

# **Cash flow uncertainty, state ownership and corporate real estate holding**

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**Abstract:** Any corporate investment decision is highly dependent on the corporate internal cash flow and is quite sensitive to the variance of cash flow uncertainty. This paper empirically examines the association between cash flow uncertainty, state ownership and corporate real estate holding using the data of A-share listed companies in China from 2005 to 2016. This study finds that there is a significantly negative association between cash flow uncertainty and corporate real estate holdings, and this effect is more prominent for financially constrained firms. However, when considering the presence of state ownership, the negative association is only significant for privately-owned-enterprises (non-SOEs). We show that state-owned-enterprises (SOEs) benefit from credit discrimination, as evidenced by having higher financial leverages and lower borrowing costs, which mitigate the effect of cash flow uncertainty. Our results are robust after various methods are performed to address potential endogeneity problems and a set of other robustness tests.

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## **Abstract**

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## 1. Introduction

Since the beginning of its housing reform, real estate has promoted the development of the national economy. Driven by high profits, a large number of manufacturing enterprises in China have concentrated their limited financial resources on real estate over the past twenty years. By the first half of 2021, 2,204 A-share listed companies hold “investment property” up to 1.75 trillion CNY, that is, nearly half of the listed companies are flipping houses. It may induce industrial enterprises to gradually diverge from their main business, inhibit corporate innovation, and cause Chinese economy to face the dual crisis of a ‘capital bubble’ and a ‘real economy hollowing out’. Therefore, it is necessary to study the intrinsic motivation of real estate investment of enterprises in China, cash flow uncertainty.

Any investment decision of a company is subject to internal factors: the stability of cash flow. The stability of internal cash flow reflects not only a firm’s current operation ability, but also its future risk-taking ability and financing ability. Because Chinese real estate industry is capital-intensive, industrial enterprises holding real estate have the characteristics of high systemic risk and high holding costs, and tend more to buy land and houses by adding more leveraged. Therefore, real estate is highly dependent on the stability of corporate internal cash flow relative to other assets investment. There is no consistent conclusion about the impact of cash flow uncertainty on corporate investment. With respect to enterprise investment, cash flow uncertainty may not only form the supporting effect (Boyle and Guthrie, 2003; Hirth and Viswanatha, 2011), which contributes to the flexibility and incentive of investment decisions, but also form the precautionary effect (Almeida and Campello, 2007; Minton and Schrand, 1999), which makes the investment decisions of the management tend to be conservative and prudent. Besides, financial constraints could increase the sensitivities of investment on cash flow volatility (FHP, 1988, 1998; Minton & Schrand, 1999). If non-state-owned firms are more financially constrained than state-owned firms in China, their investments should be more sensitive to the cash flow volatility. Based on this argument, our paper investigates the mechanism of cash flow uncertainty on corporate real estate holdings by considering the specific ownership structure in China.

For the sample period of 2005-2016, we utilize the data of A-share listed companies excluding real estate and finance companies to investigate the effect of cash flow uncertainty on corporate real estate holding and the moderating effect of state ownership on the relationship between the two. Our work is related to a growing literature exploring the relationship between cash flow uncertainty and corporate investments (FHP, 1988, 1998; Minton & Schrand, 1999; Almeida & Campello, 2007). Most of these papers focus on the United States and fail to consider that the relationship between cash flow uncertainty and corporate investments may

differ across ownership structure. We extend the literature to China, an emerging market where state ownership is frequent and where ownership structure is important to financial outcomes. We find that the corporate investments from non-state-owned firms are more sensitive than those from state-owned firms to cash flow uncertainty since non-state-owned firms are more financially constrained than state-owned firms in China. To our knowledge, this is the first study that estimates the influences of ownership structure on the relationship between cash flow uncertainty and corporate investments. Particularly related to our study is Zhao and Sing (2016) who find that, in the US, cash flow uncertainty leads firms to be more conservative and cautious on their corporate real estate investments. However, our paper documents that, in China, the negative correlation between cash flow uncertainty and corporate real estate investments only holds for non-state-owned firms. The cash flow uncertainty of state-owned-firms does not lead to less corporate real estate holdings. Therefore, our work expands the literature by discussing the relationship between cash flow uncertainty and corporate real estate investments from developed countries to China, the largest developing country. Our findings from China highlight the importance of ownership structure in understanding the relationship between cash flow uncertainty and corporate real estate holdings.

This study contributes to several strands as follows: ①our research explores the studies on the determinants of enterprises holding real estate. Prior studies on real estate mainly focus on house-price rises and consumption, real estate investment and economic growth, and house-price rise. Although Zhao and Sing (2016) find a negative correlation between cash flow uncertainty and real estate holdings of American enterprises, this relationship can not directly apply to Chinese enterprises. The particularity of China's real estate market, such as nationalised land, and several of China's real estate enterprises flooding into the field, and forming a cross-border arbitrage boom, which is different from other countries. Therefore, we make an in-depth discussion on the effect of cash flow uncertainty on corporate real estate holding; ② Early literature (including Zhao and Sing, 2016) lacks the analysis of special characteristics of Chinese financial market: credit discrimination caused by state ownership, and thus this study considers the effect of state ownership on the relationship between cash flow uncertainty and corporate real estate. This study also investigates the existence of credit discrimination, and the relationship between cash flow uncertainty, financial constraints and corporate real estate holding; ③we adopt a variety of methods to address potential endogeneity concerns. In addition to the Difference-in-Difference test of the implementation of 'Property Rights Act', we use other robustness tests, including the two-way fixed effect, instrumental variable method, excluding special samples and so on.

The study is structured as follows: Section 2 develops the literature review and hypothesis development, then Section 3 details the research design. Section 4 presents the empirical analysis, followed by robustness tests in Section 5. Finally, Section 6 concludes the study.

## 2. Literature review and hypothesis development

Corporate real estate (CRE), including both land and structures, weighs as one major fixed capital investments for most corporations (Campello and Giambona, 2013; Zhao and Sing, 2016; Delfim and Hoesli, 2019; Pfñuer et al., 2021). The incentives for firms to hold CRE assets are mainly explained by two genres of literatures. First, the “collateral channel effect” argues that firms hold CRE for future financing. Benmelech et al. (2005), Glancy et al. (2019) and Glancy et al. (2022) suggest that firms with more CRE assets would receive larger loans with longer maturities and durations, and lower interest rates. Gan (2007a) documents a positive relationship between collateral value and firms’ debt capacity, which suggests that higher CRE holdings would increase the ability and easiness of firms to get debt financing. Furthermore, Chaney et al. (2012) and Deng et al. (2018) claim that firms would use their CRE assets as collaterals to finance new investment projects. The value increase of CRE assets would further promote higher aggregate corporate investments. Second, the “empire building effect” is another important justification for CRE holdings. Prior studies such as Williamson (1964), Kanniainen, (2000), Hope et al. (2008), and Gul et al. et al. (2020) claim that managers have motivations to increase the resources under their control that can potentially increase their power and compensations. Acquiring CRE assets is one of the important channels for managers to do so. Leung (2013), Yung et al. (2017), and Xu and Ooi (2018) directly point out that CRE holdings are a form of managerial empire building. Firms with weaker corporate governance and a lower degree of financial constraint tend to have more CRE assets. Other studies such as Agrawal and Mandelker (1987), Veale (1989), Aggarwal and Samwick (2002), Coles et al. (2006), and Wu et al. (2015) also provide ample support for this argument.

The holdings of real estate also bring costs and financial burdens to firms. Tuzel (2010) and Ambrose et al. (2017) suggest that real estate properties depreciate over time. Hence, firms with high CRE holdings tend to be more vulnerable to negative shocks, making these companies riskier. Zhao and Sing (2016) tacitly support this view by showing that higher adjustment costs on CRE assets would lower firms’ CRE holdings, indicating that firms with high risk levels are expected to hold less CRE assets. Therefore, it is reasonable to conjure that firms that are not financially strong in terms of cash flow stability tend to have less CRE holdings. A group of studies implicitly support this argument. Minton and Schrand (1999), Moshirian et al. (2017), and Harris and Roark (2019) show that firms with higher cash flow

volatility are associated with lower levels of capital investments. They claim that firms do not use external financing to fully fund their capital investments, but put more weight on internal cash flows when making decisions. Almeida et al. (2004) and Moyen (2004) claim that financially constrained firms have propensities to save cash out of cash flows, i.e., making build cash stocks, a practice that would make these firms less likely to make large capital expenditures. Denis and Sibilkov (2010) agree with this view by providing evidence that cash holdings are more valuable for financially constrained firms than for unconstrained firms. The aforementioned effect is later empirically confirmed by Keefe and Tate (2013), Driver and Muñoz-Bugarin (2019), and Beladi et al. (2021). These studies collectively claim that financially constrained firms would decrease investments when experiencing high volatility and negative cash flow growth realizations. This effect is not found among financially unconstrained firms. Moreover, from the real option perspective, Boyle and Guthrie (2003) and Hirth and Viswanatha (2011) offer alternative evidence by showing that firms with high cash flow volatility tend to delay or forgo capital investments, because this would make the real option more valuable. In summary, corporate real estate holdings imposes financial costs on firms. Hence, firm's cash flows should play an important role on corporate real estate holdings. We propose the first hypothesis as follows:

*Hypothesis 1: Firms with higher cash flow uncertainty should have lower corporate real estate holdings.*

On the other hand, it is important to note that the natures of the firm are fundamentally different between state-owned-enterprises (SOEs) and privately-owned-enterprises (non-SOEs). As evidenced by Ramanadham (1991), Gortner et al. (1993), Rainey (1996), Jones and Zou (2017), Ding et al. (2019), and Matuszak and Kabaciński (2021), the main purpose of SOEs is not for profit maximization but for promoting government agendas. Previous literature provides three mainstream theories as the foundation: public choice theory (Niskanen, 1971; Tullock, 1976), property rights theory (Alchian and Demsetz, 1973), and agency cost theory (Jensen and Meckling, 1976; Boycko et al., 1996; Shleifer and Vishny, 1994). Extensive studies have reviewed and provided ample empirical evidence to support such as Aharoni (1986), Vining and Boardman (1992), Domberger and Piggott (1986), Gathon and Pestiau (1996), Tittenbrun (1996), Megginson and Netter (2001), and Wei et al. (2005).

However, SOEs significantly benefit from political favouritism over non-SOEs in China (La Porta et al., 2002; Brandt and Li, 2003; Khwaja and Mian, 2005; Faccio, 2006; Charumlind et al., 2006; Mariotti and Marzano, 2020). Banks give priorities and special financing treatments to SOEs, since both are controlled by the governments and they have incentives to pursue

sound relationships with each other (Brandt and Li, 2003; Chen et al., 2019). Aharony et al. (2000), Brandt and Li (2003), Wang et al. (2008), Su and Yang (2009), Chen et al. (2019), and Lin et al. (2020) collectively indicate that non-SOEs are negatively discriminated in both debt financing and equity financing. A variety of reasons are proposed by previous studies. First, as evidenced by Cull and Xu (2003), Chen et al. (2019), and Lin et al. (2020), banks are subject to the so called “policy lending” in which banks are guided to prioritize their loans to SOEs. Second, from the perspective of risk management, banks treat loans made to SOEs as safe investment vehicles because the government would ultimately bail out SOEs should they have financial distresses or illiquidity problem. Last, SOEs are able to obtain more assistance for their funding as comparing to non-SOEs. Banks and other interested parties are fully motivated to push through the loan approval process for SOEs with the attempt to promote better networks with the government as well as political capitals (Kornai, 1993; Qian, 1994; Li and Zhou, 2005; Wang et al., 2008; Kusnadi et al., 2015). Consequently, bank discrimination significantly favours SOEs, making these firms have easy access to both short-term and long-term debt financing (Allen et al., 2005, 2008; Lu et al., 2012; Zhu and Yang; 2016; Ding et al., 2019). The hypothesis of the negative association between cash flow uncertainty and CRE holdings builds on the argument that CRE holdings would impose financial costs on firms so that those with stable cash flows tend to have more CRE holdings. However, as evidenced by these prior studies, SOEs significantly benefit from governmental favouritism and easy financing because of bank discrimination. Therefore, the financial burden on CRE holdings should be more of a concern for non-SOEs. We propose the second hypothesis as follows:

*Hypothesis 2: State ownership weakens the negative effect of cash flow volatility.*

### **3. Research design**

#### **3.1. Sample composition and data sources**

For the sample period of 2005–2016, we utilise corporate financial data and real estate data of A-share listed companies sourced from the China Stock Market & Accounting Research database, together with macroeconomic data sourced from China’s National Bureau of Statistics and the CEInet Statistics Database. We merge corporate financial data and real estate data using the stock code. We process the dataset as follows. First, we exclude financial and real estate companies based on the Industry Classification Benchmark code. Second, we exclude firms with a null value for innovation. Third, we excluded ST and ST\* companies.

Finally, we winsorise corporate financial continuous variables at the 1% level. Following these steps, our final sample comprise 15,379 firm-year observations.

The samples period is selected from 2005 to 2016 for the following reasons: ①The period from 1997 to 2017 was the 20-year golden development period of China's real estate industry. During this period, Chinese government's policy supervision on the real estate industry was weak and even encouraged development, so the number and scale of Chinese real estate enterprises continued to increase. ②2017 was the year of the most severe real estate regulation. Since then, China has adopted a "tight" real estate regulation policy and repeatedly emphasized the positioning of "houses are for living, not for speculation" to control real estate financial risks. Therefore, this paper selects 2005-2016 as the sample period, including the golden era of commercial housing from 2005 to 2007 and the post-golden era from 2008 to 2016. Data after 2016 are not included because these data are greatly affected by large policy fluctuations, which makes the conclusion of this paper more robust.

### **3.2. Variable setting**

Following literature from (Keefe and Tate 2013; Wang and Rong 2014; Zhao and Sing 2016), the independent variable for cash flow uncertainty is  $\text{cashflowvol}_{i,t}$ ,  $\text{cashflowvol2}_{i,t}$ , the dependent variable for corporate real estate holding is  $\text{Revalue}_{i,t}$  ( $\text{Revalue1}$ ,  $\text{Revalue2}$ ) , SOE represents state ownership, control variables include financial leverage ( $\text{leverage}_I$ ), firm size( $\logassets_I$ ), market value to book value ( $\text{TobinQ}_I$ ), other property, plant and equipment assets ( $PPE$ ) excluding real estate assets( $Exppe$ ), per capita GDP( $\text{Per capita GDP}$ ), M2 growth rate( $\text{growthrateofM2}$ ), and the city house-price index( $chpi$ ).

#### **3.2.1 Cash Flow Uncertainty index**

Following the methods of Bates et al. (2009), Keefe and Tate ( 2013 ) and Zhao and Sing ( 2016 ) , we construct two indicators to measure cash flow uncertainty : the first one is  $\text{Cashflowvol}_{i,t-1}$ , which is measured by the rolling standard deviation of cash flows from operations (  $T \geq 6$  ) , as shown in Model (1). The second proxy variable is  $\text{Cashflowvol2}_{i,t-1}$  , which is defined as the time-differences between firm-level cash flow uncertainty and the average industry-level cash flow uncertainty (  $T \geq 6$  ) , as shown in Model (2) and (3) .

$$Cashflowvol_{it} = \sqrt{\frac{1}{T-1} \sum_{t=1}^T (rcashflow_{i,t} - \frac{1}{T} \sum_{t=1}^T rcashflow_{i,t})^2} \quad (1)$$

$$C_{it} = rcashflow_{i,t} - \frac{1}{N_I} \sum_{i=1}^{N_I} rcashflow_{i,t} \quad (2)$$

$$Cashflowvol2_{it} = \sqrt{\frac{1}{T-1} \sum_{t=1}^T (C_{i,t} - \frac{1}{T} \sum_{t=1}^T C_{i,t})^2} \quad (3)$$

Where  $i, t$  represent the enterprise and year, respectively,  $T \geq 6$  is a time window over 6 years,  $N_I$  represents the number of enterprises in the same industry  $I$  in year  $t$ ,  $rcashflow_{it}$  is the cash flow rate of operating activities, which is the rate of cash flows to total assets.

### 3.2.2 Corporate real estate holding index

We use two indicators to measure corporate real estate holding in our baseline regressions. ① The ratio of the book value of enterprise real estate assets (the sum of the book value of buildings, property under construction, land use rights and investment real estate) to the book value of total assets (Wu et al., 2015). ② In order to avoid the differences in the real estate holding rates among different industries, we also construct the relative index of real estate holding following the method of Zhao and Sing (2016). That is, we calculate the difference between real estate holding of enterprise  $i$  and the average real estate holding of  $n$  enterprises in industry  $I$  in year  $t$ , as shown in Model (4).

$$Revalue2 = Revalue1 - \frac{1}{N_I} \sum_{i=1}^{N_I} Revalue1 \quad (4)$$

### 3.3. Variable definitions and descriptive statistics

Table 1 presents the definitions of the key indicators, while Table 2 reports each variable's statistics. As Table 2 shows, the mean value of corporate real estate holding index (*Revalue1*) – i.e. the ratio of *Revalue1* is 0.132. It means that real estate assets of industrial companies account for 13.2% of the total assets on average. The mean value of relative corporate real estate holding index (*Revalue2*) – i.e. the ratio of *Revalue2* is 0.001, indicating that the difference between firm-level real estate holding and industry-level real estate holding is 0.1%. The distributions of other variables are basically consistent with those reported in prior studies, and no abnormal distribution is found.

**Table 1**

### Variable definitions

Variables	Description
<b>Dependent variables</b>	
<i>Revalue1</i>	Ratio of corporate real estate holding, the book value of corporate real estate holding/total assets
<i>Revalue2</i>	Relative ratio of corporate real estate holding, the difference between the ratio of corporate real estate holding and the average ratio of industrial real estate holding
<i>Revalue3</i>	Ratio of investment property, investment property/total assets
<b>Independent variables</b>	
<i>cashflowvol_1</i>	Cash flow uncertainty 1, the rolling standard deviation of cash flows from operations( $T \geq 6$ )
<i>cashflowvol2_1</i>	Cash flow uncertainty 2, the time-differences between firm-level cash flow uncertainty and the average industry-level cash flow uncertainty( $T \geq 6$ )
<i>risk3</i>	Cash flow uncertainty 3, the rolling standard deviation of ROA( $T \geq 3$ )
<b>Moderator variables</b>	
<i>SOE</i>	Dummy variable of state-owned firm: equals 1 if firm $i$ is a state-owned firm, and 0 otherwise
<i>cons</i>	Dummy variable of financially unconstrained companies: equal 1 if the value of SAIndex (Hadlock and Pierce, 2010) is in the top 30 percentile, and 0 otherwise
<b>Control variables</b>	
<i>leverage_1</i>	Natural logarithm of the ratio of long-term debt to total assets
<i>size_l</i>	Natural logarithm of firm size
<i>TobinQ_l</i>	Natural logarithm of total market value/total assets
<i>Exppe_l</i>	Natural logarithm of other PPE assets excluding real estate assets
<i>PercapitaGDP</i>	Per capita GDP
<i>growthrateofM2</i>	Annual growth rate of M2
<i>Chpi</i>	House-price index of the city where the company is headquartered
<b>Credit discrimination variables</b>	
<i>LEV</i>	Loan rate, calculated by (ending short-term borrowing + ending long-term liabilities within one year + ending long-term borrowing - beginning short-term borrowing - ending long-term liabilities within one year - beginning long-term liabilities)/ (ending total assets + beginning total assets)
<i>SHORTLEV</i>	Short-loan rate, calculated by (short-term loans at the end + short-term

	loans at the beginning)/(total assets at the end + total assets at the beginning)
<i>LONGLEV</i>	Long-loan rate, calculated by (long-term loans at the end + long-term loans at the beginning)/ (total assets at the end + total assets at the beginning)

**Table 2**

Summary Statistics

Variable	Mean	Sd	P25	P50	P75
<i>Revalue1</i>	0.132	0.128	0.024	0.100	0.206
<i>Revalue2</i>	0.001	0.106	-0.066	-0.018	0.043
<i>cashflowvol_l</i>	0.070	0.152	0.019	0.034	0.063
<i>cashflowvol2_l</i>	0.069	0.146	0.019	0.033	0.062
<i>Leverage_l</i>	0.068	0.096	0	0.019	0.104
<i>size_l</i>	7.937	1.329	7.032	7.775	8.663
<i>tobinQ_l</i>	1.957	1.791	0.734	1.418	2.540
<i>Exppe</i>	0.161	0.837	0.022	0.107	0.262
<i>SAIndex</i>	-3.844	0.247	-4.035	-3.862	-3.710
<i>Firmage</i>	19.69	5.067	17	19	24
<i>percapitaGDP</i>	37000	13000	26000	40000	47000
<i>Chpi</i>	68.869	50.468	0	101.050	105.983
<i>LEV</i>	0.209	0.556	0.052	0.176	0.309
<i>SHORTLEV</i>	0.127	0.519	0.018	0.087	0.183
<i>LONGLEV</i>	0.056	0.090	0.000	0.015	0.076

#### 4. Empirical analysis

##### 4.1. Cash flow uncertainty, state ownership, and corporate real estate holding

In this section, we test Hypothesis 1 (that firms with higher cash flow uncertainty should have

lower corporate real estate holdings) and Hypothesis 2 (that state ownership weakens the negative effect of cash flow volatility). We put forward the following baseline regression models:

$$Revalue_{i,t} = \alpha + \beta cashflowvol_{i,t-1} + \gamma X_{i,t-1} + \sigma_i + \tau_t + \varepsilon_{i,t} \quad (5)$$

$$Revalue_{i,t} = \alpha + \beta_1 cashflowvol_{i,t-1} + \beta_2 SOE + \beta_3 SOE \times cashflowvol_{i,t-1} + \gamma X_{i,t-1} + \sigma_i + \tau_t + \varepsilon_{i,t} \quad (6)$$

where  $i$  and  $t$  represent the firm and year respectively,  $Revalue_{i,t}$  ( $Revalue1$  and  $Revalue2$ ) represents corporate real estate holding,  $Cashflowvol_{i,t-1}$  ( $cashflowvol\_1$ ,  $cashflowvol2\_l$ ) is corporate cash flow uncertainty,  $SOE$  represents state ownership, a dummy variable of state-owned firms,  $SOE \times Cashflowvol_{i,t-1}$  is an interaction between  $SOE$  and  $Cashflowvol_{i,t-1}$ .

Also in the regression model,  $X_{i,t-1}$  represents the control variables;  $\sigma_i$  is the firm fixed effect,  $\tau_t$  is the year fixed effect, and  $\varepsilon_{i,t}$  stochastic disturbance term. To avoid endogeneity problems, all explanatory variables are delayed by one period. All variables are as defined in Table 1.

Tables 3 presents the regression results for cash flow uncertainty and corporate real estate holding. We separately verify the impact of  $cashflowvol\_1$ ,  $cashflowvol2\_l$  on  $Revalue1$  in columns (1) and (2) while investigating the impact of  $cashflowvol\_1$ ,  $cashflowvol2\_l$  on  $Revalue2$  in columns (3) and (4). Our results find that the all indicators of cash flow uncertainty ( $cashflowvol\_1$ ,  $cashflowvol2\_l$ ) are negatively significant at the 5% level in explaining corporate real estate holding. For example, the magnitude of the significant coefficient of  $cashflowvol_{i,t-1}$  indicates that a one standard deviation increase in  $cashflowvol_{i,t-1}$  decreases  $Revalue1$  by 22.50% (-0.0297/0.132) in Column (1) whereas, a one standard deviation increase in  $cashflowvol_{i,t-1}$  decreases  $Revalue2$  by 22.95% (0.0303/0.132) in Column (2), relative to their mean values. Overall, these results support the prediction of Hypothesis 1 that the precautionary effect of cash flow uncertainty on corporate real estate holding dominates, implying that enterprises with higher cash flow uncertainty tend to hold less real estate assets.

**Table 3**

Cash flow uncertainty and corporate real estate ownership

Variables are as defined in Table 1. Z/T statistics are based on a robust corporate clustering standard error. \*\*\*, \*\* and \* represent significance at the 1%, 5% and 10%, levels,

respectively.

	(1)	(2)	(3)	(4)
Regressor	Revalue1	Revalue1	Revalue2	Revalue2
cashflowvol_1	-0.0297** (-2.09)		-0.0293** (-2.12)	
cashflowvol2_1		-0.0303** (-2.05)		-0.0299** (-2.06)
logassets_1	-0.0127*** (-6.68)	-0.0127*** (-6.67)	-0.0118*** (-6.24)	-0.0118*** (-6.22)
leverage_1	0.1816*** (7.97)	0.1816*** (7.97)	0.1786*** (8.00)	0.1785*** (7.99)
tobinQ_1	-0.0008 (-0.75)	-0.0008 (-0.75)	-0.0004 (-0.38)	-0.0004 (-0.38)
ppe_excludingrealstate_1	-0.0712*** (-6.24)	-0.0712*** (-6.24)	-0.0664*** (-5.85)	-0.0664*** (-5.85)
percapitaGDP	0.0000*** (12.90)	0.0000*** (12.91)	0.0000 (0.74)	0.0000 (0.74)
growthrateofM2	0.0116*** (37.40)	0.0116*** (37.41)	0.0009*** (3.01)	0.0009*** (3.01)
Chpi	-0.0001** (-2.35)	-0.0001** (-2.35)	-0.0001** (-2.38)	-0.0001** (-2.38)
_cons	-0.0577** (-2.26)	-0.0578** (-2.27)	0.0699*** (2.77)	0.0697*** (2.76)
YEAR	YES	YES	YES	YES
IND	YES	YES	YES	YES
N	16323	16323	16323	16323
r2_a	0.3045	0.3045	0.0347	0.0347

We define the dummy variable *SOE* as a proxy for state ownership: it equals 1 if the firm is a state-owned firm, and 0 otherwise. *SOE\_cashflowvol1*, *SOE\_cashflowvol2* are defined as the interaction between *SOE* and *Cashflowvol<sub>i,t-1</sub>*. We measure corporate real estate holding by *Revalue1* and *Revalue2*.

Panel A in Table 4 tests the effect of cash flow volatility on *Revalue1* whereas Panel B verifies

the effect of corporate estate investment on *Revalue2* after considering state ownership. Presented in columns (1) and (4) of Panel A, two indicators of cash flow uncertainty (*cashflowvol\_1* , *cashflowvol2\_1*) are negatively significant at the 1% level in explaining corporate real estate holding. It means that enterprises with higher cash flow uncertainty tend to hold less real estate assets. However, *SOE\_cashflowvol1* and *SOE\_cashflowvol2* are significantly and positively correlated to *Revalue1* at the 5% level. Specifically, the magnitude of the significant coefficient of *SOE\_cashflowvol1* indicates that a one standard deviation increase in *SOE\_cashflowvol1* increases *Revalue1* by 47.80% (0.0631/0.132) in Column (1) whereas, a one standard deviation increase in *SOE\_cashflowvol2* increases *Revalue1* by 49.77% (0.0657/0.132) in Column (4), relative to their mean values. It implies that *SOE* tends to reduce the negative impact of cash flow uncertainty, encouraging the management more boldly to increase the real estate assets. As shown in Columns (2), (3), (5) and (6), we further classify the sample into two groups (non-state-owned firms and state-owned firms) and separately investigate the influence of cash flow volatility on corporate real estate holding in each. Notably, the coefficients of cash flow volatility indicators (*cashflowvol\_1* , *cashflowvol2\_1*) in the state-owned firms are less significant than in the non-state-owned firms. Specifically, all coefficients of the indicators are significantly negative at 1% level in the non-state-owned firm group but the coefficients are insignificant negative in the state-owned firm group. Panel B shows a similar result with Panel A. It further proves that all coefficients of real estate investment indicators (*cashflowvol\_1* , *cashflowvol2\_1*) in the group of state-owned firms are less significant than those in the group of non-state-owned firms. Overall, our results support H2 that cash flow uncertainty tends to increase the possibility of capital shortage and reduces management's willingness to hold real estate assets. However, state ownership weakens this negative effect of cash flow uncertainty. It may be due to the credit discrimination of China's financial market that makes Chinese state-owned firms financially unconstrained and less affected by the shortage of funds.

**Table 4**

Cash flow uncertainty, state ownership, and corporate real estate holding

*Revalue1* and *Revalue2* represent corporate real estate holding, and *cashflowvol\_1* , *cashflowvol2\_1* is corporate cash flow uncertainty, *SOE* is a dummy variable of state-owned firms, control variables include *leverage\_1*, natural logarithm of the ratio of long-term debt to total assets; *size\_1*, natural logarithm of firm size; *TobinQ\_1*, natural logarithm of total market value/total assets; *ppe\_excludingrealstat*, Other PPE assets excluding real estate assets;

*PercapitaGDP*, per capita GDP; *growthrateofM2*, annual growth rate of M2; *Chpi*, house-price index of the city where the company is headquartered. Z/T statistics are based on a robust corporate clustering standard error. \*\*\*, \*\* and \* represent significance at the 1%, 5% and 10% levels, respectively.

	Full sample	SOE=0	SOE=1	Full sample	SOE=0	SOE=1
Panel A	(1)	(2)	(3)	(4)	(5)	(6)
	Revalue1	Revalue1	Revalue1	Revalue1	Revalue1	Revalue1
cashflowvol_1	-0.0547*** (-3.80)	-0.0506*** (-3.50)	0.0045 (0.18)			
cashflowvol2_1				-0.0568*** (-3.80)	-0.0527*** (-3.52)	0.0054 (0.21)
SOE_cashflowvol1	0.0631** (2.30)				0.0657** (2.31)	
SOE_cashflowvol2						
SOE	0.0047 (1.04)				0.0046 (1.01)	
size_1	-0.0143*** (-7.37)	-0.0145*** (-5.05)	-0.0148*** (-5.73)	-0.0143*** (-7.37)	-0.0146*** (-5.06)	-0.0148*** (-5.72)
leverage_1	0.1800*** (7.61)	0.1587*** (4.09)	0.1949*** (6.86)	0.1800*** (7.61)	0.1587*** (4.09)	0.1949*** (6.86)
tobinQ_1	-0.0012 (-1.10)	-0.0005 (-0.38)	-0.0023 (-1.29)	-0.0012 (-1.10)	-0.0005 (-0.38)	-0.0023 (-1.29)
Exppe_1	-0.0713*** (-5.94)	-0.0367* (-1.85)	-0.0875*** (-5.97)	-0.0713*** (-5.93)	-0.0367* (-1.85)	-0.0875*** (-5.97)
percapitaGDP	0.0000*** (13.64)	0.0000*** (19.94)	0.0000*** (10.39)	0.0000*** (13.66)	0.0000*** (19.99)	0.0000*** (10.39)
growthrateofM2	0.0117*** (37.07)	0.0084*** (15.24)	0.0116*** (30.26)	0.0117*** (37.09)	0.0084*** (15.26)	0.0116*** (30.26)
chpi	-0.0001** (-2.56)	-0.0001 (-1.26)	-0.0001** (-2.34)	-0.0001** (-2.56)	-0.0001 (-1.26)	-0.0001** (-2.34)
_cons	-0.0491* (-1.84)	-0.0195 (-0.54)	-0.0507 (-1.30)	-0.0491* (-1.84)	-0.0195 (-0.54)	-0.0508 (-1.31)
YEAR	YES	YES	YES	YES	YES	YES
IND	YES	YES	YES	YES	YES	YES
N	15379	6455	8924	15379	6455	8924

r2_a	0.3104	0.2993	0.3253	0.3104	0.2993	0.3253
Panel B	(1)	(2)	(3)	(4)	(5)	(6)
	Revalue2	Revalue2	Revalue2	Revalue2	Revalue2	Revalue2
cashflowvol_1	-0.0534*** (-3.70)	-0.0499*** (-3.50)	0.0043 (0.18)			
cashflowvol2_1				-0.0551*** (-3.67)	-0.0516*** (-3.48)	0.0053 (0.21)
SOE_cashflowvol1	0.0611** (2.31)					
SOE_cashflowvol2				0.0635** (2.32)		
SOE	0.0045 (1.02)			0.0044 (0.99)		
size_1	-0.0131*** (-6.83)	-0.0135*** (-4.75)	-0.0135*** (-5.27)	-0.0131*** (-6.82)	-0.0136*** (-4.76)	-0.0135*** (-5.26)
leverage_1	0.1751*** (7.57)	0.1500*** (4.06)	0.1931*** (6.85)	0.1750*** (7.57)	0.1499*** (4.06)	0.1931*** (6.85)
tobinQ_1	-0.0009 (-0.82)	-0.0004 (-0.31)	-0.0018 (-1.01)	-0.0009 (-0.82)	-0.0004 (-0.31)	-0.0018 (-1.01)
Exppe_1	-0.0675*** (-5.62)	-0.0322 (-1.62)	-0.0843*** (-5.74)	-0.0674*** (-5.62)	-0.0321 (-1.62)	-0.0843*** (-5.74)
percapitaGDP	0.0000* (1.95)	0.0000* (1.78)	0.0000 (1.02)	0.0000* (1.96)	0.0000* (1.79)	0.0000 (1.02)
growthrateofM2	0.0010*** (3.20)	0.0013** (2.49)	0.0007** (1.98)	0.0010*** (3.21)	0.0013** (2.50)	0.0007** (1.98)
chpi	-0.0001*** (-2.63)	-0.0001 (-1.23)	-0.0001** (-2.45)	-0.0001*** (-2.63)	-0.0001 (-1.24)	-0.0001** (-2.45)
_cons	0.0771*** (2.92)	0.0798** (2.25)	0.0810** (2.09)	0.0770*** (2.91)	0.0797** (2.25)	0.0809** (2.09)
YEAR	YES	YES	YES	YES	YES	YES
IND	YES	YES	YES	YES	YES	YES
N	15379	6455	8924	15379	6455	8924
r2_a	0.0389	0.0322	0.0547	0.0388	0.0322	0.0547

#### 4.2. State ownership and credit discrimination

There exists serious "credit discrimination" in China's financial market, that is, banks "favours"

state-owned enterprises while "discriminating" private enterprises when lending to enterprises (Brandt and Li, 2003; Allen et al, 2005). It is reflected in two aspects: ① state-owned enterprises have relatively easy access to loans than non-state-owned enterprises; ② and the loan cost of state-owned enterprises is lower than that of non-state-owned enterprises.

Table 5 presents the results of the different test of capital structure levels from 2005 to 2016 according to whether it is a state-owned enterprise. Annual results show that the ratios of loans, *LEV*, are obviously greater than that of non-state-owned enterprises and the differences has increased over time. For examples, the state-owned firms have a loan rate of 0.231 on average, while the average in non-state-owned firms is only 0.186 in 2010. The loan rate increased to 0.244 on average in the state-owned firms, while the average in non-state-owned firms is only 0.186 in 2016. The difference between the two is statistically significant. Moreover, *SHORTLEV* and *LONGLEV* in the state-owned firms are significantly greater than those in the non-state-owned firms. The state-owned firms have a short-term loan rate of 0.089 on average, while the average in non-state-owned firms is only 0.082 in 2016. The state-owned firms have a long-term loan rate of 0.089 on average, while the average in non-state-owned firms is only 0.052 in 2016. This may be due to the influence of soft budget constraints and certain correlation relationship between state-owned firms and banks.

**Table 5**

Annual comparison of capital structure level

	LEV			SHORTLEV			LONGLEV		
	SOE=0	SOE=1	T-value	SOE=0	SOE=1	T-value	SOE=0	SOE=1	T-value
2005	0.275	0.251	0.024**	0.202	0.167	0.035***	0.048	0.064	-0.016***
2006	0.266	0.251	0.016	0.196	0.162	0.033***	0.046	0.066	-0.020***
2007	0.249	0.246	0.003	0.173	0.152	0.021***	0.047	0.068	-0.020***
2008	0.232	0.243	-0.011	0.157	0.147	0.01	0.046	0.068	-0.023***
2009	0.218	0.241	-0.023**	0.143	0.134	0.009	0.048	0.077	-0.029***
2010	0.186	0.231	-0.045***	0.117	0.118	-0.001	0.047	0.082	-0.035***
2011	0.149	0.221	-0.071***	0.097	0.111	-0.014***	0.034	0.077	-0.042***
2012	0.138	0.216	-0.077***	0.092	0.112	-0.020***	0.029	0.072	-0.043***
2013	0.132	0.205	-0.073***	0.092	0.110	-0.018***	0.028	0.070	-0.041***
2014	0.137	0.200	-0.063***	0.094	0.103	-0.009**	0.030	0.070	-0.040***
2015	0.139	0.190	-0.051***	0.094	0.096	-0.002	0.031	0.066	-0.036***
2016	0.186	0.244	-0.058***	0.082	0.089	-0.007*	0.052	0.089	-0.038***

To prove the existence of supply-led discrimination in the credit market, we investigate the

effect of state ownership (*SOE*) on the level of loans (*LEV*, *SHORTLEV* and *LONGLEV*) in Table 6. Presented in columns (1), (3) and (5), *SOE* is significantly and positively correlated to *LEV* and *LONGLEV* at the 1% level but insignificantly and positively correlated to *SHORTLEV* without considering control variables. As shown in Columns (2), (4) and (6), we add control variables into the regression and find that, all coefficients of *SOE* are positively significant in explaining the level of loans (*LEV*, *SHORTLEV* and *LONGLEV*). Specifically, the magnitude of the significant coefficient of *SOE* indicates that a one standard deviation increase in *SOE* increases *LEV* by 6.22% (0.013/0.209) in Column (2) whereas, a one standard deviation increase in *SOE* increases *LONGLEV* by 32.14% (0.018/0.056) in Column (6), relative to their mean values. It supports existing literatures that state-owned enterprises have relatively easy access to loans than non-state-owned enterprises.

**Table 6**

State ownership and supply-led discrimination in the credit market

*SOE* is a dummy variable of whether a firm is a state-owned firm, the indicators of the level of borrowing include: *LEV*, calculated by (ending short-term borrowing + ending long-term liabilities within one year + ending long-term borrowing - beginning short-term borrowing - ending long-term liabilities within one year - beginning long-term liabilities)/(ending total assets + beginning total assets), *SHORTLEV*, calculated by (short-term loans at the end + short-term loans at the beginning)/(total assets at the end + total assets at the beginning), *LONGLEV*, calculated by (long-term loans at the end + long-term loans at the beginning)/(total assets at the end + total assets at the beginning); control variables include *BLEV*, *LEV* at the beginning, *firmage*, *roa*, *cashflow*, *ppe*, *salesgrowth*, *percapitaGDP*.

	(1)	(2)	(3)	(4)	(5)	(6)
	LEV	LEV	SHORTLEV	SHORTLEV	LONGLEV	LONGLEV
<i>SOE</i>	0.028*** (4.79)	0.013** (2.51)	0.003 (0.77)	-0.006* (-1.65)	0.021*** (7.49)	0.018*** (5.96)
<i>BLEV_1</i>		0.213* (1.65)		0.129* (1.72)		0.062 (1.50)
<i>firmage</i>		0.002** (2.09)		0.001 (1.19)		0.001 (1.43)
<i>roa_1</i>		-0.000*** (-2.65)		-0.000*** (-2.94)		-0.000 (-1.61)
<i>cashflow_1</i>		-0.000 (-1.49)		-0.000*** (-2.75)		0.000* (1.87)
<i>salesgrowth_1</i>		-0.003		-0.008***		0.007***

		(-1.41)		(-5.66)		(5.65)
percapitaGDP		-0.000***		-0.000***		0.000***
		(-6.05)		(-14.74)		(5.62)
_cons	0.248***	0.189***	0.210***	0.215***	0.030**	-0.006
	(11.66)	(7.03)	(12.80)	(10.01)	(2.56)	(-0.38)
YEAR	YES	YES	YES	YES	YES	YES
IND	YES	YES	YES	YES	YES	YES
N	19130	16020	21044	17378	19808	16505
r2_a	0.143	0.292	0.103	0.219	0.237	0.271

We further investigate the second reflection of credit discrimination on the difference of loan costs between SOEs and Non-SOEs. We define *Debcost1*, the ratio of interest expenditure to total debts, and *Debcost2*, the ratio of interest expenditure to average debts, as two proxy variables of the loan cost in Table 7. Presented in columns (1) and (2), all coefficients of *SOE* are negatively significant in explaining the cost of loan (*Debcost1* and *Debcost2*), implying that SOEs tend to have a lower debt cost. That is, it supports existing literature that the loan cost of state-owned enterprises is lower than that of non-state-owned enterprises.

**Table 7**

#### State ownership and cost of debt

*SOE* is a dummy variable of whether a firm is a state-owned firm, the indicators of the level of borrowing include: *Debcost1*, the ratio of interest expenditure to total debts, and *Debcost2*, the ratio of interest expenditure to average debts between total debts at the beginning and total debts at the end; control variables include *size*, *roa*, *ppe*, *leverage*, *cashflow*, *MN* and *salesgrowth*. Z/T statistics are based on a robust corporate clustering standard error. \*\*\*, \*\* and \* represent significance at the 1%, 5% and 10% levels, respectively.

	(1)	(2)
	Debcost1	Debcost2
SOE	-0.025*** (-2.88)	-0.026*** (-2.81)
size_1	0.031*** (4.66)	0.033*** (4.51)
roa_1	0.000*** (4.79)	0.000*** (4.67)
ppe	0.000*** (3.99)	0.000*** (3.78)

leverage_1	-0.253*** (-4.36)	-0.264*** (-4.50)
cashflow_1	-0.000*** (-4.79)	-0.000*** (-4.56)
MN	-0.012 (-0.73)	-0.013 (-0.77)
salesgrowth_1	0.004 (1.49)	0.005 (1.47)
_cons	0.456** (2.47)	0.440** (2.06)
YEAR	YES	YES
IND	YES	YES
N	13346	13348
r2_a	0.358	0.383

As shown in Table 8, we further classify the sample into two groups (*cons*, financially constrained firms and *uncons*, financial unconstrained firms) and separately investigate the influence of cash flow volatility on corporate real estate holding in each. Notably, the coefficients of cash flow volatility indicators (*cashflowvol\_1*, *cashflowvol2\_1*) in the financially constrained firms are more significant than in the financial unconstrained firms. Specifically, all coefficients of the indicators are significantly negative at 1% level in the financially constrained firm group but the coefficients are insignificant negative in the non-financially constrained firm group. Our results indicate that financial unconstrained firms tend to be less affected by the negative effect of cash flow volatility, owing to their relatively sufficient funds or financing capacity. This further support that state ownership weakens the negative effect of cash flow volatility, that is, Chinese state-owned firms as financial unconstrained firms suffer less negative effect of cash flow volatility relative to non-state-owned firms.

**Table 8**

Cash flow uncertainty, financial constraints and corporate real estate holding

*Revalue1* and *Revalue2* represent corporate real estate holding, and *cashflowvol\_1* , *cashflowvol2\_1* is corporate cash flow uncertainty, control variables include *leverage\_1*, natural logarithm of the ratio of long-term debt to total assets; *size\_l*, natural logarithm of firm size; *TobinQ\_1*, natural logarithm of total market value/total assets; *ppe\_excludingrealestat*, Other PPE assets excluding real estate assets; *PercapitaGDP*, per capita GDP; *growthrateofM2*,

annual growth rate of M2; *Chpi*, house-price index of the city where the company is headquartered. Z/T statistics are based on a robust corporate clustering standard error. \*\*\*, \*\* and \* represent significance at the 1%, 5% and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	cons	uncons	cons	uncons	cons	uncons	cons	uncons
	Revalue1	Revalue1	Revalue1	Revalue1	Revalue2	Revalue2	Revalue2	Revalue2
cashflowvol_1	-0.049** (-1.98)	-0.035 (-1.37)			-0.052** (-2.16)	-0.031 (-1.24)		
cashflowvol2_1			-0.050* (-1.95)	-0.035 (-1.35)			-0.053** (-2.11)	-0.032 (-1.22)
logassets_1	-0.014*** (-5.54)	-0.016*** (-4.11)	-0.014*** (-5.52)	-0.016*** (-4.11)	-0.012*** (-5.04)	-0.015*** (-3.79)	-0.012*** (-5.02)	-0.015*** (-3.78)
leverage_1	0.192*** (6.01)	0.177*** (4.61)	0.192*** (6.01)	0.177*** (4.61)	0.188*** (5.93)	0.177*** (4.67)	0.188*** (5.92)	0.177*** (4.67)
tobinQ_1	-0.002 (-1.11)	-0.003 (-1.32)	-0.002 (-1.11)	-0.002 (-1.31)	-0.001 (-0.70)	-0.002 (-1.30)	-0.001 (-0.70)	-0.002 (-1.29)
Exppe_1	-0.076*** (-4.44)	-0.069*** (-3.33)	-0.075*** (-4.44)	-0.069*** (-3.33)	-0.076*** (-4.44)	-0.065*** (-3.12)	-0.076*** (-4.44)	-0.065*** (-3.12)
percapitaGDP	0.000*** (9.14)	0.000*** (6.75)	0.000*** (9.16)	0.000*** (6.75)	0.000 (0.85)	0.000 (0.03)	0.000 (0.87)	0.000 (0.03)
growthrateofM2	0.012*** (25.43)	0.011*** (22.67)	0.012*** (25.46)	0.011*** (22.67)	0.001** (2.42)	-0.000 (-0.14)	0.001** (2.42)	-0.000 (-0.14)
chpi	-0.000*** (-2.92)	-0.000 (-0.68)	-0.000*** (-2.92)	-0.000 (-0.68)	-0.000*** (-2.88)	-0.000 (-0.81)	-0.000*** (-2.88)	-0.000 (-0.81)
_cons	-0.072** (-2.36)	0.084 (1.41)	-0.073** (-2.36)	0.083 (1.41)	0.062** (2.03)	0.196*** (3.34)	0.062** (2.02)	0.195*** (3.33)
YEAR	YES							
IND	YES							
N	7238	5174	7238	5174	7238	5174	7238	5174
r2_a	0.342	0.271	0.342	0.271	0.052	0.043	0.051	0.043

#### 4.4. Endogeneity problems

Our findings are consistent with the results of early studies (Gan, 2007; Chaney et al., 2012; Bates et al., 2009; Keefe and Tate, 2013; Zhao and Sing, 2016), and we also use industry and year dummy variables to control for the potential determinants of corporate real estate holding. However, our conclusions still face the challenge of endogeneity problems, particularly

omitted variables. To mitigate the impact of omitted variables on our conclusions, we must first find a suitable instrumental variable not directly correlated with corporate real estate holding but able to directly influence a firm's cash flow uncertainty. For this purpose, we follow the method of Lin et al. (2013), Chen (2015), and Ye et al. (2019) by using average industry-year-city cash flow uncertainty (*Meancashflow*) as the IV of cash flow uncertainty of firm  $i$ .

Table 9 shows that *Meancashflow* has a significantly positive impact on cash flow uncertainty indicators, including *cashflowvol\_1* and *cashflowvo2\_1*. The results indicate that *Meancashflow* should be a valid instrument. Although this method is unlikely to fully solve endogeneity problems, it can partially alleviate the effect of omitted variables, which do not vary with time according to our conclusions.

We use the two-stage least squares (2SLS) and the generalised method of moment (GMM) to run the regression. The results in Table 9 show that cash flow uncertainty indicators exert significantly negative effects on corporate real estate holding (*Revalue1*, *Revalue2*) in the non-SOE samples but insignificantly positive effects in the SOE samples. We also find that all coefficients of cash flow uncertainty are similar after controlling for the effects of omitted variables in both the 2SLS and GMM. Therefore, although this study's results may be affected by omitted variables, our conclusions remain valid.

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**Table 9**

Endogeneity problems caused by omitted variables: 2SLS /GMM: *cashflowvol\_1* and *cashflowvol2\_1*

We follow the method of Lin et al. (2013), Chen (2015), and An et al. (2016) by using average industry-year-city relative cash flow uncertainty (*Meancashflow*) as the IV of cash flow uncertainty of firm *i*. *Revalue1* and *Revalue2* represent corporate real estate holding. *cashflowvol\_1* and *cashflowvol2\_1* represent corporate cash flow uncertainty, *SOE* is a dummy variable of whether a firm is a state-owned firm, control variables include *leverage\_1*, natural logarithm of the ratio of long-term debt to total assets; *size\_1*, natural logarithm of firm size; *TobinQ\_1*, natural logarithm of total market value/total assets; *ppe\_excludingrealestat*, Other PPE assets excluding real estate assets; *PercapitaGDP*, per capita GDP; *growthrateofM2*, annual growth rate of M2; *Chpi*, house-price index of the city where the company is headquartered.

	SOE=0	SOE=1	SOE=0	SOE=1	SOE=0	SOE=1	SOE=0	SOE=1	SOE=0	SOE=1
Panel A	1 <sup>st</sup> stage	1 <sup>st</sup> stage	2 <sup>nd</sup> stage	2 <sup>nd</sup> stage	2 <sup>nd</sup> stage	GMM	GMM	GMM	GMM	GMM
	<i>cashflowvol_1</i>	<i>cashflowvol_1</i>	<i>Revalue1</i>	<i>Revalue1</i>	<i>Revalue2</i>	<i>Revalue2</i>	<i>Revalue1</i>	<i>Revalue1</i>	<i>Revalue2</i>	<i>Revalue2</i>
Meanrisk	1.0315*** (12.62)	0.8109*** (9.23)								
<i>cashflowvol_1</i>			-0.0468** (-2.23)	0.0116 (0.20)	-0.0549*** (-2.64)	0.0123 (0.27)	-0.0468** (-2.23)	0.0116 (0.20)	-0.0549*** (-2.64)	0.0123 (0.27)
<i>size_1</i>	-0.0353*** (-6.76)	-0.0124*** (-5.60)	-0.0227*** (-7.14)	-0.0168*** (-5.96)	-0.0120*** (-4.30)	-0.0124*** (-4.86)	-0.0227*** (-7.14)	-0.0168*** (-5.96)	-0.0120*** (-4.30)	-0.0124*** (-4.86)
<i>leverage_1</i>	0.1468*** (4.10)	0.0469** (2.45)	0.1547*** (3.63)	0.2080*** (6.54)	0.1298*** (3.49)	0.1723*** (6.07)	0.1547*** (3.63)	0.2080*** (6.54)	0.1298*** (3.49)	0.1723*** (6.07)
<i>tobinQ_1</i>	0.0020 (0.87)	0.0041** (2.18)	-0.0065*** (-4.66)	-0.0011 (-0.63)	0.0004 (0.30)	0.0000 (0.03)	-0.0065*** (-4.66)	-0.0011 (-0.63)	0.0004 (0.30)	0.0000 (0.03)
<i>Exppe_1</i>	-0.0596*** (-0.0596***)	0.0098 (0.0098)	-0.0683*** (-0.0683***)	-0.0686*** (-0.0686***)	-0.0434** (-0.0434**)	-0.0722*** (-0.0722***)	-0.0683*** (-0.0683***)	-0.0686*** (-0.0686***)	-0.0434** (-0.0434**)	-0.0722*** (-0.0722***)

	(-2.87)	(1.15)	(-3.38)	(-4.72)	(-2.41)	(-5.68)	(-3.38)	(-4.72)	(-2.41)	(-5.68)
percapitaGDP	0.0000	0.0000***	0.0000***	0.0000***	0.0000	0.0000	0.0000***	0.0000***	0.0000	0.0000
	(1.10)	(3.05)	(9.49)	(18.25)	(0.40)	(0.58)	(9.49)	(18.25)	(0.40)	(0.58)
growthrateofM2	-0.0003	0.0001	0.0059***	0.0065***	0.0008*	0.0005	0.0059***	0.0065***	0.0008*	0.0005
	(-0.79)	(0.44)	(13.79)	(21.35)	(1.85)	(1.59)	(13.79)	(21.35)	(1.85)	(1.59)
chpi	0.0001	-0.0000	-0.0002***	-0.0002***	-0.0001	-0.0001**	-0.0002***	-0.0002***	-0.0001	-0.0001**
	(1.51)	(-0.78)	(-2.97)	(-3.72)	(-1.49)	(-2.49)	(-2.97)	(-3.72)	(-1.49)	(-2.49)
_cons	0.2633***	0.0810***	0.1640***	0.0705***	0.0919***	0.1089***	0.1640***	0.0705***	0.0919***	0.1089***
	(6.19)	(4.40)	(6.02)	(3.04)	(3.89)	(5.24)	(6.02)	(3.04)	(3.89)	(5.24)
YEAR	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
IND	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
N	6457	8925	6455	8924	6455	8924	6455	8924	6455	8924
r2_a	0.5382	0.4040	0.0615	0.0990	0.0217	0.0382	0.0615	0.0990	0.0217	0.0382
Panel B	1 <sup>st</sup> stage	1 <sup>st</sup> stage	2 <sup>nd</sup> stage	2 <sup>nd</sup> stage	2 <sup>nd</sup> stage	GMM	GMM	GMM	GMM	GMM
	cashflowvol2_1	cashflowvol2_1	Revalue1	Revalue1	Revalue2	Revalue2	Revalue1	Revalue1	Revalue2	Revalue2
Meanrisk	0.9883***	0.7854***								
	(12.57)	(9.33)								
cashflowvol2_1			-0.0489**	0.0120	-0.0573***	0.0127	-0.0489**	0.0120	-0.0573***	0.0127
			(-2.23)	(0.20)	(-2.64)	(0.27)	(-2.23)	(0.20)	(-2.64)	(0.27)
size_1	-0.0343***	-0.0121***	-0.0227***	-0.0168***	-0.0120***	-0.0124***	-0.0227***	-0.0168***	-0.0120***	-0.0124***
	(-6.84)	(-5.56)	(-7.14)	(-5.96)	(-4.30)	(-4.86)	(-7.14)	(-5.96)	(-4.30)	(-4.86)
leverage_1	0.1419***	0.0452**	0.1548***	0.2080***	0.1299***	0.1723***	0.1548***	0.2080***	0.1299***	0.1723***

	(4.09)	(2.44)	(3.63)	(6.54)	(3.49)	(6.07)	(3.63)	(6.54)	(3.49)	(6.07)
tobinQ_1	0.0019 (0.82)	0.0041** (2.21)	-0.0065*** (-4.66)	-0.0011 (-0.63)	0.0004 (0.29)	0.0000 (0.03)	-0.0065*** (-4.66)	-0.0011 (-0.63)	0.0004 (0.29)	0.0000 (0.03)
Exppe_1	-0.0572*** (-2.85)	0.0100 (1.21)	-0.0683*** (-3.38)	-0.0686*** (-4.72)	-0.0435** (-2.41)	-0.0722*** (-5.68)	-0.0683*** (-3.38)	-0.0686*** (-4.72)	-0.0435** (-2.41)	-0.0722*** (-5.68)
percapitaGDP	0.0000 (1.33)	0.0000*** (3.08)	0.0000*** (9.50)	0.0000*** (18.25)	0.0000 (0.42)	0.0000 (0.58)	0.0000*** (9.50)	0.0000*** (18.25)	0.0000 (0.42)	0.0000 (0.58)
growthrateofM2	-0.0002 (-0.53)	0.0001 (0.44)	0.0059*** (13.79)	0.0065*** (21.35)	0.0008* (1.86)	0.0005 (1.59)	0.0059*** (13.79)	0.0065*** (21.35)	0.0008* (1.86)	0.0005 (1.59)
chpi	0.0001 (1.42)	-0.0000 (-0.90)	-0.0002*** (-2.98)	-0.0002*** (-3.72)	-0.0001 (-1.50)	-0.0001** (-2.49)	-0.0002*** (-2.98)	-0.0002*** (-3.72)	-0.0001 (-1.50)	-0.0001** (-2.49)
_cons	0.2556*** (6.23)	0.0795*** (4.45)	0.1642*** (6.02)	0.0705*** (3.03)	0.0921*** (3.89)	0.1089*** (5.23)	0.1642*** (6.02)	0.0705*** (3.03)	0.0921*** (3.89)	0.1089*** (5.23)
YEAR	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
IND	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
N	6457	8925	6455	8924	6455	8924	6455	8924	6455	8924
r2_a	0.5335	0.4043	0.0614	0.0990	0.0216	0.0382	0.0614	0.0990	0.0216	0.0382

In order to mitigate the endogeneity problem caused by omitted variables, we take finite difference to mean value as the proxy variables (Zhao and Sing, 2016). *DRevalue1* and *DRevalue2* represent the difference of corporate real estate holding from mean value, and *Dcashflowvol\_1*、*Dcashflowvol2\_1* is the difference of corporate cash flow uncertainty from mean value. As shown in Table 10, the elasticity coefficients of *Dcashflowvol* are significantly negative at the 1% level in the non-state-owned firm group but the coefficients are insignificantly positive in the state-owned firm group, supporting our basic conclusion.

**Table 10**

Endogeneity problems caused by omitted variables: *Finite difference to mean value*  
*DRevalue1* and *DRevalue2* represent the difference of corporate real estate holding from mean value, and *Dcashflowvol\_1*、*Dcashflowvol2\_1* is the difference of corporate cash flow uncertainty from mean value, control variables include *Dleverage\_1*, *Dsize\_1*, *DTobinQ\_1*, *Dppe\_excludingrealstat*, and *DChpi*.

	SOE=0	SOE=1	SOE=0	SOE=1
Panel A	(1)	(2)	(3)	(4)
	DRevalue1	DRevalue1	DRevalue1	DRevalue1
Dcashflowvol1	-0.0076** (-2.18)	0.0013 (0.90)		
Dcashflowvol2			-0.0077** (-2.16)	0.0013 (0.90)
Dlogassets	-0.0114*** (-5.18)	-0.0109*** (-4.41)	-0.0114*** (-5.18)	-0.0109*** (-4.41)
Dleverage1	0.1178*** (3.53)	0.1618*** (3.64)	0.1178*** (3.53)	0.1618*** (3.64)
DExppe	-0.0044*** (-3.46)	-0.0961*** (-5.37)	-0.0044*** (-3.46)	-0.0961*** (-5.37)
DtobinQ	-0.0000*** (-7.68)	-0.0000** (-2.22)	-0.0000*** (-7.68)	-0.0000** (-2.22)
Dchpi	-0.0001* (-1.76)	-0.0001** (-2.52)	-0.0001* (-1.76)	-0.0001** (-2.52)
_cons	0.0102 (0.38)	-0.0234 (-0.84)	0.0102 (0.38)	-0.0234 (-0.84)
YEAR	YES	YES	YES	YES
IND	YES	YES	YES	YES

N	7457	9371	7457	9371
r2_a	0.0375	0.0783	0.0375	0.0783
Panel B	(1)	(2)	(3)	(4)
	DRevalue2	DRevalue2	DRevalue2	DRevalue2
Dcashflowvol1	-0.0089** (-2.51)	0.0011 (0.77)		
Dcashflowvol2			-0.0090** (-2.49)	0.0011 (0.78)
Dlogassets	-0.0120*** (-5.30)	-0.0112*** (-4.42)	-0.0120*** (-5.30)	-0.0112*** (-4.42)
Dleverage1	0.1259*** (3.55)	0.1627*** (3.49)	0.1259*** (3.55)	0.1627*** (3.49)
DExppe	-0.0048*** (-4.08)	-0.0929*** (-4.88)	-0.0048*** (-4.08)	-0.0929*** (-4.88)
DtobinQ	-0.0000*** (-6.36)	-0.0000*** (-3.48)	-0.0000*** (-6.36)	-0.0000*** (-3.48)
Dchpi	-0.0001* (-1.72)	-0.0001** (-2.43)	-0.0001* (-1.72)	-0.0001** (-2.43)
_cons	0.0912*** (3.36)	0.0462 (1.60)	0.0912*** (3.36)	0.0462 (1.60)
N	7457	9371	7457	9371
r2_a	0.3080	0.3370	0.3079	0.3370

Also, in order to further mitigate the impact of omitted variables, we consider the external impact of China's financial policies on the relation between cash flow uncertainty and corporate real estate holding. We use the Difference-in-Difference model (DID model) to examine how the Property Rights Act published on March, 2007 affect corporate real estate holding through cash flow uncertainty. Existing literature proposes that the reform of guarantee property systems has improved the willingness of commercial banks and other financial institutions to provide mortgage loans to enterprises, which enhances enterprises' financing capacity and ease the degree of financial constraints since the promulgation of the Property Right Act promulgated. Specifically, the Property Right Act can promote the development of China's financial credit, expand the collateral scope, strengthen the protection of mortgage assets and creditors' rights, and further promote corporate external financing (Qian and Fang, 2017; Qi and Wan, 2018). We take the firms which are financially constrained firm as the treatment group, and all other firms in the sample as the control group in Table 11, where

t is 2007 (the year when Property Rights Act were first implemented). Table 11 empirically shows that cash flow uncertainty still restrains corporate real estate holding after considering the Property Right Act. Our results report that the coefficients of *cashflowvol* are significantly negative at the 1% level in the non-state-owned firm group but the coefficients are insignificantly negative in the state-owned firm group. Besides, significantly positive estimates of *DD\_cashflowvol1* and *DD\_cashflowvol2* mean that China's introduction of Property Right Act has a significantly positive influence on corporate real estate holding across different cities. That, the reform of guarantee property system is conducive to improving the financing capacity of financially constrained enterprises and reducing the negative impact of cash flow uncertainty.

**Table 11**

The effect of ‘Property Right Act’

We take the firms which are financially constrained firm as the treatment group, and all other firms in the sample as the control group in Table 11, where t is 2007 (the year when Property Rights Act were first implemented). *Revalue1* and *Revalue2* represent corporate real estate holding, and *cashflowvol\_1*、*cashflowvol2\_l* is corporate cash flow uncertainty, *SOE* is a dummy variable of whether a firm is a state-owned firm, control variables include *leverage\_1*, natural logarithm of the ratio of long-term debt to total assets; *size\_l*, natural logarithm of firm size; *TobinQ\_l*, natural logarithm of total market value/total assets; *ppe\_excludingrealestat*, Other PPE assets excluding real estate assets; *PercapitaGDP*, per capita GDP; *growthrateofM2*, annual growth rate of M2; *Chpi*, house-price index of the city where the company is headquartered.

Panel A	Full sample	SOE=0	SOE=1	Full sample	SOE=0	SOE=1
	(1)	(2)	(3)	(4)	(5)	(6)
	Revalue1	Revalue1	Revalue1	Revalue1	Revalue1	Revalue1
DD_cashflowvol1	0.6828*** (3.16)	0.5515** (2.04)	0.8771*** (2.68)			
DD_cashflowvol2				0.6945*** (3.19)	0.5566** (2.05)	0.8890*** (2.69)
cashflowvol_1	-0.0396*** (-2.89)	-0.0538*** (-3.73)	-0.0016 (-0.06)			
cashflowvol2_1				-0.0410*** (-2.87)	-0.0562*** (-3.75)	-0.0010 (-0.04)
DD	-0.0271***	-0.0173*		-0.0342***	-0.0273***	-0.0173*
						-0.0344***

	(-3.65)	(-1.87)	(-2.96)	(-3.67)	(-1.87)	(-2.97)
size_1	-0.0129*** (-6.63)	-0.0137*** (-4.82)	-0.0140*** (-5.42)	-0.0129*** (-6.63)	-0.0138*** (-4.84)	-0.0140*** (-5.41)
leverage_1	0.1768*** (7.50)	0.1563*** (4.04)	0.1943*** (6.84)	0.1768*** (7.50)	0.1564*** (4.04)	0.1943*** (6.84)
tobinQ_1	-0.0014 (-1.26)	-0.0006 (-0.46)	-0.0022 (-1.28)	-0.0014 (-1.26)	-0.0006 (-0.46)	-0.0023 (-1.28)
Exppe_1	-0.0704*** (-5.95)	-0.0373* (-1.89)	-0.0888*** (-6.11)	-0.0704*** (-5.95)	-0.0374* (-1.89)	-0.0888*** (-6.11)
percapitaGDP	0.0000*** (13.14)	0.0000*** (18.92)	0.0000*** (10.34)	0.0000*** (13.15)	0.0000*** (18.96)	0.0000*** (10.33)
growthrateofM2	0.0116*** (37.06)	0.0083*** (15.05)	0.0116*** (30.13)	0.0116*** (37.07)	0.0083*** (15.07)	0.0116*** (30.13)
chpi	-0.0001** (-2.42)	-0.0001 (-1.20)	-0.0001** (-2.32)	-0.0001** (-2.43)	-0.0001 (-1.21)	-0.0001** (-2.32)
_cons	-0.0545** (-2.03)	-0.0228 (-0.63)	-0.0565 (-1.45)	-0.0545** (-2.03)	-0.0227 (-0.63)	-0.0566 (-1.45)
YEAR	YES	YES	YES	YES	YES	YES
IND	YES	YES	YES	YES	YES	YES
N	15379	6455	8924	15379	6455	8924
r2_a	0.3096	0.3000	0.3267	0.3096	0.3000	0.3267
Panel B	(1) Revalue2	(2) Revalue2	(3) Revalue2	(4) Revalue2	(5) Revalue2	(6) Revalue2
DD_cashflowvol1	0.5849*** (2.79)	0.4591* (1.76)	0.7947** (2.46)			
DD_cashflowvol2				0.5923*** (2.80)	0.4590* (1.75)	0.8045** (2.47)
cashflowvol_1	-0.0382*** (-2.83)	-0.0526*** (-3.70)	-0.0010 (-0.04)			
cashflowvol2_1				-0.0392*** (-2.78)	-0.0546*** (-3.69)	-0.0003 (-0.01)
DD	-0.0240*** (-3.36)	-0.0139 (-1.56)	-0.0324*** (-2.89)	-0.0241*** (-3.37)	-0.0138 (-1.55)	-0.0325*** (-2.89)
size_1	-0.0118*** (-6.14)	-0.0128*** (-4.55)	-0.0128*** (-4.97)	-0.0118*** (-6.13)	-0.0129*** (-4.56)	-0.0128*** (-4.96)
leverage_1	0.1721***	0.1482***	0.1926***	0.1720***	0.1482***	0.1925***

	(7.46)	(4.03)	(6.84)	(7.46)	(4.03)	(6.83)
tobinQ_1	-0.0010 (-0.96)	-0.0005 (-0.38)	-0.0017 (-0.98)	-0.0010 (-0.96)	-0.0005 (-0.39)	-0.0017 (-0.98)
Exppe_1	-0.0664*** (-5.61)	-0.0326* (-1.65)	-0.0853*** (-5.85)	-0.0664*** (-5.61)	-0.0327* (-1.65)	-0.0853*** (-5.85)
percapitaGDP	0.0000* (1.76)	0.0000 (1.55)	0.0000 (1.15)	0.0000* (1.77)	0.0000 (1.57)	0.0000 (1.15)
growthrateofM2	0.0009*** (3.09)	0.0013** (2.35)	0.0007* (1.86)	0.0009*** (3.09)	0.0013** (2.36)	0.0007* (1.85)
chpi	-0.0001** (-2.50)	-0.0001 (-1.18)	-0.0001** (-2.43)	-0.0001** (-2.50)	-0.0001 (-1.19)	-0.0001** (-2.43)
_cons	0.0722*** (2.72)	0.0771** (2.17)	0.0752* (1.94)	0.0721*** (2.72)	0.0770** (2.17)	0.0751* (1.94)
YEAR	YES	YES	YES	YES	YES	YES
IND	YES	YES	YES	YES	YES	YES
N	15379	6455	8924	15379	6455	8924
r2_a	0.0375	0.0329	0.0565	0.0374	0.0329	0.0565

## 5. Robustness tests

### 5.1. Sample selection

To avoid sample selection bias, we further exclude enterprises in ‘Agriculture, forestry, animal husbandry, fishery’, ‘Mining’, ‘Scientific research and technology services’, ‘Water conservancy, environment and public facilities management’, and other industries. Enterprises in ‘Agriculture, forestry, animal husbandry, fishery’ or in ‘Mining’ require a large amount of land as a production factor. Meanwhile, enterprises in ‘Scientific research and technology services’ or in ‘Water conservancy, environment and public facilities management’ are mostly public institutions or state-owned enterprises. ‘Financial’ and ‘real estate’ enterprises are usually excluded from the sample because the former mostly use real estate as a way of operating lease and are not reflected in the financial statements, while the latter’s main business is to operate real estate. The results in table 12 show that the coefficients of *cashflowvol\_1* and *cashflowvo2\_1* are significantly negative at the 5% level, thus supporting our basic conclusion.

**Table 12**

Sample selection

Variables are as defined in Table 1. Z/T statistics are based on a robust corporate clustering standard error. \*\*\*, \*\* and \* represent significance at the 1%, 5% and 10% levels, respectively.

	(1)	(2)	(3)	(4)
	Revalue1	Revalue1	Revalue2	Revalue2
cashflowvol_1	-0.0398*** (-2.80)		-0.0389*** (-2.78)	
cashflowvol2_1		-0.0411*** (-2.77)		-0.0400*** (-2.73)
SOE	0.0093** (2.15)	0.0093** (2.15)	0.0092** (2.17)	0.0092** (2.17)
size_1	-0.0137*** (-6.86)	-0.0137*** (-6.86)	-0.0125*** (-6.28)	-0.0125*** (-6.27)
leverage_1	0.1837*** (7.63)	0.1837*** (7.63)	0.1793*** (7.60)	0.1793*** (7.60)
tobinQ_1	-0.0010 (-0.89)	-0.0010 (-0.88)	-0.0008 (-0.66)	-0.0008 (-0.65)
Exppe_1	-0.0713*** (-5.69)	-0.0713*** (-5.69)	-0.0686*** (-5.46)	-0.0686*** (-5.46)
percapitaGDP	0.0000*** (12.97)	0.0000*** (12.99)	0.0000 (1.64)	0.0000* (1.65)
growthrateofM2	0.0115*** (35.39)	0.0115*** (35.41)	0.0008*** (2.60)	0.0008*** (2.60)
chpi	-0.0001*** (-2.92)	-0.0001*** (-2.93)	-0.0001*** (-2.98)	-0.0001*** (-2.99)
_cons	-0.0485* (-1.73)	-0.0486* (-1.73)	0.0797*** (2.86)	0.0796*** (2.85)
YEAR	YES	YES	YES	YES
IND	YES	YES	YES	YES
N	14064	14064	14064	14064
r2_a	0.3225	0.3225	0.0387	0.0387

## 5.2. Alternative dependent variable: *Revalue3*

Companies hold real estate for three purposes: occupation, leasing to earn rent, and selling to gain capital appreciation. The first is non-investment real estate while the second and third are investment property. Non-investment real estate and investment property can be mutually converted under certain conditions. China's accounting standards set up the 'investment property' accounting course in 2006, but the quality of preliminary data is not good, so we only

use investment property as an independent variable when testing the robustness of the main findings.

We use *Revalue3* instead of the key dependent variables *Revalue1* and *Revalue2* to test the impact of corporate real estate holding on innovation activities as shown in table 13. Our results indicate that the coefficients of *cashflowvol\_1* and *cashflowvo2\_l* are significantly negative at the 1% level, thereby verifying with an alternative measure of corporate real estate holding that entering the real estate industry generally is restrained by firms' cash flow uncertainty. This finding demonstrates the robustness of our main conclusions.

**Table 13**

Alternative dependent variable: *Revalue3*

Variables are as defined in Table 1. Z/T statistics are based on a robust corporate clustering standard error. \*\*\*, \*\* and \* represent significance at the 1%, 5% and 10% levels, respectively.

	(1)	(2)
	Revalue3	Revalue3
cashflowvol_1	-0.0054*	
	(-1.84)	
cashflowvol2_1		-0.0057*
		(-1.88)
SOE	-0.0004	-0.0004
	(-0.46)	(-0.46)
logassets_1	-0.0021***	-0.0021***
	(-5.90)	(-5.92)
leverage_1	0.0107***	0.0107***
	(2.70)	(2.71)
tobinQ_1	-0.0008***	-0.0008***
	(-4.18)	(-4.17)
ppe_excludingrealestate_1	-0.0175***	-0.0175***
	(-9.26)	(-9.26)
percapitaGDP	0.0000***	0.0000***
	(16.37)	(16.38)
growthrateofM2	0.0008***	0.0008***
	(15.38)	(15.39)
chpi	0.0000**	0.0000**
	(2.42)	(2.42)

_cons	-0.0036 (-0.89)	-0.0036 (-0.88)
YEAR	YES	YES
IND	YES	YES
N	16323	16323
r2_a	0.1690	0.1690

### 5.3. Alternative independent variable : *risk3*

For investors, the drastic fluctuation of cash flow means high corporate risk. Cash flow uncertainty can be reflected in the company's stock price. Based on Chaya and Suh (2009), Cui et al. (2018), we adopt the standard deviation of ROA in last three fiscal years as the proxy variable of *cashflowvol\_1*, *cashflowvol2\_1* to run the regression. The results in Table 14 show that the coefficients of *risk3\_1* are significantly negative at the level of 1%, indicating that cash flow uncertainty significantly inhibit corporate real estate holdings. Our basic conclusion is robust.

**Table 14**

Alternative independent variable: *risk3*

Variables are as defined in Table 1. Z/T statistics are based on a robust corporate clustering standard error. \*\*\*, \*\* and \* represent significance at the 1%, 5% and 10% levels, respectively.

	(1)	(2)
	Revalue1	Revalue2
risk3	-0.000002*** (-7.03)	-0.000002*** (-8.20)
SOE	0.01256*** (3.17)	0.01315*** (3.34)
size_1	-0.01343*** (-7.19)	-0.01235*** (-6.67)
leverage_1	0.18462*** (7.94)	0.18359*** (7.95)
tobinQ_1	-0.00300*** (-3.04)	-0.00263*** (-2.66)
Exppe_1	-0.07070*** (-5.95)	-0.06693*** (-5.62)

percapitaGDP	0.00000*** (12.91)	0.00000 (1.18)
growthrateofM2	0.01083*** (38.59)	0.00016 (0.58)
chpi	-0.00015*** (-4.14)	-0.00015*** (-4.21)
_cons	-0.02405 (-0.99)	0.10032*** (4.21)
YEAR	YES	YES
IND	YES	YYES
N	17148	17148
r2_a	0.29827	0.03480

#### 5.4. Alternative estimation method of financial constraints

Based on the method of (Tong, 2011), we classify the sample into two groups (financially constrained firms and non-financially constrained firms) and we separately investigate the influence of cash flow uncertainty on corporate real estate holding in each, as shown in Table 15. We define a firm as the financially constrained firm if its leverage is more than the mean leverage of the full sample, otherwise the non-financially constrained firm. The results support the basic conclusion, and further confirm that financially constrained companies have higher debt costs. To avoid excess the costs of real estate holding, those companies will use internal cash flows more cautiously.

**Table 15**

Alternative estimation method of financial constraints

Variables are as defined in Table 1. Z/T statistics are based on a robust corporate clustering standard error. \*\*\*, \*\* and \* represent significance at the 1%, 5% and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH
	Revalue1	Revalue1	Revalue1	Revalue1	Revalue2	Revalue2	Revalue2	Revalue2
cashflowvol_1	-0.025 (-1.25)	-0.063*** (-3.45)			-0.027 (-1.35)	-0.061*** (-3.31)		
cashflowvol2_1			-0.026 (-1.23)	-0.064*** (-3.39)			-0.027 (-1.32)	-0.063*** (-3.25)
SOE	0.003 (0.57)	0.015*** (2.61)	0.003 (0.57)	0.015*** (2.61)	0.004 (0.71)	0.015*** (2.59)	0.004 (0.71)	0.015*** (2.59)

logassets_1	-0.011*** (-3.34)	-0.018*** (-6.45)	-0.011*** (-3.34)	-0.018*** (-6.44)	-0.010*** (-3.28)	-0.016*** (-5.89)	-0.010*** (-3.27)	-0.016*** (-5.88)
leverage_1	0.376 (1.01)	0.171*** (5.76)	0.375 (1.01)	0.171*** (5.76)	0.366 (1.01)	0.164*** (5.54)	0.366 (1.01)	0.164*** (5.53)
tobinQ_1	-0.001 (-0.62)	-0.001 (-0.61)	-0.001 (-0.62)	-0.001 (-0.61)	-0.000 (-0.35)	-0.001 (-0.48)	-0.000 (-0.35)	-0.001 (-0.47)
Exppe_1	-0.046** (-2.36)	-0.096*** (-5.64)	-0.045** (-2.36)	-0.096*** (-5.64)	-0.046** (-2.37)	-0.092*** (-5.37)	-0.046** (-2.37)	-0.092*** (-5.37)
percapitaGDP	0.000*** (19.28)	0.000*** (8.34)	0.000*** (19.28)	0.000*** (8.34)	-0.000 (-0.46)	0.000 (0.64)	-0.000 (-0.45)	0.000 (0.64)
growthrateofM2	0.008*** (16.02)	0.012*** (25.97)	0.008*** (16.03)	0.012*** (25.98)	0.000 (0.31)	0.001** (2.57)	0.000 (0.32)	0.001** (2.57)
chpi	-0.000*** (-3.14)	-0.000 (-1.32)	-0.000*** (-3.15)	-0.000 (-1.32)	-0.000*** (-3.03)	-0.000 (-1.49)	-0.000*** (-3.03)	-0.000 (-1.49)
_cons	-0.061 (-1.62)	-0.010 (-0.31)	-0.061 (-1.63)	-0.011 (-0.32)	0.078** (2.12)	0.119*** (3.54)	0.078** (2.11)	0.119*** (3.53)
YEAR	YES							
IND	YES							
N	5376	7036	5376	7036	5376	7036	5376	7036
r2_a	0.279	0.334	0.279	0.334	0.022	0.061	0.022	0.061

## 6. Conclusion

Any investment decision of a company is subject to internal factors: the stability of cash flow. The stability of internal cash flow not only reflects the currently normal operation ability of an enterprise now, but also reflects the risk defense ability and financing ability of the enterprise in the future. Cash flow uncertainty makes enterprise do a trade-off between current investment and future investment. It may not only form the supporting effect, which contributes to the flexibility and incentive of corporate real estate holding decisions, but also may form the precautionary effect, which makes the corporate real estate holding decision of the management tend to be conservative and prudent. Under the background of the "real estate investment boom" of China's industrial enterprises, this study mainly investigates the association between cash flow uncertainty and corporate real estate holding after considering the particularity of China's real estate market like credit discrimination caused by state ownership.

This study investigates the relationship between cash flow uncertainty and corporate real estate

holdings. Previous literature suggests that cash flow uncertainty represents the indicator of firm's financial constraint. If a firm has a high degree of cash flow uncertainty, it would be more conservative and cautious about its capital investment decisions. The empirical evidence of study supports this argument. We find that there is a significantly negative association between cash flow uncertainty and CRE holdings, and this effect is more prominent for financially constrained firms. However, when considering the presence of state ownership, the negative association is only significant for non-SOEs. We show that SOEs benefit from credit discrimination, as evidenced by having higher financial leverages and lower borrowing costs, since banks have preferences and are willing to give easy access to debt financing for SOEs. This effect mitigates the impact of cash flow uncertainty on CRE holdings for SOEs. Our results are robust after accounting for potential endogeneity problems by employing instrumental variable method and GMM approach. To further rule out the impact of potential omitted variables, we use finite difference to mean value as the proxy for the dependent variable, as well as the Difference-in-Difference method for the event of 'Property Right Act'. Additional robustness tests are run for various sample selections, alternative dependent variables, alternative independent variables, and alternative measures of financial constraints.

The paper has certain practical significance to research the internal motivation of enterprises holding real estate, providing a reference for the trade-off between short-term capital investment (real estate) and long-term capital investment (productive investment).

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