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# Heterogeneous Institutional Investors, Short Selling and Stock Price Crash Risk: Evidence from China

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**ABSTRACT:** This study investigates the relation between heterogeneous institutional investors and stock price crash risk, then explores the effect of short selling on the relationship. By using a dataset of 1064 firms from China for the 2007–2015 period, we find that different from the developed countries, in China both grey and independent institutional investors have positive effects on the stock price crash risk. Moreover, we also discover that for firms without short selling ban, positive correlation between grey institutional investors and stock price crash risk is weaker, while the relationship between independent institutional investors and the crash risk is not affected.

**KEY WORDS:** Grey investors, heterogeneous institutional investors, independent investors, short selling, stock price crash risk

The effects of institutional investors' shareholding on listed companies have been widely studied in the developed countries (Aggarwal et al. 2011; Cao and Petrasek 2014; Yan and Zhang 2009), while there is much less research of their counterparts in the developing countries (Firth et al. 2016). As the biggest emerging market in the world and a large transition economy (Wen et al. 2018), China has been studied by more and more scholars in recent years. Since 2000, China has made great efforts to develop institutional investors, leading to the institutional investors growing rapidly (Cai and Song 2010). In this study, we try to examine the role of institutional investors in influencing the firm's stock price crash risk.

According to the agency theory and the view of information asymmetry, recent studies claim that managers have motivations to withhold bad news from investors, such as keeping their position and salary (Ball 2009; Graham, Harvey, and Rajgopal 2005; Verrecchia 2001) or increasing the value of option in short term (Kim, Li, and Zhang 2011). When bad news accumulates and reaches the threshold level, managers tend to give up (Callen and Fang 2013). At that point, all of the negative firm-specific shocks become public leading to a crash immediately (Hutton, Marcus, and Tehrani 2009; Jin and Myers 2006). Some researchers try to find the factors affecting the stock price crash risk from the inside of the firm, such as Chief Executive Officer (CEO) and Chief Financial Officer (CFO) equity incentives (Kim, Li, and Zhang 2011), corporate real earnings management (Li, Francis, and Hasan 2011), CEO overconfidence (Kim, Wang, and Zhang 2016) and earnings guidance and bias (Hamm, Li, and Ng 2016); others try to explore the external factors, like mandatory accounting standards (DeFond et al. 2014), religion (Callen and Fang 2015), investor sentiment (He, He, and Wen 2018; Yin and Tian 2017) and social trust (Li, Wang, and Wang 2017).

As one of the major external factors of the crash risk, institutional investors constitute an important part of the capital market, and its impact on the stock price crash risk has arrested extensive attention recently. In the study of U.S. market, Callen and Fang (2013) discovered that stable institutional groups played a

monitoring role in reducing future stock price crash risk through pre-empting bad news hoarding activities by management. By using a large sample of the U.S. publicly traded firms during 1987–2010, An and Zhang (2013) argued that dedicated (transient) institutional ownership was negatively (positively) related to the firms' crash risk. An, Wu, and Wu (2016) explored the relationship between the stock crash risk of Real Estate Investment Trusts (REITs) and different types of institutional investors, and they pointed that the ownership of pension funds (bank trusts) was negatively (positively) related to the REIT crash risk.

However, compared to the institutional investor in developed countries, the institutional investors in China are faced with immature regulatory, legal mechanisms, and inadequate disclosure of financial information (Firth et al. 2016). And Jiang and Kim (2015) mentioned that when it comes to the external governance in China, there are some different characteristics and qualities with other developed countries, especially the role of institutional investors in China. Therefore, what role the institutional investor plays in China's stock market is necessary to be investigated. Although Dai, Tang, and Liu (2015) studied the relation between institutional investors and stock price crash risk, they used an outdated sample from 2005 to 2010, and they did not consider the influence of the institutional factors, such as the lift of short selling ban. With the dataset of 1064 firms from China 2007–2015, the relationship between institutional investors' shareholding and the stock price crash risk is examined in this paper. The result shows that the institutional investors' shareholding is significantly positively associated with the crash risk.

Considering different investors may have different invest targets, this research tries to take the institutional investors heterogeneity into consideration for a further study, displaying a more profound insight into the relationship. Not all institutional investors have the same interests or the same modus operandi (Brickley, Lease, and Smith 1988; De-la-Hoz and Pombo 2016; Hartzell and Starks 2003; Wen et al. 2014a). According to the potential business ties to a corporation, Ferreira and Matos (2008) classified institutions into independent versus grey institutions, and they reveal that independent institutions, with potentially fewer business ties to firms, were involved in monitoring corporations.

Following the previous literature (Ferreira and Matos 2008; Ward, Yin, and Zeng 2018), we divide the institutional investors into independent and grey investors according to the business ties between investors and firms and examine the relation between different investors and the crash risk. In this paper, we find that in China both independent and grey investors' shareholdings are significantly positively associated with future stock price crash risk. The results show that in China institutional investors are fixated on current performance, regardless whether they have business ties with firms.

In this paper, we further investigate the effect of short selling on the relationship between institutional investors and the crash risk. Hong and Stein (2003) argued that short-sales constraints limited the trading of pessimistic investors, which made negative information can't react on the stock price in time. Therefore, the negative information would accumulate and then reached the threshold, finally leading to a crash. Since March 2010 China has lifted bans on short-sale for stocks on an expanding designated list (Luo and Ren 2016), whether the short sale can affect the relation between institutional investors and the crash risk need to be explored. The results show that for firms without short selling ban, positive correlation between the grey institutional investors and stock price crash risk is weaker, while the relationship between the independent institutional investors and the crash risk is not influenced.

Our study contributes to the literature in several ways. Considering the fast-growing importance of China's capital market to international investors and the different external governance, the role of institutional investors in the stock market can no longer be simply extrapolated from the researches in western countries. To our knowledge, this is the first study to investigate the relation between the heterogeneous institutional investors and the stock price crash risk in China. And different with the findings of An and Zhang (2013) and Callen and Fang (2013), our results show that in China both independent and grey investors' shareholdings are significantly positively associated with future stock price crash risk. Besides, in recent years the institutional environment in China has been widely changed resulting that the investors have more investment strategies to use. Therefore, in this paper we try to figure out whether the institutional factor affects the relation between the heterogeneous investors or not. After taking the short selling into consideration, the result shows that the short selling can be used for grey investors to stabilize the market, which means the institutional environment in China still needs to be improved for the investors.

The paper proceeds as follows: the prior literature is reviewed and the hypotheses are further developed in Section 2. Section 3 describes the sample data, variables, and the empirical model. Section 4 presents the main empirical tests. The robust tests are shown in Section 5, and Section 6 briefly concludes this study.

## Literature Review and Hypotheses Development

Recent researches show that managers tend to hide the negative information, for the reason such as keeping their own position (Ball 2009; Graham, Harvey, and Rajgopal 2005; Verrecchia 2001), or increasing value of the option in the short term (Kim, Li, and Zhang 2011). Because of the information asymmetry, investors fail to know the hiding information, and therefore overvalue the stock price. When the information could not be withheld, all the negative firm-specific shocks become public at once, and a crash takes place. The asymmetry between the managers and external investors is the main cause of the crash risk.

The relation between institutional investors and the crash risk has been concerned in recent years. Callen and Fang (2013), An and Zhang (2013) and An, Wu, and Wu (2016) found that in the U.S. stock market, the institutional investors mainly stabilized stock markets by reducing the stock price crash risk, and further discovered that different types of institutional investors had different impacts on the risk of stock price crash. However, after investigating the firms in China, Dai, Tang, and Liu (2015) found that institutional investors did not play the role of stock market stabilizer in China, but propelled the crash risk.

To figure out the differences between developed and developing countries, this paper tries to explore the relation between heterogeneous institutional investors and the crash risk in China. Grounded in the existing literature (De-la-Hoz and Pombo 2016; Ferreira and Matos 2008; Firth et al. 2016; Ward, Yin, and Zeng 2018), we divide the institutional investors into independent and grey investors, according to the business ties between the investors and the firms. The independent investors are those who have little business ties with the listed firms, while the grey investors have potential associations with the firms.

Compared to the individual investors, institutional investors have more information and a greater ability to interpret the information (Han et al. 2015). In China's stock market, the institutional investors' shareholding is still lower than that in the developed countries, which makes independent investors lack the motivation to participate in corporate governance (Jiang and Kim 2015). On the one hand, independent investors are fixated on current performance. After collecting the negative information, they would choose to propel the stock price crash risk and ride bubbles for short-term interest. On the other hand, because there are no business ties between the independent investors and the firms that they invest, they do not need to consider the results of the firm's stock price crash.

Presupposing that independent investors induce short-termism leads to our hypothesis regarding the relation between independent investors' shareholding and future crash risk:

**Hypothesis 1.** Independent investors' shareholding is positively related to future stock crash risk.

As for grey investors, they have more information than the independent investors because of the potential business ties. But how to use the information for the grey investors remains to be discussed. To protect the long-term interest of firms, grey investors should keep the stock price stable and reflect the negative news to the price in time, which can reduce the crash risk. But in the other hand, according to the strategic alignment hypothesis, the grey investors may cooperate with firms for greater benefits. In such a way, even if they have negative information about a firm, they would not like to disclose it. Therefore, it further increases the information asymmetry between the individual and institutional investors, which would lead to the stock price crash.

In this paper, it is hypothesized that both effects can co-exist. It is an empirical question whether the magnitude of either effect is more pronounced.

**Hypothesis 2a.** Grey investors' shareholding is positively associated with future crash risk.

**Hypothesis 2b.** Grey investors' shareholding is negatively associated with future crash risk.

Hong and Stein (2003) argued that short-sales constraints limited the trading of pessimistic investors, which made the stock price only reflect the positive news, so that the negative information accumulated and then reached the threshold, leading to the stock price crash. Based on Hong and Stein (2003) heterogeneous beliefs model, Chen and Zhang (2009) suggested that the crash phenomenon would decrease if the policy were taken to lift the short-sale bans. Since March 2010 China has lifted bans on short-sale for stocks on an expanding designated list (Luo and Ren 2016). Using the data of Chinese companies from 2010 to 2012, Chang, Luo, and Ren (2014) argued that after the ban was lifted, price efficiency increased while stock return volatility decreased. By using a sample from 2009 to 2014, Li et al. (2017) pointed out that short selling helped to stabilize stock prices and improve market quality, even in an emerging economy, i.e. China with a less developed stock market than that in the US and Europe. Whether the short selling can reduce the stock price crash risk in firm-level remains to be discussed.

Before lifting short selling bans, institutional investors could not reflect their information on the stock price in time, even if they have information superiority. As a result, the firm's stock price will crash ultimately. After the ban is lifted, heterogeneous institutional investors can take different strategies to achieve their investment goals.

For independent investors, as there are no business ties between them and firms, they always focus on their own interest. If they have any negative information, they would not reflect it on the stock price in time and would better rib the bubble. The short sale restriction only affects investors who have the bearish information and are willing to reflect it on the stock price. Therefore, the short selling may have little effect on the relation between independent investors and crash risk. When it comes to grey investors, as the existence of the short selling restriction even if they want to stabilize the stock prices, they always could not have a channel to reflect the negative information on the stock price. But after lifting the short selling ban, grey investors have an alternative way to reflect the negative information on the price which could reduce the future stock price crash risk of a firm. Specifically, we hypothesize that:

**Hypothesize 3.** The short selling can reduce the positive association between the grey investor and crash risk.

**Hypothesize 4.** The short selling has no effect on the relation between the independent investor and crash risk.

## Sample and Empirical Methodology

### Sample

To construct our sample, we start with Chinese A-share listed companies during the 2007–2015 period. We obtain the financial data from the China Securities Market and Accounting Research (CSMAR) database and the institutional investors' shareholding data from the WIND database. The new Financial Reporting Standards was carried out in 2007, which will further influence the crash risk (DeFond et al. 2014; Hutton, Marcus, and Tehranian 2009), so we choose our sample from 2007.

Following the literature (Chen et al. 2017; Jin and Myers 2006; Li, Wang, and Wang 2017), we exclude (1) financial services firms<sup>1</sup>, (2) firms with fewer than 30 trading weeks of stock returns in a fiscal year<sup>2</sup>, and (3) firm-year observations with missing information for the control variables. Our final sample includes 8407 firm-year observations representing 1064 individual firms. We also

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<sup>1</sup> Because the disclosure requirements and accounting rules of the financial services firms are significantly different for this regulated industry, we drop the financial services firms. In the WIND database, we can select non-financial firms. And considering the consistency effect of the short selling, we choose the 1410 firms in 2007 as our basic sample. From Table 1, we can see from the mean value (0.42) of the variable List in the sample that the percentage of the stocks in the designated list is reasonable to some extent.

<sup>2</sup> To ensure the calculation of firm-specific stock price crash risk, we require more than 30 trading weeks of stock returns in a fiscal year. Then, we get a sample of 1233 firms with 9864 firm-year observations.

1. This robust test is based on the anonymous reviewer's comment. Here, we want to express the depth of my gratitude to the anonymous reviewer.

**Table 1. Descriptive statistics.**

Variable	Mean	Std. Dev.	Minimum	25th percentile	Median	75th percentile	Maximum
<i>InsHold<sub>t</sub></i>	0.09	0.11	0.00	0.01	0.04	0.12	0.81
<i>Ncskew<sub>t</sub></i>	-0.29	0.90	-3.00	-0.82	-0.25	0.30	1.83
<i>Duvol<sub>t</sub></i>	-0.09	0.32	-0.92	-0.29	-0.08	0.12	0.75
<i>Grey<sub>t</sub></i>	0.01	0.03	0.00	0.00	0.01	0.02	0.81
<i>InDep<sub>t</sub></i>	0.08	0.11	0.00	0.01	0.03	0.10	0.65
<i>List<sub>t</sub></i>	0.42	0.49	0.00	0.00	0.00	1.00	1.00
<i>PostList<sub>t</sub></i>	0.12	0.32	0.00	0.00	0.00	0.00	1.00
<i>LEV<sub>t</sub></i>	0.52	0.20	0.08	0.38	0.53	0.66	0.98
<i>ROA<sub>t</sub></i>	0.06	0.07	-0.16	0.03	0.06	0.09	0.31
<i>Turnover<sub>t</sub></i>	-0.02	0.35	-0.91	-0.22	-0.02	0.16	0.87
<i>Size<sub>t</sub></i>	22.05	1.29	19.11	21.16	21.95	22.84	25.59
<i>BM<sub>t</sub></i>	1.08	0.97	0.09	0.44	0.76	1.37	5.25
<i>Ret<sub>t</sub></i>	-0.17	0.64	-1.70	-0.57	-0.20	0.20	1.75
<i>Sigma<sub>t</sub></i>	0.05	0.02	0.02	0.04	0.05	0.06	0.11
<i>AbsACC<sub>t</sub></i>	0.36	0.26	0.00	0.16	0.31	0.53	1.16

Winsorize the continuous variables at the 1% and 99% levels to mitigate the effect of outliers (Li, Wang, and Wang 2017).

**Measuring Firm-Specific Crash Risk**

Following Kim, Li, and Zhang (2011), Xu et al. (2014) and Li, Wang, and Wang (2017), firm-specific crash risk is measured using two statistics: the negative coefficient of skewness of firm-specific weekly returns (*NCSKEW<sub>i,t</sub>*) and the crash likelihood measure of the Down-to-Up Volatility (*DUVOL<sub>i,t</sub>*) of firm-specific weekly returns. At first, we calculate the firm-specific weekly returns (*W<sub>i,t</sub>*) as the natural logarithm of one plus the residual return from below regression:

$$r_{i,t} = \alpha + \beta_{1,i}r_{m,t-2} + \beta_{2,i}r_{m,t-1} + \beta_{3,i}r_{m,t} + \beta_{4,i}r_{m,t+1} + \beta_{5,i}r_{m,t+2} + \varepsilon_{i,t} \tag{1}$$

where *r<sub>i,t</sub>* and *r<sub>m,t</sub>* are respectively corresponding the weekly return of firm *i* and market *m*. The lead and lag items of the market are employed to reduce the deviation because of no synchronous trading (Dimson 1979).

The first measure, *NCSKEW<sub>i,t</sub>* is calculated by the equation (2):

$$NCSKEW_{i,t} = - \left[ n(n-1)^{\frac{3}{2}} \sum W_{i,t}^3 / \left[ (n-1)(n-2) \left( \sum W_{i,t}^2 \right)^{3/2} \right] \right] \tag{2}$$

where *n* is the number of trading weeks of firm *i* in year *t*. The front negative sign gives us a better interpretation of the measure, i.e., an increase in *NCSKEW<sub>i,t</sub>* indicates that the firm is more likely to crash.

The second measure of crash risk, *DUVOL<sub>i,t</sub>* is calculated as follows:

$$DUVOL_{i,t} = \log \left\{ \left[ (n_u - 1) \sum_{DOWN} W_{i,t}^2 \right] / \left[ (n_d - 1) \sum_{UP} W_{i,t}^2 \right] \right\} \tag{3}$$

where *n<sub>u</sub>*(*n<sub>d</sub>*) is the number of weeks that firm *i*'s specific weekly returns are higher (lower) than the mean firm-specific weekly return over year *t*. Firms with a higher level of *DUVOL<sub>i,t</sub>* are more likely to crash.

## Variables

The institutional investors' shareholding ( $InsHold_{i,t}$ ): Following Dai, Tang, and Liu (2015), we select quarterly data of the institutional investors' shareholding. Then, we obtain the annual data by averaging the quarterly institutional investors' shareholding.

Heterogeneous institutional investors: According to the literature (Ferreira and Matos 2008; Ward, Yin, and Zeng 2018), we address the sources of investor heterogeneity by dividing and contrasting the sample of institutional investors into two groups according to the potential business ties to a corporation: Independent investor ( $Indep_{i,t}$ ), and grey investors ( $Grey_{i,t}$ ). Ferreira and Matos (2008) mention that there are cross-country differences between definitions of institutional categories. In WIND database, the categories of the institutional investors are mainly the mutual fund, Chinese National Social Security Fund (CNSSF), Qualified Foreign Institutional Investors (QFII), banks, trusts, insurance companies, financial companies, and securities companies.

In China, since the CNSSF is managed and operated by the National Council for Social Security Fund, it can be regarded as a public pension fund, which is regarded as one of the independent investors (Ward, Yin, and Zeng 2018). As for the QFII, they are often more sophisticated and more likely to provide significant monitoring of their investing firms (Aggarwal, Hu, and Yang 2015). Therefore, in this paper, the independent investors include the mutual fund, CNSSF, and QFII. The banks, insurance companies, and securities companies are the institutional investors that have business ties with the firms (Firth et al. 2016). And as for the financial companies, they often have the current or prospective relation with the firms based on their main business. So, the banks, trusts, insurance companies, financial companies, and securities companies are regarded as the grey institutional investors in this paper.

The short selling: China has lifted bans on short-sale for stocks on an expanding designated list since March 2010 (Luo and Ren 2016). Since then, the list has been revised fourth. In December 2011, the exchanges substantially expanded the list to 278 qualified constituent stocks. In January 2013, the number of the list expanded to 500. The list of the qualified constituent stocks expanded to 700 in September 2013. The latest revision was in September 2014, with the list number reaching 900. If the stock was on the list in the first half year, we set the variable  $PostList_{i,t}$  to 1, otherwise, the value is set to 0. For the reason that Luo and Ren (2016) found stocks on the designated list are not randomly chosen, we assign a dummy variable  $List_i$  to control this effect. If the firm has been on any version of the designated list this variable equals 1, and 0 otherwise.

The control variables: The control variables ( $CV_{i,t}$ ) are the potential factors that have been shown in the literature to predict future crash risk. In this paper, we include eight firm-level control variables in the model. Hong and Stein (2003) suggest that investor opinion heterogeneity is a predictor of stock price crash risk. Therefore, we control for the detrended stock trading volume ( $Turnover_{i,t-1}$ ), which is a proxy for investor opinion heterogeneity. Chen, Hong, and Stein (2001) suggest that the past returns are related to future crash risk because the bubble built up by past returns is typically followed by a sudden drop in prices. Also, most investors prefer to choose a small number of stocks to invest (Dai and Wen 2018). For this reason, we include past returns ( $Ret_{i,t-1}$ ), the book-to-market ratio ( $BM_{i,t-1}$ ), and firm size ( $Size_{i,t-1}$ ) in our regression. Own to the potential serious correlation (Xiao et al. 2018), we control for the lagged crash risk. We also include stock volatility ( $Sigma_{i,t-1}$ ) since stocks that are more volatile are more likely to undergo a future price crash. Additional firm-level control variables are financial leverage ( $LEV_{i,t-1}$ ), profitability ( $ROA_{i,t-1}$ ) and the absolute value of abnormal accruals ( $AbsACC_{i,t-1}$ ), which is a proxy for earnings management (Hutton, Marcus, and Tehranian 2009; Kim, Li, and Zhang 2011; Kim and Zhang 2016).

## Empirical Models

To investigate the institutional investors' effect on the stock price crash risk, we estimate the following model:

$$Crash_{i,t+1} = \beta_0 + \beta_1 \times Heter_{i,t} + \sum_{q=2}^m \beta_q (qth\ CV_{i,t}) + YR + Ind + \varepsilon_{i,t} \quad (4)$$

where the dependent variable,  $Crash_{i,t+1}$  is measured by  $NCSKEW_{i,t}$  or  $DUVOL_{i,t}$ , and the main independent variable,  $Heter_{i,t}$  ( $Indep_{i,t}$  or  $Grey_{i,t}$ ) is the shareholding of independent investors or grey investors. According to the coefficient  $\beta_1$ , we can know the relation between the independent investors and the crash risk, thereby we can verify the Hypothesis 1 and Hypothesis 2. If the  $\beta_1$  is significantly positive, it implies that this kind of investors will intensify the crash risk, otherwise it will reduce the firm-level stock price crash risk. Industry and year fixed effects ( $Ind$  and  $YR$ ) are included in the regressions as well. Further, we cluster the standard errors at the firm level (Petersen 2009).

To examine the impact of the short selling on the relation between heterogeneous investors and crash risk, we test Hypothesis 3 and Hypothesis 4 by including  $PostList_{i,t}$ , an indicator variable for short selling, as well as the interaction between short selling and investors' shareholding ( $PostList_{i,t} * Heter_{i,t}$ ):

$$Crash_{i,T+1} = \beta_0 + \beta_1 \times PostList_{i,t} * Heter_{i,t} + \beta_2 * Heter_{i,t} + \beta_3 \times PostList_{i,t} + \beta_4 \times List_i + \sum_{q=5}^m \beta_q (qth\ CV_{i,t}) + YR + Ind + \varepsilon_{i,t} \quad (5)$$

If the coefficient of the interaction  $PostList_{i,t} * Heter_{i,t}$  is negative, it suggests that the short selling can help the institutional investors reduce the stock price crash risk. And if the coefficient  $\beta_1$  is positive, it means that the short selling increases the relation between the shareholding of institutional investors and future crash risk.

## Empirical Results

### Descriptive Statistics

Table 1 reports the summary statistics on the variables used in our study. The mean and standard deviation values of  $NCSKEW_{i,t}$  are  $-0.29$  and  $0.90$ , whereas the mean and standard deviation of  $DUVOL_{i,t}$  are  $-0.08$  and  $0.32$ . The mean value and standard deviation of the institutional investors' shareholding are  $0.09$  and  $0.11$ , respectively, which suggests that the institutional investors in China still need to be further developed. The mean values of the grey and independent investors' shareholding are  $1.4\%$  and  $7.5\%$ , which are similar to the statistics reported in the prior study (Firth et al. 2016). Among 8407 firm-year observations, about 42% have been in the list of the short selling.

### Benchmark Analysis

Table 2 shows the regression results of the aggregate institutional investors' shareholding and the short selling respectively correlated with the stock price crash risk. Column 1 suggests that  $NCSKEW_{i,t}$  is significantly and positively associated with all institutional investors' shareholding. Similarly, the result in Column 3 using  $DUVOL_{i,t}$  as the proxy for stock price crash risk also shows a positive significant relation between institutional investors and the crash risk. Different with the findings of Callen and Fang (2013), institutional investors in China play a role of the short-termism, and the more shareholding the institutional investors have, the more future crash risk the firms meet. The conclusions are consistent with the research of Dai, Tang, and Liu (2015) that institutional investors in China can raise the stock price crash risk rather than mitigate it.

Next, in Column 2 and 4 we study the effect of the short sell on stock price crash risk. As we can see, the coefficient of the variable  $List_i$  is negatively associated with future crash risk. The result is consistent with what we mentioned before that stocks on the designated list are not randomly chosen. After controlling the year and industry fix effects, we find that the short selling increases the future stock price crash risk, rather than stabilizes the price. This finding shows that after the ban of short sell lifted, the crash risk of the stocks arises.



**Table 2. Effects of institutional investors and the short selling respectively on crash risk.**

	Ncskew <sub>t+1</sub>		Duvol <sub>t+1</sub>	
	(1)	(2)	(3)	(4)
<i>InsHold<sub>t</sub></i>	0.95*** (10.60)		0.28*** (8.17)	
<i>PostList<sub>t</sub></i>		0.08** (2.04)		0.05*** (3.24)
<i>List<sub>t</sub></i>		-0.14*** (-5.86)		-0.07*** (8.38)
<i>Turnover<sub>t</sub></i>	-0.03 (-0.71)	-0.08** (-1.97)	-0.01 (0.44)	-0.02 (1.57)
<i>Ncskew<sub>t</sub></i>	0.05*** (3.45)	0.07*** (4.80)		
<i>Duvol<sub>t</sub></i>			0.02 (1.38)	0.04** (2.51)
<i>Size<sub>t</sub></i>	0.07*** (6.23)	0.13*** (11.05)	0.03*** (8.51)	0.06*** (13.13)
<i>Ret<sub>t</sub></i>	0.17*** (8.91)	0.18*** (9.40)	0.06*** (7.74)	0.06*** (8.39)
<i>Sigma<sub>t</sub></i>	0.62 (0.76)	1.99** (2.41)	-0.10 (0.35)	0.38 (1.29)
<i>LEV<sub>t</sub></i>	0.12** (2.07)	0.11* (1.91)	0.02 (0.82)	0.01 (0.61)
<i>BM<sub>t</sub></i>	-0.16*** (-9.16)	-0.21*** (-11.47)	-0.06*** (9.69)	-0.08*** (12.07)
<i>ROA<sub>t</sub></i>	-0.19 (-1.14)	0.33** (2.02)	-0.13** (2.18)	0.04 (0.62)
<i>AbsACC<sub>t</sub></i>	0.12*** (2.85)	0.11*** (2.63)	0.04*** (2.97)	0.04*** (2.69)
Year	YES	YES	YES	YES
Industry	YES	YES	YES	YES
Cluster at firm	YES	YES	YES	YES
N	8407	8407	8407	8407
adj-R <sup>2</sup>	0.11	0.10	0.10	0.10

Note: The t-statistics reported in parentheses are based on standard errors clustered by firm. \*, \*\*, and \*\*\* indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

**Main Regression Analysis**

Table 3 reports the estimates of the main regression model (4). Column 2 suggests that *NCSKEW<sub>i,t</sub>* is significantly and positively associated with the independent investors’ shareholding. Similarly, the result in Column 4 using *DUVOL<sub>i,t</sub>* as the proxy for stock price crash risk also shows a positive significant relation between the institutional investors and the crash risk. We can find that in China independent investors are short-termism and they will increase the firm-level stock price crash risk. The results are consistent with Hypothesis 1.

Column 1 and 3 of Table 3 show that grey investors’ shareholding is also positively related to the *NCSKEW<sub>i,t</sub>* and *DUVOL<sub>i,t</sub>*, which means that grey investors also propel the crash risk, instead of stabilizing the market. The results are consistent with Hypothesis 2a and refuse the Hypothesis 2b.

**Table 3. Heterogeneous institutional investors and the stock price crash risk.**

	Ncskew <sub>t+1</sub>		Duvol <sub>t+1</sub>	
	(1)	(2)	(3)	(4)
<i>Grey<sub>t</sub></i>	1.24*** (3.70)		0.40*** (3.47)	
<i>InDep<sub>t</sub></i>		0.97*** (10.01)		0.28*** (7.57)
<i>LEV<sub>t</sub></i>	0.13** (2.21)	0.12** (2.01)	0.02 (0.96)	0.02 (0.77)
<i>Ret<sub>t</sub></i>	0.18*** (9.30)	0.17*** (8.85)	0.06*** (8.18)	0.06*** (7.69)
<i>AbsACC<sub>t</sub></i>	0.13*** (3.01)	0.11*** (2.75)	0.05*** (3.12)	0.04*** (2.91)
<i>Sigma<sub>t</sub></i>	1.46* (1.78)	0.71 (0.86)	0.14 (0.48)	-0.08 (0.26)
<i>Size<sub>t</sub></i>	0.10*** (9.73)	0.07*** (6.45)	0.04*** (11.57)	0.04*** (8.71)
<i>BM<sub>t</sub></i>	-0.19*** (-10.63)	-0.16*** (-9.13)	-0.07*** (11.04)	-0.06*** (9.68)
<i>Turnover<sub>t</sub></i>	-0.06* (-1.65)	-0.03 (-0.81)	-0.02 (1.20)	-0.01 (0.53)
<i>Ncskew<sub>t</sub></i>	0.06*** (4.53)	0.05*** (3.53)		
<i>Duvol<sub>t</sub></i>			0.04** (2.27)	0.02 (1.43)
<i>ROA<sub>t</sub></i>	0.24 (1.48)	-0.18 (-1.10)	-0.01 (0.09)	-0.13** (2.11)
Year	YES	YES	YES	YES
Industry	YES	YES	YES	YES
Cluster at firm	YES	YES	YES	YES
N	8407	8407	8407	8407
adj-R <sup>2</sup>	0.10	0.11	0.09	0.10

Note: The t-statistics reported in parentheses are based on standard errors clustered by firm. \*, \*\*, and \*\*\* indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

In sum, we can see that different with the findings in developed countries, in China neither independent investors nor grey investors play a role of monitoring and reduce the future crash risk. In fact, they are both short-termism and increase the firm-level crash risk of a firm.

### **Effect of the Short Selling**

Luo and Ren (2016) suggest that firm' crash risk may be affected by the short selling. Table 4 reports the empirical results of the model (5). Column 1 and 3 show that the coefficients of the interaction  $PostList_{i,t} * Grey$  are negative, regardless of which measure for crash risk is used. The results are consistent with the Hypothesis 3, suggesting that the short selling can efficiently reduce the positive relation between the grey investors and crash risk.

Column 2 and 4 in Table 4 suggest that the coefficients of the interaction  $PostList_{i,t} * Indep$  are both insignificant, regardless of using the  $NCSKEW_{i,t}$  or  $DUVOL_{i,t}$ . The results are consistent with the Hypothesis 4, indicating that the short selling has little effect on the relationship between the independent investors and the future crash risk.

**Table 4. The effect of the short selling.**

	Ncskew <sub>t+1</sub>		Duvol <sub>t+1</sub>	
	(1)	(2)	(3)	(4)
<i>Grey<sub>t</sub></i>	1.43*** (3.82)		0.51*** (3.97)	
<i>PostList<sub>t</sub>*Grey<sub>t</sub></i>	-1.58* (-1.75)		-0.93** (2.56)	
<i>InDep<sub>t</sub></i>		1.07*** (11.08)		0.32*** (8.88)
<i>PostList<sub>t</sub>*InDep<sub>t</sub></i>		-0.10 (-0.28)		-0.01 (0.04)
<i>PostList<sub>t</sub></i>	0.11*** (2.48)	0.12** (2.35)	0.06*** (3.89)	0.06*** (2.96)
<i>List<sub>t</sub></i>	-0.14*** (-5.98)	-0.17*** (-7.28)	-0.07*** (8.52)	-0.08*** (9.66)
<i>LEV<sub>t</sub></i>	0.12** (1.97)	0.10* (1.74)	0.01 (0.66)	0.01 (0.44)
<i>Ret<sub>t</sub></i>	0.18*** (9.50)	0.17*** (9.05)	0.07*** (8.50)	0.06*** (7.94)
<i>AbsACC<sub>t</sub></i>	0.11*** (2.74)	0.10** (2.41)	0.04*** (2.78)	0.04** (2.50)
<i>Sigma<sub>t</sub></i>	1.86** (2.25)	1.11 (1.35)	0.34 (1.15)	0.11 (0.37)
<i>Size<sub>t</sub></i>	0.13*** (10.70)	0.10*** (7.86)	0.06*** (12.82)	0.05*** (10.26)
<i>BM<sub>t</sub></i>	-0.21*** (-11.39)	-0.18*** (-9.98)	-0.08*** (11.99)	-0.07*** (10.66)
<i>Turnover<sub>t</sub></i>	-0.07* (-1.80)	-0.04 (-0.89)	-0.02 (1.41)	-0.01 (0.65)
<i>Ncskew<sub>t</sub></i>	0.07*** (4.67)	0.05*** (3.57)		
<i>Duvol<sub>t</sub></i>			0.04** (2.45)	0.02 (1.46)
<i>ROA<sub>t</sub></i>	0.31** (1.92)	-0.14 (-0.82)	0.03 (0.53)	-0.11* (1.78)
Year	YES	YES	YES	YES
Industry	YES	YES	YES	YES
Cluster at firm	YES	YES	YES	YES
N	8407	8407	8407	8407
adj-R <sup>2</sup>	0.10	0.11	0.10	0.10

Note: The t-statistics reported in parentheses are based on standard errors clustered by firm. \*, \*\*, and \*\*\* indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

## Robustness Test

In this section, several robustness tests are performed. First, following the studies of Gong et al. (2017) and Wen et al. (2014b), we change the period of the sample as a robust test by selecting the subsample from 2010–2015. In March 2010, the ban of short selling was lifted. By changing the sample interval, we can see from Column 1 and 5 in Table 5, that the coefficient of the grey investors' shareholding is significant and positive. Column 3 and 7 show that the independent investors are also positively associated with the crash risk. The results are consistent with the

evidence in Table 3. Column 2 and 6 suggest that the short selling indeed affects the relation between the grey investors and the crash risk. And the results of Column 4 and 8 indicate that the short selling has no effect on the association between the independent investors and the crash risk. This evidence is consistent with the results in Table 4.

Second, giving that the stock index futures trading and the short selling was implemented at the same time, we add the variable *SIF* to the regression to exclude the effect of the stock index futures

**Table 5. Empirical results based on the dataset from 2010 to 2015.**

	Ncskew <sub>t+1</sub>				Duvol <sub>t+1</sub>			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>Grey<sub>t</sub></i>	1.51*** (3.17)	1.95*** (2.86)			0.48** (2.47)	0.73*** (3.05)		
<i>PostList<sub>t</sub>*Grey<sub>t</sub></i>		-1.78* (-1.71)				-0.99** (2.35)		
<i>InDep<sub>t</sub></i>			0.99*** (5.47)	1.13*** (5.83)			0.37*** (5.48)	0.42*** (5.99)
<i>PostList<sub>t</sub>*InDep<sub>t</sub></i>				-0.13 (-0.33)				-0.03 (0.20)
Control variable	YES	YES	YES	YES	YES	YES	YES	YES
Year	YES	YES	YES	YES	YES	YES	YES	YES
Industry	YES	YES	YES	YES	YES	YES	YES	YES
Cluster at firm	YES	YES	YES	YES	YES	YES	YES	YES
N	5252	5252	5252	5252	5252	5252	5252	5252
adj-R <sup>2</sup>	0.10	0.10	0.11	0.11	0.09	0.09	0.09	0.10

Note: The t-statistics reported in parentheses are based on standard errors clustered by firm. \*, \*\*, and \*\*\* indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

**Table 6. The robust test with controlling the effect of the stock index futures trading.**

	Ncskew <sub>t+1</sub>				Duvol <sub>t+1</sub>			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>Grey<sub>t</sub></i>	1.28*** (3.81)	1.43*** (3.82)			0.40*** (3.47)	0.51*** (3.97)		
<i>PostList<sub>t</sub>*Grey<sub>t</sub></i>		-1.58** (-1.75)				-0.93** (2.56)		
<i>InDep<sub>t</sub></i>			1.07*** (11.03)	1.07*** (11.08)			0.28*** (7.57)	0.32*** (8.88)
<i>PostList<sub>t</sub>*InDep<sub>t</sub></i>				-0.10 (-0.28)				-0.01 (0.04)
<i>SIF<sub>t</sub></i>	0.06 (1.27)	0.06 (1.27)	0.11*** (2.37)	0.11*** (2.37)	0.02 (0.98)	-0.01 (0.38)	0.03** (1.99)	0.01 (0.57)
Control variable	YES	YES	YES	YES	YES	YES	YES	YES
Year	YES	YES	YES	YES	YES	YES	YES	YES
Industry	YES	YES	YES	YES	YES	YES	YES	YES
Cluster at firm	YES	YES	YES	YES	YES	YES	YES	YES
N	8407	8407	8407	8407	8407	8407	8407	8407
adj-R <sup>2</sup>	0.10	0.10	0.11	0.11	0.09	0.10	0.10	0.10

Note: The t-statistics reported in parentheses are based on standard errors clustered by firm. \*, \*\*, and \*\*\* indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

trading. The stock index futures trading can provide a channel for the negative investors to reflect their opinions on the whole market. In this study, we set the value of the *SIF* to 1 after the stock index futures trading being carried out, and 0 otherwise. The results are reported in Table 6, which are consistent with the evidence from Table 3 and Table 4.

Third, considering many institutions only disclose their top 10 holding stocks in the quarterly reports in March and September<sup>3</sup>, we also recalculate the shareholding of the investors by using the data in June and December. Table 7 reports the results by utilizing the new institutional investors' shareholding which also shows that our results are robust.

### Conclusions

By investigating the empirical relation between heterogeneous institutional investors and future stock price crash risk in China from 2007 to 2015, institutional investors are found to increase the future firm-level crash risk, regardless of the type of investors. The results suggest that institutional investors in China still need to be further standardized and developed. We further take the short selling into consideration and discover that when the environment becomes better, the positive relation between grey investors and the future crash risk is weakened. But after the short selling ban is lifted, the relation between independent investors and the crash risk is unchanged. The results suggest that in China, grey investors are gradually playing a role in stabilizing the stock market. Because independent investors prefer the short-term interests, they would always increase the stock price crash risk. The results are robust after reselecting the sample, considering stock index futures trading and using a new measurement of the institutional investors' shareholding.

The findings of this study suggest that the role of institutional investors in China is not the same as that of developed countries. The institutional investors still need to be supervised, especially the independent investor. The grey investors who can stabilize the stock market in China should be cultivated. And a more efficiency and healthy institutional environment still need for investors in China.

**Table 7. The robust test with another measurement of the institutional investors' shareholding.**

	Nc skew <sub>t+1</sub>				Duvol <sub>t+1</sub>			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>Grey<sub>t</sub></i>	1.17*** (3.39)	1.41*** (3.60)			0.35*** (2.85)	0.48*** (3.48)		
<i>PostList<sub>t</sub>*Grey<sub>t</sub></i>		-1.64* (1.92)				-0.91*** (2.63)		
<i>InDep<sub>t</sub></i>			0.80*** (10.10)	0.88*** (11.11)			0.23*** (7.75)	0.27*** (9.05)
<i>PostList<sub>t</sub>*InDep<sub>t</sub></i>				-0.01 (0.03)				0.02 (0.12)
Control variable	YES	YES	YES	YES	YES	YES	YES	YES
Year	YES	YES	YES	YES	YES	YES	YES	YES
Industry	YES	YES	YES	YES	YES	YES	YES	YES
Cluster at firm	YES	YES	YES	YES	YES	YES	YES	YES
N	8407	8407	8407	8407	8407	8407	8407	8407
adj-R <sup>2</sup>	0.10	0.10	0.10	0.11	0.09	0.10	0.10	0.10

Note: The t-statistics reported in parentheses are based on standard errors clustered by firm. \*, \*\*, and \*\*\* indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

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