



## Research article

## Stock pledged loans and market crash risk: Evidence from China

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## ABSTRACT

Stock pledged loans have become prevalent among large shareholders of listed firms in China. The *largest* shareholder pledges a greater fraction of her holdings as collateral for credit when the firm is in growth industries, less profitable, *not* state owned, and has higher leverage. Stock performance of highly pledged firms is indistinguishable from that of firms with low pledge ratios in 2017. During 2018, however, highly pledged firms have worse stock returns and operating performance, and experienced ‘contagion’ – the crash risk of one highly pledged stock spreading to others. Using a regulatory reform in 2013 that allowed securities companies to provide stock pledged loans, we find that obtaining these personal loans had *no* adverse effects on the firms when the pledge ratio was low. Overall, forced sales of pledged stocks and worsened agency conflict are responsible for the poor performance of highly pledged firms during the 2018 bear market.

## 1. Introduction

The Chinese domestic, “A share” stock market, with more than 3400 firms listed in the Shanghai Stock Exchange (SSE) and Shenzhen Stock Exchange (SZSE), was the second largest in the world as measured by the total market capitalization at the end of 2017. It was one of the worst performing markets globally in 2018, falling by 26% from end-of-2017 level. In this paper, we document a contributing factor to the downturn in the market: the prevalent use of stock pledged loans—loans with shareholders’ stock as collateral—by the *largest* shareholders of listed firms and the amplifying effects of the forced sales of the pledged stocks during a market downturn.

At the end of 2018, more than 95% of the 3434 listed firms have at least one shareholder using stock as collateral in exchange for credit. The total number of pledged stocks is 634.5 billion shares, with the total value of the pledged stocks reaching RMB 4.23 trillion, or 10% of the total market capitalization. More than 95% of the stock pledged loans are taken by the *largest* shareholder of the firms, and these pledged stocks and their shareholders are the focus of our study. The distributions of the ratios of pledged stocks over both the total

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shares outstanding of the firms and the holdings of the largest shareholders are skewed. For example, while the median of pledge ratios of the largest shareholders increased from 0% (at the beginning of 2017) to 13.8% (at the end of 2018), the pledge ratio of the 75th percentile of the distribution increased from 46.2% to 68.8%. By the end of 2018, there are nearly 500 firms with their largest shareholders pledging more than 90% of their holdings (see Fig. 1).

With the sample of all the listed firms on SSE and SZSE from 2011 through 2018, we provide the first study on the determinants of stock pledged loans by large shareholders and their impact on firm performance under different market conditions. The largest shareholder pledges a greater fraction of her stock holdings in exchange for credit when the firm is more financially constrained, less profitable, *not* an SOE (state-owned enterprise), and operates in a growth industry. The stock performance of firms with high pledge ratios is not significantly different from that of firms with low pledge ratios in 2017, when the broad market index (Shanghai Composite) rose by 6.56%.

During 2018, however, highly pledged firms have lower stock returns and worse operating performance. The crash risk of these stocks is ‘contagious,’ in that the negative price ‘momentum’ of one highly pledged stock spreads to others. The largest shareholders of highly pledged firms are also more likely to conduct value-destroying related-party transactions (RPTs), including ‘tunneling’ assets from the firms and forcing the firms to provide guarantees on questionable loans (for themselves or related parties). Interestingly, using a regulatory reform in 2013 that allowed securities companies to provide stock pledged loans, we find that obtaining these personal loans had *no* adverse effects on the firms during this earlier period, when the pledge ratio was low.

We conclude that forced sales of pledged stock and worsened agency conflict are responsible for the poor performance of high-pledged firms during the bear market of 2018. Overall, our results extend the literature by showing that a financial innovation—stock pledged loans for individual investors—can lead to different outcomes for the listed firms depending on market conditions, the level of stock pledging (by the largest shareholder), and the strength of corporate governance. In addition, concentrated selling of pledged stocks during market downturns can generate systemic risk.

Stocks of listed firms, especially those with high valuation, have become a popular choice for collateral in exchange for credit for large shareholders in the A share market during the past decade. However, stock prices are sensitive to the macroeconomic environment and market conditions. Hence, the value of a stock as collateral can fluctuate more than other types of collateralizable assets (e.g., real estate properties), and imposes greater risk on the investors as well as the listed firms, especially during periods of heightened market volatilities.

When the stock price drops below the “forced sale level,” the lender—a financial institution—will ask the borrower—the largest shareholder—to increase margins (by pledging more stocks or other liquid assets including cash) or force the sale of stocks in order to cover its (the lender’s) losses. A forced sale of the pledged stock can lead to a downward spiral. Concentrated selling of the stock has a negative impact on its own price; when investors realize more forced sales of pledged stocks are imminent, they will accelerate the selling of *other* stocks with high pledge ratios, in order to avoid large amount of losses when the next wave of forced sales occurs. Selling of a broader set of stocks leads to large drops in their prices, which will then trigger more forced sales of stocks with high pledge ratios and then stocks with moderate pledge ratios, and even more investor panic and fire sales, and so on.

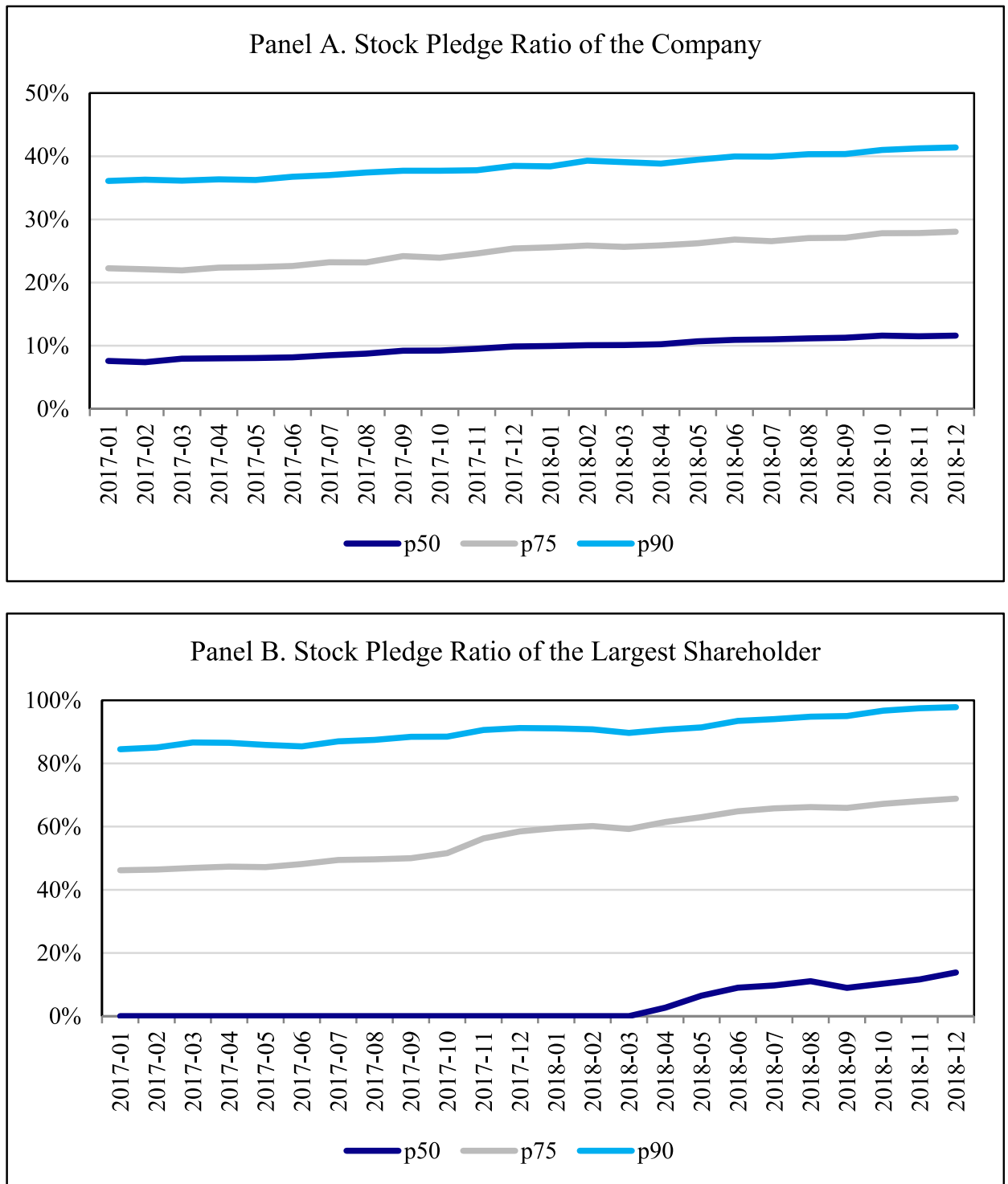
During this process, lenders such as commercial banks and securities companies will also have large losses regardless of whether they can force the sales of pledged stocks—as long as they use ‘mark-to-market’ accounting; lenders will incur losses on their books if stock prices fall below the forced sale level even if no sales occur.<sup>1</sup> If stock pledged loans account for a large portion of all the loans of the lending institutions, they can end up in a crisis of their own, and this crisis can spread to the real sectors, like what we observe in the 2008–2009 global financial crisis.

In our first set of empirical tests, we examine the above hypotheses of the impact of stock pledged loans, and in particular, the effects of forced sales of pledged stocks in a bear market, and conduct analyses for the period 2017–2018. The year 2017 was a “normal” period for stocks as compared to 2018, and so we include this year in our tests as benchmark, in order to shed light on the adverse effects of forced sales of pledged stocks. We use the stock pledge ratio of the largest shareholder at the end of 2016—prior to the testing period, as the key independent variable.

We sort stocks into six groups based on the pledge ratio of the largest shareholder at the end of 2016. The stock returns of firms with high levels of stock pledged loans in 2017 are not significantly different from those of firms with low levels of stock pledged loans. However, in 2018, firms with high stock pledge ratios underperformed other groups of firms: the cumulative return of the high-pledged stock portfolio is –44.20%, which is 15.84% lower than the return of the non-pledged stock portfolio and 13.22% lower than the return of the low-pledged stock portfolio. We obtain similar results in multivariate regressions: high-pledged stocks underperform other stocks by 0.788% per month (or 9.456% per annum), after controlling for industry and firm characteristics and time effects. In addition, while most firms’ operating performance worsened in 2018 (e.g., drop in cash holdings and returns on assets, or ROA, and increase in leverage), firms with high levels of pledged stocks experienced greater deterioration.

We also find firms with high levels of stock pledged loans have stronger short-term stock momentum as compared to those with low levels of stock pledged loans. In multivariate regressions of *daily* stock returns on momentum measures, we find momentum effects are present for stocks in 2018, but these effects exist only after a *downward* trend—that is, stocks are more likely to fall following negative returns over the previous three trading days, but no significant pattern is detected after positive returns over the same prior trading period. Moreover, the negative momentum effects for stocks with high pledge ratios are much stronger than that for stocks with low

<sup>1</sup> According to the pre-announcement of their annual reports of 2018, three securities companies, Pacific Securities, Industrial Securities, Founder Securities announced that the impairment losses of assets are up to RMB 971 million, 651 million, and 470 million, respectively, and the losses are mainly driven by stock pledge lending business.



**Fig. 1.** Stock Pledge Ratios of the Company and the Largest Shareholder (2017–2018)  
 This figure plots the fraction of stocks pledged (for loans) of the listed firm and of the largest shareholder. Panel A plots the stock pledge ratio of the company at the end of each month from Jan. 2017 to Dec. 2018. Stock pledge ratio of the company is calculated as the total shares pledged divided by total shares outstanding (in the A share market). Panel B plots the stock pledge ratio of the largest shareholder at the end of each month from Jan. 2017 to Dec. 2018. Stock pledge ratio of the largest shareholder is calculated as the percentage of the largest shareholder's stock holdings that is pledged. In Panel A and Panel B, we plot the median, 75th percentile, 90th percentile of stock pledge ratio of the company and the largest shareholder at the end of each month.

levels of pledge ratios, consistent with the hypothesis that forced sales of high-pledged stocks put more downward pressure on these stocks in a market downturn.

We study the contagion effect by examining the *cross-momentum* effects of the “first-tier” high-pledged stocks on the *other* stocks: the portfolio of “first-tier” high-pledged stocks consist of stocks with the pledge ratio of the largest shareholder greater than 95%. We find that a negative return of the portfolio with the highest pledge ratios leads to negative returns of other highly pledged stocks—the portfolio of the “second-tier” high-pledged stocks (stocks with the pledge ratio of the largest shareholder greater than 80% and less than or equal to 95%). In fact, the negative cross-momentum effects of the “first-tier” high-pledged stocks on the other stocks outweigh the momentum effects of the other stocks themselves. By contrast, the negative momentum of the most highly pledged stocks has almost no impact on non-pledged stocks. When we run the same tests in 2017, we find that the impact of the negative momentum of the most highly pledged stocks on other highly pledged stocks is much weaker.

In 2013, China Securities Regulatory Commission (CSRC) and the stock exchanges announced a policy reform that allowed securities companies (as pledgees) to provide stock pledged loans to shareholders of listed firms. This led to a sharp increase in the provision of stock pledged loans as securities firms were not actively involved in this form of lending prior to the reform. This announcement led to a positive market reaction, especially for those financially constrained firms and those with more growth options. We find that the largest shareholders of these firms were indeed more likely to initiate stock pledged loans, and the announcement period returns for the stocks were positive. Using a propensity-score matching procedure and difference-in-difference tests, we find that obtaining these loans did not have any adverse effects on the listed firms, as compared to control firms, during the period of 2011–2015. In fact, based on different types of RPTs, we observe a net *inflow* of funds and/or assets from the largest shareholder to the listed firms.

Based on all the results, we conclude that stock pledged loans relax the financial constraints for individual investors and have no adverse effects on listed firms when the pledge ratio is low, while forced sales of pledged stock and worsened agency conflict are responsible for the poor performance of high-pledged firms during the bear market of 2018.

Our approach and results extend several strands of literature on the impact of stock pledged loans on listed firms' performance and stock market crash risks. The first strand of literature examines the economic consequences of stock pledged loans by the largest shareholders. Since controlling shareholders are sensitive to the value of pledged stocks, changes in stock prices could significantly affect the company's decisions especially for highly pledged firms. Hence, this type of loans may aggravate the agency problem between the controlling shareholders and minority shareholders and other stakeholders, in terms of control rights (e.g., [Chen et al., 2007](#)), a firm's earnings management (e.g., [DeJong et al., 2020](#)) and share repurchases (e.g., [Chan et al., 2018](#)). Prior literature also finds a negative correlation between the stock pledge ratio and the firm's operating performance (e.g., [Ouyang et al., 2019](#); [Pang and Wang, 2020](#)), valuation (e.g., [Chen and Kao, 2011](#); [Dou et al., 2019](#)), and increased distress risk ([Chiou et al., 2002](#)).

The second strand of literature studies stock price co-movements and contagion risks.<sup>2</sup> For example, [Allen and Carletti \(2006\)](#) argue that in time of financial crisis, mark-to-market accounting can lead to contagions where none would occur with historic cost accounting. [Bian et al. \(2018a\)](#) use account-level trading data of a large sample of margin accounts, and document direct evidence for deleveraging-induced fire sales during market crash. [Bian et al. \(2018b\)](#) further explore the contagion effect of this deleverage-induced fire-sale through the network of margin investors. By studying the real estate market collapse in Japan, [Gan \(2007\)](#) examines how a shock to collateral value leads banks to cut lending and forced sales of assets.

Our paper differs from earlier studies in a number of ways. First, our paper contributes to the literature on stock pledged loans by studying the direct influence of this type of loans on stock prices through the channel of forced sales, while prior literature mainly focuses on the negative signals of stock pledging and studies the relation between stock pledged loans and stock performance indirectly. Second, much of prior literature concludes that there is a negative relationship between stock pledging and firm performance, but we show that stock pledged loans act as a double-edged sword: they can help alleviate (investors') credit constraints and lead to better (firm) performance, but this form of lending can also do harm to firms' performance, especially when the level of stock pledged loans is high and when the market hits downturns. Moreover, our tests and results contribute to the literature on contagions and stock market crises: stocks with high pledge ratios face greater crash risk and lower returns due part to forced sales; and large drops of stock prices are likely to trigger declines of stock prices of firms in the same or related industries, and lead to forced sales of other high-pledged stocks.

In Section II of the paper we review related literature, introduce our data sets and study the background of Chinese stock pledge market. We conduct empirical tests to examine the influence of stock pledge on firms' stock performance in Section III, and operating performance in Section IV. Section V includes the robustness check and other results. Section IV concludes. [Appendix A](#) contains explanations of the variables used in the paper.

## 2. Background of China's stock pledge market, and data

Even though stock pledging was defined by China's Guarantee Law back in 1995, the market for stock pledging had developed slowly before 2013, with more than 90% of total shares pledged to commercial banks and trusts. On May 24th, 2013, a new regulation on the approval of stock pledge repurchase transactions, was announced by the SSE, SZSE, and the China Securities Depository and Clearing

<sup>2</sup> Using cross-country samples, [Morck et al. \(2000\)](#) show that greater individual stock price variation as a proportion of total variation means more specific information content in price behavior and more efficient markets, and that the extent to which stocks move together depends on the relative importance of firm-level and market-level information capitalized into stock prices. [Jin and Myers \(2006\)](#) and [Hutton et al. \(2009\)](#) document that poor corporate governance and opaqueness can explain the high synchronicity of stock returns in emerging markets including China. They argue that opaque firms (using earnings management as the measure) are more likely to experience stock price crashes.

Corporation. Compared to stock pledge in over-the-counter (OTC) market, stock pledge repurchase transactions are standardized with clearly specified participating lender types, loan maturities, underlying stocks, and the transaction fee rates. This standardization procedure simplifies the loan approval process with stock pledging and lowers the financing costs, which in turn facilitates the use of stock pledging as one of shareholders' financing channels.

With the convenience of the newly established stock pledge repurchase agreements, stimulating monetary policies and restrictions on large shareholders' reduction in their shareholdings,<sup>3</sup> China's stock pledge market has grown rapidly since 2013, and securities companies have become the major lender in this new market,<sup>4</sup> as indicated in Fig. 2. The growth of the market slows down when regulators realize the potential risks of stock pledged loans, and introduce regulations to restrict the stock pledge market in 2018.<sup>5</sup> However, the average stock pledge ratios of listed firms and of the largest shareholder have already reached very high levels.

With regards to forced-sales of pledged stocks, contract terms of stock pledging, including the transaction fee, forced-sales threshold, and pledge timing, intervention from the regulators, and financial conditions of the borrower are all influencing factors. While it is difficult to verify the exact time and scale of a forced sale (of pledged stock), according to the disclosure requirements of SSE and SZSE, large shareholders (with shareholdings more than 5% of total shares) are required to disclose the level of their stock pledging, while supplementary information, for instance, whether cash and other forms of collateral is used, is not required to be disclosed. Since a higher stock pledge ratio can be considered as a negative signal that the largest shareholder encounters financing difficulties and pressure from increasing margins, stock pledge ratio of the largest shareholder is a reasonable proxy for the risk of forced-sales.

### 2.1. Data sources and sample construction

We employ two samples in this paper. For empirical tests conducted for the sample period of 2017–2018, we use measures of the largest shareholders' stock pledging information at the end of 2016 to alleviate potential endogeneity problem on the shareholder's choice of a particular pledge ratio. The first sample thus includes listed firms of SSE and SZSE (the "A-share" market) at the end of 2016, excluding financial firms, and firms with the "special treatment" status (ST firms) or with negative book assets. The final sample consists of 2860 listed firms, 59,831 firm-month observations, and 1,200,989 firm-date observations. In order to establish casual effects of stock pledging on stock returns and operating performance, we also perform tests using a propensity score matching (PSM) procedure, and the sample includes 168 pairs of treatment firms (high-pledged firms) and matched control firms (non-pledged firms).

To investigate the operating performance of listed firms before and after the policy change in 2013, we build the second sample with firm-year observations in 2011–2012, and 2014–2015. With financial firms, ST firms, and those with negative book assets excluded, the sample includes 2094 listed firms. We again use the PSM procedure, which yields 281 pairs of treatment firms (pledged firms) and their corresponding control firms (non-pledged firms).

We collect information on stock pledged loans, ownership structures, illegal behavior, issuances of directional shares from WIND. We extract stock returns (daily and monthly), accounting variables and related-party transactions data from CSMAR. All continuous variables are winsorized at top and bottom 1% to reduce the impacts of outliers. Appendix A contains definitions of the variables used in the paper.

## 3. Stock pledged loans and stock performance

### 3.1. Descriptive statistics

Table 1 presents the summary statistics of firm characteristics in 2017 for firms in different stock pledging portfolios. At the end of 2016, we choose firms with no shares pledged by the largest shareholders to construct the non-pledged portfolio. For the rest of the firms, we sort them into 5 equal groups based on the stock pledge ratio of the largest shareholder at the end of 2016. We thus have 6 portfolios in total: non-pledged portfolio, low-pledged to high-pledged portfolios (five portfolios, each with the same number of stocks). While more than half (59.2%) of the listed firms' largest shareholders didn't pledge any stocks, the mean stock pledge ratio of the largest shareholder for high-pledged firms is up to 97.8%.

With regard to the attributes of ultimate controller, 50.3% of non-pledged firms are SOEs, while only 2.3% of high-pledged firms are SOEs. Firm size is comparable between non-pledged (low-pledged) firms and high-pledged firms. The mean *Size* is 15.943 (15.911) for non-pledged (low-pledged) firms and 15.877 for high-pledged firms.<sup>6</sup> High pledged firms have lower *B/M* (with the mean of 0.399) than non-pledged firms (with the mean of 0.445). In terms of liquidity, high-pledged firms hold less cash and have higher leverage compared to non-pledged and low-pledged firms, indicating that high-pledged firms are more likely to be financial constrained. Moreover, high-pledged firms underperform non-pledged and low-pledged firms in terms of *ROA*. The mean *ROA* is 4.3% (5.2%) for non-pledged (low-pledged) firms and 3.0% for high-pledged firms. In high-pledged firms, 37.8% of board members are independent directors, which is

<sup>3</sup> To deal with the market crash of China's stock market in 2015, CSRC published rules regarding restrictions on major shareholders' reduction in shareholdings.

<sup>4</sup> The lenders of stock pledge repurchase agreement are limited to securities companies.

<sup>5</sup> On Mar 12th, 2018, a regulation on the restrictions of stock pledge repurchase transactions was implemented. On May 30th, a new restriction of securities companies participating in over-the-counter market was issued.

<sup>6</sup> *Size* is the natural logarithm of the market capitalization of equity; the mean market capitalization is RMB 22.394 (15.417) billion for non-pledged (low-pledged) firms and RMB 11.201 billion for high-pledged firms; while the median market capitalization is RMB 6.569 (6.617) billion for non-pledged (low-pledged) firms and RMB 7.596 for high-pledged firms.

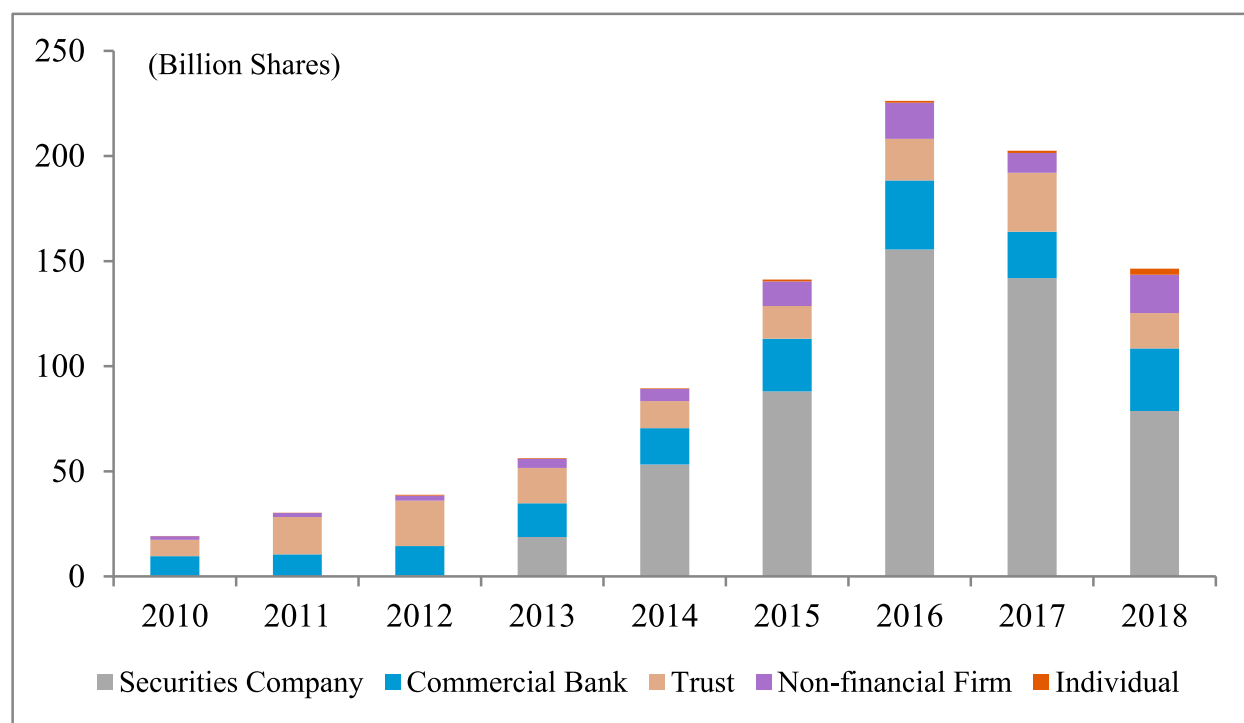


Fig. 2. Number of Shares Pledged (as Collateral) to Different Types of Lenders (2010–2018)

This figure plots the number of common stock shares pledged as collateral (for loans) to different types of lenders in the stock pledging market each year from 2010 to 2018. The types of lenders include: securities companies, commercial banks, trusts, non-financial firms and individuals.

slightly higher than non-pledged firms (37.4%) and low-pledged firms (38.0%). The percentage of shareholdings by institutional investors is lower for high-pledged firms compared to non-pledged firms, and the largest shareholders, on average, hold 27.6% of shares in high-pledged firms and 35.0% of shares in non-pledged firms.

In addition, holding the stock pledge portfolios unchanged, we calculate the buy-and-hold returns (BHRs) by accumulating equal-weighted monthly portfolio returns. Fig. 3 plots the equal-weighted BHRs of the stock pledge portfolios from Jan. 2017 to Dec. 2018. The market experiences a sustained downward trend during the whole sample period, with larger declines occurring in 2018. As compared to 2018, 2017 is a “normal” period for stocks, with no significant differences of stock performances between stock pledge portfolios. The cumulative return is  $-15.9\%$  for high-pledged portfolio in 2017, which is  $3.4\%$  ( $2.0\%$ ) lower than non-pledged (low-pledged) portfolio, and the difference is statistically insignificant. However, the high-pledged portfolio significantly underperforms others in 2018. The cumulative return is  $-44.20\%$  for high-pledged portfolio in 2018, which is  $15.84\%$  ( $13.22\%$ ) lower than that of the non-pledged (low-pledged) portfolio, and the difference is statistically significant at 1% level. Since the mean *Size* for high-pledged firms is not significantly different from that for non-pledged and low-pledged firms (as indicated in Table 1), poor stock performances of small-sized firms in 2018 can't fully explain the differences. We study forced-sales of pledged stocks as one of the possible explanations below.

### 3.2. Monthly stock returns of firms with stock pledged loans

Table 2 presents OLS regression results for monthly returns of firms for the sample period of 2017–2018. The dependent variable is *MRet*, the monthly stock return of the firm in percentage points, adjusted for stock splits and including cash dividends, and multiplied by 100. We use two measures of the largest shareholders' stock pledge as main explanatory variables in regressions, a continuous variable *PledgePct* and a dummy variable *High Pledge*. *PledgePct* is the percentage of the largest shareholder's ownership that is pledged at the end of 2016; *High Pledge* is an indicator taking the value of one if *PledgePct* is larger than 80%. To distinguish the case of “normal” period (2017) from the “abnormal” period (2018), we include *Dum 2017*, which is an indicator taking the value of one if the observation takes place in 2017, in the regressions. In all the specifications, we control for month and the industry fixed effects based on the CSRC level-1 industry classification, and the standard errors are clustered by months and by companies.

In Columns (1) and (2), we only include the stock pledge measures (*PledgePct* and *High Pledge*) and their interactions with *Dum2017* in the regressions. The coefficients on stock pledge measures are negative and significant at 1% level, suggesting that firms with high levels of stock pledged loans have remarkably lower returns than those firms with low levels of stock pledged loans in the bear market of 2018. The coefficient of  $-1.546$  (on *High Pledge*) indicates that, high-pledged firms, on average, underperform other firms by 1.546% per



**Table 1**

Summary Statistics of Firms in Different Stock Pledge Portfolios

(portfolios formed at the end of 2016; firm characteristics collected at the end of 2017).

Stock Pledge Portfolios	Observations	PledgePct	SOE	Size	B/M	LEV	Cash	ROA	Indep	Inst	Top1
Non-pledged	1693	0.000	0.503	15.943	0.445	0.428	0.179	0.043	0.374	0.422	0.350
Low-pledged	237	0.151	0.128	15.911	0.368	0.383	0.167	0.052	0.380	0.336	0.346
2	234	0.364	0.147	15.887	0.396	0.416	0.156	0.045	0.377	0.321	0.314
3	236	0.543	0.176	15.851	0.418	0.441	0.143	0.036	0.378	0.349	0.318
4	232	0.775	0.009	16.010	0.405	0.457	0.145	0.039	0.373	0.349	0.297
High-pledged	228	0.978	0.023	15.877	0.399	0.487	0.159	0.030	0.381	0.378	0.276
High-pledged - Low-pledged			-0.105*** (-4.36)	-0.034 (-0.41)	0.031 (1.45)	0.104*** (5.63)	-0.007 (-0.74)	-0.022*** (-4.48)	0.001 (0.15)	0.042** (2.16)	-0.070*** (-5.74)
High-pledged - Non-pledged			-0.481*** (-30.10)	-0.066 (-1.07)	-0.046*** (-2.64)	0.059*** (3.91)	-0.020** (-2.40)	-0.013*** (-3.48)	0.008** (1.98)	-0.044*** (-3.18)	-0.074*** (-8.34)

This table presents firm characteristics of stock pledge portfolios. At the end of 2016, we choose firms with no shares pledged by the largest shareholders to construct the non-pledged portfolio. For the rest of the firms, we sort them into 5 equal groups based on the stock pledge ratio of the largest shareholder at the end of 2016. We thus have 6 portfolios in total: non-pledged, low-pledged to high-pledged portfolios (five equal portfolios). *PledgePct* is the percentage of the largest shareholder's stock holding that is pledged at the end of 2016. *SOE* is a dummy variable that equals 1 if the firm is ultimately controlled by the central State-owned Assets Supervision and Administration Commission of the State Council (SASAC), local SASAC, Ministry of Finance, or other government agencies, and 0 otherwise. *Size* is the natural logarithm of the market capitalization of equity. *B/M* is book assets divided by market capitalization of equity. *LEV* is total liabilities divided by total assets. *Cash* is cash and cash equivalents divided by total assets. *ROA* is net income trailing twelve months divided by total assets. *Indep* is the ratio of the number of independent directors to board size. *Inst* is the percentage of shareholdings by institutional investors. *Top1* is the percentage of shareholdings held by the largest shareholder. All firm characteristics are collected at the end of 2017, and reported as the portfolio mean. In addition, we examine the differences in means of firm characteristics between high- and low-pledged portfolios, and also high- and non-pledged portfolios. See detailed variable definitions in [Appendix A](#). \*\*\*, \*\* and \* denote the statistical significance at the 1%, 5% and 10% levels, respectively.

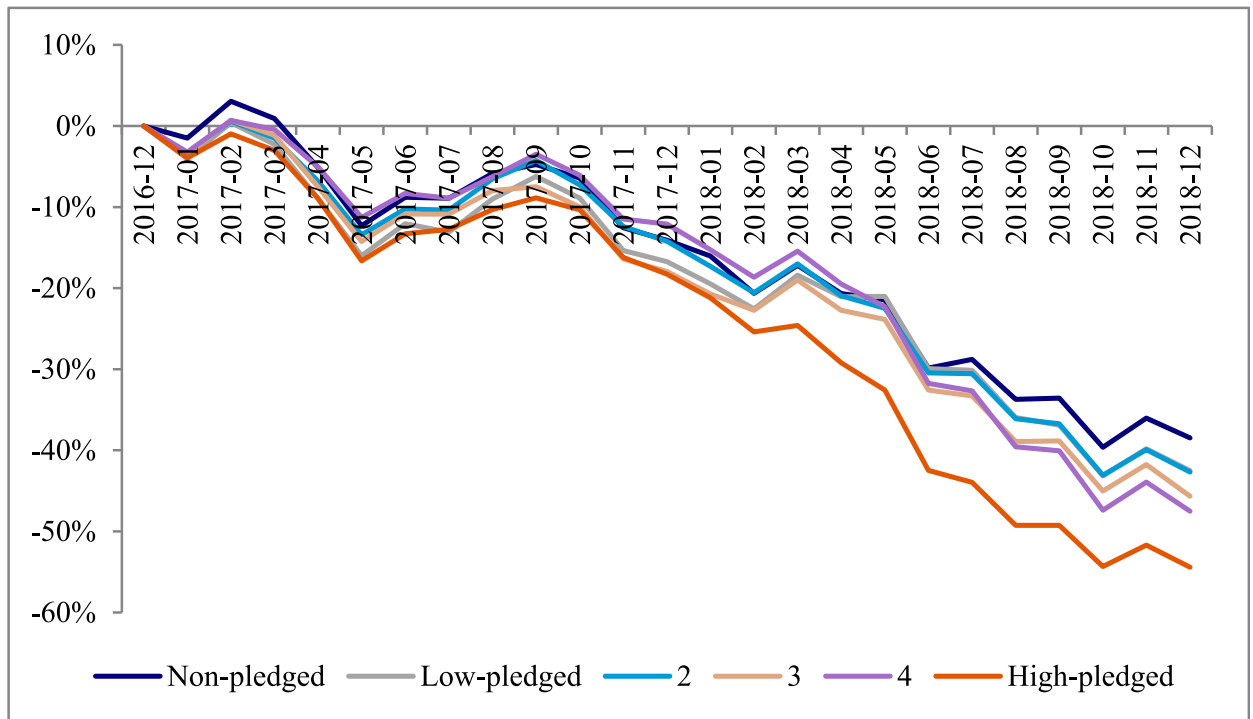


Fig. 3. Cumulative Returns of Stock Pledging Portfolios (Jan.2017–Dec.2018)

This figure plots the equal-weighted buy-and-hold returns (BHRs) of the stock pledge portfolios from January 2017 to December 2018. At the end of 2016, we form the non-pledged portfolio by choosing firms with no shares pledged by the largest shareholder, and we sort the rest of the firms into five equal groups based on the pledge ratio of the largest shareholder. Six portfolios are constructed in total: non-pledged, low-pledged to high-pledged portfolios (five equal portfolios). Firms in each portfolio are kept unchanged from Jan. 2017 to Dec. 2018, and the BHRs are calculated by accumulating equal-weighted monthly portfolio returns. The returns are adjusted for stock splits and including cash dividends.

month (or 18.55% per annum), after controlling for industry and time effects. In addition, the coefficients on cross term  $PledgePct \times Dum$  2017 ( $High\ Pledge \times Dum\ 2017$ ) is positive and significant at 1% level, with the magnitude similar to the coefficient on  $PledgePct$  ( $High\ Pledge$ ), indicating that stock performances of high-pledged firms are not significantly different from other firms in a “normal” period of 2017, which is consistent with patterns in Fig. 3. When firm characteristics are included in regressions of Columns (3)–(6), we continue to find positive coefficients on stock pledge measures ( $PledgePct$  and  $High\ Pledge$ ), and negative coefficients on the cross terms ( $PledgePct \times Dum2017$  and  $High\ Pledge \times Dum\ 2017$ ). The coefficient of  $-0.788$  (on  $High\ Pledge$ ) in Column (6) indicates that, on average, the monthly returns of high-pledged firms are 0.788% (or 9.456% per annum) lower than other firms during the “abnormal” period of 2018, with firm characteristics, industry effects and time effects controlled. To summarize, these results indicate that, the stock returns of firms with high levels of stock pledged loans in 2017 are not significantly different from those of firms with low levels of stock pledged loans. However, in 2018, firms with high stock pledge ratios underperformed other firms.

Coefficients on other firm controls are generally consistent with prior literature. The negative coefficients on  $PriorRet$  suggest that, higher cumulative returns in the previous three months are associated with lower stock returns of firms in the next month, which is consistent with the overreaction-related mispricing hypothesis (De Bondt and Thaler, 1985). As Fama and French (2015) and Penman and Zhu (2014), our results also indicate that higher  $B/M$ , leverage and profitability are associated with higher bankruptcy risk and earnings growth risk, and thus requires more risk compensation. In addition,  $Inst$  takes positive coefficient, suggesting that institutional investors with supervising roles help improve corporate governance, and lower the tail risks during market downturns.

### 3.3. Stock momentum of firms with stock pledged loans

Forced sales of pledged shares put downward pressure on stock prices, and can lead to large waves of declines of stock prices in a short term. Examining stock momentum effects of firms with stock pledged loans provides us with more understandings on the impact of forced sales of pledged shares. In this case, we look at daily returns of stocks listed in A share market in 2018, and examine the momentum effects of firms in the bear market, especially the momentum effects of high-pledged stocks/firms. To compare the case of the bear market with the “normal” period, we also examine the momentum effects of stocks in 2017 as the benchmark.

Table 3 presents OLS regression results on the existence of momentum effects of firms with stock pledged loans; Panels A and B report results for 2018 and 2017 respectively. The dependent variable is  $DRet$ , which is the daily stock return of the firm and again in



**Table 2**  
Monthly stock returns of firms with various degrees of stock pledging (2017–2018).

Variables	Monthly Stock Return (MRet)					
	(1)	(2)	(3)	(4)	(5)	(6)
<i>PledgePct</i>	−1.683*** (−4.07)		−0.986*** (−2.64)		−1.015*** (−2.76)	
<i>PledgePct</i> × <i>Dum2017</i>	1.505*** (2.97)		0.905* (1.91)		0.905* (1.90)	
<i>High Pledge</i>		−1.546*** (−4.42)		−0.726** (−2.16)		−0.788** (−2.37)
<i>High Pledge</i> × <i>Dum2017</i>		1.340*** (3.31)		0.685* (1.74)		0.696* (1.76)
<i>SOE</i>			0.098 (0.34)	0.193 (0.68)	−0.098 (−0.37)	−0.010 (−0.04)
<i>PriorRet</i>			−2.073** (−2.24)	−2.065** (−2.23)	−2.074** (−2.24)	−2.067** (−2.23)
<i>Size</i>			0.151 (0.56)	0.144 (0.53)	0.043 (0.16)	0.033 (0.12)
<i>B/M</i>			2.178*** (3.21)	2.156*** (3.16)	2.136*** (3.19)	2.115*** (3.14)
<i>LEV</i>			1.490*** (3.19)	1.415*** (2.92)	1.366*** (2.95)	1.294*** (2.69)
<i>Cash</i>			0.326 (0.48)	0.418 (0.60)	0.168 (0.24)	0.261 (0.37)
<i>ROA</i>			13.715*** (4.01)	13.852*** (4.05)	13.595*** (3.98)	13.704*** (4.02)
<i>Indep</i>					0.687 (1.15)	0.709 (1.20)
<i>Inst</i>					1.316*** (3.04)	1.338*** (3.14)
<i>Top1</i>					0.088 (0.19)	0.121 (0.26)
<i>Constant</i>	−5.093*** (−11.37)	−5.353*** (−11.29)	−10.143** (−2.22)	−10.213** (−2.24)	−9.084** (−2.06)	−9.136** (−2.08)
Month and Industry FEs	Yes	Yes	Yes	Yes	Yes	Yes
Observations	59,831	59,831	59,831	59,831	59,831	59,831
Adj. R <sup>2</sup>	0.19	0.19	0.21	0.21	0.21	0.21

This table presents OLS regression results for monthly returns of firms listed in the A share market on the stock pledge ratio of the largest shareholders. The sample period is 2017–2018. *MRet* is the monthly stock return of the firm, adjusted for stock split and including cash dividends, and multiplied by 100. *High Pledge* is a dummy variable that equals 1 if the stock pledge ratio of the largest shareholder is larger than 80%, and 0 otherwise. *PriorRet* is the buy-and-hold returns over the previous three months. *Dum2017* is a dummy variable that equals 1 if the observation belongs to 2017, and 0 otherwise. *SOE*, *Size*, *B/M*, *LEV*, *Cash*, *ROA*, *Indep*, *Inst* and *Top1* are firm characteristics collected at the end of previous quarter. See detailed variable definitions in Appendix A. In all the specifications, we control for month and industry fixed effects based on the CSRC level-1 industry classification. T-values calculated using the standard errors clustered by months and by companies are reported in the parentheses. \*\*\*, \*\* and \* denote the statistical significance at the 1%, 5% and 10% levels, respectively.

percentage points, adjusted for stock splits and including cash dividends, and multiplied by 100. The indicator variable *High Pledge* is the measure of the largest shareholders' stock pledge level, and the main explanatory variable in this table. *Mom* is the buy-and-hold returns over the previous three trading days. We control for month and industry fixed effects, and *MktMom*, which is the buy-and-hold returns of Shanghai Composite Index over the previous three trading days, in all specifications, and standard errors are clustered by dates and by companies.

As indicated in Columns (1) through (3), the positive coefficients on *Mom* and cross term *High Pledge* × *Mom* are significant at 1% level, suggesting that momentum effects exist for all listed stocks in 2018, and momentum effects for stocks with high level of stock pledged loans are stronger than that for stocks with low levels of stock pledged loans. In order to distinguish downward momentum effects from upward momentum effects, we split the sample into positive momentum (Columns 4–6) and negative momentum (Columns 7–9) and include cross terms *High Pledge* × *Mom* in both subsamples. From Columns (8) and (9), the coefficients on the interaction term are positive and significant at 1% level for the negative momentum subsample. On the other hand, neither the momentum or the interaction term is statistically significant for the positive momentum subsample, indicating that momentum effects exist only after a short-term downward trend—that is, stocks are more likely to fall following negative returns over the previous three trading days, but no evident pattern exists after positive returns over the same prior trading period. Moreover, the negative momentum effects for high-pledged stocks are much stronger than other stocks, which is consistent with the hypothesis that forced sales of high-pledged stocks put more downward pressure on these stocks in a market downturn. When including firm controls in the regressions (Column 9), coefficients on main explanatory variables indicate that, on average, a 1% falling of stock price in the previous three trading days is associated with a 0.0245% falling for all listed firms in the next trading day, and leads to a 0.0441% additional falling for high-pledged firms in 2018.

**Table 3**  
Stock momentum of firms with different levels of stock pledging (2017–2018).

Panel A. Sample of 2018									
Daily Stock Return (DRet)									
Variables	Sample of Positive and Negative Mom			Sample of Positive Mom			Sample of Negative Mom		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
<i>Mom</i>	1.727*** (6.65)	1.456*** (5.49)	1.437*** (5.43)	-0.304 (-1.05)	-0.444 (-1.41)	-0.427 (-1.36)	3.163*** (7.24)	2.577*** (5.89)	2.452*** (5.62)
<i>High Pledge</i>		-0.043*** (-5.25)	-0.031*** (-3.79)		-0.029 (-1.27)	-0.025 (-1.11)		0.059** (2.47)	0.071*** (2.90)
<i>Mom*High Pledge</i>		2.353*** (6.56)	2.341*** (6.53)		1.212 (1.63)	1.138 (1.54)		4.571*** (6.20)	4.405*** (6.01)
<i>MktMom</i>	35.979*** (86.85)	35.983*** (86.88)	35.983*** (86.87)	32.115*** (69.65)	32.114*** (69.65)	32.124*** (69.56)	38.424*** (80.46)	38.427*** (80.44)	38.425*** (80.45)
Firm Characteristics Controlled?	No	No	Yes	No	No	Yes	No	No	Yes
Month and Industry FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	617,415	617,415	617,415	285,417	285,417	285,417	331,998	331,998	331,998
Adj. R <sup>2</sup>	0.28	0.28	0.28	0.21	0.21	0.21	0.34	0.34	0.34
Panel B. Sample of 2017									
Daily Stock Return (DRet)									
Variables	Sample of Positive and Negative Mom			Sample of Positive Mom			Sample of Negative Mom		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
<i>Mom</i>	1.060*** (4.47)	1.010*** (4.19)	0.909*** (3.80)	1.284*** (3.57)	1.185*** (3.21)	1.253*** (3.38)	0.735** (2.10)	0.692* (1.94)	0.334 (0.96)
<i>High Pledge</i>		-0.017* (-1.92)	-0.013 (-1.52)		-0.036* (-1.79)	-0.032 (-1.54)		-0.011 (-0.66)	-0.006 (-0.34)
<i>Mom*High Pledge</i>		0.475 (1.39)	0.488 (1.42)		0.928 (1.03)	0.910 (1.01)		0.461 (0.79)	0.474 (0.82)
<i>MktMom</i>	44.667*** (53.43)	44.666*** (53.43)	44.656*** (53.43)	42.081*** (52.65)	42.082*** (52.66)	42.100*** (52.68)	46.329*** (47.64)	46.329*** (47.64)	46.276*** (47.56)
Firm Characteristics Controlled?	No	No	Yes	No	No	Yes	No	No	Yes
Month and Industry FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	583,574	583,574	583,574	276,493	276,493	276,493	307,081	307,081	307,081
Adj. R <sup>2</sup>	0.15	0.15	0.15	0.11	0.11	0.11	0.19	0.19	0.19

This table presents OLS regression results on the existence of momentum effects of firms with various degrees of stock pledging (of their largest shareholder). Panels A and B report results for years 2018 and 2017 respectively. *DRet* is the daily stock return of the firm, adjusted for stock split and including cash dividends, and multiplied by 100. *Mom* is the buy-and-hold returns over the previous three trading days. *MktMom* is the buy-and-hold returns of Shanghai Composite Index over the previous three trading days. In each panel, Columns (1)–(3) report results for the whole sample (with positive and negative *Mom*); to distinguish downward momentum effects from upward momentum effects, we also split the sample into two subsamples: Columns (4)–(6) report results for the subsample with positive *Mom*, while Columns (7)–(9) report results for the subsample with negative *Mom*. Firm characteristics are included in some specifications, including *SOE*, *Size*, *B/M*, *LEV*, *Cash*, *ROA*, *Indep*, *Inst* and *Top1*. See detailed variable definitions in Appendix A. In all the specifications, we control for month and industry fixed effects based on the CSRC level-1 industry classification. T-values calculated using the standard errors clustered by dates and by companies are reported in the parentheses. \*\*\*, \*\* and \* denote the statistical significance at the 1%, 5% and 10% levels, respectively.

Panel B reports the regression results on the existence of momentum effects in a “normal” period of 2017. In most of the specifications, coefficients on *Mom* are positive and statistically significant (at 1% level in Columns 1–6), indicating that short-term momentum effects exist for stocks in 2017. However, coefficients on the interaction terms (*Mom\*High Pledge*) are all insignificant, suggesting that there is no evidence that momentum effects for high-pledged stocks are stronger than other stocks. In conclusion, while momentum is widespread for all stocks in the bear market of 2018, high-pledged stocks face more downward pressure than other stocks, due to forced sales of pledged stock. In a “calm” period of 2017, on the other hand, no significant differences in momentum effects between high-pledged stocks and other stocks, and thus no clear evidence on forced sales of pledged shares in this subperiod.

### 3.4. Contagion (cross-momentum) effects of firms with stock pledged loans

When investors realize more fire sales (of stocks) might be coming in the near future, they will accelerate the selling of other stocks with high stock pledge ratios in order to get out of the market, leading to large drops in the prices of the other stocks, and thus result in forced sales of other stocks with high levels of stock pledged loans. We conduct a test based on cross-momentum to verify the existence of contagion effects among high-pledged stocks. Once again, we look at daily returns of stocks in 2018 and take the “normal” period of 2017 as a reference. We define those firms with stock pledge ratios of the largest shareholders greater than 95% as “first-tier” high-pledged firms, and define firms with stock pledge ratios in the interval of (80%, 95%) as the “second-tier” high-pledged firms. At the

**Table 4**  
Contagion (cross-momentum) effects of firms with different levels of stock pledging (2017–2018).

Panel A. Sample of 2018												
Variables	Daily Stock Return (DRet)											
	Sample of Positive and Negative CrMom				Sample of Positive CrMom				Sample of Negative CrMom			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
<i>CrMom</i>	4.527*** (10.94)	4.429*** (10.54)	4.458*** (10.61)	4.526*** (10.34)	4.005*** (4.53)	3.974*** (4.45)	4.082*** (4.57)	3.619*** (3.82)	2.961*** (2.75)	2.965*** (2.75)	3.029*** (2.81)	2.555** (2.11)
<i>High Pledge</i>		−0.046*** (−3.31)	−0.034** (−2.49)			−0.106*** (−3.17)	−0.091*** (−2.71)			0.032 (0.96)	0.041 (1.22)	
<i>High Pledge × CrMom</i>		2.247*** (2.98)	2.245*** (2.98)			0.805 (0.67)	0.791 (0.66)			2.234* (1.89)	2.268* (1.92)	
<i>Zero Pledge</i>				0.021*** (3.43)				0.061*** (4.50)				−0.020 (−1.16)
<i>Zero Pledge × CrMom</i>				0.063 (0.19)				0.997* (1.89)				0.939 (1.11)
<i>Mom</i>	−0.109 (−0.49)	−0.111 (−0.50)	−0.142 (−0.64)	−0.141 (−0.64)	0.049 (0.18)	0.045 (0.16)	−0.072 (−0.27)	−0.071 (−0.26)	−0.810*** (−2.99)	−0.808*** (−2.98)	−0.876*** (−3.20)	−0.875*** (−3.20)
<i>MktMom</i>	35.979*** (88.51)	35.980*** (88.51)	35.980*** (88.51)	35.980*** (88.49)	38.885*** (84.22)	38.885*** (84.22)	38.888*** (84.22)	38.887*** (84.21)	29.567*** (44.57)	29.567*** (44.57)	29.565*** (44.58)	29.566*** (44.60)
Firm Characteristics Controlled?	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes
Month and Industry FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	582,358	582,358	582,358	582,358	335,146	335,146	335,146	335,146	247,212	247,212	247,212	247,212
Adj. R <sup>2</sup>	0.29	0.29	0.29	0.29	0.34	0.34	0.34	0.34	0.18	0.18	0.18	0.18
Panel B. Sample of 2017												
Variables	Daily Stock Return (DRet)											
	Sample of Positive and Negative CrMom				Sample of Positive CrMom				Sample of Negative CrMom			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
<i>CrMom</i>	2.385*** (4.25)	2.387*** (4.21)	2.537*** (4.49)	2.295*** (3.55)	−3.473*** (−3.41)	−3.572*** (−3.47)	−3.089*** (−2.97)	−2.835** (−2.42)	2.197 (1.38)	2.375 (1.49)	2.366 (1.48)	−0.399 (−0.21)
<i>High Pledge</i>		0.002 (0.20)	−0.005 (−0.43)			0.045** (2.12)	0.034 (1.57)			0.033 (1.11)	0.029 (1.01)	
<i>High Pledge × CrMom</i>		−0.039 (−0.06)	−0.067 (−0.10)			1.980* (1.70)	1.906 (1.61)			−3.650 (−1.60)	−3.670 (−1.61)	
<i>Zero Pledge</i>				0.004 (0.63)				−0.003 (−0.20)				−0.046*** (−3.11)
<i>Zero Pledge × CrMom</i>				0.407 (1.04)				−0.270 (−0.40)				4.456*** (3.72)
<i>Mom</i>	0.020 (0.10)	0.019 (0.10)	−0.130 (−0.72)	−0.128 (−0.71)	0.240 (0.98)	0.241 (0.99)	−0.245 (−1.07)	−0.248 (−1.08)	−0.216 (−0.94)	−0.218 (−0.94)	−0.206 (−0.90)	−0.198 (−0.86)
<i>MktMom</i>	44.311*** (55.22)	44.311*** (55.21)	44.309*** (55.23)	44.308*** (55.22)	43.806*** (46.32)	43.806*** (46.32)	43.796*** (46.33)	43.797*** (46.32)	43.165*** (39.22)	43.164*** (39.22)	43.164*** (39.22)	43.172*** (39.25)
Firm Characteristics Controlled?	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes

(continued on next page)

Table 4 (continued)

Panel B. Sample of 2017												
Variables	Daily Stock Return (DRet)											
	Sample of Positive and Negative CrMom				Sample of Positive CrMom				Sample of Negative CrMom			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Month and Industry FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	546,458	546,458	546,458	546,458	270,922	270,922	270,922	270,922	275,536	275,536	275,536	275,536
Adj. R <sup>2</sup>	0.16	0.16	0.16	0.16	0.21	0.21	0.21	0.21	0.12	0.12	0.12	0.12

This table presents OLS regression results on the existence of cross-momentum effects of firms with various degrees of stock pledging (by their largest shareholders). Panels A and B report results for years 2018 and 2017 respectively. We first define those firms with stock pledge ratio of the largest shareholders higher than 95% at the end of 2016 as “*First-tier*” high-pledged firms. We then construct an equal-weighted portfolio of “*First-tier*” high-pledged firms at the end of 2016, and keep the portfolio firms unchanged during 2017–2018. *CrMom* is defined as the BHRs of this portfolio over the previous three trading days. *Zero Pledge* is a dummy variable that equals 1 if the largest shareholder of the firm pledges no shares at the end of 2016, and 0 otherwise. For both sample periods, we exclude “*First-tier*” high-pledged firms in the regressions, and firm characteristics are included in some specifications (including *SOE*, *Size*, *B/M*, *LEV*, *Cash*, *ROA*, *Indep*, *Inst* and *Top1*). See detailed variable definitions in [Appendix A](#). In each panel, Columns (1)–(4) report results for the whole sample (with positive and negative *CrMom*); to distinguish downward momentum effects from upward cross-momentum effects, we split the sample into 2 subsamples: Columns (5)–(8) report results for the subsample of positive *CrMom*, and Columns (9)–(12) report results for the subsample of negative *CRMom*. In all the specifications, we control for month and industry fixed effects based on the CSRC level-1 industry classification. T-values calculated using the standard errors clustered by dates and by companies are reported in the parentheses. \*\*\*, \*\* and \* denote the statistical significance at the 1%, 5% and 10% levels, respectively.

end of 2016, there are a total of 175 “first-tier” high-pledged firms, accounting for 6.1% of all listed companies, and 207 “second-tier” high-pledged firms (7.2% of all listed firms). We construct an equal-weighted portfolio of “first-tier” high-pledged firms at the end of 2016, and keep the portfolio unchanged during 2017 and 2018.

Table 4 presents OLS regression results on the existence of cross-momentum effects of high pledged stocks. Panels A and B report results for sample period of 2018 and 2017 respectively. The dependent variable is again *DRet*, the daily stock return expressed in percentage points, adjusted for stock splits and including cash dividends, and multiplied by 100. *CrMom* is defined as the buy-and-hold returns of the portfolio “first-tier” high pledged firms over the previous three trading days. *High Pledge* is a dummy variable equals one if the listed firm is a “second-tier” high pledged firm at the end of 2016, and zero otherwise; *Zero Pledge* is another dummy variable equals one if the largest shareholder of the firm pledges no shares at the end of 2016, and zero otherwise. In all specifications, we exclude “first-tier” high-pledged firms in the regressions, and control for month and the industry fixed effects, individual momentum (*Mom*) and market momentum (*MktMom*), and standard errors are clustered by dates and by companies.

As indicated in Columns (1) through (3) in Panel A, the coefficients on *CrMom* and the interaction term *High Pledge* × *CrMom* are significant at 1% level, suggesting that cross-momentum effects of “first-tier” high-pledged portfolio on other stocks exist, and cross-momentum effects are stronger on “second-tier” high-pledged firms than on other firms. As indicated in Column (4), we include the interaction term *Zero Pledge* × *CrMom* in the regression as a comparison, and find the coefficient much smaller in magnitude (as compared to that of *High Pledge* × *CrMom*) and statistically insignificant, which can be regarded as a “falsification” test on cross-momentum, and improves the robustness of regression results on high pledged stocks.

We again split the sample into positive *CrMom* and negative *CrMom* subsamples to further study contagion effects in market downturns. The coefficient on *High Pledge* × *CrMom* is positive and significant (at 10% level) in the negative *CrMom* subsample (Columns 10 and 11), while it is much smaller in magnitude and statistically insignificant in the positive *CrMom* subsample (Columns 6 and 7). The contrast in the two subsamples indicate that, the cross-momentum effects on “second-tier” high-pledged firms are stronger than on other stocks, but only under the condition that “first-tier” high-pledged portfolio is in a short-term downtrend. Moreover, in Columns (1) through (8), the coefficient on *Mom* becomes statistically insignificant as compared to regression results in Table 3; in Columns (9) through (12), the coefficient on *Mom* remains statistically significant, but its magnitude less than that of *CrMom*. These results suggest that the cross-momentum effects of the “first-tier” high-pledged firms on other stocks outweigh the momentum effects of the stocks themselves.

Panel B reports the regression results for 2017. We find that the coefficient on *High Pledge* × *CrMom* to be negative and statistically insignificant for the whole sample and the negative *CrMom* subsample, which sharply contrast the findings in 2018 (Panel A). In this case, we can't draw the conclusion that spillover effects of “first-tier” high-pledged portfolio are stronger on “second-tier” high-pledged firms, and thus can't provide evidence of (negative) contagion effects in 2017. To summarize, cross-momentum tests in Table 4 provide evidence on contagion effects of forced sales of high-pledged stocks in a bear market of 2018.

#### 4. Stock pledged loans' effects on firms' operating performance

##### 4.1. Analyses on firms' operating performances and financial conditions (2017–2018)

We have shown that stock pledged loans impose substantial risk on firms' stock performance, especially during market downturns. It is important to find out whether lower stock returns of high-pledged firms are merely driven by liquidity issues in the market, or they also reflect possible deterioration in operating performance and financial conditions. We conduct difference-in-difference (DID) tests on firms' operating performance and financial conditions from 2017 to 2018.

We define treatment firms as firms with the percentage of the largest shareholder's ownership larger than 80% at the end of 2016. Firms with the largest shareholders pledging no shares at the end of 2016 are potential control firms. We define *High Pledge* as a dummy variable equals one for treatment firms, and zero otherwise, and further conduct a PSM procedure to make sure that the treatment and control firms are comparable. To be more specific, we first run a Probit regression of treatment dummy (*High Pledge*) on firm controls, including *SOE*, *Size*, *B/M*, *LEV*, *Cash*, *ROA*, *Indep*, *Inst* and *Top1*. Then we use the predicted propensity score to select one control firm for each treatment firm with the nearest score from the same industry.<sup>7</sup> Following this procedure, we find 168 pairs of treatment and control firms. The regression sample includes observations of treatment firms and their corresponding control firms in 2017 and 2018, and we define *Dum2018* as a dummy variable equals one if the observation belongs to 2018, and zero otherwise. In all specifications, we control for industry fixed effect, and standard errors are clustered by years and by companies.

Table 5 presents the regression results of DID analysis on firms' operating performance and financial conditions. In Columns (1) and (2), the dependent variable is *ROA*. The coefficient on *High Pledge* × *Dum2018* is negative and statistically significant (at 1% level in Column (1), and significant at 5% level in Column (2) when firm controls are included). The negative coefficient in Column (2) suggests that, on average, the change in *ROA* for high-pledged firms is 5.5% lower than non-pledged firms in 2018, with firm characteristics, industry effects and time effects controlled. In Columns (3) and (4), the dependent variable is *Cash*, and the results show that high-pledged firms, on average, have a larger declines of cash holdings in 2018 (result statistically insignificant). In Columns (5) and (6), we find that high-pledged firms' leverage ratio increases more than non-pledge firms in 2018 (significant at 5%). To summarize, stock pledging leads to a higher degree of worsening in firms' operation performance and financial conditions in 2018.

Aggravated expropriation by the largest (controlling) shareholders (e.g., Jiang et al., 2010) provides a possible explanation for results in Table 5. To investigate the possible mechanisms on how stock pledged loans harm the listed firms' operating performance and

<sup>7</sup> The difference in propensity scores for the treatment firm and selected control firm is no more than 15%.

**Table 5**  
Analyses on firms' operating performance and financial conditions (2017–2018).

Variables	ROA	ROA	Cash	Cash	LEV	LEV
	(1)	(2)	(3)	(4)	(5)	(6)
<i>High Pledge</i>	−0.012 (−1.08)	−0.012 (−1.14)	−0.022* (−1.82)	−0.020** (−1.97)	0.053** (2.33)	0.034** (2.11)
<i>Dum2018</i>	−0.014** (−2.10)	−0.011 (−1.44)	−0.008 (−1.50)	−0.004 (−0.50)	0.006 (0.91)	0.002 (0.21)
<i>High Pledge</i> × <i>Dum2018</i>	−0.063*** (−2.94)	−0.055** (−2.44)	−0.013 (−1.56)	−0.003 (−0.21)	0.050** (2.53)	0.041** (2.19)
<i>SOE</i>		−0.012 (−0.70)		0.024 (1.06)		−0.028 (−0.17)
<i>Size</i>		0.002 (0.16)		−0.010 (−1.13)		0.016 (1.33)
<i>B/M</i>		−0.002 (−0.06)		−0.022 (−1.33)		−0.006 (−0.12)
(Lag) <i>LEV</i>		−0.023 (−0.77)		−0.010 (−0.44)		0.882*** (22.88)
(Lag) <i>Cash</i>		0.027 (0.61)		0.665*** (13.18)		−0.102* (−1.69)
(Lag) <i>ROA</i>		0.536*** (3.39)		0.057 (0.51)		−0.140 (−0.74)
<i>Indep</i>		0.070 (0.70)		0.084 (1.39)		−0.198 (−1.49)
<i>Inst</i>		0.050 (1.36)		−0.002 (−0.08)		−0.007 (−0.14)
<i>Top1</i>		0.044 (1.27)		0.079** (2.39)		0.008 (0.19)
<i>Constant</i>	−0.081 (−0.91)	−0.061 (−0.36)	0.265** (2.42)	0.210 (1.53)	0.342*** (4.01)	−0.026 (−0.12)
<i>Ind</i>	Yes	Yes	Yes	Yes	Yes	Yes
Observations	672	672	672	672	672	672
Adj. R <sup>2</sup>	0.07	0.11	0.07	0.50	0.14	0.51

This table presents the regression results on the changes in firms' operating performance and financial conditions from 2017 to 2018, using the PSM method. We define treatment firms as firms with the percentage of the largest shareholder's ownership larger than 80% at the end of 2016; firms with the largest shareholders pledging no shares at the end of 2016 are potential control firms. We select control firms from this subsample (of non-pledged firms) following the PSM procedure, and require the treatment firm and the control firm: (1) to be in the same industry, and (2) the difference of propensity scores is no more than 15%. The sample includes observations of treatment firms and their corresponding control firms in 2017 and 2018. *High Pledge* is a dummy variable that equals 1 for treatment firms, and 0 for control firms. *Dum2018* is a dummy variable that equals 1 if the observation belongs to 2018, and 0 otherwise. In Columns (1) and (2), the dependent variable is *ROA*; in Columns (3) and (4), the dependent variable is *Cash*; and in Columns (5) and (6), the dependent variable is *LEV*. *SOE*, *Size*, *B/M*, (Lag) *LEV*, (Lag) *Cash*, (Lag) *ROA*, *Indep*, *Inst* and *Top1* are firm characteristics collected at the end of previous year. We use the symbol (Lag) to differentiate independent variables (of the previous year) from other (contemporaneous) independent variables. See detailed variable definitions in Appendix A. In all the specifications, we control the industry fixed effect based on the CSRC level-1 industry classification. T-values calculated using the standard errors clustered by years and companies are reported in the parentheses. \*\*\*, \*\* and \* denote the statistical significance at the 1%, 5% and 10% levels, respectively.

financial conditions, we conduct DID tests on illegal behavior of the largest shareholders and cash (out)flows from the listed firms to the largest shareholders (i.e., tunneling).

Table 6 presents the regression results on the changes in the largest shareholders' illegal behavior from 2017 to 2018. The dependent variable is *Illegal Dummy*, an indicator that equals one if the firm is found (by CSRC, CBRC and PBOC) to have misconduct on “illegal guaranteed loans to the largest shareholder” and “illegal occupation of resources by the largest shareholder” in a given year, and zero otherwise. In all the specifications, we report the marginal effects of Probit regressions, and control for industry fixed effect. Standard errors are clustered by years and by companies. As indicated in Table 6, coefficients on the dummy variable *High Pledge* are positive and significant, suggesting that the largest shareholders of highly-pledged firms are more likely to engage in tunneling activities – by forcing the firm to provide guarantees on (questionable) loans and occupying firms' resources. This is consistent with the expropriation hypothesis in terms of stock pledge (Yeh et al., 2003; Chan et al., 2018). In addition, the coefficients on *High Pledge* × *Dum2018* are positive and significant at 1% level, providing evidence that forced sales of pledged shares aggravate the expropriation by the largest shareholders. The coefficient of 0.062 (on *High Pledge* × *Dum 2018*) in Column (2) indicate that, the largest shareholder of a high pledged firm is 6.2% more likely to engage in tunneling activities in 2018 than that of the non-pledged firms in 2017.

Table 7 presents the results of analyses on the changes in RPTs between the largest shareholders and the firms from 2017 to 2018, following Allen et al. (2023). In Columns (1) and (2), the dependent variable is *RPT Net Inflow (Lending)*, which is defined as the amount of net lending from the largest shareholder to the firm in a given year, divided by total assets. The negative coefficient on *High Pledge* × *Dum 2018* (significant at 10% level) suggests that, in 2018, the largest shareholder of high-pledged firms reduces the amount of



**Table 6**  
Analyses on illegal behavior of listed firms' largest shareholders (2017–2018).

Variables	Illegal Dummy	
	(1)	(2)
<i>High Pledge</i>	0.141*** (3.32)	0.134*** (3.42)
<i>Dum2018</i>	0.010 (1.04)	0.008 (0.92)
<i>High Pledge</i> × <i>Dum2018</i>	0.066*** (4.76)	0.062*** (4.36)
<i>SOE</i>		−0.027 (−0.66)
<i>Size</i>		−0.003 (−0.15)
<i>B/M</i>		−0.033 (−0.56)
<i>LEV</i>		0.149** (2.08)
<i>Cash</i>		0.001 (0.01)
<i>ROA</i>		−0.120 (−0.64)
<i>Indep</i>		−0.157 (−0.73)
<i>Inst</i>		0.058 (0.91)
<i>Top1</i>		0.025 (0.23)
Industry FE	Yes	Yes
Observations	672	672
Pseudo R <sup>2</sup>	0.21	0.22

This table presents the regression results on the changes in the largest shareholders' illegal behavior from 2017 to 2018, using the PSM method. We define treatment firms as firms with the percentage of the largest shareholder's ownership larger than 80% at the end of 2016; firms with the largest shareholders pledging no shares at the end of 2016 are potential control firms. We select control firms from this subsample (of non-pledged firms) following the PSM procedure, and require the treatment firm and the control firm: (1) to be in the same industry, and (2) the difference of propensity scores is no more than 15%. The sample includes observations of treatment firms and their corresponding control firms in 2017 and 2018. *Illegal Dummy* is an indicator that equals 1 if the firm is identified by CSRC, CBRC, and PBOC as having violations on “illegal guaranteed loans to the largest shareholder” and “illegal occupation of resources by the largest shareholder” in a given year, and 0 otherwise. *SOE*, *Size*, *B/M*, *LEV*, *Cash*, *ROA*, *Indep*, *Inst* and *Top1* are firm characteristics collected at the end of previous year. See detailed variable definitions in Appendix A. In all the specifications, we report the marginal effects from Probit regressions, and control industry fixed effect based on the CSRC level-1 industry classification. T-values calculated using the standard errors clustered by years and companies are reported in the parentheses. \*\*\*, \*\* and \* denote the statistical significance at the 1%, 5% and 10% levels, respectively.

lending to the listed firms (or raises the amount of borrowing from the listed firms) as compared to non-pledged firms in 2017. In Columns (3) and (4), the dependent variable is *RPT Net Inflow (Total)*, which is defined as the aggregated amount of cash flows a listed firm receives from the largest shareholder minus cash flows paid out to the shareholder in RPTs in a given year, divided by total assets. The negative coefficient on *High Pledge* × *Dum2018* again supports the expropriation hypothesis from the perspective of overall RPTs. In Columns (5) and (6), the dependent variable is *Private Placement*, a dummy variable that equals one if the firm issues directional shares to its largest shareholder in a given year, and zero otherwise. The coefficient on *High Pledge* × *Dum2018* is negative and significant at 1% level, suggesting that, in 2018, with firm characteristics and industry effects controlled, the largest shareholder of a high-pledged firm is 6.8% less likely to purchase new shares issued by the firm (and contribute capital to the firm in the process), as compared to non-pledged firms. Results in Table 7 support the aggravated expropriation hypothesis from the perspective of debt financing, equity financing and overall related-party transactions.

To summarize, forced sales of pledged stocks worsen the financial condition of the largest shareholders, and, as a result of worsened expropriation conflict, these shareholders with high levels of stock pledged loans are more likely to engage in value-destroying tunneling activities, which then leads to a worsening of firms' operating performance and financial conditions.

#### 4.2. Policy change on stock pledged loans in 2013 and its effects on firms' operating performance and investments (2011–2012, 2014–2015)

We have documented that high levels of stock pledged loans of the largest shareholders have had a negative impact on firms' stock returns and operating performance during the bear market of 2018. But is stock pledging always harmful to listed firms? Intuitively,

**Table 7**  
Analyses on RPTs between the largest shareholders and the listed firms (2017–2018).

Variables	RPT Net Inflow (Lending)		RPT Net Inflow (Total)		Private Placement	
	(1)	(2)	(3)	(4)	(5)	(6)
<i>High Pledge</i>	0.041 (1.38)	0.038 (1.32)	0.024 (1.30)	0.023 (1.28)	0.041 (0.94)	0.038 (0.87)
<i>Dum2018</i>	-0.034 (-1.42)	-0.031 (-1.21)	0.007 (0.41)	0.010 (0.56)	-0.005 (-0.16)	-0.004 (-0.13)
<i>High Pledge</i> × <i>Dum2018</i>	-0.053* (-1.94)	-0.049* (-1.75)	-0.025 (-0.72)	-0.026 (-0.71)	-0.079*** (-2.83)	-0.068** (-2.56)
<i>SOE</i>		0.035 (0.51)		0.027 (1.26)		0.075** (2.25)
<i>Size</i>		-0.001 (-0.05)		0.009 (1.01)		-0.028** (-1.99)
<i>B/M</i>		-0.054 (-1.54)		-0.026* (-1.80)		-0.019 (-0.41)
<i>LEV</i>		0.055 (0.95)		-0.031 (-0.71)		0.226*** (3.78)
<i>Cash</i>		-0.272 (-1.64)		-0.206 (-1.29)		-0.089 (-1.01)
<i>ROA</i>		-0.452* (-1.75)		-0.311 (-1.56)		0.464*** (2.81)
<i>Indep</i>		0.053 (0.42)		0.070 (1.03)		-0.162 (-0.85)
<i>Inst</i>		-0.030 (-0.71)		-0.026 (-0.97)		0.028 (0.65)
<i>Top1</i>		0.032 (0.51)		-0.002 (-0.12)		-0.074 (-1.01)
<i>Constant</i>	0.029 (1.42)	0.182 (0.77)	-0.010 (-0.69)	-0.072 (-0.67)		
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	672	672	672	672	672	672
Adj. R <sup>2</sup>	0.04	0.08	0.01	0.06		
Pseudo R <sup>2</sup>					0.05	0.17

This table presents the results of the changes in cash flow-based RPTs between the largest shareholders and the firms from 2017 to 2018, using the PSM method. We define treatment firms as firms with the percentage of the largest shareholder's ownership larger than 80% at the end of 2016, firms with the largest shareholders pledging no shares at the end of 2016 are potential control firms. We select control firms from this subsample (of non-pledged firms) following the PSM procedure, and require the treatment firm and the control firm: (1) to be in the same industry and (2) the difference of propensity scores is no more than 15%. The sample includes observations of treatment firms and their corresponding control firms in 2017 and 2018. In Columns (1) and (2), the dependent variable is *RPT Net Inflow (Lending)*, which is defined as the amount of net lending from the largest shareholder to the firm in a given year, divided by total assets. In Columns (3) and (4), the dependent variable is *RPT Net Inflow (Total)*, which is defined as the aggregated amount of cash flows a listed firm receives from the largest shareholder minus cash flows paid out to the shareholder in RPTs in a given year, divided by total assets. In Columns (5) and (6), the dependent variable is *Private Placement*, which is a dummy variable that equals 1 if the firm issues directional shares to its largest shareholder in a given year, and 0 otherwise. We report the marginal effects from Probit regressions in Columns (5) and (6). *SOE*, *Size*, *B/M*, *LEV*, *Cash*, *ROA*, *Indep*, *Inst* and *Top1* are firm characteristics collected at the end of previous year. See detailed variable definitions in [Appendix A](#). In all the specifications, we control industry fixed effect based on the CSRC level-1 industry classification. T-values calculated using the standard errors clustered by years and companies are reported in the parentheses. \*\*\*, \*\* and \* denote the statistical significance at the 1%, 5% and 10% levels, respectively.

when the largest shareholder receives a stock pledged loan, his own financial condition can be improved, which can also lead to better conditions of the listed firms if their interests are properly aligned. A policy change that permits securities companies to participate in stock pledge activities in 2013, provides us with an opportunity to examine the hypothesis. To be more specific, on May 24th, 2013, a new policy on the approval of stock pledge repurchase transactions was jointly announced by the SSE, SZSE, and the China Securities Depository and Clearing Corp. As discussed earlier, stock pledge repurchase transactions greatly simplify the process of stock pledging and using stock as collateral in the credit/lending market. As indicated in [Fig. 4](#), the number of the largest shareholders (of listed companies) with their shares pledged increased dramatically from 7 on April 30th, 2013 (before the announcement of the new regulation), to 349 on Dec 31st, 2013.

[Table 8](#) presents results on the largest shareholders' decision to pledge stocks upon the announcement of policy change on May 24th, 2013, and the stock market's reaction. The sample includes observations of listed firms in 2012, and we exclude 7 firms of which the largest shareholders pledging their shares before the announcement of policy change in the regressions. With May 24th, 2013 as the event day, Column (1) reports OLS regression results of announcement effects of the policy change, where the dependent variable is the CAR (Cumulative Abnormal Returns) measured using the CAPM over the event window [-1,1]. Coefficients on firm controls including *Cash*, *Current Ratio*, *PPET*, and *B/M* are all negative and statistically significant, indicating that market reaction upon the policy announcement toward growth firms with financial constraints is positive. Column (2) reports the results from Probit regressions, where

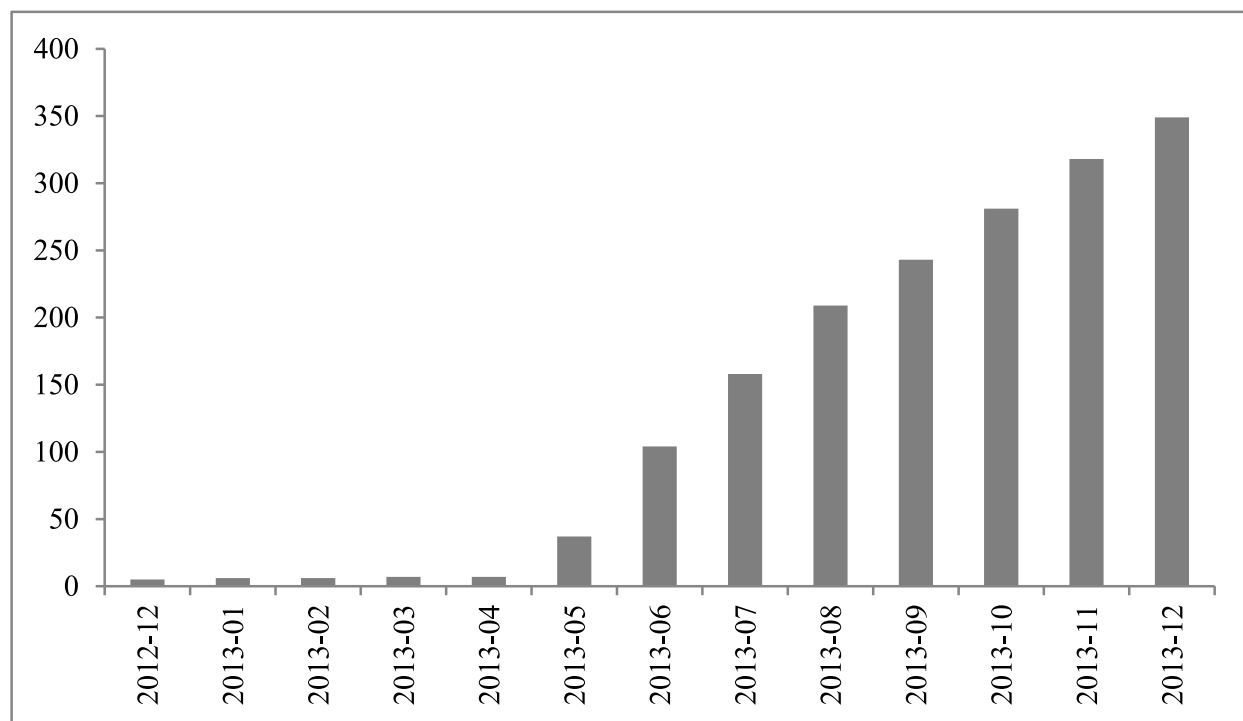


Fig. 4. Number of Firms with the Largest Shareholders Pledging their Shares (2013)

This figure plots the number of the largest shareholders (of listed firms) pledging their shares at the end of each month from December 31, 2012 to December 31, 2013. On May 24, 2013, a new regulation on the approval of stock pledge repurchase transactions that simplifies the process of stock pledged loans, was jointly issued by the SSE, SZSE, and the China Securities Depository and Clearing Corp.

the dependent variable *Pledged* is a dummy variable that equals one if the percentage of the largest shareholder's ownership that is pledged is positive at the end of 2013, and zero otherwise. We continue to find negative coefficients on firm controls (*Cash*, *Current Ratio*, *PPET* and *B/M*), suggesting that those firms which receives positive market reaction to the new regulation, are more likely to have their largest shareholders start employing stock pledged loans as a new financing channel in 2013; indeed, we find a positive and significant correlation between  $CAR_{[-1,1]}$  and *Pledged* (correlation coefficient is 0.34, significant at 1% level).

We further examine the announcement effects of the largest shareholders' stock pledging in 2013, and the results are shown in Table 9. We define "pledged firms" as firms with their largest shareholders pledging their shares at the end of 2013, and select matched non-pledged firms from firms with their largest shareholders pledging no shares at the end of 2013, following the PSM procedure. Taking the announcement of the largest shareholders' stock pledge (for the first time in 2013) as the event day, Table 9 presents the mean cumulative returns of pledged firms, market index (Shanghai Composite Index) and matched non-pledged firms over event window  $[-1,1]$ , post-event window  $[1,10]$ ,  $[1,30]$  and  $[1,60]$ , respectively. The mean cumulative return of pledged firms over event window  $[-1,1]$  is 0.05%, which is 0.55% and 0.37% higher than that of the market index and matched non-pledged firms. Moreover, for post-event windows, the differences in cumulative return of pledged firms and market index (matched non-pledged) actually rise as the event window becomes longer. For instance, the mean cumulative returns of pledged firms over post-event window  $[1,60]$  is 10.94%, which is 8.86% (4.03%) higher than market index (matched non-pledged firms), and the differences are significant at 1% level. The empirical results of Tables 8 and 9 indicate that the market regards stock pledging by the largest shareholder as a result of the policy shock, as positive news for listed firms.

Table 10 presents the regression results of analyses on the changes in firms' operating performance and investments before and after the policy change in 2013. We define treatment firms as firms with the largest shareholders pledging their shares at the end of 2013. Firms with the largest shareholders pledging no shares at the end of 2013 are potential control firms. We select control firms following the PSM procedure, and find a total of 281 pairs of firms. The sample includes observations of treatment firms and their corresponding control firms in 2011–2012 and 2014–2015, and we again exclude those 7 firms of which the largest shareholders pledging their shares before the announcement of policy change on May 24th, 2013 in the regressions. Thus, *Pledged* equals one for treatment firms (and zero for control firms). *Post* is a dummy variable equals one if the observation belongs to the post-policy change period (2014 and 2015), and zero if the observation belongs to pre-policy change period (2011 and 2012).

In Columns (1) and (2), the dependent variable is ROA. The coefficient on the interaction term, *Pledged*  $\times$  *Post*, is positive but statistically insignificant, suggesting that improvement in profitability for pledged firms is not significant different from non-pledged

**Table 8**  
Stock market reaction upon the announcement of policy change on May 24, 2013 and the largest shareholders' decision to pledge stocks for loans.

Variables	$CAR_{[-1,1]}$	Pledged
	(1)	(2)
<i>Cash</i>	-0.030*** (-3.99)	-0.330** (-1.99)
<i>Current Ratio</i>	-0.002** (-2.23)	-0.042** (-2.35)
<i>PPET</i>	-0.023*** (-3.53)	-0.745** (-2.49)
<i>B/M</i>	-0.009*** (-2.68)	-0.494*** (-2.93)
<i>SOE</i>	-0.005 (-1.31)	-0.702*** (-3.97)
<i>Natural Person</i>	0.002 (0.69)	0.644*** (3.91)
<i>Size</i>	-0.006*** (-5.10)	0.047 (0.86)
<i>LEV</i>	-0.011 (-1.59)	0.516* (1.90)
<i>ROA</i>	-0.015 (-0.69)	-2.376** (-2.45)
<i>Indep</i>	0.019 (1.25)	0.182 (0.28)
<i>Inst</i>	0.005 (1.26)	0.284 (1.51)
<i>Top1</i>	-0.004 (-0.65)	0.874*** (3.40)
<i>Constant</i>	0.118*** (5.47)	
Industry FE	Yes	Yes
Observations	2094	2094
Adj. R <sup>2</sup>	0.14	
Pseudo R <sup>2</sup>		0.17

This table presents the stock market reaction upon the announcement of the policy change on May 24, 2013 (issued by SSE, SZSE, and the China Securities Depository and Clearing Corp.), as well as the largest shareholders' decision to pledge stocks for loans following the announcement. The sample includes observations of listed firms in 2012, and we exclude 7 firms of which the largest shareholders pledging their shares before the announcement of the new policy in the regressions. With May 24, 2013 as the event day, Column (1) reports OLS regression results of announcement effects of the policy change, where the dependent variable is the CAR (Cumulative Abnormal Returns) measured using the CAPM over the event window [-1,1]. Column (2) reports the results of Probit regressions, where the dependent variable *Pledged* is a dummy variable that equals 1 if the percentage of the largest shareholder's stock holdings pledged is positive at the end of 2013, and 0 otherwise. *Current Ratio* is the current assets divided by current liabilities, *PPET* is the net book value of fixed assets divided by total assets, *Natural Person* is an indicator that equals 1 if the firm is ultimately controlled by natural persons, and 0 otherwise. All the independent variables are collected at the end of 2012. In all the specifications, we control the industry fixed effects based on the CSRC level-1 industry classification. T-values calculated using the standard errors clustered by companies are reported in the parentheses.

firms. In Columns (3) and (4), the dependent variable is *Investment*. We find that the coefficient on the interaction term *Pledged* × *Post* is positive and statistically significant, indicating that stock pledged loans of the largest shareholders help increase the scale of investments for listed firms.

To further examine how stock pledged loans (by the firm's largest shareholder) leads to an increase in firm investments, we analyze the cash flows from the largest shareholders to listed firms before and after the policy change, as shown in Table 11. The coefficient on the interaction term *Pledged* × *Post* in Columns (1)–(2) and (5)–(6) is positive and statistically significant, suggesting that the largest shareholders of pledged firms strengthened their financial support to the listed firms through debt financing (lending) and equity financing (issuance of directional shares). These results thus provide evidence on the hypothesis that the largest shareholders use

**Table 9**  
Event studies following the announcements of the largest shareholders' stock pledging.

	Cumulative Returns (%)			
	Event Window	Post-event Window		
	[-1,1]	[1,10]	[1,30]	[1,60]
Pledged Firms	0.05	-0.29	4.61	10.94
Market index (Shanghai Composite Index)	-0.49	-0.87	0.48	2.09
Matched Non-pledged Firms	-0.32	-0.74	1.67	6.91
Pledged Firms - Market Index	0.55 (1.49)	0.58 (1.48)	4.13*** (5.41)	8.86*** (7.75)
Pledged Firms - matched Non-pledged Firms	0.37 (0.69)	0.45 (0.74)	2.94*** (3.08)	4.03*** (3.80)

This table presents the event study results of the largest shareholders' stock pledging in 2013. We define pledged firms as firms with their largest shareholders pledging their shares at the end of 2013, and exclude 7 firms of which the largest shareholders pledging their shares before the announcement of policy change on May 24, 2013. We select matched non-pledged firms from firms with their largest shareholders pledging no shares at the end of 2013, using the PSM procedure, and require the pledged firm and the matched non-pledged firm: (1) to be in the same industry, and (2) the difference of propensity scores is no more than 15%. With the announcement of stock pledging by the largest shareholder (for the first time in 2013) as the event day, we calculate the mean of cumulative returns of pledged firms, market index (Shanghai Composite Index), and of matched non-pledged firms over the event window [-1,1], and the post-event windows [1,10], [1,30] and [1,60], respectively. In addition, we examine the differences in means of cumulative returns between pledged-firms and market index, and also pledged-firms and matched non-pledged firms. \*\*\*, \*\* and \* denote the statistical significance at the 1%, 5% and 10% levels, respectively.

(partial) proceeds from their stock pledged loans to help relax the financial constraints of the listed firms.<sup>8</sup> The controlling shareholders are willing to do so when the level of (personal) stock pledging is low, and when the interests of the largest shareholders are aligned with those of the listed firms (and all the other shareholders).

In conclusion, based on a policy change in 2013 that allows securities companies to provide stock pledged loans to shareholders of listed firms, we reject the hypothesis that stock pledged loans adversely affects listed firms' operating performance in the early stages of China's stock pledging market. Instead, the market generally regards stock pledging by the largest shareholder as positive news for listed firms, and there is also evidence suggesting that the largest shareholders use the proceeds from stock pledged loans to boost their financial support of the listed firms. These results provide sharp contrast to those found in the bear market of 2018, and our conclusion is that forced sales of pledged stock and worsened agency conflict are responsible for the poor performance of high-pledged firms during 2018.

## 5. Robustness checks and additional results

In this section, we conduct a few robustness checks and additional tests: (1) we use the PSM procedure to examine the impact of forced sales of pledged stocks on the market; (2) we conduct new tests using alternative stock market crash risk measures to further investigate the impact of stock pledge on market performance, and provide additional evidence of asymmetrical momentum effects; (3) we examine the relationship between stock pledged loans and the probability of (listed firms') bond defaults.

### 5.1. Tests on stock returns: robustness checks

In Section III above we use the stock pledge ratio of the largest shareholder at the end of 2016 (prior to the test period) as the key independent variable in tests on stock performances. We admit that endogeneity issues might still exist in our study: unobserved omitted variables could drive both stock pledge ratios and stock returns. To mitigate this concern and confirm the effects of stock pledging and forced sales of pledged stocks on returns, we now perform tests on stock returns using the PSM method. We define treatment firms and control firms as we do in Table 5, and the sample includes observations of treatment firms and their corresponding control firms in 2017 and 2018.

Table 12 presents regression results of stock returns of listed firms, using the PSM method. Panel A reports regression results of monthly returns. We continue to find negative and significant coefficient on the measure of stock pledging (*High Pledge*), and positive and significant coefficient on the interaction term (*High Pledge* × *Dum 2017*), indicating that high-pledged firms underperformed other firms significantly in 2018, but no such patterns exist in 2017. Panels B1 and B2 report regression results on the existence of momentum effects of firms with stock pledged loans in 2018 and 2017, respectively. While statistical significance of the main explanatory variables decrease somewhat compared to those in Table 3, in Panel B1, we continue to find positive and significant (at 10% level) coefficients on the interaction term *Mom* × *High Pledge* in Columns (8) and (9), suggesting that forced sales of high-pledged stocks put more downward

<sup>8</sup> With manually collected data, He et al. (2022) find that a portion of the proceeds from the largest shareholders' stock pledged loans is used outside the listed firm, including funding entrepreneurial activities in start-ups.

**Table 10**

Analyses on firms' operating performance and investments before and after the policy change in 2013 (2011–2012, 2014–2015).

Variables	ROA		Investment	
	(1)	(2)	(3)	(4)
<i>Pledged</i>	−0.004 (−1.27)	−0.004 (−1.61)	0.000 (0.01)	−0.001 (−0.08)
<i>Post</i>	−0.015*** (−5.45)	−0.001 (−0.54)	−0.049*** (−6.37)	−0.039*** (−4.43)
<i>Pledged</i> × <i>Post</i>	0.001 (0.29)	0.001 (0.43)	0.017* (1.77)	0.018* (1.86)
<i>SOE</i>		0.001 (0.20)		−0.011 (−0.45)
<i>Size</i>		0.005*** (3.04)		0.005 (1.02)
<i>B/M</i>		−0.027*** (−6.75)		−0.044** (−2.38)
<i>LEV</i>		−0.014** (−2.27)		−0.007 (−0.29)
<i>Cash</i>		0.015* (1.71)		0.004 (0.14)
( <i>Lag</i> ) <i>ROA</i>		0.560*** (12.22)		0.093 (0.95)
<i>Indep</i>		−0.008 (−0.43)		−0.077 (−1.31)
<i>Inst</i>		0.013*** (3.13)		−0.007 (−0.50)
<i>Top1</i>		0.001 (0.18)		0.030 (1.27)
<i>Constant</i>	0.046*** (3.80)	−0.055** (−2.22)	0.114*** (2.80)	0.029 (0.35)
Year and Industry FEs	Yes	Yes	Yes	Yes
Observations	2248	2248	2248	2248
Adj. R <sup>2</sup>	0.06	0.46	0.04	0.05

This table presents the regression results of the changes in firms' operating performance and investments before and after the policy change in 2013. We define treatment firms as firms with the largest shareholders pledging their shares at the end of 2013, firms with the largest shareholders pledging no shares at the end of 2013 are potential control firms. We select control firms following the PSM procedure, and require the treatment firm and the control firm: (1) to be in the same industry and (2) the difference of propensity scores is no more than 15%. The sample includes observations of treatment firms and their corresponding control firms in 2011, 2012, 2014 and 2015 (and exclude those 7 firms of which the largest shareholders pledging their shares before the policy change date of May 24, 2013). *Pledged* is a dummy variable that equals 1 for treatment firms, and 0 for control firms. *Post* is a dummy variable that equals 1 if the observation belongs to post-policy period (2014 and 2015), and 0 if the observation belongs to pre-policy period (2011 and 2012). In Columns (1) and (2), the dependent variable is *ROA*; and in Columns (3) and (4), the dependent variable is *Investment*, defined as the change of inventories and fixed assets divided by total assets. *SOE*, *Size*, *B/M*, *LEV*, *Cash*, (*Lag*) *ROA*, *Indep*, *Inst* and *Top1* are firm characteristics collected at the end of previous year. We use a symbol (*Lag*) to differentiate independent variables (of the previous year) from other (contemporaneous) independent variables. See detailed variable definitions in Appendix A. In all the specifications, we control the year and industry fixed effects based on the CSRC level-1 industry classification. T-values calculated using the standard errors clustered by years and companies are reported in the parentheses. \*\*\*, \*\* and \* denote the statistical significance at the 1%, 5% and 10% levels, respectively.

pressure on these stocks in a market downturn. Panels C1 and C2 report regression results on the existence of cross-momentum effects in 2018 and 2017. Similar to what we find in Table 4, in Panel C1, the coefficients on the interaction term, *High Pledge* × *CrMom*, are positive and significant at 10% level in Columns (10) and (11), providing further evidence of contagion effects. To conclude, our main results on the relationship between stock pledging and returns are robust to using the PSM procedure.

## 5.2. Additional tests

### 5.2.1. Stock crash risk of firms with stock pledged loans

Following Hutton et al. (2009) and Kim et al. (2011), we construct two measures of crash risk based on firm-specific weekly returns: *DUVOL* and *NCSKEW*. Firm-specific weekly return equals to  $\ln(1 + \text{residual})$ , where the *residual* is  $\varepsilon_{i,t}$  from the expanded index-model regression:

$$r_{i,t} = a_i + b_1 \cdot r_{m,t-2} + b_2 \cdot r_{m,t-1} + b_3 \cdot r_{m,t} + b_4 \cdot r_{m,t+1} + b_5 \cdot r_{m,t+2} + \varepsilon_{i,t},$$

where  $r_{i,t}$  is the return on stock  $i$  in week  $t$ , and  $r_{m,t}$  is the return of Shanghai Composite Index in week  $t$ . *NCSKEW* is calculated by taking the negative value of the third moment of firm-specific weekly returns for each year and normalizing it by the standard deviation of firm-specific weekly returns raised to the third power. *DUVOL* is the variance of the firm-specific weekly returns (of the year) whenever the



**Table 11**

Analyses on RPTs between the largest shareholders and the firms before and after the policy change in 2013 (2011–2012, 2014–2015).

Variables	RPT Net Inflow (Lending)		RPT Net Inflow (Total)		Private Placement	
	(1)	(2)	(3)	(4)	(5)	(6)
<i>Pledged</i>	−0.009*** (−2.64)	−0.010** (−2.57)	0.005 (0.34)	0.011 (0.74)	−0.038 (−1.63)	−0.039* (−1.68)
<i>Post</i>	−0.001 (−0.21)	−0.002 (−0.39)	−0.002 (−0.16)	−0.017 (−1.16)	0.094*** (5.04)	0.094*** (3.38)
<i>Pledged</i> × <i>Post</i>	0.012** (2.33)	0.011** (2.09)	0.021 (1.35)	0.013 (0.78)	0.035* (1.75)	0.042** (2.16)
<i>SOE</i>		0.025*** (2.90)		−0.030 (−1.22)		−0.027 (−1.20)
<i>Size</i>		−0.006 (−1.38)		−0.007 (−0.67)		−0.015 (1.47)
<i>B/M</i>		−0.029*** (−2.80)		−0.081*** (−2.83)		−0.062** (−2.05)
<i>LEV</i>		0.034** (2.48)		0.148*** (3.46)		0.230*** (4.64)
<i>Cash</i>		−0.013 (−0.81)		−0.038 (−0.71)		0.050 (1.02)
<i>ROA</i>		−0.020 (−0.29)		−0.252* (−1.73)		−0.075 (−0.94)
<i>Indep</i>		0.001 (0.04)		0.012 (0.12)		−0.030 (−0.24)
<i>Inst</i>		−0.002 (−0.19)		−0.019 (−0.65)		−0.013 (−0.38)
<i>Top1</i>		0.034** (2.09)		0.074* (1.67)		−0.056 (−1.05)
<i>Constant</i>	0.078 (1.12)	0.138 (1.57)	0.175** (2.21)	0.232 (1.24)		
Year and Industry FEs	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2248	2248	2248	2248	2248	2248
Adj. R <sup>2</sup>	0.04	0.09	0.03	0.06		
Pseudo R <sup>2</sup>					0.05	0.09

This table presents the regression results of the changes in RPTs between the largest shareholders and the firms before and after the policy change, using the PSM method. We define treatment firms as firms with the largest shareholders pledging their shares at the end of 2013, firms with the largest shareholders pledging no shares at the end of 2013 are potential control firms. We select control firms following the PSM procedure, and require the treatment firm and the control firm: (1) to be in the same industry and (2) the difference of propensity scores is no more than 15%. The sample includes observations of treatment firms and their corresponding control firms in 2011, 2012, 2014 and 2015 (and exclude those 7 firms of which the largest shareholders pledging their shares before the policy change date of May 24, 2013). In Columns (1) and (2), the dependent variable is *RPT Net Inflow (Lending)*; in Columns (3) and (4), the dependent variable is *RPT Net Inflow (Total)*; and in Columns (5) and (6), the dependent variable is *Private Placement*. We report the marginal effects from Probit regressions in Columns (5) and (6). *SOE*, *Size*, *B/M*, *LEV*, *Cash*, *ROA*, *Indep*, *Inst* and *Top1* are firm characteristics collected at the end of previous year. See detailed variable definitions in Appendix A. In all the specifications, we control the year and industry fixed effects based on the CSRC level-1 industry classification. T-values calculated using the standard errors clustered by years and companies are reported in the parentheses. \*\*\*, \*\* and \* denote the statistical significance at the 1%, 5% and 10% levels, respectively.

firm-specific weekly return is lower than the mean of firm-specific weekly returns (of the year), divided by the variance of the firm-specific weekly returns whenever the firm-specific weekly return is higher than the mean of firm-specific weekly returns. The OLS regression results (Appendix Table 1 of the Internet Appendix) of crash risk measures indicate that, high-pledged firms are more likely to crash and deliver large negative returns in the bear market of 2018. However, in the normal period of 2017, the relationship between crash risk measures and the largest shareholder's stock pledge ratio is much weaker. These results are consistent with the conclusions inferred from Table 3 (lower returns of high-pledged firms in 2018) and Table 4 (asymmetrical momentum effects).

### 5.2.2. Bond defaults of firms with stock pledged loans

In 2018, with credit risks continuing to rise, a wave of bond defaults occurs in China's capital market. In this case, we select the sample period of 2018, and use a subsample of non-SOEs with bonds not mature at the end of the previous year (2017), to test the relationship between stock pledging of the largest shareholders and the probability of bond defaults in the next year. We conduct Probit regressions of the dummy variable *Default*, which takes the value one if the firm defaults on its bond in 2018, on the measure of the largest shareholders' stock pledging. Regression results (Appendix Table 2 in the Internet Appendix) indicate that probability of bond defaults for firms with high levels of stock pledged loans is 8.7% higher than others, with firm characteristics and industry effects controlled.

Results on bond defaults provide additional evidence on the economic consequences of the largest shareholders' expropriation of listed firms due to stock pledge, and are consistent with the fact that stock pledge leads to a larger extent of worsening in firms' operation performance and financial conditions, as indicated in Table 5.

**Table 12**  
Analyses on Stock Performances using Propensity Score Matching Method (2017–2018).

Panel A. Monthly Stock Returns (2017–2018)									
Variables	Monthly Return ( <i>MRet</i> )								
	(1)								
<i>High Pledge</i>	−0.458** (−2.14)								
<i>High Pledge</i> × <i>Dum2017</i>	0.416** (2.06)								
Firm Characteristics Controlled?	Yes								
Month and Industry FEs	Yes								
Observations	9982								
Adj. R <sup>2</sup>	0.21								
Panel B1. Stock Momentum (2018)									
Daily Stock Return ( <i>DRet</i> )									
Variables	Sample of Positive and Negative Mom			Sample of Positive Mom			Sample of Negative Mom		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
<i>Mom</i>	2.560*** (6.83)	1.681*** (4.37)	1.659*** (4.34)	−0.110 (−0.16)	−1.200 (−1.47)	−1.226 (−1.49)	5.071*** (7.30)	3.978*** (5.34)	3.788*** (5.15)
<i>High Pledge</i>		−0.024* (−1.83)	−0.021 (−1.51)		−0.049 (−1.18)	−0.048 (−1.14)		−0.001 (−0.02)	0.002 (0.05)
<i>Mom</i> × <i>High Pledge</i>		1.823*** (3.06)	1.808*** (3.04)		2.252* (1.74)	2.204* (1.69)		2.158* (1.83)	2.105* (1.80)
<i>MktMom</i>	34.640*** (53.18)	34.651*** (53.23)	34.650*** (53.22)	30.505*** (41.93)	30.508*** (41.99)	30.513*** (41.94)	37.183*** (50.30)	37.191*** (50.30)	37.185*** (50.29)
Firm Characteristics Controlled?	No	No	Yes	No	No	Yes	No	No	Yes
Month and Industry FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	73,706	73,706	73,706	33,322	33,322	33,322	40,384	40,384	40,384
Adj. R <sup>2</sup>	0.25	0.25	0.25	0.18	0.18	0.18	0.31	0.31	0.31
Panel B2. Stock Momentum (2017)									
Daily Stock Return ( <i>DRet</i> )									
Variables	Sample of Positive and Negative Mom			Sample of Positive Mom			Sample of Negative Mom		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
<i>Mom</i>	0.518* (1.79)	0.423 (1.14)	0.253 (0.68)	0.110 (0.18)	−0.106 (−0.13)	−0.224 (−0.28)	0.570 (1.13)	0.364 (0.58)	0.007 (0.01)
<i>High Pledge</i>		−0.012 (−0.87)	−0.016 (−1.34)		−0.026 (−0.96)	−0.026 (−0.89)		0.000 (0.02)	−0.002 (−0.06)
<i>Mom</i> × <i>High Pledge</i>		0.211 (0.49)	0.261 (0.60)		0.467 (0.41)	0.486 (0.44)		0.477 (0.55)	0.681 (0.80)
<i>MktMom</i>	41.413*** (40.83)	41.413*** (40.83)	41.403*** (40.83)	39.191*** (34.30)	39.188*** (34.32)	39.198*** (34.31)	42.817*** (38.26)	42.819*** (38.26)	42.802*** (38.13)
Firm Characteristics Controlled?	No	No	Yes	No	No	Yes	No	No	Yes
Month and Industry FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

(continued on next page)

Table 12 (continued)

Panel B2. Stock Momentum (2017)												
Daily Stock Return (DRet)												
Variables	Sample of Positive and Negative Mom			Sample of Positive Mom			Sample of Negative Mom					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)			
Observations	74,880	74,880	74,880	35,052	35,052	35,052	39,828	39,828	39,828			
Adj. R <sup>2</sup>	0.15	0.15	0.15	0.12	0.12	0.12	0.19	0.19	0.19			
Panel C1. Contagion (Cross-momentum) Effects (2018)												
Daily Stock Return (DRet)												
Variables	Sample of Positive and Negative CrMom				Sample of Positive CrMom				Sample of Negative CrMom			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
<i>CrMom</i>	3.894*** (5.31)	3.474*** (4.18)	3.508*** (4.22)	4.696*** (6.14)	2.360* (1.92)	2.184 (1.55)	2.292 (1.62)	3.025** (2.45)	2.082 (1.20)	2.126 (1.18)	2.240 (1.24)	2.822 (1.51)
<i>High Pledge</i>		-0.038** (-2.22)	-0.030 (-1.59)			-0.074* (-1.89)	-0.070* (-1.71)			0.012 (0.28)	0.027 (0.61)	
<i>High Pledge</i> × <i>CrMom</i>		1.973** (2.21)	1.932** (2.20)			0.634 (0.43)	0.604 (0.42)			1.465* (1.73)	1.458* (1.72)	
<i>Zero Pledge</i>				0.037** (2.11)				0.055 (1.33)				0.017 (0.45)
<i>Zero Pledge</i> × <i>CrMom</i>				-1.660** (-2.01)				-1.295 (-0.95)				-1.317 (-0.79)
<i>Mom</i>	1.249** (2.31)	1.247** (2.30)	1.213** (2.24)	1.101** (2.11)	1.638*** (2.61)	1.635*** (2.60)	1.528** (2.41)	1.390** (2.21)	0.138 (0.21)	0.142 (0.21)	0.057 (0.09)	-0.017 (-0.03)
<i>MktMom</i>	35.066*** (51.15)	35.069*** (51.15)	35.069*** (51.14)	35.082*** (51.26)	38.367*** (50.25)	38.369*** (50.25)	38.372*** (50.24)	38.367*** (50.29)	27.847*** (30.67)	27.848*** (30.66)	27.845*** (30.67)	27.879*** (30.71)
Firm Characteristics Controlled?	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes
Month and Industry FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	56,276	56,276	56,276	56,276	32,416	32,416	32,416	32,416	23,860	23,860	23,860	23,860
Adj. R <sup>2</sup>	0.26	0.26	0.26	0.26	0.32	0.33	0.33	0.33	0.16	0.16	0.16	0.16
Panel C2. Contagion (Cross-momentum) Effects (2017)												
Daily Stock Return (DRet)												
Variables	Sample of Positive and Negative CrMom				Sample of Positive CrMom				Sample of Negative CrMom			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
<i>CrMom</i>	2.296*** (3.02)	2.380*** (3.02)	2.581*** (3.27)	2.086** (2.07)	-1.614 (-1.23)	-2.002 (-1.46)	-1.579 (-1.14)	-1.268 (-0.69)	1.180 (0.54)	1.567 (0.69)	1.669 (0.73)	1.389 (0.50)
<i>High Pledge</i>		-0.002 (-0.13)	-0.013 (-0.93)			0.033 (1.03)	0.017 (0.54)			0.001 (0.03)	-0.005 (-0.12)	
<i>High Pledge</i> × <i>CrMom</i>		-0.278 (-0.29)	-0.282 (-0.30)			1.294 (0.79)	1.288 (0.77)			-1.310 (-0.45)	-1.387 (-0.47)	
<i>Zero Pledge</i>				0.014 (1.09)				0.002 (0.06)				0.022 (0.63)
<i>Zero Pledge</i> × <i>CrMom</i>				0.616 (0.65)				-0.007 (-0.00)				-0.047 (-0.02)

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Table 12 (continued)

Panel C2. Contagion (Cross-momentum) Effects (2017)												
Daily Stock Return (DRet)												
Variables	Sample of Positive and Negative CrMom				Sample of Positive CrMom				Sample of Negative CrMom			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
<i>Mom</i>	−0.163 (−0.45)	−0.165 (−0.45)	−0.379 (−1.05)	−0.428 (−1.18)	−0.481 (−0.99)	−0.478 (−0.99)	−0.943* (−1.93)	−0.990** (−2.01)	0.257 (0.50)	0.251 (0.49)	0.163 (0.32)	0.111 (0.22)
<i>MktMom</i>	41.384*** (39.91)	41.385*** (39.91)	41.385*** (39.92)	41.383*** (39.88)	40.911*** (35.71)	40.909*** (35.71)	40.908*** (35.73)	40.889*** (35.67)	40.526*** (29.42)	40.525*** (29.42)	40.526*** (29.42)	40.551*** (29.40)
Firm Characteristics Controlled?	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes
Month and Industry FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	56,102	56,102	56,102	56,102	27,840	27,840	27,840	27,840	28,262	28,262	28,262	28,262
Adj. R <sup>2</sup>	0.15	0.15	0.15	0.15	0.19	0.19	0.19	0.19	0.11	0.11	0.11	0.11

This table presents regression results of stock returns (monthly and daily returns) of listed firms, using the PSM method. We define treatment firms as firms with the percentage of the largest shareholder's ownership larger than 80% at the end of 2016, firms with the largest shareholders pledging no shares at the end of 2016 are potential control firms. We select control firms from this subsample (of non-pledged firms) following the PSM procedure, and require the treatment firm and the control firm: (1) to be in the same industry, and (2) the difference of propensity scores is no more than 15%. The sample includes observations of treatment firms and their corresponding control firms in 2017 and 2018. *High Pledge* is a dummy variable that equals 1 for treatment firms, and 0 for control firms. Panel A reports regression results of monthly returns of firms with various degrees of stock pledged loans of their largest shareholders. Panels B1 and B2 report regression results on the existence of momentum effects in years 2018 and 2017, respectively. Panels C1 and C2 report regression results on the existence of cross-momentum effects in years 2018 and 2017, respectively. Firm characteristics are included in some specifications, including *SOE*, *PriorRet* (only in Panel A), *Size*, *B/M*, *LEV*, *Cash*, *ROA*, *Indep*, *Inst* and *Top1*. See detailed variable definitions in Appendix A. In all the specifications, we control for month and the industry fixed effects based on the CSRC level-1 industry classification. T-values calculated using the standard errors clustered by dates (by months in Panel A) and by companies are reported in the parentheses. \*\*\*, \*\* and \* denote the statistical significance at the 1%, 5% and 10% levels, respectively.

## 6. Conclusion

Loans with a listed firm's stock as collateral have become a popular financing channel for shareholders in China, especially for firms which operate in growth industries, are less profitable, not majority owned by the government, and have higher leverage ratios. While stock pledged loans relax financial constraints of the largest shareholders and have no negative impact on the firms when the pledge ratio is low, they can impose substantial risk on the firms during stock market downturns.

With the sample of all the listed firms in the A share market from 2011 through 2018, we obtain three sets of results. First, while the stock returns of high-pledged firms are not significantly different from other firms in 2017, a year in which the Shanghai Composite Index rose 6.56%, firms with high levels of stock pledged loans have worse stock returns in the bear market of 2018. In addition, while most firms' operating performance worsened in 2018, firms with high levels of pledged stocks experienced greater deterioration. The largest shareholders of highly pledged firms are also more likely to conduct value-destroying tunneling transactions.

Second, there is some evidence on the short-term stock momentum of high-pledged stocks, and on the contagion effect from the selling of one high-pledged stock to another during market downturns. We find that firms with high levels of stock pledged loans have stronger short-term stock momentum as compared to those with low levels of stock pledged loans in 2018, and these effects exist only after a short-term downward trend. Moreover, a negative return of the portfolio with the highest pledge ratios leads to negative returns of other highly pledged stocks in 2018. By contrast, we do not find these patterns of stock momentum and cross-momentum in 2017.

Third, the impact of stock pledged loans on firms' performance varies with different stock pledge ratios. We find that the announcement in 2013 that allowed securities companies to provide stock pledged loans led to a positive market reaction for stocks, especially for those financially constrained firms and those with more growth options. Using a propensity-score matching procedure and difference-in-difference tests, we find that obtaining these loans had no adverse effects on firms' operating performance during the period of 2011–2014.

We conclude that stock pledged loans relax the financial constraints for individual investors and have no adverse effects on listed firms when the pledge ratio is low, while forced sales of pledged stock and worsened agency conflict are responsible for the poor performance of high-pledged firms during the bear market of 2018. Overall, our results extend the literature by showing that a financial innovation—stock pledged loans for individual investors—can lead to different outcomes for the listed firms depending on market conditions and the strength of corporate governance, and concentrated selling of pledged stocks during market downturns can generate systemic risk.

### Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

### Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jfds.2023.100104>.

### Appendix A. Variable Definitions

Variable	Definition
<i>PledgePct</i>	Percentage of the largest shareholder's ownership that is pledged at the end of 2016.
<i>High Pledge</i>	Equal to one if the percentage of the largest shareholder's ownership that is pledged is larger than 80% at the end of 2016, and zero otherwise.
<i>MRet</i>	Monthly stock returns of the firm, adjusted for stock split and including cash dividends, and multiplied by 100.
<i>Dum2017</i>	Equal to one if the observation belongs to 2017, and zero otherwise.
<i>SOE</i>	Equal to one if the firm is ultimately controlled by the central State-owned Assets Supervision and Administration Commission of the State Council (SASAC), local SASAC, Ministry of Finance, or other government agents, and zero otherwise.
<i>PriorRet</i>	Buy-and-hold returns over the previous three months.
<i>Size</i>	The natural logarithm of the market capitalization of equity.
<i>B/M</i>	Book assets divided by market capitalization of equity.
<i>LEV</i>	Total liabilities divided by total assets.
<i>Cash</i>	Cash and cash equivalents divided by total assets.
<i>ROA</i>	Net income trailing twelve months divided by total assets.
<i>Indep</i>	Number of independent directors divided by the size of board.
<i>Inst</i>	Percentage of shareholdings by institutional investor.
<i>Top1</i>	Percentage of shareholdings by the largest shareholder.
<i>DRet</i>	Daily stock returns of the firm, adjusted for stock split and including cash dividends, and multiplied by 100.
<i>Mom</i>	Buy-and-hold returns over the previous three trading days.

(continued on next page)

(continued)

Variable	Definition
<i>MktMom</i>	Buy-and-hold returns of Shanghai Composite Index over the previous three trading days.
<i>CrMom</i>	Buy-and-hold returns over the previous three trading days for the equal-weighted portfolio of firms with the largest shareholders pledging more than 95% of their shares at the end of 2016.
<i>Zero Pledge</i>	Equal to one if the largest shareholder pledges no shares at the end of 2016, and zero otherwise.
<i>Dum2018</i>	Equal to one if the observation belongs to 2018, and zero otherwise.
<i>Illegal Dummy</i>	Equal to one if the firm is disclosed by CSRC, CBRC and PBOC to have violations on “illegal guaranteed loans to the largest shareholder” and “illegal occupation of resources by the largest shareholder” in a given year, and zero otherwise.
<i>RPT Net Inflow (Lending)</i>	The amount of net borrowing from the largest shareholder to the firm in a given year, divided by total assets.
<i>RPT Net Inflow (Total)</i>	The aggregated amount of cash flows received from the largest shareholder minus cash flows paid out to the largest shareholder in related-party transactions in a given year, divided by total assets.
<i>Private Placement</i>	Equal to one if the firm issues directional shares to its largest shareholder in a given year, and zero otherwise.
<i>Pledged</i>	Equal to one if the percentage of the largest shareholder's ownership that is pledged is nonzero at the end of 2013, and zero otherwise.
<i>Current Ratio</i>	Current assets divided by current liabilities.
<i>PPET</i>	Net book value of fixed assets divided by total assets.
<i>Natural Person</i>	Equal to one if the firm is ultimately controlled by natural persons, and zero otherwise.
<i>Investment Post</i>	Change of inventories and fixed assets divided by total assets. Equal to one if the observation belongs to post-policy period (2014 and 2015), and zero if the observation belongs to pre-policy period (2011 and 2012).

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