,-1)$ is relative short-selling, measured as the ratio of shorted shares to traded shares for the stock over the interval of (-N, -1):

$$RELSS(-N,-1) = \frac{Short\_volume(-N,-1)}{trade\_volume(-N,-1)} \qquad (17)$$

To check the relation of the short sales and post-announcement stock performance, we run the following model:

$$RELSS(-5,-1) = \alpha + \beta_1 RET(0,1) + \beta_2 RET(-5,-1) + \beta_3 NORMRELSS + \varepsilon \qquad (18)$$

Where *RET(0,1)* is the return on the stock on the event day and following trading day, *RET(-5,-1)* is the return on the stock from the closing price of day -6 to -1. *NORMRELSS* is the

RELSS in the non-announcement period. *RET(-5,-1)* works as a control variable accounting for the possibility that the price changes before the earnings announcements affect the short selling activities. NORMRELSS works as another control variable in the equation accounting for the contemporaneous correlation between spikes in trading volume and abnormal short selling volume. The regression results of two models are shown in Table 5.

Table 5: regression results following Christophe, Ferri and Angel (2004) model

	Intercept	Ret(0,+1)	Ret(-5,-1)	Normrelss
1	0.0002108	-0.00418	0.00683	0.67354
(2010Q4)	(1.16)	(-0.92)	(2.04)**	(5.95)***
2.	0.00069017	0.0047	0.00959	0.74406
(2011Q1)	(2.53)**	(0.75)	(1.8)*	(4.74)***
3.	0.00292	-0.03335	0.01501	1.06962
(2011Q2)	(4.67)***	(-2.13)**	(1.16)	(2.73)***
4.	0.00269	0.00622	-0.02142	0.72452
(2011Q3)	(2.49)**	(0.33)	(-1.8)*	(7.38)***

Note: the regression model is:

$$RELSS(-5,-1) = \gamma + \gamma_1 RET(0,+1) + \gamma_2 RET(-5,-1) + \gamma_3 NORMRELSS + \varepsilon$$

Where RELSS is pre-announcement period abnormal short sales volume, RET(0,1) is the event day and following day's return. RET(-5,-1) is past stock returns, NORMRELSS is the level of relative short sales in non-announcement period. RET(-5,-1) and NORMRELSS work as control variables.

*** indicates significance at 1% level, ** at 5% level and * 10% level. Without asterisk indicates insignificance at conventional levels.

If the short sales are informed trading, i.e. short sellers build up short positions before the earnings announcements because they have private information, the coefficient of RET(0,1) variable in the models ought to be negatively significant. In other words, short sellers make money on the average.

Our regression results support this view. We notice that the coefficient of RET(0,1) is -0.03335 for 2011Q3 with 95% confidence level. This result says that short sellers possibly know bad news of the earnings announcement and short sell the shares before the announcement. However, for other quarters, the coefficients of RET(0,1) are insignificant. These results might be attributed to the relatively light short sales volume in Chinese market. Compared with the sample of Christophe, Ferri and Angel (2004), in which RELSS has average of 0.18, RELSS in our sample has average of 0.02. The insufficiency of the data leads to difficulty to find significant relations.

Another remarkable result is significance of the coefficient of RET(-5,-1) in the models when the RET(0,1) coefficient is insignificant. Christophe, Ferri & Angel (2004) finds no significance and conclude that the short term price movement before the earnings announcement doesn't affect abnormal short sales. Our results for 2011Q3 are consistent with it. If the coefficient of RET(-5,-1) is significant, it implies that short sellers are based on historic returns to build up their positions. As a result, this kind of short sales don't have information to

predict post-announcement returns. In general, although our results are not robust for different quarters, we do find that returns are associated with the pre-announcement abnormal short sales.

5. Conclusions

In this paper, we investigate two issues related to the short sales in Chinese stock markets. The first one is whether allowing short sales improve market efficiency. The second one is what kind of information of short sales can help predict stock returns.

We adopt regression R-squared method to test if market efficiency gets improved after April 1st 2010 when short sales began in Chinese stock markets. We find that R-squared gets lower than before. This result indicates that individual stock price movement contains less co-movement with the market portfolio. In other words, stock price reflects more on individual stock information.

We also apply Dimson Beta method to investigate whether adjusting speed changed after April 1st 2010. Results show that individual stocks react to market information quickly and the short sales allowance doesn't improve the speed. However, by considering the individual stock idiosyncratic risk, we do find that the speed also gets quicker. This result plus the result from R-squared method gives us a clear picture that short sales do function well in the stock market by reflecting more information, reflecting information quicker.

Regarding the second issue, we cannot find predictability of short sales for short term stock returns in general. Contrasts to our initial expectation, the short sellers lose money (in book, in short run) on those Shanghai Stock Exchange listed companies. To investigate the short sales on earnings announcement events, we find that short sales contain information that can be used to predict post-announcement returns.

We follow Christophe, Ferri and Angel (2004) method, and find similar results in Chinese stock market in the 2011 the 3rd Quarter. Pre-announcement abnormal return is negatively related to the announcement day and the following day's return. Although a little weak, the results do give us an idea that short sales provide some information in addition to the price, volume.

Endnotes

[1] One of original 90 stocks was removed from the list in December 2011.
[2] Using market up/down conditions are better than using individual stocks' performance.
[3] Our results show just in contrast. On the negative market movements, R-squared gets lower.

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