Margin Trading and Corporate Investments: Evidence from a Quasi-natural Experiment in China

G. Nathan Dong[*] — Columbia University

Ming Gu[†] — Xiamen University

Weiwei Huang[‡] — Renmin University of China

K.C. John Wei[☆] — Hong Kong Polytechnic University

First draft: January 11, 2018
This version: July 20, 2018

ABSTRACT

What are the real effects of margin trading for a company's exchange-listed stocks on its internal corporate policies in financial, investment, and organizational practices? We identify the causal impact of loosening the trading-on-margin restrictions on the level of corporate investment by exploiting a policy experiment whereby a selected number of publicly traded firms are suddenly eligible for margin trading in China. We find that capital and R&D expenditures dramatically increase when the company's stocks become eligible for margin trading and that they decrease with ineligibility. When we compare the capital and R&D expenditures of firms with different degrees of financing constraints, the positive relationship between margin trading and corporate investment is more pronounced in those highly constrained firms. This evidence is consistent with the idea that corporate investment is reacting to changing market conditions: capital allocation efficiency is dramatically improved due to reduced external financing costs and relaxed external financing constraints.

Keywords: margin trading, corporate investments, quasi-experiment

JEL Classification: G14; G18; M41; M48

[*] Department of Health, Policy, and Management, Columbia University, E-mail: gd2243@columbia.edu.

[†] School of Economics and WISE, Xiamen University, E-mail: guming@xmu.edu.cn.

[‡] Hanqing Advanced Institute of Economics and Finance, Renmin University of China, Email: hww@ruc.edu.cn.

[☆] School of Accounting and Finance, Hong Kong Polytechnic University, Kowloon, Hong Kong, E-mail: johnwei@ust.hk.

Margin Trading and Corporate Investments: Evidence from a Quasi-natural Experiment in China

ABSTRACT

What are the real effects of margin trading for a company's exchange-listed stocks on its internal corporate policies in financial, investment, and organizational practices? We identify the causal impact of loosening the trading-on-margin restrictions on the level of corporate investment by exploiting a policy experiment whereby a selected number of publicly traded firms are suddenly eligible for margin trading in China. We find that capital and R&D expenditures dramatically increase when the company's stocks become eligible for margin trading and that they decrease with ineligibility. When we compare the capital and R&D expenditures of firms with different degrees of financing constraints, the positive relationship between margin trading and corporate investment is more pronounced in those highly constrained firms. This evidence is consistent with the idea that corporate investment is reacting to changing market conditions: capital allocation efficiency is dramatically improved due to reduced external financing costs and relaxed external financing constraints.

Keywords: margin trading, corporate investments, quasi-experiment

JEL Classification: G14; G18; M41; M48

1. Introduction

Does trading activity on Wall Street influence corporate policies in financial, investment, and organizational practices on Main Street? Especially in corporate finance research, understanding the relation between financial markets and the real economy has become an important topic for scholars such as Chen, Goldstein, and Jiang (2007), Bakke and Whited (2010), Bond, Edmans, and Goldstein (2012), and Foucault and Fresard (2014) to name a few. In theory, the most important effect must come from primary financial markets due to the adverse selection or moral hazard problem that limits the ability of firms to raise external capital, and in turn, constrains real investment, eventually reducing real economic activity (Bernanke and Gertler 1989; Kiyotaki & Moore 1997).

Right after the firm has raised much-needed funds from primary financial markets, however, there is no additional capital flowing to the firm. According to the neoclassical investment theory, there should be no difference in the cost of capital between internal funds and funds raised from external capital markets. The cost and availability of capital from external sources, comparing to internal funds available to the firm, would not matter for investment decisions, controlling for investment opportunities (Fazzari, Hubbard, and Petersen 1988; Hubbard, Kashyap, and Whited 1995). Therefore, a substantial fraction of activity occurs in secondary financial markets, in which securities are traded among investors, should play no role in investment decisions, controlling for investment opportunities.

This may be true in frictionless capital markets where the degree of information asymmetry between the market and the firm is relatively low. But even so, worsening of the information environment can potentially increase the cost of capital (e.g., Stiglitz and Weiss 1981; Myers and Majluf 1984; Diamond 1985; Merton 1987; Lucas and McDonald 1990; Botosan 1997). The

main reason is that the information asymmetry in the stock market induces a form of systematic risk and in equilibrium investors require compensation for bearing such risk (Easley and O'Hara 2004). In turn, the firm learns from the information conveyed in its stock prices and makes financial or operational decisions (Chang and Yu 2010).

Indeed, empirical research has demonstrated that the operation of secondary financial markets does matter for corporate policies such as capital structure and investment. In the line of research mentioned at the beginning of this article, managers do constantly trace the performance of their firms' stocks and adjust their real investment in response to changes in market conditions. Such literature has typically focused on cross-sectional regressions of investment on measures of stock market activity. Yet, few studies have reliably estimated the real impact from the stock market to the firm due to a lack of identification strategies for shocks that are exogenous to the firm. This apparently calls for a more rigorous econometric method to disentangle the outcome from the counterfactuals and investigate the causal relation, utilizing instruments or natural experiments. For example, Edmans, Goldstein, and Jiang (2012) use mutual fund flows to instrument for stock price changes to study the link from stock price to takeovers. Derrien and Kecskés (2013) use the closures and mergers of brokerage houses as exogenous events that reduce analyst coverage to study the effects on an important corporate policy: investment.

In this research, our focus is on the effects on corporate policies of one particular shock in the stock market: the removal of margin-trading restrictions. We examine the effect of financing constraints on corporate investment using a series of policy experiments that gradually introduce margin trading and short selling to the Shanghai and Shenzhen Stock Exchanges in China since 2010 (Carpenter, Lu, and Whitelaw 2018). The lift of the margin-trading and short-selling bans reduced stock return volatility and enhanced market liquidity (Wang and Wei 2017), which has

profound implications on the informativeness of the stock prices (Holmström and Tirole 1993). The theoretical discussion presented earlier clearly emphasizes the informative role of the stock prices, claiming that it is the main channel through which both the firm and investors are able to learn from each other. Chang and Yu (2010) study the underlying mechanism between information asymmetry and liquidity costs in the equity and suggest that while the firm can make an investment decision based on what it learns from the information produced by informed investors and, this comes with a cost: the adverse selection between informed and uninformed investors would increase the firm's cost of capital as evidenced in Lesmond, O'Connor, and Senbet (2008). More specifically on the difference in the cost of capital between internal and external funds, the availability of financing will be likely to affect the investment practices if the cost of capital differs by source of funds. For example, the availability of internal funds allows firms to undertake desirable investment projects without resorting to high-cost external financing (Fazzari et al. 1988) and firms face a larger gap between the internal and external costs of capital are more likely to be financially constrained (Kaplan and Zingales 1997).

Therefore, we hypothesize that this increase in trading activity on the secondary markets helps reduce information asymmetry and, hence, the cost of external financing. This, in turn, improves the profitability of investment opportunities and the optimal amount of corporate investment and associated financing. We further hypothesize that such effects depend on the degree of financing constraints at the time of the shocks in capital markets. It should be noted that both hypotheses rest on the foundation laid by Wang and Wei (2017) that the price efficiency increased for firms that were included in the pilot program. The enhanced liquidity and information efficiency of stock prices would provide more relevant information for managers to guide their investment decisions. Indeed, we provide empirical evidence for our

hypotheses: an increase in margin trading activity—through the resulting reduction in information asymmetry and thus the cost of capital—causes an increase in capital and R&D expenditures. Moreover, the magnitude of the effect is larger for firms that are more financially constrained. Overall, firms do respond to changes in financing constraints that would otherwise distort efficient allocation of investment.

Our main results are summarized as follows. The difference-in-difference tests indicate that the level of corporate investments including capital and R&D expenditures increased after margin trading and short selling are allowed for a selected number of Chinese firms. More importantly, the volume of margin trading dominates that of short selling in China; therefore, the effects mainly come from margin trading activity. Yes, we are cautious in making this conclusion. To disentangle the effect of margin trading from that of short selling, we use the leveraged mutual fund ownership to instrument for margin trading and find a significantly positive relationship between margin trading eligibility and the level of investment.

We then exploit the cross-sectional variation across firms to delve deeper into the underlying mechanisms for the results. As shown in Chang, Luo and Ren (2014) and Wang and Wei (2017), the price efficiency suddenly increases and stock return volatility decreases after the firm's stocks become eligible for margin trading in China. Clearly, the pilot program enhances the liquidity and the information efficiency of stock prices, which in turn leads to more efficient capital allocation, by providing more relevant information for managers to guide their investment decisions. It has been suggested in the literature that investments of financially constrained firms are less responsive to investment opportunities because external financing is more costly (Hubbard 1998) and industry sectors with higher external financing needs grow faster in countries with more developed financial markets (Rajan and Zingales 1998). Thus, the economic

benefit would be greater for financially constrained firms. In other words, if the pilot program improves capital allocation efficiency by reducing external financing costs and relaxing external financing constraints for a selected number of firms, we would observe a larger increase of investment in them. Consistent with our expectations, we find that the positive relationship between margin trading and corporate investments is more significant in firms with higher degree of financial constraints.

In addition to the liquidity and information channel that help reduce the cost of equity capital, a more informative equity price and a higher level of equity price can be associated with a lower cost of debt (Sunder 2004). Therefore, we can also attribute the willingness to increase capital and R&D expenditures to the fact that firms can raise debt capital at a lower cost. Indeed, margin trading has a positive impact on firms' stock price, and the higher market value helps firms raise external debt capital. While the use of external equity financing does not differ between the firms included in the pilot program and those not, one should not be surprised by this finding. The reason is that debt financing is still the predominant source of new external funds for most publicly listed companies in China, and many restrictions on equity financing still remain in place in Chinese stock markets.

Our study contributes to the literature in several ways. To our best of knowledge, our study is the first paper to document the economic link between margin trading and corporate investments. Different from previous studies on the effects of short-selling (Grullon, et al. 2015) and information asymmetry (Derrien and Kecskés, 2013) on corporate investments, our findings suggest that the relaxation of borrowing constraints causes an increase in investment and financing. Our study also contributes the growing literature on recent Chinese margin trading program. Chang, et al (2014) and Wang and Wei (2017) mainly study the aggregate market by

showing that the market efficiency increases and market volatility decreases after the pilot program. We employ this quasi-natural experiment and investigate whether borrowing constraints can affect real corporate decisions at the firm level. Finally, given that the research subjects are publicly traded companies located in the largest developing country and the event is an important part of the market reform planned by the central government to promote economic growth, this article deepens our understanding of the underlying mechanisms by which financial market reforms exert beneficial effects on the real economy. Empirical evidence has shown that the progress in financial liberalization reduces firms financing constraints and the cost of external finance, for example, the cost of equity capital (Bekaert and Harvey 2000; Henry 2000) and especially for small firms (Laeven 2003). Institutional factors certainly play an important role protecting outside investors from abuse by inside managers (Bolton and Scharfstein 1990; Hart and Moore 1998) and it would be expected that once better accounting standards and more timely disclosure requirements were enforced, the efficiency of corporate investment would improve (Stein 2003). Galindo, Schiantarelli, and Weiss (2007) show that financial reforms have led to an increase in the efficiency with which investment funds are allocated, and stock market liberalizations have led to real economic growth, partially through its effect on financial development (Bekaert, Harvey, and Lundblad 2005). Extensive work has gone into investigating the channel through which this effect operates. It is possible that countries with more developed financial systems do a better job of channeling funds to firms with strong (or better) investment opportunities but scarce internal resources (Rajan and Zingales 1998; Demirguc-Kunt and Maksimovic 1998; Wurgler 2000). The findings reported in this article clearly substantiate this interpretation and indicate the direction of growth-oriented reform policies in China: relaxing external financing constraints to allow capital to flow to the best investment opportunities.

The remainder of the paper is organized as follows. Section 2 presents the sample data and empirical method. Section 3 evaluates the main results difference-in-difference tests and pooled OLS regressions. Section 4 provides a possible channel to understand the main results. Section 5 discusses the policy implications of these findings and concludes.

2. Literature review and summary statistics

2.1 Literature review and China background

Before we present our analysis, it is essential to review the related policy experiment in the U.S. and introduce the unique institutional context of the pilot program in China. In July 2004, the Securities and Exchange Commission (SEC) adopted a new regulation governing short selling activities in the U.S. equity markets – Regulation SHO program. Regulation SHO allowed stocks in the pilot program exempted from short-sale price tests between May 2005 and August 2007. The growing studies employ SHO pilot program as an exogenous shock to examine the effect of short selling on several aspects. Recent two studies investigate whether the short-selling activity has an impact on financing and investment decisions. For example, Grullon, Michenaud, and Weston (2015) examine the effect of short-selling constraints on stock prices and real economic activity in the US. They find that an increase in short-selling activity causes prices to fall, and small firms react to these lower prices by reducing equity issues and investment. Deng and Mortal (2017) provide empirical support for the view that short selling constraints can alleviate distortions in stock prices and corporate investment, even across countries.[1] On March 31, 2010, the China Securities Regulatory Commission (CSRC) introduces

[1] Other related studies examine the effect of short-selling on order execution and market quality (Alexander and Peterson 2008), short-sale trades and short-sales volume (Diether, Lee and Werner 2009), bond yields (Kecskés, Mansi and Zhang 2013), insider trading (Masa, Qian, Xu, and Zhang 2015), and earnings management (Fang, Huang and Karpoff 2016; Massa, Zhang and Zhang 2015).

the pilot program of margin trading and short selling to incorporate more information into stocks prices. Initially, 90 blue chip stocks are selected in the program in 2010. After several rounds of qualification standards loosening, there are about 900 stocks included in the pilot program to the end of 2014, accounting for more than one-third of total listed stocks in China. The direct impact of the introduction of margin trading and short selling by the pilot program on the Chinese stock markets runs in precisely the opposite direction of that Regulation SHO's pilot program that prohibits short selling in the U.S.

2.2. Sample and definition of variables

Our sample covers the period from January 2006 through December 2014. On March 31, 2010, the China Securities Regulatory Commission (CSRC) announced that 90 blue-chip stocks were included in the pilot program of margin trading and short selling and we create two dummy variables to indicate the periods prior to and during the policy experiment. The $Pre\text{-}program$ variable is for the period from January 2006 to December 2009, and the $During$ variable is for the period from January 2011 to December 2014. There are two reasons that we decide to exclude the year 2010 from the sample: (1) to eliminate the announcement effect, and (2) due to limited availability of transaction data from April 2010 to December 2010 when the policy first came into effect. To identify the treatment group of the experiment, we use a dummy variable *PILOT* that equals one if a firm's stock is designated as a pilot stock in the margin trading program and zero otherwise.

We employ two measures of the firms' real investment: $Capex$ (capital expenditures) and Capex$R\&D$ (the sum of capital and R&D expenditures). Both $Capex$ and $CapexR\&D$ are the

percentage of the total assets of the previous fiscal year end.[2] We define $MarginBuy$ as total RMB remaining balance of margin buying, and $\Delta MarginBuy$ as the net change in purchases on margin. These two measures are standardized by total trading volume in RMB of the underlying stocks. $MarginBuy$ measures the potential borrowing amount of the underlying stock at the year end. $\Delta MarginBuy$ measures the realized change in borrowing amount of the underlying stock within one year. We similarly define $ShortSell$ and $\Delta ShortSell$ as the total remaining balance of a firm's short selling and the net RMB value change of a firm's short selling. As the trading volume of short selling is much lower than that of margin buying, we multiply $ShortSell$ and $\Delta ShortSell$ by 100, and then standardize them by the trading volume in RMB of the underlying stocks to make the magnitude of short selling measures comparable to that of the margin buying measures.[3]

As we discussed at the onset, after controlling for investment opportunities, firms should be indifferent between internal and external sources of funds in a world of perfect capital markets according to the neoclassical theory of investment such as Modigliani and Miller (1958). Therefore, we need to explicitly capture the effect of the firm's investment opportunity set. We employ two variables. First, the market-to-book (M/B) ratio is used to proxy for the long-term growth prospects of a firm. The M/B variable is the firm's market value of equity plus book value of total assets minus the book value of equity minus deferred taxes, scaled by its book value of total assets. Second, the firm's ability to generate enough cash is critical to finance its

[2] The R&D expense data is available from 2007 when CSRC published "Administrative Measures for the Disclosure of Information of Listed Companies". To construct *CapexR&D*, we add the R&D expense to capital expenditures when the *R&D* data is available. In the later section, the regression results of *R&D* alone are qualitatively similar to those of *Capex* and *CapexR&D*.

[3] The market trading activity highly depends on the market aggregate performance. Given our trading measures are at the annual basis, we scale the trading activity measures by trading volume to address this potential measurement bias. The main results are qualitatively similar when we scale the trading activity measures by total share outstanding.

current investment policies that reflect investment opportunities in the current period. The $Cash\ flow$ variable is the firm's net income before extraordinary items plus depreciation and amortization expenses, scaled by start-of-year total assets.

In addition, we consider several other control variables for firm size, operating profitability, and financial leverage. The $Ln(TA)$ variable is the natural logarithm of firm's total assets in billions of RMB at the previous fiscal year end. The $Profitability$ variable is operating income before depreciation and amortization, scaled by start-of-year total assets. The $Leverage$ variable is the firm's long-term debt plus debt in current liabilities, scaled by the sum of long-term debt, debt in current liabilities, and total stockholders' equity. We recognize that our analysis, even after controlling for investment opportunities and firm characteristics, does not completely eliminate estimation bias because margin trading activity can still be endogenously driven by various types of investment motives. To address the concern, we use instrumental variables (IV) regressions using the ownership of leverage mutual funds to instrument for margin trading. We also employ the institution ownership, the Amihud (2002) illiquidity, analyst coverage, and turnover to instrument for short selling in Appendix B. Data for the dependent variables ($Capex$ and Capex$R\&D$), margin trading variables, control variables, and instrument variables come from Chinese Securities Market and Accounting Research (CSMAR). All variables are winsorized at the 2.5% and 97.5% levels to remove outliers, and their detailed definitions of all variables are provided in Appendix A.

It should be noted the pilot program that lifts margin trading and short selling bans were gradually introduced by the CSRC. Initially, only 90 blue-chips stocks are included in the pilot program list. After a few rounds of criteria relaxation, roughly 900 stocks are in the list up to the end of 2014. We thus believe it is worth the effort to pool the samples and study them in two

different ways: the balanced panel and the unbalanced panel. In the balanced panel sample, the pilot (treatment) group contains firms participating in the pilot program consecutively from 2011 to 2014. After removing stocks that do not meet the sample requirements of having all data available for our variables throughout the entire sample period, we identify 150 firms to be included in the treatment group of the balanced sample. Accordingly, the control group contains firms that have never participated in the pilot program during the sample period. We then perform difference-in-differences tests on this balanced panel to compare changes in capital and R&D expenditures before and after the introduction of margin trading in 2010. For the unbalanced panel sample, the treatment (pilot) group includes firms participating in the pilot program in any year after 2011 (189 firms in 2011, 193 firms in 2012, 411 firms in 2013, and 478 firms in 2014). The control group includes firms that have never participated in the pilot program in that particular year from 2011 to 2014. Because the sample size of the unbalanced panel is much larger than that of the balanced one, we use pooled OLS regressions on this unbalanced panel to identify the effect of margin trading on corporate investment using variation in margin trading activity across firms over time.

2.3 Summary statistics

The summary statistics of $Capex$, Capex$R\&D$, margin trading activity, and other firm characteristic variables for both samples of the balanced panel and unbalanced panel are shown in Table 1.

[Insert Table 1 Here]

Panels A and B of Table 1 report the statistics for the treatment and control groups in the balanced panel sample before and after the introduction of the pilot program, respectively. As for the levels of $Capex$ and Capex$R\&D$ in the pilot group, the mean values of $Capex$ and Capex$R\&D$ substantially increase, from 11.349 and 11.736 in the $Pre\text{-}program$ period to 11.776 and 12.069 in the $During$ period. During the pilot program (2011-2014), the level of $Capex$ and Capex$R\&D$ in the pilot group is substantially higher than those in the control group in both the $Pre\text{-}program$ period and the $During$ period. When comparing firm characteristics between the pilot and control groups before the pilot program, the pilot firms have a larger size, higher market-to-book ratio, higher profitability, and higher cash flow, consistent with the pilot program selection criteria published by CSRC. As pilot firms are quite different from controls firms in terms of several measures of firm characteristics, we control them in our regression analysis.

Panel C of Table 1 reports the summary statistics for the pilot group in the unbalanced panel sample during the pilot program (2011-2014). We observe that $MarginBuy$ is 0.111, measured as the remaining margin buying balance standardized by trading volume in RMB. $\Delta MarginBuy$ is 0.017, measured as net purchases on margin standardized by trading volume in RMB. There are far less short selling activities in the contemporaneous period, where $ShortSell$ (×100) and $\Delta ShortSell$ (×100) are 0.078 and 0.002. The data presented in Panel C clearly suggests that the volume of margin buying (in RMB value) is about 100 times as much as that of short selling. We therefore argue that margin buying activity dominates short selling activity in the Chinese stock market.[4]

[4] Chang et al (2014) suggest several reasons such as the transaction cost, the limited supply of short selling, the up-tick rule, and Chinese investors trading traditions, to understand why margin trading dominates the short selling.

3. The effect of margin trading on the corporate investments

3.1 Difference-in-differences (DID) tests

We first conduct a univariate difference-in-differences test on the balanced panel sample to compare the difference in capital expenditures ($Capex$) between the pilot and control groups and report results in Panel A of Table 2. Before the pilot program (the $Pre\text{-}program$ period), the difference in the mean values of $Capex$ is 4.598 (*t*-stat = 3.31) and the difference increases to 4.905 (*t*-statistic = 2.45) after the pilot program is introduced (the $During$ period). The overall change in differences of 0.307 ($During - Pre$) is statistically significant at the 1% level (*t*-statistic = 2.80). We then repeat the same test on the sum of capital and R&D expenditures ($CapexR\&D$) and report the results in Panel B of Table 2. Similarly to the findings of capital expenditures, before the pilot program, the difference in the mean values of $CapexR\&D$ is 4.863 (*t*-statistic = 3.49), and the difference increases to 5.157 (*t*-statistic = 2.56) after the pilot program is introduced. The overall change in differences of 0.294 ($During - Pre$) is statistically significant at the 1% level (*t*-statistic = 2.59).

[Insert Table 2 Here]

We should note that after the policy shocks that lift margin-trading and short-selling constraints, corporate investments, as measured by $Capex$ and Capex$R\&D$, increase in both treatment and control firms. However, the magnitude of the effect is much greater for firms that are included in the pilot program. It is possible that our results are biased by the non-randomized nature of the policy shocks, meaning that firms could have been purposely selected into the pilot program by the CSRC, the regulator of the Chinese stock markets. For example, the pilot firms

in the treatment group have a larger size, higher market-to-book ratio, higher profitability, and higher cash flow as shown in Panel A of Table 1. Therefore, we cannot find those perfectly matched non-pilot firms in control group as Fang, Huang, and Karpoff (2016) do in the US study. To mitigate the potential bias caused by the selection of treatment firms, we conduct an alternative multivariate difference-in-differences test to control for firm characteristics. The regression specification is shown in equation (1):

$$Capex_{i,t}\left(or\ CapexR\&D_{i,t}\right) = \alpha + \beta_1 PILOT_i \times During_t + \beta_2 Pilot_i + \beta_3 During_t + \beta_4 Control_{i,t} + \varepsilon_{i,t}, \quad (1)$$

where the dependent variable is $Capex$ or Capex$R\&D$. $PILOT$ is a dummy variable that equals to one if a firm's stock is included in the pilot program and zero otherwise. $During$ is a dummy variable that equals to one if a firm's fiscal year end falls between January 2011 and December 2014 and zero otherwise. The control variables include firm size, market-to-book ratio, profitability, leverage ratio, and cash flow.

Table 3 reports the multivariate difference-in-differences tests of $Capex$ and Capex$R\&D$ for the balanced panel sample. The first two columns report the multivariate difference-in-differences test of $Capex$. The results show that the regression coefficients on $PILOT \times During$ without and with control variables are both significantly positive. Specifically, column (2) shows that after controlling for firm characteristics, industry and year fixed effects, the coefficient on $PILOT \times During$ is 1.50 (*t*-statistic = 2.11), which is significant at the 5% level. Columns (3) and (4) report the multivariate difference-in-differences test of Capex$R\&D$. The regression coefficients on $PILOT \times During$ are both significantly positive as well. Specifically, in column (4), the coefficient estimate on $PILOT \times During$ is 1.64 (*t*-statistic = 2.03), which is significant at the 5% level. The multivariate regression DID test results from Table 3 are consistent with

Table 2 that corporate investments ($Capex$ and Capex$R\&D$) of pilots firms increase more significantly than control firms in the $During$ period.

[Insert Table 3 Here]

Overall, the results in Table 3 confirm our previous findings using univariate DID tests that managers of firms do react to stock market shocks by changing their investment policies in capital and R&D expenditures. The effect of relaxing margin trading and short selling constraints in the Chinese market is slightly different to that of the "*pure*" short-selling experiment in the US (i.e., the Regulation SHO program). For example, an increase in short-selling activity causes prices to fall, and small firms react to these lower prices by reducing equity issues and investment (Grullon et al. 2015). However, Masa et al. (2015) find that short selling increases R&D investment but reduces capital expenditures. We attribute the difference in our findings to the fact that margin trading dominates the leveraged trading in the Chinese stock market. As shown in Panel C of Table 1, the volume of margin trading is about 100 times as much as that of short selling. Therefore, the policy shock in China is actually a relaxation of margin buy constraints (without much effect from short selling). To substantiate this argument, we will perform pooled OLS regressions by including variables that measure both margin buy and short sell volumes in the next section.

3.2 Pooled OLS regressions on the unbalanced panel sample

As we mentioned in the previous section, the unbalanced panel sample includes more treatment firms as long as these firms participate in the pilot program in any year from 2011 to

2014. To take advantage of a larger sample size of the unbalanced panel, we run pooled OLS regressions on this sample with all firm-year observations. The regression specification is defined as follows:[5]

$$Capex_{i,t}\left(or\ CapexR\&D_{i,t}\right) = \alpha + \beta_1 MarginBuy_{i,t} + \beta_2 Control_{i,t} + \varepsilon_{i,t}, \quad (2)$$

where the dependent variable is $Capex$ or Capex$R\&D$. $MarginBuy$ is the total remaining balance of a firm's margin purchase in RMB at the end of fiscal year *t*, scaled by trading volume. To check robustness, we also use the change in margin buying between year *t*-1 and year *t*, $\Delta MarginBuy = MarginBuy(t) - MarginBuy(t-1)$. The control variables include firm size, market-to-book ratio, profitability, leverage ratio, cash flow, and industry and year fixed effects.

[Insert Table 4 Here]

Table 4 reports the regression results. Columns (1) and (2) show the effect of margin trading on $Capex$. The regression coefficients on $MarginBuy$ and $\Delta MarginBuy$ are 4.02 (*t*-statistic = 2.13) and 4.37 (*t*-statistic = 2.16), respectively. Both are significant at the 5% level. Columns (3) and (4) report the relation between margin trading and Capex$R\&D$. The regression coefficients on $MarginBuy$ and $\Delta MarginBuy$ are both positive and significant at the 5% level with the values of 4.54 (*t*-statistic = 2.10) and 4.84 (*t*-statistics = 2.12), respectively. When we add short selling trading measures into the regression, the results remain qualitatively and quantitatively similar. The coefficient estimates on $MarginBuy$ and $\Delta MarginBuy$ remain

[5] In equation (2), we examine the contemporaneous relation between corporate investments and margin trading. To construct a firm's capital and R&D expenditures, we use the fiscal year-end data. On the right hand side, we use the calendar year-end data to construct the margin trading data. According to the regulations of the CSRC, the listed firms must file the fiscal year report of year *t* before April 30 of year *t*+1. So there is no reverse causality concern in the regression equation. For other control variables, we lagged *Ln*(*TA*), *M/B*, *Profitability*, and *Leverage* by one year except for *Cash flow*.

significantly positive. By contrast, the untabulated result indicates that the coefficients on two short selling measures, $ShortSell$ and $\Delta ShortSell$, are negative but insignificant. The result suggests that the economic magnitude of the effect from short selling is indeed quite small.

Again, the results using pooled OLS regressions are similar to those of difference-in-difference tests reported in the previous sections. However, statistically insignificant coefficients on two short-selling measures do not necessarily mean that the confounding effect of short-selling activity does not bias our findings. While it is admittedly difficult to clearly separate the effect of one from the other as they are often occurring at the same time, we will employ an instrument variables approach to minimize possible confounding of the effect by margin trading in the next subsection.

3.3 The instrument variables of margin trading and short selling

The fraction of stock ownership by leveraged mutual funds could serve as an ideal instrument of margin trading for two reasons. First, the leveraged mutual funds are not related to active control of the managers of a firm, since mutual funds are typically passive investors neither related to activism nor related to information. Second, investors can purchase leveraged mutual funds to meet their sole leverage needs. Therefore, it meets both the exclusion restriction (unrelated to corporate investments except through the margin trading channel) and the inclusion restriction (leveraged mutual funds makes shares available to margin traders). Moreover, there is an interesting institutional feature in China: leveraged mutual funds expand very quickly after 2012, making them invest in almost every company publicly traded in the Chinese stock markets.[6]

[6] Leveraged mutual funds (indirect investing) recently develop very quickly in the Chinese stock market after 2012. The Chinese retail investors can purchase this type of mutual funds like ETFs. Different from margin trading

The two-stage least squares (2SLS) regression specification is defined as follows. In the first stage, we regress $MarginBuy$ or $\Delta MarginBuy$ on leveraged mutual fund ownership and obtain the fitted values for the second stage. In the second stage, the dependent variable is $Capex$ or Capex$R\&D$. We regress $Capex$ and Capex$R\&D$ on the fitted values from the first stage with several control variables.

First stage: $$MarginBuy_{i,t} = \alpha + \beta \times MutualFund_{i,t} + \gamma \times X_{i,t} + \varepsilon_{i,t}, \quad (3)$$

Second stage: $$Capex_{i,t}\left(or\ CapexR\&D_{i,t}\right) = \alpha + \beta \times \widehat{MarginBuy}_{i,t} + \gamma \times X_{i,t} + \varepsilon_{i,t}, \quad (4)$$

where $MarginBuy$ refers to the margin buying measured by $MarginBuy$ or $\Delta MarginBuy$. $MutualFund_{i,t}$ is the fraction of stock ownership by leveraged mutual funds. Other control variables include $Ln(TA)$, M/B, $Profitabiity$, $Leverage$, and $Cash\ flow$.

Table 5 reports the results of 2SLS regressions using leveraged mutual fund ownership (in both the level and change) to instrument for margin trading. From the coefficient estimates in the first stage, we find that the fraction of leveraged mutual fund ownership has statistically significant predictive power for direct margin buying activity. In columns (1) and (3) of Panel A, the coefficients on $MutualFund$ instrumenting for $MarginBuy$ (the level) and $\Delta MarginBuy$ (the change) are 0.0052 (*t*-statistic = 1.69) and 0.0518 (*t*-statistic = 5.55), respectively. Columns (2) and (4) report the results of the second-stage regressions. Clearly, there is a significantly positive relation between margin trading instrumented by leveraged mutual fund ownership ($\widehat{MarginBuy}$) and the level of capital expenditures. The coefficients on $\widehat{MarginBuy}$ and $\Delta\widehat{MarginBuy}$ are 5.34 (*t*-statistic = 2.42) and 7.84 (*t*-statistic = 2.53), both statistically significant at the 5% level. We repeat the same regressions with Capex$R\&D$ as the dependent

requiring an initial balance greater than RMB 500,000, leveraged mutual fund requires a very low initial capital with a minimum purchase of 1,000 shares. From 2012 to 2015, the average fund leverage ratio is around 2, and median fund size is 125 RMB millions. Comparing to direct margin buying, leverage mutual funds are not the main contributor to the Chinese leverage trading market.

variable in the 2SLS specification. The result is reported in Panel B of Table 5. The columns (1) and (2) report the result for instrumenting $MarginBuy$ (the level) and columns (3) and (4) for instrumenting $\Delta MarginBuy$ (the change). Similar to the findings reported in Panel A for $Capex$, the instrumented margin trading variables have a significant impact on Capex$R\&D$. The coefficients on $\widehat{MarginBuy}$ and $\Delta\widehat{MarginBuy}$ are 7.78 (*t*-statistic = 2.10) and 8.58 (*t*-statistic = 2.52). Both are statistically significant at the 5% level.

[Insert Table 5 Here]

Moreover, given the coexistence of the effects from margin buying and short selling on corporate investments, we also consider the use of several instrumental variables for short selling activity: institutional ownership, illiquidity, analyst coverage, and turnover ratio. The $Institutional\ oweship$ instrument is total shareholding percentage owned by institutions in a firm's annual reports. The $Illiquidity$ instrument is based on the measure in Amihud (2002). The $Analsyt\ coverage$ instrument is the number of analysts following the firm appeared in a firm's annual reports. Finally, the $Turnover$ instrument is the cumulative turnover rate with one year. For each instrumental variable, we employ a 2SLS regression using the specification similar to equations (3) and (4). To save space, the results are report in Table A1 of Appendix B. We find that the coefficient estimates in the first stage are all significant (i.e., instruments can predict short selling). However, there is no strong statistical link between short selling instrumented by the aforementioned four variables and corporate investments as measured by $Capex$ (in the first four columns) and Capex$R\&D$ (in the next four columns). Overall, the results

here confirm the significantly positive effect of margin trading on corporate investments after controlling for short selling activity.

4. Further analysis

Finally, we exploit the cross-sectional variation across firms to delve deeper into the underlying mechanisms for the results found in the previous section. The first potential channel is the change in the informativeness of stock prices. After the margin trading ban was lifted in 2010, there is an increase in price efficiency and a decrease in stock return volatility (Chang et al. 2014; Wang and Wei 2017). Clearly, the pilot program enhances the liquidity and the information efficiency of stock prices, which leads to more efficient capital allocation, by providing more relevant information to managers that guide their investment decisions.

The second potential channel is the change in financing cost. Hubbard (1998) suggests that investments of financially constrained firms are less responsive to investment opportunities because external financing is costly. Rajan and Zingales (1998) also find that industry sectors with higher external financing needs grow faster in countries with more developed financial markets. Thus, the benefit of a reduction in external financing costs could be greater for financially constrained firms. In other words, if the pilot program improves capital allocation efficiency by reducing external financing costs and relaxing external financial constraints, we expect that the effect is more pronounced for firms that have a higher degree of financial constraints. We split the full sample into two subsamples: firms with higher financial constraints and firms with lower financial constraints. We use the KZ index in Kaplan and Zingales (1997) and Lamont, Polk, and Saa-Requejo (2001) and the WW index in Whited and Wu (2006) to proxy for the financial constraints that firms face. We repeat our pooled OLS regressions as

shown in Table 4. Compared to firms with low financial constraints, there is a much greater link between margin trading and corporate investments for firms with high financial constraints.

The results are reported in Table 6. Panel A of Table 6 shows the results using the KZ index. We find that the effect of $MarginBuy$ on $Capex$ and Capex$R\&D$ is more double among firms with high financial constraints than among firms with low financial constraints. More specifically, the coefficients on $MarginBuy$ are 2.51 (*t*-statistic = 1.67) for $Capex$ and 3.31 (*t*-statistic = 1.86) for Capex$R\&D$ among firms with a lower degree of financial constraints (specifications 1 and 3). Meanwhile, the coefficients on $MarginBuy$ are 5.64 (*t*-statistic = 2.78) for $Capex$ and 7.61 (*t*-statistic=3.32) for Capex$R\&D$ among firms with higher financially constrained (specifications 5 and 7). The results from $\Delta MarginBuy$ are similar. The coefficients on $\Delta MarginBuy$ are 3.38 (*t*-statistic=2.07) for $Capex$ and 3.05 (*t*-statistic=1.65) for $Capex$ and Capex$R\&D$ among firms with lower financial constraints (specifications 2 and 4). Meanwhile, the coefficients on $\Delta MarginBuy$ are 6.46 (*t*-statistic=2.93) for $Capex$ and 6.16 (*t*-statistic=2.67) for Capex$R\&D$ among firms with higher financially constrained (specifications 6 and 8). Panel B of Table 6 reports the results using the WW index to measure financial constraints. The results are similar. Overall, the results in Table 6 provide evidence supporting the financial constraints as a potential channel to drive our results.

[Insert Table 6 Here]

The third potential channel can be the positive externality that a more informative stock price creates: reducing the cost of debt (Sunder 2004). Thus, a more efficient market price of equity also helps reduce the cost of raising external debt capital. If this is the case that those

firms that are included in the pilot program can raise new debt capital more easily, the managers of pilot firms will be more likely to invest in capital and R&D expenditures. To verify this conjecture, we regress the amount of debt and equity raised after the lift of margin trading bans on firm characteristics. The results are reported in Table 7. The sample is the unbalanced panel that contains all firms that have ever participated in the pilot program during the experiment period from 2011 to 2014. $Debt$ is the net cash flow received from external debt financing. $Equity$ is the net cash flow received from external equity financing. Appendix A provides the detailed definition of debt financing and equity financing. $PILOT$ is a dummy variable that equals to one if a firm is eligible for margin trading in a year and zero otherwise.

[Insert Table 7 Here]

We find that the coefficient on $PILOT$ is positive but insignificant at 14.97 with a *t*-statistic of 0.94 for equity financing (Column 2), and it is positive and statistically significant at the 1% level with a value of 8.46 (*t*-statistic = 2.96) for debt financing (Column 1). Therefore, although the changes in stock market activity do not necessarily affect bond market conditions directly, those firms with their stocks eligible for margin trading are able to raise more debt capital from external sources. On the other hand, there is not much change in the equity financing capabilities. We attribute this finding to the fact that there are still many restrictions on equity financing by the CSRC and issuing debt remains the primary method for raising capital in China.[7]

We further employ the investment-to-Q sensitivity as the investment efficiency measure (Chen, Goldstein, and Jiang 2007; Foucault and Frésard 2012), and study the effect of the pilot

[7] In China, equity financing needs the approval from the CSRC. Moreover, firms need to pass certain conditions before they can apply for equity financing. Moreover, the CSRC often suspends equity financing completely.

program on investment efficiency. We use the previous fiscal year end market-to-book ratio to measure a firm's Tobin' (1969) Q. The D_Pilot variable is an indicator that equals one if a firm is included in the pilot program making its stocks eligible for margin trading. The interaction term of $PILOT \times M/B$ is the main variable of interest and captures the effect of margin trading on the investment-Q sensitivity. It can be interpreted as the degree of change that a firm's Tobin's Q will affect its investment as a response to its stock becoming eligible for margin trading. Both columns of Table 8 show the significantly positive coefficients on $\times M/B$. The result suggests that when firms are selected into the margin trading pilot program, the investment-to-Q sensitivity increases, suggesting that the investment efficiency is improved.

[Insert Table 8 Here]

Overall, the results from robustness tests reported in this section support Bushman and Smith (2001) that more efficient prices lead to more efficient capital allocation through reducing external financing costs and relaxing external financing constraints. When an increase in margin buying activity enhances liquidity, price level, and the informativeness of stock prices, firms react to that by increasing corporate investments and improving investment efficiency.

5. Conclusion

We provide evidence on the real effects of financial markets on corporate policies. More specifically, the effect of a company's stock being allowed to trade on margin (which represents a large fraction of stock market activity) on corporate investments. The effect is relatively under-studied and not well understood, and little is known about the economic channel that links the

stock trading activity to investment activity. We use quasi-exogenous shocks to stock trading activity in the secondary markets—occurring due to a pilot policy that permits trading stocks of a selected number of public traded firms on margin in China—as a quasi-experiment. We show that financial market reforms affect corporate investment. The reform was initially intended to raise the sophistication and depth of the secondary markets. However, it actually also affects the real economy by reducing firms' financing constraints and costs of capital.

The use of exogenous policy events in this study is essential for identifying this effect since secondary market trading activity is endogenous and likely driven by managerial discretion on investments. This is the main weakness in the literature that is mainly based on the cross-sectional study. We instead identify the trigger effect using exogenous policy changes and model the relation between the secondary market activity and corporate investment in a difference-in-differences framework that accounts for firm heterogeneity. By doing so, we are able to find a cleaner causal effect of margin trading on both capital and R&D investments.

To better understand the underlying economic drivers of this result, we investigate whether the Chinese pilot program helps capital allocation by reducing external financing costs and in turn giving managers more investment flexibility. As shown by Chang et al. (2014) and Wang and Wei (2017), stock price efficiency does improve and return volatility decreases after the trading ban on margin trading was lifted in China. Indeed, we find that the magnitude of the effect is greater among firms that have a higher degree of financing constraints. Not only the do firms' stock prices rise, but also the firms included in the pilot program are more likely to raise external debt. Hence, firms with equity that can be traded on margin are willing to increase their long-term investment in both intangible and tangible assets (e.g., R&Ds and fixed capital

expenditures). It is consistent with the idea that the acquisition of knowledge from the stock market enables managers to make "informed" corporate policy choices.

Our findings have profound policy implications for secondary financial markets, especially in emerging economies. The reason for financial reforms to make stock markets more efficient, by allowing margin trading and short selling, is rooted in the fact that the liberalization should enhance equity market liquidity and relax financing constraints, which, in turn, improve capital allocation efficiency. Moreover, restrictions on margin borrowing may lead to investors' excessive demand for risky assets (Frazzini and Pedersen, 2014). As a result, the dark side of marginal trading can result in excessive margin borrowing that may destabilize the market due to liquidity dry-up during market downturns (Brunnermeier and Pedersen, 2009). Therefore, one should not be surprised to see that informative speculators are often blamed for producing excess volatility and destabilizing the market (e.g., Bian, He, Shue, and Zhou, 2017).

While we demonstrate that margin trading in financial markets does have an effect on business investment inside the firm, it is silent on mechanisms that are not related to financing constraints or costs of capital. It is plausible that financial market activities have an effect because managers overreact to them, and, as a result, rely on them too over-optimistic to make investment decisions. For example, a possible mechanism is that margin trading signals overall optimistic investment opportunities in the sector and managers are able to identify them and simply follow suit. While our analysis is able to identify the causal effect of financing constraints on real investment, we are only able to estimate the effects for individual firms as a whole, rather than allow these effects to depend on individual managerial characteristics such as professional experience, political connection, and ownership incentives, due to limitations of the data. In

future research, it would be interesting to extend our analysis to study the executive-level determinants of these effects such as management “style” in Bertrand and Schoar (2003).

References

Alexander, G. J., and Peterson, M. A., 2008, The effect of price tests on trader behavior and market quality: An analysis of Reg SHO, *Journal of Financial Markets* 11, 84–111.

Amihud, Yakov, 2002, Illiquidity and stock returns: Cross-section and time-series effects, *Journal of Financial Markets* 5, 31-56.

Bakke, T. E., Whited, T.M, 2010, Which firms follow the market? An analysis of corporate investment decisions, *Review of Financial Studies* 23, 1941–1980.

Bekaert G., and C. Harvey, 2000, Foreign speculators and emerging equity markets, *Journal of Finance* 55, 565-613.

Bekaert G., C. Harvey, and C. Lundblad, 2005, Does financial liberalization spur growth, *Journal of Financial Economics* 77, 3-55.

Bertrand, M. and A. Schoar, 2003, Managing with Style: The effect of managers on firm policies, *Quarterly Journal of Economics* 118, 1169–1208.

Bian, Jiangze, Zhiguo He, Kelly Shue, and Hao Zhou, 2017, Leverage-induced fire sales and stock market crashes, Working Paper.

Bolton, P., and D.S. Scharfstein, 1990, A theory of predation based on agency problems in financial contracting, *American Economic Review* 80, 93−106.

Bond, P., Edmans, A., and Goldstein, I., 2012, The real effects of financial markets, *Annual Review of Financial Economics* 4, 339-360.

Botosan, Christine A., 1997, Disclosure level and the cost of equity capital, *Accounting Review* 72, 323–349.

Bushman, R., Smith, A., 2001, Financial accounting information and corporate governance, *Journal of Accounting and Economics* 32, 237-333.

Carpenter, J. N., F. Lu, and R. F. Whitelaw, 2018, The real value of China's stock market, NYU Stern Working Paper.

Chang, Eric C., Yan Luo, and Jinjuan Ren, 2014, Short-selling, margin-trading, and price efficiency: Evidence from the Chinese market, *Journal of Banking and Finance* 48, 411-424.

Chang C., and X. Yu, 2010, Informational efficiency and liquidity premium as the determinants of capital structure, *Journal of Financial and Quantitative Analysis* 45, 401–440.

Chen, Q., I. Goldstein, and W. Jiang, 2007, Price informativeness and investment sensitivity to stock price, *Review of Financial Studies* 20, 619–650.

Demirguc-Kunt, A., and V. Maksimovic, 1998, Law, finance, and firm growth, *Journal of Finance* 53, 2107-2137.

Deng, Xiaohu and Sandra Mortal, 2017, The real effects of short selling constraints: Cross-country evidence, working paper.

Derrien, F, and A Kecskés, 2013, The real effects of financial shocks: Evidence from exogenous changes in analyst coverage, *Journal of Finance* 68, 1407–1440

Diamond, DouglasW., 1985, Optimal release of information by firms, *Journal of Finance* 40, 1071–1094.

Diether, K. B., Lee, K. H., and Werner, I. M., 2009, It's SHO time! Short-sale price tests and market quality, *Journal of Finance* 64, 37–73.

Easley, David, and Maureen O'Hara, 2004, Information and the cost of capital, *Journal of Finance* 59, 1553–1583.

Edmans A., Goldstein, I., and Jiang, W., 2012, The real effects of financial markets: the impact of prices on takeovers, *Journal of Finance* 67, 933–971.

Fang. V.W., Huang A., and Karpoff J., 2016, Short selling and earnings management: A controlled experiment, *Journal of Finance* 71, 1251-1294.

Fazzari, S. M., R. G. Hubbard, and B. C. Petersen, 1988, Financing Constraints and Corporate Investment, *Brookings Papers on Economic Activity* 1, 141-195.

Foucault, T., and L. Frésard, 2012, Cross-listing, investment sensitivity to stock price, and the learning hypothesis, *Review of Financial Studie*s 25, 3305–3350.

Frazzini, A., and L. H. Pedersen, 2014, Betting against beta, *Journal of Financial Economics* 111, 1-25.

Galindo, A., F. Schiantarelli, and A. Weiss, 2007, Does financial liberalization improve the allocation of investment? Micro-evidence from developing countries, *Journal of Development Economics* 83, 562-587.

Grullon, G., Michenaud, S., and Weston, J., 2015, The real effects of short-selling constraints, *Review of Financial Studies* 28, 1737–1767.

Hart, O., and J. Moore, 1998, Default and renegotiation: a dynamic model of debt, *Quarterly Journal of Economics* 113, 1−41.

Henry, P. B., 2000, Stock market liberalization, economic reform and emerging market equity prices, *Journal of Finance* 55, 529-564.

Holmström, B., and J. Tirole, 1993, Market liquidity and performance monitoring, *Journal of Political Economy* 101, 678-709.

Hubbard, G., 1988, Capital market imperfections and investment, *Journal of Economic Literature* 36, 193-225.

Hubbard, R. G., A. K. Kashyap, and T. M. Whited, 1995, Internal finance and firm investment, *Journal of Money, Credit and Banking* 27, 683-701.

Kaplan, S., Zingales, L., 1997, Do investment-cash flow sensitivities provide useful measures of financing constraints? , *Quarterly Journal of Economics* 112, 169-215.

Kecskés, A., Mansi, S. A., and Zhang, A., 2013, Are short sellers informed? Evidence from the bond market, *The Accounting Review* 88, 611–639.

Kyle, A. S. 1985, Continuous auctions and insider trading, *Econometrica* 53, 1315–1336.

Lamont, Owen, Christopher Polk, and Jesus Saa-Requejo, 2001, Financial constraints and stock returns, *Review of Financial Studies* 14, 529–554.

Leaven, L., 2003, Does financial liberalization reduce financing constraints? *Financial Management*, Spring, 5-31.

Lesmond, D., P. O'Connor, and L. Senbet, 2008, Capital structure and equity liquidity, Working Paper, Tulane University and University of Maryland.

Lucas, Deborah J., and Robert L. McDonald, 1990, Equity issues and stock price dynamics, *Journal of Finance* 45, 1019–1043.

Massa, Massimo, Bohui Zhang, and Hong Zhang, 2015, The invisible hand of short selling: Does short-selling discipline earnings management? *Review of Financial Studies* 28, 1701-1736.

Massa, Massimo, Wenlan Qian, Weibiao Xu, and Hong Zhang, 2015, Competition of the informed: does short selling affect insider trading, *Journal of Financial Economics* 118, 268-288.

Massa, Massimo, Fei Wu, Bohui Zhang, and Hong Zhang, 2015, Saving long-term investment from short-termism: the surprising role of short selling, working paper.

Merton, Robert C., 1987, A simple model of capital market equilibrium with incomplete information, *Journal of Finance* 42, 483–510.

Modigliani, Franco, and Merton H. Miller, 1958, The cost of capital, corporation finance and the theory of investment, *American Economic Review* 48, 261–297.

Myers, Stewart C., and Nicholas Majluf, 1984, Corporate financing and investment decisions when firms have information that investors do not have, *Journal of Financial Economics* 13, 187–221.

Rajan, R., Zingales, L., 1998. Financial dependence and growth, *American Economic Review* 88, 559–586.

Stein, J. C., 2001, Agency, information, and corporate investment, Handbook of the Economics of Finance (George Constantinides, Milton Harris, and Rene Stulz, eds.), North-Holland, Amsterdam.

Stiglitz, Joseph E., and Andrew Weiss, 1981, Credit rationing in markets with imperfect information, *American Economic Review* 71, 393–410.

Sunder, J., 2004, Information spillovers and capital structure: Theory and evidence, New York University Dissertation.

Tobin, J, 1969, A general equilibrium approach to monetary theory, *Journal of Money, Credit and Banking* 1, 15–29.

Wang, Shujing and K.C. John Wei, 2017, Borrowing constraints and asset prices: evidence from the Chinese Stock market, working paper.

Whited, T., and G. Wu, 2006, Financial constraints risk, *Review of Financial Studies* 19, 531–559.

Wurgler, J., 2000, Financial markets and the allocation of capital, *Journal of Financial Economics* 58, 187-214.

Appendix A: Variable definition

Dependent variables	
$Capex$	Capital expenditure divided by its total assets at the end the previous fiscal year, multiplied by 100.
$CapexR\&D$	The sum of capital expenditures and research and development expenses divided by its total assets at the end the previous fiscal year, multiplied by 100.

Experiment-related Variables	
$Pilot$	A dummy variable that equals to 1 if a firm's stock is designated as a pilot stock in the margin trading program.
$Pre\text{-}program$	A dummy variable that equals to 1 if a firm's fiscal year end falls between 2006 and 2009 and zero otherwise.
$During$	A dummy variable that equals to 1 if a firm's fiscal year end falls between 2011 and 2014 and zero otherwise.
$MarginBuy$	Total remaining balance in RMB of a firm's margin buying at the end of fiscal year *t*, as a percentage of total RMB trading volume during year *t*.
$\Delta MarginBuy$	The change in $MarginBuy$ between year *t* and year *t*-1: $\Delta MarginBuy1(t) = MarginBuy(t) - MarginBuy(t\text{-}1)$.
$ShortSell$	Total remaining balance in RMB of a firm's short selling at the end of fiscal year *t*, as a percentage of total RMB trading volume during year *t*.
$\Delta ShortSell$	The change in $ShortSell$ between year *t* and year *t*-1: $\Delta ShortSell(t) = ShortSell(t) - ShortSell(t\text{-}1)$.

Firm Characteristics	
$Ln(TA)$	Natural logarithm of a firm's total assets in billions of RMB at the end of the previous fiscal year.
M/B	The market value of equity plus book value of total assets minus the book value of equity minus deferred taxes, scaled by the book value of total assets.
$Profitability$	Ratio of operating income before depreciation and amortization to total assets.
$Leverage$	Long-term debt plus debt in current liabilities divided by the sum of long-term debt, debt in current liabilities, and stockholders' equity.
$Cash\ flow$	Net income before extraordinary items plus depreciation and amortization expenses divided by total assets.

Explanation-related variables	
$KZ\ index$	The Kaplan and Zingales (1997) index of financial constraints, defined following Lamont, Polk, and Saa-Requejo (2001) as: $KZ\ index = -1.001909CF_{i,t} + 3.139193TLTD_{i,t} - 39.36780TDIV_{i,t} - 1.314759CASH_{i,t} + 0.282639Q_{i,t},$ where $CF_{i,t}$ is the ratio of cash flow to total assets; $TLTD_{i,t}$ is the ratio of long-term debt to

	total assets; $TDIV_{i,t}$ is the ratio of total dividends to assets; $CASH_{i,t}$ is the ratio of liquid assets to total assets; $Q_{i,t}$ is Tobin's q.
$WW\ index$	The WW Index is from Whited and Wu (2006) and is defined as: $WW\ index = -0.091CF_{i,t} + 0.021TLTD_{i,t} - 0.062DIVPOS_{i,t} - 0.044LNTA_{i,t} + 0.102ISG_{i,t} - 0.035SG_{i,t}$, where $CF_{i,t}$ is the ratio of cash flow to total assets; $TLTD_{i,t}$ is the ratio of long-term debt to total assets; $DIVPOS_{i,t}$ is an indicator that equals one if the firm pays cash dividends and zero otherwise; $LNTA_{i,t}$ is the natural log of total assets; $ISG_{i,t}$ is the firm's industry sales growth. $SG_{i,t}$ is the firm's sales growth
$Debt$	Net cash flow received from external debt financing and defined as: $Debt_t = (\Delta LTD_t + \Delta LTN_t - \Delta STD_t) \times 100/ATA_{t-1}$, where ΔLTD_t is the change in long-term debt; ΔLTN_t is the change in long-term notes; ΔSTD_t is the change in total short-term debt; and ATA_{t-1} is the average of the beginning and ending total assets of the reporting year.
$Equity$	Net cash flow received from external equity financing and defined as: $Equity_t = (\Delta CST_t + \Delta CSurplus_t) \times 100/ATA_{t-1}$, where ΔCST_t is the change in common stock; $\Delta CSurplus_t$ is the change in capital surplus; and ATA_{t-1} is the average of the beginning and ending total assets of the reporting year.

Instrument-related Variables

$MutualFund$	Annual average holdings by leverage mutual funds as a percentage of total number of shares outstanding.
$Institution$	Percentage of total shareholdings owned by institutions in the firm's annual reports.
$Illiquidity$	The Amihud illiquidity measure and defined as: $Illiquidity_{i,t} = \frac{10^9}{D_t}\sum_{d=1}^{D_t}\frac{\lvert R_{i,d}\rvert}{DVOL_{i,d}}$, where $R_{i,d}$ is the return for stock *i* on day *d*, $DVOL_{i,d}$ is the daily dollar trading volume in millions on day *d*, and D_t is the number of trading days in year *t*. The arbitrary scaling by 10^9 to simply generates a convenient magnitude of the illiquidity measure.
$Coverage$	Analysts coverage and defined as the number of analysts following a firm appeared in the firm's annual reports.
$Turnover$	Annual share turnover measured as a percentage of total shares outstanding.

Appendix B
Table A1: Two-stage least squares regressions using instrument variables of short selling

This table reports the two-stage least squares regressions, using firms of the pilot group in the unbalanced panel. The pilot group in the unbalanced panel contains firms participating in the pilot program in certain years from 2011 to 2014. We employ institutional ownership, Amihud illiquidity, analyst coverage, and turnover as instrumental variables for short selling. In the first stage, we regress $ShortSell$ (or $\Delta ShortSell$) on institutional ownership (in Panel A), on the Amihud illiquidity (in Panel B), on analyst coverage (in Panel C), and on annual turnover (in Panel D) and obtain fitted values for $ShortSell$ and $\Delta ShortSell$ (i.e., $\widehat{ShortSell}_{i,t}$ and $\Delta\widehat{ShortSell}_{i,t}$). In the second stage, dependent variable is $Capex_{i,t}$ or $CapexR\&D_{i,t}$. We regress $Capex_{i,t}$ or $CapexR\&D_{i,t}$ on margin trading, $\widehat{ShortSell}_{i,t}$ (or $\Delta\widehat{ShortSell}_{i,t}$), and control variables. $Capex$ is the capital expenditures and $CapexR\&D$ is the sum of capital expenditures and research and development expenses. Both $Capex$ and $CapexR\&D$ are the percentage of the total assets of the previous fiscal year end. $MarginBuy$ is the total outstanding RMB amount of marginal buying at the end of year *t*, as a percentage of total RMB trading volume during year *t*; $\Delta MarginBuy$ is the change in $MarginBuy$ from year *t*-1 to year *t*, defined as : $\Delta MarginBuy(t) = MarginBuy(t) - MarginBuy(t\text{-}1)$. $ShortSell$ is the total outstanding RMB amount of short selling at the end of year *t*, as a percentage of total RMB trading volume during year *t*; $\Delta ShortSell$ is the change in $ShortSell$ from year *t*-1 to year *t*, defined as : $\Delta ShortSell(t) = ShortSell(t) - ShortSell(t\text{-}1)$. We multiply $ShortSell$ and $\Delta ShortSell$ by 100. The two-stage regression model is as follows:

First stage: $ShortSell_{i,t} = \alpha + \beta \times Instrument_{i,t} + \gamma \times X_{i,t} + \varepsilon_{i,t}$,

Second stage: $Capex_{i,t}\left(or\ CapexR\&D_{i,t}\right) = \alpha + \beta_1 \times \widehat{ShortSell}_{i,t} + \beta_2 \times Margin_{i,t} + \gamma \times X_{i,t} + \varepsilon_{i,t}$,

Control variables include $Ln(TA)$, M/B, $Profitabiity$, $Leverage$, and $Cash\ flow$. Appendix A provides the detailed definitions of these control variables. Standard errors are clustered at the firm level in all specifications. The *t*-statistics of coefficient estimates are displayed in parentheses. ***, **, * indicated significance at the 1%, 5% and 10% levels.

Panel A. Institutional ownership as instrument variable of short selling

Dependent Variable	1st stage $ShortSell$	2nd stage Capex	1st stage $\Delta ShortSell$	2nd stage Capex	1st stage $ShortSell$	2nd stage CapexR&D	1st stage $\Delta ShortSell$	2nd stage CapexR&D
Institutional Ownership	0.0011***		0.0018***		0.0011***		0.0018***	
	(7.47)		(4.80)		(7.47)		(4.80)	
$ShortSell$		-3.01				-3.49		
		(-0.49)				(-0.52)		
$MarginBuy$		**2.25****				**2.76****		
		(2.11)				**(2.32)**		
$\Delta ShortSell$				-1.48				-2.41
				(-0.29)				(-0.43)
$\Delta MarginBuy$				**2.12****				**2.77**
				(2.05)				**(2.30)**
Ln(TA)	0.0448***	-5.64***	0.0369***	-5.29***	0.0448***	-5.24***	0.0369***	-5.25***
	(7.94)	(-6.38)	(4.66)	(-3.48)	(7.94)	(-5.50)	(4.66)	(-3.17)
M/B	0.0245***	0.30	0.0171*	0.33	0.0245***	0.11	0.0171*	0.17
	(11.48)	(1.38)	(1.76)	(1.54)	(11.48)	(0.50)	(1.76)	(0.73)
Profitability	0.0011	0.65	-0.0064	0.53	0.0011	0.33	-0.0064	0.22
	(0.33)	(1.30)	(-0.52)	(1.09)	(0.33)	(0.61)	(-0.52)	(0.41)
Leverage	-0.0538***	-6.84***	-0.1374*	-7.64***	-0.0538***	-7.91***	-0.1374*	-8.75***
	(-3.72)	(-2.83)	(-1.96)	(-3.04)	(-3.72)	(-3.04)	(-1.96)	(-3.20)
Cash Flow	0.0080	3.66*	0.1085	4.09*	0.0080	5.69**	0.1085	5.86**
	(0.16)	(1.67)	(0.79)	(1.90)	(0.16)	(2.41)	(0.79)	(2.50)
Industry and Year fixed effects	YES	YES	YES	YES	YES	YES	YES	YES
Obs	1271	1271	1271	1271	1271	1271	1271	1271
adj. R2	0.411	0.118	0.491	0.152	0.413	0.104	0.087	0.114

Panel B. Amihud illiquidity as instrument variable of short selling

Dependent Variable	1st stage $ShortSell$	2nd stage Capex	1st stage $\Delta ShortSell$	2nd stage Capex	1st stage $ShortSell$	2nd stage CapexR&D	1st stage $\Delta ShortSell$	2nd stage CapexR&D
Amihud	-0.0378***		-0.3634***		-0.0378***		-0.3634***	
	(-3.18)		(-4.43)		(-3.18)		(-4.43)	
$ShortSell$		-2.55				-2.12		
		(-1.07)				(-1.01)		
$MarginBuy$		**5.10****				**5.13*****		
		(2.38)				**(2.62)**		
$\Delta ShortSell$				-6.03*				-9.81*
				(-1.76)				(-1.83)
$\Delta MarginBuy$				**10.50****				**12.51*****
				(2.56)				**(2.73)**
Ln(TA)	0.0455***	-7.14***	0.0134	-0.63*	0.0455***	-6.75***	0.0134	0.25
	(10.45)	(-6.18)	(1.45)	(-1.79)	(10.45)	(-5.49)	(1.45)	(0.64)
M/B	0.0308***	0.09	0.0139	0.39	0.0308***	-0.09	0.0139	0.46
	(15.35)	(0.35)	(1.16)	(1.23)	(15.35)	(-0.34)	(1.16)	(1.32)
Profitability	0.0035	0.95	0.0045	1.28***	0.0035	0.63	0.0045	1.90***
	(0.86)	(1.64)	(0.33)	(3.02)	(0.86)	(1.03)	(0.33)	(4.03)
Leverage	-0.0517***	-5.68**	-0.0978	-0.01	-0.0517***	-6.74**	-0.0978	-0.60
	(-3.23)	(-2.04)	(-1.45)	(-0.00)	(-3.23)	(-2.28)	(-1.45)	(-0.28)
Cash Flow	0.0259	4.68*	0.1543	30.51***	0.0259	6.71**	0.1543	33.54***
	(0.41)	(1.85)	(1.26)	(9.04)	(0.41)	(2.50)	(1.26)	(8.91)
Industry and Year fixed effects	YES	YES	YES	YES	YES	YES	YES	YES
Obs	1271	1271	1271	1271	1271	1271	1271	1271
adj. R2	0.424	0.122	0.413	0.062	0.410	0.075	0.413	0.050

Panel C. Analyst coverage as instrument variable of short selling

Dependent Variable	1st stage $ShortSell$	2nd stage Capex	1st stage $\Delta ShortSell$	2nd stage Capex	1st stage $ShortSell$	2nd stage CapexR&D	1st stage $\Delta ShortSell$	2nd stage CapexR&D
Analyst coverage	0.0003***		0.0003***		0.0003***		0.0003***	
	(4.42)		(4.56)		(4.42)		(4.56)	
$ShortSell$		-4.13				-4.05		
		(-1.49)				(-1.13)		
$MarginBuy$		**11.33****				**10.22****		
		(2.04)				**(2.01)**		
$\Delta ShortSell$				-3.37*				-6.96*
				(-1.57)				(-1.88)
$\Delta MarginBuy$				**6.68****				**8.11****
				(2.01)				**(2.35)**
Ln(TA)	0.0338***	-1.80	0.0281**	-1.37	0.0338***	-0.40	0.0281**	-0.14
	(4.90)	(-0.89)	(2.87)	(-0.60)	(4.90)	(-0.17)	(2.87)	(-0.05)
M/B	0.0251***	0.82**	0.0228	0.11	0.0251***	0.78*	0.0228	0.12
	(11.20)	(2.20)	(1.54)	(0.32)	(11.20)	(1.75)	(1.54)	(0.29)
Profitability	-0.0025	0.12	-0.0083	0.61	-0.0025	-0.64	-0.0083	0.32
	(-0.85)	(0.15)	(-0.64)	(0.78)	(-0.85)	(-0.70)	(-0.64)	(0.34)
Leverage	-0.0306*	9.80***	-0.1153	-5.13	-0.0306*	-11.64***	-0.1153	-5.47
	(-1.96)	(2.71)	(-1.76)	(-1.28)	(-1.96)	(-2.71)	(-1.76)	(-1.14)
Cash Flow	-0.0195	1.06	0.1197	4.37	-0.0195	2.41	0.1197	6.23
	(-0.33)	(0.32)	(0.94)	(1.26)	(-0.33)	(0.62)	(0.94)	(1.50)
Industry and Year fixed effects	YES	YES	YES	YES	YES	YES	YES	YES
Obs	1271	1271	1271	1271	1271	1271	1271	1271
adj. R2	0.438	0.069	0.488	0.184	0.438	0.017	0.488	0.018

Panel D. Annual turnover as instrument variable of short selling

Dependent Variable	1st stage $ShortSell$	2nd stage Capex	1st stage $\Delta ShortSell$	2nd stage Capex	1st stage $ShortSell$	2nd stage CapexR&D	1st stage $\Delta ShortSell$	2nd stage CapexR&D
Turnover	0.0035***		0.0099***		0.0035***		0.0099***	
	(6.13)		(4.17)		(6.13)		(4.17)	
$ShortSell$		-4.61*				-4.99		
		(-1.88)				(-1.11)		
$MarginBuy$		**5.80****				**4.57****		
		(2.09)				**(2.02)**		
$\Delta ShortSell$				-4.44				-6.38
				(-0.57)				(-0.57)
$\Delta MarginBuy$				**9.08*****				**11.59*****
				(2.59)				**(2.58)**
Ln(TA)	0.0419***	-6.69***	0.0620***	-5.77	0.0419***	-6.56***	0.0620***	7.62
	(9.39)	(-6.56)	(4.65)	(-0.31)	(9.39)	(-5.86)	(4.65)	(0.35)
M/B	0.0304***	0.15	0.0362**	0.29	0.0304***	0.07	0.0362**	0.55
	(15.71)	(0.64)	(2.41)	(0.23)	(15.71)	(0.25)	(2.41)	(0.37)
Profitability	0.0037	0.86	-0.0019	0.75	0.0037	0.59	-0.0019	0.47
	(0.93)	(1.58)	(-0.18)	(0.39)	(0.93)	(0.99)	(-0.18)	(0.22)
Leverage	-0.0478***	6.03**	-0.1651**	-0.55	-0.0478***	6.89**	-0.1651**	-0.49
	(-3.11)	(2.30)	(-2.49)	(-0.04)	(-3.11)	(2.39)	(-2.49)	(-0.03)
Cash Flow	0.0260	4.37*	0.1708	4.88	0.0260	6.58**	0.1708	6.78
	(0.48)	(1.84)	(1.55)	(0.58)	(0.48)	(2.52)	(1.55)	(0.70)
Industry, Year Fes	YES	YES	YES	YES	YES	YES	YES	YES
N	1271	1271	1271	1271	1271	1271	1271	1271
Adj. R^2	0.432	0.114	0.488	0.174	0.432	0.057	0.488	0.076

Table 1: Summary statistics of firm characteristics and margin trading

This table reports the summary statistics of firm characteristics and margin trading for the balanced and unbalanced panels. The pilot group in the balanced panel contains firms consecutively participating in the pilot program each year from 2011 to 2014. The control group in the balanced panel contains firms never participating in the pilot program. The pilot group in the unbalanced panel contains firms participating in the pilot program in certain years after 2011. $Capex$ is the capital expenditures and $CapexR\&D$ is the sum of capital expenditures and research and development expenses. Both $Capex$ and $CapexR\&D$ are the percentage of the total assets of the previous fiscal year end. *Ln(TA*) is the log of firm's total assets in billions of RMB of the previous fiscal year end; *M/B* is firm's market value of equity plus book value of assets minus book value of equity minus deferred taxes, scaled by book value of total assets; *Profitability* is a previous fiscal year end ratio of operating income before depreciation and amortization to start-of-year total assets; *Leverage* is firm's long term debt plus debt in current liabilities scaled by the sum of long term debt, debt in current liabilities, and total stockholders' equity; *Cash flow* is firm's net income before extraordinary items plus depreciation and amortization expenses, scaled by start-of-year total assets. $MarginBuy$ is the total outstanding RMB amount of marginal buying at the end of year *t*, as a percentage of total RMB trading volume during year *t*; $\Delta MarginBuy$ is the change in $MarginBuy$ from year *t*-1 to year *t*, defined as : $\Delta MarginBuy(t) = MarginBuy(t) - MarginBuy(t\text{-}1)$. $ShortSell$ is the total outstanding RMB amount of short selling at the end of year *t*, as a percentage of total RMB trading volume during year *t*; $\Delta ShortSell$ is the change in $ShortSell$ from year *t*-1 to year *t*, defined as : $\Delta ShortSell(t) = ShortSell(t) - ShortSell(t\text{-}1)$. We multiply $ShortSell$ and $\Delta ShortSell$ by 100. The sample requires a firm to have available data to calculate firm characteristics in the entire sample period (i.e. 2006-2014). All variables are winsorized at 2.5% and 97.5% levels.

Panel A and Panel B display the summary statistics of firm characteristics in the pilot group and control group of the balanced panel before the pilot program (2006-2009), and during the pilot program (20011-2014), where the pilot group consists of firms consecutively participating in the pilot program each year from 2011 to 2014. Panel C displays the summary statistics of the margin trading measures and firm characteristics of the pilot group of the unbalanced panel during the pilot program (2011-2014), where the pilot group consists of firms participating in the pilot program in certain years from 2011 to 2014.

Panel A. Firm characteristics of pilot and control groups before the pilot program (2006-2009)

	Pilot Group					Control Group				
	mean	std	P25	median	P75	mean	std	P25	median	P75
Capex	11.349	16.596	3.123	7.308	13.099	6.751	8.937	1.568	4.037	8.647
CapexR&D	11.736	16.619	3.195	7.915	14.377	6.873	8.967	1.634	4.182	8.853
Ln(TA)	8.826	1.169	8.087	8.723	9.372	7.462	0.964	6.828	7.417	8.020
M/B	1.540	2.259	0.259	0.765	1.965	1.006	1.386	0.197	0.537	1.301
Profitability	1.026	0.951	0.467	0.791	1.264	0.857	0.800	0.433	0.683	1.051
Leverage	0.514	0.186	0.396	0.512	0.648	0.503	0.703	0.372	0.517	0.629
Cash Flow	0.099	0.178	0.030	0.087	0.168	0.063	0.113	0.013	0.057	0.111

Panel B. Firm characteristics of pilot and control groups during the pilot program (2011-2014)

	Pilot Group					Control Group				
	mean	std	P25	median	P75	mean	std	P25	median	P75
Capex	11.776	21.429	3.339	7.464	13.429	6.871	28.445	1.439	3.676	7.486
CapexR&D	12.069	21.522	4.054	9.912	14.795	6.912	28.776	1.950	4.787	9.047
Ln(TA)	9.948	1.157	9.191	9.850	10.665	8.082	1.139	7.344	8.068	8.786
M/B	1.005	1.467	0.181	0.522	1.250	1.167	1.534	0.275	0.662	1.509
Profitability	0.884	0.733	0.406	0.729	1.071	1.123	6.453	0.427	0.696	1.071
Leverage	0.523	0.186	0.416	0.543	0.668	0.522	0.277	0.363	0.520	0.665
Cash Flow	0.065	0.093	0.015	0.061	0.115	0.064	0.667	-0.005	0.040	0.090

Panel C. Firm characteristics and margin trading of pilot group during the pilot program (unbalanced panel)

Variable	Mean	Std Dev	P25	Median	P75
Capex	11.912	15.788	3.972	6.823	13.113
CapexR&D	10.377	16.176	2.936	7.440	12.142
Ln(TA)	9.339	1.078	8.556	9.306	10.166
M/B	1.047	1.400	0.221	0.576	1.322
Profitability	1.083	2.421	0.444	0.743	1.124
Leverage	0.517	0.189	0.391	0.534	0.659
Cash Flow	0.072	0.175	0.010	0.053	0.113
$MarginBuy$	0.111	0.084	0.054	0.090	0.149
$\Delta MarginBuy$	0.017	0.627	-0.104	0.031	0.069
$ShortSell$	0.078	0.107	0.009	0.032	0.103
$\Delta ShortSell$	0.002	0.398	-0.024	0.004	0.039

Table 2: Difference-in-Difference tests of capital and R&D expenditures

This table reports the statistics of capital and R&D expenditures of the pilot and control groups in the balanced panel. The pilot group contains firms consecutively participating in the pilot program each year from 2011 to 2014. The control group contains firms never participating in the pilot program. $Capex$ is the capital expenditures and $CapexR\&D$ is the sum of capital expenditures and research and development expenses. Both $Capex$ and $CapexR\&D$ are the percentage of the total assets of the previous fiscal year end. The sample requires a firm to have available data to calculate firm capital and R&D expenditures in the entire sample period (i.e. 2006-2014). ***, **, * indicated significance at the 1%, 5% and 10% levels.

Panel A. Difference-in-difference test of Capex before and during the pilot program

	Pilot Group (PILOT=1)		Control Group (PILOT=0)		Test for difference
Variable of interest	obs	mean	obs	Mean	Mean *t*-stat
Capex					
Pre(06-09)	150	11.349	844	6.751	4.598*** (3.31)
During(11-14)	150	11.776	844	6.871	4.905** (2.45)
During-Pre	150	0.427	844	0.120	0.307*** (2.80)

Panel B. Difference-in-difference test of CapexR&D before and during the pilot program

	Treatment Group (PILOT=1)		Control Group (PILOT=0)		Test for differences
Variable of interest	obs	Mean	obs	Mean	Mean *t*-stat
CapexR&D					
Pre(06-09)	150	11.736	844	6.873	4.863*** (3.49**)**
During(11-14)	150	12.069	844	6.912	5.157** (2.56)
During-Pre	150	0.333	844	0.039	0.294*** (2.59)

Table 3: Multivariate difference-in-difference tests of capital and R&D expenditures

This table performs the multivariate difference-in-difference tests. The table reports the regression results of capital and R&D expenditures of pilot and control firms before and during the pilot program. The pilot group contains firms consecutively participating in the pilot program each year from 2011 to 2014. The control group contains firms never participating in the pilot program. $Capex$ is the capital expenditures and $CapexR\&D$ is the sum of capital expenditures and research and development expenses. Both $Capex$ and $CapexR\&D$ are the percentage of the total assets of the previous fiscal year end. *PILOT* is a dummy variable that equals to 1 if a firm belongs to pilot group. *DURING* is a dummy variable that equals to 1 if a firm's fiscal year falls between 2011 and 2014. Control variables include *Ln(TA)*, *M/B*, *Profitability*, *Leverage*, and *Cash flow*. Appendix A provides the detailed definitions of these control variables. The sample requires a firm to have available data to calculate capital and R&D expenditures in the entire sample period (i.e. 2006-2014). Standard errors are clustered at the firm level in all specifications. The *t*-statistics of coefficient estimates are displayed in parentheses. ***, **, * indicated significance at the 1%, 5% and 10% levels.

	(1)	(2)	(3)	(4)
Dependent Variable	Capex	Capex	CapexR&D	CapexR&D
PILOT*During	1.69**	1.50**	1.94**	1.64**
	(2.00)	(2.11)	(2.32)	(2.03)
PILOT	4.29***	1.28***	4.50***	1.38***
	(4.13)	(2.78)	(4.40)	(3.17)
During	-1.37***	2.46***	0.00	-1.12
	(-4.40)	(2.81)	(0.01)	(-1.43)
Ln(TA)		-3.76**		-0.75
		(-2.18)		(-1.15)
M/B		1.85***		1.97***
		(2.58)		(2.77)
Profitability		-0.48		-0.68
		(-0.52)		(-0.77)
Leverage		-3.94*		-3.47
		(-1.73)		(-1.52)
Cash Flow		35.22***		36.59***
		(4.52)		(4.72)
Industry effects	YES	YES	YES	YES
obs	7952	7952	7952	7952
adj. R^2	0.023	0.172	0.022	0.154

Table 4: The effects of margin trading on capital and R&D expenditures

This table reports the results of pooled regressions with fixed effect, using data of the pilot group in the unbalanced panel. The pilot group in the unbalanced panel contains firms participating in the pilot program in certain years from 2011 to 2014. $Capex$ is the capital expenditures and $CapexR\&D$ is the sum of capital expenditures and research and development expenses. Both $Capex$ and $CapexR\&D$ are the percentage of the total assets of the previous fiscal year end. $MarginBuy$ is the total outstanding RMB amount of marginal buying at the end of year *t*, as a percentage of total RMB trading volume during year *t*; $\Delta MarginBuy$ is the change in $MarginBuy$ from year *t*-1 to year *t*, defined as : $\Delta MarginBuy(t) = MarginBuy(t) - MarginBuy(t\text{-}1)$. Control variables include *Ln(TA)*, *M/B*, *Profitability*, *Leverage*, and *Cash flow*. Appendix A provides the detailed definitions of these control variables. Standard errors are clustered at the firm level in all specifications. The *t*-statistics of coefficient estimates are displayed in parentheses. ***, **, * indicated significance at the 1%, 5% and 10% levels.

	(1)	(2)	(3)	(4)
Dependent Variable	Capex	Capex	CapexR&D	CapexR&D
$MarginBuy$	4.02**		4.54**	
	(2.13)		(2.10)	
$\Delta MarginBuy$		4.37**		4.84**
		(2.16)		(2.12)
Ln(TA)	-0.13	4.19**	-0.74	0.75
	(-0.59)	(-2.01)	(-0.87)	(0.92)
M/B	0.27	0.24	3.93**	3.92**
	(0.90)	(0.81)	(2.29)	(2.23)
Profitability	0.99***	0.93***	0.41	0.36
	(3.72)	(3.46)	(1.52)	(1.52)
Leverage	3.12	3.00	0.45	0.46
	(1.09)	(1.01)	(0.22)	(0.22)
Cash Flow	23.76***	23.79***	48.31**	48.26**
	(4.99)	(4.96)	(2.40)	(2.40)
Industry and Year fixed effects	YES	YES	YES	YES
obs	1271	1271	1271	1271
adj. R^2	0.269	0.366	0.215	0.215

Table 5: Two-stage least-squares regressions using instrument variable of margin trading

This table reports the two-stage least-squares regressions, using data of the pilot group in the unbalanced panel. The pilot group in the unbalanced panel contains firms participating in the pilot program in certain years from 2011 to 2014.We employ the fraction of stock ownership by leverage mutual fund as the instrument variable for margin trading. In the first stage, we regress $MarginBuy$ ($\Delta MarginBuy$) on leverage mutual fund ownership and obtain the fitted values for the second stage. In the second stage, we regress *Capex* and *CapexR&D* on the fitted values from the first stage with several control variables $Capex$ is the capital expenditures and $CapexR\&D$ is the sum of capital expenditures and research and development expenses. Both $Capex$ and $CapexR\&D$ are the percentage of the total assets of the previous fiscal year end. $MarginBuy$ is the total outstanding RMB amount of marginal buying at the end of year *t*, as a percentage of total RMB trading volume during year *t*; $\Delta MarginBuy$ is the change in $MarginBuy$ from year *t*-1 to year *t*, defined as : $\Delta MarginBuy(t) = MarginBuy(t) - MarginBuy(t\text{-}1)$. The two-stage regression model is reported as follows:

First Stage: $\text{Margin\_buy}_{i,t} = \alpha + \beta * \text{Mutual\_fund}_{i,t} + \gamma * X_{i,t} + \varepsilon_{i,t}$

Second Stage: $Capex_{i,t}\ [\text{CapexR\&D}_{i,t}] = \alpha + \beta * \text{Fitted Margin\_buy on Mutual\_fund}_{i,t} + \gamma * X_{i,t} + \varepsilon_{i,t}$

Control variables include *Ln(TA)*, *M/B*, *Profitability*, *Leverage*, and *Cash flow*. Appendix A provides the detailed definitions of these control variables. Standard errors are clustered at the firm level in all specifications. The *t*-statistics of coefficient estimates are displayed in parentheses. ***, **, * indicated significance at the 1%, 5% and 10% levels.

Panel A. Two-stage least-squares regressions for Capex

Dependent Variable	1st stage $MarginBuy$	2nd stage Capex	1st stage $\Delta MarginBuy$	2nd stage Capex
Mutual_fund	0.0052*		0.0518***	
	(1.69)		(5.55)	
$MarginBuy$		5.34**		
		(2.42)		
$\Delta MarginBuy$				7.84**
				(2.53)
Ln(TA)	0.0003	-6.14***	0.1385***	-18.27
	(0.12)	(-6.88)	(6.62)	(-0.75)
M/B	0.0006	0.60**	0.0596**	1.51
	(0.26)	(2.17)	(2.30)	(0.67)
Profitability	-0.0123***	0.68	-0.0152	2.15
	(-4.65)	(1.30)	(-0.81)	(0.66)
Leverage	0.0018	-7.61***	-0.3138***	0.52
	(0.15)	(-2.94)	(-3.82)	(0.03)
Cash Flow	-0.0085	1.97	0.2328*	-15.05
	(-0.57)	(0.78)	(1.66)	(-0.43)
Industry and Year fixed effects	YES	YES	YES	YES
Obs	1271	1271	1271	1271
adj. R2	0.335	0.017	0.202	0.018

Panel B. Two-stage least-squares regressions for CapexR&D

Dependent Variable	1st stage $MarginBuy$	2nd stage CapexR&D	1st stage $\Delta MarginBuy$	2nd stage CapexR&D
Mutual_fund	0.0052*		0.0518***	
	(1.69)		(5.55)	
$MarginBuy$		7.78**		
		(2.10)		
$\Delta MarginBuy$				8.58**
				(2.52)
Ln(TA)	0.0003	-8.42***	0.1385***	-1.87**
	(0.12)	(-5.02)	(6.62)	(-2.42)
M/B	0.0006	0.95*	0.0596**	0.37
	(0.26)	(1.83)	(2.30)	(0.82)
Profitability	-0.0123***	0.26	-0.0152	5.31***
	(-4.65)	(0.27)	(-0.81)	(7.96)
Leverage	0.0018	-15.04***	-0.3138***	-6.67*
	(0.15)	(-3.09)	(-3.82)	(-1.67)
Cash Flow	-0.0085	3.82	0.2328*	53.46***
	(-0.57)	(0.80)	(1.66)	(9.80)
Industry and Year fixed effects	YES	YES	YES	YES
Obs	1271	1271	1271	1271
adj. R2	0.335	0.034	0.202	0.128

Table 6: Samples partitioned by financial constraints

This table reports the financial constraints subsample results of pooling regressions with fixed effect. We split the full sample into low and high financial constraints groups by KZ index (Kaplan and Zingales, 1997) and WW Index (Whited and Wu, 2006). $Capex$ is the capital expenditures and $CapexR\&D$ is the sum of capital expenditures and research and development expenses. Both $Capex$ and $CapexR\&D$ are the percentage of the total assets of the previous fiscal year end. $MarginBuy$ is the total outstanding RMB amount of marginal buying at the end of year *t*, as a percentage of total RMB trading volume during year *t*; $\Delta MarginBuy$ is the change in $MarginBuy$ from year *t*-1 to year *t*, defined as : $\Delta MarginBuy(t) = MarginBuy(t) - MarginBuy(t\text{-}1)$. Control variables include *Ln(TA)*, *M/B*, *Profitability*, *Leverage*, and *Cash flow*. Appendix A provides the detailed definitions of these control variables. Standard errors are clustered at the firm level in all specifications. The *t*-statistics of coefficient estimates are displayed in parentheses. ***, **, * indicated significance at the 1%, 5% and 10% levels.

Panel A: Financial constraints measured by KZ Index

	Low Financial Constraints				High Financial Constraints			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent Variable	Capex	Capex	CapexR&D	CapexR&D	Capex	Capex	CapexR&D	CapexR&D
$MarginBuy$	2.51*		3.31*		5.64***		7.61***	
	(1.67)		(1.86)		(2.78)		(3.32)	
$\Delta MarginBuy$		3.38**		3.05*		6.46***		6.16***
		(2.07)		(1.65)		(2.93)		(2.67)
Ln(TA)	0.12	0.07	-3.01	0.15	-0.03	0.05	-7.53***	0.14
	(0.38)	(0.22)	(-1.17)	(0.49)	(-0.14)	(0.22)	(-3.65)	(0.33)
M/B	1.16***	1.18***	-0.22	-0.90**	0.27	0.23*	0.29	0.20
	(3.06)	(3.22)	(-0.51)	(-2.56)	(1.08)	(1.90)	(0.57)	(0.74)
Profitability	1.18***	1.19***	0.36	2.04***	1.28**	1.22*	0.98	1.13
	(2.88)	(2.74)	(0.85)	(3.13)	(1.97)	(1.88)	(0.80)	(0.98)
Leverage	-1.54	-1.45	-10.18**	-1.33	6.00**	5.89**	8.39	5.59*
	(-0.66)	(-0.63)	(-2.49)	(-0.34)	(2.09)	(1.96)	(1.01)	(1.93)
Cash Flow	22.40***	22.38***	5.19***	19.99***	24.64***	24.73***	9.33**	31.30***
	(4.73)	(4.76)	(4.25)	(4.63)	(5.06)	(5.05)	(2.22)	(8.03)
Industry and Year fixed effects	YES	YES	YES	YES	YES	YES	YES	YES
Obs	584	584	656	656	687	687	687	687
adj. R^2	0.375	0.275	0.796	0.297	0.301	0.280	0.355	0.307

Panel B: Financial constraints measured by WW Index

	low financial constraints				high financial constraints			
	(3)	(4)	(1)	(2)	(7)	(8)	(5)	(6)
Dependent Variable	Capex	Capex	CapexR&D	CapexR&D	Capex	Capex	CapexR&D	CapexR&D
$MarginBuy$	3.01*		1.71*		5.64***		9.59***	
	(1.66)		(1.82)		(2.89)		(2.99)	
$\Delta MarginBuy$		3.14*		1.88*		5.25***		9.51***
		(1.87)		(1.90)		(2.82)		(2.94)
Ln(TA)	-0.02	-0.03	-4.89*	-0.15	-0.14	-0.27	-3.85***	-1.27*
	(-0.06)	(-0.11)	(-2.10)	(-0.58)	(-0.47)	(-0.85)	(-5.08)	(-2.04)
M/B	0.96***	0.98***	0.39	0.07	0.18	0.11	0.44	0.10
	(3.10)	(3.22)	(1.13)	(0.25)	(0.70)	(0.43)	(0.83)	(0.50)
Profitability	1.66***	1.63***	0.88	1.45***	0.63	0.58	0.85	0.89
	(3.26)	(3.18)	(1.38)	(5.37)	(0.61)	(0.57)	(0.08)	(1.13)
Leverage	-0.56	-0.56	-8.23	-3.11	-5.86**	-5.63*	-12.99	-1.32
	(-0.20)	(-0.20)	(-1.29)	(-0.74)	(-2.33)	(-2.12)	(-0.74)	(-0.85)
Cash Flow	18.73***	18.65***	5.67**	28.48***	28.64***	28.83***	5.59	4.19**
	(4.03)	(4.03)	(2.19)	(6.11)	(7.24)	(7.36)	(0.55)	(2.58)
Industry and Year fixed effects	YES	YES	YES	YES	YES	YES	YES	YES
Obs	656	656	656	656	615	615	615	615
adj. R^2	0.264	0.264	0.264	0.285	0.299	0.303	0.236	0.231

Table 7: Difference test of corporate financing

The table reports the regression results of corporate financing of the pilot and non-pilot firms from 2011 to 2014. The pilot group in the unbalanced panel contains firms participating in the pilot program in certain years. *DEBT* is the net cash flow received from external debt financing. *EQUITY* is the net cash flow received from external equity financing. We scale the *DEBT* and *EQUITY* measures by multiplying 100. *PILOT* is a dummy variable that equals to 1 if a firm belongs to pilot group. Control variables include *Ln(TA)*, *M/B*, *Profitability*, *Leverage*, and *Cash flow*. Appendix A provides the detailed definitions of debt financing, equity financing and control variables. Standard errors are clustered at the firm level in all specifications. The *t*-statistics of coefficient estimates are displayed in parentheses. ***, **, * indicated significance at the 1%, 5% and 10% levels.

	(1) *DEBT*	(2) *EQUITY*
PILOT	8.46***	14.97
	(2.96)	(0.94)
Ln(TA)	-5.58***	-19.52
	(-3.90)	(-1.38)
M/B	1.95*	0.16
	(1.95)	(0.02)
Profitability	0.59	7.33*
	(0.35)	(1.82)
Leverage	6.49	66.54*
	(1.06)	(2.03)
Cash Flow	16.04	111.82
	(1.24)	(1.29)
Industry and Year fixed effects	YES	YES
obs	4685	4685
adj. R^2	0.008	0.021

Table 8: The effect of pilot program on investment-Q sensitivity

The table reports the effect of the pilot program on investment-Q sensitivity from 2011 to 2014. The pilot group contains firms participating in the pilot program in certain years. $Capex$ is the capital expenditures and $CapexR\&D$ is the sum of capital expenditures and research and development expenses. Both $Capex$ and $CapexR\&D$ are the percentage of the total assets of the previous fiscal year end. *PILOT* is a dummy variable that equals to 1 if a firm belongs to pilot group. Control variables include *Ln(TA)*, *Profitability*, *Leverage*, and *Cash flow*. Appendix A provides the detailed definitions of these control variables. Standard errors are clustered at the firm level in all specifications. The *t*-statistics of coefficient estimates are displayed in parentheses. ***, **, * indicated significance at the 1%, 5% and 10% levels.

	(1) Capex	(2) CapexR&D
PILOT	3.72***	1.43***
	(3.26)	(2.73)
M/B	3.17***	0.18*
	(3.11)	(1.78)
M/B* PILOT	2.49***	2.07**
	(2.84)	(2.46)
Ln(TA)	-0.74	-0.07
	(-0.98)	(-0.59)
Profitability	0.51	0.88***
	(0.43)	(3.79)
Leverage	2.12*	0.17
	(1.99)	(0.11)
Cash Flow	47.84***	19.43***
	(3.42)	(6.52)
Industry and Year fixed effects	YES	YES
obs	4685	4686
adj. R^2	0.056	0.202