Large government shareholders and derivative use efficiency: Evidence from Chinese local state-owned enterprises

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Abstract

Using manually collected data on both ownership and derivative use of Chinese listed firms, this study investigates how the relationship between controlling and non-controlling government shareholders affects the risk-reducing effect of corporate derivative use in local state-owned enterprises (SOEs). We find that a higher-level government relative to the ultimate controller of a local SOE performs a monitoring role through its affiliated non-controlling government shareholder and improves the derivative use efficiency of this local SOE. This monitoring effect is sensitive to the strength of corporate governance and government regulation. Moreover, the identity, contestability and investment horizon shape this monitoring effectiveness. As the government ownership remains pervasive around the world, this ownership structure with the shareholdings of a higher-level government could be a potential governance mechanism when other forms of governance are ineffective.

Keywords: Government ownership, political hierarchical levels, derivative use efficiency, corporate governance

JEL Classification: D22; G23; G32; G38; H73

1. Introduction

The role of the government in corporate and public governance is widely examined in the extant literature (Boubakri et al., 2013; Bradshaw et al., 2019; Jia et al., 2019). A growing strand of literature shows that the effect of government ownership on corporate governance varies with government identity (Cheung et al., 2010; Lin and Chang, 2019). However, existing literature focuses on the role of one single government as the controlling shareholder (Jiang et al., 2010; Opie et al., 2019), and little is known about the role of multiple government shareholders in state-owned enterprises (SOEs). Large shareholders controlled by governments with different hierarchical levels can jointly influence corporate policies of one single SOE. Employing this scenario, our paper studies the effect of multiple large government shareholders on corporate governance of local SOEs, especially how the relationship between controlling and non-controlling government shareholder (s) in local SOEs (we call it intergovernmental shareholding in this paper) affects corporate policies.

Recent emerging literature on risk management focuses on the determinant of risk management (e.g., Giambona and Wang, 2020; Rampini et al., 2020). In this paper, we explore the economic consequences of intergovernmental shareholding in the context of corporate risk management. This type of relationship is a useful setting for risk management research for two reasons. First, the literature shows that derivative use efficiency varies with the strength of corporate governance (e.g., Fauver and Naranjo, 2010; Lel, 2012; Allayannis et al., 2012), and is significantly reduced by state ownership (Guo et al., 2020). Given that governments with different hierarchical levels via shareholdings can have a combined effect on corporate policies of one single firm, we can examine the joint role of government ownership and intergovernmental shareholding in corporate governance and thus in derivative use efficiency. Furthermore, the well-established corporate governance mechanisms in developed countries may differ from those in China, and considering the effect of political system might help build a new corporate governance model (Jiang and Kim, 2020). The political power of a higher-level government offers a potential solution when the traditional corporate governance mechanisms cannot be applied in a market with a concentrated ownership.

Second, risk management is the focus of government regulation on enterprises around the globe (e.g., Australian Securities and Investment Commission, Regulatory guide 259; [1] U.S. Securities and Exchange Commission, 33-9089; [2] Chinese State-owned Asset Supervision and Administration Commission of the State Council, No.108 [2006][3]). In China, policies of corporate risk management regulation are issued by the central government and implemented by governments with different hierarchical levels. Taking advantage of different government ownership in one single firm, we can examine whether the implementation efficiency varies with the intergovernmental shareholding. Therefore, understanding the impact of intergovernmental shareholding on derivative use efficiency has clear policy implications for regulating corporate risk management.

Studying the intergovernmental shareholding with Chinses firms is important because China is one of the largest emerging markets where political power dominates the economy, offering us a unique setting to understanding how different governments interact with each other within one single firm. Moreover, focusing on Chinese local SOEs offers two additional advantages for studying the intergovernmental shareholding. First, a higher-level government with respect to the ultimate controller of a SOE only exists in local SOEs. The presence of a higher-level government enables us to examine the intergovernmental shareholding within one single firm. Second, the government intervention in local SOEs is more prominent than that in central SOEs (Opie et al., 2019), resulting in a significantly lower derivative use efficiency (Guo et al., 2020). Therefore, examining the potential governance effect of intergovernmental shareholding in local SOEs is more relevant.

Using the hand-collected data of ownership structure in Chinese SOEs, our study examines the intergovernmental shareholding between governments with different hierarchical levels within a single local SOE. Our sample consists of 837 local SOEs over the period of 2007 to 2018. We manually collect data on the ultimate controller of each shareholder listed as the top 10 largest shareholders and obtain the data of government shareholders controlled by different governments in local SOEs. We find that in a local SOE with the shareholdings of a higher-level government relative to the ultimate controller,

[1] https://asic.gov.au/media/4196472/rg259-published-27-march-2017.pdf.
[2] https://www.sec.gov/rules/final/2009/33-9089.pdf.
[3] http://www.sasac.gov.cn/n2588035/n2588320/c4258529/content.html. We present an excerpt in Appendix A.

derivative use leads to a 16.67% decrease of firm risk. This risk-reducing effect of derivative use is 93.39% larger than that in other local SOEs without the shareholdings of a higher-level government. Moreover, this monitoring role is stronger when the strength of corporate governance in local SOEs is weak, indicating that the presence of a higher-level government via shareholdings could be a governance mechanism when other forms of governance are less effective. Furthermore, taking advantage of the significant change in the government regulation on corporate risk management around 2010, we find that this monitoring role is more pronounced after central and local governments strengthen the supervision on derivative use in SOEs, consistent with the complementary role of government regulation in countries with a poor institutional environment.

We proceed to perform a battery of tests to deepen our understanding of the monitoring role of a higher-level government shareholder. First, we show that this monitoring role varies with government identity. Due to the higher-quality corporate governance in central SOEs (Lin and Chang,2019) and greater power of the central government compared to local governments, we find that large government shareholders controlled by the central government have a greater effect in improving the derivative use efficiency compared to those controlled by local governments. Second, our results show that the monitoring role of a higher-level government via shareholdings increases with the difference between its hierarchical level and that of the ultimate controller of the local SOE, a proxy for the relative power of the former with respect to the latter. We also find that the monitoring effect is more pronounced when a higher-level government controls the second largest shareholder of a local SOE compared with third largest shareholder or below and when its ownership is larger. These findings are consistent with the prior literature that large shareholders with greater contestability relative to the controlling shareholder have a stronger monitoring role (Ben-Nasr et al., 2015; Jiang et al., 2018). We finally show that the positive effect of the presence of a higher-level government shareholder on derivative use efficiency is more pronounced when this government shareholder is a long-term shareholder, providing additional evidence supporting that monitoring efficacy of shareholders is conditional on investment horizon (Jiang and Kim, 2020).

In robustness tests, we first exploit the treatment effect model to account for the potential self-selection bias related to the presence of a higher-level government. Given that the possibility that higher-level governments invest selectively, we estimate the propensity of the presence of a higher-level government in the first stage of the treatment effect model. Our main findings remain in the second-stage regressions, suggesting that selection bias is not the driving force of our results. Second, following Chang et al. (2016), we apply the propensity score matching (PSM) method to account for the differences in firm characteristics between derivative users and non-users. We obtain qualitatively similar results with these matched samples. Finally, we conduct several additional robustness tests, including (1) using alternative proxies to mitigate the bias from measurement errors; (2) adding an ultimate controller identity fixed effect to control the ultimate controller heterogeneity; (3) employing different thresholds of ownership to alleviate the concern that our findings are driven by the threshold of 5% ownership; and (4) dropping the sample in which a higher-level government and its ultimate controller are in different provinces. Our empirical results remain qualitatively unchanged with these robustness tests.

Our study advances the literature in several ways. First, we add to the ongoing debate of whether government ownership is value-enhancing or value-destroying (Cheung et al., 2010; Boubakri et al., 2013; Chen et al., 2017; Boubakri et al., 2018). Our study suggests that the impact of government ownership on corporate governance could be dependent on the hierarchical level of governments. We find that a higher-level government via shareholdings in local SOEs can play a monitoring role and improve the risk-reducing effect of corporate derivative use. Another distinguished feature of our paper is that we focus on the intergovernmental shareholding and its impact on corporate governance, complementing previous literature which explores the role of one single government as the ultimate controller in enterprises (Cheung et al, 2010; Jiang et al., 2010; Lin and Chang, 2019; Opie et al., 2019). Our findings also challenge the view that government ownership is associated with a lower governance quality (Borisova et al., 2012; Borisova et al., 2015).

Second, our paper also contributes to the literature on corporate governance in transition economies. One common phenomenon in economic transition is that state bureaucrats have considerable power

over the economy (Haveman et al., 2017). By considering the government's monitoring role derived from the political hierarchical level, we find a mechanism through which state bureaucrats could improve the quality of corporate governance in SOEs. This is a mechanism that has not been empirically examined in corporate governance research before. Our empirical findings also prove that it is helpful to take the effect of the political system into account when building a new corporate governance model (Jiang and Kim, 2020). Furthermore, the existing empirical literature on corporate governance rarely discusses SOEs and non-SOEs separately. Since these two kinds of firms are different in their importance in China's economy and agency problems (Jiang and Kim, 2020), we focus on SOEs, and find a significant monitoring role of government non-controlling shareholders in derivative use when they are controlled by a higher-level government. Therefore, separate analyses on SOEs and non-SOEs could provide a clearer picture of corporate governance in China.

Finally, our study helps enrich the understanding on the determinants of corporate derivative use efficiency. Prior research provides valuable insights into various rationales for derivative use, such as financing corporate investment policies (Jankensgård and Moursli, 2020), encouraging risk-taking by lenders and promoting innovation (Chang et al., 2019), and reducing uncertainty about the prospects of the firms and creating a commitment to employee benefits (Huang et al., 2019). However, considering the potential role of derivatives in accounting scandals as well as market stability (Bartram, 2019), derivatives would not benefit investors when managers use them for self-interest or speculation (Allayannis et al., 2012). Our paper indicates that the risk-reducing effect of derivative use is more pronounced when a higher-level government via shareholdings acts as a corporate governance mechanism, extending the literature on the firm-level determinants of derivative use efficiency (Guo et al., 2020) and the relationship between corporate governance and derivative use (Allayannis et al., 2012; Lel, 2012).

The rest of our study is organized as follows. In Section 2, we review the relevant literature. In Section 3, we provide the institutional background and develop our hypotheses. In Section 4, we describe our data and sample. In Section 5, we report the summary statistics, regression results, and robustness tests. We conclude in Section 6.

2. Literature review

2.1. Ownership identity and corporate governance

Understanding the consequences of various types of corporate control is pivotal in corporate finance research (Aminadav and Papaioannou, 2020). Extant research provides strong evidence that ownership structure is an important determinant of corporate governance. For instance, the monitoring role of institutional shareholders is well established (McCahery et al., 2016), and generates positive outcomes, such as the enhancement of managerial efficiency by forcing managers to exert more efforts (Baghdadi et al., 2018). Whidbee and Wohar (1999) show that managers are more likely to hedge when institutional ownership increases. In addition, a growing strand of literature discusses the role of multiple large shareholders in corporate governance and has not obtained unidirectional evidence. On one hand, large shareholders provide oversight to the firm, and over each other (Jiang and Kim, 2015). On the other hand, the coordination friction among large shareholders reduces their monitoring efficiency and benefits managerial expropriation (Fang et al., 2018).

The government ownership, which presents a global surge mainly due to government purchases of stocks as investments (Borisova et al., 2015), also plays a significant role in corporate governance (Bradshaw et al., 2019). In general, government ownership is labeled as lacking adequate monitoring of managerial activities (Boubakri et al., 2013; Chen et al., 2017). Further analysis of Borisova et al. (2012) finds that legal origin influences the relationship between government ownership and corporate governance. While government ownership can lead to greater monitoring due to the governments' monopoly on the use of coercive power, this monitoring effect only exists in civil law countries. Besides institutional factors, the strength of corporate governance of government ownership is also conditional on the identity of governments. Lin and Chang (2019) develop a corporate governance index based on the corporate charter provisions in China. With this index, they find that, compared to SOEs controlled by provincial governments, SOEs controlled by the central government are associated with a higher value of this corporate governance index, indicating that the latter are more protective of minority shareholders. Similarly, Jia et al. (2019) find a stronger alignment between agents' private interests and firm value in Chinese SOEs when these firms are governed by a higher-quality government. In regard

with the impact on corporate derivative use, the findings of Guo et al. (2020) suggest that the derivative use in central SOEs is more efficient than that in local SOEs.

2.2. Corporate governance and derivative use efficiency

Prior studies suggest that the value of derivative use varies with the strength of corporate governance. Allayannis et al. (2012) find that the positive relationship between derivative use and firm value only exists in well-governed firms, consistent with the findings of Lel (2012) that strongly governed firms use derivatives to reduce firm risk and overcome costly external financing. Firms with strong governance mechanisms are more likely to hedge with derivatives rather than to speculate or pursue managers' self-interest. In contrast, agency problem results in excess hedging which is value-reducing for firm value (Huang et al., 2013). Moreover, due to inefficient monitoring, derivative use could have an insignificant risk-reducing effect (Bartram, 2019), and even be negatively associated with firm value (Fauver and Naranjo, 2010).

3. Institutional background and hypothesis development

3.1. Institutional background of China's hierarchical level and corporate risk management regulation

China's political system is composed of five top-down layers of state administration: the center (zhongyang), provinces (sheng), prefectures (diqu), counties (xian) and townships (xiang). One distinguished feature of this political system is that higher-level government officials assess the performance of lower-level government officials and perform the monitoring role of the latter. We cite excerpts from the Organic Law of the Local People's Congresses and Local People's Governments of the People's Republic of China revised in 2015 as follows:

"…Local people's governments at various levels shall be responsible, and report on their work to the people's congresses at the corresponding levels and to the State administrative organs at the next higher level…", as documented in Chapter IV Article 55.

"…A local people's government at or above the county level shall exercise the following functions and powers:…(2) to direct the work of its subordinate departments and of the people's governments at

lower levels; (3) to alter or annul… inappropriate decisions and orders of the people's governments at lower levels…(10) to handle other matters assigned by State administrative organs at higher levels…", as documented in Chapter IV article 61.

Using this multi-tier administrative system in which the higher-level government manages and supervises the immediately following lower-level government, the central government can extend its control to all levels of regions, and rule China, the country with a massive population and continental size (Jia et al., 2021).

How to improve the efficiency of SOEs' risk management is an important duty of Chinese governments. In 2006, the central State-owned Asset Supervision and Administration Commission of the State Council (SASAC) issued the guideline of comprehensive risk management in central SOEs. Henceforth, local SASACs issued similar guidelines of risk management in local SOEs following the guideline of central SASAC. Since then, Chinese governments has called for a continued enhancement of comprehensive risk management in SOEs. Moreover, to enhance the effective derivative use in central SOEs, in 2005, the central SASAC conducted a survey of central SOEs' investment in high-risk projects and strengthened the supervision of high-risk business including derivative use of SOEs in 2006. Our study echoes the risk management regulation by exploring how the intergovernmental shareholding affects the implementation efficiency of corporate risk management practice in local SOEs. We provide a summary of relevant government policies of corporate risk management in Appendix A.

3.2. The monitoring role of a higher-level government via shareholdings

Due to the "absent owner" problem, the degree of monitoring over managers in Chinese SOEs is inefficiently low (Lin and Chang, 2019; Jiang and Kim, 2020). Since the ultimate owners of SOEs are the 1.4 billion Chinese citizens, it is too dispersed to effectively monitor the managers. Without effective monitoring from shareholders, managers in SOEs are likely to make corporate decisions that serve their own interest and hurt the interest of shareholders. For example, Zhang and Liu (2020) find that SOE managers expand the size of their firms to obtain more compensation, which, to some extent, decreases the firm value. Moreover, the low managerial ownership deteriorates the agency issue between

managers and shareholders (Jiang and Kim, 2020). Without clearly identifiable principals and effective monitoring, managers in SOEs are less likely to be motivated to make efficient corporate hedging decisions.

Existing literature shows that managers have incentives to use derivatives for their self-interests and thereby hurt the benefits of shareholders (Smith and Stulz, 1985; Fauver and Naranjo, 2010). Better monitoring of managerial activities can significantly improve the derivative use efficiency (Lel, 2012). The government with a higher hierarchical level possess greater power than the one with a lower hierarchical level, such as personnel appointment and evaluation, and fiscal revenue assignment, and thus can intervene easily in the policy decision of the latter (Jia et al., 2021). Since the distribution of political power within government hierarchy is important to governance quality (Markevich and Zhuravskaya, 2011), the higher-level government is expected to execute the supervision over the policy implementation of the lower-level governments. Besides, the regulation implementation of corporate risk management by a government directly influences the risk management policy in enterprises controlled by this government. When a higher-level government controls or is a shareholder of one SOE controlled by a lower-level government, the former can gain a better understanding of the regulation implementation of corporate risk management by the latter. Furthermore, a higher-level government through holdings shares can directly intervene the risk management policy in this SOE, and thus perform a better monitoring role assigned by the political hierarchical level.

Given that managers in a SOE are exposed to weak monitoring and a higher-level government as a large shareholder is expected to perform a monitoring role over the regulation implementation of corporate risk management, we expect that, in a SOE whose ultimate controller is the government, the large shareholder controlled by the higher-level government relative to the ultimate controller of this SOE enhances the monitoring over corporate risk management policies, and inhibits managers from undertaking value-destroying activities. Therefore, this enhancement of monitoring from the large shareholder controlled by a higher-level government is likely to improve the efficiency of derivative use, and we present our hypothesis as follows:

Hypothesis 1. Local SOEs have a stronger risk-reducing effect of derivative use if they have a large shareholder controlled by a higher-level government with respect to the ultimate controller of the local SOEs.

4. Research design

4.1. Sample selection and data source

In this paper, we focus on Chinese local SOEs and explore whether the existence of a higher-level government through holding firms' shares could be a potential corporate governance mechanism for these firms. Given that Chinese firms are required to disclose their derivative use in annual reports since year 2007, we start by selecting A-share listed firms for the period 2007 to 2018 from the China Stock Market and Accounting Research (CSMAR) database. Following previous literature on corporate derivative use (Chang et al., 2016; Bartram, 2019), we discard financial firms based on the 2012 China Security Regulatory Commission (CSRC) industry classification. Since Chinese firms only disclose the identity and shareholdings of their top 10 largest shareholders, following Jiang et al. (2018), we manually collect the ultimate controller of each shareholder listed in the top 10 largest shareholders from the China Listed Firm's Shareholders Research Database, provided by the CSMAR, and sum their shareholdings if they are controlled by the same ultimate controller. We define a firm as a SOE if its ultimate controller is the government and obtain 11,848 SOE firm-year observations. We also exclude SOEs with missing stock market information, and those controlled by the central government (central SOEs). The final sample consists of 7,662 firm-year observations representing 837 local SOEs. It is also noteworthy that this sample selection process does not suffer from survivorship bias because if a local SOE delists or bankrupts in a specific year, the firm-year observations we identified that are prior to the year of delisting or bankruptcy remain in the sample. Table 1 presents the sample selection process. Different from previous literature which identifies whether the government shareholder is local or central (Cheung et al., 2010; Lin and Chang, 2019), we further classify the government shareholder as central-, province-, prefecture-, county-, or township-level shareholder and examine whether the difference in hierarchical levels of governments has an impact on derivative use efficiency.

<Insert Table 1>

To analyze the effect of intergovernmental shareholding, we define a large government shareholder as the one that is controlled by the government and holds 5% or more of the shares outstanding (Beuselinck et al., 2017; Jiang et al., 2018; Aminadav and Papaioannou, 2020). For simplicity, we classify a local SOE as a "High SOE" when it has at least one non-controlling large government shareholder controlled by a higher-level government with respect to the ultimate controller of the listed local SOEs.[4] Other local SOEs without the presence of a higher-level government shareholder are referred to as "non-High SOEs". We use the term "higher-level government shareholder" to describe the large government shareholder controlled by the higher-level government. If a firm has more than one non-controlling large government shareholder and these shareholders are controlled by the governments of different hierarchical levels (11 firms with 43 firm-year observations), we use the one controlled by the government of the higher (or the highest) hierarchical level. If a firm has more than one non-controlling large government shareholder and these shareholders are controlled by the governments of the same hierarchical level (2 firms with 7 firm-year observations), we use the one with larger shareholdings.

The data on corporate derivative use are hand-collected from corporate annual reports released on Juchao, the disclosure website authorized by the CSRC. Following Chang et al. (2016) and Bartram (2019), we restrict our focus to macroeconomic factors including foreign exchange (FX) risk, interest rate (IR) risk, and commodity price (CP) risk, and conduct a keyword search to identify FX/IR/CP derivative users. To eliminate possible errors in the keyword search of annual reports, following Guo et al., (2020), we also read corporate announcements and public news, and verify the existence of derivative programs and the type of risk managed with derivatives. Other data are obtained from the CSMAR database. All the continuous variables are winsorized at the 1st and 99th percentiles to mitigate the influence of outliers.

[4] For instance, Wasu Media Holding Co., Ltd (000156 SHZ) disclosed in 2013 that the ultimate controller of its controlling shareholder is Hangzhou government (city-level government), and the ultimate controller of its second largest shareholder is Zhejiang government (province-level government). Since the hierarchical level of Zhejiang government is higher than that of Hangzhou government, we classify this firm as a High SOE.

4.2. Empirical specifications and variables

We use the following empirical model to test whether a higher-level government via shareholdings plays a monitoring role in corporate derivative use:

$$Std.Dev_{i,t} = \alpha_0 + \beta_1 Derivatives_{i,t} + \beta_2 High_{i,t} + \beta_3 High_{i,t} \times Derivatives_{i,t} + \beta_4 Controls_{i,t} + Industry_i + Year_t + \varepsilon_{i,t}, \quad (1)$$

where *Std.Dev* is the ratio of the daily stock return standard deviation to the market return standard deviation, a proxy for firm risk (Bartram, 2019). To calculate *Std.Dev*, we require at least 36 non-missing daily stock returns during each fiscal year (Bartram, 2019). *Derivatives* is an indicator that equals one if the sample firm is a derivative user, and zero otherwise. The coefficient β_1 measures the effect of corporate derivative use on firm risk. *High* is an indicator variable that equals one if the sample firm is a High SOE, and zero otherwise. The coefficient β_3 measures the effect of a higher-level government via shareholdings on corporate derivative use. Following previous literature on corporate derivative use (Chang et al., 2016; Bartram, 2019; Guo et al., 2020), we control for *Size*, *Leverage*, *Tobin's q*, *ROA*, *Cash Ratio*, and *Tang*, defined in Table 2. To account for the impact of ownership concentration and difference in ownership, we include the ownership of controlling shareholder (*Controlling SR*), total shareholdings of the top 10 largest shareholders (*Top 10 SR*), and ownership of the higher-level government shareholder (*High SR*) as our control variables. We also include the year- and industry-fixed effects to control for overall macroeconomic factors over time and industry characteristics.

<Insert Table 2>

5. Results

5.1. Descriptive statistics

In Table 3, we report the number of sample firms and derivative users across years and industries from 2007 to 2018. Panel A in Table 3 shows that the number of High SOEs is stable across sample years. The ratio of derivative users increases in general, from 3.890% to 18.574%. In Panel B of Table 3, we present the industry classification of High SOEs and derivative users. On average, 21.505% of

local SOEs in each industry are High SOEs which have a higher-level government shareholder. There is a great variation in derivative users across industries, and on average 20.789% of SOEs in each industry are derivative users.

<Insert Table 3>

Panel A of Table 4 provides summary statistics of all key variables. 10.5% firms in our sample are classified as derivative users. The mean of *High* is 0.128, indicating that 12.8% of local SOEs in our sample have a large government shareholder controlled by a higher-level government with respect to the ultimate controllers of the listed local SOEs presented in their top 10 largest shareholders lists. The average ownership of the controlling shareholder is 41.1%, indicating that the concentrated ownership structure is prevailing in Chinese local SOEs.

We further divide our sample into High SOEs and non-High SOEs and report the univariate analysis of variables in Panel B of Table 4. The median of *Std. Dev* in High SOEs is equal to 1.757, which is lower than the 1.827 for non-High SOEs at a significance level of 1%. The difference in corporate derivative use between High SOEs and non-High SOEs is significant at the level of 1%. We also find that High SOEs and non-High SOEs are different in other firm characteristics. The difference in firm characteristics between High SOEs and non-High SOEs is likely to be driven by self-selection bias. Thus, we conduct a treatment effect model in robustness tests to address this issue.

<Insert Table 4>

Table 5 illustrates the variations in higher-level government shareholders. Panel A presents the distribution of higher-level government shareholders based on their ownership rankings. The total number of High SOEs is 980. Observations whose second largest shareholder is the higher-level government shareholder account for 73.265% of all High SOEs. Panel B shows that the average ownership of higher-level government shareholders is 11.73%. Panel C presents a more detailed distribution of the shareholdings. As shown in Panel C, the ownership of higher-level government shareholders concentrates on 5%-10%.

<Insert Table 5>

5.2. Baseline regression results

In this section, we examine the monitoring role of a higher-level government via shareholdings in corporate derivative use by estimating Equation (1) and present the results in Table 6. We first examine the overall effect of derivative use on firm risk and present the results in Panel A of Table 6. The coefficient on *Derivatives* is -0.184 (*t*-stat=-7.555), indicating a significant and negative relationship between derivative use and corporate total risk in local SOEs. Derivative use can lead to a 9.21% (=0.184/1.997×100%) decrease in firm risk relative to its mean (1.997), in line with the literature that derivatives are used to reduce firm risk (e.g., Donohoe, 2015; Chang et al., 2016; Bartram, 2019; Guo et al., 2020). This panel also shows that firms with larger size (*Size*), lower leverage (*Leverage*), higher market value (*Tobin's q*), and more intangible assets (*Tang*) have lower firm risk (*Std.Dev*).

We next add the interaction term between *Derivatives* and *High* to the regression and present the results in Panel B of Table 6. For an average High SOE, derivative use leads to a 16.67% [=(-0.172-0.162)/2.004×100%] decrease in firm risk relative to its mean (2.004); for an average non-High SOE, derivative use leads to a 8.62% (=-0.172/1.996×100%) decrease in firm risk relative to its mean (1.996). The coefficient on the interaction term between *Derivatives* and *High* is statistically significant at the 5% level, indicating that compared to non-High SOEs, High SOEs present a stronger risk-reducing effect of derivative use. On average, High SOEs have a 93.39% [=(16.67%-8.62%)/8.62%×100%] increase in the risk-reducing effect compared to non-High SOEs. This result is consistent with our Hypothesis 1 and supports the monitoring role of a higher-level government as a large shareholder.

To show that our results are not driven by sample size, we repeat the analysis above using two different subsamples and present the results in columns (2) and (3) of Panel B. We exclude non-High SOEs which have two or more different large government shareholders, and compare the derivative use efficiency of High SOEs to that of non-High SOEs with a single large government shareholder in column (2) of Panel B. Moreover, we exclude non-High SOEs with one single large government shareholder and compare the derivative use efficiency of High SOEs to that of non-High SOEs with two or more different large government shareholders in column (3). We run Equation (1) with these two different subsamples and obtain similar results. Besides, the results in column (3) of Panel B also

suggest that our findings are not totally driven by the existence of multiple large government shareholders. One common phenomenon in economic transition is that state bureaucrats have considerable power over the economy (Haveman et al., 2017). Since China has a strict and top-down political system, higher-level governments have absolute power relative to lower-level governments. Our empirical results show that a higher-level government with respect to the ultimate controller plays a monitoring role in SOEs' derivative use via shareholdings. This finding provides evidence of the positive impact of government ownership from the perspective of relative hierarchical level of different governments and complement the literature on state capitalism (Boubakri et al., 2018; Jia et al., 2019).

<Insert Table 6>

5.3. The moderating effects of corporate governance

The monitoring role of various governance mechanisms is interdependent (Jiang et al., 2018). In this part, we examine the impact of the strength of other governance mechanisms on the monitoring role of a higher-level government via shareholdings, and we expect that the role of a higher-level government shareholder in prompting governance changes is more important for firms with severe expropriation by managers.

To measure the extent of the expropriation by managers, we use the excess managerial perk consumption based on the approach of Luo et al. (2011) and Wang et al. (2014). More excess perks indicate more severe agency problems between managers and shareholders (Jensen and Meckling, 1976).[5] We define *Total Perks* as administrative expense minus the sum of compensation of directors, executives and members of supervisory committee, allowance for doubtful accounts and obsolete inventory (since 2007, these two items are included into impairment loss), and amortization of intangibles. Excess perk consumption is calculated with the following Equation (2):

$$\frac{Total\ Perks_{i,t}}{Asset_{i,t-1}} = \beta_0 + \beta_1 \times \frac{1}{Asset_{i,t-1}} + \beta_2 \times \frac{\Delta Sales_{i,t}}{\Delta Asset_{i,t-1}} + \beta_1 \times \frac{PPE_{i,t}}{Asset_{i,t-1}} + \beta_1 \times \frac{Inventory_{i,t}}{Asset_{i,t-1}} + \beta_1 \times lnEmployee_{i,t} + \varepsilon_{i,t}, \quad (2)$$

[5] Another strand of literature argues that perks can generate positive benefits for firms (Fama, 1980), such as enhancing managerial productivity (Rajan and Wulf, 2006). Since the conditions required to generate a positive effect of perks seem unlikely to hold in Mainland China (Gul et al., 2011), we use the agency perspective of perks in our paper.

where *Asset* is book assets at the end of year, Δ*Sales* equals sales in year *t* minus sales in year *t*-1, *PPE* is property, plant and equipment, *Inventory* is gross inventory at the end of year, and *lnEmployment* is the logarithm of the number of employees. We run this equation by year and industry. The residual from Equation (2) is considered to be the level of *Perks*.

Columns (1) and (2) of Table 7 present the regression results, distinguishing between sample firms with less or more perks, based on the median of *Perks*. To mitigate endogeneity, we use *Perks* measured at period *t*-1. Specifically, the coefficient on the interaction term *Derivatives*×*High* in column (1) is negative but insignificant, suggesting that a higher-level government shareholder does not have a pronounced impact on the risk-reducing effect of derivatives when the excess managerial perks consumption in local SOEs is low. In contrast, the coefficient on the interaction term *Derivatives*×*High* in column (2) is negative and statistically significant at the 1 % level for firms with more perks. Economically, derivative use for an average High SOE (non-High SOE) with more perks leads to a 24.76%[6] (13.03%[7]) decrease in firm risk. This implies that, on average, High SOEs have a 90.02% increase in the risk-reducing effect when firms have above-median excess perks consumption. These results in Table 7 suggest that the monitoring role of a higher-level government shareholder is more salient for firms with more excess managerial perks. This finding confirms our earlier conjecture that a higher-level government shareholder plays a more pronounced monitoring role when other forms of governance mechanism are less effective.

<Insert Table 7>

5.4. Government regulation change and the monitoring role of a higher-level government shareholder

In the previous section, we find a monitoring role of a higher-level government via shareholding in derivative use. This monitoring role is driven by its political duty of supervising the regulation implementation of a lower-level government. If this is the case, the monitoring role should be more pronounced when a higher-level government is strongly incentivized by a newly issued regulation of

[6] Similarly, 24.76% is the sum of coefficients on *Derivatives* and *Derivatives*×*High* in column (2) of Table 7, divided by the mean of the firm risk in High SOEs with more *Perks*.
[7] Similarly, 13.03% is the coefficient on *Derivatives* in column (2) of Table 7, divided by the mean of the firm risk in non-High SOEs with more *Perks*.

corporate derivative use. We accordingly employ the change in government regulation of corporate derivative use around 2010 to better understand the channels through which a higher-level government affects corporate derivative use efficiency.

In 2009, the central SASAC issued the notice of strengthening the government supervision over the derivative use of central SOEs. Until 2010, most local SASACs followed the guidelines of the central SASAC and promulgated interim measures for the supervision over the derivative use of local SOEs. Furthermore, in 2010, the derivative use in SOEs was emphasized in the "three important and one large" (*San Zhong Yi Da*) decision policy. Therefore, there was a significant difference in the strength of government regulation of SOEs' derivative use around 2010, allowing us to examine whether the government regulation impacts the monitoring role of a higher-level government.

Taken the rigidity and response time of corporate policy into consideration, we exclude year 2009, and define year 2007 to 2008 as the pre-regulation period, and year 2010 to 2011 as the post-regulation period. We re-estimate Equation (1) using these two periods separately and present the results in Table 8. In column (1), the coefficient on the interaction term *Derivatives*×*High* is negative but insignificant. This result suggests that the monitoring role of a higher-level government in the pre-regulation period is not statistically significant. In contrast, in column (2), the coefficient on the interaction term *Derivatives*×*High* is negative and significant, indicating that the existence of a higher-level government shareholder improves the efficiency of corporate derivative use in local SOEs after the government supervision over derivative use in SOEs strengthens. For an average High SOE, derivative use leads to a 19.37%[8] decrease in its firm risk relative to its mean. Taken together, results presented in columns (1) and (2) show that after the government supervision over derivative use in SOEs strengthens, the existence of a higher-level government shareholder results in a more pronounced risk-reducing effect of derivative use in SOEs. Previous literature shows that government regulation has a great impact on enterprises' decisions and performance (Chen et al., 2010; Ke and Zhang, 2020). Our findings are

[8] Similarly, 19.37% is the sum of coefficients on *Derivatives* and *Derivatives*×*High* in column (2) of Table 8, divided by the mean of the firm risk of High SOEs in post-regulation period.

consistent with their conclusions and provide additional evidence for the efficacy of public enforcement in countries with a weak institutional environment.

<Insert Table 8>

5.5. Further analysis

In this section, we conduct several tests to analyze the variations in higher-level government shareholders. We firstly examine the impact of government identity on the monitoring role of a higher-level government. We next explore whether the contestability of a higher-level government shareholder matters. Finally, we investigate the sensitivity of this monitoring role to investment horizon. These tests complement our evidence in governance mechanism of a higher-level government.

First, the existing literature shows that SOEs controlled by central and local governments differ in managers' tunneling and expropriation (Jiang et al., 2010; Cheung et al, 2010). A recent working paper by Lin and Chang (2019) also argue that the corporate governance in central SOEs is better than that in local SOEs due to the stricter monitoring and supervision in central SOEs. Therefore, taking into consideration the higher-quality corporate governance in central SOEs as well as greater power of the central government compared to local governments, we expect that large government shareholders controlled by the central government have a greater effect in improving firms' corporate governance, and increase the risk-reducing effect of corporate derivative use.

To examine whether the monitoring role of a higher-level government varies with government identity, we conduct two indicator variables: *Central* and *Local*. *Central* (*Local*) equals one for High SOEs whose higher-level government is the central government (a local government), and zero otherwise. Bradshaw et al. (2019) employ similar measure to compare local and central state ownership. Column (1) in Table 9 presents the results including the interaction terms *Derivatives*×*Central* and *Derivatives*×*Local*. For an average High SOE whose higher-level government is the central government

(other SOEs), derivative use leads to a 18.07%[9] (8.61%[10]) decrease in firm risk relative to its mean. The significant and negative coefficient for the interaction term between *Derivatives* and *Central* shows that derivative use has a stronger risk-reducing effect when the higher-level government shareholder is controlled by the central government. On average, as shown in column (1) of Table 9, High SOEs have a 109.87% increase in the risk-reducing effect compared to other SOEs. However, the coefficient on *Derivatives*×*Local* is insignificant. Thus, the shareholdings of the central government in a High SOE appear more influential in improving derivative use efficiency than does local government ownership in a High SOE, confirming our earlier conjecture.

<Insert Table 9>

Our second test is to analyze the relative power of the higher-level government to the ultimate controller of SOEs. Since the hierarchical level of governments in China includes five levels: township, county, prefecture, province, and center, we assign scores 1, 2, 3, 4, and 5 to these five levels. *Relative Power* is the difference in the hierarchical levels of governments separately controlling the controlling shareholder and the higher-level government shareholder. For example, if a firm's controlling shareholder is controlled by a provincial government, and its higher-level government shareholder is controlled by the central government, the *Relative Power* equals 1 (1=5-4).

Based on the median of *Relative Power* (which is 1), we construct two indicator variables: *Greater* and *Smaller*. *Greater* (*Smaller*) equals one if a High SOE's *Relative Power* is more than one (is one), and zero otherwise. Column (2) in Table 9 reports the results of regressions including the interaction terms *Derivatives*×*Greater* and *Derivatives*×*Smaller*. For an average High SOE whose higher-level government has greater relative power (other SOE), derivative use leads to a 18.95% [11](8.61%[12]) decrease in firm risk relative to its mean. The significant and negative coefficient for the interaction

[9] Similarly, 17.82% is the sum of coefficients on *Derivatives* and *Derivatives*×*Central* in column (1) of Table 9, divided by the mean of the firm risk in sample with *Central* of value 1.
[10] Similarly, 8.47% is the coefficient on *Derivatives* in column (1) of Table 9, divided by the mean of the firm risk in sample with *Central* of value 0.
[11] Similarly, 18.30% is the sum of coefficients on *Derivatives* and *Derivatives*×*Greater* in column (2) of Table 9, divided by the mean of the firm risk in sample with *Greater* of value 1.
[12] Similarly, 7.97% is the coefficient on *Derivatives* in column (2) of Table 9, divided by the mean of the firm risk in sample with *Greater* of value 0.

term between *Derivatives* and *Greater* suggests that when the relative power of the higher-level government shareholder to the controlling shareholder is larger, derivative use has a stronger risk-reducing effect. Economically, an average High SOE has a 120.09% increase in the risk-reducing effect compared to other SOEs. However, the coefficient on *Derivatives*×*Smaller* is insignificant. Collectively, these findings suggest that the monitoring effect of a higher-level government via shareholdings increases with the relative power of this government to the ultimate controller of a SOE.

The relative power of governments increases with the difference in the hierarchical level of these governments, and the monitoring effect of a higher-level government via shareholdings is stronger when this government has a greater relative power. This finding is also consistent with the studies of Ben-Nasr et al. (2015) and Jiang et al. (2018) which show that a greater contestability of other large shareholders enhances their ability to monitor the controlling shareholder. Besides, we also analyze the effect of ranking and ownership of a higher-level government shareholder on its monitoring role and present the results in columns (3) and (4). We find that this monitoring role is stronger when the higher-level government controls the second largest shareholder and when it has a larger ownership, further supporting that the monitoring role of a higher-level government shareholder increases with its contestability.

Our final analysis is to test whether the monitoring role of a higher-level government shareholder is stronger when this government shareholder is a long-term shareholder. Investment horizon is also a factor that impacts the monitoring efficacy (McCahery et al., 2016; Jiang and Kim, 2020). We define a shareholder as a long-term shareholder if it holds shares for at least nine and a half years, which is the median of the length of higher-level government shareholders' shareholding period.[13] *Longer* (*Shorter*) equals one for High SOEs whose higher-level government shareholder is long-term (short-term), and zero otherwise. Column (5) in Table 9 presents the results including the interaction terms *Derivatives*×*Longer* and *Derivatives*×*Shorter*. For an average High SOE whose higher-level

[13] Following McCahery et al. (2016), we define a shareholder as a long-term shareholder if its holding period of shares is more than two years, and obtain similar results.

government shareholder is long-term (other SOE), derivative use leads to a 19.41%[14] (8.41%[15]) decrease in firm risk relative to its mean. The significant and negative coefficient for the interaction term *Derivatives*×*Longer* shows that derivative use has a stronger risk-reducing effect when the higher-level government shareholder is a long-term shareholder. On average, High SOEs have a 130.80% increase in the risk-reducing effect compared to other SOEs. However, the coefficient on *Derivatives*×*Shorter* is insignificant. Taken them together, these results show that the monitoring efficiency of a higher-level government via shareholdings is more pronounced when this government hold shares for a longer horizon, supporting the effect of investment horizon in corporate governance (Jiang and Kim, 2015, 2020; McCahery et al., 2016).

5.6. Robustness tests

In this section, we perform a battery of robustness tests of our primary findings. We first use a treatment effect model and address the self-selection bias related to the existence of a higher-level government. We further mitigate the self-selection bias related to derivative use with a PSM approach. Finally, we conduct additional tests to address the measurement error, heterogeneity of ultimate controller and analyze alternative thresholds of ownership.

5.6.1. Addressing self-selection bias

The significant difference between High SOEs and non-High SOEs presented in Panel B of Table 4 indicates that the presence of a higher-level government is likely to be conditional on firm characteristics. To mitigate the possibility that our results may simply reflect the selective investment decisions of a higher-level government with respect to the ultimate controller of a SOE, rather than the type of government ownership, in the first stage, we estimate the propensity of the presence of a higher-level government using the control variables in Equation (1) as well as *Derivatives*.[16] Then we compute the hazard ratio (*Lambda*) based on the first-stage regression and include it in our second-stage model

[14] Similarly, 20.60% is the sum of coefficients on *Derivatives* and *Derivatives*×*Longer* in column (3) of Table 9, divided by the mean of the firm risk in sample with *Longer* of value 1.
[15] Similarly, 7.87% is the coefficient on *Derivatives* in column (3) of Table 9, divided by the mean of the firm risk in sample with *Longer* of value 0.
[16] We exclude *High SR* in the control variables since it equals zero for non-High SOEs. The variations in *High SR* are insufficient to get an estimation of propensity.

examining the monitoring role of a higher-level government via shareholdings.

Column (1) of Table 10 presents the first-stage regression results with the dependent variable of *High*. We find that derivative use is negatively related to the existence of a higher-level government shareholder. SOEs with less cash and more tangible assets are likely to have a higher-level government shareholder. A higher-level government is more likely to retain control when the controlling shareholder has less ownership and the Top 10 largest shareholders have more ownership. Column (2) of Table 10 reports the second-stage regression results of the joint impact of *Derivatives* and *High* on firm risk. The results are similar to those in Panel B of Table 6 and suggest a causal effect of a higher-level government shareholder on derivative use efficiency in local SOEs. Overall, the results in Table 10 suggest that self-selection bias does not drive our main finding.

<Insert Table 10 here>

5.6.2. PSM approach

To address the potential concern as to the endogeneity of derivative use, following Chang et al. (2016), we use the PSM approach to identify a control group of derivative non-users and account for the difference in firm characteristics between derivative users and non-users. We first select all control variables in Equation (1) and *High* as matching variables. Using a one-to-one with replacement matching approach, we then conduct a probit regression to estimate the propensity of derivative use based on the matching variables.[17] We also use a one-to-two with replacement matching approach to examine the robustness of our results.

Panel A of Table 11 shows the results of a univariate analysis before using the PSM approach. Panels B and C show the results of a univariate analysis after using one-to-one and one-to-two matching approach, separately. The differences in firm characteristics between derivative users and non-users have significantly reduced after matching. Panel D reports the regression results after matching derivative users to non-users. The results show that the monitoring role of a higher-level government

[17] Following the suggestion of Roberts and Whited (2013), we use PSM with replacements, allowing for better matches with less bias and alleviating the sensitivity of the estimated effect towards the order in which the treatment observations are matched

via shareholdings in corporate derivative use still remains strong after using two alternative matching approaches.

<Insert Table 11 here>

5.6.3. Additional robustness tests

In this section, we examine a variety of alternative specifications and undertake additional tests to check the robustness of our empirical findings. First, we employ the volatility of operating cash flow using 3 years of annual data (*t*, *t*+1, *t*+2) as an alternative proxy for firm risk (Bartram et al., 2011; Bartram, 2019).[18] We also use the industry-adjusted method and measure the difference between a firm's operating cash flow and the average operating cash flow across firms in the same industry. The results reported in columns (1) and (2) of Table 12 are consistent with our previous findings. Second, we use an alternative proxy for a higher-level government. In the baseline regression, we use a dummy variable *High* indicating the presence of a higher-level government. In this part, we use the ordinal variable *Relative Power*, defined as the difference in the hierarchical levels of a SOE's ultimate controller and the higher-level government, as the proxy for the contestability of the higher-level government shareholder with regard to the controlling shareholder. We present this result in column (3) of Table 12 and find that the coefficient on the interaction term is negative and significant at the level of 1%, indicating that our main finding does not vary with the measure of a higher-level government. Third, SOEs with different ultimate controllers are likely to vary in fundamental characteristics, such as size and access to financial resources. To mitigate the impact of ultimate controllers of SOEs on our findings, we include an ultimate controller fixed effect in Equation (1) to control the impact of ultimate controller heterogeneity. The result in column (4) of Table 12 shows that a higher-level government plays a monitoring role via shareholdings and strengthens the risk-reducing effect of derivative use even after controlling the impact of ultimate controllers of SOEs. Fourth, in the main regression, we use 5% as the threshold to define a large government shareholder. Since the threshold of ownership affects the sample size of High SOEs, to mitigate the impact of thresholds, in this part, we use different thresholds

[18] In untabulated tests, we also utilize the volatility of operating cash flow using 8 forward quarters (from q to q+7) as an alternative proxy for firm risk. Our main findings are robust to this alternative measures of firm risk as well.

of ownership to define a large government shareholder and test the robustness of our main findings. Columns (5)-(8) in Table 12 show the results with no threshold, and with thresholds of 1%, 3%, and 10%, separately. We find that the monitoring role of a higher-level government via shareholdings still exists with different thresholds of ownership, providing additional evidence of the robustness of our empirical results.[19] Finally, given that a higher-level local government is unlikely to monitor a lower-level local government if they are in different provinces, we drop a High SOE if the higher-level government shareholder and the ultimate controller of listed local SOEs are in different provinces (10 firms with 37 firm-year observations). Thus, the new sample size is reduced to 7625. The results are reported in column (9) of Table 12 and show that our evidence remain qualitatively.

<Insert Table 12>

6. Conclusion

This study extends the governance literature by investigating whether and how the intergovernmental shareholding affects corporate risk management policy. China's institutional environment grants governments with a higher hierarchical level political power to monitor the governments with a lower hierarchical level. Furthermore, the data of government ownership through which different governments impose joint impact on corporate policies in Chinese SOEs provide us an ideal setting to examine the impact of intergovernmental shareholding within one single firm.

With manually collected data on ownership structure, we find that the presence of a higher-level government via holding shares acts as a governance mechanism and improves the risk-reducing effect of corporate derivative use. This finding is in line with previous literature that government ownership can play a monitoring role in corporate policies under certain circumstances (Borisova et al., 2012). This monitoring effect of a higher-level government shareholder is more pronounced when the local SOEs are not well-governed, and when the government regulation on corporate derivative use is stronger. Further tests show that this monitoring role in derivative use efficiency is stronger when a

[19] The results with different thresholds of ownership also illustrate that our main findings are not driven by the existence of multiple large shareholders.

higher-level government serving as a non-controlling shareholder (1) is the central government, (2) has a greater relative power to the ultimate controller of a SOE, (3) controls the second largest shareholder, (4) holds more shareholdings, and (5) is a long-term shareholder. Our results remain the same after addressing the self-selection bias and using PSM approach. They are also robust to alternative proxies and hold for different thresholds to define large shareholders.

By assessing the monitoring role of a higher-level government via shareholdings, our study provides an unexplored corporate governance mechanism through which government ownership could affect shareholder value. Beuselinck et al. (2017) find that the value of government ownership during the global financial crisis is driven by the implicit and explicit government guarantee. Our findings indicate another potential value of government ownership from the perspective of risk management efficiency. Besides, using the sample of Chinese SOEs, our study also provides implications for the countries experiencing economic transitions. Since well-functioned corporate governance mechanisms in developed markets do not work well in developing countries (Jiang and Kim, 2020), there is an urge to identify mechanisms catering the institutions of these markets. Given that one distinguished feature of the transitional economy is that the rule of law is weak and state bureaucrats retain power over the economy, our research examines the role of intergovernmental shareholding in corporate governance and offers potential solutions to these markets.

Our findings complement the existing evidence that government ownership can be value-enhancing (Cheung et al., 2010; Boubakri et al., 2018). We caution that this is only one of many facets of government ownership on corporate governance. For instance, literature on privatization argues that government shareholders are inefficient and do not maximize shareholder value (Boubakri et al., 2013; Chen et al., 2017). A more systematic evaluation of government ownership is needed for future research. Besides, in a more general sense, this paper identifies a monitoring mechanism resulted from the intergovernmental shareholding. However, whether this governance mechanism should work effectively in improving the efficiency of other corporate policies, such as investment or innovation will warrant a future study.

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Table 1

Sample Selection Procedure.

This table reports the process of sample selection.

Firm-year observations of A-share listed firms in China	30,529
Subtract:	
Observations of financial firms	907
Observations of non-SOEs	17,774
Observations with missing values	176
Observations of central SOEs	4,010
Final sample	7,662

Table 2

Variable definitions.

The table reports the variables used in the hypotheses tests and their definitions.

Variable	Definition
Std.Dev	Ratio of the daily stock return standard deviation to the market return standard deviation.
Derivatives	An indicator with value 1 if a SOE uses derivatives, and 0 otherwise.
High	An indicator with value 1 if a SOE has at least one large non-controlling shareholder controlled by a higher-level government with respect to its ultimate controller, and 0 otherwise.
Size	Logarithm of book assets at the end of this year.
Leverage	Book value of total debts over total book assets.
Tobin's q	Market value divided by the book value of the firm.
ROA	Net income divided by total assets.
Cash Ratio	Cash and short-term equivalents divided by book assets.
Tang	Property, plant, and equipment (PP&E) divided by book assets.
Controlling SR	The ownership of the controlling shareholder.
Top 10 SR	The sum of the ownership of the Top 10 largest shareholders.
High SR	The ownership of the higher-level government shareholder. We set this variable to zero if a SOE does not have a higher-level government shareholder.

Table 3

Year and industry distribution of sample.

This table reports the distribution of firms and derivative users across years and industry in Panel A and B, separately. In Panel A, Pct (%) of High SOEs equals the number of High SOEs divided by the number of firms in the same year ((4)=(2)/(1)×100), and Pct (%) of Users equals the number of derivative users divided by the number of firms in the same year ((5)=(3)/(1)×100). In Panel B, we use the industry classification that the CSRC issued in 2012. Pct (%) of High SOEs equals the number of High SOEs divided by the number of firms within the same industry ((4)=(2)/(1)×100), and Pct (%) of Users equals the number of derivative users divided by the number of firms within the same industry ((5)=(3)/(1)×100).

Panel A: year distribution of sample

Year	No. of Firms (1)	No. of High SOEs (2)	No. of Derivative Users (3)	Pct (%) of High SOEs (4)	Pct (%) of Users (5)
2007	617	83	24	13.452	3.890
2008	625	79	34	12.640	5.440
2009	618	73	43	11.812	6.958
2010	635	79	54	12.441	8.504
2011	626	89	60	14.217	9.585
2012	646	92	66	14.241	10.217
2013	643	85	65	13.219	10.109
2014	641	82	75	12.793	11.700
2015	638	76	78	11.912	12.226
2016	643	76	86	11.820	13.375
2017	657	83	91	12.633	13.851
2018	673	83	125	12.333	18.574
Total	7,662	980	801	12.790	10.454

Panel B: industry distribution of sample

Industry code	Industry title	No. of Firms (1)	No. of High SOEs (2)	No. of Derivative Users (3)	Pct (%) of High SOEs (4)	Pct (%) of Users (5)
A	Agriculture, Forestry, Livestock Farming, & Fishery	14	2	5	14.286	35.714
B	Mining	36	8	11	22.222	30.556
C	Manufacturing	417	78	106	18.705	25.420
D	Utilities	60	19	9	31.667	15.000
E	Construction	18	3	1	16.667	5.556
F	Wholesale & Retails	71	10	18	14.085	25.352
G	Transportation, Warehousing & Postal Service	57	28	12	49.123	21.053
H	Lodging & Cantering	7	0	2	0.000	28.571
I	Information & Technology	27	6	3	22.222	11.111
K	Real Estate	57	7	2	12.281	3.509
L	Leasing & Business Services	14	4	3	28.571	21.429
M	Scientific Research & Technical Services	7	2	0	28.571	0.000
N	Water Conservancy, Environment & Public	18	7	0	38.889	0.000

	Facilities Management					
O	Residents, Repair & Other Services	0	0	0	0.000	0.000
P	Education	1	0	0	0.000	0.000
Q	Sanitation & Social Work	0	0	0	0.000	0.000
R	Culture, Sports & Entertainment	24	3	1	12.500	4.167
S	Conglomerate	9	3	1	33.333	11.111
Total		837	180	174	21.505	20.789

Table 4

Summary statistics.

This table reports the summary statistics of variables over the full sample in Panel A and mean and median difference tests grouped by *High* in Panel B. *Std.Dev* is the ratio of the daily stock return standard deviation to the market return standard deviation. *Derivative* is an indicator with value 1 if a SOE uses derivatives, and 0 otherwise. *High* is an indicator with value 1 if a SOE has at least one large non-controlling shareholder controlled by a higher-level government with respect to its ultimate controller, and 0 otherwise. *Size* is logarithm of book assets at the end of this year. *Leverage* is book value of total debts over total book assets. *Tobin's q* is market value divided by the book value of the firm. *ROA* is net income divided by total assets. *Cash Ratio* is cash and short-term equivalents divided by book assets. *Tang* is Property, plant, and equipment (PP&E) divided by book assets. *Controlling SR* is the ownership of the controlling shareholder. *Top 10 SR* is the sum of the ownership of the Top 10 largest shareholders. *High SR* is the ownership of the higher-level government shareholder. We set this variable to zero if a SOE does not have a higher-level government shareholder.

Panel A: summary statistics of firm characteristics

Variable	*N*	Mean	SD	Median	Min	Max
Std.Dev	7662	1.997	0.813	1.819	1.084	8.735
Derivatives	7662	0.105	0.306	0	0	1
High	7662	0.128	0.334	0	0	1
Size	7662	22.390	1.286	22.260	19.670	26.510
Leverage	7662	0.523	0.202	0.532	0.077	1.008
Tobin's q	7662	1.177	1.146	0.830	0.083	7.147
ROA	7662	0.030	0.057	0.028	-0.230	0.194
Cash Ratio	7662	0.144	0.107	0.115	0.008	0.575
Tang	7662	0.460	0.319	0.416	0.004	1.396
Controlling SR	7662	0.411	0.157	0.401	0.056	0.899
Top 10 SR	7662	0.560	0.158	0.562	0.127	1.000
High SR	7662	0.015	0.044	0	0	0.368

Panel B: difference tests (by *High*)

	High SOEs			Non-High SOEs			Difference Test	
	N	Mean	Median	*N*	Mean	Median	MeanDiff	MedianDiff
Variables								
Std.Dev	980	2.004	1.757	6682	1.996	1.827	0.008	-0.070***
Derivatives	980	0.053	0	6682	0.112	0	-0.059***	0.000***
Size	980	22.490	22.440	6682	22.380	22.250	0.110**	0.190***
Leverage	980	0.512	0.513	6682	0.525	0.535	-0.013*	-0.022**
Tobin's q	980	1.089	0.773	6682	1.190	0.839	-0.101***	-0.066**
ROA	980	0.032	0.034	6682	0.030	0.028	0.002	0.006***
Cash Ratio	980	0.125	0.103	6682	0.146	0.117	-0.021***	-0.014***
Tang	980	0.538	0.527	6682	0.449	0.398	0.089***	0.129***
Controlling SR	980	0.383	0.356	6682	0.415	0.409	-0.032***	-0.053***
Top 10 SR	980	0.633	0.637	6682	0.549	0.550	0.084***	0.087***
High SR	980	0.117	0.096	6682	0	0	0.117***	0.096***

Table 5

Variations in higher-level government shareholders.

Panel A shows the ranking distribution of higher-level government shareholders in Top 10 shareholders across observations. Panel B describes the summary statistics of the ownership of higher-level government shareholders, and Panel C presents the distribution of the ownership of these shareholders.

Panel A: ranking distribution of higher-level government shareholders

Ranking	Firm-years	Pct (%)
2nd largest shareholder	718	73.265
3rd largest shareholder	189	19.286
4th largest shareholder	60	6.122
5th largest shareholder	10	1.020
6th largest shareholder	3	0.306
Total	980	100%

Panel B: summary statistics of the ownership of higher-level government shareholders

	Observations	Min	25%	Mean	Median	75%	Max	SD
Ownership	980	5.00%	7.11%	11.73%	9.64%	15.41%	36.76%	6.05

Panel C: distribution of the ownership of higher-level government shareholders

Ownership	Firm-years	Pct (%)
5%-10%	519	52.959
10%-15%	204	20.816
15%-20%	125	12.755
20%-25%	101	10.306
25%-30%	20	2.041
30%-35%	9	0.918
35%-40%	2	0.204
Total	980	100%

Table 6

The monitoring role of a higher-level government shareholder in corporate derivative use.

Table 6 reports the regression results concerning the monitoring role of a higher-level government via shareholdings. Panel A presents the overall effect of derivative use on firm risk, and Panel B shows the results of regression including the interaction term between *Derivatives* and *High*. In column (1) of Panel B, we run the Equation (1) with the full sample and compare the risk-reducing effect of High SOEs to non-High SOEs. In column (2), we exclude non-High SOEs which have at least two different government shareholders and compare the risk-reducing effect of High SOEs to that of non-High SOEs with one single government shareholder (single-government SOEs). In column (3), we exclude non-High SOEs with one single government shareholder and compare the risk-reducing effect of High SOEs to that of non-High SOEs which have at least two different government shareholders (multiple-government SOEs). The dependent variables of all columns are *Std.Dev*. *Std.Dev* is the ratio of the daily stock return standard deviation to the market return standard deviation. *Derivative* is an indicator with value 1 if a SOE uses derivatives, and 0 otherwise. *High* is an indicator with value 1 if a SOE has at least one large non-controlling shareholder controlled by a higher-level government with respect to its ultimate controller, and 0 otherwise. *Size* is logarithm of book assets at the end of this year. *Leverage* is book value of total debts over total book assets. *Tobin's q* is market value divided by the book value of the firm. *ROA* is net income divided by total assets. *Cash Ratio* is cash and short-term equivalents divided by book assets. *Tang* is Property, plant, and equipment (PP&E) divided by book assets. *Controlling SR* is the ownership of the controlling shareholder. *Top 10 SR* is the sum of the ownership of the Top 10 largest shareholders. *High SR* is the ownership of the higher-level government shareholder. We set this variable to zero if a SOE does not have a higher-level government shareholder. *t* statistics in parentheses denote two-tailed tests. *, **, and *** indicate significance at the 10%, 5% and 1% levels, respectively. The estimations correct the error structure for heteroskedasticity using the White-Huber estimator.

Panel A: the risk-reducing effect of derivative use in all sample	
	Std.Dev
Derivatives	-0.184***
	(-7.555)
Size	-0.218***
	(-15.452)
Leverage	0.389***
	(7.390)
Tobin's q	-0.030***
	(-3.004)
ROA	0.343*
	(1.878)
Cash Ratio	0.268***
	(2.604)
Tang	-0.099***
	(-3.644)
Controlling SR	-0.089
	(-0.880)
Top 10 SR	0.626***
	(5.584)
High SR	0.048
	(0.178)

Industry FE	Yes
Year FE	Yes
Constant	1.361***
	(16.020)
Observations	7662
Adjusted R^2	0.357

Panel B: the monitoring role of a higher-level government shareholder in different sample compositions

	(1)	(2)	(3)
		Std.Dev	
	High vs. non-High SOEs	High vs. single-government SOEs	High vs. multiple-government SOEs
Derivatives	-0.172***	-0.173***	-0.235***
	(-6.908)	(-6.701)	(-2.592)
High	0.065	0.071	0.045
	(1.077)	(1.170)	(0.508)
Derivatives×*High*	-0.162**	-0.159**	-0.202*
	(-2.345)	(-2.294)	(-1.756)
Size	-0.218***	-0.219***	-0.313***
	(-15.468)	(-15.042)	(-6.682)
Leverage	0.388***	0.388***	0.438**
	(7.374)	(7.159)	(2.424)
Tobin's q	-0.030***	-0.033***	-0.124***
	(-3.018)	(-3.119)	(-3.645)
ROA	0.346*	0.389**	0.665
	(1.891)	(2.045)	(1.377)
Cash Ratio	0.271***	0.254**	1.335***
	(2.627)	(2.388)	(3.609)
Tang	-0.099***	-0.106***	0.063
	(-3.628)	(-3.857)	(0.660)
Controlling SR	-0.084	-0.072	-0.087
	(-0.830)	(-0.678)	(-0.277)
Top 10 SR	0.621***	0.612***	1.395***
	(5.537)	(5.182)	(4.044)
High SR	-0.325	-0.294	-0.866
	(-0.640)	(-0.577)	(-1.512)
Industry FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Constant	1.362***	1.367***	0.818***
	(16.047)	(14.930)	(3.242)
Observations	7662	7387	1255
Adjusted R^2	0.357	0.357	0.305

Table 7

Moderating effects of perks on the monitoring role of a higher-level government shareholder.

Table 7 presents the effect of perks on the monitoring role of a higher-level government via shareholdings. Columns (1) and (2) show the regression results of Equation (1) in subsamples with low and high *Perks* in year *t*-1, separately. The dependent variables of both columns are *Std.Dev*. *Std.Dev* is the ratio of the daily stock return standard deviation to the market return standard deviation. *Derivative* is an indicator with value 1 if a SOE uses derivatives, and 0 otherwise. *High* is an indicator with value 1 if a SOE has at least one large non-controlling shareholder controlled by a higher-level government with respect to its ultimate controller, and 0 otherwise. *Perks* is the excess managerial perk consumption. *Size* is logarithm of book assets at the end of this year. *Leverage* is book value of total debts over total book assets. *Tobin's q* is market value divided by the book value of the firm. *ROA* is net income divided by total assets. *Cash Ratio* is cash and short-term equivalents divided by book assets. *Tang* is Property, plant, and equipment (PP&E) divided by book assets. *Controlling SR* is the ownership of the controlling shareholder. *Top 10 SR* is the sum of the ownership of the Top 10 largest shareholders. *High SR* is the ownership of the higher-level government shareholder. We set this variable to zero if a SOE does not have a higher-level government shareholder. *t* statistics in parentheses denote two-tailed tests. *, **, and *** indicate significance at the 10%, 5% and 1% levels, respectively. The estimations correct the error structure for heteroskedasticity using the White-Huber estimator.

	(1)	(2)
	Std.Dev	
	low $Perks_{t-1}$	high $Perks_{t-1}$
Derivatives	-0.075***	-0.265***
	(-3.004)	(-5.840)
High	0.022	0.097
	(0.475)	(0.856)
Derivatives×*High*	-0.016	-0.271***
	(-0.141)	(-3.007)
Size	-0.107***	-0.305***
	(-9.159)	(-12.646)
Leverage	0.486***	0.327***
	(8.742)	(3.799)
Tobin's q	0.054***	-0.079***
	(4.309)	(-5.599)
ROA	0.021	0.543*
	(0.100)	(1.921)
Cash Ratio	-0.033	0.369**
	(-0.404)	(2.282)
Tang	-0.005	-0.199***
	(-0.168)	(-4.435)
Controlling SR	0.002**	-0.002
	(2.034)	(-1.534)
Top 10 SR	0.000	0.010***
	(0.169)	(5.561)
High SR	-0.003	0.001
	(-0.786)	(0.107)
Industry FE	Yes	Yes

Year FE	Yes	Yes
Constant	1.368***	1.368***
	(18.149)	(9.105)
Observations	3552	4110
Adjusted R^2	0.524	0.314

Table 8

Government regulation change and monitoring role of a high-level government shareholder.

This table presents the effect of government regulation change in SOEs' derivative use. Columns (1) and (2) presents the results of subgroup analysis before and after the regulation change. The dependent variables of both columns are *Std.Dev*. *Std.Dev* is the ratio of the daily stock return standard deviation to the market return standard deviation. *Derivative* is an indicator with value 1 if a SOE uses derivatives, and 0 otherwise. *High* is an indicator with value 1 if a SOE has at least one large non-controlling shareholder controlled by a higher-level government with respect to its ultimate controller, and 0 otherwise. *Size* is logarithm of book assets at the end of this year. *Leverage* is book value of total debts over total book assets. *Tobin's q* is market value divided by the book value of the firm. *ROA* is net income divided by total assets. *Cash Ratio* is cash and short-term equivalents divided by book assets. *Tang* is Property, plant, and equipment (PP&E) divided by book assets. *Controlling SR* is the ownership of the controlling shareholder. *Top 10 SR* is the sum of the ownership of the Top 10 largest shareholders. *High SR* is the ownership of the higher-level government shareholder. We set this variable to zero if a SOE does not have a higher-level government shareholder. *t* statistics in parentheses denote two-tailed tests. *, **, and *** indicate significance at the 10%, 5% and 1% levels, respectively. The estimations correct the error structure for heteroskedasticity using the White-Huber estimator.

	(1)	(2)
	Std.Dev	
	2007-2008	2010-2011
Derivatives	-0.049	-0.115
	(-0.560)	(-1.278)
High	-0.012	0.060
	(-0.066)	(0.578)
Derivatives×High	-0.227	-0.276**
	(-1.240)	(-2.239)
Size	-0.143***	-0.186***
	(-3.627)	(-5.509)
Leverage	0.258*	0.018
	(1.743)	(0.150)
Tobin's q	-0.056**	-0.089***
	(-2.279)	(-3.833)
ROA	0.371	0.336
	(0.887)	(0.845)
Cash Ratio	1.070**	0.142
	(2.415)	(0.703)
Tang	-0.134*	-0.075
	(-1.951)	(-1.062)
Controlling SR	-0.124	-0.266
	(-0.435)	(-0.988)
Top 10 SR	0.525**	0.714**
	(1.964)	(2.242)
High SR	0.817	0.169
	(0.494)	(0.161)
Industry FE	Yes	Yes

Year FE	Yes	Yes
Constant	1.495***	2.159***
	(8.766)	(6.760)
Observations	1242	1261
Adjusted R^2	0.118	0.078

Table 9

Further analysis on higher-level government shareholders.

Table 9 reports further analysis related to government identity, relative power, rankings, ownership and investment horizon. Column (1) shows the results of regressions distinguishing High SOEs whose higher-level government shareholder is controlled by the central government from other SOEs. Column (2) shows the results of relative power between the controlling shareholder and the higher-level government shareholder. Column (3) shows the monitoring role of a higher-level government via shareholdings if it controls the second largest shareholder of the firm. Column (4) shows the monitoring role if the higher-level government shareholder's shareholding is above the median. Column (5) shows the results related with the investment horizon. The dependent variables of all columns are *Std.Dev*. *Std.Dev* is the ratio of the daily stock return standard deviation to the market return standard deviation. *Derivative* is an indicator with value 1 if a SOE uses derivatives, and 0 otherwise. *Central* equals one for High SOEs whose higher-level government shareholder is controlled by the central government, and zero otherwise. Local equals one for High SOEs whose higher-level government shareholder is controlled by a local government, and zero otherwise. *Relative Power* is the difference in the hierarchical levels of governments separately controlling the controlling shareholder and the higher-level government shareholder. *Greater* equals one if a High SOE's *Relative Power* is more than one, and zero otherwise. *Smaller* equals one if a High SOE's *Relative Power* is one, and zero otherwise. *2nd SH* equals one for High SOEs whose higher-level government controls the second largest shareholder of this SOE, and zero otherwise. *Other SH* equals one for High SOEs whose higher-level government controls other shareholders except for the second largest shareholder of this SOE, and zero otherwise. *Large SR* equals one if the shareholdings of the higher-level government shareholder in the High SOE are above the median of those of all higher-level government shareholders, shown in the Panel B of Table 5, and zero otherwise. *Small SR* equals one if the shareholdings of the higher-level government shareholder in the High SOE are below the median of those of all higher-level government shareholders, shown in the Panel B of Table 5, and zero otherwise. *Longer* equals one if the higher-level government shareholder in High SOEs is long-term, and zero otherwise. *Shorter* equals one if the higher-level government shareholder in High SOEs is short-term, and zero otherwise. *Size* is logarithm of book assets at the end of this year. *Leverage* is book value of total debts over total book assets. *Tobin's q* is market value divided by the book value of the firm. *ROA* is net income divided by total assets. *Cash Ratio* is cash and short-term equivalents divided by book assets. *Tang* is Property, plant, and equipment (PP&E) divided by book assets. *Controlling SR* is the ownership of the controlling shareholder. *Top 10 SR* is the sum of the ownership of the Top 10 largest shareholders. *High SR* is the ownership of the higher-level government shareholder. We set this variable to zero if a SOE does not have a higher-level government shareholder. *t* statistics in parentheses denote two-tailed tests. *, **, and *** indicate significance at the 10%, 5% and 1% levels, respectively. The estimations correct the error structure for heteroskedasticity using the White-Huber estimator.

	(1)	(2)	(3)	(4)	(5)
			Std.Dev		
	Government identity	Relative power	Rankings	Ownership	Investment horizon
Derivatives	-0.172***	-0.172***	-0.170***	-0.172***	-0.169***
	(-6.905)	(-6.914)	(-6.822)	(-6.905)	(-6.817)
Central	0.093				
	(1.449)				
Local	0.012				
	(0.159)				
Derivatives×Central	-0.190***				
	(-2.608)				

Derivatives×Local	-0.058				
	(-0.305)				
Greater		0.063			
		(0.966)			
Smaller		0.069			
		(0.943)			
Derivatives×Greater		-0.208**			
		(-2.448)			
Derivatives×Smallerr		-0.101			
		(-0.906)			
2nd SH			0.033		
			(0.486)		
Other SH			0.108		
			(1.463)		
Derivatives×2nd SH			-0.156**		
			(-2.038)		
Derivatives×Other SH			-0.166		
			(-1.137)		
Large SR				0.038	
				(0.308)	
Small SR				0.060	
				(0.927)	
Derivatives× Large SR				-0.171**	
				(-2.472)	
Derivatives× Small SR				-0.152	
				(-1.330)	
Longer					-0.071
					(-1.154)
Shorter					0.142**
					(2.012)
Derivatives× Longer					-0.210***
					(-2.644)
Derivatives× Shorter					-0.093
					(-0.923)
Size	-0.219***	-0.218***	-0.217***	-0.218***	-0.215***
	(-15.481)	(-15.459)	(-15.347)	(-15.465)	(-15.361)
Leverage	0.388***	0.388***	0.387***	0.388***	0.396***
	(7.367)	(7.381)	(7.357)	(7.370)	(7.500)
Tobin's q	-0.031***	-0.031***	-0.030***	-0.030***	-0.027***
	(-3.031)	(-3.026)	(-2.974)	(-3.016)	(-2.737)
ROA	0.352*	0.347*	0.344*	0.348*	0.378**
	(1.922)	(1.894)	(1.881)	(1.895)	(2.043)
Cash Ratio	0.274***	0.270***	0.273***	0.271***	0.249**
	(2.652)	(2.601)	(2.647)	(2.622)	(2.419)

Tang	-0.097***	-0.099***	-0.097***	-0.099***	-0.110***
	(-3.578)	(-3.651)	(-3.556)	(-3.622)	(-4.031)
Controlling SR	-0.089	-0.084	-0.064	-0.084	-0.068
	(-0.882)	(-0.833)	(-0.636)	(-0.831)	(-0.669)
Top 10 SR	0.624***	0.621***	0.599***	0.621***	0.607***
	(5.562)	(5.537)	(5.312)	(5.532)	(5.421)
High SR	-0.403	-0.335	-0.206	-0.185	-0.077
	(-0.801)	(-0.639)	(-0.397)	(-0.245)	(-0.151)
Industry FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Constant	1.362***	1.361***	1.364***	1.361***	1.359***
	(16.034)	(16.035)	(16.076)	(16.016)	(16.009)
Observations	7662	7662	7662	7662	7662
Adjusted R^2	0.357	0.357	0.357	0.357	0.359

Table 10

Regression results using a treatment effect model.

Table 10 presents estimates of a treatment effect model. Column (1) reports the coefficients and *t*-values from the first-stage probit regression with the dependent variable of *High*, and column (2) presents the results of the second-stage regression with the dependent variable of *Std.Dev*. *Std.Dev* is the ratio of the daily stock return standard deviation to the market return standard deviation. *Derivative* is an indicator with value 1 if a SOE uses derivatives, and 0 otherwise. *High* is an indicator with value 1 if a SOE has at least one large non-controlling shareholder controlled by a higher-level government with respect to its ultimate controller, and 0 otherwise. *Size* is logarithm of book assets at the end of this year. *Leverage* is book value of total debts over total book assets. *Tobin's q* is market value divided by the book value of the firm. *ROA* is net income divided by total assets. *Cash Ratio* is cash and short-term equivalents divided by book assets. *Tang* is Property, plant, and equipment (PP&E) divided by book assets. *Controlling SR* is the ownership of the controlling shareholder. *Top 10 SR* is the sum of the ownership of the Top 10 largest shareholders. *High SR* is the ownership of the higher-level government shareholder. We set this variable to zero if a SOE does not have a higher-level government shareholder. *t* statistics in parentheses denote two-tailed tests. *, **, and *** indicate significance at the 10%, 5% and 1% levels, respectively. The estimations correct the error structure for heteroskedasticity using the White-Huber estimator.

	(1)	(2)
	High	*Std.Dev*
Derivatives	-0.586***	-0.367**
	(-6.167)	(-2.228)
High		0.086
		(1.376)
Derivatives×*High*		-0.143**
		(-2.015)
Size	-0.049	-0.234***
	(-1.636)	(-12.473)
Leverage	0.195	0.453***
	(1.403)	(6.499)
Tobin's q	0.033	-0.019
	(1.470)	(-1.451)
ROA	-0.637	0.171
	(-1.439)	(0.715)
Cash Ratio	-0.961***	-0.048
	(-3.926)	(-0.162)
Tang	0.286***	-0.003
	(3.791)	(-0.036)
Controlling SR	-4.768***	-1.569
	(-26.003)	(-1.245)
Top 10 SR	5.288***	2.270
	(28.632)	(1.626)
High SR		-0.571
		(-1.030)
Lambda		0.389
		(1.216)

Industry FE	Yes	Yes
Year FE	Yes	Yes
Constant	-3.033***	0.098
	(-10.539)	(0.095)
Observations	7576	7576
Log-likelihood	-2267.258	
Pseudo/Adjusted R^2	0.223	0.359

Table 11

Regression results using PSM approach.

This table reports the difference tests before and after PSM and regression coefficients from OLS regression after PSM. Panel A presents the difference tests of the derivative user group and non-user group before PSM. Panel B shows the difference tests of the derivative user group and non-user group after PSM with a one-to-one with replacement matching approach, and Panel C presents the difference tests with a one-to-two with replacement matching approach. Panel D reports the coefficients and *t*-values from regressions of firm risk on *Derivatives* and *High* after PSM. Column (1) in Panel D presents the results with a one-to-one with replacement matching approach and column (2) with a one-to-two with replacement matching approach. The dependent variables in columns (1) and (2) of Panel D are *Std.Dev*. *Std.Dev* is the ratio of the daily stock return standard deviation to the market return standard deviation. *Derivative* is an indicator with value 1 if a SOE uses derivatives, and 0 otherwise. *High* is an indicator with value 1 if a SOE has at least one large non-controlling shareholder controlled by a higher-level government with respect to its ultimate controller, and 0 otherwise. *Size* is logarithm of book assets at the end of this year. *Leverage* is book value of total debts over total book assets. *Tobin's q* is market value divided by the book value of the firm. *ROA* is net income divided by total assets. *Cash Ratio* is cash and short-term equivalents divided by book assets. *Tang* is Property, plant, and equipment (PP&E) divided by book assets. *Controlling SR* is the ownership of the controlling shareholder. *Top 10 SR* is the sum of the ownership of the Top 10 largest shareholders. *High SR* is the ownership of the higher-level government shareholder. We set this variable to zero if a SOE does not have a higher-level government shareholder. *t* statistics in parentheses denote two-tailed tests. *, **, and *** indicate significance at the 10%, 5% and 1% levels, respectively. The estimations correct the error structure for heteroskedasticity using the White-Huber estimator.

Panel A: difference tests before PSM

	Derivative users			Derivative non-users			Difference tests	
Variable	*N*	Mean	Median	*N*	Mean	Median	Mean	Median
High	801	0.065	0	6861	0.135	0	0.070***	0***
Size	801	23.380	23.360	6861	22.280	22.150	-1.098***	-1.210***
Leverage	801	0.580	0.600	6861	0.516	0.520	-0.063***	-0.080***
Tobin's q	801	0.842	0.569	6861	1.216	0.865	0.374***	0.296***
ROA	801	0.030	0.027	6861	0.030	0.029	0	0.002
Cash Ratio	801	0.125	0.103	6861	0.146	0.116	0.021***	0.013***
Tang	801	0.415	0.382	6861	0.465	0.420	0.050***	0.038**
Controlling SR	801	0.403	0.400	6861	0.412	0.402	0.009	0.002
Top 10 SR	801	0.576	0.565	6861	0.558	0.561	-0.018***	-0.004
High SR	801	0.007	0	6861	0.016	0	0.009***	0***

Panel B: difference tests after PSM using a one-to-one with replacement matching approach

	Derivative users			Derivative non-users			Difference tests	
Variable	*N*	Mean	Median	*N*	Mean	Median	Mean	Median
High	801	0.065	0	665	0.081	0	0.016	0
Size	801	23.380	23.360	665	21.920	21.890	-1.458***	-1.470***

Leverage	801	0.580	0.600	665	0.576	0.585	-0.003	-0.015
Tobin's q	801	0.842	0.569	665	0.931	0.729	0.089**	0.160***
ROA	801	0.030	0.027	665	0.032	0.029	0.002	0.002
Cash Ratio	801	0.125	0.103	665	0.124	0.101	-0.001	-0.002
Tang	801	0.415	0.382	665	0.431	0.386	0.016	0.004
Controlling SR	801	0.403	0.400	665	0.404	0.406	0.001	0.006
Top 10 SR	801	0.576	0.565	665	0.572	0.576	-0.005	0.011
High SR	801	0.007	0	665	0.008	0	0.001	0

Panel C: difference tests after PSM using a one-to-two with replacement matching approach

	Derivative users			Derivative non-users			Difference tests	
Variable	*N*	Mean	Median	*N*	Mean	Median	Mean	Median
High	801	0.065	0	1221	0.075	0	0.010	0
Size	801	23.380	23.360	1221	21.970	21.920	-1.406***	-1.440***
Leverage	801	0.580	0.600	1221	0.574	0.586	-0.005	-0.014
Tobin's q	801	0.842	0.569	1221	0.938	0.743	0.096***	0.174***
ROA	801	0.030	0.027	1221	0.032	0.028	0.002	0.001
Cash Ratio	801	0.125	0.103	1221	0.128	0.103	0.003	0
Tang	801	0.415	0.382	1221	0.429	0.383	0.014	0.001
Controlling SR	801	0.403	0.400	1221	0.408	0.404	0.005	0.004
Top 10 SR	801	0.576	0.565	1221	0.573	0.577	-0.003	0.012
High SR	801	0.007	0	1221	0.008	0	0.001	0

Panel D: the monitoring role of a higher-level government shareholder after PSM

	(1)	(2)
	Std.Dev	
	one-to-one matching	one-to-two matching
Derivatives	-0.190***	-0.184***
	(-4.296)	(-5.083)
High	-0.186	0.043
	(-0.665)	(0.174)
Derivatives×High	-0.335*	-0.406**
	(-1.673)	(-2.516)
Size	-0.228***	-0.227***
	(-8.258)	(-8.725)

Leverage	0.446***	0.312**
	(2.933)	(2.536)
Tobin's q	-0.062**	-0.074***
	(-2.310)	(-3.065)
ROA	1.863***	1.614***
	(3.446)	(3.623)
Cash Ratio	0.328	0.324
	(1.323)	(1.571)
Tang	-0.137**	-0.105*
	(-2.003)	(-1.844)
Controlling SR	0.217	0.200
	(1.151)	(1.243)
Top 10 SR	0.381**	0.433***
	(2.153)	(2.776)
High SR	3.551	1.946
	(0.966)	(0.754)
Industry FE	Yes	Yes
Year FE	Yes	Yes
Constant	1.347***	1.482***
	(7.957)	(8.583)
Observations	1466	2022
Adjusted R^2	0.388	0.368

Table 12

Additional robustness tests.

This table presents the results of additional robustness tests. Columns (1) and (2) show the results with alternative proxies for firm risk. Column (3) shows the result with an alternative proxy for a higher-level government. Column (4) shows the result with the fixed effect of the ultimate controllers of SOEs. Columns (5)–(8) show the results with different thresholds of ownership. Column (9) shows the result excluding the sample in which a higher-level government and its ultimate controller are in different provinces. The dependent variables in columns (1)–(2) are *CFV*, and *adjusted CFV*, separately. The dependent variables in columns (3)–(9) are *Std.Dev*. *High* in column (3) is measured by the difference in the hierarchical levels of a SOE's ultimate controller and the higher-level government shareholder. We set this variable to zero for non-High SOEs. *High* in other columns is defined an indicator with value 1 if a SOE has at least one large non-controlling shareholder controlled by a higher-level government with respect to its ultimate controller, and 0 otherwise. *CFV* is measured by the standard deviation of operating cash flow over the forward three-year overlapping periods. *Adj CFV* is measured by the standard deviation of industry-adjusted *CFV* over the forward three-year overlapping periods. *Std.Dev* is the ratio of the daily stock return standard deviation to the market return standard deviation. *Derivative* is an indicator with value 1 if a SOE uses derivatives, and 0 otherwise. *Size* is logarithm of book assets at the end of this year. *Leverage* is book value of total debts over total book assets. *Tobin's q* is market value divided by the book value of the firm. *ROA* is net income divided by total assets. *Cash Ratio* is cash and short-term equivalents divided by book assets. *Tang* is Property, plant, and equipment (PP&E) divided by book assets. *Controlling SR* is the ownership of the controlling shareholder. *Top 10 SR* is the sum of the ownership of the Top 10 largest shareholders. *High SR* is the ownership of the higher-level government shareholder. We set this variable to zero if a SOE does not have a higher-level government shareholder. *t* statistics in parentheses denote two-tailed tests. *, **, and *** indicate significance at the 10%, 5% and 1% levels, respectively. The estimations correct the error structure for heteroskedasticity using the White-Huber estimator.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	CFV	*Adj CFV*	*Std.Dev*	*Std.Dev*	*Std.Dev*				*Std.Dev*
					No threshold	1% threshold	3% threshold	10% threshold	
Derivatives	0.003*	0.003*	-0.173***	-0.180***	-0.148***	-0.144***	-0.153***	-0.180***	-0.171***
	(1.860)	(1.789)	(-6.969)	(-7.260)	(-4.971)	(-4.830)	(-5.977)	(-7.243)	(-6.856)
High	-0.000	0.000	0.030	0.091	-0.036*	-0.059***	0.039	0.049	0.047
	(-0.182)	(0.026)	(0.869)	(1.489)	(-1.905)	(-2.772)	(0.979)	(0.397)	(0.766)
Derivatives×High	-0.018***	-0.017***	-0.101**	-0.153**	-0.077*	-0.104***	-0.242***	-0.153**	-0.151**
	(-4.143)	(-3.914)	(-2.558)	(-2.208)	(-1.868)	(-2.689)	(-4.480)	(-2.181)	(-2.177)
Size	-0.008***	-0.007***	-0.218***	-0.229***	-0.217***	-0.216***	-0.218***	-0.218***	-0.217***
	(-10.642)	(-10.466)	(-15.479)	(-15.995)	(-15.276)	(-15.198)	(-15.447)	(-15.425)	(-15.348)
Leverage	0.051***	0.049***	0.388***	0.389***	0.385***	0.385***	0.390***	0.389***	0.387***

	(12.933)	(12.437)	(7.364)	(7.402)	(7.305)	(7.332)	(7.408)	(7.400)	(7.328)
Tobin's q	0.006***	0.006***	-0.030***	-0.033***	-0.030***	-0.030***	-0.030***	-0.030***	-0.029***
	(7.270)	(7.588)	(-3.011)	(-3.225)	(-3.005)	(-2.987)	(-2.955)	(-3.003)	(-2.897)
ROA	-0.016	-0.021	0.348*	0.414**	0.336*	0.346*	0.340*	0.342*	0.339*
	(-0.976)	(-1.285)	(1.901)	(2.257)	(1.842)	(1.898)	(1.864)	(1.874)	(1.833)
Cash Ratio	0.023***	0.021***	0.268***	0.258**	0.261**	0.266**	0.262**	0.266***	0.262**
	(4.054)	(3.746)	(2.600)	(2.507)	(2.532)	(2.574)	(2.543)	(2.582)	(2.541)
Tang	-0.001	-0.000	-0.100***	-0.103***	-0.100***	-0.099***	-0.100***	-0.098***	-0.097***
	(-0.426)	(-0.155)	(-3.662)	(-3.751)	(-3.658)	(-3.652)	(-3.683)	(-3.602)	(-3.553)
Controlling SR	0.014***	0.015***	-0.084	-0.144	-0.001	-0.001	-0.001	-0.001	-0.086
	(3.024)	(3.464)	(-0.834)	(-1.385)	(-1.130)	(-1.237)	(-1.157)	(-1.116)	(-0.843)
Top 10 SR	0.003	-0.001	0.621***	0.634***	0.007***	0.007***	0.007***	0.007***	0.619***
	(0.656)	(-0.179)	(5.539)	(5.621)	(5.841)	(5.866)	(5.861)	(5.781)	(5.478)
High SR	-0.017	-0.020	-0.159	-0.499	0.001	0.003	-0.003	-0.004	-0.255
	(-0.943)	(-1.178)	(-0.390)	(-0.980)	(0.242)	(0.890)	(-0.851)	(-0.491)	(-0.496)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ultimate Controller FE	No	No	No	Yes	No	No	No	No	No
Constant	0.020***	0.024***	1.360***	1.128***	1.370***	1.373***	1.354***	1.356***	1.365***
	(3.314)	(3.940)	(16.009)	(11.006)	(16.160)	(16.227)	(15.897)	(15.907)	(16.073)
Observations	7000	7000	7662	7662	7662	7662	7662	7662	7625
Adjusted R^2	0.190	0.188	0.357	0.359	0.357	0.358	0.357	0.356	0.354

Appendix A. Relevant government policies of corporate risk management

A1. Regulation of corporate risk management in SOEs

"…Comprehensive risk management in enterprises is a very important task, which is related to the preservation and appreciation of state-owned assets, and the sustainable, healthy and stable development of enterprises. In order to guide enterprises in the implementation of comprehensive risk management, further improve their management level, enhance their competitiveness, and promote their steady development, we formulate the Guidelines for Comprehensive Risk Management in Central State-owned Enterprises"…", as documented in the Guidelines for Comprehensive Risk Management in Central State-owned Enterprises, which was issued by the central SASAC in June 2006.

"…In order to ensure and promote the sustainable, healthy and steady development of municipal state-owned economy, promote the construction of a comprehensive risk management system for municipal state-owned enterprises, and execute relevant comprehensive risk management task, we issue this guideline in accordance with the Guidelines for Comprehensive Risk Management in Central State-owned Enterprises…", as documented in the Guideline for Comprehensive Risk Management in Shenzhen State-owned Enterprises, which was issued by the Shenzhen SASAC in March 2009.

A2. Regulation of corporate derivative use in SOEs

"…How to correctly understand and employ financial derivative instruments, and strengthen the risk management and control of financial derivative transactions is …an important issue faced by state-owned asset regulatory agencies at various levels…(the central SASAC) will gradually establish the supervision system of high-risk investment, effectively strengthen the supervision of high-risk investment…", as documented in the speech of Rong Li, director of the central SASAC, in October 2006.

"…In order to further strengthen the supervision of financial derivatives in central state-owned enterprises, establish an effective mechanism of risk prevention, and realize the stable operation, we hereby issue the requirements as follows…2. Strictly implement the approval procedures…3. Strictly obey the hedging principle…4. Effectively manage and control the risk…", as documented in the Notice of Further Strengthening Supervision over Financial Derivatives in Central State-owned Enterprises from SASAC, which was issued by the central SASAC in February 2009.

"…The main scope of 'three important and one large' issues includes… arrangements for important projects…such as…options, futures and other financial derivatives", as documented in the Opinions on Further Promoting the Implementation of the 'Three Important and One Large' Decision-making Policy for State-owned Enterprises, which was issued by the General Office of the Central Committee of the Communist Party of China and the General Office of the State Council in July 2010.