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Crisis rescue via direct purchase: Evidence from China☆

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ABSTRACT

During the 2015 stock market crisis, the Chinese government used hundreds of billions of dollars to purchase shares directly in the secondary market. We find that compared with non-rescued firms, rescued firms have significantly lower liquidity after being rescued. Policy uncertainty regarding subsequent interventions better explains the reduction in liquidity than the liquidity dry-up and bad firm signaling hypotheses. Inconsistent with the potential moral hazards associated with government bailouts, the investment policies of rescued firms become more conservative after being rescued. Our evidence warns of the unintended consequences of direct purchase rescue programs.

1. Introduction

Governments have numerous intervention tools at their disposal when facing capital market crises, such as monetary policy adjustments, establishing lending facilities and injecting capital into distressed sectors (e.g., the Troubled Asset Relief Program), and secondary market intervention (e.g., short-selling ban). There is a fourth alternative: rescue through direct purchases, a type of rescue program in which a government directly purchases securities in its domestic stock market. While the first three market rescue approaches have been studied extensively,[1] the direct purchase approach has received relatively little attention. In this article, we investigate the effects of a large-scale (US $200 billion) direct purchase rescue program carried out by the Chinese government to purchase the shares of public companies in response to the 2015 stock market crash.

Following a one-year boom, the Chinese A-share market began to plummet on Monday, June 15, 2015, with one third of market capitalization lost in three weeks.[2] Given the massive turmoil in the stock market, the government chose to rescue it via direct purchase. The rescue program implemented by the Chinese government through state-owned institutions (also known as the National Team) lasted from early July to mid-August 2015, with an overall expenditure of more than $200

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[1] A few studies discuss the relationship between monetary policy and asset pricing in the stock market (Bernanke and Gertler 2001; Mishkin 2011; Bekaert, Hoerova, and Duca 2013; Gali and Gambetti 2015). Adrian, Kimbrough, and Marchioni (2011) and Duygan-Bump et al. (2013) study the effects of the Federal Reserve's new loan facilities. Bayazitova and Shivdasani (2012) study both banks' decision to participate in and the effect of the Troubled Asset Relief Program (TARP). Bhanot and Kadapakkam (2006) assess the impact of the purchase of the Hang Seng index by the Hong Kong Monetary Authority (HKMA) during the 1998 financial crisis. Several studies, such as Duchin and Sosyura (2012) and Berger and Roman (2015), examine the effects of TARP on recipient banks. Boehmer, Jones, and Zhang (2013) examine the effects of the short-selling ban on market quality.

[2] See Section 2 for detailed descriptions regarding the stock market crash and the rescue by the Chinese government.

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billion, or 1.8 % of China's GDP and 2.5 % of its total market capitalization.[3] The government directly purchased shares of more than 1360 firms during the rescue and ended up holding 3.1 % of all shares outstanding of these firms. Although the stock market turmoil appears to have stopped after the Chinese government's intervention, it is unclear to what extent this government intervention reshaped the stock market.

We examine how the post-rescue stock market differs from the pre-rescue market, using a standard difference-in-differences (DID) research design. The treated group consists of firms that were rescued by the government (i.e., those that experienced an increase in government ownership during the third quarter of 2015, as disclosed in the list of top 10 shareholders in their quarterly financial reports), and the control firms are those without any change in government ownership. We match each rescued firm with a non-rescued firm using propensity score matching based on the variables that drive target selection.[4] Our DID estimation reveals that rescued firms experience a significant decline in liquidity during the six weeks following the rescue, as indicated by both stock turnover (down by 12.7 %) and the Amihud illiquidity measure (up by 10.0 %), compared with matched non-rescued firms. However, we do not observe any discernible change in volatility. Our results suggest that China's 2015 rescue program did little to stabilize the market but substantially affected short-term liquidity.

Why did stock liquidity decline after the rescue program? A potential explanation is policy uncertainty. In China's attempt to stabilize the stock market through direct purchases, little information was released to the public about how the government executed the rescue program and, more importantly, what the government planned to do afterward. In contrast, large-scale rescue programs in developed markets are often accompanied by detailed press releases to the public. For instance, TARP, which was implemented in 2018 by the U.S. government, provided specific parameters regarding rescue targets and government exit. The scarcity of public information regarding China's direct rescue generated a high level of uncertainty among market participants following the implementation of the program.[5] Policy uncertainty due to the noise created by the Chinese government's intervention (e.g., Brunnermeier et al., 2022) may have deterred investors from trading the rescued stocks and compromised market liquidity. Supporting this policy uncertainty explanation, we observe a stronger liquidity decline in firms with stock returns that are more sensitive to economic policy uncertainty (Baker et al., 2016). Our results are also in line with prior studies showing that policy uncertainty leads to reduced liquidity in equity and equity options markets (Battalio & Schultz, 2011; Rehse et al., 2019).

Another potential explanation is the drying up of liquidity induced by the rescue program (i.e., the liquidity dry-up hypothesis). When the government holds the purchased shares instead of actively trading them, the number of shares circulating in the market decreases, potentially leading to reduced liquidity. Contrary to the prediction of this hypothesis, firms with more shares purchased by the National Team do not exhibit a significantly greater decrease (increase) in stock turnover (Amihud illiquidity) after the rescue program.

The reduction in liquidity may also be explained by the bad firm signaling hypothesis, which posits that the Chinese government's rescue program signals to investors that the rescued firms are of lower quality, similar to the adverse signaling role of TARP funds (Bayazitova & Shivdasani, 2012). By observing the government's choice of rescue targets, investors update their perception of firm quality and start issuing sell orders, which tends to reduce liquidity. Contradicting this hypothesis, the liquidity effects persist after we control for the impact of firm quality measured by post-rescue stock returns. Moreover, we find that firms with low post-rescue returns are not the primary drivers of the observed liquidity decline.

Firms could increase their risk-taking after being rescued due to the moral hazard associated with government ownership (i.e., the "too big to fail" hypothesis), which may reduce stock liquidity by increasing return volatility (e.g., Stoll, 1978). However, our findings reveal that rescued firms actually become more conservative, evidenced by a 9.6 % decrease in R&D expenditure and a 22.7 % decline in asset growth. We do not find significant changes in the financing activities of rescued firms. These findings refute the "too big to fail" hypothesis and indicate that China's opaque direct purchase rescue program pushes listed firms to "hibernate."[6]

To better understand the nature of the government's rescue program, we also examine whether the reduction in liquidity is temporary or lasting. We find that the liquidity of rescued firms shows a sharp drop in the first six weeks, followed by a partial reversal over the next 18 weeks. This finding indicates a lasting decline in liquidity triggered by the direct purchase rescue program and that investors appear to overreact to the liquidity shock.

Finally, the Chinese government adjusted its holdings in the rescued firms during the fourth quarter of 2015, providing us with a valuable opportunity to better understand the effects of the direct purchase rescue program. Similar to our baseline findings, stocks with a further increase in government ownership show a decrease in liquidity. Interestingly, the government's subsequent sales following its direct purchases contribute to further increasing market illiquidity, implying that subsequent sales of rescued stocks amplify concerns about future government interventions and lending further support to the policy uncertainty story.

Our paper makes two distinct contributions to the literature. First, although previous studies extensively discuss the effectiveness of monetary policy (e.g., Bernanke & Gertler, 2001; Mishkin, 2011; Bekaert et al., 2013; Gali & Gambetti, 2015), capital injections (e.g., Adrian et al., 2011; Bayazitova & Shivdasani, 2012; Duchin & Sosyura, 2012; Duygan-Bump et al., 2013; Berger & Roman, 2015), and changes in trading rules (e.g., Boehmer et al., 2013), their conclusions are mixed. Focusing on China, the world's largest emerging market, our study takes a different perspective by comprehensively investigating the Chinese government's choice of rescue targets and, more importantly, the unintended consequences of China's direct purchase rescue program. Our study provides new and important insights into potential stock market intervention tools and their implications.

Second, compared with other studies of the same event, our study provides a better understanding of the overall effectiveness of the government's rescue program in China. Most previous studies of China's direct purchase rescue program focus on the value generated by this intervention. For instance, Huang et al. (2019) estimate that this government intervention increased the value of the non-financial firms

[3] China's GDP in 2015 was US$11.061 trillion (in current dollars), according to the World Bank. Additionally, WIND data indicate that by the end of 2015, the market capitalization of listed firms in China was approximately US$8.079 trillion (in current dollars). More details of the institutional background are provided in Section 2.

[4] Regarding the selection of rescue targets, we find that index constituent stocks, stocks eligible for margin trading, stocks with sharp price declines, firms in systemically important industries (e.g., manufacturing and financial industries), large firms, and those with high institutional ownership and high pre-rescue liquidity are more likely to be rescued than other firms.

[5] https://www.cnbc.com/2015/11/27/chinas-national-team-stock-market-ownership.html

[6] Duchin and Sosyura (2012) show that following government bailouts, banks make riskier loans and shift their asset portfolios toward riskier securities, suggesting that moral hazard issues arise from such governmental support. After the direct purchase rescue program, we do not observe that Chinese listed firms take more risks, such as increasing investment or borrowing. This difference could be attributed to policy uncertainty, as firm managers remain unsure about the government's exit strategy, casting doubt on whether their firms qualify as "too big to fail."

rescued by 206 billion yuan (around US$28.5 billion). Using the event study technique, Chi and Li (2019) show that the positive abnormal returns observed in 63 firms that voluntarily disclosed that their shares had been purchased by the government disappeared when investors later learned of the scale of the rescue program, suggesting that this government intervention did not really create value. By focusing on market liquidity and volatility, as well as firm fundamentals, our study provides a comprehensive evaluation of China's rescue program. More importantly, we highlight the unintended consequences of this program (i.e., reduced liquidity and post-sale increase in volatility) and explore the mechanism behind these consequences.

2. Institutional background

To improve market efficiency, the CSRC introduced leveraged trading in 2010, which includes margin buying and short selling. On March 31, 2010, the Shanghai and Shenzhen stock exchanges initiated margin trading for 90 pilot stocks, all large and liquid, included in the Shanghai Exchange 50 Index or the Shenzhen Component Index. Over the next four years, the number of eligible stocks gradually increased, reaching 900 in September 2014. Initially, margin traders in 2010 needed a minimum of 0.5 million yuan in their brokerage accounts and an account history of at least 18 months. These restrictions were relaxed by the CSRC in 2013 to promote margin buying. For example, investors only need to have an account for six months before they become qualified for margin trading. According to Bian et al. (2019), investors who meet the requirements can obtain margin loans from their brokerage firms at an annual interest rate of approximately 8 %–9 %. The margin loans, combined with their own funds, are used to purchase stocks for which margin buying is allowed. Qualified investors can also borrow stocks from brokerage firms for short selling. However, short selling is rare in practice. According to Wind Financial Terminal (WIND), the average share of weekly stock trading volumes attributed to margin loans was 18.1 % between early 2013 and June 2015, compared with only 1.3 % for trading volumes from short selling during the same period.

Margin purchases surged in 2014, escalating from 296 billion yuan in January to over 2.8 trillion yuan by year's end, paralleled by a 50 % rise in the Shanghai Composite Index during the second half of 2014. The rapid increase in the value of the index likely fueled further margin buying, with the total volume of margin purchases more than doubling in the first half of 2015, as shown in Fig. 1. During the same period, many individual investors, ineligible for brokerage-provided margin loans, turned to unregulated *shadow* financing for stock purchases. Shadow margin loan providers offered significantly higher leverage ratios than brokers, albeit with higher interest rates on the loans. The shadow margin loan market channels funds to millions of unqualified individual investors and facilitates margin trading. Along with an unprecedentedly large volume of margin purchases, the Chinese stock market continued to skyrocket: the Shanghai Composite Index increased from 3000 in January 2015 to 5000 in early June 2015.

The sharp increase in stock prices, accompanied by a substantial volume of trading using unregulated margin loans, raised concerns among regulators about potential stock market instability. In January 2015, regulators imposed mild measures like warnings and mandatory self-examinations on margin trading. However, margin trading activities were barely affected by these regulations, and the stock market index continued to rise by another 50 % over the next three months. At the end of May 2015, the CSRC issued detailed guidelines to regulate margin trading activities, requiring brokerage firms to strictly comply with these guidelines. On June 13, 2015, the CSRC announced further measures to discipline the unregulated margin buying market, stating that "*any brokerage firm that violates the requirement that forbids brokers from facilitating margin purchasing through the use of (unregulated) platforms such as HOMS would be subject to penalty*."[7] According to Bian et al. (2019), these restrictions may have triggered a downward liquidity spiral: investors facing margin calls began selling their shares, which greatly depressed stock prices, forcing more margin-trading investors to sell their shares. Eventually, June 15 saw the start of a stock market collapse, with about one third of the market value evaporating over the next three weeks.

In an effort to stabilize the plummeting stock market, regulators and several government entities immediately made several regulatory changes, the timing of which is outlined in Appendix Table A.1. However, none of these attempts succeeded in preventing the collapse of the market. On July 3, 2015, the direct purchase rescue plan started and the CSRC confirmed that China Securities Finance Corporation, Ltd. (CSFC) and Central Huijin Investment, Ltd. (CHI) would actively purchase shares to stabilize the stock market.[8] Given the role of CSFC and CHI in the rescue program, they are usually referred to as the National Team. However, as no official guidelines were provided, general investors were not informed of the details of this purchase plan. As a direct consequence of this opaque purchase program that is observable to outsiders, CSFC and CHI became among the top 10 shareholders of nearly half of the listed firms on China's A-share market after the end of the program in mid-August 2015. As shown in Appendix Table A.2, CFSC and CHI were present in 743 and 1113 firms, respectively, collectively holding 1363 A-share firms, or 3.1 % of all shares outstanding in the A-share market on average (equivalent to 2.5 % of market capitalization).

Table A.3 in the Appendix further compares the average ownership of the top 10 National Team and non-National Team shareholders. For instance, when the National Team is the second largest shareholder, its ownership has a mean of 3.2 % and a median of 3.0 %. Meanwhile, when non-National Team shareholders are the second largest shareholders, their ownership has a mean of 6.7 % and a median of 5.0 %. National Team investors tend to acquire large stakes in large firms, as shown in the last two columns of Appendix Table A.3. Unfortunately, it is difficult to estimate the precise cost of the government's rescue program as the government did not disclose relevant details. Using a conservative approach, which assumes that the government purchased stocks at their average price during the rescue window, our estimate indicates that the

[7] After the 2015 stock market crash, the CSRC opened an investigation into illegal trading activities using shadow margin accounts. The conclusion was officially announced on November 25, 2016. The CSRC sent a fine of US$124 million to various market participants, including three IT service providers, four brokerage firms, four asset management companies, and one individual. The official announcement regarding the penalty can be found on the following website:http://www.csrc.gov.cn/pub/newsite/zjhxwfb/xwdd/201611/t20161125_306638. The announcement banning illegal margin trading using shadow margin accounts can be found at http://finance.sina.com.cn/stock/y/20150613/123122425154.shtml.

[8] On July 3, 2015, Xiaojun Zhang, spokesman of the CSRC, announced that "China Securities Finance Corporation, Ltd. (CSFC, the only government agency that provides margin financing loan services to qualified securities companies in China) will increase its capital from 24 billion yuan to 100 billion ... to stabilize the capital market" (https://finance.people.com.cn/stock/n/2015/0703/c67815-27251482.html). The CSRC also confirmed that Central Huijin Investment, Ltd. (CHI), China's sovereign wealth fund, would actively participate in the purchase program.

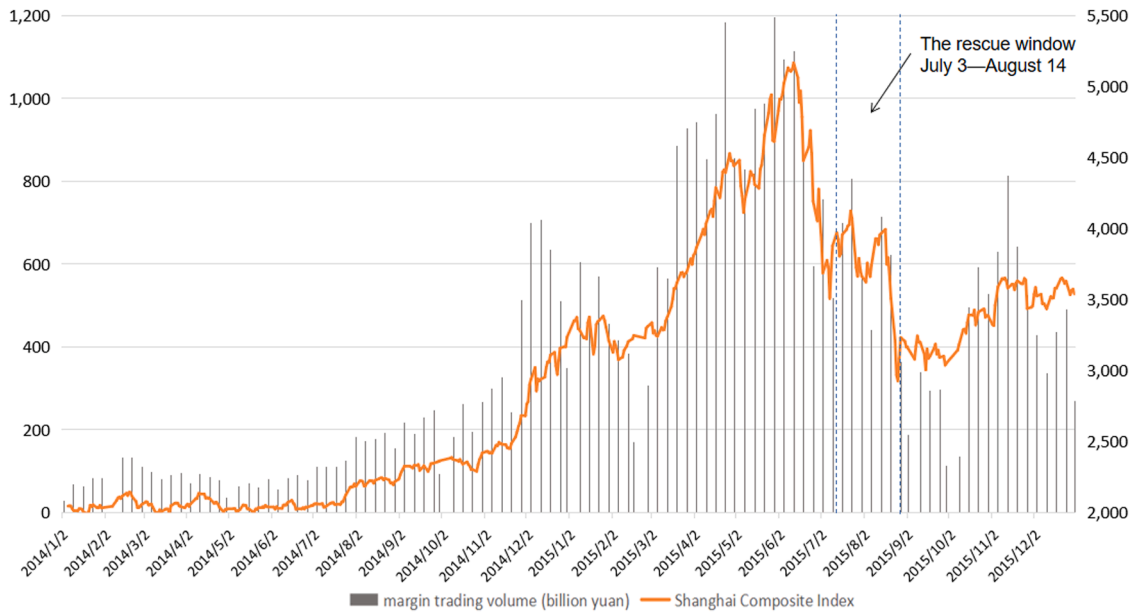


Fig. 1. The 2015 Chinese Stock Market Crash
This figure shows the daily Shanghai Composite Index and weekly margin trading volumes in 2014 and 2015. The stock market crash began on June 15, 2015, and the Chinese government launched its rescue program on July 3, 2015, which ended on August 14. Margin trading volume data are obtained from WIND. The rescue window refers to the period between July 3 and August 14.

Chinese government spent more than 1.2 trillion yuan (about US$200 billion) purchasing shares.[9]

On August 14, 2015, the CSRC announced that the direct purchase operation carried out by CSFC had been a success, which was interpreted as signaling the end of the direct purchase rescue program. Compared with other rescue programs, such as TARP and the HKMA's rescue program, China's program is notable for its massive scale and extended holding period. In addition, the operation of the rescue program remains opaque: the selection of target firms, purchasing guidelines, and, more importantly, what the government would do after the end of the program were never explicitly disclosed. The opacity of the program created great uncertainty among investors. As shown in Fig. 2, although rescued and non-rescued firms had similar stock turnover before the rescue program, the stocks of rescued firms were traded less actively afterward, consistent with the argument that policy uncertainty regarding subsequent government interventions makes investors reluctant to trade.

Although the CSRC indicated that CSFC would not exit the stock market in the near future, the National Team adjusted its holdings after the rescue program. Fig. 3 details the National Team's post-rescue operations, showing increases, decreases, and complete exits in stock ownership of target firms. In almost every quarter since the end of 2015, the magnitude of ownership decrease has been much smaller than that of ownership increases. An exception in the fourth quarter of 2015 saw significant reductions and even complete exits in government ownership. Specifically, government ownership decreased in 386 firms and completely exited in 146 firms, out of the 1363 firms initially rescued. Nevertheless, for the majority of rescued firms, government ownership remained stable between 2015 and 2017.

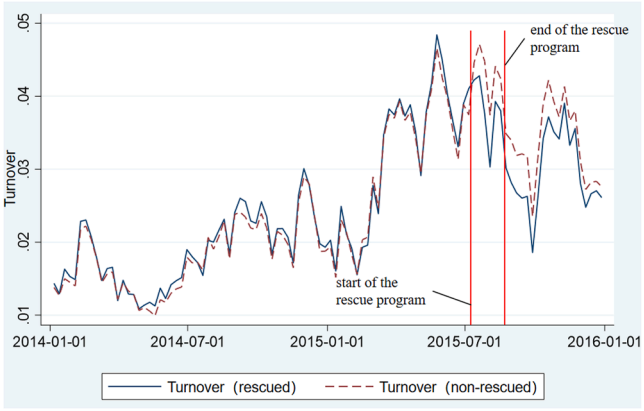


Fig. 2. Stock Turnover of Rescued Versus Non-rescued Stocks (matched sample)
This figure shows the weekly turnover ratio of rescued and non-rescued firms during the period from January 2014 to December 2015. The start of the rescue program corresponds to the week of July 3, 2015 and the end of the rescue program corresponds to the week of August 14, 2015.

3. Data and methodology

3.1. Sample

To examine the effect of China's direct purchase rescue program, we need to identify firms whose shares were purchased by the National Team after the stock market crash. We begin with 2767 firms listed on China's A-share market as of early June 2015, for which valid information on the identity and shareholdings of the top 10 shareholders is available in the WIND database. However, due to the opacity of this program, it is difficult to determine which institutions were part of the National Team and participated in the rescue program. In this paper, we

[9] Considering the opacity of this rescue program, it is not surprising that other institutions obtain figures of different magnitudes. For example, Reuters' estimate is about US$800 billion spent in July 2015 (source: http://www.reuters.com/article/us-china-markets-rescue-idUSKCN0PX0BA20150723). Goldman Sachs provides an updated estimate of US$236 billion spent in September 2015 (source: http://money.cnn.com/2015/09/08/investing/china-stock-market-bailout-beijing/index.html).

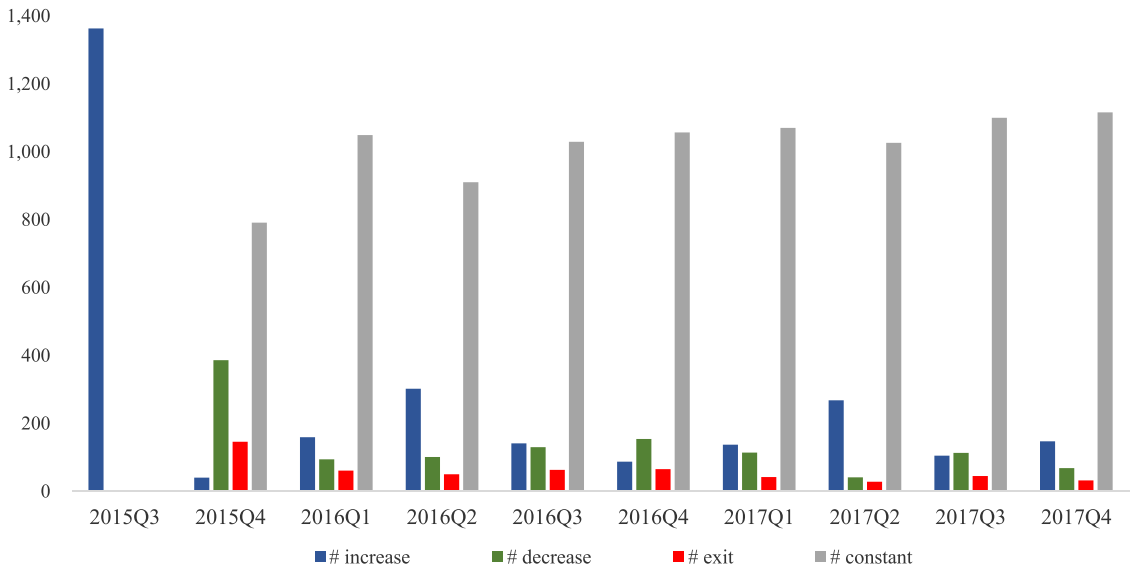


Fig. 3. The Change in National Team Ownership in Rescued Firms during the Post-crash Period
This figure shows the National Team's ownership in firms who were rescued during the crash for each quarter from 2015Q3 to 2017Q4. In each quarter, we count the number of firms in which National Team ownership increased, decreased, or remained constant relative to that in the previous quarter, among all initially rescued firms in 2015Q3. We further divide firms whose National Team ownership decreased into two groups, namely firms with positive ownership after the decrease and firms with government exit.

take a conservative approach and only include CSFC and CHI as National Team investors.[10] Both institutions are 100 % state-owned. Although they operate in the form of corporations, they are essentially quasi-bureaucratic entities. Therefore, they fully serve the interests of the central government.

We then analyze the shareholdings of CSFC and CHI in each firm and define a firm as a rescued firm if there was an increase in ownership by these two institutions in the third quarter of 2015 compared with that in the second quarter. As shown in Panel A of Appendix Table A.2, CSFC held shares in 743 firms and CHI in 1113 firms in the third quarter of 2015, with these two institutions collectively owning 1363 firms. These 1363 firms are considered rescued by the government, and the non-rescued group includes the remaining 1404 firms. We estimate that the Chinese government spent more than 1.2 trillion yuan (about US $200 billion) purchasing stocks from early July to mid-August 2015, resulting in an average stake of 2.5 % in the rescued firms.[11] The amount of share purchases by the National Team is substantial, given that the average shareholdings of the top 10 non-National Team shareholders was 4.6 % before the rescue program. Panel B shows that no particular industry has an exceptionally high proportion of rescued firms.

Our sample period spans the six weeks before July 4, 2014 (the pre-rescue period) and the six weeks after August 14, 2015 (the post-rescue period). For the pre-rescue period, we do not use the six weeks before the start of the rescue program (July 3, 2015) to prevent potential contamination of our results by the stock price bubbles of the first half of 2015. Our results still hold under different pre-rescue periods, though.

[10] CSFC was established in 2011 and serves as an intermediary that facilitates the flow of margin loans and securities for short selling between investors and their brokerage firms. Founded in 2003, CHI represents the central government in making equity investments in state-owned financial institutions.

[11] The estimated amount of money is calculated as follows. For each rescued stock, we calculate the number of shares purchased by the National Team and multiply that number by an estimated purchase price. As the Chinese government has never disclosed the actual purchase price, we consider the minimum, mean, and median prices of each stock during the rescue period and calculate the corresponding amount spent by the government. The minimum and median values are 1.00 trillion and 1.22 trillion yuan, respectively.

3.2. Stock market variables

We study the capital market impacts related to liquidity, volatility, and firm fundamentals. We construct two variables to measure stock liquidity, i.e., the stock turnover rate and the Amihud illiquidity ratio, both calculated on a weekly basis. Stock turnover is defined as the ratio of average daily trading volume to total market capitalization each week. The Amihud illiquidity measure is defined as the weekly average price impact (in percentage) for each million yuan of transactions, following Amihud (2002). Specifically, it is calculated as follows:

$$Amihud_{ij} = \sum_{t=1}^{N_{ij}} \left(\frac{|R_{ijt}|}{Vol_{ijt}} \right) \Big/ N_{ij} \tag{1}$$

where R_{ijt} is the stock return of stock i on day t in week j (in percentage), Vol_{ijt} is the corresponding daily trading volume (in million yuan), and N_{ij} is the number of trading days in week j for stock i.

We construct two variables to measure stock return volatility. *TVOL* is calculated as the standard deviation of all daily stock returns during the six weeks before and after the rescue period, separately. We require at least 10 trading days to generate a reliable measure of volatility. As our second measure of volatility, we follow Garman and Klass (1980) and use daily high and low stock prices to calculate range-based volatility (*Range*), as follows:

$$range_{it} = \sqrt{\frac{(H_{it} - L_{it})^2}{4log_e 2}} \tag{2}$$

where H_{it} and L_{it} are the log-transformed high and low prices, respectively, of stock i on day t. Weekly range-based volatility is defined as the median daily range-based volatility.

3.3. Summary statistics

In Table 1, we present the summary statistics of all of the above variables. In total, we have 15,566 stock-week observations for turnover, Amihud illiquidity, and range-based volatility, all defined at the weekly level. However, the number of observations for total volatility is much lower because it is calculated using daily stock prices over a six-

Table 1
Summary statistics of the rescue sample.

Panel A: Capital market variables						
Statistics	N	Mean	Median	P25	P75	Std
Turnover	15,566	0.022	0.017	0.008	0.031	0.018
Amihud	15,566	0.048	0.037	0.021	0.065	0.035
TVOL	2434	0.043	0.043	0.019	0.066	0.024
Range	15,566	0.032	0.028	0.014	0.049	0.019
Panel B: Corporate investment and financing decisions						
Statistics	N	Mean	Median	P25	P75	Std
R&D	5936	0.149	0.069	0.004	0.171	0.222
Capex	5936	0.363	0.208	0.089	0.455	0.414
Asset growth	5937	0.179	0.098	0.014	0.251	0.258
Leverage	5937	0.139	0.113	0.021	0.228	0.125
Asset liquidity	5937	0.224	0.225	0.058	0.390	0.226

This table presents the summary statistics of the main variables used in the paper. The sample period in Panel A spans the six weeks before July 3, 2014 (the pre-rescue period) and the six weeks after August 14, 2015 (the post-rescue period). For the pre-rescue period, we do not use the six weeks before the start of the rescue program (July 3, 2015) to avoid the price bubbles of the first half of 2015. Our robustness tests show that our results still hold when we use different pre-rescue periods. Turnover, Amihud illiquidity, and range-based volatility (*Range*) are calculated at the weekly level using daily stock prices for each week, and total volatility is calculated using all daily stock prices during the six weeks before and after the rescue period, separately. Panel B shows the summary statistics of the variables related to corporate investment and financing decisions. Financial firms (industry code "J") are excluded from the sample. These real-effect variables are calculated using firms' accounting information from their annual reports from 2013 to 2016.

week window. On average, 2.2 % of China's total market capitalization is traded each day. Daily return volatility is about 4.3 % during our sample period. Panel B shows the summary statistics of corporate financing and investment activities that are retrieved from annual reports between 2013 and 2016.

3.4. Methodology

To study the capital market impacts and possible real effects of China's direct purchase rescue program, we conduct a DID analysis by comparing treatment (rescued) stocks and matched control (non-rescued) stocks. To ensure that we reliably estimate key capital market indicators (e.g., volatility), we first remove special treatment (ST) stocks from the sample and require all stocks to have at least three trading days in a week. To minimize the difference between the treatment and control groups, we use a matched sample based on propensity score matching according to the propensity scores obtained from the logit regression in Column (2) of Table 2, which predicts the selection of rescue targets. Specifically, we perform our matching analysis in two steps. First, we estimate a logit model that predicts the government's choice of rescue targets using the following firm characteristics, defined in Table A.4 of the Appendix: *Margin, Cumulative return, Manufacturing, Utilities, Finance, Real estate, SOE, Political connection, Size, HS300, Leverage*, Log *(BM), ROE, Institutional, ST*, and *TO*. In the second step, using the propensity scores obtained from the logit model in the first step, we match rescued firms with non-rescued firms, using 1:1 nearest neighbor matching with common support and without replacement and a caliper of 0.03. After matching, we obtain 769 pairs of rescued and non-rescued stocks. Appendix Table A.5 shows the summary statistics for the unmatched and matched samples. As shown in Appendix Table A.5, the differences between rescued and non-rescued stocks become minimal after matching. Moreover, we rerun the rescue prediction regression using the matched sample that contains 1538 stocks. None of the coefficients are statistically significant at the 10 % level.

To facilitate interpretation, all dependent variables are first transformed into natural log form. We then estimate the following regression:

Table 2
The government's rescue decision.

	(1)	(2)
Probability of Bubbles		
Margin	0.287***	0.101***
	(13.85)	(3.45)
Cumulative return	−0.179***	−0.155***
	(−6.56)	(−5.87)
Industry preferences		
Manufacturing	0.051**	0.039
	(1.99)	(1.48)
Utilities	0.050	−0.031
	(0.86)	(−0.49)
Finance	0.205***	0.005
	(3.05)	(0.06)
Real estate	0.011	−0.014
	(0.24)	(−0.30)
Political concerns		
SOE		−0.003
		(−0.11)
Political connection		0.023
		(1.02)
Firm characteristics		
Size		0.103***
		(4.55)
HS300		0.306***
		(6.09)
Leverage		−0.270***
		(−3.47)
Log(BM)		−0.004
		(−0.17)
ROE		0.501***
		(3.76)
Institutional		0.002***
		(2.70)
ST		−0.384***
		(−4.04)
TO		1.543*
		(1.67)
N	2527	2527
Pseudo R-sq	0.109	0.173

This table shows the marginal effects of the rescue program estimated using logit regressions in which the dependent variable is *Rescue*, a dummy that takes a value of one if the National Team acquired a firm's stocks in the third quarter of 2015. Detailed definitions of the variables can be found in Appendix Table A.4. All standard errors are robust to heteroskedasticity. ***, **, and * indicate significance at the 1 %, 5 %, and 10 % levels, respectively.

$$Y_{i,t} = \alpha_i + \alpha_t + \beta * TREAT_i * AFTER_t + \sum_k \gamma_k * X_{i,k,t-1} + \epsilon_{i,t} \quad (3)$$

The dependent variable, $Y_{i,t}$, represents the outcome variables that are potentially affected by the rescue program. When studying the capital market impacts of China's direct purchase rescue program, we consider four outcome variables, namely turnover, Amihud illiquidity, total volatility, and range-based volatility. $TREAT_i$ is a dummy indicating rescued firms, and $AFTER_t$ is an indicator of observations after the end of the direct purchase rescue program. The variable $X_{i,k,t-1}$ represents the k-th control variable for stock i, namely size, book-to-market ratio, volatility, turnover, and past returns, all calculated using stock prices from the previous calendar month. All regressions include firm and week fixed effects with standard errors clustered at both the firm and week levels, except for regressions using Log*(TVOL)* as the dependent variable, in which the pre-rescue and post-rescue dummies are controlled with standard errors clustered at the firm level.

4. The rescue decision

As the direct purchase rescue program was costly for the government, it is important to understand how the money was allocated. For example, if the liquidity spiral of marginable stocks drives the market to a liquidity crisis, would the government target these stocks to save the

market? In this section, we examine whether the likelihood of being rescued is related to various firm characteristics. Specifically, following the literature, we study whether the government's industry preferences, political factors, bubble concerns, and several firm fundamentals determine its rescue decision (Faccio et al., 2006; Duchin & Sosyura, 2012).

We first construct two measures of the probability of a fire sale. The first measure, *Margin*, is a dummy that equals one if a stock allows margin trading. As margin trading stocks are subject to the greatest fire sale pressure, it is reasonable to expect the government to rescue these stocks. The second measure is based on stock returns. We use pre-rescue cumulative stock returns during the period between January 1 and July 2 of 2015 to assess the severity of fire sales. We expect the government to purchase stocks whose prices fall more due to the drying up of market liquidity.

We also examine other determinants of the selection of rescue targets. We first consider industry preferences. We expect the government to prioritize the financial and manufacturing industries as these two industries are probably "too important to fail." Index constituent stocks also have a vital impact on the market index. Therefore, we expect the government to be likely to rescue stocks in the Shanghai Shenzhen 300 Index. In addition, we consider political connections, including a dummy for state-owned enterprises (SOEs) and a dummy for politically connected top executives. We also construct several accounting variables, namely firm size, leverage, book-to-market ratio, and ROE, all calculated using accounting numbers from firms' 2014 annual reports. Furthermore, as documented by Chi and Li (2019), the presence of institutional investors predicts the rescue decision. We thus include institutional ownership in the first quarter of 2015 as one predictor of the likelihood of being rescued. As explained in Section 3.4, "ST status" in the Chinese stock market is a label assigned by regulators to high-risk stocks. S.T. stocks are very likely to be excluded from the rescue. Our regression model also includes *TO*, the average daily turnover in the first quarter of 2015, as the government may rescue firms with high pre-crisis liquidity in the hope of restoring their liquidity.

We include the above determinants in the following logit model:

$$\log\left(\frac{p_i}{1-p_i}\right) = X_i'\theta + \varepsilon_i, \tag{4}$$

where p_i denotes the probability that a firm's stocks were purchased by the government during the 2015 stock market crash. X_i is a vector of all aforementioned determinants for a stock purchased by the National Team. Our sample includes 2527 firms with non-missing values for the predictor variables, and the unconditional likelihood of being rescued is 50 %. We control for industry preferences and first examine the liquidity concern. We then add all predictors to one regression as a stronger form of testing. The results are shown in Table 2.

In Column (1) of Table 2, without firm-level controls, stocks eligible for margin trading and stocks with a larger decline in stock prices are significantly more likely to be rescued by the government. In terms of economic significance, the likelihood of being rescued is 29 % higher for margin trading stocks than for other stocks, which is substantial compared with the unconditional likelihood. The government is also concerned about price declines. A one standard deviation decrease in pre-rescue stock prices is associated with a 23.4 % higher likelihood of being rescued. The effects of margin trading and price declines persist when we include the firm-level controls in Column (2). For industry preferences, firms operating in the manufacturing and financial industries have a significantly higher likelihood of being rescued than firms in other industries. Firms in the manufacturing industry employ the bulk of China's labor force, which makes it a policy-sensitive industry. Our results support the social goal-driven resource allocation of the stock market rescue program.[12]

For the firm controls in Column (2), regarding the political concern variables, neither the SOE dummy nor the political connection variable are significant. Our findings differ from those of Duchin and Sosyura (2012) and Li (2013), who document that politically connected firms are more likely to receive TARP funds in the U.S. than other firms.

Regarding firm fundamentals, firm size and index membership are the most important elements in rescue decision-making. Saving large firms appears to be prevalent in the bailout of global corporations (Faccio et al., 2006) and banks (Bayazitova & Shivdasani, 2012). This was also the case in China during the 2015 stock market crash. Firms with higher financial risks are less likely to be rescued than other firms, as evidenced by the significant and negative coefficients of leverage. Consistent with the findings of Chi and Li (2019), stocks with larger institutional ownership are significantly more likely to be rescued. Firms that have difficulty generating cash flow, i.e., those with low ROE and ST status, are also less likely to be rescued, which implies that the government's rescue program tends to exclude firms that are not economically viable. The coefficient of *TO* is significant and positive, consistent with the argument that the government tends to rescue firms with higher pre-crisis liquidity in the hope of restoring their liquidity via the direct purchase rescue program.

5. The impact of the direct purchase rescue program

In this section, we investigate the financial and real consequences of the direct purchase rescue program. We also test four competing hypotheses related to the mechanism of this program.

5.1. The capital market impacts of the direct purchase rescue program

Using the matched sample, which contains 769 rescued firms and the same number of non-rescued firms, we perform DID regressions to examine the impact of China's direct purchase rescue program on liquidity and volatility. Table 3 reports the results. The coefficients in Panel A show that rescued firms experience a greater decline in stock trading activities than their non-rescued counterparts. Specifically, stock turnover decreases by up to 12.7 % due to the rescue program. A similar effect is observed if we use the Amihud illiquidity measure as a proxy for illiquidity. As shown in Column (4), the Amihud illiquidity of rescued stocks increases by 10.0 % after the rescue program, compared with their non-rescued counterparts.

Prior studies demonstrate that direct government intervention in the stock market, such as imposing a short-selling ban, leads to a decline in stock liquidity and, more generally, a deterioration in market quality (e.g., Boehmer et al., 2013). This was also the case during the 2015 stock market crash in China. We perform a back-of-the-envelope calculation to quantify the magnitude of the liquidity deterioration. In our sample, the

[12] Driven by the policy goal of "maintaining a harmonious society," resource allocation in China (e.g., capital allocation) sometimes leans toward social goals, such as reducing unemployment, instead of maximizing profits. For instance, Chen et al. (2017) examine capital allocation in business groups in China and find that capital flows are negatively correlated with investment opportunities for state groups, while the Q sensitivity of investment is positive in private groups. They also find that the negative Q sensitivity of state groups is largely driven by the policy goal of maintaining social stability, such as boosting local employment.

Table 3
The capital market effects of the direct purchase rescue program (matched sample).

Panel A: The effect of the direct purchase rescue program on liquidity				
Dependent var.	(1) *Log (Turnover)*	(2) *Log (Turnover)*	(3) *Log (Amihud)*	(4) *Log (Amihud)*
*TREAT*AFTER*	−0.191***	−0.127***	0.179**	0.100***
	(−4.33)	(−4.41)	(4.63)	(3.47)
Log(Market cap)		−0.095*		−0.544***
		(−2.00)		(−9.45)
Log(BM)		−0.176***		−0.158***
		(−3.81)		(−3.29)
Log(Volatility)		−0.110**		−0.000
		(−2.47)		(−0.00)
Log(Turnover)		0.646***		−0.396***
		(11.62)		(−9.80)
Previous return		1.359***		−1.108***
		(4.60)		(−5.14)
Firm FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
N	15,637	15,566	15,637	15,566
Adj. R-sq	0.698	0.792	0.639	0.707
Panel B: The effect of the direct purchase rescue program on volatility				
Dependent var.	(1) *Log(TVOL)*	(2) *Log(TVOL)*	(3) *Log(Range)*	(4) *Log(Range)*
*TREAT*AFTER*	−0.029	−0.013	−0.022	0.006
	(−1.17)	(−0.62)	(−1.13)	(0.42)
Log(Market cap)		−0.036		0.018
		(−1.03)		(0.77)
Log(BM)		−0.020		−0.049*
		(−0.72)		(−2.00)
Log(Volatility)		0.219***		0.209***
		(6.60)		(5.83)
Log(Turnover)		0.095***		0.076***
		(4.85)		(4.29)
Previous return		0.825***		0.744***
		(10.22)		(4.27)
Firm FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
N	2484	2434	15,637	15,566
Adj. R-sq	0.801	0.854	0.817	0.841

This table presents the results of DID regressions examining the impact of the direct purchase rescue program implemented by the Chinese government. We use a matched sample based on propensity score matching using the propensity scores obtained from the logit regression in Column (2) of Table 2 that predicts the selection of rescue targets. The post-rescue sample period spans the six weeks after August 14, 2015. The pre-rescue period includes the six weeks before July 3, 2014. We do not use the six weeks before the start of the rescue program (July 3, 2015) to avoid potential contamination by the price bubbles during this period. The dependent variables in Panel A are turnover (in natural log) and Amihud illiquidity (in natural log). Panel B examines the impact of the direct purchase rescue program on total volatility and price range. Turnover, Amihud illiquidity, and range-based volatility (*Range*) are calculated at the weekly level using daily stock prices for each week, and total volatility is calculated using all daily stock prices during the six weeks before/after the rescue period. *TREAT* is an indicator of rescued firms, and *AFTER* is an indicator of observations after the end of the direct purchase rescue program. Our control variables include size, book-to-market ratio, volatility, turnover, and return in the previous month. The control variables are calculated using stock prices from the previous calendar month. All regressions include firm and week fixed effects with standard errors clustered at both the firm and week levels, except for regressions using Log *(TVOL)* as the dependent variable, in which the pre-rescue and post-rescue dummies are controlled with standard errors clustered by firm. The t-statistics are shown in parentheses. ***, **, and * denote significance at the 1 %, 5 %, and 10 % levels, respectively.

average price impact per million yuan of transactions for rescued firms in the pre-rescue period is 0.046 %. In Column (4), a 10 % relative increase in Amihud illiquidity translates into a 0.0046 % higher price impact for rescued firms. As the average daily trading volume of the rescued firms is 198.9 million yuan after the rescue program, the additional price impact due to the program is 0.91 % (= 0.0046 % *198.9). This impact is substantial, considering that the absolute daily return of rescued firms during the post-rescue period has a mean of 2.72 % and a standard deviation of 2.13 %.

[Insert Table 3 here]

In Columns (1) and (2) of Panel B, where the dependent variable is Log*(TVOL)*, the coefficients of *TREAT*AFTER* are −0.029 (t-statistic = −1.17) and −0.013 (t-statistic = −0.62), respectively, implying a nonsignificant reduction in the return volatility of rescued stocks. We obtain similar results in Columns (3) and (4), where the dependent variable is Log*(Range)*. In robustness tests, we show that total volatility decreases by less than 3 % in some model specifications. Therefore, our empirical results suggest that the direct purchase rescue program only marginally reduces return volatility at best.

Overall, we show that while it is unclear whether China's direct purchase rescue program achieved its goal of stabilizing the market, the

Table 4
Robustness tests.

Panel A: Unmatched full sample				
Dependent var.	(1) *Log(Turnover)*	(2) *Log(Amihud)*	(3) *Log(TVOL)*	(4) *Log(Range)*
*TREAT*AFTER*	−0.103***	0.072*	0.018	0.041*
	(−4.31)	(1.93)	(1.06)	(1.95)
Controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
N	26,730	26,730	4030	26,730
Adj. R-sq	0.802	0.749	0.857	0.837
Panel B: The nine-week window (matched sample)				
Dependent var.	(1) *Log(Turnover)*	(2) *Log(Amihud)*	(3) *Log(TVOL)*	(4) *Log(Range)*
*TREAT*AFTER*	−0.121***	0.097***	−0.029	0.001
	(−4.73)	(3.50)	(−1.59)	(0.07)
Controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
N	22,162	22,162	2514	22,162
Adj. R-sq	0.781	0.715	0.866	0.812
Panel C: Using weeks of 2015 as the pre-event period (matched sample)				
Dependent var.	(1) *Log(Turnover)*	(2) *Log(Amihud)*	(3) *Log(TVOL)*	(4) *Log(Range)*
*TREAT*AFTER*	−0.138***	0.070**	−0.012	−0.001
	(−5.23)	(2.76)	(−1.28)	(−0.07)
Controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
N	15,453	15,453	2592	15,453
Adj. R-sq	0.748	0.810	0.656	0.525

This table shows the results of our robustness tests for the model specifications in Table 3. In Panel A, we conduct our analyses using the unmatched full sample. The sample period spans the six weeks before July 3, 2014 (the pre-rescue period) and the six weeks after August 14, 2015 (the post-rescue period). For the pre-rescue period, we do not use the six weeks before the start of the rescue program (July 3, 2015) to avoid the price bubbles of the first half of 2015. In Panel B, the sample period spans the nine weeks before July 3, 2014 (the pre-rescue period) and the nine weeks after August 14, 2015 (the post-rescue period). In Panel C, we use the six weeks before the start of the rescue program (July 3, 2015) as the pre-event sample period, retaining the six weeks after the 2015 rescue program as the post-event sample period. Our control variables include size, book-to-market ratio, volatility, turnover, and return in the previous month. For brevity, the coefficients of the control variables are omitted from the table. All regressions include firm and week fixed effects with standard errors clustered at both the firm and week levels, except for regressions with Log *(TVOL)* as the dependent variable, in which the pre-rescue and post-rescue dummies are controlled with standard errors clustered by firm. The t-statistics are shown in parentheses. ***, **, and * denote significance at the 1 %, 5 %, and 10 % levels, respectively.

program substantially compromised market liquidity.

We next conduct several robustness tests and report the results in Table 4. First, we rerun the baseline regressions using the full sample of firms, without adjusting for potentially endogenous selection of rescue targets. As shown in Panel A of Table 4, we observe a similar decline in liquidity, while return volatility does not change significantly after the rescue program. Second, in Panel B, we expand our sample to cover the nine weeks before July 4, 2014 (the pre-rescue period) and the nine weeks after August 14, 2015 (the post-rescue period). Consistent with our main results, stock market liquidity declines significantly after the rescue program, accompanied by marginally lower levels of total volatility and a nonsignificant change in range-based volatility. Finally, in Panel C, we use the six weeks before the start of the rescue program (July 3, 2015) as the pre-event period, keeping the six weeks after the 2015 rescue program as the post-event period. Our results are robust to this alternative pre-event sample period.

One concern in DID analyses is that the results may be driven by pre-existing trends. In Table 5, we test the dynamic effect of the direct purchase rescue program on market liquidity. The dependent variables are turnover (in natural log) and Amihud illiquidity (in natural log). *TREAT* is an indicator of rescued firms. $AFTER^{-3}$, $AFTER^{-2}$, $AFTER^{-1}$, $AFTER^{1}$, $AFTER^{2}$, $AFTER^{3}$, and $AFTER^{4+}$ are indicator variables that equal one for observations the third week before, the second week before, one week before, one week after, the second week after, the third week after, and the fourth week or more after the direct purchase rescue program, respectively.

The dependent variable in Column (1) is Log*(Turnover)*. In Column (1), the coefficients of the interaction terms between *TREAT* and the pre-event time dummies are not significant at conventional levels. In contrast, the coefficients of the interaction terms between *TREAT* and the time dummies for the post-rescue period are all negative and significant at the 1 % level. In Column (2), where the dependent variable is Log*(Amihud)*, we obtain similar results. Therefore, our results are unlikely to be explained by pre-existing trends in liquidity. We illustrate our results in Fig. 4, where the x-axis represents the week dummies. The y-axis represents turnover and Amihud illiquidity for subfigure (a) and (b), respectively. The regression models are the same as those used in Table 5. As shown by the 95 % confidence intervals of the coefficients, the difference in liquidity between the treatment and control firms only exists in the post-rescue period.

Table 5
Dynamic analyses (matched sample).

Dependent var.	(1) *Log(Turnover)*	(2) *Log(Amihud)*
$TREAT*AFTER^{-3}$	−0.026	0.013
	(−1.60)	(1.07)
$TREAT*AFTER^{-2}$	−0.011	−0.024
	(−0.44)	(−1.54)
$TREAT*AFTER^{-1}$	−0.009	−0.021
	(−0.34)	(−1.63)
$TREAT*AFTER^{1}$	−0.132***	0.112***
	(−4.71)	(4.83)
$TREAT*AFTER^{2}$	−0.180***	0.068**
	(−6.18)	(2.71)
$TREAT*AFTER^{3}$	−0.200***	0.126***
	(−6.72)	(4.77)
$TREAT*AFTER^{4+}$	−0.099***	0.088**
	(−3.17)	(2.47)
Controls	Yes	Yes
Firm FE	Yes	Yes
Time FE	Yes	Yes
N	15,566	15,566
Adj. R-sq	0.792	0.707

This table reports the results of DID regressions examining the dynamic effect of the direct purchase rescue program on market liquidity. The dependent variables are turnover (in natural log) and Amihud illiquidity (in natural log). *TREAT* is an indicator of rescued firms. $AFTER^{-3}$, $AFTER^{-2}$, $AFTER^{-1}$, $AFTER^{1}$, $AFTER^{2}$, $AFTER^{3}$, and $AFTER^{4+}$ are indicator variables that equal one for observations the third week before, the second week before, one week before, one week after, the second week after, the third week after, and the fourth week or more after the direct purchase rescue program, respectively. Our control variables include size, book-to-market ratio, volatility, turnover, and return in the previous month. For brevity, the coefficients of the control variables are omitted from the table. We control for firm and week fixed effects in all specifications. Robust standard errors are clustered at both the firm and week levels. The t-statistics are shown in parentheses. ***, **, and * denote significance at the 1 %, 5 %, and 10 % level, respectively, for the two-tailed test.

5.2. The policy uncertainty hypothesis

A plausible explanation for the observed decline in liquidity is related to policy uncertainty. Unlike capital market rescue programs in other markets, China's direct purchase rescue program lacked transparency, leading to policy uncertainty about what the government planned to do afterward (Brunnermeier et al., 2022). Studies show that uncertainty in general, and regulatory uncertainty in particular, leads to reduced market liquidity (Easley & O'Hara, 2010; Battalio & Schultz, 2011; Rehse et al., 2019). Therefore, the adverse impact of policy uncertainty on liquidity is likely to be greater for firms that are sensitive to policy uncertainty than for other firms.

We derive firms' sensitivity to policy uncertainty by regressing stock returns on the economic policy uncertainty (EPU) index.[13] Following prior studies (e.g., Brogaard & Detzel, 2015), for each firm, we regress its monthly stock returns on the natural log of the EPU index plus one, controlling for market returns. The EPU index for China comes from Baker et al. (2013). We run the above regression using 10 years of data (from June 2006 to May 2015), requiring at least 48 observations for each firm, and obtain the EPU coefficient. Next, we halve our sample based on the magnitude of the estimated EPU coefficients.

Table 6 presents the regression results when we rerun the regressions in Table 3 using subsamples of firms that differ in terms of their EPU sensitivity. With Log*(Turnover)* as the proxy for liquidity, the coefficient of the DID term for the low EPU sensitivity subsample is −0.071, with a t-statistic of −1.99, while the coefficient for the high EPU sensitivity subsample is −0.111, with a t-statistic of −2.89. To compare the coefficient of *TREAT*AFTER* between subsamples, we conduct Fisher's permutation test using 1000 bootstrap samples.[14] We find that the difference between these two coefficients is statistically significant, implying that the reduction in liquidity is more pronounced for firms that are more sensitive to policy uncertainty. We obtain similar results when using Log*(Amihud)* as a proxy for liquidity.

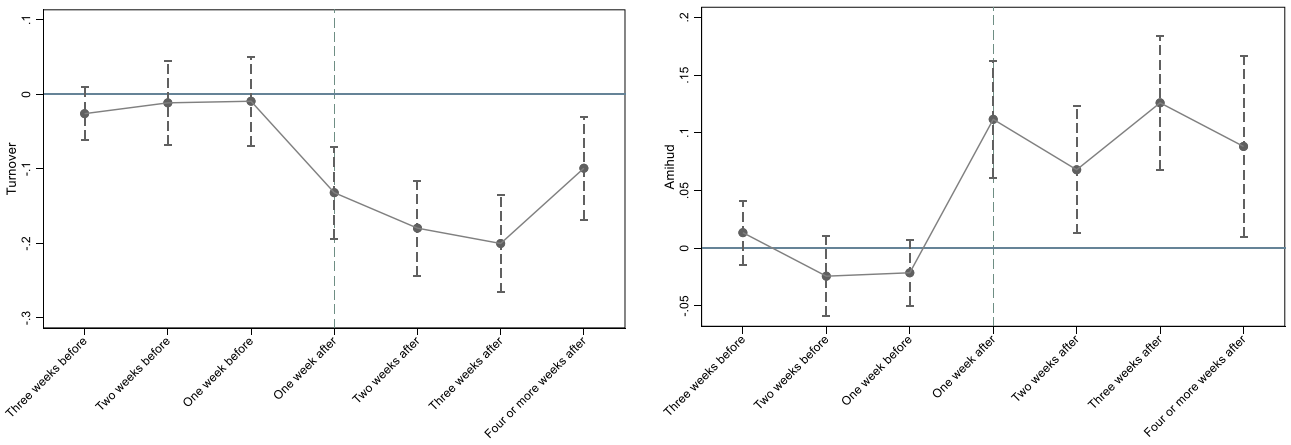
Overall, our results support the conjecture that the decline in liquidity is mainly due to the policy uncertainty associated with the direct purchase rescue program.

5.3. The liquidity dry-up hypothesis

An alternative explanation may be the reduced number of actively traded shares or the drying up of liquidity as a result of the National Team's purchases. To test the liquidity dry-up hypothesis, we split firms into two groups based on the number of outstanding shares purchased by National Team investors during the rescue program. In the subsample where the government purchased more (fewer) shares, the average

[13] We thank an anonymous reviewer for suggesting this test.

[14] Fisher's permutation test, also called a permutation or randomization test, is a non-parametric statistical significance test used to determine whether two or more samples come from the same distribution. Unlike parametric tests, which make assumptions about the distribution of the data (such as heteroskedasticity and normal distribution in the case of a traditional t-test), permutation tests do not require such assumptions and are thus applicable to a wider range of data types. Permutation tests are widely adopted in previous research (e.g., Cleary 1999; Bradbury et al. 2019; Guo et al. 2021).



(a) (b)

Fig. 4. Time Trends in Stock Liquidity

This figure shows the time trends in stock liquidity by regressing the liquidity measures on the interaction of the week dummies and the treatment dummy. The regression models are the same as those in Table 5. The x-axis represents the week dummies, with the first few weeks omitted as a benchmark. The y-axis plots turnover and Amihud illiquidity for subfigure (a) and (b), respectively. The dotted lines (solid lines) represent the coefficients (95 % confidence intervals) of the interaction between the corresponding week dummies and the treatment dummy.

Table 6

Policy uncertainty and the effect of the direct purchase rescue program (matched sample).

Dependent var.	(1) *Log(Turnover)*	(2)	(3) *Log(Amihud)*	(4)
EPU sensitivity	Low	High	Low	High
*TREAT*AFTER*	−0.071*	−0.111**	0.021	0.087*
	(−1.99)	(−2.89)	(0.52)	(2.00)
Log(Market cap)	0.044	−0.125	−0.771***	−0.714***
	(0.56)	(−1.53)	(−9.40)	(−6.87)
Log(BM)	−0.253***	−0.278***	−0.106	−0.089
	(−3.21)	(−4.41)	(−1.54)	(−1.22)
Log(Volatility)	−0.128**	−0.064	0.030	0.014
	(−2.66)	(−1.08)	(0.58)	(0.22)
Log(Turnover)	0.645***	0.566***	−0.378***	−0.328***
	(9.45)	(7.92)	(−7.71)	(−5.88)
Previous return	1.315***	1.526***	−1.253***	−1.177***
	(5.31)	(4.49)	(−5.58)	(−5.52)
p-value: equal coefficients	0.016		0.001	
Firm FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
N	6251	6211	6251	6211
Adj. R-sq	0.829	0.780	0.713	0.713

This table presents the regression results using subsamples of firms that differ in terms of the sensitivity of their stock returns to policy uncertainty. The sample period spans the six weeks before July 3, 2014 (the pre-rescue period) and the six weeks after August 14, 2015 (the post-rescue period). For the pre-rescue period, we do not use the six weeks before the start of the rescue program (July 3, 2015) to avoid the price bubbles of the first half of 2015. The dependent variables are turnover (in natural log) and Amihud illiquidity (in natural log). *TREAT* is an indicator of rescued firms, and *AFTER* is an indicator of observations after the direct purchase rescue program. We adopt the same specification as in Table 3. We control for firm and week fixed effects in all specifications. Robust standard errors are clustered at both the firm and week levels. The t-statistics are shown in parentheses. To compare the coefficients of *TREAT*AFTER* estimated using the subsamples, we conduct Fisher's permutation test based on 1000 bootstrap samples. ***, **, and * denote significance at the 1 %, 5 %, and 10 % levels, respectively.

percentage of shares purchased is 3.95 % (0.91 %). If the decline in liquidity is a mechanical result of the reduced number of actively traded shares, we should observe a more pronounced impact on firms with more shares purchased by the National Team.

We rerun the regressions in Table 3 using these two subsamples and present the results in Table 7. In Column (1), for firms with more shares purchased, the coefficient of *TREAT*AFTER* is −0.138 (t-statistic =

Table 7

The liquidity dry-up hypothesis and the effect of the direct purchase rescue program (matched sample).

Dependent var.	(1) *Log(Turnover)*	(2)	(3) *Log(Amihud)*	(4)
% shares bought	High	Low	High	Low
*TREAT*AFTER*	−0.138***	−0.120***	0.112**	0.097**
	(−3.60)	(−3.24)	(2.84)	(2.58)
Log(Market cap)	−0.091	−0.112	−0.451***	−0.644***
	(−1.60)	(−1.47)	(−6.25)	(−7.67)
Log(BM)	−0.197***	−0.171**	−0.045	−0.262***
	(−3.86)	(−2.49)	(−0.74)	(−3.53)
Log(Volatility)	−0.118*	−0.106*	0.025	−0.017
	(−2.04)	(−2.10)	(0.44)	(−0.30)
Log(Turnover)	0.675***	0.614***	−0.413***	−0.386***
	(11.42)	(9.34)	(−8.90)	(−7.81)
Previous return	1.350***	1.345***	−0.966***	−1.261***
	(4.69)	(4.27)	(−4.50)	(−5.34)
p-value: equal coefficients	0.148		0.204	
Firm FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
N	7795	7771	7795	7771
Adj. R-sq	0.803	0.780	0.732	0.671

This table presents the regression results using subsamples of firms that differ in terms of the proportion of outstanding shares purchased by the government. The sample period spans the six weeks before July 3, 2014 (the pre-rescue period) and the six weeks after August 14, 2015 (the post-rescue period). For the pre-rescue period, we do not use the six weeks before the start of the rescue program (July 3, 2015) to avoid the price bubbles of the first half of 2015. The dependent variables are turnover (in natural log) and Amihud illiquidity (in natural log). *TREAT* is an indicator of rescued firms, and *AFTER* is an indicator of observations after the direct purchase rescue program. We adopt the same specification as in Table 3. We control for firm and week fixed effects in all specifications. Robust standard errors are clustered at both the firm and week levels. The t-statistics are shown in parentheses. To compare the coefficients of *TREAT*AFTER* estimated using subsamples, we conduct Fisher's permutation test based on 1000 bootstrap samples. ***, **, and * denote significance at the 1 %, 5 %, and 10 % levels, respectively.

−3.60), while it is −0.120 (t-statistic = −3.24) in Column (2) for firms with fewer shares purchased. We find that although the economic magnitude of the DID coefficient for the subsample with higher National Team purchase is larger than that of the sample with lower purchase, the difference is of rather small magnitude and not statistically significant, according to Fisher's permutation test. In Columns (3) and (4), where the dependent variable is Log*(Amihud)*, we also find that the effect on Amihud illiquidity estimated using the two subsamples is not statistically different. Overall, our results do not support the conjecture that the reduction in the number of actively traded shares or the drying up of liquidity is the main reason for the decline in the liquidity of rescued stocks. In Section 5.7, we further refute the liquidity dry-up hypothesis by studying the impact of subsequent changes in National Team ownership.

5.4. The bad firm signaling hypothesis

Another possible explanation for our results is that the government's rescue program reveals information about the quality of the rescued firms. The government may choose to rescue firms with weak fundamentals, which are therefore more susceptible to liquidity shocks. In other words, being rescued by the government sends a negative signal to the stock market (Bayazitova & Shivdasani, 2012).[15] By observing the government's choice of rescue targets, investors update their perception of firm quality and start issuing sell orders, which can harm stock liquidity. We use the following two tests to examine this possibility.

First, if the observed decline in liquidity is due to the rescue program's signaling of bad firms, the observed effects should substantially diminish or even vanish when we control for firm quality. We compute the buy-and-hold stock return (*BHR*) of each stock over a one-year window following the end of the rescue program (i.e., August 14, 2015) and use this variable to capture firm quality. The average *BHR* of rescued firms is −10.1 %, while that of non-rescued firms is −8.2 %. Although the BHR of the former group is lower than that of the latter, the magnitude of this difference is small. To account for the impact of firm quality, we interact *BHR* with *AFTER* and use the interaction term as an additional control in the regressions. In Columns (1) and (2) of Table 8, Panel A, where the dependent variables are Log*(Turnover)* and Log *(Amihud)*, respectively, the coefficients of *TREAT*AFTER* are −0.137 (t-statistic = −4.74) and 0.109 (t-statistic = 3.81). These two coefficients are similar to our main results in Panel A of Table 3. Therefore, the results in Panel A of Table 8 are inconsistent with the bad firm signaling hypothesis.

Second, to determine whether our results are driven by rescued firms with poor post-rescue performance, we partition our sample based on the firms' post-rescue returns measured by *BHR* in Panel B. When we use Log*(Turnover)* to measure liquidity, the coefficient of *TREAT*AFTER* for firms with high post-rescue returns is −0.150 (t-statistic = −3.56), while that for firms with low post-rescue returns is −0.113 (t-statistic = −3.05). Fisher's permutation test reveals a statistically significant difference between these two coefficient estimates. Contrary to the prediction of the bad firm signaling hypothesis, the reduction in liquidity is not greater for lower quality firms. Columns (3) and (4) show similar results when using Log*(Amihud)* as a proxy for liquidity, except that the difference between the high and low subsamples is not significant. In untabulated analysis, the above results still hold when we use firms' accounting performance (i.e., ROE) in 2015 as an alternative proxy for firm quality.

Overall, the results in Table 8 suggest that our findings are unlikely to be explained by the bad firm signaling hypothesis. Of course, we cannot completely rule out the possibility that the negative signals sent by the government's rescue program play a role in the reduction in liquidity documented in this paper, considering the difficulty of measuring firm quality.

Table 8
The bad firm signaling hypothesis and the effect of the direct purchase rescue program (matched sample).

Panel A: Controlling for stock returns after the rescue program

Dependent var.	(1) *Log(Turnover)*	(2) *Log(Amihud)*
*TREAT*AFTER*	−0.137***	0.109***
	(−4.74)	(3.81)
*BHR*AFTER*	−0.339***	0.282***
	(−4.46)	(4.20)
Log(Market cap)	−0.128**	−0.516***
	(−2.57)	(−9.04)
Log(BM)	−0.183***	−0.151***
	(−3.95)	(−3.28)
Log(Volatility)	−0.104**	−0.005
	(−2.40)	(−0.11)
Log(Turnover)	0.628***	−0.382***
	(11.19)	(−9.51)
Previous return	1.368***	−1.116***
	(4.66)	(−5.26)
Firm FE	Yes	Yes
Time FE	Yes	Yes
N	15,560	15,560
Adj. R-sq	0.794	0.709

Panel B: Subsample analyses based on post-rescue stock returns

Dependent var.	(1) *Log(Turnover)*	(2)	(3) *Log(Amihud)*	(4)
Post-rescue returns	High	Low	High	Low
*TREAT*AFTER*	−0.150***	−0.113**	0.116**	0.096**
	(−3.56)	(−3.05)	(3.03)	(2.48)
Log(Market cap)	−0.004	−0.196***	−0.594***	−0.471***
	(−0.05)	(−3.11)	(−9.21)	(−5.72)
Log(BM)	−0.057	−0.252***	−0.221***	−0.111
	(−0.92)	(−4.17)	(−3.80)	(−1.68)
Log(Volatility)	−0.176***	−0.032	0.063	−0.069
	(−3.40)	(−0.59)	(1.27)	(−1.17)
Log(Turnover)	0.650***	0.610***	−0.413***	−0.356***
	(10.97)	(9.64)	(−10.89)	(−6.77)
Previous return	1.417***	1.311***	−1.132***	−1.096***
	(4.01)	(5.05)	(−4.83)	(−5.24)
p-value: equal coefficients	0.017		0.125	
Firm FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
N	7665	7895	7665	7895
Adj. R-sq	0.771	0.813	0.706	0.694

This table presents the results examining whether the reduction in liquidity can be explained by the bad firm signaling hypothesis. In Panel A, in addition to the controls used in the model specification in Table 3, our regressions control for the interaction of *BHR* and *AFTER*, where *BHR* is the one-year buy-and-hold returns after August 14, 2015. Panel B shows the regression results using subsamples of firms that differ in terms of post-rescue stock returns measured by *BHR*, where we adopt the same specification as in Table 3. In Panels A and B, the sample period spans the six weeks before July 3, 2014 (the pre-rescue period) and the six weeks after August 14, 2015 (the post-rescue period). For the pre-rescue period, we do not use the six weeks before the start of the rescue program (July 3, 2015) to avoid the price bubbles of the first half of 2015. The dependent variables are turnover (in natural log) and Amihud illiquidity (in natural log). *TREAT* is an indicator of rescued firms, and *AFTER* is an indicator of observations after the direct purchase rescue program. We control for firm and week fixed effects in all specifications. Robust standard errors are clustered at both the firm and week levels. The t-statistics are shown in parentheses. To compare the coefficients of *TREAT*AFTER* estimated using the subsamples, we conduct Fisher's permutation test based on 1000 bootstrap samples. ***, **, and * denote significance at the 1 %, 5 %, and 10 % levels, respectively.

5.5. The "too big to fail" hypothesis

Previous research shows that bailing out distressed firms is

[15] We thank an anonymous referee for suggesting this set of tests.

associated with various consequences (e.g., Faccio et al., 2006; Jiang et al., 2014). In particular, studies on TARP show that recipient banks engage in more risk-taking afterward (Black & Hazelwood, 2013; Duchin & Sosyura, 2014). If the associated moral hazard (e.g., "too big to fail") incentivizes firms to take more risks, stock liquidity may decline after the government's rescue program, as liquidity is negatively influenced by return volatility due to heightened adverse selection and inventory risk (e.g., Stoll, 1978). In this section, we test this alternative explanation by examining whether the secondary market rescue program implemented by the Chinese government is followed by more aggressive corporate financial and investment policies.

Following prior studies (e.g., Cassell et al., 2012; Grullon et al., 2015), we use *R&D, Capex*, and *Asset growth* as measures of the riskiness of corporate investment policies and *Leverage* and *Asset liquidity* as measures of the riskiness of corporate financing activities. Detailed definitions of the variables can be found in Appendix Table A.4. We retrieve firms' accounting information from their annual reports, and the sample period spans two years before and two years after the rescue program, i.e., from 2013 to 2016. We only control for a firm's beginning-of-year assets (in natural log) to avoid the "bad control" problem as it is very likely the rescue program generates various firm-level outcomes (Angrist & Pischke, 2009). We control for firm and year fixed effects in all specifications.

The results are reported in Table 9. The coefficients of *TREAT*AFTER* in Columns (1) and (3) imply that the government's purchase of stocks in the secondary market leads to lower R&D investment and slower asset growth. Specifically, R&D expenditure declines by 1.5 % and asset growth slows by 3.4 %, representing a decline of 9.6 % (= 0.015/0.156) and 22.7 % (= 0.034/0.150) of their respective pre-rescue average for rescued firms. These results suggest that rescued firms become more conservative in making new investments instead of pursuing riskier investments. However, the rescue program does not lead to a significant change in the debt burden or the liquidity of firm assets, as shown in Columns (4) and (5).

Overall, instead of taking more risks after being rescued by the government, rescued firms appear to become more conservative in their investment activities, which is inconsistent with the moral hazard symptoms that usually arise when rescuing "too big to fail" institutions. Interestingly, the "hibernation" of rescued firms in the Chinese market contrasts sharply with the response of TARP recipient banks (e.g., Black & Hazelwood, 2013; Duchin & Sosyura, 2014; Berger & Roman, 2015).

Table 9
The riskiness of firm policies after the rescue program (matched sample).

Dependent var.	(1) *R&D*	(2) *Capex*	(3) *Asset growth*	(4) *Leverage*	(5) *Asset liquidity*
*TREAT*AFTER*	−0.015**	−0.007	−0.034***	0.001	−0.001
	(−2.21)	(−0.43)	(−2.61)	(0.20)	(−0.16)
Log(Assets)	−0.004	−0.042	−0.295**	0.033***	−0.043***
	(−0.32)	(−0.98)	(−2.32)	(4.85)	(−3.49)
Firm FE	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes
N	5936	5936	5937	5937	5937
Adj. R-sq	0.003	0.023	0.103	0.027	0.026

This table presents the results of regressions examining the impact of the direct purchase rescue program on corporate investment and financing decisions. The sample period includes two years before and two years after the event year (i.e., from 2013 to 2016). The dependent variables are *R&D, Capex, Asset growth, Leverage*, and *Asset liquidity*, whose definitions can be found in Appendix Table A.4. *TREAT* is an indicator of rescued firms, and *AFTER* is an indicator of observations after the direct purchase rescue program. We only control for firms' beginning-of-year assets (in natural log) to avoid the "bad control" problem as in Angrist and Pischke (2009). We control for firm and year fixed effects in all specifications. Robust standard errors are clustered at both the firm and year levels. The t-statistics are shown in parentheses. ***, **, and * denote significance at the 1 %, 5 %, and 10 % levels, respectively.

The distinct nature of the rescue package may be the cause of the different effects identified here. Whereas TARP effectively strengthened banks' balance sheets by injecting preferred equity, the Chinese National Team sought to reduce volatility and restore liquidity by directly purchasing common stocks in the secondary market, which does not directly affect the balance sheet of firms. In fact, as a byproduct, the government's direct rescue program introduced policy uncertainty and deteriorated stock market quality, which may explain the observed "hibernation."

5.6. The long-term effect of the rescue program

Is the decline in liquidity temporary? Furthermore, is it possible that investors underreact or overreact to liquidity shocks? To answer these questions, we examine the liquidity impact of the rescue program over a longer post-rescue window.[16] Following prior studies (e.g., Bali et al., 2014), we extend the post-rescue horizon to six months after the event. We first investigate the possibility of a reversal. In Columns (1) and (2) of Table 10, we restrict the post-rescue window to the period from the seventh week to the 24th week after August 14, 2015. We find that the coefficient of *TREAT*AFTER* in Column (1) is −0.081 (t-statistic = −3.64), while that in Column (2) is 0.090 (t-statistic = 3.85), indicating

Table 10
The long-term effect of the direct purchase rescue program (matched sample).

	(1) *Log (Turnover)*	(2) *Log (Amihud)*	(3) *Log (Turnover)*	(4) *Log (Amihud)*
*TREAT*AFTER*	−0.081***	0.090***		
	(−3.64)	(3.85)		
*TREAT*AFTER_Short*			−0.156***	0.111***
			(−5.65)	(3.99)
*TREAT*AFTER_Long*			−0.079***	0.089***
			(−3.68)	(3.88)
Log(Market cap)	−0.010	−0.560***	0.003	−0.553***
	(−0.34)	(−14.76)	(0.09)	(−14.47)
Log(BM)	−0.121***	−0.108***	−0.137***	−0.098***
	(−4.69)	(−3.12)	(−5.15)	(−3.00)
Log(Volatility)	−0.036	−0.042	−0.003	−0.083**
	(−1.03)	(−1.07)	(−0.07)	(−2.22)
Log(Turnover)	0.519***	−0.342***	0.499***	−0.327***
	(9.10)	(−8.83)	(8.73)	(−8.71)
Previous return	1.061***	−0.479***	1.033***	−0.642***
	(6.84)	(−3.14)	(8.05)	(−4.72)
Firm FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
N	33,569	33,569	41,167	41,167
Adj. R-sq	0.765	0.772	0.762	0.778

This table presents the results of DID regressions examining the long-term impact of the direct purchase rescue program implemented by the Chinese government. The pre-rescue period includes the six weeks before July 3, 2014. In Columns (1) and (2), the post-rescue period extends from the seventh week to the 24th week after August 14, 2015. *TREAT* is an indicator of rescued firms, and *AFTER* is an indicator of observations after the direct purchase rescue program. In Columns (3) and (4), the post-rescue period spans the 24 weeks after August 14, 2015. *AFTER_Short* is an indicator of observations within six weeks after the direct purchase rescue program, while *AFTER_Long* is an indicator of observations from the seventh week to the 24th week after the direct purchase rescue program. The dependent variables are turnover (in natural log) and Amihud illiquidity (in natural log). Our control variables include size, book-to-market ratio, volatility, turnover, and return in the previous month. The control variables are calculated using stock prices from the previous calendar month. All regressions include firm and week fixed effects with standard errors clustered at both the firm and week levels. The t-statistics are shown in parentheses. ***, **, and * denote significance at the 1 %, 5 %, and 10 % levels, respectively.

[16] We thank an anonymous referee for suggesting this test.

a lasting decline in liquidity following the direct purchase rescue program.

In Columns (3) and (4), we examine whether investors underreact or overreact to liquidity shocks by contrasting short-term effects with longer-term effects. *AFTER_Short* is an indicator of observations within six weeks after the direct purchase rescue program, while *AFTER_Long* is an indicator of observations from the seventh week to the 24th week after the direct purchase rescue program. In both Columns (3) and (4), the coefficients of *TREAT*AFTER_Short* are consistently larger in magnitude than those of *TREAT*AFTER_Long*, indicating a sharp drop in liquidity of rescued firms over the first six weeks, followed by a partial reversal over the next 18 weeks. Overall, the results in this section suggest that the rescue-induced decline in liquidity is lasting and that investors appear to overreact to liquidity shocks.

5.7. The effect of subsequent interventions

As shown in Fig. 3, during the fourth quarter of 2015, the National Team reduced its ownership in a large portion of the initially rescued firms. Due to strong public criticism of the substantial sale of its ownership stakes, the National Team has since made only marginal adjustments to its holdings. In this section, we examine subsequent changes in National Team ownership during the fourth quarter of 2015, namely additional purchases and sales of stocks, to understand the long-term effects of the government's rescue program. One of the merits of this exercise is that it enables us to distinguish the liquidity dry-up hypothesis from the policy uncertainty hypothesis. According to the liquidity dry-up hypothesis, the decline in stock liquidity after the government's rescue program is mechanical if the government chooses to keep the rescued shares and not sell them afterward. If this is the case, we expect an increase in liquidity following ownership reduction of the National Team as the number of shares tradable increases. In contrast, rescue-induced policy uncertainty implies that subsequent interventions, whether they take the form of purchases or sales, tend to make the market less liquid.

Of the 1318 non-financial firms that were rescued during the third quarter of 2015, 785 firms did not report any changes in National Team ownership in the fourth quarter. Among the remaining firms, 37 reported an increase in ownership and 496 reported a decrease. We thus compare firms experiencing changes in government ownership with those where government ownership remained constant by interacting the variables *Increase* and *Decrease* with the dummy *PostQ4*. To facilitate comparison between different types of subsequent interventions (e.g., purchases and sales), instead of running separate regressions, we add the two interaction terms to a single model. We control for firm fixed effects in all specifications. Our sample spans the six weeks before and the six weeks after the end of 2015Q4.

Table 11 presents the estimated effect of subsequent ownership changes. In Columns (1) and (2), the dependent variables are Log *(Turnover)* and Log*(Amihud)*, respectively. The coefficients of *Increase*PostQ4* are −0.095 (t-statistic = −1.90) and 0.125 (t-statistic = 3.19), respectively, implying that further government purchases again lead to a decline in liquidity. More importantly, we find that the coefficients of *Decrease*PostQ4* in Columns (1) and (2) are −0.012 (t-statistic = −0.41) and 0.082 (t-statistic = 2.22), respectively. Therefore, our results do not support the suspicion that the government's rescue program mechanically reduces stock liquidity, because we do not observe an increase in liquidity following stock selling by the National Team. This market reaction contrasts with that observed during the Hong Kong Monetary Authority's (HKMA's) intervention, where the HKMA gradually sold its purchased shares without adversely affecting the stock market. The distinct effects between the direct purchase rescue program implemented by the HKMA and mainland China can again be attributed to policy uncertainty.

We also observe a decline in total volatility and nonsignificant changes in range-based volatility, according to the coefficients in Columns (3) and (4). Interestingly, we find that when the government decreases its position, stock returns become more volatile, as indicated by the coefficient of the interaction term between *Decrease* and *PostQ4*. This finding implies that opaque market rescue programs can lead to market disruptions during subsequent unexpected sales.

Table 11
The capital market effect of subsequent interventions.

Dependent var.	(1) *Log(Turnover)*	(2) *Log(Amihud)*	(3) *Log(TVOL)*	(4) *Log(Range)*
*Increase * PostQ4*	−0.095*	0.125***	−0.044**	0.013
	(−1.90)	(3.19)	(−2.04)	(0.32)
*Decrease * PostQ4*	−0.012	0.082**	0.014*	0.050*
	(−0.41)	(2.22)	(1.75)	(1.68)
PostQ4	−0.160**	0.363*	0.409***	0.104
	(−2.38)	(1.76)	(45.37)	(0.78)
Log(Market cap)	0.377***	−0.474***	−0.161***	0.150
	(4.39)	(−3.05)	(−3.35)	(1.23)
Log(BM)	−0.232***	0.341	0.239***	−0.040
	(−3.80)	(1.10)	(3.95)	(−0.22)
Log(Volatility)	−0.000	−0.224***	−0.105***	−0.111
	(−0.00)	(−2.70)	(−7.13)	(−1.48)
Log(Turnover)	0.056	−0.333***	−0.022	−0.205
	(0.39)	(−2.74)	(−0.85)	(−1.38)
Previous return	0.674***	−2.105***	−0.016	−0.654**
	(4.07)	(−3.56)	(−0.45)	(−2.00)
Firm FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
N	14,523	14,523	2488	14,523
Adj. R-sq	0.243	0.638	0.823	0.344

This table shows the results of regressions examining the effect of subsequent changes in National Team ownership in initially rescued firms. Firms with constant National Team ownership are compared with those with higher (*Increase*) or lower (*Decrease*) ownership during the fourth quarter of 2015. The sample includes the six weeks before and the six weeks after the end of 2015Q4. The dummy variable *PostQ4* takes a value of one for observations after the fourth quarter of 2015. We control for firm fixed effects in all specifications. *Increase* and *Decrease* are absorbed by stock fixed effects. Detailed definitions for the other variables can be found in Appendix Table A.4. Standard errors are clustered at both the firm and week levels, except for regressions with Log*(TVOL)* as the dependent variable, in which standard errors are clustered by firm. The t-statistics are shown in parentheses. ***, **, and * denote significance at the 1 %, 5 %, and 10 % levels, respectively.

In summary, the findings presented in Table 11 highlight important concerns regarding the direct purchase rescue program, specifically emphasizing the negative impact of government exit (e.g., reduced liquidity and increased volatility).

6. Conclusion

After the Shanghai Composite Index lost more than 30 % of its value in less than three weeks in 2015, the Chinese government used hundreds of billions of dollars to save the stock market from the crisis. We find that firms eligible for margin trading, firms with sharp price declines, and firms in systemically important industries are more likely to be rescued than other firms. The primary goal of the government's rescue program was to preserve financial stability. After the government ended its stock purchase program, we find a significant reduction in the liquidity of the stocks purchased. Our partition analysis shows that policy uncertainty regarding subsequent interventions better explains the adverse effect on liquidity than the liquidity dry-up hypothesis or the bad firm signaling hypothesis. Excessive risk-taking linked to the "too big to fail" hypothesis cannot explain the decline in liquidity either, as we do not find that rescued firms' investment or financial policies become more aggressive after the government's rescue program. Finally, our results show that the government's subsequent trading activities further compromise market quality to some extent.

We draw two important implications from our results. First, the Chinese government's secondary market share purchases marginally

stabilized the stock market, as evidenced by a negligible reduction in return volatility in some model specifications, at the cost of a loss of liquidity, likely due to the high policy uncertainty stemming from the intervention's opacity. Our paper corroborates with studies regarding the short-selling ban (e.g., Boehmer et al., 2013), suggesting that government intervention in the secondary stock market can have unintended consequences. Second, studies of the net benefits of China's government rescue program in 2015 show conflicting results. Our comprehensive analyses of changes in stock liquidity, volatility, and firm fundamentals after the rescue program raise serious concerns about the rescue program.

We acknowledge three limitations of our study. First, without a clear control of counterfactuals, we cannot determine whether the market would have been better off had the government chosen a *laissez-faire* stance or adopted alternative policies. Second, our results depend on the nature of the crisis. The 2015 Chinese stock market crash was more of a liquidity crisis than a fundamental deterioration. Third, our results depend on the institutional environment. In particular, some of our analyses reveal that the effect of government intervention depends on the transparency of policy details. Increased policy uncertainty, resulting from a lack of transparency, can lead to a range of unintended consequences. Further studies are needed to better understand the relationship between rescue programs and the financial market.

CRediT authorship contribution statement

Lu Li: Writing – review & editing, Visualization, Validation, Formal analysis, Data curation. **Chunbo Liu:** Writing – review & editing, Writing – original draft, Methodology, Investigation, Formal analysis, Data curation. **Yongxin Xu:** Writing – review & editing, Writing – original draft, Supervision, Project administration, Methodology, Investigation, Conceptualization. **Xiaoyan Zhang:** Writing – original draft, Validation, Supervision, Methodology, Formal analysis, Conceptualization. **Gaoping Zheng:** Writing – review & editing, Supervision, Resources, Project administration, Investigation.

Data availability

Data will be made available on request.

APPENDIX

Table A.1
Timeline of events related to the 2015 stock market crash and the government's rescue program.

Before the crisis
November 21, 2014: The People's Bank of China reduced its benchmark deposit rate (one-year) by 0.25 % to 2.75 % and decreased the one-year loan rate by 0.4 % to 5.6 %. This was the first reduction since the summer of 2012.
January 16, 2015: Mr. Gang Xiao, president of the CSRC, issued a report highlighting the potential risk caused by the dramatic increase in margin trading since 2014. The CRSC also imposed regulatory measures on 12 brokerage firms for violating margin trading rules. The CSI300 Index (this index represents the performance of the top 300 stocks traded on the Shanghai and Shenzhen stock exchanges) opened down 6.1 % the following Monday.
May 21, 2015: The CSRC and the Securities Association of China asked Chinese brokerage firms to self-assess and suspend activities that may facilitate margin buying through HOMS software.
June 12, 2015: The CSRC publicly reaffirmed the ban on brokerage firms facilitating margin trading.
During the crisis
June 15 to June 19, 2015: The Shanghai Composite Index fell more than 13 % this week.
June 26, 2015: The Shanghai Composite Index had fallen about 20 % since June 15.
June 27, 2015: The People's Bank of China cut its one-year benchmark loan rate by 0.25 % to 4.85 % and its one-year deposit rate by 0.25 % to 2 %.
June 29, 2015: An official draft was released, suggesting that China's pension funds could be allowed to invest in the stock market.
July 1, 2015: Transaction fees on exchanges would be reduced by 30 % starting August 1.
July 3, 2015: The stock market continued to decline, about 30 % below its position in mid-June. The CSRC announced that initial public offerings would be reduced and more funds would be infused into CSFC to stabilize the stock market. An investigation into suspected stock market manipulation was also launched.
July 4, 2015: 21 brokerage firms collectively announced that they would use more than 120 billion yuan to stabilize the stock market by purchasing blue-chip ETFs.
July 5, 2015: The People's Bank of China announced that it would provide liquidity to CSFC to further stabilize the stock market. CHI also announced that it had started purchasing ETFs and would continue similar operations in the future.
July 8, 2015: The CSRC requested that in the next six months, controlling shareholders, shareholders with more than 5 % ownership, directors, and managers not sell their stakes. Until then, more than 1000 listed firms, or about 30 % of the overall total of listed firms on the Chinese stock market, had voluntarily suspended their share trading.
July 9, 2015: The Ministry of Public Security of the People's Republic of China joined the CSRC to investigate "malicious short selling."
August 14, 2015: The CSRC announced that the rescue program was temporarily terminated. CFSC should not fully exit the stock market in the coming years or actively intervene in stock trading.

Table A.2
Sample distribution.

Panel A: Ownership position of National Team investors			
Investors	Number of stocks purchased	Percentage of firms with ownership (total = 2767)	Average percentage of ownership
CFSC	743	26.85 %	2.44 %
CHI	1113	40.22 %	2.15 %

(*continued on next page*)

Table A.2 (*continued*)

Panel A: Ownership position of National Team investors					
Investors	Number of stocks purchased	Percentage of firms with ownership (total = 2767)	Average percentage of ownership		
National Team	1363	49.26 %	3.09 %		
Panel B: Industry distribution of rescued and non-rescued firms					
Sector	Description	Non-rescued firms	Rescued firms	All	% rescued firms
1	Consumer goods	201	159	360	44.2 %
2	Manufacturing, energy, and utilities	621	636	1257	50.6 %
3	High-tech, telecommunication	264	197	461	42.7 %
4	Healthcare	84	96	180	53.3 %
5	Other	234	275	509	54.0 %
	Total	1404	1363	2767	

Panel A presents the number of stocks purchased by the National Team, i.e., CFSC and CHI, during the direct purchase rescue program implemented by the Chinese government to cope with the 2015 A-share market crash. We define a firm as a rescued firm if there was an increase in National Team ownership in the third quarter of 2015 compared with that in the second quarter. Note that a firm's shares can be purchased by both CFSC and CHI. Panel B shows the industry distribution of the 2762 firms for which we can identify the corresponding Fama–French 5 industry.

Table A.3
Distribution of ownership among the top 10 shareholders.

Panel A: Ownership distribution of National Team investors					
		% ownership		Market capitalization	
Rank	N	Mean	Median	Mean	Median
1	85	0.090	0.052	38.527	1.587
2	356	0.032	0.030	29.426	10.334
3	354	0.022	0.019	30.589	9.485
4	297	0.019	0.017	21.909	8.982
5	221	0.016	0.015	17.688	7.664
6	165	0.014	0.013	17.508	8.003
7	123	0.012	0.011	17.069	6.041
8	98	0.010	0.009	17.500	7.730
9	85	0.008	0.007	10.855	4.899
10	72	0.008	0.006	8.355	4.569
Panel B: Ownership distribution of non-National Team investors					
		% ownership		Market capitalization	
Rank	N	Mean	Median	Mean	Median
1	2682	0.275	0.240	11.205	4.714
2	2409	0.067	0.050	9.362	4.273
3	2406	0.032	0.025	9.208	4.261
4	2455	0.020	0.016	10.858	4.368
5	2527	0.015	0.012	11.590	4.469
6	2569	0.012	0.010	11.716	4.516
7	2596	0.010	0.008	11.741	4.530
8	2610	0.009	0.007	11.805	4.547
9	2596	0.008	0.007	11.114	4.556
10	2547	0.007	0.006	9.446	4.486

This table presents the ownership percentage of the top 10 shareholders and the market capitalization of Chinese A-share firms in the third quarter of 2015. Market capitalization is expressed in billions of yuan. Panel A shows the ownership distribution of National Team investors among the top 10 shareholders and Panel B shows the ownership distribution of non-National Team investors.

Table A.4
Variable definitions.

Variable	Definition	Source
Government's secondary market intervention		
Rescue	A dummy variable indicating whether the change in National Team ownership between the third quarter of 2015 and the second quarter is greater than zero	WIND
Increase	A dummy variable equal to one if the National Team continued to purchase the shares of a rescued firm in the fourth quarter of 2015	WIND
Decrease	A dummy variable equal to one if the National Team sold the shares of a rescued firm in the fourth quarter of 2015	WIND
Stock market variables		
Turnover	The weekly average of daily stock turnover	CSMAR
Amihud	Weekly Amihud illiquidity ratio, defined as the weekly average price impact (in percentage) for each million yuan of transactions	CSMAR
TVOL	Stock return volatility, calculated using daily stock returns over a six-week period	CSMAR
Range	Calculated as $range_{it} = \sqrt{\frac{(H_{it} - L_{it})^2}{4log_e 2}}$, where H_{it} and L_{it} are the log-transformed high and low prices of stock i on day t. Weekly range-based volatility is defined as the median daily range-based volatility	CSMAR
Margin	A dummy variable equal to one if a stock allows trading using margin loans or short selling	WIND

(*continued on next page*)

Table A.4 (*continued*)

Variable	Definition	Source
Log(Market cap)	The natural logarithm of market capitalization, defined as the product of stock prices (weekly) and the number of common shares outstanding	CSMAR
Log(BM)	The natural logarithm of the ratio of the book value of equity to market capitalization	CSMAR
Firm characteristics		
Size	The natural logarithm of the book value of assets	CSMAR
Leverage	Total debt scaled by the book value of assets	CSMAR
ROE	Net income divided by total equity	CSMAR
HS300	A dummy variable indicating whether a stock was a constituent stock of the Shanghai Shenzhen 300 Index on the day before the rescue program start date	CSMAR
SOE	A dummy variable indicating ultimate control by the government	CSMAR
Political connection	A dummy variable equal to one if the CEO or Chair of the Board has a political background, and zero otherwise. Political background includes work experience in parliaments or government agencies	CSMAR
Institutional	Institutional ownership	CSMAR
ST	A dummy variable equal to one if a firm has been labeled "special treatment (ST)" by regulators. Usually, firms that meet one of several criteria (e.g., two consecutive years of losses) will receive ST status and therefore be considered high investment risk	CSMAR
TO	Average daily turnover in the first quarter of 2015	CSMAR
R&D	R&D expenditure scaled by beginning-of-period fixed assets	CSMAR
Capex	Capital expenditure scaled by beginning-of-period fixed assets	CSMAR
Asset growth	The change in total assets divided by beginning-of-period total assets	CSMAR
Asset liquidity	Current assets minus current liabilities scaled by total assets	CSMAR

Table A.5
Propensity score matching.

	(1) Before matching	(2)	(3)	(4) After matching	(5)	(6)
Variable	Control group	Treatment group	Difference	Control group	Treatment group	Difference
Margin	0.180	0.467	0.287	0.273	0.241	−0.033
Cumulative return	0.989	0.626	−0.364	0.652	0.629	−0.023
Manufacturing	0.210	0.258	0.047	0.235	0.229	−0.007
Utilities	0.026	0.038	0.012	0.029	0.026	−0.003
Finance	0.011	0.037	0.027	0.010	0.009	−0.001
Real estate	0.043	0.051	0.007	0.043	0.048	0.005
SOE	0.293	0.428	0.135	0.364	0.343	−0.021
Political connection	0.389	0.445	0.057	0.398	0.388	−0.010
Size	21.524	22.472	0.947	21.847	21.777	−0.070
HS300	0.014	0.204	0.190	0.026	0.022	−0.004
Leverage	0.437	0.456	0.019	0.424	0.417	−0.008
Log(BM)	−1.725	−1.420	0.304	−1.538	−1.580	−0.042
ROE	0.053	0.086	0.033	0.061	0.062	0.002
Institutional	36.542	45.147	8.605	42.199	40.241	−1.958
ST	0.036	0.001	−0.035	0.005	0.003	−0.003
TO	0.025	0.024	−0.002	0.025	0.025	0.000
Observations	1404	1363	2767	769	769	1538

This table reports the balance test for propensity score matching. We perform our matching analysis in two steps. First, we estimate a logit model that predicts the government's choice of rescue targets using a battery of firm characteristics, namely *Margin, Cumulative return, Manufacturing, Utilities, Finance, Real estate, SOE, Political connection, Size, HS300, Leverage*, Log*(BM), ROE, Institutional, ST*, and *TO*. In the second step, using the propensity scores obtained from the logit model in the first step, we match rescued firms with non-rescued firms, using 1:1 nearest neighbor matching with common support and without replacement and a caliper of 0.03. All matching variables are defined in Table A.4.

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