Short Selling Threats and Firm Risk-taking: Evidence from a Quasi-Natural Experiment

First draft: September 15, 2015
This version: September 18, 2016

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Abstract

We study the effect of increased short selling threats on firm risk-taking. In 2010, the China Securities Regulatory Commission initiated a pilot program that gradually removes short-sale constraints. We exploit this regulatory change as a quasi-natural experiment and find that pilot firms undertake less risk. Further analyses indicate that the negative effect is driven by increased managerial myopia. Pilot firms accumulate more cash, take less debt, invest less in R&D, attempt fewer M&As, have a lower asset growth rate, worse financial performances, and lower market values. These findings suggest that short selling can affect real economic activities in emerging markets.

JEL Code: G34, G38, G14
Keywords: short selling; firm risk-taking; corporate governance; quasi-natural experiment

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*We thank Alexander Borisov (discussant), Xuechen Gao (discussant), Xiaosheng Ju, Zhisheng Li, Yao Lu, Fangyuan Ma, Jihad Al Okaily (discussant), Jinjuan Ren (discussant), Hao Wang, Han Yu (discussant), Chi Zhang, Fengyi Zhang, Xiaofeng Zhao, Weikang Zhu and participants in the 2016 Midwest Finance Association Annual Meeting (Atlanta), 2016 Southwestern Finance Association Annual Meeting (Oklahoma City), 2016 Eastern Finance Association Annual Meeting (Baltimore), 2016 American Accounting Association Mid-Atlantic Region Meeting (Morgantown), 2016 International Finance and Banking Society Conference (Barcelona), 2016 Financial Management Association European Conference (Helsinki), 2016 World Finance Conference (New York City) and 2016 Northern Finance Association Annual Meeting (Quebec) for their valuable comments. We also thank the 2016 SWFA's program committee for awarding us the Best Paper Award in Corporate Governance, and the 2016 AAA Mid-Atlantic's program committee for awarding us the Best PhD Paper Award. All errors are our responsibility.

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I. INTRODUCTION

The recent financial crisis has brought new scrutiny to the long-lasting policy debate regarding the economic impact of short selling. Short selling has been criticized for creating panic in the capital markets and distorting firm activities. Interestingly, empirical evidence on the real effects of short selling is mixed. While some studies document that short selling increases price efficiency (Chang, Cheng, and Yu, 2007; Saffi and Sigurdsson, 2010), curbs earnings management (Massa, Zhang, and Zhang, 2015; Fang, Huang, and Karpoff, 2016) and improves innovation quality (He and Tian, 2015), others find that short selling distorts firm investment and equity issues (Grullon, Michenaud, and Weston, 2015). In this paper, we exploit the staggered removal of short-sale constraints in the Chinese stock market as a quasi-natural experiment to study the causal effect of short selling threats on firm risk-taking.

From a theoretical perspective, the impact of short selling threats on firm risk-taking is ambiguous. On the one hand, short selling threats can impede risk-taking through at least two channels. First, short selling may exacerbate managerial myopia because a sudden drop in stock price may increase the probability of a takeover or a forced removal of top management (Stein, 1988; Morck, Shleifer, and Vishny, 1990). Survey evidence suggests that managers are willing to sacrifice economic growth in order to meet short-term earnings targets (Graham, Harvey, and Rajgopal, 2005). Facing downward price pressure from short selling, managers may cut investment in riskier projects and focus on safer projects with guaranteed short-term profits in order to limit their exposure to downside risk (De Angelis, Grullon, and Michenaud,

2015). We name this the *market pressure* hypothesis, which argues that short selling pressure impedes firm risk-taking by imposing short-term pressures on managers and exaggerating managerial myopia.

Short selling can also impede firm risk-taking through a financial constraints channel. The presence of short-sale constraints limits the voice of pessimistic investors, resulting in overvalued stock prices that reflect only the view of optimistic investors (Miller, 1977; Diamond and Verrecchia, 1987). Therefore, short-sale constraints are positively associated with firm valuation (e.g. Allen, Morris, and Postlewaite, 1993; Chen, Hong, and Stein, 2002; Hong and Stein, 2003), and negatively associated with the cost of debt and equity capital (Morck et al., 1990; Stein, 1996; Baker, Stein, and Wurgler, 2003; Gilchrist, Himmelberg, and Huberman, 2005). A sudden relaxation of short-sale constraints may exogenously increase financing costs and force financially constrained firms to pass up investment opportunities. We call this the *financial constraints* hypothesis, which argues that short selling threats impede firm risk-taking by increasing the cost of external financing.

On the other hand, short selling may positively affect firm risk-taking through at least two channels. First, due to the separation of ownership and control, managers are prone to "enjoy the quiet life" and "play it safe" by taking less risk than is desired by diversified shareholders (Jensen and Meckling, 1976; Bertrand and Mullainathan, 2003; Gormley and Matsa, 2016). The presence of short sellers acts as a form of external governance, leading managers to undertake riskier projects with higher returns (John et al., 2008). We call this the

external governance hypothesis.

Second, short sellers are informed traders who specialize in information gathering and processing (Diamond and Verrecchia, 1987; He and Tian, 2015). Chen, Goldstein and Jiang (2007) show that managers can learn from the private information in the stock price about their own firms' fundamentals and update their investment decisions. If short selling makes the stock price more efficient by incorporating the negative information from pessimistic investors (Saffi and Sigurdsson, 2010; Boehmer and Wu, 2013), firms can learn about prospects of profitable projects and engage in more value-enhancing but riskier projects. We term this view the *information learning* hypothesis.

Given these competing predictions, the question of whether short selling threats encourage or impede firm risk-taking is an empirical one. However, due to the endogenous nature of short selling, identifying the causal effects is empirically challenging. To address this issue, we exploit a quasi-natural experiment in the Chinese stock market that exogenously removes short-sale constraints.

The Chinese stock market does not allow short selling until 2010. Since 2010, the China Securities Regulatory Commission (henceforth CSRC, the Chinese counterpart of the Securities and Exchange Commission) has been gradually including stocks that meet certain requirements in a list; listed stocks are allowed to be sold short. This list is updated over time. Each update serves as a quasi-natural shock to the short-sale constraints of firms that are included on the list. These regulatory changes create both time-series and cross-sectional

variation in the Chinese stock market. Compared with U.S. studies that use Regulation SHO as a single shock to the short-sale constraints, our study makes inferences from multiple shocks that are staggered over time. Our results are therefore less likely to be driven by potential confounding effects, compared to other studies that draw inferences from a single event. Moreover, since China is the largest emerging market in the world, with the largest stock market outside the U.S., our study can also shed light on how government intervention affects economic growth in a representative developing economy.

We start by examining the relation between short selling and firm risk-taking. Following previous literature (John et al., 2008; Hilary and Hui, 2009; Faccio, Marchica, and Mura, 2011; Boubakri, Cosset, and Saffar, 2013), we use the industry-adjusted standard deviation of firm ROA as our primary proxy for the degree of risk-taking. Using a panel of 31,316 firm-quarter observations from 2008 to 2014 and a difference-in-differences methodology, we find that the relaxation of short-sale constraints leads to a significant decline in firms' earnings volatilities. After controlling for time-invariant heterogeneity across firms and time-varying differences across time with firm and quarter fixed effects, our estimation result indicates that the average firm reduces earnings volatility by 11.8% after inclusion in the short-sale list.

Next, we examine whether our results are driven by omitted variables that are related to both risk-taking and inclusion on the short-sale list. To that end, we conduct two tests. First, following Bertrand and Mullainathan (2003), we conduct timing tests to check for the parallel

trend assumption. Results from the timing tests suggest that pilot firms do not decrease their risk prior to inclusion in the list. The negative effect is only significant two or more quarters after inclusion in the list. Therefore, the observed results are unlikely to be driven by reverse causality.

Second, we use alternative methods to construct the control group. We repeat the difference-in-differences tests within the member of Shanghai Shenzhen CSI 300 Index (SHSZ300) and within the treatment group. The negative causal relation between short selling and firm risk-taking still holds. To further alleviate the omitted variable concern, we examine and confirm that the effects hold on a propensity score matched sample. In addition, to address the concern that quarterly-ROA volatilities are likely to be affected by earnings management and firms' seasonal activities, we use alternative proxies of firm risk; our baseline results still hold.

We next conduct a cross-sectional test to examine the validity of our results. If inclusion on the short-sale list represents an exogenous increase in short selling threats, our baseline results should be more pronounced when firms suffer from more severe ex ante overvaluation problems. We use the market-to-book ratio and the analyst forecast dispersion as proxies for overvaluation. Estimation results from a differences-in-differences-in-differences model suggest that our baseline results are indeed stronger among firms with more severe ex ante overvaluation problems.

After establishing the negative relation between short selling threats and firm risk-taking,

we next examine cross-sectional variation to pin down the underlying mechanisms that drive our findings. First, we examine the cross-sectional variation with respect to the strength of internal governance. We introduce three measures of internal governance: board size, the ratio of independent directors, and the separation between control rights and cash-flow rights. The negative impact of short selling threats is stronger among firms with weaker internal governance. This finding is consistent with the *market pressure* hypothesis, which predicts that downward pressure from short sellers can exaggerate managerial myopia, while strong corporate governance mechanisms can alleviate such problems.

We also test whether short selling threats impede firm risk-taking by increasing external financing costs. If the decrease in firm risk is due to an increase in external financing cost, the effect should be stronger among ex ante financially constrained firms. The negative effect of short selling is stronger among financially unconstrained firms. Therefore, the observed negative effect could not be explained by the *financial constraints* hypothesis.

We next consider the effect of short selling threats on corporate policies. We find that after inclusion in the short-sale list, pilot firms accumulate more cash, take less debt, invest less in R&D, attempt fewer M&As, and a have lower asset growth rate. Further, these firms perform worse and have lower market values. These results suggest that managers react to the downside risk of short selling by undertaking more conservative financial policies and shareholders are worse off.

In the last section, we discuss other possible explanations. First, we examine whether

changes in institutional investor composition could help explain our results. As shown in Aghion, Van Reenen, and Zingales (2013), dedicated institutional investors shield managers from short-term price pressures and reduce managerial myopia. We find that after inclusion in the short-sale list, holdings by dedicated institutional investors drops significantly. This evidence supports the *market pressure* hypothesis, which predicts that dedicated institutional investors shield managers from short-term pressures and therefore mitigate the negative impact of short selling on firm risk-taking.

Second, we examine whether the main results are driven by increased margin trading activities rather than heightened short selling threats to take care of the concern that inclusion in the short-sale list represents a joint relaxation of short selling restraints and margin trading. We find that the intensity of margin trading activities is positively associated with firm risk-taking. This finding is inconsistent with the negative baseline relation. Therefore, increased margin trading activities cannot explain our baseline results. Finally, we test and reject the alternative hypotheses that CEO career concerns, short sellers' bear raiding, and the Hawthorne effect are driving our results.

Overall, our findings suggest that downside price pressure from short selling decrease firm risk-taking through exacerbating managerial myopia. Myopic managers focus on short-term earnings and pass up riskier but higher return projects. This result is in line with Gormley and Matsa (2011), who show that managers respond to an increase in liability risk by undertaking safer projects. We also document that corporate governance mechanisms

affect how managers react to short-sale pressures. Good corporate governance reduces managerial myopia and ensures an appropriate level of risk-taking. This paper also contributes to the line of research by John et al. (2008), Acharya, Amihud and Litov (2011), Faccio et al. (2011), and Gormley and Matsa (2016), who emphasize the important role of corporate governance in encouraging firm risk-taking.

This paper also contributes to the growing literature that explores the real effects of short selling. Chang, Lin, and Ma (2015) provide evidence on the disciplining effect of short selling on mergers and acquisitions. He and Tian (2015) find that short sellers have a positive effect on the quality, efficiency, and originality of innovations. Grullon et al. (2015) find that firms react to an increase in short-selling activity by reducing investment. This paper contributes to the short selling literature by providing additional evidence on the negative effect of short selling: a sudden removal of short-sale constraints increases managerial myopia and leads to a significant reduction in firm risk. Our findings complement De Angelis et al. (2015), who study Regulation SHO in the U.S. and find that an exogenous decrease in short-sale constraints increase downside risk, and firms response to the shock by granting more stock options.

In addition, this paper contributes to the literature that examines the impact of government policy on firm risk-taking (Bargeron, Lehn, and Zutter, 2010; Agrawal and Matsa, 2013; Dasgupta, Lin, and Yamada, 2014; Gormley and Matsa, 2016). We contribute to this literature by showing that the threat of short selling is an important determinant of firm

risk-taking. Further, a sudden removal of short-sale constraints can exert substantial negative effects on real economic activities.

The remainder of the paper is organized as follows. Section II provides an institutional background of short selling in China. Section III describes the data and the construction of the main variables. Section IV presents our identification strategy and establishes the empirical evidence on the relation between short selling threats and firm risk-taking. Section V investigates underlying mechanisms through which short selling affects firm risk-taking and the economic implications of short selling. Section VI provides several other explanations of our baseline results and a discussion of related issues. Section VII concludes the paper.

II. SHORT SELLING IN THE CHINESE STOCK MARKET

Short selling and margin trading were prohibited in the Chinese stock market prior to March 2010. In March 2010, the China Securities Regulatory Commission (CSRC) initiated a pilot program that allows stocks included on the short-sale list to be sold short and purchased on margin. The launch of this program occurred at a time when market regulators around the world were restricting short-selling activities, an example of "swimming against the tide" of international regulations (Sharif, Anderson, and Marshall, 2014). We obtained historical versions of the short-sale list from the website of Shanghai Stock Exchange and Shenzhen

Stock Exchange.[1] Initially, the list included only 90 constituent stocks. Since then, the CSRC has been changing the requirements and including more firms on the short sale list. Stocks that fail to satisfy certain requirements are removed from the list. There are five major revisions to the qualification list between 2010 and 2014 (March 2010; November 2011; January 2013; September 2013; and September 2014); several minor revisions also occurred between major revisions. In total, the original list was revised 17 times through December 2014. By the end of our sample period, 899 stocks (out of 1,894 stocks in our sample) could be sold short. We report summary statistics of these revisions in Table 1.

[Insert Table 1 here]

The short-sale program of the CSRC resembles the pilot schema for regulating short selling in the Hong Kong Stock Exchange, as stocks have to meet several criteria to be eligible for short-selling and margin trading.[2] The CSRC also specifies that only qualified investors can buy stocks on margin or sell stocks short, the requirements differing among security companies.[3] In Section IV, we find that these exogenous changes of the short-sale list are largely unexpected to firms; this situation facilitates a quasi-experimental design. We

[1] For detailed description of the revisions of the short-sale list, see the website of the Shanghai Stock Exchange: www.sse.com.cn; and the website of the Shenzhen Stock Exchange: www.szse.cn.

[2] These criteria change over time. According to the latest version of requirements, to be eligible for short-selling, a qualified stock should have more than 200 million tradable shares outstanding, have no less than 4000 individual shareholders, have an average daily return not deviates more than 4% from the market return, have a return volatility that is less than five times of the market index volatility, is not currently under a merger, buyout, reorganization, or investigation of possible illegal activities by the CSRC. For a detailed description of the criteria, see Chen, Dong, and Gu (2016). Chang et al. (2007) provide a thorough discussion of the pilot scheme for regulated short selling in the Hong Kong Stock Exchange.

[3] From March 2010 to August 2012, qualified investors can borrow money or stock only from security companies. After August 2012, qualified investors can borrow from other financial institutions such as banks and insurance companies. For a detailed description, see Chang, Luo, and Ren (2014).

also construct a propensity-score-matched sample to cautiously differentiate the pure effect of changes in short selling threats on firm risk-taking from the impact of other factors. In the last section of this paper, we obtain daily short-sale/margin trading volume data from the RESSET Database and disentangle the effect of margin trading from the effect of short selling on firms' risk-taking decisions.

III. DATA AND VARIABLE CONSTRUCTION

3.1 Sample selection

The sample period is from January of 2008 to December of 2014. We begin with all listed companies on the Chinese A-share stock market. We obtain financial data from the CSMAR and RESSET databases. This sample is then matched with short-sale information obtained from the Shanghai/Shenzhen Exchange website. To construct our final sample, we clean the data according to the following procedures. First, we exclude firms from the financial industry according to the 2-digit CSRC classification. Second, we exclude ST, *ST, suspension, and delisted firms. Third, we exclude firms with missing values of dependent variables and control variables. Fourth, we exclude stocks that eventually dropped from the short-sale list. All continuous variables are winsorized at the top and bottom 1% to avoid the impact of outliers. The final sample consists of 31,316 firm-quarter observations.

3.2 The main explanatory variable: short selling threat

We use the event of short-sale listing to proxy for the threat of short selling. Our main explanatory variable is an indicator variable that equals one if the stock is in the short-sale list in a given quarter, and zero otherwise. At the beginning of the pilot program, the list included only 90 stocks. At the end of the sample period, there are 899 stocks on the list. They represent approximately one-half of total listed stocks in our sample.

3.3 Construction of the dependent variable: risk-taking

Following the previous literature on firm risk-taking (John et al., 2008; Hilary and Hui, 2009; Faccio et al., 2011; Boubakri et al., 2013), we choose the volatility of firms' earnings over the next four quarters as our primary proxy for firm risk-taking. It is calculated as the standard deviation of the firm's industry-adjusted quarterly ROA from quarter t to quarter t+3 using the following equation:

$$Risk_{i,t} = \sqrt{\frac{1}{T-1}\sum_{n=t}^{t+T-1}(ADJ\_ROA_{i,n} - \frac{1}{T}\sum_{n=t}^{t+T-1} ADJ\_ROA_{i,n})^2} \quad (1)$$

where *i* indexes firm, *t* indexes quarter, and *ADJ_ROA* is industry-adjusted ROA (ROA minus the industry average ROA). Throughout this paper, we choose T=4 to calculate the primary dependent variable. The industry is defined as the 2-digit CSRC level. In the panel regressions, we measure performance volatility in four overlapping quarterly periods (t to t+3, t+1 to t+4, t+2 to t+5, t+3 to t+6, etc.). We view four quarters of industry-adjusted ROA volatility as the most comprehensive measure of firm risk-taking. For robustness, we also choose T=8, 12 in our calculation and use other definitions such as stock return volatility and

idiosyncratic risk to measure firm risk-taking. Additionally, we examine the real effects of short selling threats on firms' financial policies and investment decisions. Our main results remain qualitatively similar when we use alternative measures.

3.4 Control variables

We also control for a vector of firm characteristics that have been shown to affect risk-taking. Except for the risk-taking measure calculated above, all variables are computed for firm i over quarter t. In the baseline regressions, the control variables include firm size, *Logasset*, measured by the logarithm of total assets; firm leverage, *Leverage*, measured by the ratio of total debt to total assets; firm age, *Age*, measured by the logarithm of one plus the number of quarters the firm is listed on A-share market; cash flow, *Cashflow*, measured by the ratio of operating cash flow to total assets; sales growth, *Gsale*, measured by the growth rate of sales revenue; market value, *Logmv*, measured by the logarithm of firm market capitalization; book-to-market ratio, *MB*, measured by the ratio of total capitalization to total assets; the largest shareholder ownership, *Top1*, measured by the fraction of shares held by the largest shareholder; turnover rate, *Turnover*, measured by the turnover rate of stock in a quarter; exchange place, *Exchange*, a dummy variable that equals one if the firm is listed on the Shanghai stock exchange and zero otherwise; market trend, *Market*, a dummy variable that equals one if the stock earns a positive return in quarter t and equals zero otherwise.

Appendix Table A.1 provides detailed definitions of all variables. Descriptive statistics are shown in Table 2.

[Insert Table 2 here]

IV. ESTIMATES OF SHORT SELLING THREATS ON FIRM RISK-TAKING

In this section, we estimate the effect of short selling threats on firm risk-taking. Section 4.1 presents results from a standard difference-in-differences regression. In Section 4.2, we conduct a timing test to address potential reverse causality issues. In Section 4.3, we address the concerns that our estimation results are driven by observable heterogeneity between the treated and controlled firms by constructing the control group using two alternative methods, and by establishing a propensity-score matched sample. Section 4.4 presents estimation results from a series of additional robustness checks.

4.1 Short selling and firm risk-taking: a difference-in-differences approach

In this subsection, we empirically examine the causal effect of short selling on firm risk-taking. Following Bertrand and Mullainathan (2003), we use the following difference-in-differences specification:

$$Risk_{i.t} = \alpha_0 + \beta Short\_list_{i,t} + \gamma Control_{i,t} + \varphi_i(\eta_j) + \tau_t + \varepsilon_{i,t} \quad (2)$$

where *i* indexes firm, *j* indexs industry, *t* indexes quarter, and the dependent variable $Risk_{i,t}$ is the risk-taking measure calculated as equation (1). Our main variable of interest is a dummy

variable that equals one if firm i's stock is designated as a pilot stock in the short-sale list in quarter *t*, and zero otherwise. $Control_{i,t}$ is a vector of control variables described in Section 3.3. We control for time-invariant unobserved industry and firm characteristics by including industry fixed effects (η_j) or firm fixed effects (φ_i). We further include year-by-quarter fixed effects (τ_t) to control for time-varying characteristics. In addition, we control for serial correlation by clustering the standard errors at the firm level.

Table 3 presents estimation results from equation (1). In column (1), we control for industry and time fixed effects. The coefficient on *Short_List* is significant at the 5% level, suggesting that firms reduce their risk level when they face short selling pressure. In column (2), we control for firm and year fixed effects. The coefficient on *Short_List* is significant at the 1% level. Also, the negative effect is stronger after controlling for firm fixed effects. These estimation results provide strong evidence that firms react to short-sell pressure by reducing risk.

[Insert Table 3 here]

4.2 Timing tests / Pre-Treatment Trends /Reverse causality

In this section, we examine whether our results are driven by reverse causality. CSRC may cherry pick stocks with lower risk and add them on the list to maintain the stabilization of the market. Following Bertrand and Mullainathan (2003), we conduct timing tests to

determine whether preexisting trends in risk-taking exist prior to a firm's inclusion on the list. We use the following equation to examine dynamic coefficient trends:

$$Risk_{i.t} = \alpha_0 + \tau_1 Short\_list(-2,-1)_{i,t} + \tau_1 Short\_list(0)_{i,t} + \tau_1 Short\_list(+1)_{i,t} + \tau_1 Short\_list(\geq +2)_{i,t} + \gamma Control_{i,t} + \varphi_i(\eta_j) + \tau_t + \varepsilon_{i,t} \quad (3)$$

where *Short_List(-2,-1)* is a dummy variable that equals one if it is one or two quarters before inclusion in the short-sale list; *Short_List(0)* is a dummy variable that equals one if it is the quarter that the stock is included on the short-sale list; *Short_List(+1)* is a dummy variable that equals one if it has been one quarter since inclusion in the short-sale list; *Short_List(⩾ +2)* is a dummy variable that equals one if it has been at least two quarters since inclusion in the short-sale list. The coefficient on *Short_List(-2,-1)* is rather important because its significance and magnitude indicate whether there are preexisting trends in firm risk-taking.

We present timing test results in columns (3) and (4) of Table 3. The coefficients of pre-treatment dummies are not significant, suggesting that there are no preexisting trends in firms' risk-taking prior to inclusion in the short-sale list. The coefficients on *Short_List(⩾+2)* in columns (3) and (4) are both significant at the 1% level, implying that inclusion in the short-sale list has a long-lasting effect on a firm's risk. These estimates strongly suggest that firms reduce their risk-taking level only after being included in the short-sale list and the results are not driven by reverse causality.

4.3 Addressing potential endogeneity problems

In this section, we further investigate the possibilities that our results are driven by omitted variables that are related to both inclusion in the short-sale list and a decrease in firm risk. As shown in Chen, Dong and Gu (2016), firms included on the short-sale list differ from the remainder of the firms in a number of ways. These differences generate a selection bias when estimating the impact of short selling and should be controlled. To address this issue, we re-estimate the effect in three subsamples and provide estimation results in Table 4.

First, we examine the effect within a subsample that consists only of firms on the SHSZ300 Index. SHSZ300 Index is a single index representing the market portfolio of the Chinese stock market. As suggested by Li, Chen and Lin (2015), a number of stocks in the short-sale list are on the list of Shenzhen CSI 300 Index (SHSZ300). As these stocks are constituents of a representative market index, they are more likely to share similar *ex ante* characteristics. Estimation results are presented in columns (1) and (2) of Table 4. The coefficients on inclusion in the short-sale list dummies are similar in sign and magnitude to those in columns (1) and (2) of Table 3. More importantly, the effect is only significant one quarter after the inclusion, suggesting that the results are not driven by reverse causality.

Second, we examine the effect within the treated group. In this way, firms in the sample are more likely to share similar characteristics, as they all must meet certain requirements in order to be included on the short sale list. Estimation results in columns (3)-(4) are consistent with the results in columns (1)-(2). Evidence from these two columns suggests that the negative effect of short selling on firm risk is robust within the treatment group.

Finally, we conduct a propensity score matched sample analysis to control for all the observable heterogeneities. First, we perform a Logit regression to estimate the probability of inclusion on the short-sale list with previously used control variables. We then match each treated firm to up to three control firms (since the number of potential control firm-quarter observations is considerably larger than the number of treatment firm-quarter observations) on the year, industry, and the estimated propensity score (with a max difference of 0.01). Post-match diagnostic tests results (see Table A.2 in the Appendix) suggest that the sample means between the treated and control groups are not significantly different, further suggesting that our matching process is successful. We then estimate the effect of short selling on firm risk-taking on the propensity score matched sample. Columns (5)-(6) of Table 4 show the estimation results. Column (5) reveals that the coefficient on *Short_List* is still negative and significant even after controlling for heterogeneous differences between the treated and controlled firms. The estimated effect on the propensity score matched sample is even stronger (0.343) compared to the corresponding estimates based on the whole sample in Table 3 (0.258 in column (2)). Timing tests in column (6) suggests that reverse causality does not drive our results. In conclusion, the negative impact of short selling on firm risk-taking is not driven by observable heterogeneities between treated and control firms, and the decline in firm risk is caused only by the exogenous increase in short-sale pressure.

[Insert Table 4 here]

4.4 Robustness checks

In this section, we present several additional tests to examine if our main results are robust to different model specifications and variable definitions. We present estimates in Table 5. In Panel A, we calculate alternative measures based on ROA volatilities. First, we consider the possibility that actions taken by CEOs to reduce firm risk may take longer than one year to realize. Therefore, we create risk-taking measures up to four and eight quarters later. We present estimates in columns (1) and (2) of Table 5. The coefficients on *Short_List* are significant at the 1% level and the economic magnitude (-0.530 and -0.555 respectively) is higher than the corresponding estimate in Table 2 (-0.258 in column (2)). This result suggests that the effect of short selling threats on risk-taking is long-lasting and do not reverse. In column (3), we replace the quarterly explanatory variables with annual variables and re-estimate equation (2) at the year-level. The coefficients on *Short_List* are significant at the 1% level, indicating that our main results are robust to year-level specifications.

Second, we calculate the main dependent variable using different time periods. In particular, we calculate firms' industry-adjusted ROA volatility from quarter t to quarter t+7 (Risk_8) (t+12, Risk_12) and use these values as dependent variables. The coefficients on *Short_List* are significant at the 1% level in column (4), and significant at the 5% level in column (5). In addition, we calculate firms' unadjusted ROA volatility from quarter t to quarter t+3 (Risk_abs) as an alternative dependent variable. Estimates are presented in

column (6). The coefficient on *Short_List* is significant at the 1% level. These results indicate that our main results are robust to different measures of firm risk-taking.

In Panel B, to address the concern that ROA volatilities are prone to earnings management, we introduce measures with definitions other than ROA volatilities. Third, we use firms' daily return data and calculate their quarterly total risk and idiosyncratic risk as alternative measures of risk-taking. Following Panousi and Papanikolaou (2012), we begin by estimating the following equation:

$$r_{i,\tau} = \alpha_0 + \alpha_1 r_{M,\tau} + \alpha_2 r_{IND,\tau} + \varepsilon_{i,\tau} \quad (4)$$

where and are the market-value-weighted market return and industry return based on 2-digit CSRC classification, respectively. We estimate this equation in each quarter and calculate the residual terms. Then, the total risk and the idiosyncratic risk of stock *i* in quarter *t* can be calculated as:

$$Total\_risk = \sqrt{\sum_{\tau \in t}(r_{i,\tau} - \overline{r_{i,\tau}})^2} \quad (5)$$

$$Idio\_risk = log\sqrt{\sum_{\tau \in t} \varepsilon_{i,\tau}^2} \quad (6)$$

Columns (1) and (2) of Panel B of Table 5 document the effect of short selling on a firm's total risk and idiosyncratic risk. The coefficients on *Short_List* are negative and significant, suggesting that increased short selling threats leads to a significant decrease in both total risk and idiosyncratic risk.

Fourth, following Faccio et al. (2011), we calculate the firm risk-taking variable using firms' ROE as a measure of cash flow in equation (1). Also, we construct an absolute-ROE

measure similar to column (6). The results of this test are presented in columns (3) and (4). The negative relation between short selling and firm risk-taking remains unchanged. In addition to previous tests, we calculate firms' quarterly industry-adjusted/unadjusted return volatility from quarter *t* to quarter *t+3* (*Risk_r* in column (5) and *Risk_absr* in column (6)) as alternative dependent variables and present regression results. The coefficients on Short_List are still significant at the 1% level.

[Insert Table 5 here]

V. UNDERLYING MECHANISMS

In this section, we discuss several possible underlying mechanisms through which inclusion in the short-sale list can impede firm risk-taking. We first examine whether inclusion in the short-sale list represents increased short selling threats. Next, we investigate the managerial myopia hypothesis, which predicts the effect of short selling to be weaker among firms with better corporate governance. We then examine whether short selling threats can affect firm risk-taking through the channel of increased financial constraints. In addition, we discuss whether the decrease is driven by increases in financing costs. Finally, we examine the real impact of short selling on firms' cash holdings, debt ratios, R&D expenditures, M&A, investments, financial performance, and market values.

5.1 Short selling, overvaluation, and firm risk-taking

We begin by examining whether inclusion in the short-sale list represents an exogenous increase in short selling threats. We conjecture that if short selling can curtail the overvaluation problem, then our baseline results should be more pronounced when firms suffer from more severe *ex ante* overvaluation problems. We use two measures to proxy for the severity of the overvaluation problem. The first is market-to-book ratio, *MB*, a commonly used proxy for overvaluation (Baker et al., 2003). The second is analyst forecast dispersion, *Dispe*, which proxy for investors' dispersion of beliefs. Firms with greater disagreement among investors are more likely to be overvalued in the presence of short-selling constraints (Diether, Malloy,and Scherbina, 2002). We use the value before the quasi-natural experiment to examine *ex ante* overvaluation problems.

We present estimation results in Table 6. In column (1), we introduce an interaction term of *Short_List* and *MB*. The coefficient on this interaction term is negative and significant, indicating that a higher *ex ante* market-to-book ratio will exaggerate the negative impact of short selling threats. In columns (2) and (3), an observation is considered to suffer from severer (less) *ex ante* overvaluation problem if *MB* is above (below) the sample median by the end of 2009. Estimation results are consistent with column (1). The effect is significant among firms with above median market-to-book ratio. In columns (4)-(6), we use *Dispe* to measure the severity of the *ex ante* overvaluation problem. An observation is considered to suffer from severer (less) *ex ante* overvaluation problem if *Dispe* is above (below) the sample median by the end of 2009. Although the interaction term of *Short_List* and *Dispe* is not

significant in column (4), estimation results in columns (5) and (6) show that our baseline results concentrate in firms with a higher dispersion of investors. These findings support our conjectures that inclusion in the short-sale list represents a larger increase in short selling threats if a firm suffers from severer overvaluation problem under short-sale constraints.

5.2 Short selling, internal governance, and firm risk-taking

In this part, we examine whether the presence of internal governance mechanisms can mitigate the negative impact of short selling. Facing downward price pressure, myopic managers have incentives to avoid risky projects and focus on routine tasks that offer quicker and safer returns. John et al. (2008) show that good corporate governance can reduce managerial myopia and ensure sufficient risk-taking. Therefore, stronger firm-level governance mechanisms may alleviate the negative impact of short-sell pressure on firm risk-taking.

We use three measures to evaluate the strength of internal governance mechanisms. The first proxy is the number of board members, *Board_num*. CEO power in decision-making increases with the size of the board (Jensen, 1993). Cheng (2008) argues that agency problems, such as free-riding by directors, become more severe as a board becomes larger. Thus, we expect firms with larger boards to have weaker internal governance mechanisms. The second proxy is the ratio of independent directors on the board, *Ind_ratio*. Independent directors act as monitors and may exert significant influence on the negative impact of short

selling. Firms with higher percentages of independent directors have better governance (Baysinger and Butler, 1985; Byrd and Hickman, 1992; Brickley, Coles, and Terry; 1994). The third proxy is ownership separation, *Separation*, a dummy variable that equals one if the firm has larger control rights than cash-flow rights. In emerging markets, the divergence between control rights and cash-flow rights creates a separation of ownership and control that aggravates agency conflicts (Shleifer and Vishny, 1997; Claessens, Djankov, Fan, and Lang, 2002). To alleviate the concern that corporate governance may change in response to policy changes, we construct subsamples based on firm characteristics by the end of 2009, before the pilot program was launched.

Table 7 presents how the negative effect of short selling on firm risk is associated with the cross-sectional variation of internal governance. In Panel A of Table 7, we interact *Short_List* with each of the internal governance proxies. In column (1), the coefficient of the interaction term is negative and significant, suggesting that the negative effect of short selling is stronger among firms with a larger board (weaker governance). The interaction term in column (2) is positive and significant, which suggests that firms with strong corporate governance actually increased risk-taking after inclusion in the short sale list. Finally, the interaction term of *Short_List* and *Separation* is negative and significant in column (3), indicating that managers are less likely to undertake risk when the divergence between the control rights and the cash-flow rights is larger. Overall, evidence from Panel A of Table 7

suggests that good corporate governance mitigates the negative effect of managerial myopia, while weaker corporate governance exacerbates the managerial myopia.

We next test the effect in subsamples based on the median value of each governance proxy. Results are shown in Panel B of Table 7. In columns (1)-(2), an observation is under strong (weak) governance if *Board_num* is below (above) the sample median by the end of 2009. Estimation results indicate that the negative impact of short selling is significant only when *Board_num* is large, indicating that strong internal governance can mitigate short-sale pressure on managers. In columns (3)-(4), we use *Ind_ratio* as the measure of internal governance and conduct a similar regression. An observation is considered to be under strong (weak) governance if its *Ind_ratio* is above (below) the sample median by the end of 2009. The negative impact is significant only in the subsample with low *Ind_ratio*. In columns (5)-(6), we continue to find similar patterns as in columns (1)-(4). An observation is considered to be under strong (weak) governance if its *Separation* equals to zero (one) by the end of 2009. The negative impact of short selling is revealed to be significant only when the firm has excessive control rights. In sum, cross-sectional evidence suggests that the negative effect of short selling on firm risk-taking is only significant among firms with weak governance, supporting the managerial myopia hypothesis.

[Insert Table 7 here]

5.3 Short selling, financial constraints and firm risk-taking

We now examine whether short selling can affect firm risk-taking through a financial constraints channel. The removal of short sale constraints allows the information of pessimistic investors to be reflected in the stock price and increase the cost of capital. If the reduction in firm risk is due to the financial constraints channel, then the effect should be stronger in the subsample of firms that are *ex ante* more financially constrained. Following Chen et al. (2012), we use firm size and firm age as proxies for financial constraints because traditional financial constraints measures such as credit rating and dividend policy do not capture financial constraints under the Chinese background.

We split the sample into two subsamples based on the median value of firm size and firm age and estimate the regression in Table 8. The interaction term between short list and low financial constraints dummy is negative and significant, suggesting that the negative effect is stronger among less financially constrained firms. Further, subsample evidence in columns (2)-(3) and (5)-(6) also suggests that the negative effect of short selling on firm risk is stronger among the subsample of firms with low financial constraints. In conclusion, we reject the *financial constraints* hypothesis because evidence from this table indicates that the reduction in firm risk is not driven by an increase in financial constraints. The negative impact of short selling is stronger among the subsample of firms that are less financially constrained.

[Insert Table 8 here]

5.4 Short selling and corporate policies

Our evidence so far suggests a negative and significant causal relation between short selling and firm risk. In this section, we attempt to understand the channels through which short selling affects risk-taking. Specifically, we examine how short selling threats affect different corporate policies. We present estimates using industry-unadjusted dependent variables in Panel A of Table 9 and estimates using industry-adjusted dependent variables in Panel B of Table 9.

First, we analyze the impact of short-sale listing on firms' cash policies. Following precautionary motive theory (Opler, Pinkowitz, Stulz, and Williamson, 1999; Bates, Kahle, and Stulz, 2009), firms accumulate cash in anticipation of adverse shocks and financial distress. We use *Cash*, defined as the logarithm of the ratio of cash and cash equivalents to net assets (total assets minus cash and cash equivalents) in quarter *t*, as the dependent variable. Estimation results in column (1) suggest that firms increase cash holdings after inclusion in the short sale list, which is consistent with the precautionary motive for cash holdings.

Second, firms facing short-sell pressure could reduce leverage to reduce the risk of distress. We expect that inclusion in the short-sale list has a negative causal effect on firms' leverage. We use *Leverage*, defined as the ratio of total debt to total assets, as the dependent variable. Estimation results are reported in column (2). Consistent with our hypothesis, we find a negative and significant relation between short selling and leverage.

Third, we focus on R&D expenditures. In the face of downward price pressure, myopic managers should want to reduce R&D expenditures and invest in safer projects. Estimation results are reported in column (3). Short selling has a negative and significant effect on R&D expenditures. Our findings focus on the R&D expenditure rather than innovation outcome. Therefore, our findings here do not conflict with the findings of He and Tian (2015), that short sellers have a positive effect on the quality, efficiency, and originality of corporate innovation.

Fourth, we examine the impact of short selling threats on firms' decisions to become involved in merger activities. Mergers and acquisitions (M&As) represent major corporate investments that require substantial managerial effort. Gormley and Matsa (2016) show that when managers are shielded from takeover threats, managerial myopia increase and managers "play it safe" by reducing mergers and acquisitions. We follow Gormley and Matsa (2016) and construct the variable M&A by calculating the number of acquisition bids made by a firm in a quarter. Estimation results in column (4) suggest that short selling decreases industry adjusted M&A.

Fifth, following Grullon et al. (2015), we examine whether short selling has real effects on firm investment. We use two measures of firm investment. The first is capital expenditure, *Capx*, and the second asset growth rate, *Assetg*. Estimation results are reported in columns (5)-(6). We find no significant change in capital expenditure, while asset growth rate

decreases significantly. Combined with findings above, these results indicate that faced with short selling threats, firms cut riskier investments.

In conclusion, faced with short selling threats, firms accumulate more cash, incur less debt, invest less in R&D, attempt fewer mergers, and have a lower asset growth rate compared to an average firm in the same industry. These results suggest that short selling has a comprehensive impact on corporate policies.

[Insert Table 9 here]

5.5 Short selling and firm performance

In this section, we evaluate the overall impact of short selling threats on firm performance. We use future firm performances as dependent variables. Estimation results are presented in Table 10. Columns (1)-(4) in Panel A reveal that short selling has negative impacts on ROA and sales growth. Columns (5)-(6) use Tobin's Q as dependent variables and reveal that pilot firms have lower market value. In Panel B, we use industry-adjusted measures of firm performances, and the negative impact of short selling still holds. Overall, evidence from this table indicates that short selling has adverse effects on firm valuations.

[Insert Table 10 here]

VI. OTHER POSSIBLE EXPLANATIONS AND DISCUSSIONS

6.1 Short selling, institutional investors and firm risk-taking

We now examine whether changes in institutional ownership composition could explain our results. As shown in Aghion et al. (2013), dedicated institutional investors serve as an external governance mechanism that ensures sufficient risk-taking by managers. At the same time, they protect managers when firms face short-term price pressures. Therefore, the presence of dedicated institutional investors reduces managerial myopia when facing an exogenous increase in downward price pressures from short sellers. If inclusion in the short-sale list leads to a decrease in dedicated institutional investors, managerial myopia should increase and managers will reduce risk-taking. To test this channel, we follow Bushee (1998) and classify mutual fund, QFII, and social insurance fund as dedicated institutional investors, and other types as non-dedicated institutional investors. We then calculate total institutional ownership, *I.O.*, dedicated institutional ownership, *I.O._Ded*, and non-dedicated institutional ownership, *I.O._NonDed*, for every quarter respectively.

In column (1), Table 11, we examine the relation between institutional ownership and firm risk-taking. The coefficient on *I.O.* is insignificant, which suggest that total institutional ownership in China does not affect managerial risk-taking. However, when we break down total institutional ownership into dedicated and non-dedicated institutional ownership in columns (2) and (3), we find that dedicated institutional ownership is positively correlated with firm risk-taking, while non-dedicated institutional ownership is negatively correlated with firm risk-taking. This finding is consistent with Aghion et al. (2013). As we introduce both *I.O._Ded* and *I.O._NonDed* as independent variables in column (4), the coefficients

remain significant. In columns (5) and (6), we examine the direct effect of short selling on dedicated and non-dedicated institutional ownership respectively. Inclusion in the short sale list has a significant negative effect on dedicated institutional ownership, but the effect on non-dedicated institutional ownership is not significant. Given the negative relation between short selling and firm risk-taking, it is reasonable to infer that short selling impedes firm risk-taking by decreasing the holdings of dedicated institutional investors.

[Insert Table 11 here]

6.2 Short selling, margin trading and firm risk-taking

In this paper, we focus on the "threat" of short selling rather than real short selling activities. However, as the pilot program lifts the constraint on short selling and margin trading simultaneously, the impact of margin trading may bias our main findings. In this section, we address the concern that the reduced risk-taking after being included in the short-sale list is driven by increased margin trading activities rather than heightened short selling threats. Following Ni and Zhu (2016), we introduce two measures, *DShort* and *DMargin* (defined as in Table A1 in Appendix), to proxy for the intensity of short selling and margin trading activities in a given quarter respectively. For this test, we focus on stocks that are eventually included in the short-sale list, as these two measures for other stocks are always zero throughout our sample period.

We report estimation results in Table 12. In column (1), the coefficient on *DShort* is negative and significant at the 1% level, indicating that more intense short selling activities are associated with less risk-taking. Columns (2)-(3) reveal no significant relation of the intensity of margin trading and firm risk-taking. In columns (4)-(6), we include *Short_List* in the regression model. It turns out that the negative relation of the intensity of short selling activities and firm risk-taking still holds, while the intensity of margin trading activities is positively associated with firm risk-taking. Such results provide strong evidence that increased margin trading activities do not explain our main findings. Also, estimation results in column (6) indicate that after controlling for both short selling and margin trading activities, the coefficient on *Short_List* is still negative and significant, which is in accordance with our prediction that the "threat" of short selling can impede firm risk-taking.

[Insert Table 12 here]

6.3 Alternative explanations

We now examine whether CEO career concerns could explain our results. As shown in numerous studies, CEO career concerns are negatively related to firm risk (Hirshleifer and Thakor, 1992; Holmstrom, 1999; Scharfstein and Stein, 1990). Since career concern is stronger among younger CEOs, we divide our sample based on the median value of CEO age. If our results are driven by CEO career concerns, the effect should be stronger among firms with younger CEOs. We test this alternative explanation in columns (1) and (2) of Table 13.

Estimation results suggest that the negative effect of short selling on firm risk is stronger among firms with older CEOs. This finding is inconsistent with the career concern hypothesis, but is in line with Serfling (2014), who finds that CEO age is negatively related to firm risk.

We next examine whether our results are driven by short sellers' bear raiding. Since short sellers specialize in identifying earnings management and correcting mispricing (Fang et al., 2016; Massa et al., 2015), we predict that the negative effect should be stronger among firms with high earnings management. To test this hypothesis, we divide firms into subsamples based on the median value of discretionary accruals (*DAccrual*) and study the effect in each subsample. Estimation results in columns (3) and (4) of Table 13 suggest that the effect of short selling is actually stronger among firms with below median earnings management. Therefore, we reject the bear raiding hypothesis.

A Hawthorne effect could also potentially explain our results, which predicts that firms may change their behavior because they are being observed by short sellers. If that is the case, the negative impact of short selling should be more pronounced among firms with *ex ante* low visibility. Inclusion on the short sale list significantly increases their visibility and affects their behavior. We use *Coverage*, defined as the number of analysts following as the measure of visibility. We split the sample based on the median value of *Coverage*. Estimates in columns (5)-(6) of Table 13 reveal that the negative impact of short selling is more pronounced in subsamples with more analyst coverage. Thus, the reduction in firm risk-taking is not due to a Hawthorne effect.

[Insert Table 13 here]

VII. CONCLUSIONS

Using a regulatory change on the Chinese A-share market as a quasi-natural experiment, we find that inclusion on the short-sale list has a negative and significant effect on firm risk. Further analyses indicate that the negative impact of short selling is largely driven by managers' increased short-term concerns when faced with downside price pressure. We provide comprehensive evidence that these pilot firms accumulate more cash, take less debt, invest less in R&D, attempt fewer M&As, have a lower asset growth rate, worse financial performances, and lower market values. Overall, evidence from the paper complements previous studies that find a negative effect of short selling on corporate investment policies. Our findings suggest that regulation changes aimed at relaxing short-sale constraints can exert substantial effects on real economic outcomes by exacerbating managerial myopia. The good news is that strong internal governance mechanisms can mitigate such adverse effects.

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APPENDIX

Table A.1 Variable Definitions

Variables	Definitions
Panel A: main variables	
Short_List	A dummy variable that equals one if firm i's stock is designated as a pilot stock under the pilot program and included in the short-sale list in quarter t, and zero otherwise
Risk	$\mathrm{Risk}_{i,t} = \sqrt{\frac{1}{T-1}\sum_{n=t}^{t+T-1}(\mathrm{Adj\_ROA}_{i,n} - \frac{1}{T}\sum_{n=t}^{t+T-1}\mathrm{Adj\_ROA}_{i,n})^2}\ |T=4$ where *Adj_ROA* equals *ROA* minus industry average *ROA*
Logasset	Firm size, the logarithm of total assets in quarter t
Leverage	Firm leverage, the ratio of total debt to total assets in quarter t
Age	Firm age, 1+(current year minus listing year)*4
Cashflow	Operating cash flow, the ratio of operating cash flow to total assets in quarter t
Gsale	Firm growth, the growth rate of sales revenue in quarter t
Logmv	Market value, the logarithm of total capitalization in quarter t
MB	Market-to-book ratio, the ratio of total capitalization to total assets in quarter t
Top1	Large shareholder ownership, the sum of the fractions of shares held by the largest shareholders in quarter t
Turnover	Stock turnover rate in quarter t. We set missing observations of *Turnover* equal to zero to maintain sample size
Turnover_Dum	A dummy variable that equals one if the value of *Turnover* is available, and zero otherwise. As suggested by Kim and Lu (2011), this variable allows the intercept term to capture the mean of the Turnover for missing values.
Exchange	A dummy variable that equals one if the firm is listed on the Shanghai exchange, and zero otherwise.
Market	A dummy variable that equals one if the firm's stock has positive return in quarter t, and zero otherwise.
Panel B: Alternative measures of firm risk-taking	
Risk_8	$Risk\_8_{i,t} = \sqrt{\frac{1}{T-1}\sum_{n=t}^{t+T-1}(Adj\_ROA_{i,n} - \frac{1}{T}\sum_{n=t}^{t+T-1}Adj\_ROA_{i,n})^2}\ |T=8$

Risk_12

$$Risk\_12_{i,t} = \sqrt{\frac{1}{T-1}\sum_{n=t}^{t+T-1}(Adj\_ROA_{i,n} - \frac{1}{T}\sum_{n=t}^{t+T-1} Adj\_ROA_{i,n})^2} \,|T = 12$$

Risk_abs

$$Risk\_abs_{i,t} = \sqrt{\frac{1}{T-1}\sum_{n=t}^{t+T-1}(ROA_{i,n} - \frac{1}{T}\sum_{n=t}^{t+T-1} ROA_{i,n})^2} \,|T = 4$$

Total_Risk

$$Total\_risk = \sqrt{\sum_{\tau \in t}(r_{i,\tau} - \overline{r_{i,\tau}})^2}$$

where $r_{i,\tau}$ is firm i's stock return in date τ. $\overline{r_{i,\tau}}$ is the average of firm I's stock return in quarter t.

Idio_Risk

$$Idio\_risk = log\sqrt{\sum_{\tau \in t}\varepsilon_{i,\tau}^2}$$

where $\varepsilon_{i,\tau}$ is obtained by estimating $r_{i,\tau} = \alpha_0 + \alpha_1 r_{M,\tau} + \alpha_2 r_{IND,\tau} + \varepsilon_{i,\tau}$ in quarter t. $r_{M,\tau}$ and $r_{IND,\tau}$ are the market-value-weighted market return and industry return on date τ respectively.

Risk_roe

$$Risk\_roe_{i,t} = \sqrt{\frac{1}{T-1}\sum_{n=t}^{t+T-1}(Adj\_ROE_{i,n} - \frac{1}{T}\sum_{n=t}^{t+T-1} Adj\_ROE_{i,n})^2} \,|T = 4$$

where *Adj_ROE* equals to *ROE* minus industry average *ROE*

Risk_absroe

$$Risk\_absroe_{i,t} = \sqrt{\frac{1}{T-1}\sum_{n=t}^{t+T-1}(ROE_{i,n} - \frac{1}{T}\sum_{n=t}^{t+T-1} ROE_{i,n})^2} \,|T = 4$$

Risk_r

$$Risk\_r_{i,t} = \sqrt{\frac{1}{T-1}\sum_{n=t}^{t+T-1}(Adj\_RETURN_{i,n} - \frac{1}{T}\sum_{n=t}^{t+T-1} Adj\_RETURN_{i,n})^2} \,|T = 4$$

where *Adj_RETURN* equals *RETURN* minus industry average *RETURN*, and *RETURN* is firm stock's return in quarter t

Risk_absr	$$Risk\_r_{i,t} = \sqrt{\frac{1}{T-1}\sum_{n=t}^{t+T-1}(RETURN_{i,n} - \frac{1}{T}\sum_{n=t}^{t+T-1} RETURN_{i,n})^2 \,|T = 4}$$

Panel C: Other variables

Board_num	Board size, equal to the number of board members in quarter t
Ind_ratio	Independent director ratio, the ratio of independent directors to board size in quarter t
Separation	Ownership separation, a dummy variable equals one if the controlling shareholder in a firm has excess control rights (control rights larger than cash-flow rights) in quarter t, and zero otherwise.
Cash	Cash holding, the logarithm of the ratio of cash and cash equivalents to net assets(total assets minus cash and cash equivalents) in quarter t
R&D	R&D expenditure, R&D expenditure in quarter t minus R&D expenditure in quarter t-4, scaled by total assets in quarter t-4
M&A	Mergers and acquisitions, the number of acquisitions a firm involves in as the acquirer in quarter t
Inv	Investment, PP&E in quarter t minus PP&E in quarter t-4, scaled by total assets in quarter t-4. PP&E is defined as cash payments for fixed assets, intangible assets, and other long-term assets from the cash flow statement, minus cash receipts from selling these assets
Assetg	Asset growth rate, the logarithm of total assets in quarter t minus the logarithm of total assets in quarter t-1
Dispe	Analyst forecast dispersion. This measure is calculated as $\frac{1}{P_{i,t0}} * sd(Fore\_EPS)_t$ where $P_{i,t0}$ is stock i's price in the beginning of year t, sd(Fore_EPS) is the standard deviation of predicted earnings-per-share of year t.
I.O.	Institutional ownership, the sum of the fractions of shares held by institutional investors in quarter t
I.O._Ded	Dedicated institutional ownership, the sum of the fractions of shares held by dedicated institutional investors (including mutual funds, QFII, and social insurance funds) in quarter t
I.O._NonDed	Non-dedicated institutional ownership, the sum of the fractions of shares held by institutional investors excluding mutual funds, QFII and social insurance funds in quarter t
DShort	Intensity of in short-sale trading, the average of daily short-sale volume denominated by daily trading volume in quarter t minus the average of daily margin trading denominated by daily trading volume in quarter t-1.
DMargin	Intensity of margin trading, the average of daily margin trading volume denominated by daily trading volume in quarter t minus the average of daily margin trading

	denominated by daily trading volume in quarter t-1.
CEO_age	CEO age, the age of CEO in a given year
DAccrual	Discretionary accruals. This measure is calculated following the process in Cornett (2008) using a modified-Jones model: $$\mathrm{TA}_{i,t} = NI_{i,t} - OCF_{i,t}$$ $$\frac{\mathrm{TA}_{i,t}}{A_{i,t-1}} = \alpha_0 \frac{1}{A_{i,t-1}} + \alpha_1 \frac{\Delta Sales_{i,t}}{A_{i,t-1}} + \alpha_2 \frac{PPE_{i,t}}{A_{i,t-1}} + \varepsilon_{i,t}$$ $$\mathrm{NDAC}_{i,t} = \hat{\alpha}_0 \frac{1}{A_{i,t-1}} + \hat{\alpha}_1 \frac{\Delta Sales_{i,t} - \Delta Receivables_{i,t}}{A_{i,t-1}} + \hat{\alpha}_2 \frac{PPE_{i,t}}{A_{i,t-1}}$$ $$\mathrm{DAC}_{i,t} = \frac{\mathrm{TA}_{i,t}}{A_{i,j-1}} - \mathrm{NDAC}_{i,t}$$ $$\mathrm{Abs\_Acc}_{i,t} = \left|\mathrm{DAC}_{i,t}\right|$$ where TA denotes total accruals calculated by net income (NI) minus operating cash flow (OCF); A denotes total assets; $\Delta Sales$ denotes changes in total sales; PPE denotes property, denotes plant and equipment; $\Delta Receivables$ denotes changes in account receivables.
Coverage	Analyst coverage, the number of analysts issue forecasts of firm performance in quarter t

Table A.2 Propensity Score Matching Post-Match Differences

This table presents statistics of post-match differences in propensity score matching. Column (2) presents sample average of firm characteristics in the treated group. Column (3) presents sample average of firm characteristics in the control group. Column (5) presents the value of t-test of the differences between Columns (2) and (3). Column (6) presents the significant level of the sample-mean difference test between Columns (2) and (3). Definitions of all these variables are provided in Table A.1 in Appendix.

	Treated	**Control**	**%Bias**	**t-value**	**p-value**
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Logasset	21.64	21.59	3.8	0.55	0.58
Leverage	0.46	0.47	-3.7	-0.46	0.65
Age	2.93	3.00	-6.5	-0.86	0.39
Cashflow	0.07	0.07	-3.8	-0.48	0.63
Gsale	10.26	13.84	-11.1	-1.33	0.18
Logmv	22.48	22.42	6.9	1.15	0.25
MB	6.60	6.70	-0.8	-0.10	0.92
Top1	0.39	0.39	-2.4	-0.29	0.77
Turnover	2.36	2.26	6.7	0.91	0.37
Turnover_Dum	0.97	0.97	0.0	0.00	1.00
Exchange	0.54	0.54	-0.8	-0.11	0.92
Market	0.99	0.99	-4.9	-0.82	0.41

Table 1 List Changes and Addition Events

This table reports the occurrence of events in which individual stocks on the Chinese stock market experienced short-sale restriction changes. Column (1) reports the dates on which a new version of the list of designated securities for short selling took effect. Column (2) reports the dates on which a new version of the list was announced. Columns (3) reports the number of firms added to the list every time. Column (4) reports the number of firms deleted to the list every time. Column (5) reports the number of firms on the list after each revision. Column (6) reports the exchange that announces the revision. Shanghai indicates that the revision is announced by Shanghai Exchange. Shenzhen indicates that the revision is announced by Shenzhen Exchange. Shanghai/Shenzhen indicates that the revision is announced by Shanghai Exchange and Shenzhen Exchange simultaneously.

Effective Date	Announcement Date	Firms Added	Firms Deleted	Firms on List	Exchange
(1)	(2)	(3)	(4)	(5)	(6)
31-Mar-2010	12-Feb-2010	90	0	90	Shanghai/Shenzhen
1-Jul-2010	21-Jun-2010	5	5	90	Shanghai
29-Jul-2010	16-Jul-2010	1	1	90	Shanghai
5-Dec-2011	25-Nov-2011	189	1	278	Shanghai/Shenzhen
31-Jan-2013	25-Jan-2013	222	0	500	Shanghai/Shenzhen
6-Mar-2013	5-Mar-2013	0	1	499	Shanghai
7-Mar-2013	7-Mar-2013	0	1	498	Shenzhen
29-Mar-2013	28-Mar-2013	0	1	497	Shanghai
29-Mar-2013	29-Mar-2013	0	1	496	Shenzhen
2-May-2013	26-Apr-2013	0	1	495	Shanghai
3-May-2013	2-May-2013	0	1	494	Shanghai
16-Sep-2013	6-Sep-2013	206	0	700	Shanghai/Shenzhen
28-Mar-2014	27-Mar-2014	0	1	699	Shanghai
1-Apr-2014	31-Mar-2014	0	1	698	Shanghai
29-Apr-2014	29-Apr-2014	0	1	697	Shenzhen
5-May-2014	30-Apr-2014	0	2	695	Shanghai
22-Sep-2014	12-Sep-2014	205	0	900	Shanghai/Shenzhen
4-Dec-2014	4-Dec-2014	0	1	899	Shenzhen

Table 2 Summary Statistics

This table reports summary statistics of variables used in the regressions estimated by the sample consisting of firm-quarter observations. Columns (2)-(7) report the summary statistics, of the variables in the full sample. Panel A presents summary statistics of variables used in the main part of this paper. Panel B presents summary statistics of measures of firm risk-taking. Panel C presents summary statistics of other variables used in this paper. Variable definitions are provided in Appendix 1.

	N	Mean	Median	Std. Dev.	Min	Max
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: main variables						
Risk	31316	2.189	1.806	1.701	0.000	18.293
Short_List	31316	0.072	0.000	0.258	0.000	1.000
Logasset	31316	21.599	21.391	1.206	18.806	25.782
Leverage	31316	0.412	0.399	0.255	0.003	4.524
Age	31316	2.779	2.996	1.029	0.000	4.190
Cashflow	31316	0.013	0.011	0.068	-1.021	0.728
Gsale	31316	18.378	13.719	36.784	-58.261	193.944
Logmv	31316	22.040	21.886	0.993	17.373	28.656
BM	31316	0.944	0.605	1.785	0.030	63.823
TOP1	31316	0.377	0.366	0.152	0.003	0.906
Turnover	31316	1.081	0.679	1.373	0.000	19.413
Turnover_Dum	31316	0.632	1.000	0.482	0.000	1.000
Exchange	31316	0.370	0.000	0.483	0.000	1.000
Market	31316	0.715	1.000	0.451	0.000	1.000
Panel B: Alternative measures of firm risk-taking						
Risk_8	25827	2.326	1.965	1.565	0.145	17.184
Risk_12	19032	2.382	2.034	1.536	0.108	14.087
Risk_abs	31316	2.311	1.938	1.751	0.000	18.044
Total_Risk	35222	0.219	0.206	0.096	0.035	10.245
Idio_Risk	35222	-1.854	-1.836	0.361	-4.539	2.328
Risk_roe	31316	2.189	1.806	1.701	0.000	18.293
Risk_absroe	31011	4.127	3.455	3.087	0.000	37.979
Risk_r	10695	0.218	0.200	0.123	0.007	3.273
Risk_absr	10695	0.231	0.212	0.129	0.011	3.308
Panel C: Other variables						
Cash	31454	-1.612	-1.674	1.210	-7.879	3.420
R&D	26803	0.001	0.000	0.007	-0.071	0.310

M&A	31507	0.136	0.000	0.387	0.000	6.000
Inv	26606	0.012	0.001	0.080	-0.579	4.514
Assetg	30664	0.053	0.022	0.180	-2.060	4.172
Board_num	31507	11.051	10.000	3.318	2.000	31.000
Ind_ratio	31407	36.991	36.360	9.344	5.880	100.000
Mown	31335	0.143	0.001	0.221	0.000	4.450
InsOwn	31507	0.145	0.084	0.168	0.000	1.594
InsOwn_Ded	31507	0.042	0.014	0.063	0.000	0.571
InsOwn_NonDed	31507	0.103	0.028	0.160	0.000	1.594
CEO_age	17948	47.561	48.000	6.615	25.000	75.000
Coverage	31507	3.320	1.000	4.425	0.000	38.000

Table 3 Short Selling and Firm Risk-taking

This table estimates the impacts of short selling on firm risk-taking. The dependent variable, *Risk*, is firm risk-taking measured by the standard deviation of the firm's industry-adjusted quarterly ROA from quarter t to quarter t+3. *Short_List* is a dummy variable that equals one if the firm's stock is designated as a pilot stock under the pilot program of margin trading and included in the short-sale list, and zero otherwise. *Short_List(-2,-1)* is a dummy variable that equals one if it is 1 or 2 quarters before the firm's stock is included in the short-sale list; *Short_List(0)* is a dummy variable that equals one if firm i's stock is included in the short-sale list in that quarter; *Short_List(+1)* is a dummy variable that equals one if it is 1 quarter after the firm's stock is included in the short-sale list; *Short_List(>=+2)* is a dummy variable that equals one if it is at least 2 quarters after the firm's stock is included in the short-sale list. Definitions of control variables are provided in Table A.1 in Appendix. The sample period covers 2008Q1 through 2014Q4. Columns (1) and (3) include industry and quarter fixed effects. Columns (2) and (4) include firm and quarter fixed effects. Industries are defined at the two-digit CSRC. Robust standard errors clustered at the firm level are reported in parentheses. Coefficients marked with *, **, and *** are significant at 10%, 5%, and 1%, respectively.

	Risk			
Variables	**(1)**	**(2)**	**(3)**	**(4)**
Short_List	-0.189***	-0.258***		
	(0.067)	(0.073)		
Short_List(-2,-1)			-0.016	-0.049
			(0.066)	(0.069)
Short_List(0)			-0.074	-0.114
			(0.071)	(0.076)
Short_List(+1)			-0.129*	-0.171**
			(0.070)	(0.075)
Short_List(>=2)			-0.270***	-0.380***
			(0.092)	(0.102)
Logasset	-0.867***	-0.976***	-0.860***	-0.966***
	(0.102)	(0.139)	(0.102)	(0.139)
Leverage	0.741	1.000	0.735	0.991
	(0.544)	(0.718)	(0.544)	(0.717)
Age	-0.349***	-0.495***	-0.350***	-0.499***
	(0.035)	(0.042)	(0.035)	(0.042)
Cashflow	1.571***	1.353***	1.566***	1.347***
	(0.264)	(0.277)	(0.264)	(0.276)
Gsale	0.003***	0.003***	0.003***	0.003***
	(0.000)	(0.000)	(0.000)	(0.000)
Logmv	1.004***	0.933***	0.997***	0.923***
	(0.089)	(0.100)	(0.089)	(0.101)

MB	0.009*	0.001	0.009*	0.001
	(0.005)	(0.005)	(0.005)	(0.005)
Top1	-0.133	-0.065	-0.134	-0.073
	(0.200)	(0.381)	(0.200)	(0.382)
Turnover	-0.039***	-0.029***	-0.038***	-0.029***
	(0.010)	(0.010)	(0.010)	(0.010)
Turnover_Dum	-0.115	-0.123	-0.113	-0.120
	(0.095)	(0.093)	(0.095)	(0.093)
Market	0.160**		0.162**	
	(0.080)		(0.080)	
Exchange	0.061**	0.039	0.062**	0.040
	(0.027)	(0.028)	(0.027)	(0.028)
Constant	-1.084	3.161	-1.092	3.195
	(1.141)	(2.086)	(1.152)	(2.096)
Quarter FE	Y	Y	Y	Y
Industry FE	Y	N	Y	N
Firm FE	N	Y	N	Y
N	31,316	31,316	31,316	31,316
Adj-R^2	0.144	0.611	0.144	0.611

Table 4 Alternative Control Groups

This table estimates the impacts of short selling on firm risk-taking using propensity score matching and members of the Shanghai-Shenzhen 300 CSI Index (SHSZ300) to establish control groups. The dependent variable, *Risk*, is firm risk-taking measured by the standard deviation of the firm's industry-adjusted quarterly ROA from quarter t to quarter t+3. *Short_List* is a dummy variable that equals one if the firm's stock is designated as a pilot stock under the pilot program of margin trading and included in the short-sale list, and zero otherwise. *Short_List(-2,-1)* is a dummy variable that equals one if it is 1 or 2 quarters before the firm's stock is included in the short-sale list; *Short_List(0)* is a dummy variable that equals one if firm i's stock is included in the short-sale list in that quarter; *Short_List(+1)* is a dummy variable that equals one if it is 1 quarter after the firm's stock is included in the short-sale list; *Short_List(>=+2)* is a dummy variable that equals one if it is at least 2 quarters after the firm's stock is included in the short-sale list. All regressions include firm and quarter fixed effects. The sample period covers 2008Q1 through 2014Q4. Columns (1) and (2) use members of Shanghai-Shenzhen 300 Index to establish control groups. Column (3) and (4) examine the effect within the treatment group. Columns (5) and (6) use propensity score matching to establish control groups. Estimates in Columns (3) and (4) Robust standard errors clustered at the firm level are reported in parentheses. Coefficients marked with *, **, and *** are significant at 10%, 5%, and 1%, respectively.

	Risk					
	SHSZ300		Within Treatment Group		Propensity Score Matching	
Variables	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Short_List	-0.264**		-0.300***		-0.343***	
	(0.117)		(0.081)		(0.117)	
Short_List(-2,-1)		-0.059		-0.011		0.056
		(0.113)		(0.070)		(0.124)
Short_List(0)		-0.146		-0.170**		-0.180
		(0.128)		(0.082)		(0.137)
Short_List(+1)		-0.222*		-0.239***		-0.261**
		(0.133)		(0.084)		(0.123)
Short_List(>=2)		-0.384**		-0.415***		-0.471***
		(0.173)		(0.123)		(0.158)
Controls	Y	Y	Y	Y	Y	Y
Quarter FE	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y
N	3,384	3,384	11,603	11,603	12,085	12,085
Adj-R^2	0.731	0.731	0.656	0.656	0.542	0.542

Table 5 Robustness Checks

This table estimates the impacts of short selling using alternative measures of firm risk-taking. The dependent variables include a series of alternative measures of firm risk-taking. *Short_List* is a dummy variable that equals one if the firm's stock is designated as a pilot stock under the pilot program of margin trading and included in the short-sale list, and zero otherwise. Definitions of these measures are provided in Table A.1 in Appendix. All the regressions include firm and quarter fixed effects. The sample period covers 2008Q1 through 2014Q4. Robust standard errors clustered at the firm level are reported in parentheses. Coefficients marked with *, **, and *** are significant at 10%, 5%, and 1%, respectively.

Panel A: Risk measures based on ROA

	F4.Risk	*F8.Risk*	*Risk*	*Risk_8*	*Risk_12*	*Risk_abs*
Variables	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Short_List	-0.530***	-0.555***	-0.543***	-0.375***	-0.273**	-0.242***
	(0.106)	(0.138)	(0.152)	(0.092)	(0.109)	(0.074)
Controls	Y	Y	Y	Y	Y	Y
Quarter FE	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y
N	25,830	19,034	6,363	25,827	19,032	31,316
Adj-R^2	0.613	0.628	0.554	0.723	0.807	0.620

Panel B: Risk measures with other definitions

	F.Total_Risk	*F.Idio_Risk*	*Risk_roe*	*Risk_ absroe*	*Risk_r*	*Risk_absr*
Variables	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Short_List	-0.008***	-0.074***	-0.259***	-0.621***	-0.019**	-0.025***
	(0.002)	(0.010)	(0.073)	(0.143)	(0.007)	(0.008)
Controls	Y	Y	Y	Y	Y	Y
Quarter FE	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y
N	32,630	32,630	31,316	31,014	10,695	10,695
Adj-R^2	0.364	0.414	0.611	0.537	0.356	0.346

Table 6 Short Selling, Overvaluation, and Firm Risk-taking

This table examines whether overvaluation can affect the relation between short selling and firm risk-taking. The dependent variable, *Risk*, is firm risk-taking measured by the standard deviation of the firm's industry-adjusted quarterly ROA from quarter t to quarter t+3. *Short_List* is a dummy variable that equals one if the firm's stock is designated as a pilot stock under the pilot program of margin trading and included in the short-sale list, and zero otherwise. *MB* is the market-to-book ratio, and *Dispe* is the dispersion of analyst forecast. Detailed definitions of all these variables are provided in Table A.1 in Appendix. All the regressions include firm and quarter fixed effects. The sample period covers 2008Q1 through 2014Q4. Robust standard errors clustered at the firm level are reported in parentheses. Coefficients marked with *, **, and *** are significant at 10%, 5%, and 1%, respectively.

	Risk					
	Overvalue =MB	High MB	Low MB	Overvalue =Dispe	High Dispe	Low Dispe
Variables	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Short_List	-0.162	-0.572***	-0.115	-0.324***	-0.484***	-0.105
	(0.101)	(0.132)	(0.088)	(0.109)	(0.126)	(0.106)
*Short_List*Overvalue*	-0.032***			-0.007		
	(0.012)			(1.668)		
Controls	Y	Y	Y	Y	Y	Y
Quarter FE	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y
N	22,183	11,013	11,170	16,961	8,376	8,585
Adj-R^2	0.594	0.590	0.503	0.645	0.545	0.737

Table 7 Short Selling, Internal Governance, and Firm Risk-taking

This table examines whether internal governance mechanisms can affect the relation between short selling and firm risk-taking. The dependent variable, *Risk*, is firm risk-taking measured by the standard deviation of the firm's industry-adjusted quarterly ROA from quarter t to quarter t+3. *Short_List* is a dummy variable that equals one if the firm's stock is designated as a pilot stock under the pilot program of margin trading and included in the short-sale list, and zero otherwise. *Board_num* is the number of board members, *Ind_ratio* is the ratio of independent directors to board size, and *Separation* is a dummy variable that equals one if the controlling shareholder in a firm has excess control rights (control rights larger than cash-flow rights) in quarter t, and zero otherwise. Detailed definitions of all these variables are provided in Table A.1 in Appendix. All the regressions include firm and quarter fixed effects. The sample period covers 2008Q1 through 2014Q4. Robust standard errors clustered at the firm level are reported in parentheses. Coefficients marked with *, **, and *** are significant at 10%, 5%, and 1%, respectively.

Panel A:

	Risk		
Internal_G=	Board_num	Ind_ratio	Separation
Variables	**(1)**	**(2)**	**(3)**
Short_List	0.345	-0.767***	-0.162*
	(0.257)	(0.259)	(0.094)
*Short_List*Internal_G*	-0.052**	0.014**	-0.027***
	(0.021)	(0.007)	(0.008)
Controls	Y	Y	Y
Quarter FE	Y	Y	Y
Firm FE	Y	Y	Y
N	28,792	28,077	22,014
Adj-R^2	0.601	0.600	0.594

Panel B:

	Risk					
	Low Board_num	High Board_num	High Ind_ratio	Low Ind_ratio	Separation =0	Separation =1
Variables	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Short_List	-0.070	-0.363***	-0.198*	-0.350***	-0.158	-0.519***
	(0.140)	(0.090)	(0.101)	(0.111)	(0.103)	(0.134)
Controls	Y	Y	Y	Y	Y	Y
Quarter FE	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y
N	12,275	16,517	13,975	14,102	11,900	10,114
Adj-R^2	0.648	0.575	0.597	0.604	0.604	0.590

Table 8 Short Selling, Financial constraints, and Firm Risk-taking

This table examines whether financial constraints can affect the relation between short selling and firm risk-taking. The dependent variable, *Risk*, is firm risk-taking measured by the standard deviation of the firm's industry-adjusted quarterly ROA from quarter t to quarter t+3. The independent variable with main interest *Short_List* a dummy variable equal to one if the firm's stock is designated as a pilot stock under the pilot program of margin trading and included in the short-sale list, and zero otherwise. *Logmv* is the logarithm of total capitalization, and *Age* is the number of quarters since the firm is listed on the A-share market. Detailed definitions of all these variables are provided in Table A.1 in Appendix. All the regressions include firm and quarter fixed effects. The sample period covers 2008Q1 through 2014Q4. Robust standard errors clustered at the firm level are reported in parentheses. Coefficients marked with *, **, and *** are significant at 10%, 5%, and 1%, respectively.

	Risk					
	FC =Logmv	High Logmv	Low Logmv	FC =Age	High Age	Low Age
Variables	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Short_List	4.536***	-0.256***	-0.171	1.093***	-0.426***	-0.261**
	(1.641)	(0.086)	(0.183)	(0.302)	(0.113)	(0.121)
*Short_List*FC*	-0.208***			-0.395***		
	(0.070)			(0.093)		
Controls	Y	Y	Y	Y	Y	Y
Quarter FE	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y
N	22,183	10,767	11,416	31,316	11,208	10,975
Adj-R^2	0.572	0.688	0.493	0.612	0.548	0.650

Table 9 Implications of Short Selling on Firms' Financial Policies

This table examines the impact of short selling on firms' financial policies. *Short_List* is a dummy variable that equals one if the firm's stock is designated as a pilot stock under the pilot program of margin trading and included in the short-sale list, and zero otherwise. Detailed definitions of all these variables are provided in Table A.1 in Appendix. All regressions include firm and quarter fixed effects. The sample period covers 2008Q1 through 2014Q4. Robust standard errors clustered at the firm level are reported in parentheses. Coefficients marked with *, **, and *** are significant at 10%, 5%, and 1%, respectively.

Panel A:

	Cash	*Leverage*	*R&D*	*M&A*	*Capx*	*Assetg*
Variables	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Short_List	0.056*	-0.013***	-0.004**	-0.095	-0.004	-0.046***
	(0.034)	(0.005)	(0.002)	(0.086)	(0.004)	(0.005)
Controls	Y	Y	Y	Y	Y	Y
Quarter FE	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y
N	35,314	35,370	32,030	30,729	30,412	34,534
Adj-R^2	0.769	0.877	0.232	0.015	0.098	0.217

Panel B:

	$Cash_{adj}$	$Leverage_{adj}$	$R\&D_{adj}$	$M\&A_{adj}$	$Capx_{adj}$	$Assetg_{adj}$
Variables	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Short_List	0.069**	-0.016***	-0.004**	-2.047**	-0.004	-0.046***
	(0.034)	(0.005)	(0.002)	(0.947)	(0.004)	(0.005)
Controls	Y	Y	Y	Y	Y	Y
Quarter FE	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y
N	35,314	35,370	32,030	1,384	30,412	34,534
Adj-R^2	0.710	0.844	0.219	0.256	0.089	0.194

Table 10 Short Selling and Firm Performance

This table examines the impact of short selling on firms' accounting performances. *Short_List* is a dummy variable that equals one if the firm's stock is designated as a pilot stock under the pilot program of margin trading and included in the short-sale list, and zero otherwise. Detailed definitions of all these variables are provided in Table A.1 in Appendix. All the regressions include firm and quarter fixed effects. The sample period covers 2008Q1 through 2014Q4. Robust standard errors clustered at the firm level are reported in parentheses. Coefficients marked with *, **, and *** are significant at 10%, 5%, and 1%, respectively.

Panel A:

	F4.ROA	*F8.ROA*	*F4.Gsale*	*F8.Gsale*	*F4.TobinQ*	*F8.TobinQ*
Variables	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Short_List	-0.489***	-1.163***	-7.315***	-10.778***	-0.308***	-0.467***
	(0.137)	(0.246)	(1.826)	(2.067)	(0.051)	(0.082)
Controls	Y	Y	Y	Y	Y	Y
Quarter FE	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y
N	30,587	24,120	30,557	24,079	28,813	22,319
Adj-R^2	0.646	0.641	0.306	0.309	0.784	0.797

Panel B:

	F4.ROA$_{adj}$	*F8.ROA$_{adj}$*	*F4.Gsale$_{adj}$*	*F8.Gsale$_{adj}$*	*F4.TobinQ$_{adj}$*	*F8.TobinQ$_{adj}$*
Variables	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Short_List	-0.441***	-0.882***	-6.251***	-7.832***	-0.234***	-0.264***
	(0.134)	(0.240)	(1.758)	(2.021)	(0.050)	(0.078)
Controls	Y	Y	Y	Y	Y	Y
Quarter FE	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y
N	30,587	24,120	30,557	24,079	28,813	22,319
Adj-R^2	0.634	0.622	0.254	0.269	0.736	0.748

Table 11 Short Selling, Institutional Ownership, and Firm Risk-taking

This table estimates whether short selling can affect firm risk-taking through changes of institutional ownership. In columns (1)-(4), the dependent variable, *Risk*, is firm risk-taking measured by the standard deviation of the firm's industry-adjusted quarterly ROA from quarter t to quarter t+3. In column (5), the dependent variable is dedicated institutional ownership. In column (6), the dependent variable is non-dedicated institutional ownership. *Short_List* is a dummy variable that equals one if the firm's stock is designated as a pilot stock under the pilot program of margin trading and included in the short-sale list, and zero otherwise. Detailed definitions of all these variables are provided in Table A.1 in Appendix. All the regressions include firm and quarter fixed effects. The sample period covers 2008Q1 through 2014Q4. Robust standard errors clustered at the firm level are reported in parentheses. Coefficients marked with *, **, and *** are significant at 10%, 5%, and 1%, respectively.

	Risk				*I.O._Ded*	*I.O._NonDed*
Variables	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Short_List	-0.258***	-0.246***	-0.256***	-0.244***	-0.008***	0.004
	(0.073)	(0.072)	(0.073)	(0.072)	(0.002)	(0.006)
I.O.	-0.061					
	(0.084)					
I.O._Ded		1.588***		1.543***		
		(0.369)		(0.367)		
I.O._NonDed			-0.256***	-0.218**		
			(0.088)	(0.087)		
Controls	Y	Y	Y	Y	Y	Y
Quarter FE	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y
N	31,316	31,316	31,316	31,316	35,370	35,370
Adj-R^2	0.611	0.612	0.611	0.612	0.653	0.593

Table 12 Short Selling, Margin Trading, and Firm Risk-taking

This table examines the impact of short selling on firms' accounting performances. The dependent variable, *Risk*, is firm risk-taking measured by the standard deviation of the firm's industry-adjusted quarterly ROA from quarter t to quarter t+3. *DShort* is the average of daily short-sale volume denominated by daily trading volume in quarter t minus the average of daily margin trading denominated by daily trading volume in quarter t-1. *DMargin* is the average of daily margin trading volume denominated by daily trading volume in quarter t minus the average of daily margin trading denominated by daily trading volume in quarter t-1. *Short_List* is a dummy variable that equals one if the firm's stock is designated as a pilot stock under the pilot program of margin trading and included in the short-sale list, and zero otherwise. All the regressions include firm and quarter fixed effects. The sample period covers 2008Q1 through 2014Q4. Robust standard errors clustered at the firm level are reported in parentheses. Coefficients marked with *, **, and *** are significant at 10%, 5%, and 1%, respectively.

	Risk					
Variables	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
DShort	-89.817***		-89.642***	-58.396***		-52.417**
	(22.045)		(22.068)	(20.862)		(20.963)
DMargin		-0.215	-0.166		3.099***	3.030***
		(0.626)	(0.626)		(0.805)	(0.804)
Short_List				-0.340***	-0.453***	-0.440***
				(0.081)	(0.095)	(0.095)
Controls	Y	Y	Y	Y	Y	Y
Quarter FE	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y
N	10,967	10,967	10,967	10,967	10,967	10,967
Adj-R2	0.672	0.672	0.672	0.674	0.674	0.674

Table 13 Alternative Explanations

This table examines alternative mechanisms through which short selling can affect firm risk-taking. The dependent variable, *Risk*, is firm risk-taking measured by the standard deviation of the firm's industry-adjusted quarterly ROA from quarter t to quarter t+3. *Short_List* is a dummy variable that equals one if the firm's stock is designated as a pilot stock under the pilot program of margin trading and included in the short-sale list, and zero otherwise. Detailed definitions of all these variables are provided in Table A.1 in Appendix. All the regressions include firm and quarter fixed effects. The sample period covers 2008Q1 through 2014Q4. Robust standard errors clustered at the firm level are reported in parentheses. Coefficients marked with *, **, and *** are significant at 10%, 5%, and 1%, respectively.

	Risk					
	Career Concern		Bear Raid		Hawthorne effect	
	Low CEO_Age	High CEO_Age	Low DAccrual	High DAccrual	High Coverage	Low Coverage
Variables	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Short_List	-0.149	-0.280**	-0.406***	-0.044	-0.237***	-0.165
	(0.188)	(0.125)	(0.109)	(0.091)	(0.080)	(0.147)
Controls	Y	Y	Y	Y	Y	Y
Quarter FE	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y
N	8,739	9,061	15,595	14,950	15,864	15,452
Adj-R^2	0.640	0.658	0.585	0.643	0.656	0.586