STATIC AND DYNAMIC IMPACTS OF VENTURE CAPITAL SHAREHOLDING ON STOCK PRICE CRASH RISK

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ABSTRACT

With the rapid development of venture capital industry in China, venture capital firms are playing an increasingly active role in funding startups. As more and more companies with venture capital shareholders go public, venture capital firms become an important group of institutional investors that can bring significant influence on companies' stock price. In the past decade, extremely high exit returns from IPO of venture capital firms raised the public and Chinese scholars' attention. However, few researches inspected the venture capital's post-IPO influence. In this paper, we examine whether venture capital shareholding will lead to companies' higher stock crash risk, and whether different venture capital shareholders' different behavior of holding and selling after lockup period will have different impacts on companies' crash risk.

The research used descriptive statistics and regression analysis to analyze the quarterly data of Chinese A-share companies from 2005-2016. We found that: (1) Companies with venture capital shareholders in a specific quarter will have greater incentive of earnings management (exaggerating revenue and profit) and greater stock price crash risk in the next quarter then companies without venture capital shareholders. (2) Venture capital shareholders continuing to hold non-restricted shares after lockup period is considered as a positive signal, thus reduce the crash risk. Venture capital shareholders selling shares is considered as a negative signal, thus increase the crash risk.

BIOGRAPHICAL SKETCH

Bin Yang is a graduate student at Cornell University, in the field of Applied Economics and Management. At the same time, he is a graduate student at Shanghai University of Finance and Economics, in the field of International Business. He got his Bachelor's degree in Shanghai University of International Business and Economics, majored in Finance. He had several working experiences in PwC, ABC Capital and China Securities Regulatory Commission, which deepen his understanding of Chinese capital market, listed companies and venture capital. His research is in capital market, venture capital, corporate finance and behavioral finance.

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1 INTRODUCTION

In recent years, YT Jia, a famous entrepreneur and his diversified ecological empire has attracted great attention from many entrepreneurs, VC/PE investors and stock investors. We witnessed him started from Le.com, an online video company, and step by step built LeEco in the past decade. At his peak, LeEco was valued around $50 billion, covering various business including cellphone, TV set, super electric car, movies, sports, cloud computing, e-commerce, real-estates, etc, with every subsidiary chased by billions of venture capital. Many renowned venture capitals in China such as SCGC, HNA Capital and Yunfeng Capital invested YT Jia and his business to help him build the empire. However, endless expansion, unprofitable M&As and capital expenditures, as well as great capital needed to build Farady Future (the super car business) sent LeEco to the expectable ending - running out of cash. The collapse of the LeEco empire and the crash of Le.com's stock price raise people's reflection on the "smart capital". Le.com is one of many "story telling" companies that label themselves as "new economy", "unicorn"， "disruptive technology", etc., raising considerable venture fund and go IPO, but finally fail to reach expectation or even go out of business. We can't stop wondering, are those venture capitals, known as smart investors, hoodwinked by fantastic stories and throwing money blindly? Do they give positive guidance in business operation and corporate governance as supposed? Will venture capital amplify the boom

and crash of those invested firms, or even that of those hot industries (eg. Internet, AI, block chain etc.)?

The authors of this paper believe that many venture capitals are speculators, or educated gamblers, instead of real growth investors. We can find many evidences that venture capitals contribute to the collapse of growing companies or growing industries. Dated back to the US Dotcom bubble in the 2000s, venture capitals crowded to invest those high-risk, unprofitable Internet startups, helped them to boost their "revolutionary business model", "promising future" and "sustainable profitability", and finally got substantial return by pushing them to Nasdaq. However, as is very common at that time, venture capitalists that invested in Pets.com and Webvan didn't necessarily believe the Internet was the best way to sell pet food and groceries, but they knew that if they didn't finance these firms, other VCs would. In order to pursue better performance, most of them continued to devote themselves to the round after round of valuation bubbles. The irrationality didn't stop until the FED raised the interest rate and cooled down the market. Within one year after the bubble burst, for Nasdaq, the index dropped nearly 70%, 8 out of 10 companies lost over 80% Mkt Cap, 4 out of 10 companies delisted and over 500 companies went bankrupt. It was obvious that the US economy, especially the financial market and the Internet industry, went through a painful recession.

In 2015, China's ChiNext Board (established for growing companies) also witnessed an unprecedented technology stock bubble. The average PE ratio reached 135x and average PE ratio

for technology companies surpassed 250x. After the ChiNext Board Index touched the peak (4,037), the market suddenly collapsed and kept going down for the following two years, with the index value halved. By curiosity, I listed the TOP 30 ChiNext stocks with largest decrease in price during these 2 years and found out the IPO shareholder information from prospectus. It's surprising that 26 out of 30 of these worst crashed stocks were invested by venture capitals when they went public. Among those venture capitals, some are famous investors such as Sequoia Capital, IDG Capital, Intel Capital and SZVC. But a large number of them are young domestic capitals, which made a lot of money and be known to the public by investing "Star Stock" such as ASXX and QTJY.

Table 1.1 TOP 30 Stocks with Largest Decrease in ChiNext Board

Rank	Stock	2015.6.5 Close ¥	2015.6.5-2017.6.5 Decrease	VC shareholders when IPO?
1	ASXX	168.61	85.26%	Zhangjiang Han Century Fund, Junlian Wisdom
2	CLKJ	234.58	83.55%	China Merchants Capital
3	DJRJ	123.81	83.20%	Equity Dynamic, WEP, Full Cycle, etc.
4	JTL	271.26	82.21%	N/A
5	JYKJ	55.49	82.12%	Dehui Investment、Florin Investment Group、JD Capital
6	YZJ	114.00	80.37%	N/A
7	RQGF	38.66	79.00%	Pingan Caizhi
8	QTJY	153.90	78.79%	Guangdong SME Equity Investment Fund、China Capital Group
9	SLWW	170.00	78.76%	China Business Media (Strategic Investment)
10	HPF	167.01	78.70%	N/A
11	WNJK	91.03	78.22%	Sunway Investment
12	ZRKJ	161.09	77.75%	GGV Capital, Fortune Venture Capital, Intel Capital, Pingan Caizhi
13	TBKJ	55.80	77.70%	Shenzhen Capital Group, Futian Investment, Guosen H&S, Veken Ventures
14	WDXX	140.00	77.42%	Shanghai SAT Investment, Jinwin Investment
15	JYJG	78.50	77.35%	N/A
16	XKP	63.82	77.30%	Guolian Zhuocheng Ventures
17	AJB	48.51	75.95%	Hetai Ventures, Haihui Ventures, GF Xinde Investment
18	BLYY	60.60	75.65%	Beijing Science and Technology, IPV Capital
19	HBKJ	179.00	75.49%	TusPark Ventures, Everbright new industry, Grains Valley Venture Capital, etc.
20	NFKJ	96.50	75.30%	Guangdong Tongying Venture Capital
21	KLG	81.45	75.08%	Hony Capital, Mianyang Fund, Hunan Hi-tech Venture Capital, Sequoia Capital
22	BFKJ	241.98	75.06%	IDG Capital, Jin Haipeng Investment, Huawei Investment, Tsinghua Holdings Capital, etc.
23	FRGF	137.99	74.93%	Kaideyuan Investment, China High-tech Investment, Ordos Asset Management
24	XGD	137.40	74.89%	Shenzhen Venture Capital, Futian Capital, Ruichi Fenghe
25	TXGF	186.00	74.49%	Tesir Investment, Star Moon Venture, Huijin Cube, Capesize Investment
26	BJYY	166.00	74.29%	Fortune Capital
27	DWX	45.70	74.04%	Oriental Fortune Capital, Shanghai Chengye Investment, ZS Venture Capital, Huarui Investment
28	XXZY	46.61	73.89%	China Merchants Investment, CX Venture, CSC Investment
29	LMKJ	91.80	73.68%	Lenovo Investment, Leadyond Capital
30	TRS	45.45	73.38%	Shenzhen Capital Group, Fortune Venture Capital

IPO (Initial Public Offerings) is the most important and most profitable way of exit for venture capital. As the number of VC increases and more companies going to public have VC background, venture capitals are playing a more important role in the capital market, especially in the IPO process. In existing literatures, scholars have paid lots of attentions to venture capitals' impact on the invested companies' long term development, mainly concluding into two effects – governance effect and grandstanding effect. In recent research of capital market, some scholar has discussed heatedly about factors affecting stock price crash risk, including information disclosure, financial opacity, management behaviors, analyst recommendation, etc. However, few scholars figure out there may be strong probability that venture capital shareholders can influence listed companies' stock price crash risk. Venture capitals as early investors, will add value to invested companies by offering capital, improving corporate governance and promoting business performance, in order to get higher valuation in IPO or M&A. However, since venture capitals are neither interested in stock investment, nor interested in holding company's equity for a long-term, they tend to cash their investment at an ideally high price after success IPO. During the exit period, venture capitals are short-term focused and show significant grandstanding incentives. That is to say, in order to exit at a high price, venture capital may loosen its supervision on governance, press disclosures and earnings management, as well as allow management to hide bad news and release good news. As bad news accumulates, someday it will explode to the public at one time, which causes significant negative hit to company's stock price and lead to price crash. But if there are venture

capital shareholders in some cases continue to hold the shares after the lock-up period, it may be a positive signal, which leads to lower risk of stock price crash. Venture capitals may keep holding shares because they expect the invested company to grow rapidly in the following quarters, or they don't have immediate demand to cash their investment return out of motivated by grandstanding needs.

China's capital market is relative young - regulatory authorities are at an exploratory stage, and regulations and market mechanisms still need to improve. In terms of market participants, a large number of them are small and individual investors, who lack professional investment knowledge and risk awareness. Therefore, China's stock market has significant herding effect, market sentiment effect and speculative atmosphere. How to avoid stock crash and market crash, and to stabilize the growth of the stock market is highly concerned by both academics and practitioners. Venture capitals as a group of the increasingly active participants of stock market and important external shareholders, their impact on invested companies' stock price fluctuation should be further examined.

In this paper, the author will use the venture capital shareholder data from RESSET financial database and trading data from CSMAR, between 2005-2016, to explore the impact of VC shareholding, and VC shareholders' holding behavior after lockup period, on the stock price crash risk of specific company. The paper will try to answer the following questions: (1) Will venture capital shareholding significantly increase the stock price crash risk? (2) Will venture capital's

different behaviors of holding or selling after lockup period have different effect on stock price crash risk? By careful empirical research, we can better understand the current status of development of venture capital industry, and the transmission of price risk from primary market to secondary market. After that, we can have better idea of how to regulate the venture capital industry, and also further improve the lockup mechanism and other regulatory measures, thus contribute to the healthy development of China's stock market.

The paper is structured as follows. Section 2 is an overlook of literature review and research hypothesis. Section 3 describe the sampling process and methodology to test our hypothesis. Section 4 provides the descriptive analysis and regression analysis. Section 5 is the conclusion.

2 LITERATURE REVIEW AND HYPOTHESIS

2.1 Literature Review

Venture capitals are institutional investors with capital, management experience and specific industry background, who provide capital for startups in exchange for equity. In order to help the investee companies to obtain rapid growth and increase in valuation which leads to quick and fruitful exit return, venture capital firms will try to make the best use of their resources (Barry et al., 1990[1], Hochberg et al, 2007[2]) and to help startups enhance their technological advantages (Hellmann and Puri, 2000[3], Kortum and Lerner, 2001[4], Guo and Jiang, 2013[5]), improve corporate governance and financial performance (Barry et al., 1990, Brunninge and Nordqvist, 2004[6], Hellmann and Puri, 2002[7], Long Xin and Ning Ma, 2016[8]). Venture capitals' value-added and supervision effects for startups has been recognized in many studies, especially in developed markets in Europe and North America, where venture capital market has developed for decades and venture capitals are more professional and experienced.

However, the story can be a little different in Chinese market at current stage as most of domestic venture capitals are pretty young, venture capital specialists are scarce and the market environment is immature. Scholars haven't got concurrent opinion about venture capital's positive effects. Wang Lei and Dang Xinghua (2008) [9] found that the amount of venture capital invested was

positive correlated with the technological innovation, but VC's role in increasing the number of patent granted was not significant.

Wu Qiaozhen (2009) [10] and Chen Jianli (2011) [11] found that Chinese domestic venture capital preferred later stage investment, and make quick money by taking investee public instead of helping them improve core competence. Yuan Jiguo (2013) [12] found that in companies with venture capital background, executive compensation was more closely correlated with business performance. However, Jing Ming and Wang Juan (2010) [13] believed that Chinese domestic venture capital firms helped SMEs increase their market value but didn't help with their corporate governance.

Opposite to the above positive value-added and supervision effects, venture capitals may adversely influence the investees' long-term growth, stemmed from their goal of creating highest return in limited fund life. "Grandstanding" is probably one of the major reasons that incentivize venture capital firms' short-term focus in investees' IPO and neglecting of investees' dishonesty in information disclosures and financial reports. Gompers (1996) developed the "grandstanding" hypothesis suggesting that young venture firms take investees public earlier than older venture capital firms in order to build reputation quickly and raise capital new funds easily. To achieve IPO quickly, venture capital firms tend to push investees to achieve high growth in financial performance, which easily increase investees' incentive of earnings management to to exaggerate the revenue and profit (Ning Cai, 2015[14], Jia Ning and Li Dan, 2011[15], Wu Cuifeng et al, 2012[16]).

Once a company begins earnings management, it is more likely for them to continue doing so, which is a vicious circle, and will harm the company's long-term financial health.

Moreover, as the discrepancy between accounting result and real operation result accumulates, the truth will finally be revealed to the public which subsequently leads to the crash of companies' value. According to Jin and Myers (2006)[17], stock crash happens when the bad news or results hidden by insiders accumulated to a limit value that insiders give up and all the bad truths come out at once. Hutton, Marcus, and Tehranian (2009)[18] used earnings management as a measure of the information transparency, and found that companies with lower information transparency has greater stock price crash risk. Other scholars also find that shareholders' and the management's behavior of holding and selling shares is related to company's stock crash risk (Wu Zhanqi and Li Xiaolong, 2015[19], Quan Xiaofeng and Yin Hongying, 2017[20], Sun Shuwei et al., 2017[21]).

2.2 Research Hypothesis

Since taking investee public is the most important and most profitable way for venture capital firms to cash the investment, venture capital firms act as a important bridge transmitting "risk and return" from the primary market to the secondary market, and from insiders to outside investors. Ideally, venture capital firms help investees grow up by providing capital, experience and value-added services, and share the gain from IPO. However, if the venture capital firm want to get high return without increasing the company value of its investee, it may use its insider information advantage to grab short-term profit while leave crash risk for outside investors. According to

existing research about stock crash risk, information opacity (Hutton et al., 2009, Pan Yue at al., 2011[22], Ye Kangtao et al., 2015[23]), the management hiding bad news (Jin and Myers, 2006, Kothari et al., 2009[24]) and collusions between of the management and institutional investors can aggravate the stock crash risk. Therefore, we propose the Hypothesis 1:

Hypothesis 1-a: Venture capital shareholding has significant positive correlation with stock price crash risk. That is, venture capital shareholding will aggravate the crash risk.

Hypothesis 1-b: Venture capital shareholding has significant negative correlation with stock price crash risk. That is, venture capital shareholding will reduce the crash risk.

After IPO, there is a lockup period (usually 12 months for venture capital shareholders in China), after which venture capital firms can sell shares and cash the investment. In practice, sometimes venture capital firms will sell all shares right after the lockup period, while in some cases they will exit gradually and even hold a small portion for future price upsides.

Some scholars have studied the phenomenon that venture capital firms don't exit at once right after the end of the IPO lifting period. Lin and Smith (1998)[25] believed that information asymmetry brought higher costs to insider trading, which in turn encouraged venture capital firms as insiders to tradeoff between the cost of continuing holding stocks and the negative market reactions brought about by the reduction of shares. Cummming and MacIntosh (2003)[26] found that venture capital firms would convey positive signal for the company's quality by retaining part of shares, in order to stabilize the stock price and maximize total exit revenue.

As most of Chinese domestic venture capital firms are young, which may have greater "grandstanding" incentive to establish the reputation and realize high return in a short time. Under this circumstance, if venture capital firms are willing to sacrifice the opportunity of reinvestment and hold non-restricted stocks for longer time, does this behavior send positive message for the company's stock price? If so, the venture capital firms' retaining non-restricted stock, either out of positive outlook towards the company or reducing the negative market reaction, will lead to lower crash risk in the future.

Therefore, we propose the Hypothesis 2:

Hypothesis 2-a: Venture capital firms' holding no-restricted shares after lockup period has negative correlation with stock price crash risk, that is, it will reduce the risk.

Hypothesis 2-b: Venture capital firms' selling shares after lockup period has positive correlation with stock price crash risk, that is, it will aggravate the risk.

3 RESEARCH DESIGN

3.1 Sample and Data

Based on the whole sample of 2005-2016 quarterly data of Chinese A-share listed companies, this paper screens the sample by using following criteria: (1) financial companies are excluded due to differences in accounting method from other companies; (2) stocks with special treatments are excluded; (3) in order to calculate variables of crash risk, samples with less than 30 trading days in a specific quarter are excluded according to Jin and Myers's (2006) method. After the above screening, we finally get the sample of 64,281 company-quarter observations. We do the Winsorization for the 1st and 99th percentile of the original data to reduce the disturbance of extreme values. We get the stock trading data and financials from the CSMAR database, and get the special data related to venture capital shareholdings from the RESSET database.

3.2 Variables Specification

3.2.1 Dependent Variables

Stock Price Crash, refers to a sudden and sharp drop in the stock price without any warning (Chen Guojin et al., 2008)[27]. According to prior researches (Chen et al., 2001[28]; Kim et al., 2011a[29], 2001b[30];), we also measure the stock price crash risk by negative coefficient of skewness of firm

specific daily returns *(NCSKEW)* and down-to-up volatility *(DUVOL)*. The detailed calculation method is as follows:

Firstly, we run the regression analysis on every daily return for every individual stock in the sample, using the market daily return of 5 trading days before and 5 trading days after t as explanatory variables:

$$\boldsymbol{r_{i,t} = \alpha_i + \sum_{n=-5}^{5} \beta_{i,n} \times r_{m,t-n} + \varepsilon_{i,t}} \quad (1)$$

$r_{i,t}$ is the daily return on stock i on the day t. is the daily return of the market index on day t. By adding lead and lag market returns to the model, we can eliminate the noise resulted from nonsynchronous trading (Dimson, 1979)[31]. $\varepsilon_{i,t}$ is the residual term of the model, representing the part of daily return that cannot be explained by market returns (or market fluctuations), which also called firm specific return. In this paper, we take logarithm to reduce the skewness of $\varepsilon_{i,t}$'s distribution, and define $R_{i,t}$ as the firm specific daily return:

$$\boldsymbol{R_{i,t} = ln\left(1 + \varepsilon_{i,t}\right)} \quad (2)$$

The first measure of crash risk - negative coefficient of skewness *(NCSKEW)*, is calculated as the inverse of the third central moment of firm specific daily returns scaled by the variance of firm-specific daily return raised to 3/2:

$$\boldsymbol{NCSKEW_{i,q} = -\left[n(n-1)^{\frac{3}{2}} \sum R_{i,t}^{3}\right] \Big/ \left[(n-1)(n-2)\left(\sum R_{i,t}^{2}\right)^{\frac{3}{2}}\right]} \quad (3)$$

q, n represent that stock i is traded for n days in quarter q. The larger the value of *NCSKEW*, the more negative skewed the stock return, the greater the crash risk.

The other measure of crash risk - down-to-up volatility *(DUVOL)*. We rank the firm specific daily return from high to low and divide into two groups. *DUVOL* is the natural logarithm of the ratio of lower-than-average group's standard deviation divided by higher-than-average group's standard deviation.

$$\boldsymbol{DUVOL_{i,q} = ln\{[(n_u - 1)\sum_{DOWN} R_{i,t}^2]/[(n_d - 1)\sum_{UP} R_{i,t}^2]\}} \quad (4)$$

n_u is the number of firm specific daily returns of company i in quarter q that are higher than the quarter's average, while n_d is the number of firm specific daily returns of firm i in quarter q that are lower than the quarter's average. The larger the *DUVOL* value, the more negative skewed the firm specific return, the greater the crash risk.

Besides Crash Risk variables, the paper also introduces the Discretionary Accural *(DA)* as a proxy of earnings management to further explore whether venture capital shareholder impact company's stock crash risk through influence on earning management. We use the Jones' (1991) model to do regression analysis on the Total Accrual *(TA)*:

$$\frac{TA_{i,q}}{Asset_{i,q-1}} = \boldsymbol{\beta_1}\frac{1}{Asset_{i,q-1}} + \boldsymbol{\beta_2}\frac{\Delta REV_{i,q}}{Asset_{i,q-1}} + \boldsymbol{\beta_3}\frac{PPE_{i,q}}{Asset_{i,q-1}} + \boldsymbol{\varepsilon_{i,q}} \quad (5)$$

TA is the total accruals, as calculated by $TA = (\Delta CA - \Delta CASH) - (\Delta CL - \Delta CLD) - DEP$, where ΔCA is the increment in current asset, is $\Delta CASH$ the increment in cash and cash equivalent, is ΔCL

the increment in current liability, ΔCLD is the increment in debt repayment within one year, DEP is the amount of depreciation and amortization. ΔREV is the increment in revenue and PPE is the value of property, plant and equipment (Su Dongwei and Lin Dapang, 2010)[32].

We calculate the modified Discretionary Accruals (Dechow et al, 1995) by equation (6), using coefficients got from the above regression. ΔREC is the increment in net account receivables. If the DA value is positive, the larger the value, the greater the positive earnings management (exaggerating the earnings). If the DA value is negative, the larger the value, the greater the negative earning management (hinding the earnings). If the DA value is close to zero, the earning is fairly reflected.

$$\boldsymbol{DA_{i,q}} = \frac{\boldsymbol{TA_{i,q}}}{\boldsymbol{Asset_{i,q-1}}} - \widehat{\boldsymbol{\beta}}_{\boldsymbol{1}} \frac{\mathbf{1}}{\boldsymbol{Asset_{i,q-1}}} - \widehat{\boldsymbol{\beta}}_{\boldsymbol{2}} \left(\frac{\boldsymbol{\Delta REV_{i,q}}}{\boldsymbol{Asset_{i,q-1}}} - \frac{\boldsymbol{\Delta REC_{i,q}}}{\boldsymbol{Asset_{i,q-1}}} \right) - \widehat{\boldsymbol{\beta}}_{\boldsymbol{3}} \frac{\boldsymbol{PPE_{i,q}}}{\boldsymbol{Asset_{i,q-1}}} \quad (6)$$

3.2.2 Independent Variables

First, we set up two rules to determine whether a listed company has venture capital stockholding background. (1) We define a dummy variable $Dtreat_i$ to describe whether the company has ever had venture capital shareholders during 2005-2016. If there are venture capitals in top 10 shareholders in any sample quarter, the value of $Dtreat_i$ is 1. Otherwise, the value of $Dtreat_i$ is 0. (2) We define another dummy variable to describe specifically whether company i has VC shareholder in quarter q. If company i has venture capitals listed in top 10 shareholders in quarter q, the value of $DVC_{i,q}$ is 1， otherwise $DVC_{i,q}$ is 0.

Then, to further analyze the different impacts of venture capital shareholders' after-lockup-period holding or selling behaviors on stocks' crash risk, we use two proxies: non-restricted shares and selling of shares in specific quarters. (1) We define a dummy variable

$Drestrs_{i,q}$ as whether the venture capital shareholder holds company i's non-restricted shares in quarter q. If true, the value is 1; otherwise the value is 0. (2) We define dummy variable $Dholdsell_{i,q}$ as whether the venture capital sells company i's shares in quarter q. If the VC shareholder sells company i's shares in quarter q, the value of $Dholdsell_{i,q}$ is 1, otherwise the value is 0.

3.2.3 Control Variables

With reference to the literature about the stock crash risk (Kim et a1., 2011a, 2011b; Xu et al., 2012), this article also includes a set of commonly used control variables that are deemed to be potential predictors of crash risk. $\Delta Turn_{i,q}$ is the average abnormal turnover, calculated the difference between the stock i's average monthly turnover of quarter q and its average monthly turnover of quarter $q-1$. $Ret_{i,q}$ is the average firm specific return, defined as company i's average firm specific daily return in quarter q. $Vol_{i,q}$ is the firm specific volatility, defined as the volatility of the company i's firm specific daily return over quarter q. $Size_{i,q}$ is firm size, calculated as the log of the company i's book value of total assets in the quarter q. $BM_{i,q}$ is the book-to-market ratio, defined as the ratio of the company i's market value of equity to its book value of equity in the quarter q. $Lev_{i,q}$ is the financial leverage, defined as the company i's total

debt scaled by total assets. $Roa_{i,q}$ is the return on assets, defined as the company i's net income scaled by total assets. $AbsDA_{i,q}$ represents the company accounting transparency, defined as the absolute value of the company i's Discretionary Accruals *(DA)* in the quarter q. The greater the $AbsDA_{i,q}$, the lower the transparency of the company.

Table 3.1 Variable Table

	Variable Name	Variable Symbol	Variable Definitions
Explained Variable	Share price collapse risk	$NCSKEW_{i,q}$	Quarterly coefficient of negative returns of *q* company *i* stock returns, as defined in formula (3)
		$DUVOL_{i,q}$	The fluctuation ratio of company *i*'s stock returns in quarter *q*, as defined in formula (4)
Explanatory Variables	Venture capital target	$Dtreat_{i,q}$	Whether company *i* has venture capital to hold its shares during the sample period
	Venture capital holdings	$DVC_{i,q}$	Whether company *i* has venture capital holdings in quarter *q*
	Venture capital holds unrestricted shares	$Drestrs_{i,q}$	Whether company *i* has venture capital to hold its unrestricted shares in quarter *q*
	Venture capital reduction	$Dholdsell_{i,q}$	Whether company *i* has a reduction of venture capital - owned shares in quarter *q*
Control Variables	Average excess turnover rate	$\Delta Turn_{i,q}$	The difference between the monthly average turnover rate of company *i* in quarter *q* and the average monthly turnover rate in quarter *q-1*
	Specific mean return	$Ret_{i,q}$	Company *i*'s average specific rate of return in quarter *q*
	Specific return volatility	$Vol_{i,q}$	The standard deviation of unique earnings of company *i* in quarter *q*
	Company Size	$Size_{i,q}$	Company *i*'s total assets book value in quarter *q*(taking natural logarithm)
	Book value to market ratio	$BM_{i,q}$	Total shareholder's equity for company *i* divided by total market capitalization in quarter *q*
	Financial Leverage	$Lev_{i,q}$	Total liabilities of company *i* divided by total assets in quarter *q*
	Return on total assets	$Roa_{i,q}$	Company *i*'s net profit divided by total assets in quarter *q*
	Corporate transparency	$AbsDA_{i,q}$	The absolute value of steerable accruals for company *i* in quarter *q*

3.3 Model Design

According to the previous theoretical basis and hypothesis, this paper wants to study the impact of venture capitals' shareholding on the stocks' crash risk and the different influences of their holding or selling behavior after the lockup period on the crash risk. Firstly, we need to examine whether venture capitals' shareholding has significant impact on stocks' crash risk, and whether it enhances or reduces the crash risk. Then, we further examine whether venture capitals' different behavior of holding or selling the stock after lockup period will have different impacts on the crash risk.

To test the first hypothesis, we build two models by two steps. To begin with, we generally inspect whether those companies that once had venture capital shareholders during 2005-2016 have significant different characteristic in crash risk with other companies that didn't have venture capital shareholders, with industry effect and quarter effect controlled.

$$\boldsymbol{CrashRisk_{i,q} = \beta_0 + \beta_1 Dtreat_{i,q-1} + \gamma Control_{i,q-1} + \varepsilon_{i,t}} \quad (7)$$

$CrashRisk_{i,q}$ is proxied by $NCSKEW_{i,q}$ and $DUVOL_{i,q}$. $Dtreat_{i,q-1}$ is the dummy variable to describe whether the company i has venture capital background, which does not change with time. $Control_{i,q-1}$ is the set of control variables. β_1 measures the difference in crash risk between those companies with venture capital background and those without. If the coefficient β_1 is significant, it suggest that the companies with venture capital background has significant difference in risk characteristics in stock crash with others no VC background companies. The difference may be

caused by some specific firm fundamentals that don't change along time, either caused by venture capital investment or attract venture capital to invest. Besides, if the coefficient β_1 is significant, it also suggests that the research is subjected to significant endogenous selection bias. In that case, we can't prove the casual relationship between the dependent variable and independent variable. However, if the the coefficient β_1 is not significant, it eliminates the endogenous problem.

Based on the above model, we add the variable $DVC_{i,q-1}$ to the model (8) to further explore the impact of venture capital shareholding in current period on the crash risk in the next period.

$$\boldsymbol{CrashRisk_{i,q} = \beta_0 + \beta_1 Dtreat_{i,q-1} + \beta_2 DVC_{i,q-1} + \gamma Control_{i,q-1} + \varepsilon_{i,t}} \quad (8)$$

$DVC_{i,q-1}$ is a dummy variable measuring whether company i has venture capital shareholders in the quarter q. If β_2 is significantly positive, it indicates that venture capitals' shareholding will significantly aggravate the stock crash risk. If β_2 is significantly negative, it indicates that venture capitals' shareholding will significantly reduce the stock crash risk.

To test the second hypothesis, we establish two parallel models – model (9) and model (10). On one hand, in the model (9), the interactive variable $DVC_{i,q-1} \times Drestrs_{i,q-1}$ is introduced to the model, describing whether company i's venture capital shareholders continue to hold unrestricted shares in quarter q after the lockup period. If β_3 is significantly positive, it indicates that venture capitals' holding non-restricted shares after lockup period will significantly aggravate the crash risk and the impact is even worse than just holding restricted shares. If β_3 is significantly negative,

it indicates that venture capitals' holding non-restricted shares after lockup period will significantly reduce the crash risk against the baseline impact caused by holding restricted shares.

$$\boldsymbol{CrashRisk_{i,q} = \beta_0 + \beta_1 Dtreat_{i,q-1} + \beta_2 DVC_{i,q-1} + \beta_3 DVC_{i,q-1} \times Drestrs_{i,q-1} + \gamma Control_{i,q-1} + \varepsilon_{i,t}} \quad (9)$$

On the other hand, the interactive variable $DVC_{i,q-1} \times Dholdsell_{i,q-1}$ is introduced to the model (10), describing whether company i's venture capital shareholders sell company's shares in quarter q after the lockup period. If β_3 is significantly positive, it indicates that compared with continuing holding, venture capitals' selling shares after lockup period will significantly aggravate the next period's crash risk. If β_3 is significantly negative, it indicates that compared with continuing holding, venture capitals' selling shares after lockup period will significantly reduce the next period's crash risk.

$$\boldsymbol{CrashRisk_{i,q} = \beta_0 + \beta_1 Dtreat_{i,q-1} + \beta_2 DVC_{i,q-1} + \beta_3 DVC_{i,q-1} \times Dholdsell_{i,q-1} + \gamma Control_{i,q-1} + \varepsilon_{i,t}} \quad (9)$$

4 EMPIRICAL RESULTS AND ANALYSIS

4.1 Descriptive Analysis

Table 4.1 shows the descriptive statistics of the main variables designed in this study. In order to reduce the influence of extreme values on the study results, we do the Winsorization for the 1st and 99th percentile of the original data.

Table 4.1 Descriptive Statistics Table of Main Variables

VARIABLES	mean	sd	p5	p50	p95	N
Panel A Dependent Variables						
NCSKEW	-0.422	0.836	-1.748	-0.430	0.930	64281
DUVOL	-0.331	0.673	-1.396	-0.349	0.804	64281
DA	0.004	0.046	-0.067	0.004	0.074	64281
Panel B Independent Variables						
Dtreat	0.236	0.424	0	0	1	64281
DVC	0.053	0.224	0	0	1	64281
Drestrs	0.042	0.200	0	0	0	64281
Dholdsell	0.013	0.111	0	0	0	64281
Panel C Control Variables						
ΔTurn	0.114	0.760	-0.578	0.001	1.183	64281
Ret	0.000	0.003	-0.005	0.000	0.004	64281
Vol	0.023	0.009	0.011	0.022	0.037	64281
Size	21.790	1.253	20.100	21.630	24.170	64281
BM	0.414	0.266	0.106	0.353	0.939	64281
Lev	0.457	0.213	0.099	0.468	0.793	64281
Roa	0.011	0.019	-0.012	0.009	0.042	64281
absDA	0.032	0.034	0.002	0.021	0.099	64281

$NCSKEW$ and $DUVOL$ are proxies of stock price crash risk. The larger the index value, the greater the crash risk. As we can see from the Table 4.1, for $NCSKEW$, the mean is -0.422, the median -0.430 and the standard deviation 0.836, while for $DUVOL$, the mean is -0.331, the median -0.349 and the standard deviation 0.673. Both of two variables reflect that the stock price crash risk has large variation, and that the distributions slightly right skewed. The skewness suggests that there are a few extreme large values (high risk) in the sample. DA is the Discretionary Accruals. The mean and median of DA is 0.004, the 5th percentile (-0.067) is smaller than the 95th percentile (0.074) in absolute term, suggesting positive earnings management is more frequent than negative earnings management.

$Dtreat$ represents whether the listed company has ever been an invested by venture capital firms during the sample period. The average value is 0.236, which means that of all the listed companies, less than a quarter of companies had venture capital background. DVC represents whether the listed company has venture capital shareholders in each quarter in the sample period. the mean of DVC (0.053) suggests that on average there are only 5.3% of companies have venture capital shareholders at a time point. The mean of $Drestrs$ (0.042) suggests that only 4.2% of all observations have venture capital shareholders holding non-restricted shares. The mean of $Dholdsell$ (0.013) suggests that only 1.3% observations have venture capital shareholders selling shares.

The rest are descriptive statistics of control variables. By controlling these variables, we can better study the correlations between dependent variables and independent variables.

We further divide the sample into VC-backed group and non-VC-backed group by the value of DVC. We aim to compare the differences in the stock crash risk, earnings management, financial indicators, and market performance between two groups.

Table 4.2 Descriptive Statistics Table of Main Variables by Groups

VARIABLES	**Non-VC-backed(*DVC=0*)**				**VC-backed(*DVC=1*)**			
	mean	**sd**	**p50**	**N**	**mean**	**sd**	**p50**	**N**
NCSKEW	-0.424	0.835	-0.433	60863	-0.379	0.841	-0.381	3418
DUVOL	-0.334	0.673	-0.353	60863	-0.286	0.671	-0.303	3418
DA	0.004	0.046	0.003	60863	0.008	0.041	0.007	3418
ΔTurn	0.118	0.764	0.002	60863	0.047	0.700	-0.009	3418
Ret	0.000	0.003	0.000	60863	0.000	0.003	0.000	3418
Vol	0.023	0.009	0.022	60863	0.023	0.008	0.022	3418
Size	21.810	1.260	21.650	60863	21.450	1.065	21.250	3418
BM	0.414	0.266	0.352	60863	0.427	0.265	0.367	3418
Lev	0.461	0.212	0.473	60863	0.383	0.212	0.379	3418
Roa	0.011	0.019	0.009	60863	0.011	0.018	0.009	3418
absDA	0.032	0.034	0.021	60863	0.030	0.031	0.020	3418

From Table 4.2, we can get following implications. (1) The values of $NCSKEW$ and $DUVOL$ in VC-backed group are significantly larger than the values in non VC-backed group, indicating that VC-backed companies have larger crash risk in the next period than non-VC-backed companies. (2) The VC-backed group has higher DA than non-VC-backed group, which suggest that VC-

backed companies have stronger incentives for positive earnings management non-VC-backed companies. This is contrary to the supervision hypothesis and in support of grandstanding hypothesis. (3) VC-backed group has lower $\Delta Turn$ than non-VC-backed companies, indicating VC-backed companies has worse liquidity. On the one hand, this to some extent reflect the fact that many VC-backed companies have at least some part of their shares still restricted from trading. On the other hand, stocks with poor liquidity are more prone to crash. (4) VC-backed companies have lower financial leverage than non-VC-backed companies, which is related to their small asset size and poor liquidity. (5) VC-backed companies has smaller size and higher book-to-market ratio than non-VC-booker companies, while no significant difference in firm-specific return and return to equity.

We also look at the distributions of $NCSKEW$, $DUVOL$, and DA, and compare the difference between VC-backed group and non-VC backed group. From the following figures, we can see that for all variables $NCSKEW$, $DUVOL$ and DA, distribution of VC-backed group is on the right of non-VC-group. The result suggests that there is systematic deviation in the stock price crash risk and earnings management between VC-backed group and non-VC-backed group. After descriptive and qualitative analysis, we will go through a more accurate and thorough regression analysis to further examine the hypothesis.

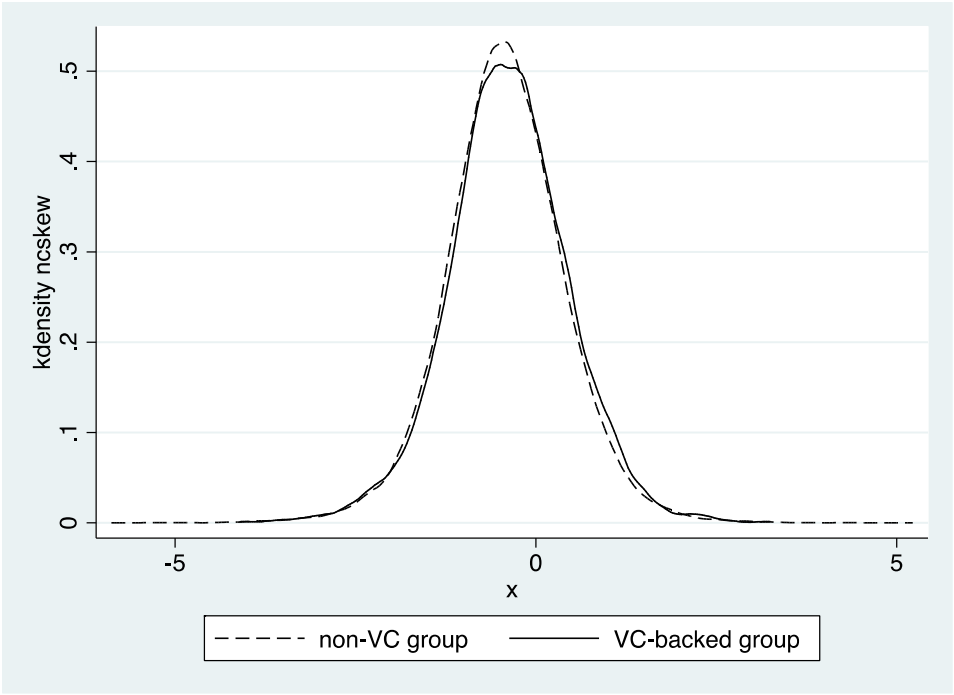

Figure 4.1 Probability Distribution of NCSKEW

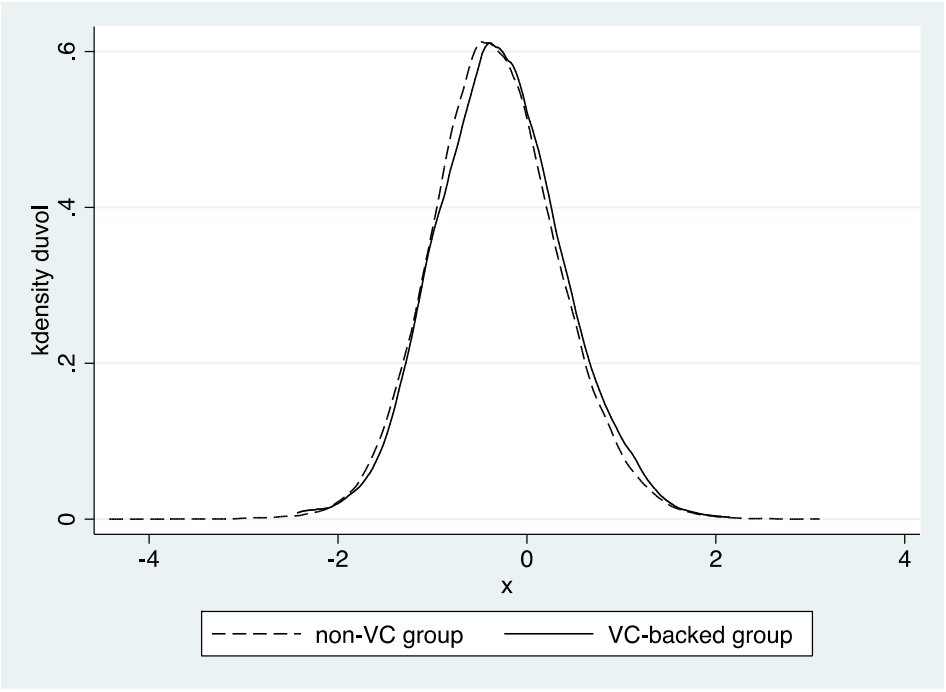

Figure 4.2 Probability Distribution of DUVOL

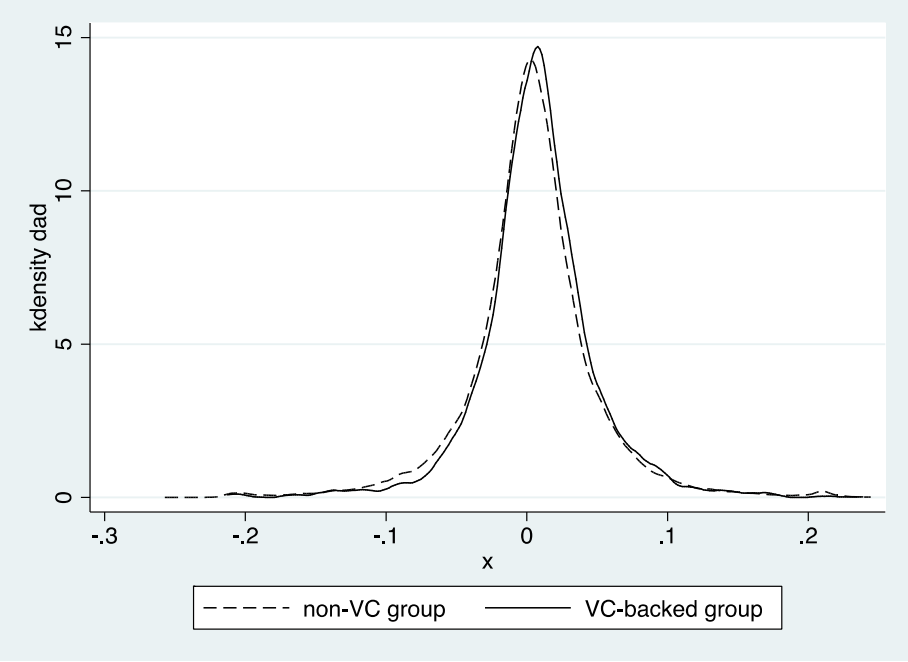

Figure 4.3 Probability Distribution of DA

4.2 Results Analysis

4.2.1 Venture Capital Shareholding and Stock Price Crash Risk

Table 4.3 Venture Capital Background and Crash Risk

	(1)	(2)	(3)	(4)
VARIABLES	$NCSKEW_t$	$DUVOL_t$	$NCSKEW_t$	$DUVOL_t$
$Dtreat_{t-1}$	0.008	0.009	0.003	0.004
	(0.87)	(1.45)	(0.38)	(0.61)
$NCSKEW_{t-1}$			0.041***	0.023***
			(7.16)	(4.80)
$\Delta Turn_{t-1}$			0.004	-0.000
			(0.82)	(-0.01)
Ret_{t-1}			43.588***	40.006***
			(14.49)	(12.98)
Vol_{t-1}			11.977***	10.141***
			(12.37)	(10.42)
$Size_{t-1}$			0.032***	0.014***
			(7.08)	(4.38)
BM_{t-1}			-0.402***	-0.260***
			(-19.25)	(-17.14)
Lev_{t-1}			-0.232***	-0.181***
			(-11.06)	(-11.70)
Roa_{t-1}			-1.004***	-1.233***
			(-5.39)	(-8.43)
$AbsDA_{t-1}$			0.154	0.052
			(1.60)	(0.69)
Quarter Effect	YES	YES	YES	YES
Industry Effect	YES	YES	YES	YES
Adj R^2	0.101	0.130	0.149	0.184
Observations	64,281	64,281	64,281	64,281

t-statistics in parentheses， *** p<0.01, ** p<0.05, * p<0.1.

Table 4.3 is the regression result of Model (7), which examines whether companies which had been once invested by venture capital will have systematic difference in stock price crash risk from companies with no venture capital background. The results using two different crash risk proxies

are very close, and both suggest that VC background is positive correlated to greater crash risk but the coefficient is not significant. The result to some extent reduces the problem of selection bias. The insignificant result proves that the difference in crash risk is not caused by some firm-specific characteristics that don't change by time, and lays a good foundation for the following analysis.

Table 4.4 Venture Capital Shareholding and Crash Risk

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	$NCSKEW_t$	$DUVOL_t$	DA_t	$NCSKEW_t$	$DUVOL_t$	DA_t
$Dtreat_{t-1}$	-0.000	0.002	0.000	-0.006	-0.004	0.001
	(-0.04)	(0.23)	(0.36)	(-0.67)	(-0.59)	(1.07)
DVC_{t-1}	0.037**	0.033***	0.002**	0.041***	0.034***	0.002**
	(2.20)	(2.74)	(2.41)	(2.61)	(2.84)	(2.37)
$NCSKEW_{t-1}$				0.041***	0.023***	0.001***
				(7.15)	(4.79)	(3.43)
$\Delta Turn_{t-1}$				0.004	0.000	-0.001***
				(0.87)	(0.04)	(-2.68)
Ret_{t-1}				43.573***	39.993***	-0.018
				(14.48)	(12.98)	(-0.20)
Vol_{t-1}				11.971***	10.136***	0.020
				(12.35)	(10.41)	(0.64)
$Size_{t-1}$				0.032***	0.014***	0.002***
				(7.12)	(4.43)	(7.61)
BM_{t-1}				-0.403***	-0.261***	-0.007***
				(-19.29)	(-17.18)	(-5.67)
Lev_{t-1}				-0.229***	-0.179***	-0.012***
				(-10.93)	(-11.57)	(-8.94)
Roa_{t-1}				-1.005***	-1.234***	0.234***
				(-5.39)	(-8.42)	(16.47)
$AbsDA_{t-1}$				0.157	0.054	0.089***
				(1.63)	(0.73)	(9.65)
Quarter Effect	YES	YES	YES	YES	YES	YES
Industry Effect	YES	YES	YES	YES	YES	YES
Adj R^2	0.101	0.130	0.0677	0.149	0.184	0.0887
Observations	64,281	64,281	64,281	64,281	64,281	64,281

t-statistics in parentheses， *** p<0.01, ** p<0.05, * p<0.1.

Table 4.4 is the regression result of Model (8), which examines the impact of venture capital shareholding on companies' stock crash risk. From the regression results (1), (2), (4) and (5), the significantly positive coefficient of DVC_{t-1} under the significance level of 0.01 indicates that companies with venture capital shareholders in a certain quarter will have greater stock crash risk in the next quarter than other non-VC companies. From regression results (3) and (6), we find significantly positive correlation between venture capital shareholding and next period's positive earnings management. That means companies with venture capital shareholders in a certain quarter will have great incentive of positive earnings management in the next quarter than other non-VC companies.

To conclude: companies with venture capital shareholders in a specific quarter will have greater incentive of earnings management (exaggerating revenue and profit) and greater stock price crash risk in the next quarter. Since we have found out in the preliminary regression that firm-specific characteristic which may attract VC investment is not a major cause of significant greater crash risk, our result here is in support of the view that existence of venture capital shareholder is the cause of greater incentive of positive earnings management and greater crash risk in the future. The result of model (8) supports the hypothesis 1-a.

4.2.2 Venture Capital's behavior after lock-up period and Stock Price Crash Risk

Through the test above, we have examined the static effects of venture capital shareholding on companies' stock crash risk. In this part, we will look at different influences of venture

shareholders' behavior of holding or selling shares after lockup period on the companies' stock crash risk.

Table 4.5 Venture Capital Shareholder Holding or Selling Shares and Crash Risk

	(1)	(2)	(3)	(4)
VARIABLES	$NCSKEW_t$	$DUVOL_t$	$NCSKEW_t$	$DUVOL_t$
$Dtreat_{t-1}$	-0.006	-0.004	-0.006	-0.004
	(-0.67)	(-0.59)	(-0.67)	(-0.59)
DVC_{t-1}	0.105***	0.092***	0.032*	0.032**
	(3.62)	(3.85)	(1.89)	(2.18)
$DVC_{t-1} \times Drestrs_{t-1}$	-0.082**	-0.074***		
	(-2.51)	(-2.85)		
$DVC_{t-1} \times Dholdsell_{t-1}$			0.079***	0.052**
			(2.87)	(2.32)
$NCSKEW_{t-1}$	0.041***	0.023***	0.041***	0.023***
	(7.15)	(4.79)	(7.15)	(4.79)
$\Delta Turn_{t-1}$	0.004	0.000	0.004	0.000
	(0.94)	(0.11)	(0.83)	(0.01)
Ret_{t-1}	43.557***	39.978***	43.564***	39.987***
	(14.45)	(12.95)	(14.47)	(12.97)
Vol_{t-1}	11.944***	10.111***	11.961***	10.130***
	(12.29)	(10.36)	(12.33)	(10.40)
$Size_{t-1}$	0.032***	0.014***	0.032***	0.014***
	(7.09)	(4.39)	(7.12)	(4.43)
BM_{t-1}	-0.402***	-0.261***	-0.403***	-0.261***
	(-19.27)	(-17.16)	(-19.29)	(-17.18)
Lev_{t-1}	-0.228***	-0.178***	-0.229***	-0.179***
	(-10.88)	(-11.50)	(-10.94)	(-11.57)
Roa_{t-1}	-1.009***	-1.238***	-1.006***	-1.235***
	(-5.41)	(-8.45)	(-5.39)	(-8.42)
$AbsDA_{t-1}$	0.158*	0.056	0.156	0.054
	(1.65)	(0.74)	(1.62)	(0.71)
Quarter Effect	YES	YES	YES	YES
Industry Effect	YES	YES	YES	YES
Adj R^2	0.149	0.184	0.151	0.185
Observations	64,281	64,281	64,281	64,281

t-statistics in parentheses， *** p<0.01, ** p<0.05, * p<0.1.

From the regression table, we can see the results using $NCSKEW$ and $DUVOL$ as proxies of crash risk are very close. From the regression results (1) and (2), we find that the coefficient of DVC_{t-1} is significantly positive and the coefficient of $DVC_{t-1} \times Drestrs_{t-1}$ is significantly negative, which indicate the stock crash risk in the next quarter increases significantly if venture capital firms hold the company's restricted stock, while stock crash risk in the next period won't see significant increase if venture capital firms hold the company's non-restricted stock. Venture capital firms holding non-restricted shares after lockup period conveys positive signal to the public and offset the general negative impact of venture capital shareholding.

From regressions (3) and (4), we can find that the coefficients of DVC_{t-1} and $DVC_{t-1} \times Dholdsell_{t-1}$ are significantly positive, which indicates that venture capital firms holding company shares in a specific quarter will generally increase the crash risk in the next quarter and that venture capital firms selling shares in specific quarter will dramatically aggravate the crash risk in the next quarter.

To conclude, our regression results support the hypothesis 2-a and 2-b. If venture capital firms hold the company's restricted shares, the next quarter crash risk of the company will be significantly higher than other non-VC companies. If venture capital firms hold the company's non-restricted shares, the next quarter crash risk won't be significantly higher than other non-VC companies. If venture capital firms sell the company's shares in a specific quarter, this selling

behavior will further increase the next period crash risk compared to the static venture capital shareholding effect.

4.3 Robust Test

In China's capital market, some listed companies will set up a special purpose company or partnership to hold a portion of shares in order to take advantage of leverage, to avoid disclosure of ownership structure, or implementing stock incentives. These special purpose entities usually call themselves as "investment firms", investment management firms", or "xx capital", and describe their business as investment or venture capital related. In research about venture capital, it is difficult to screen out those fake venture capital firms, because we currently identify venture capital firms by looking at their names and main business. In this paper, we propose a way to reduce this problem – if a venture capital firm only hold one listed company's share in the sample period, we don't consider it as real venture capital firm. According to this rule, we re-group the sample and re-assign value to independent variables. We run all the regression tests again to see whether our results are robust. The regression results are as follows:

Table 4.6 Venture Capital Background and Crash Risk

	(1)	(2)	(3)	(4)
VARIABLES	$NCSKEW_t$	$DUVOL_t$	$NCSKEW_t$	$DUVOL_t$
$Dtreat_{t-1}$	0.014	0.012*	0.009	0.006
	(1.40)	(1.80)	(0.97)	(1.00)
$NCSKEW_{t-1}$			0.041***	0.023***
			(7.16)	(4.80)
$\Delta Turn_{t-1}$			0.004	-0.000
			(0.82)	(-0.00)
Ret_{t-1}			43.586***	40.003***
			(14.49)	(12.98)
Vol_{t-1}			11.976***	10.141***
			(12.36)	(10.42)
$Size_{t-1}$			0.032***	0.014***
			(7.09)	(4.39)
BM_{t-1}			-0.402***	-0.260***
			(-19.25)	(-17.15)
Lev_{t-1}			-0.231***	-0.181***
			(-11.05)	(-11.70)
Roa_{t-1}			-1.004***	-1.234***
			(-5.39)	(-8.43)
$AbsDA_{t-1}$			0.154	0.052
			(1.60)	(0.69)
Quarter Effect	YES	YES	YES	YES
Industry Effect	YES	YES	YES	YES
Adj R^2	0.101	0.130	0.149	0.184
Observations	64,281	64,281	64,281	64,281

t-statistics in parentheses， *** p<0.01, ** p<0.05, * p<0.1.

Table 4.7 Venture Capital Shareholding and Crash Risk

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	$NCSKEW_t$	$DUVOL_t$	DA_t	$NCSKEW_t$	$DUVOL_t$	DA_t
$Dtreat_{t-1}$	0.004	0.003	0.000	-0.001	-0.002	0.001
	(0.37)	(0.46)	(0.45)	(-0.14)	(-0.27)	(0.83)
DVC_{t-1}	0.048***	0.043***	0.002**	0.049***	0.041***	0.002**
	(2.61)	(3.15)	(2.20)	(2.79)	(3.07)	(2.21)
$NCSKEW_{t-1}$				0.041***	0.023***	0.001***
				(7.15)	(4.79)	(3.43)
$\Delta Turn_{t-1}$				0.004	0.000	-0.001***
				(0.87)	(0.04)	(-2.68)
Ret_{t-1}				43.572***	39.991***	-0.018
				(14.48)	(12.98)	(-0.21)
Vol_{t-1}				11.966***	10.133***	0.020
				(12.34)	(10.40)	(0.64)
$Size_{t-1}$				0.032***	0.015***	0.002***
				(7.15)	(4.45)	(7.57)
BM_{t-1}				-0.403***	-0.261***	-0.007***
				(-19.31)	(-17.20)	(-5.67)
Lev_{t-1}				-0.229***	-0.180***	-0.012***
				(-10.94)	(-11.58)	(-8.94)
Roa_{t-1}				-1.004***	-1.234***	0.233***
				(-5.39)	(-8.43)	(16.47)
$AbsDA_{t-1}$				0.157	0.055	0.089***
				(1.63)	(0.73)	(9.66)
Quarter Effect	YES	YES	YES	YES	YES	YES
Industry Effect	YES	YES	YES	YES	YES	YES
Adj R^2	0.101	0.130	0.0677	0.149	0.184	0.0887
Observations	64,281	64,281	64,281	64,281	64,281	64,281

t-statistics in parentheses， *** p<0.01, ** p<0.05, * p<0.1.

Table 4.8 Venture Capital Shareholder Holding or Selling Shares and Crash Risk

	(4)	(5)	(3)	(4)
VARIABLES	$NCSKEW_t$	$DUVOL_t$	$NCSKEW_t$	$DUVOL_t$
$Dtreat_{t-1}$	-0.001	-0.002	-0.001	-0.002
	(-0.14)	(-0.27)	(-0.14)	(-0.27)
DVC_{t-1}	0.121***	0.116***	0.029	0.030**
	(3.43)	(4.06)	(1.42)	(2.03)
$DVC_{t-1} \times Drestrs_{t-1}$	-0.091**	-0.095***		
	(-2.34)	(-3.11)		
$DVC_{t-1} \times Dholdsell_{t-1}$			0.080**	0.052*
			(2.52)	(1.89)
$NCSKEW_{t-1}$	0.041***	0.023***	0.041***	0.023***
	(7.14)	(4.78)	(7.15)	(4.79)
$\Delta Turn_{t-1}$	0.004	0.000	0.004	0.000
	(0.93)	(0.11)	(0.83)	(0.02)
Ret_{t-1}	43.558***	39.977***	43.568***	39.989***
	(14.45)	(12.95)	(14.47)	(12.97)
Vol_{t-1}	11.941***	10.107***	11.960***	10.129***
	(12.29)	(10.35)	(12.33)	(10.40)
$Size_{t-1}$	0.032***	0.014***	0.032***	0.015***
	(7.11)	(4.41)	(7.14)	(4.45)
BM_{t-1}	-0.402***	-0.261***	-0.403***	-0.261***
	(-19.29)	(-17.17)	(-19.32)	(-17.21)
Lev_{t-1}	-0.228***	-0.178***	-0.229***	-0.180***
	(-10.89)	(-11.50)	(-10.95)	(-11.58)
Roa_{t-1}	-1.006***	-1.235***	-1.005***	-1.234***
	(-5.40)	(-8.44)	(-5.39)	(-8.43)
$AbsDA_{t-1}$	0.157	0.055	0.156	0.054
	(1.64)	(0.73)	(1.62)	(0.72)
Quarter Effect	YES	YES	YES	YES
Industry Effect	YES	YES	YES	YES
Adj R^2	0.149	0.184	0.149	0.184
Observations	64,281	64,281	64,281	64,281

t-statistics in parentheses， *** p<0.01, ** p<0.05, * p<0.1.

The regression results are consistent with the original regression: venture capital shareholding has significantly positive correlation with the earnings management and the crash risk. After adding the interactive variables of the holding non-restricted shares and selling, the outcomes are also consistent with the previous results: the non-restricted term has significant negative correlation with the crash risk while the selling term has significantly positive correlation with the crash risk. This shows that the results of this study are robust and credible.

5. CONCLUSIONS

In this paper, our empirical analysis is based on the quarterly trading data, financial data and shareholder data of Chinese A-share listed companies from 2005 to 2016. First, we examine the impact of venture capital shareholding on companies' stock crash risk. Then we also look at different influences of venture shareholders' behavior of holding or selling shares after lockup period on the companies' stock crash risk. Based on the regression results, our conclusions are as follows.

1. Companies which had been once invested by venture capital firms (also called companies with VC background) don't have significantly greater stock crash risk than companies without VC background. That means, in the following test, firm-specific characteristics that may attract venture capital investment are not major cause to explain the difference in crash risk between companies with venture capital shareholders and companies without venture capital shareholders.

2. Companies with venture capital shareholders in a specific quarter will have greater incentive of earnings management (exaggerating revenue and profit) and greater stock price crash risk in the next quarter then companies without venture capital shareholders. This result agrees to the "Grandstanding" theory that, venture capital firms who want to cash their investments in the next quarter will loose their supervision over companies' positive earnings management in order to exit at a higher price.

3. If venture capital firms hold the company's non-restricted shares, the next quarter crash risk won't be significantly higher than other non-VC companies. Therefore, venture capital firms continuing to hold non-restricted shares after lockup period is considered as positive message by the market. However, if venture capital firms sell shares in specific quarter, the stock crash risk will dramatically aggravate, and is much higher than other non-VC companies in the next quarter.

To sum up, this paper finds that generally companies with venture capital shareholders in a specific quarter will have higher stock price crash risk than companies without venture capital shareholders. By adding a treatment variable, we eliminate the possibility that some firm-specific characteristics causing higher crash risk attract venture capital investment. Therefore, we tend to believe venture capital shareholding is one of significant factors that will aggravate companies' stock crash risk. Taking the investee public and holding its shares are the last two steps before venture capital firms sell shares and cash the investment. In china, many venture capital firms at this period focus on short-term profit instead of investees' long-term development. In order to achieve higher exit return, they may trade on inside information, wink at the management's tricks such as hiding bad news, disclosing good news and positive earnings management. Therefore, either because of venture capital firms know some bad will happen, or because of the market consider insiders selling as a negative signal, the companies' stock crash risk will increase after venture capital shareholders sell companies' shares. On the contrary, if venture capital shareholders continue to hold shares after lockup period, companies' stock crash risk will decrease and be indifferent from non-VC companies. The market considers the venture capital shareholders' holding behavior as positive signal – good quality of company or less grandstanding incentive of venture capital.

REFERENCES

[1] Barry, C. B., Muscarella, C. J., Peavy Iii, J. W., & Vetsuypens, M. R. (1990). The role of venture capital in the creation of public companies: Evidence from the going-public process. *Journal of Financial economics*, 27(2), 447-471.

[2] Hochberg, Y. V., Ljungqvist, A., & Lu, Y. (2007). Whom you know matters: Venture capital networks and investment performance. *The Journal of Finance*, 62(1), 251-301.

[3] Hellmann, T., & Puri, M. (2000). The interaction between product market and financing strategy: The role of venture capital. *The Review of Financial Studies*, 13(4), 959-984.

[4] Kortum, S., & Lerner, J. (2001). Does venture capital spur innovation?. In Entrepreneurial inputs and outcomes: New studies of entrepreneurship in the United States (pp. 1-44). Emerald Group Publishing Limited.

[5] Guo, D., & Jiang, K. (2013). Venture capital investment and the performance of entrepreneurial firms: Evidence from China. *Journal of Corporate Finance*, 22, 375-395.

[6] Brunninge, O., & Nordqvist, M. (2004). Ownership structure, board composition and entrepreneurship: Evidence from family firms and venture-capital-backed firms. *International Journal of Entrepreneurial Behavior & Research*, *10*(1/2), 85-105.

[7] Hellmann, T., & Puri, M. (2002). Venture capital and the professionalization of start‐up firms: Empirical evidence. *The journal of finance*, *57*(1), 169-197.

[8] Ji, X., & Ma, N. (2016). The Impacts of Different Venture Capital Backgrounds on Accounting Information Disclosure of Listed Companies. *East China Economics Management*, 30(1), 121-128.

[9] Wang, L., & Dang, X. (2008). The R&D Expenditure, Venture Investment and the Development of New High-tech Industry——Empirical Research of Chinese Data Based on Canonical Correlation Analysis. *R&D Management*, 20(4), 13-18.

[10] Wu, Q. (2009). The Path Analysis of Venture Capital's Support to High-tech Industries in Innovation. *Management World*, 7 ,174-175.

[11] Chen, J. (2011). Did Venture Capita Imrove the Technology Innovations of Hi-tech Enterprises—A Empirical Analyse Based on the GEM of China. *Economic Management*, 33(2), 71-77.

[12] Yuan, J. (2013). The mechanism of venture capital on corporate governance—a study based on principle agent perspective. Southwestern University of Finance.

[13] Jin, M., & Wang, J. (2010). Research on the Process and Effect of Venture Capital's Intervention in Corporate Governance of Small and Medium Enterprises. *Collected Essays on Finance and Economics*, 154(6), 84-90.

[14] Cai, N. (2015). Grandstanding and Earnings Management: Evidence from Venture Capital Industry in China. *Accounting Research*, 5, 20-27+94.

[15] Jia, N., & Li, D. (2011). The Effect of Venture Capital on the Performance of IPO Companies. *Nankai Business Review*, 14(1), 96-106.

[16] Wu, C., Wu, S., & Liu, W. (2012). A Study on the Backing and Exit Motivation of Venture Capital in Chinese Listed Companies on the GEM. *Economic Management*, ,34(10), 128-138.

[17] Jin, L., & Myers, S. C. (2006). R2 around the world: New theory and new tests. *Journal of financial Economics*, *79*(2), 257-292.

[18] Hutton, A. P., Marcus, A. J., & Tehranian, H. (2009). Opaque financial reports, R2, and crash risk. *Journal of financial Economics*, *94*(1), 67-86.

[19] Wu Z., & Li X. (2015). Insider Selling, Information Environment and Stock Price Crash Risk. *Accounting Research*, 6, 48-55.

[20] Quan, X., & Yin H. (2017). Influence of venture capital ownership on stock price crash risk. *Science Research Management*, 38(12), 89-98.

[21] Sun S., Liang S., Ruan G., & Fu Y. (2017). Management Selling, Suppression of Information and Stock Price Crash Risk. *Journal of Financial Research*, 11, 175-190.

[22] Pan, Y., & D YY, L. C. (2011). Information opacity, analysts following, and crash risk of individual stock. *Journal of financial research*, *9*, 138-150.

[23] Ye, K., Cao, F., & Wang, H. (2015). Can internal control information disclosure reduce stock price crash risk. *Journal of Financial Research*, *2*, 192-206.

[24] Kothari, S. P., Shu, S., & Wysocki, P. D. (2009). Do managers withhold bad news?. *Journal of Accounting Research*, 47(1), 241-276.

[25] Lin, T. H., & Smith, R. L. (1998). Insider reputation and selling decisions: the unwinding of venture capital investments during equity IPOs. *Journal of corporate finance*, 4(3), 241-263.

[26] Cumming, D. J., & MacIntosh, J. G. (2003). Venture-capital exits in Canada and the United States. *The University of Toronto Law Journal*, 53(2), 101-199.

[27] Chen G, Zhang Y, Wang L. Review of stock market crash phenomenon[J].Economic Perspectives,2008 (11) :116—120

[28] Chen J, Hong H, Stein J C. Forecasting Crashes: Trading Volume, Past Returns, and Conditional Skewness in Stock Prices[J]. Journal of Financial Economics,2001,61 (3):345—381

[29] Kim J B, Li Y, Zhang L. Corporate Tax Avoidance and Stock Price Crash Risk: Firm-level Analysis[J1.Journal of Financial Economics,201la,100 (3):639—662

[30] Kim J B, Li Y, Zhang L. CFOs versus CEOs: Equity Incentives and Crashes[J]. Journal of Financial Economics. 20l1b,101 (3):713-730

[31] Dimson, E. (1979) Risk Measurement When Shares Are Subject to Infrequent Trading. Journal of Financial Economics, 7, 197-226.

[32] Su D, Lin D : CEO Stock Incentives, Earnings Management and Corporate Governance[J], Economic Research Journal, 2011(11):88-100