



## Directors and officers liability insurance and maturity mismatch: evidence from China

Yunxi Tang, Kung-Cheng Ho, Ji (George) Wu, Liping Zou & Shouyu Yao

**To cite this article:** Yunxi Tang, Kung-Cheng Ho, Ji (George) Wu, Liping Zou & Shouyu Yao (2023) Directors and officers liability insurance and maturity mismatch: evidence from China, *Applied Economics*, 55:32, 3747-3765, DOI: [10.1080/00036846.2022.2117782](https://doi.org/10.1080/00036846.2022.2117782)

**To link to this article:** <https://doi.org/10.1080/00036846.2022.2117782>



Published online: 09 Sep 2022.



Submit your article to this journal [↗](#)



Article views: 456



View related articles [↗](#)



View Crossmark data [↗](#)



Citing articles: 14 View citing articles [↗](#)



# Directors and officers liability insurance and maturity mismatch: evidence from China

Yunxi Tang<sup>a</sup>, Kung-Cheng Ho<sup>b</sup>, Ji (George) Wu<sup>c</sup>, Liping Zou<sup>d</sup> and Shouyu Yao<sup>d</sup>

<sup>a</sup>School of Finance, Southwestern University of Finance and Economics, Chengdu, China; <sup>b</sup>Pearl River Delta Collaborative Innovation Center of Scientific Finance and Industry, Guangdong University of Finance & Economics, Guangzhou, China; <sup>c</sup>School of Economics and Finance, Massey Business School, Massey University, Auckland, New Zealand; <sup>d</sup>College of Management and Economics, Tianjin University, Tianjin, China

## ABSTRACT

We investigate the impact of the purchase of Directors' and Officers' liability insurance (D&O insurance) on a firm's risk-taking behaviour in China, measured by the firm's maturity mismatch ratio. Using a unique manually collected dataset, we find a significant positive relationship between a firm's purchase of D&O insurance and the firm's maturity mismatch ratio, which supports the moral hazard theory. The mechanisms of our main finding are corresponding internal and external monitoring, in which the main finding is only significant for firms under weak monitoring. Our result remains significant after employing several approaches to alleviate potential endogeneity concerns, including an alternative sample and the sensitivity test model. Our paper sheds some extra light on the issue related to D&O insurance in a country with inadequate internal supervision and weak investor protection and the determinant of a firm's maturity mismatch ratio.

## KEYWORDS

Directors' and officers' liability insurance; maturity mismatch; moral hazard effect; China

## JEL CLASSIFICATION

G14; G22; G3

## 1. Introduction

Directors' and Officers' liability insurance (D&O insurance) is designed to provide senior corporate executives with cover for costs involved with potential legal actions arising from their duties. D&O insurance is closely related to corporate governance, corporate law, and the fiduciary duty owed to the firm's shareholders. According to the Chinese Banking and Insurance media report,<sup>1</sup> nearly 100% of listed firms in the U.S. and nearly 90% of listed firms in Europe purchase D&O insurance for their senior corporate executives. It has not been paid enough attention in China since its introduction in 2002. Less than 10% of Chinese listed A-share firms purchase it until nowadays (Hu and Fang 2022). It has recently become a hot topic in China due to the newly revised Securities Law, the accelerated implementation of the securities registration system, especially the Luckin Coffee fraud incident<sup>2</sup> in 2020.

Over the years, a significant controversy persists among academics regarding whether D&O insurance (as a tool to hedge the performance risk) plays

specific governance roles for listed companies. On the one hand, Gutierrez (2003) concludes that D&O insurance can help lift the performance pressure, so that top executives do not necessarily have to take a high investment and financing risk. Furthermore, the D&O insurance serves a supervisory role for senior executives' behaviour in the auditing process (Yuan, Sun, and Cao 2016; Zeng 2017; Hwang and Kim 2018). Consequently, D&O insurance should significantly reduce a firm's risk-taking behaviour. On the other hand, a few studies document that when top executives are lifted from the pressure on the firm's performance and potential legal risks, it may create more moral hazard problems, thus detrimental to the operation of the firm (Christian 2011; Lin, Officer, and Zou 2011; Lin et al. 2013; Darrough, Kim, and Zur 2019; Jia and Tang 2018). Consequently, the opportunism hypothesis suggests that purchasing D&O insurance may not play a corresponding governance role, resulting in more maturity mismatch. Recent studies explore the governance effectiveness of D&O insurance regarding earnings management

**CONTACT** Shouyu Yao  [yaosy@tju.edu.cn](mailto:yaosy@tju.edu.cn)  College of Management and Economics, Tianjin University, Tianjin, 300072 China

<sup>1</sup>China Banking and Insurance news, [https://xw.sinoin.com/2020-05/20/content\\_344541.htm](https://xw.sinoin.com/2020-05/20/content_344541.htm), 27 May 2020.

<sup>2</sup>Insurance Asia News, <https://insuranceasianews.com/trackingthe-rise-of-do-liability-in-china/>, 25 May 2020.

(Boyer and Tennyson 2015), audit pricing (Chung, Hillegeist, and Wynn 2015), cost of equity (Chen, Li, and Zou 2016), stock price crash risk (Yuan, Sun, and Cao 2016), firm value (Hwang and Kim 2018), as well as independent director behaviour (Jia and Tang 2018).

The effect of D&O insurance on a firm's performance and corporate governance practice has recently become an exciting research topic in China. Yuan, Sun, and Cao (2016) find that firms purchasing D&O insurance have a lower probability of stock price crash risk in China. The authors argue that D&O insurance improves a firm's corporate governance and thus reduces the problem of information opacity. Li, Yang, and Zhu (2022) also argue that purchasing D&O insurance does not create moral hazard problems and exacerbates agency problems for Chinese firms. Meng et al. (2022) find that managers protected by D&O insurance could generate higher stock returns upon acquisition announcements and better operating performance post-acquisition in China. The result suggests purchasing D&O insurance effectively monitors managers' engagement in firms and deters empire-building acquisitions. However, Jia and Tang (2016) present opposite evidence and argue that purchasing D&O insurance reduces the effectiveness of a firm's independent directors in corporate governance and lowers the effort of independent directors, indicating a moral hazard problem for independent directors. Wang et al. (2022) find that purchasing D&O insurance reduces firms' labour investment efficiency and increases the over-hiring problem for Chinese firms. Wang's et al. (2022) findings indicate that purchasing D&O insurance increases managerial empire-building tendencies and worsens the agency problems for Chinese firms. However, little has been done on the governance effect of D&O insurance on a firm's investment and financing decision-making, which is an essential manifestation at the governance level. This paper aims to fill some of these gaps in the existing literature to answer an important question: whether purchasing D&O insurance can be used to mitigate the risk-taking behaviour of top executives when making investment and finance decisions for listed firms in China?

We measure top executives' risk-taking behaviour by a firm's maturity mismatch of investment and financing activities, in which a firm uses more short-term debts to support long-term investment activities (Morris 1976; Diamond 1991; Acharya, Gale, and Yorulmazer 2011; Wang, Wang, and Chen 2021). Literature has a comprehensive study on the maturity mismatch in the banking sector, but the problem has been neglected in the non-financial sectors. Literature elaborates on the importance of term-matching theory from different perspectives, such as agency cost (Myers 1977), interest rate risk (Weinstein and Yafeh 1998), and difficulty encountered in the debt negotiation process (Hart and Moore 1994). Recently, Chen et al. (2019) documented that the maturity mismatch phenomenon is widespread globally according to a dataset of 46 countries. They indicate that the maturity mismatch behaviour aggravates the operational risks and reduces investment efficiency, affecting firms' long-term performance. Particularly in China, Wang, Wang, and Chen (2021) find that Chinese firms are more likely to use short-term debt to finance their long-term investment, resulting in a severe maturity mismatch problem from 1998 to 2019.

As for the driving force behind the maturity mismatch, Wang, Wang, and Chen (2021) reveal that the causes of a firm's maturity mismatch may come from both the supply and demand sides. On the supply side, the literature suggests that most Chinese firms have narrow external financing channels to borrow long term, resulting in severe financial constraints. Fan, Titman, and Twite (2012) summarized that the Chinese corporate bond market is underdeveloped; thus, Chinese firms lack long-term financing channels. As a result, Chinese firms have to adopt maturity mismatches when they cannot borrow long-term funds. This is called the 'passive mismatch view'. On the demand side, Chen et al. (2019) reveal that two factors mainly cause the active maturity mismatch view at the firm level. First, managers are under enormous pressure on their performance due to the firm's external financing constraints. In order to lower the cost of debt and thus maximize firm value, they may be forced to borrow short-term debt to finance the long-term investment, resulting in a significant maturity mismatch

phenomenon and increasing the firm's liquidity risk. In addition, prior literature has documented that the aggressive investment and financing strategy (defined as maturity mismatch) induces a shorter debt cycle relative to the investment horizon. This may result in the related investment activity having insufficient cash flows, thus magnifying the debt repayment pressure and intensifying the operational risks (Diamond 1991; Acharya, Gale, and Yorulmazer 2011). Consequently, the maturity mismatch is considered a risk-taking behaviour undertaken by firms.<sup>3</sup> Second, the managers lack appropriate supervision, leading to potential moral hazards and aggressive use of short-term debts for corporate expansion. Wang, Wang, and Chen (2021) find that Chinese firms actively borrow short-term debt to finance long-term investments as these firms do not have borrowing constraints. This

We examine the relationship between a firm's purchase of D&O insurance and its maturity mismatching behaviour in China for the following three reasons. First, China's internal and external corporate governance mechanisms are inefficient and lack adequate supervision, with few independent directors, external auditing mechanisms, and weak investor protection.<sup>4</sup> On the one hand, developing the D&O insurance may help introduce more external supervision to complement and strengthen the existing governance practices. On the other hand, introducing D&O insurance in a poor corporate governance environment may deter the effect of legal proceedings, which may further induce executives to engage in more risk-taking behaviours (Nartea et al., 2017; Zardkoohi et al. 2018). Second, it is imperative to understand the governance effects on the risk-taking behaviour of maturity mismatch in the deleveraging contexts during China's financial market development. From the formation mechanism of maturity mismatch behaviour, external financing constraints and other policy constraints are potential reasons

for the behaviour, other reasons include the lack of better capital management plans, and a risk prevention consciousness may also emerge. Third, China has an underdeveloped long-term bond market compared to the developed capital markets, resulting in an insufficient long-term corporate debt supply. This may cause Chinese firms to have a more significant maturity mismatch problem than their western peers. Understanding the determinant of the maturity mismatch for Chinese firms should be meaningful to investors, practitioners, firms, and policymakers. Therefore, China provides an exciting platform to investigate the governance effectiveness of D&O insurance on a firm's risk-taking behaviour.

Using a unique manually collected dataset in China, our results show that the maturity mismatch phenomenon is more robust for firms purchasing D&O insurance, supporting the opportunism hypothesis and the moral hazard theory. Moreover, we find that the characteristics of D&O-insured firms are having high financial leverage, more state ownership, and usually cross-listing in more stock markets. Our results also indicate that large firms, firms with a long history, and firms with more institutional investors have a lower level of maturity mismatch. We perform several tests to alleviate the potential endogeneity concerns in our main finding, i.e. the Heckman two-stage regression, the PSM approach, and the firm-fixed effect model, and our main findings remain significant. More importantly, the mechanisms behind our main finding are corresponding internal and external monitoring, measured by employing the Big 4 auditors, the analysts' coverage ratio, and the large shareholder holding ratio. Our main finding is only significant to firms without the Big 4 auditors, with low analysts' coverage ratio and lower large shareholder holding ratio. Overall, these results suggest that the effect of purchasing D&O insurance and the firm's risk-taking behaviour only exists for firms with weak monitoring. Finally, our results

<sup>3</sup>Bai, Qiu, and Wei (2016) also document that the maturity mismatch behaviour conceals plenty of potential risks, especially during the recession. Once the bank tightens its credit policy, firms will experience significant difficulties in repaying their debt obligations, resulting in a liquidity crisis.

<sup>4</sup>For internal governance, the board of supervisors, independent directors, and institutional investors can theoretically exert corresponding governance effectiveness. However, in fact, some of China's listed companies' supervisory boards and independent directors are ineffective (Tang, Du, and Hou 2013). In addition, due to the small number of institutional holdings, its effectiveness is relatively limited. Therefore, the governance effects of the three internal controls have not achieved an ideal situation (Tang, Du, and Hou 2013; Jiang and Kim 2015). Lastly, from the perspective of relevant external governance, external auditing and investor protection as per the law also demonstrate major flaws (Zou et al. 2008; Chen, Chen, and Wei 2009; Yuan, Sun, and Cao 2016).

are robust by using an alternative sample and proxies of a firm's risk-taking behaviour and performing the sensitivity test model.

This paper contributes to the existing literature in two aspects. First, to the best of our knowledge, this is the first paper to examine the impact of a firm's purchase of D&O insurance and the firm's maturity mismatching behaviour in China. Existing literature suggests that the of the firm's maturity mismatch are agency cost, interest rate risk, and difficulty in the debt negotiation process. Wang, Wang, and Chen (2021) conclude that the maturity mismatch phenomenon in China is due to the active mismatch view, in which firms with severe maturity mismatch have little financial constraints. Our results further explore the reasons behind Wang's, Wang, and Chen (2021) finding by presenting a new factor determining a firm's usage of maturity mismatch. We argue that managers' moral hazard behaviour causes the firm's maturity mismatch due to the internal and external absence of supervision. The explanation is from the aspects of corporate governance, corporate law, and the fiduciary duty owed to the firm's shareholders. Therefore, our study expands investors' and academics' understanding of the determinant of a firm's maturity mismatch.

Second, our paper empirically supports the central controversy of the effect of purchasing D&O insurance on firms' corporate governance practices. The monitoring hypothesis argues that purchasing D&O insurance strengthens the external monitoring of the firm, resulting in insured managers being more diligent and avoiding short-sighted behaviour (Core 1997; Yuan, Sun, and Cao 2016). In contrast, the opportunism hypothesis suggests that purchasing D&O insurance increases managers' opportunistic behaviour due to excessive protection, such as empire building and moral hazard behaviour (Lin, Officer, and Zou 2011; Jia and Tang 2018). We present new evidence to support the opportunism hypothesis: purchasing D&O insurance increases a firm's maturity mismatching behaviour in China. This is especially significant due to emerging markets' poor corporate governance and legal environment.

The remainder of this paper is organized as follows. Section II develops our main research

hypotheses. Section III discusses our research methodologies and data sources. Section IV reports our empirical results, and Section V concludes.

## II. Hypothesis development

Prior literature has not yet agreed on the effects of D&O insurance mechanisms on corporate governance. Two contradictory views exist regarding how D&O insurance affects the phenomenon of maturity mismatch. The monitoring hypothesis argues that D&O insurance may mitigate a firm's risk-taking behaviour, i.e. the firm's maturity mismatch, as many believe D&O insurance can lift the pressure on senior executives' performance, which leads them to adopt long-term and consistent strategies (Gutierrez 2003). Thus, D&O insurance helps to mitigate the firm's maturity mismatch.

In addition, purchasing D&O Insurance can play a corresponding corporate governance role (Holderness 1990; Core 2000). Specifically, Holderness (1990) documents that, before insurance companies decide to underwrite, they exercise detailed due diligence on the insured company and comprehensively assess its financial and governance status. The premium is then determined accordingly. When a manager makes a claim, the insurance company formally investigates the manager's behaviour. The insurance company also conducts a comprehensive reassessment before any further renewal. Therefore, the insurance company can be an external governance mechanism and regularly conduct comprehensive inspections and corporate governance evaluations for listed firms with D&O insurance. As a result, D&O insurance can play a supervisory role for directors and executives. Other findings also support the risk-reduction effects of D&O insurance on a firm's performance, for example, the reduction in stock price crash risk by Yuan, Sun, and Cao (2016), better accounting practices by Zeng (2017) and favourable corporate directors by Hwang and Kim (2018).

From the above analysis, we can see that D&O insurance can relieve the performance pressure of the management on the one hand, and on the other hand, it can exert supervision on the management. As maturity mismatch is



high-risk behaviour, we argue that a firm's purchase of D&O insurance can reduce the occurrence of such high-risk behaviour. Therefore, we propose our first hypothesis:

**Hypothesis 1a:** *The purchase of D&O insurance mitigates the maturity mismatch behaviour.*

An alternative view is that D&O insurance may aggravate the maturity mismatch phenomenon. Under the opportunism hypothesis and the moral hazard theory, introducing D&O insurance considerably lowers the responsibility of managers and lessens their legal requirements (Christian 2011; Darrrough, Kim, and Zur 2019). Therefore, the D&O insurance may motivate opportunistic behaviour and induce moral hazard among managers. For example, Lin, Officer, and Zou (2011) and Lin et al. (2013) document that D&O insurance results in higher equity costs and lower stock returns. Li and Liao (2014) conclude that, after purchasing D&O insurance, excessive investment behaviour dramatically reduces the firm's investment efficiency. In addition, Kim (2015) suggests that buying D&O insurance is associated with increased risk-taking behaviour in financial reporting. Similarly, Jia and Tang (2018) document that D&O insurance reduces the responsibility of listed firms' independent directors and weakens the governance effects of independent directors. Therefore, unlike developed capital markets, China and other emerging markets confront more moral hazards due to their relatively weaker legal environment.

As for maturity mismatch, Chen et al. (2019) argue that the managers lack appropriate supervision, leading to potential moral hazard and aggressive use of short-term debts for corporate expansion. Combining the above moral hazard theory of D&O insurance and the weaker legal environment of China, we argue that D&O insurance may aggravate the maturity mismatch phenomenon. We thus propose the following competitive hypothesis:

**Hypothesis 1b.** *The purchase of D&O insurance aggravates the maturity mismatch behaviour.*

### III. Data and methodology

#### *Sample selection and data sources*

Our sample contains all firms listed on the Shanghai Stock Exchange and the Shenzhen Stock Exchange from 2002 to 2019. We selected 2002 as the first year of our sample period because the first D&O insurance occurred in 2002. We manually collect information on D&O insurance in the disclosure documents from the shareholders' general meeting and/or the board of directors announcements for firms who have purchased D&O insurance. In addition, we supplement our data from firms' annual reports. We also eliminate all financial firms, firms with missing data, Special Treatment (ST) and Particular Transfer (PT) firms from our original sample. Our sample contains 1,845 firm-year observations with 267 D&O-insured firms.

Following D'Mello and Shroff (2000), Zou et al. (2008), and Yuan, Sun, and Cao (2016), we use a matched control sample method to construct our final sample. Specifically, we identify an alternative sample using the methodology documented in Yuan, Sun, and Cao (2016), matching each observation from the insured-firm sample by industry, year, and firm size. We, therefore, obtain 1,845 firm-year observations for our alternative sample,<sup>5</sup> with a total of 3,690 firm-year observations in our final sample. All accounting and financial data used in this paper are obtained from the China Stock Market and Accounting Research (CSMAR) database and the Wind database for the same period. We winsorize all variables at 1% on both tails.

#### *Variable definition*

##### *Dependent variable: maturity mismatch index*

Maturity mismatch documented in Chen et al. (2019) is when firms use short-term debts to finance their long-term investment projects. Thus, maturity mismatch represents a gap between the long-term investment expenditure and the long-term financing. We follow prior literature and use the capital gap to measure the degree of maturity mismatch (Frank and Goyal 2003; Bharath, Pasquariello, and Wu 2009; Pan et al. 2015;

<sup>5</sup>This matching is done through a 1:1 matching, we also undertake 1:2, 1:3 matching, as alternative samples.

Zhong, Chen, and Zhang 2016; Chen et al. 2019). Specifically, we calculate the Maturity Mismatch Index (MMI) using the following equation, documented in Chen et al. (2019):

$$\begin{aligned} & \text{Maturity Mismatch Index (MMI)} \\ &= \frac{\text{Long-term investment expenditures} - \text{Long-term financing}}{\text{Long-term assets}} \end{aligned} \quad (1)$$

A greater MMI indicates a more substantial maturity mismatch for a firm. In Equation (1), the numerator is defined as the long-term financing gap. It is calculated using Equation (2) below, following Frank and Goyal (2003) and Xiao and Li (2019):

$$\begin{aligned} & \text{Long-term financing gap} \\ &= \text{Long-term investment expenditures} - \text{Long-term financing} \\ &= \text{cash expenditure on purchase and construction of fixed assets} \\ &\quad - \left( \begin{aligned} & \text{increase of long-term debts in the current period} + \\ & \text{increase of equity in the current period} + \\ & \text{net operating cash flows in the current period} + \\ & \text{cash flow from the sale of fixed assets} \end{aligned} \right) \end{aligned} \quad (2)$$

#### Independent variable: the purchase of D&O insurance

Our primary independent variable is a dummy variable which equals one if a firm purchases D&O insurance in year  $t$  and zero otherwise.

#### 3.2.3. Control variables

To prevent the potential confounding effects, following Lin et al. (2013) and Jia and Tang (2018), we control for factors that may affect maturity mismatch, including the firm's size (*SIZE*), the firm's age (*LAGE*), whether the firm is a state-owned enterprise (*SOE*), the firm's leverage (*LEV*), the institutional investor ratio (*INST*), the fixed asset ratio (*F.A.*), the proportion of independent directors in the board (*INDEP*), whether a firm has a violation record in year  $t$  (*VIOLATION*), the ratio of the sum of the shareholdings held by the second to the fifth largest shareholders scaled by the shareholdings held by the largest shareholder (*BALANCE*), whether a firm issues B-share or H-

share (*CROSSLIST*) and among others. A detailed variable description is presented in Appendix Table A1.

## IV. Empirical results and analysis

### Descriptive statistics and correlation matrix

Table 1 presents summary statistics for all variables. The full sample is reported in Panel A, the D&O insured firms reported in Panel B, and the alternative matched sample (uninsured firms) in Panel C. The average *MMI* are  $-0.095$ ,  $-0.081$ , and  $-0.109$  in Panels A, B, and C, respectively. This suggests that the maturity mismatching is more pronounced for D&O insured firms, with an *MMI* of  $-0.081$  compared to  $-0.109$  for uninsured firms. In addition, we find that 64.3% of firms in the whole sample are state-owned, with 70.0% from the D&O insured firm sample and 58.6% from the uninsured firm sample. The leverage ratio is 51.9% in Panel A, 53.4% in Panel B, and 50.5% in Panel C, indicating slightly aggressive leverage for the D&O-insured firms. Institutional investors represent 57.7% of our overall sample, with 60.2% and 55.2% for the D&O insured and uninsured firms. The *proportion of independent directors*, *Shareholding Concentration*, and *Fixed Asset Ratio* is similar across our sample firms. Our results align with previous studies (Zou et al. 2008; Zhong, Chen, and Zhang 2016; Jia and Tang, 2016).

Table 2 presents the diagonal correlation matrix, including Spearman's (above) and Pearson's (below) correlation estimates. The results from these two correlation coefficients are similar, with a relatively low correlation between D&O and other control variables, suggesting the multicollinearity issue on the cross-sectional regression is less of a concern.

### Main results

Our main research question is whether D&O insurance can alleviate the maturity mismatch phenomenon for Chinese firms. First, we use a 1:1 matching sample<sup>6</sup> to examine the relationship between D&O insurance and maturity mismatch by using Equation (3). We then extend our matching to

<sup>6</sup>We apply a matched control sample approach following the methods documented in D'Mello and Shroff (2000), Zou et al. (2008), and Yuan, Sun, and Cao (2016).

**Table 1.** Descriptive statistics.

Variable	Mean	STD	Q1	Median	Q3	Obs.
Panel A: Overall Sample						
<i>MMI</i>	−0.095	0.236	−0.137	−0.056	0.011	3,690
<i>D&amp;O</i>	0.500	0.500	0.000	0.500	1.000	3,690
<i>SIZE</i>	23.096	1.673	21.854	22.926	24.248	3,690
<i>LEV</i>	0.519	0.206	0.370	0.542	0.676	3,690
<i>LAGE</i>	2.836	0.390	2.621	2.917	3.119	3,690
<i>SOE</i>	0.643	0.479	0.000	1.000	1.000	3,690
<i>FA</i>	0.251	0.193	0.088	0.208	0.390	3,690
<i>INST</i>	0.577	0.224	0.423	0.608	0.754	3,690
<i>INDEP</i>	0.371	0.058	0.333	0.353	0.400	3,690
<i>BALANCE</i>	−1.017	0.006	−1.019	−1.015	−1.012	3,690
<i>VIOLATION</i>	0.676	0.468	0.000	1.000	1.000	3,690
<i>CROSSLIST</i>	0.207	0.405	0.000	0.000	0.000	3,690
Panel B: D&O Insured Firms Sample						
<i>MMI</i>	−0.081	0.220	−0.124	−0.050	0.012	1,845
<i>D&amp;O</i>	1.000	0.000	1.000	1.000	1.000	1,845
<i>SIZE</i>	23.093	1.634	21.855	22.930	24.299	1,845
<i>LEV</i>	0.534	0.200	0.401	0.555	0.679	1,845
<i>LAGE</i>	2.889	0.358	2.703	2.968	3.148	1,845
<i>SOE</i>	0.700	0.459	0.000	1.000	1.000	1,845
<i>FA</i>	0.249	0.193	0.085	0.207	0.390	1,845
<i>INST</i>	0.602	0.211	0.443	0.625	0.776	1,845
<i>INDEP</i>	0.374	0.057	0.333	0.364	0.429	1,845
<i>BALANCE</i>	−1.017	0.006	−1.020	−1.016	−1.012	1,845
<i>VIOLATION</i>	0.618	0.486	0.000	1.000	1.000	1,845
<i>CROSSLIST</i>	0.315	0.465	0.000	0.000	1.000	1,845
Panel C: D&O Uninsured Firms Sample						
<i>MMI</i>	−0.109	0.249	−0.149	−0.062	0.010	1,845
<i>D&amp;O</i>	0.000	0.000	0.000	0.000	0.000	1,845
<i>SIZE</i>	23.024	1.549	21.854	22.916	24.216	1,845
<i>LEV</i>	0.505	0.211	0.347	0.528	0.673	1,845
<i>LAGE</i>	2.781	0.408	2.546	2.860	3.079	1,845
<i>SOE</i>	0.586	0.493	0.000	1.000	1.000	1,845
<i>FA</i>	0.252	0.194	0.093	0.209	0.390	1,845
<i>INST</i>	0.552	0.234	0.402	0.587	0.734	1,845
<i>INDEP</i>	0.368	0.058	0.333	0.333	0.400	1,845
<i>BALANCE</i>	−1.016	0.005	−1.019	−1.015	−1.012	1,845
<i>VIOLATION</i>	0.735	0.441	0.000	1.000	1.000	1,845
<i>CROSSLIST</i>	0.099	0.298	0.000	0.000	0.000	1,845

This table reports descriptive statistics of the variables used in the main tests from 2002 to 2019. The variables include Maturity mismatch index (*MMI*), D&O insurance (*D&O*), firm's size (*SIZE*), firm's leverage (*LEV*), firm's age (*LAGE*), State-Owned Enterprise firm (*SOE*), fixed asset ratio (*FA*), institutional investor ratio (*INST*), the proportion of independent directors (*INDEP*), the ratio of the sum of the shareholdings held by the second to the fifth-largest shareholders (*BALANCE*), violation record (*VIOLATION*), firms with cross-listing (*CROSSLIST*). All continuous variables are winsorized at the top and bottom one percentile. Each of the variables is defined in Appendix A1.

1:2, 1:3, and with the full sample. We also control the industry and time-fixed effects in our panel regression for heterogeneity issues (Ho et al. 2019). Specifically, our model is specified as the following:

$$\begin{aligned}
 MMI_{i,t} = & \beta_0 + \beta_1 D\&O_{i,t} + \beta_2 SIZE_{i,t} + \beta_3 LEV_{i,t} \\
 & + \beta_4 LAGE_{i,t} + \beta_5 SOE_{i,t} + \beta_6 FA_{i,t} \\
 & + \beta_7 INST_{i,t} + \beta_8 INDEP_{i,t} \\
 & + \beta_9 BALANCE_{i,t} + \beta_{10} VIOLATION_{i,t} \\
 & + \beta_{11} CROSSLIST_{i,t} + Year + Industry \\
 & + \varepsilon_{i,t}
 \end{aligned}
 \quad (3)$$

Table 3 presents the results from our baseline regressions. The coefficient on *D&O* in column (1) is 0.023, which is statistically significant at the 1%

level, indicating that purchasing D&O insurance increases firms' maturity mismatch, supporting our hypothesis H1b. We also use several alternative samples to perform Equation (3), for example, the 1:2 matching sample in column (2), the 1:3 matching sample in column (3), and the entire sample in column (4). The coefficients on *D&O* are all positive and statistically significant at the 5% level, indicating that our baseline results are robust.

For the control variables in column (1), the coefficients on *Size*, *LAGE*, and *INST* are negative and statistically significant at the 1% level. These suggest that large firms, firms with a long history, and firms with more institutional investors have a lower maturity mismatch. These findings are not surprising because large mature firms and firms with more institutional investors are easier to access the capital



Table 2. Correlation matrix.

	D&O	MMI	SIZE	LEV	LAGE	SOE	FA	INST	INDEP	BALANCE	VIOLATION	CROSSLIST
D&O												
MMI	0.059***											
SIZE	0.021	0.057***										
LEV	0.071**	-0.060***	0.017									
LAGE	0.140***	0.173***	-0.111***									
SOE	0.119***	0.004	0.404**	0.093***								
FA	-0.008	0.058**	0.129***	0.213**	-0.075***							
INST	0.110***	0.069***	0.313**	-0.038**	-0.130***	0.119***						
INDEP	0.048***	-0.124***	0.065***	0.113**	-0.108***	0.028**	0.007					
BALANCE	-0.067***	0.025	0.155***	0.056***	-0.027*	0.403***	0.171**	0.095***				
VIOLATION	-0.125***	0.038**	0.032**	0.090***	-0.115***	0.010	-0.063***	-0.187***	0.060***			
CROSSLIST	0.268***	0.013	-0.030*	-0.025	-0.015	-0.276***	-0.080***	0.369***	-0.032***	-0.072***		
		0.011	0.405***	0.107***	0.036**	0.271***	0.146**	0.145***	0.029	0.002**	-0.125***	0.268***
										0.061*	0.061*	-0.032
										0.027*	-0.035*	0.396***
										0.078**	-0.019	0.103***
										-0.128***	0.009	0.049***
										0.240**	-0.276**	0.271***
										0.064***	-0.077***	0.127***
										0.026***	-0.118***	0.417***
										-0.001*	0.086***	0.101***
											-0.204***	-0.194***
												-0.110***

This table reports the time-series average of the cross-sectional Spearman's (above diagonal) and Pearson's (below diagonal) correlation estimates. All variables are defined in Table A1. \*\*\*, \*\*, \* denote statistical significance at 1%, 5%, and 10%.

**Table 3.** Baseline regression.

	1:1 matching	1:2 matching	1:3 matching	Full sample
Dependent Variable	(1)	(2)	(3)	(4)
	<i>MMI</i>	<i>MMI</i>	<i>MMI</i>	<i>MMI</i>
<i>D&amp;O</i>	0.023*** (2.72)	0.014** (1.98)	0.013** (1.98)	0.013** (2.20)
<i>SIZE</i>	-0.027*** (-6.86)	-0.025*** (-7.89)	-0.027*** (-9.13)	-0.038*** (-20.46)
<i>LEV</i>	0.290*** (11.43)	0.287*** (13.63)	0.286*** (15.55)	0.284*** (27.86)
<i>LAGE</i>	-0.037** (-2.48)	-0.023* (-1.92)	-0.029*** (-2.92)	-0.033*** (-6.54)
<i>SOE</i>	0.040*** (3.73)	0.037*** (4.45)	0.042*** (5.87)	0.027*** (7.81)
<i>FA</i>	0.140*** (3.89)	0.142*** (4.96)	0.139*** (5.66)	0.133*** (11.83)
<i>INST</i>	-0.151*** (-5.48)	-0.135*** (-6.44)	-0.126*** (-6.99)	-0.125*** (-14.10)
<i>INDEP</i>	0.100 (1.27)	0.088 (1.42)	0.133** (2.27)	0.035 (1.31)
<i>BALANCE</i>	0.901 (1.00)	0.108 (1.10)	0.184 (1.11)	2.387*** (8.29)
<i>VIOLATION</i>	-0.004 (-0.41)	-0.005 (-0.70)	-0.011* (-1.67)	-0.005 (-1.52)
<i>CROSSLIST</i>	0.039*** (3.40)	0.038*** (4.09)	0.035*** (3.88)	0.048*** (7.31)
<i>Constant</i>	1.410 (1.51)	0.546*** (4.15)	0.642*** (3.38)	3.150*** (10.59)
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Obs.	3,690	5,535	7,380	29,033
Adjusted R <sup>2</sup>	0.139	0.127	0.119	0.112

This table presents the results from the ordinary least squares regression of the impact of D&O insurance on the use of maturity mismatch. The dependent variable is the maturity mismatch index (*MMI*). Other variables include the firm's size (*SIZE*), firm leverage (*LEV*), firm's age (*LAGE*), State-Owned Enterprise firm (*SOE*), fixed asset ratio (*FA*), institutional investor ratio (*INST*), the proportion of independent directors (*INDEP*), the ratio of the sum of the shareholdings held by the second to the fifth-largest shareholders (*BALANCE*), violation record (*VIOLATION*), firms with cross-listing (*CROSSLIST*). The t-statistics are reported in parentheses and based on robust standard errors clustered by firm and year. The variables are defined in Appendix A1. \*\*\*, \*\*, \* denote statistical significance at 1%, 5%, and 10%.

market. The coefficient on *LEV* is positive and statistically significant at the 1% level, indicating that more use of leverage triggers the issue of maturity mismatch. The coefficient on *SOE* is also positive and statistically significant at the 1% level, suggesting that state-owned firms experience a higher maturity mismatch, as state-owned firms can easily access the capital market in China. Moreover, the results show that coefficients of *FA* and *CROSSLIST* are also significant positive at the 1% level, suggesting that firms with a high ratio of fixed assets and cross-listing in more than one stock exchange have a high level of maturity mismatch. Results from alternative samples in columns (2), (3), and (4) are in line with those in Column (1).

## Endogeneity tests

### Heckman two-step sample selection model

We employ the Heckman two-step sample selection model to prevent sample selection bias and alleviate the corresponding estimation error. In the first step, we establish a Probit model with the binary D&O insurance dummy as the dependent variable. In the Probit model, we include the following explanatory variables<sup>7</sup> firm's size (*SIZE*), profitability (*ROA*), State-Owned Enterprise (*SOE*), the fixed asset ratio (*FA*), the proportion of independent directors (*INDEP*), CEO and chairman of the board are the same person (*DUALITY*), concentration ratio (*HHI*), violation record (*VIOLATION*), firms with cross-listing (*CROSSLIST*), the proportion of top shareholder shares (*MANHOLD*), the ratio of the sum of the shareholdings held by the second to the fifth-largest shareholders (*BALANCE*), the average of D&O insurance in the industry (*IndAvg\_D&O*). Heckman's estimator requires exogenous variables correlated with a firm's propensity to purchase D&O insurance but not with the use of short-term loans for long-term investment activities. Following Yuan, Sun, and Cao (2016), we used *IndAvg\_D&O* as the exogenous variable. When calculating the *IndAvg\_D&O*, we first select firms based on firm size so that the impact of the scale on the purchase of D&O insurance is considered. The specification of the Probit model is illustrated in Equation (4):

$$\begin{aligned}
 D_{i,t} = & \beta_0 + \beta_1 SIZE_{i,t} + \beta_2 ROA_{i,t} + \beta_3 SOE_{i,t} \\
 & + \beta_4 FA_{i,t} + \beta_5 INDEP_{i,t} + \beta_6 DUALITY_{i,t} \\
 & + \beta_7 HHI_{i,t} + \beta_8 VIOLATION_{i,t} \\
 & + \beta_9 CROSSLIST_{i,t} + \beta_{10} MANHOLD_{i,t} \\
 & + \beta_{11} BALANCE_{i,t} + \beta_{12} IndAvg\_D_{i,t} + Year \\
 & + Industry + \varepsilon_{i,t}
 \end{aligned} \quad (4)$$

The inverse Mills ratio (IMR) generated from the first step is included in the second-step model to control potential sample selection bias. The specification of the second-step model corresponds to Equation (3). Table 4 reports the Heckman model regression results. In the first-step regression, our results suggest that coefficients of *SIZE*, *ROA*, *FA*, *DUALITY*, *VIOLATION*, *MANHOLD*, and *BALANCE* are significantly negative at the 1%

<sup>7</sup>See Appendix Table A1 for detailed description.

**Table 4.** The Heckman regression.

First-step regression		Second-step regression	
Dependent Variable	<i>D&amp;O</i>	Dependent Variable	<i>MMI</i>
<i>SIZE</i>	−0.067*** (−3.63)	<i>D&amp;O</i>	0.017** (2.01)
<i>ROA</i>	−1.390*** (−3.68)	<i>IMR</i>	−0.065*** (−3.83)
<i>SOE</i>	0.063 (1.11)	<i>SIZE</i>	−0.022*** (−5.24)
<i>FA</i>	−0.374*** (−3.04)	<i>LEV</i>	0.275*** (10.59)
<i>INDEP</i>	1.384*** (3.22)	<i>LAGE</i>	−0.042*** (−2.81)
<i>DUALITY</i>	−0.285*** (−4.17)	<i>SOE</i>	0.030*** (2.76)
<i>HHI</i>	0.262 (0.87)	<i>FA</i>	0.147*** (4.09)
<i>VIOLATION</i>	−0.168*** (−3.25)	<i>INST</i>	−0.183*** (−6.49)
<i>CROSSLIST</i>	0.976*** (14.40)	<i>INDEP</i>	0.059 (0.72)
<i>MANHOLD</i>	−1.914*** (−8.11)	<i>BALANCE</i>	1.336 (1.45)
<i>BALANCE</i>	−14.459*** (−3.32)	<i>VIOLATION</i>	0.003 (0.31)
<i>IndAvg_D&amp;O</i>	1.747*** (7.02)	<i>CROSSLIST</i>	0.010 (0.69)
<i>Constant</i>	−13.362*** (−2.99)	<i>Constant</i>	1.836* (1.93)
Year FE	Yes	Year FE	Yes
Industry FE	Yes	Industry FE	Yes
Obs.	3,690	Obs.	3,690
Pseudo R <sup>2</sup>	0.111	Adjusted R <sup>2</sup>	0.119

This table reports the regression results of the Heckman model using the full sample. The first step is a Probit model with binary D&O insurance (*D&O*) dummy, and the second step is the ordinary least square regression of the D&O insurance impact on the maturity mismatch index (*MMI*). *IMR* denotes the inverse Mills ratio generated from the first step and included in the second step of this model. Control variables in the first step regression include the firm's size (*SIZE*), profitability (*ROA*), State-Owned Enterprise (*SOE*), the fixed asset ratio (*FA*), the proportion of independent directors (*INDEP*), CEO and chairman of the board are the same person (*DUALITY*), concentration ratio (*HHI*), violation record (*VIOLATION*), firms with cross-listing (*CROSSLIST*), the proportion of top shareholder shares (*MANHOLD*), the ratio of the sum of the shareholdings held by the second to the fifth-largest shareholders (*BALANCE*), the average of D&O insurance in the industry (*IndAvg\_D&O*). In the second step regression, including firm's size (*SIZE*), firm's leverage (*LEV*), firm's age (*LAGE*), State-Owned Enterprise firm (*SOE*), fixed asset ratio (*F.A.*), institutional investor ratio (*INST*), the proportion of independent directors (*INDEP*), the ratio of the sum of the shareholdings held by the second to the fifth-largest shareholders (*BALANCE*), violation record (*VIOLATION*), firms with cross-listing (*CROSSLIST*). The *t*-statistics are reported in parentheses and based on robust standard errors clustered by both firm and year. The variables are defined in Appendix A1. \*\*\*, \*\*, \* denote statistical significance at 1%, 5%, and 10%.

level, indicating an inverse relationship to the D&O insurance from these variables. On the other hand, coefficients of *CROSSLIST* and *IndAvg\_D&O* are significantly positive at the 1% level.

The second step concludes that the coefficient on D&O is positive and statistically significant at the 5% level, consistent with our baseline results in Table 3. The coefficient on *IMR* is negative and statistically significant at the 1% level, indicating a positive relationship between the D&O insurance and the level of maturity mismatch. Our Heckman

two-step regression results suggest that our baseline results remain after controlling for sample selection bias.

#### Propensity score matching approach

This section uses the propensity score matching approach (PSM) to establish matched samples to address potential self-selection behaviour during the D&O insurance purchase process. Specifically, we estimate a Probit model based on Equation (4) with the binary D&O insurance dummy (*D&O*) as

the dependent variable, using our full sample. Subsequently, we calculate a propensity score for each firm. We select one control firm with the closest propensity scores for each insured firm, and these firms constitute the matched sample. Finally, we re-estimate the regression using Equation (3) for the insured and matched samples.<sup>8</sup>

Table 5 presents results to check if the matched sample firm characteristics satisfy the balance hypothesis. Results show that the standard deviation of the treatment group and the control group is significantly reduced, and all absolute values of the standard deviation are less than 10%. In addition, there are no significant differences in firm characteristics between the control group and the treatment group.

Table 6 presents the PSM results. Results from the Probit regression conclude that coefficients on

SIZE, SOE, INDEP, CROSSLIST, and IndAvg\_D&O are all positive and statistically significant at either 1%, indicating these variables have positive effects on a firm's decision to purchase D&O insurance. From the OLS regression, the coefficient of D&O is 0.018 and statistically significant at the 5% level, which is consistent with our baseline results. Therefore, results from the PSM approach indicate that our baseline results are robust and free from self-selection bias.<sup>9</sup>

### Firm-fixed effect model

We also re-estimate the regression of Equation (3) using the firm-fixed effect model to mitigate the potential problems that may arise from omitting time-invariant and firm-specific characteristics (Pan et al. 2015; Yuan, Sun, and Cao 2016).

**Table 5.** PSM Balance test.

Variable	Matched	Mean		Bias	Reduce  bias	T-test	
		Treated	Control	(%)	(%)	T value	P value
SIZE	Before	23.109	21.937	80.8	99.9	38.96	0
	After	22.907	22.909	-0.1		-0.03	0.976
ROA	Before	0.028	0.034	-8.6	49.3	-0.038	0.001
	After	0.029	0.032	-4.4		-1.29	0.197
SOE	Before	0.698	0.436	54.8	95.6	21.79	0
	After	0.680	0.668	2.4		0.71	0.479
FA	Before	0.316	0.046	74.8	90.9	3.13	0.002
	After	0.261	0.285	-6.8		-1.32	0.176
INDEP	Before	0.374	0.367	11.4	79.2	4.70	0
	After	0.372	0.371	2.4		0.66	0.507
DUALITY	Before	0.106	0.232	-34.3	93.7	-12.50	0
	After	0.111	0.119	-2.1		-0.71	0.477
HHI	Before	0.076	0.067	12.7	94.5	5.20	0
	After	0.075	0.074	0.7		0.20	0.845
VIOLATION	Before	0.625	0.758	-29.1	92.7	-12.65	0
	After	0.629	0.639	-2.1		-0.58	0.562
CROSSLIST	Before	0.316	0.046	74.7	87.8	47.42	0
	After	0.251	0.284	-9.1		-2.13	0.033
MANHOLD	Before	0.021	0.112	-62.7	94.3	-20.25	0
	After	0.023	0.028	-3.6		-1.97	0.049
BALANCE	Before	-1.016	-1.016	0.3	66.7	0.23	0.897
	After	-1.016	-1.016	0.1		0.13	0.815
IndAvg_D&O	Before	0.099	0.055	48.4	97.9	23.26	0
	After	0.089	0.088	1.0		0.27	0.784

This table shows the results of the PSM balance test. The *Before* lists these variables' mean, bias, and *T*-test values before the PSM procedure. The *After* lists the variables' mean, bias, and *T*-test value before the PSM procedure after the PSM procedure. The Variables in the balance test include the firm's size (SIZE), profitability (ROA), State-Owned Enterprise (SOE), the fixed asset ratio (FA), the proportion of independent directors (INDEP), CEO and chairman of the board are the same person (DUALITY), concentration ratio (HHI), violation record (VIOLATION), firms with cross-listing (CROSSLIST), the proportion of top shareholder shares (MANHOLD), the ratio of the sum of the shareholdings held by the second to the fifth-largest shareholders (BALANCE), the average of D&O insurance in the industry (IndAvg\_D&O).

<sup>8</sup>To ensure that the matching is satisfactory, we also assess covariate balance by testing whether the means and medians of the covariates used in Equation (3) differ for the insured firms and matched control firms. In the untabulated result, no significant differences exist between any of the covariates' means and medians, indicating that the propensity-score-matched control sample resembles the D&O insured firms in terms of virtually all the dimensions.

<sup>9</sup>We also examine the difference in *MMI* between the treatment group and the control group from 1998 to 2002. The result shows no statistically significant difference in *MMI* between the treatment and control groups from 1998 to 2002. The result indicates that the driver of the difference in *MMI* between the treatment and control groups during the sample period might be the purchase of D&O insurance from another perspective. We do not report the result due to the space constraint. However, the results are available upon request. We appreciate an anonymous reviewer for the comment.

**Table 6.** The PSM Approach.

Probit regression		OLS regression	
Dependent Variable	<i>D&amp;O</i>	Dependent Variable	<i>MMI</i>
<i>SIZE</i>	0.178*** (17.07)	<i>D&amp;O</i>	0.018** (2.20)
<i>ROA</i>	−0.767*** (−4.08)	<i>SIZE</i>	−0.025*** (−6.15)
<i>SOE</i>	0.091*** (3.01)	<i>LEV</i>	0.251*** (8.69)
<i>FA</i>	−0.252*** (−3.64)	<i>LAGE</i>	−0.036** (−2.06)
<i>INDEP</i>	0.818*** (3.58)	<i>SOE</i>	0.036*** (3.44)
<i>DUALITY</i>	−0.184*** (−4.96)	<i>FA</i>	0.109*** (2.94)
<i>HHI</i>	−0.027 (−0.16)	<i>INST</i>	−0.141*** (−4.86)
<i>VIOLATION</i>	−0.097*** (−3.39)	<i>INDEP</i>	0.082 (1.15)
<i>CROSSLIST</i>	0.796*** (21.80)	<i>BALANCE</i>	1.024 (1.06)
<i>MANHOLD</i>	−1.506*** (−11.21)	<i>VIOLATION</i>	−0.012 (−1.30)
<i>BALANCE</i>	−11.944*** (−5.40)	<i>CROSSLIST</i>	0.037*** (3.77)
<i>IndAvg_D&amp;O</i>	0.619*** (4.07)	<i>Constant</i>	1.453 (1.47)
<i>Constant</i>	−17.915*** (−7.91)		
Year FE	Yes	Year FE	Yes
Industry FE	Yes	Industry FE	Yes
Obs.	33,417	Obs.	2,884
Pseudo R <sup>2</sup>	0.166	Adjusted R <sup>2</sup>	0.127

This table reports the PSM regression results from a Probit model with a binary *D&O* (*D&O*) insurance dummy using the full sample and the ordinary least square regression of the impact of *D&O* insurance on the maturity mismatch index (*MMI*). Control variables in the first step regression include the firm's size (*SIZE*), profitability (*ROA*), State-Owned Enterprise (*SOE*), the fixed asset ratio (*FA*), the proportion of independent directors (*INDEP*), CEO and chairman of the board are the same person (*DUALITY*), concentration ratio (*HHI*), violation record (*VIOLATION*), firms with cross-listing (*CROSSLIST*), the proportion of top shareholder shares (*MANHOLD*), the ratio of the sum of the shareholdings held by the second to the fifth-largest shareholders (*BALANCE*), the average of *D&O* insurance in the industry (*IndAvg\_D&O*). In the second step regression, including firm's size (*SIZE*), firm's leverage (*LEV*), firm's age (*LAGE*), State-Owned Enterprise firm (*SOE*), fixed asset ratio (*FA*), institutional investor ratio (*INST*), the proportion of independent directors (*INDEP*), the ratio of the sum of the shareholdings held by the second to the fifth-largest shareholders (*BALANCE*), violation record (*VIOLATION*), firms with cross-listing (*CROSSLIST*). The *t*-statistics are reported in parentheses and based on robust standard errors clustered by firm and year. The variables are defined in Appendix A1. \*\*\*, \*\*, \* denote statistical significance at 1%, 5%, and 10%.

Results are presented in Panel A of Table 7. Our results are consistent with our main conclusion, indicating that time-invariant or firm-specific characteristics do not drive our baseline results.

In addition, we use the insurance premium and coverage data as documented in prior literature (Core 1997, 2000; Boyer and Stern 2014; Boyer and Tennyson 2015; Gillan and Panasian 2015) to mitigate the dependence on proxy used. The data are manually collected from the BODs announcements from the *D&O*-insured firms' websites. They are used as the independent variables to re-estimate Equation (3). Results are presented in Panels B and C in Table 7. The coefficients on *premium* and

*coverage* are positive and statistically significant at 1% in Panel B and Panel C, regardless of the alternative sample used. These results suggest a positive relationship between the insurance premium/coverage and the maturity mismatch. The higher the premium of *D&O* insurance paid and/or the greater the insurance coverage, the greater the maturity mismatch for firms. Results in Table 7 further suggest that our baseline results are robust.

### The sensitivity model

This section uses an alternative test as a further robustness test to alleviate the problem arising



**Table 7.** The regression results of firm-fixed effects and premium/coverage.

	1:1 matching	1:2 matching	1:3 matching	Full sample
	(1)	(2)	(3)	(4)
	MMI	MMI	MMI	MMI
Panel A: Firm-fixed Effects				
D&O	0.055* (1.87)	0.041* (1.70)	0.043** (2.07)	0.034*** (2.67)
Controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Obs.	3,690	5,535	7,380	29,033
Adjusted R <sup>2</sup>	0.476	0.477	0.466	0.323
Panel B: Insurance Premium				
PREMIUM	2.952*** (3.61)	2.100*** (2.96)	2.034*** (3.10)	2.601*** (4.09)
Controls	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Obs.	2,690	4,535	6,380	28,013
Adjusted R <sup>2</sup>	0.103	0.101	0.099	0.110
Panel C: Insurance Coverage				
COVERAGE	2.289*** (3.92)	1.531*** (2.93)	1.487*** (3.06)	1.442*** (3.10)
Controls	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Obs.	2,690	4,535	6,380	28,013
Adjusted R <sup>2</sup>	0.107	0.105	0.100	0.111

This table presents the results of firm-fixed effects and D&O insurance premium/coverage. The dependent variable is the maturity mismatch index (*MMI*). The control variables also include the firm's size (*SIZE*), firm's leverage (*LEV*), firm age (*LAGE*), State-Owned Enterprise firm (*SOE*), fixed asset ratio (*F.A.*), institutional investor ratio (*INST*), the proportion of independent directors (*INDEP*), the ratio of the sum of the shareholdings held by the second to the fifth-largest shareholders (*BALANCE*), violation record (*VIOLATION*), firms with cross-listing (*CROSSLIST*). The *t*-statistics are reported in parentheses and based on robust standard errors clustered by firm and year. The variables are defined in Appendix A1. \*\*\*, \*\*, \* denote statistical significance at 1%, 5%, and 10%.

**Table 8.** Other test: the sensitivity model of "Investment-Short-term Debts".

	1:1 matching	1:2 matching	1:3 matching	Full sample
	(1)	(2)	(3)	(4)
Dependent Variable	$INV_{i,t}$	$INV_{i,t}$	$INV_{i,t}$	$INV_{i,t}$
$ShortDebt_{i,t}$	-0.025 (-1.12)	-0.017 (-1.29)	-0.003 (-0.32)	0.011** (2.44)
$D\&O_{i,t}$	-0.006 (-0.57)	-0.007 (-0.66)	-0.004 (-0.41)	0.004 (0.39)
$ShortDebt \times D\&O_{i,t}$	0.060** (2.28)	0.052*** (2.90)	0.038** (2.38)	0.026** (2.06)
$SIZE_{i,t}$	0.000 (0.04)	0.001 (0.27)	0.002 (0.51)	-0.003 (-1.03)
$LEV_{i,t}$	-0.305*** (-6.29)	-0.327*** (-8.56)	-0.299*** (-9.42)	-0.418*** (-22.41)
$ROA_{i,t}$	0.254*** (2.85)	0.262*** (3.37)	0.310*** (4.53)	0.377*** (10.49)
$TOBINQ_{i,t}$	0.012* (1.71)	0.013* (1.78)	0.016*** (2.61)	0.005* (1.65)
Constant	0.295*** (2.68)	0.305*** (3.18)	0.286*** (3.35)	0.464*** (6.57)
Industry FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Obs.	3,624	5,436	7,248	33,137
Adjusted R <sup>2</sup>	0.201	0.202	0.208	0.233

This table presents the results from the ordinary least squares regression of other test methods of maturity mismatch.  $INV_{i,t}$  is "the cash paid for the purchase and construction of fixed, intangible, and other long-term assets" in the cash flow statement, which is adjusted by the total assets to eliminate the size effect.  $ShortDebt_{i,t}$  is the increment of the current short-term loan and uses the total assets to eliminate the size effect. The interaction ( $ShortDebt_{i,t} \times D\&O_{i,t}$ ) is used to verify whether D&O insurance increases the sensitivity of investment to short-term loans. In addition, in order to control the influence of other factors, following Zhong, Chen, and Zhang (2016), we choose the control variables, including *Size*, *Lev*, *Roa*, *Tobinq*. The *t*-statistics are reported in parentheses and based on robust standard errors clustered by firm and year. The variables are defined in Appendix A1. \*\*\*, \*\*, \* denote statistical significance at 1%, 5%, and 10%.

from the proxy chosen. Specifically, we apply the Sensitivity Model of ‘Investment-Short-Term Debts’, as documented in McLean and Zhao (2014) and Zhong, Chen, and Zhang (2016), to examine the impact of D&O insurance on the maturity mismatch as the following:

$$\begin{aligned} Inv_{i,t} = & \beta_0 + \beta_1 ShortDebt_{i,t} + \beta_2 D\&O_{i,t} \\ & + \beta_3 ShortDebt \times D\&O_{i,t} + \beta_4 Size_{i,t} \\ & + \beta_5 Lev_{i,t} + \beta_6 Roa_{i,t} + \beta_7 TobinQ_{i,t} + Year \\ & + Industry + \varepsilon_{i,t} \end{aligned} \quad (5)$$

In Equation (5),  $Inv_{i,t}$  is ‘the cash paid for the purchase and construction of fixed assets,

intangible assets and other long-term assets’ in the cash flow statement, standardized by the total assets to eliminate the size effect.  $ShortDebt_{i,t}$  is the increment of the short-term debt, which is also standardized by the total assets. The interaction term ( $ShortDebt_{i,t} \times D\&O_{i,t}$ ) is used to examine the combined effects of the D&O insurance and the increase in short-term debt on firm investments. In addition, we use several variables, including  $SIZE$ ,  $LEV$ ,  $ROA$ , and  $TOBINQ$ ,<sup>10</sup> to control for potential confounding effects by following the approach in Zhong, Chen, and Zhang (2016). Table 8 presents our results from this alternative robustness test for the 1:1 matching sample in

**Table 9.** The moderating effects of the monitoring mechanism on the MMI.

Dependent Variable: <i>MMI</i>	<i>BIG 4 Auditors</i>		<i>Analyst Coverage</i>		<i>Largest Shareholder</i>	
	<i>Big 4</i> (1)	<i>Non-big 4</i> (2)	<i>Higher</i> (3)	<i>Lower</i> (4)	<i>Higher</i> (5)	<i>Lower largest shareholder ratio</i> (6)
<i>D&amp;O</i>	0.026 (1.03)	0.034*** (3.47)	0.002 (0.15)	0.036*** (2.89)	0.041*** (3.14)	0.014 (1.18)
<i>SIZE</i>	−0.027*** (−3.77)	−0.030*** (−6.13)	−0.011 (−1.45)	−0.032*** (−4.96)	−0.030*** (−4.82)	−0.031*** (−5.35)
<i>LEV</i>	0.299*** (3.20)	0.298*** (10.87)	0.226*** (4.84)	0.314*** (9.98)	0.311*** (9.07)	0.289*** (7.87)
<i>LAGE</i>	−0.120** (−2.18)	−0.015 (−0.91)	−0.026 (−1.15)	−0.044** (−2.02)	−0.057** (−2.22)	−0.021 (−1.05)
<i>SOE</i>	0.084** (2.44)	0.035*** (3.21)	0.038** (2.13)	0.041*** (2.68)	0.031* (1.74)	0.041*** (3.19)
<i>FA</i>	0.189* (1.76)	0.119*** (3.31)	0.152*** (2.67)	0.119** (2.38)	0.101* (1.96)	0.166*** (3.28)
<i>INST</i>	−0.171** (−2.07)	−0.156*** (−5.20)	−0.113*** (−2.61)	−0.179*** (−4.47)	−0.130*** (−2.62)	−0.112*** (−2.87)
<i>INDEP</i>	0.322* (1.69)	0.065 (0.68)	−0.036 (−0.33)	0.234** (1.99)	0.209* (1.76)	−0.064 (−0.66)
<i>BALANCE</i>	−1.669 (−0.80)	1.567 (1.59)	0.093 (0.08)	2.133 (1.60)	6.073 (1.55)	1.267 (0.89)
<i>VIOLATION</i>	−0.001 (−0.03)	−0.005 (−0.42)	0.009 (0.51)	−0.011 (−0.73)	−0.001 (−0.03)	−0.012 (−0.84)
<i>CROSSLIST</i>	0.007 (0.23)	0.027* (1.91)	0.028* (0.23)	0.036** (2.10)	0.049** (2.51)	0.041** (2.30)
<i>Constant</i>	−0.646 (−0.30)	2.121** (2.07)	0.305 (0.25)	2.662* (1.91)	6.655* (1.67)	1.877 (1.26)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	751	2,939	1,333	2,016	1,856	1,826
Adjusted R <sup>2</sup>	0.216	0.151	0.132	0.119	0.106	0.134
$H_0 : \beta_{D\&O}^{Strong} = \beta_{D\&O}^{Weak}$						
$\chi^2$ Test		2.68*		3.66**		2.79*
P-Value		0.093		0.045		0.087

This table reports the results of moderating effects of the monitoring mechanism on the relationship between D&O insurance and the use of short-term loans for long-term investment activities by dividing the 1:1 matching sample into two groups. We choose three dimensions to distinguish among various levels of internal and external monitoring mechanisms, including Big 4 auditors; corporate transparency, measured by the analysts’ coverage; and the ratio of the largest shareholder holding. D&O insurance (*D&O*), firm’s size (*SIZE*), firm’s leverage (*LEV*), firm’s age (*LAGE*), State-Owned Enterprise firm (*SOE*), the fixed asset ratio (*F.A.*), institutional investor ratio (*INST*), the proportion of independent directors (*INDEP*), the ratio of the sum of the shareholdings held by the second to the fifth-largest shareholders (*BALANCE*), violation record (*VIOLATION*), firms with cross-listing (*CROSSLIST*). The *t*-statistics are reported in parentheses and based on robust standard errors clustered by firm and year. The variables are defined in Appendix A1. \*\*\*, \*\*, \* denote statistical significance at 1%, 5%, and 10%.

<sup>10</sup>In addition, to ensure the robustness of the results, we also adopted the same control variable according to the previous model (3). The untabulated results are similar.

column (1), 1:2 matching sample in column (2), 1:3 matching sample in column (3), and the full sample in column (4). The coefficients on the interaction term are positive and statistically significant at the 1% in column (2) and at the 5% levels for the rest. These results suggest that the purchase of D&O insurance intensifies the dependence of long-term investment on the use of short-term debts, thus increasing the maturity mismatch. This result is consistent with our baseline result, suggesting our baseline results are robust.

### The mechanisms analysis

The regulatory environment in China's capital market has been criticized by many, and the governance level of listed companies remains relatively weak, exerting

specific adverse effects on the use of D&O insurance. We, therefore, employ the moral hazard theory to explain the interaction between the D&O insurance and maturity mismatch. We examine the corresponding internal and external monitoring mechanisms that may help prevent the potential moral hazard after purchasing the D&O insurance, thereby reducing maturity mismatch.

Specifically, we choose three dimensions to distinguish among various levels of internal and external monitoring mechanisms, including Big 4 auditors (Gong, Xu, and Gong 2018); corporate transparency (Ho et al. 2017), measured by the analysts' coverage; and the ratio of the largest shareholder holding (Pan et al. 2015), based on the average number of shares held by the largest shareholder in the same industry in the same year. We then categorize the 1:1 matching sample based

**Table 10.** Robustness Test.

Dependent Variable	(1) <i>DROA</i>	(2) <i>DEBIT</i>
<i>D&amp;O</i>	0.003** (2.03)	0.004** (2.23)
<i>SIZE</i>	−0.003*** (−3.85)	−0.003*** (−3.41)
<i>LEV</i>	0.010* (1.80)	0.008 (1.17)
<i>LAGE</i>	0.003 (1.15)	0.004 (1.38)
<i>SOE</i>	−0.002 (−1.02)	−0.004* (−1.69)
<i>FA</i>	−0.005 (−0.88)	−0.006 (−1.04)
<i>INST</i>	−0.013*** (−3.00)	−0.012*** (−2.60)
<i>INDEP</i>	−0.002 (−0.18)	−0.001 (−0.05)
<i>BALANCE</i>	−0.197 (−1.32)	−0.169 (−1.01)
<i>VIOLATION</i>	0.005*** (2.94)	0.006*** (3.14)
<i>CROSSLIST</i>	0.001 (0.59)	0.001 (0.71)
<i>Constant</i>	−0.085 (−0.57)	−0.057 (−0.34)
Year FE	Yes	Yes
Industry FE	Yes	Yes
Obs.	2,705	2,705
Adjusted R <sup>2</sup>	0.148	0.133

This table presents the results of the robustness test. The dependent variable is the degree of risk-taking in firms' operations based on the three-year volatility of industry-adjusted return of assets (*DROA*) and earnings before interest and tax (*DEBIT*). The control variables include the firm's size (*SIZE*), firm leverage (*LEV*), firm age (*LAGE*), State-Owned Enterprise firm (*SOE*), fixed asset ratio (*F.A.*), institutional investor ratio (*INST*), the proportion of independent directors (*INDEP*), the ratio of the sum of the shareholdings held by the second to the fifth-largest shareholders (*BALANCE*), violation record (*VIOLATION*), firms with cross-listing (*CROSSLIST*). The *t*-statistics are reported in parentheses and based on robust standard errors clustered by firm and year. \*\*\*, \*\*, \* denote statistical significance at 1%, 5%, and 10%.

on these three dimensions. Results are presented in Table 9. The coefficients on D&O are statistically insignificant for firms with more robust internal and external monitoring mechanisms, indicating no effect of D&O insurance on maturity mismatch. For firms with weaker monitoring mechanisms, the coefficients of D&O insurance are all positive and statistically significant at the 5% level in Model (4) and at the 1% level in Models (5) and (6). Therefore, we conclude that when the monitoring mechanism is weaker, D&O insurance significantly increases maturity mismatch.<sup>11</sup> Our findings not only further confirm the moral hazard effect of D&O insurance (Lin, Officer, and Zou 2011; Lin et al. 2013; Boyer and Stern 2014; Chen, Li, and Zou 2016) but also demonstrates the importance of internal and external monitoring mechanisms for the governance of listed companies (Yu 2008) in China.<sup>12</sup>

### Robustness tests

In this section, we further robust our main findings by replacing the *MMI* with the other two firm's risk-taking proxies widely used in the literature. We measure a firm's risk-taking behaviour as the three-year volatility of industry-adjusted return of assets (*DROA*) by following Wright et al. (2007) and the three-year volatility of earnings before interest and tax (*DEBIT*) by following Nance, Smith, and Smithson (1993). We re-perform the model (3) by replacing the dependent variable with either *DROA* or *DEBIT*. Results are reported in Table 10. Column (1) uses *DROA* as the dependent variable, and column (2) uses *DEBIT* as the dependent variable. The coefficients of *D&O* of both columns are statistically significant positive at the 5% level. Results support our baseline findings, which purchasing D&O insurance increases a firm's risk-taking behaviour in China during the testing period.

### V. Conclusion

The governance role of the D&O insurance as a tool to hedge management's performance risk remains controversial. Using a unique set of manually collected data from the Chinese stock markets, we examine whether the purchase of D&O insurance plays a governance role in mitigating maturity mismatch for firms' investment and financing strategies in China. We conclude that the purchase of D&O insurance significantly raises the risk-taking behaviour of maturity mismatch for listed firms during our testing period from 2002 to 2019. Our main finding is survived when we use the Heckman two-stage regression, the PSM approach, and the firm-fixed effect model to alleviate the potential endogeneity concerns. Also, the main result remains significant after we apply the Sensitivity Model of 'Investment-Short-Term Debts'. Overall, these results suggest that our baseline results are robust. In addition, we examine the mechanisms behind our main finding by applying the moral hazard theory to analyse the internal and external mechanisms of this positive relationship. Our results indicate that firms with weaker internal and external monitoring mechanisms experience significant increases in maturity mismatch after purchasing D&O insurance, suggesting that the moral hazard effect provides crucial linkages between the D&O insurance and the maturity mismatch. Results are also robust by using variate proxy of the firm's risk-taking variables.

Our study contributes to the ongoing debate on the corporate governance aspects of D&O insurance (Lin, Officer, and Zou 2011; Lin et al. 2013; Boyer and Stern 2014; Chen, Li, and Zou 2016; Yuan, Sun, and Cao 2016), and our results have important policy implications. We conclude that D&O insurance may aggravate the moral hazard effect in a weaker corporate governance environment. Therefore, it is imperative to recognize the negative effects of the D&O insurance so that policymakers can establish effective supervision mechanisms, especially for

<sup>11</sup>In addition, we use the interaction term model to test the relevant conclusions, yielding essentially the same results.

<sup>12</sup>To address whether managers could benefit from purchasing D&O insurance due to the litigation loss arising from corporate maturity mismatch behaviour. We empirically examine the relationship between purchasing D&O insurance and a firm's management expenses/payment gaps. Results show statistically significant positive relationship between purchasing of D&O insurance and a firm's management expenses/payment gaps. The increase in management expenses and executive compensation can represent the increase in potential moral hazard issues. Therefore, the above results prove that D&O insurance does cause moral hazard problems. We do not report these results in the manuscript due to the space constraint. However, the results are available upon request. We appreciate two anonymous reviewers for the comment.

China and other emerging markets where corporate governances are weaker.

## Disclosure statement

No potential conflict of interest was reported by the author(s).

## ORCID

Kung-Cheng Ho  <http://orcid.org/0000-0002-3475-2089>

Ji (George) Wu  <http://orcid.org/0000-0001-5937-8292>

Liping Zou  <http://orcid.org/0000-0002-7091-484X>

## References

- Acharya, V. V., D. Gale, and T. Yorulmazer. 2011. "Rollover Risk and Market Freezes." *The Journal of Finance* 66 (4): 1177–1209. doi:10.1111/j.1540-6261.2011.01669.x.
- Bai, Y. X., M. Q. Qiu, and L. I. Wei. 2016. "Maturity Mismatch of Investment and Financing and Its Institutional Explanation—evidence from Comparison of Chinese and U.S. Financial Markets." *China Industrial Economics (In Chinese)* 3: 87–98.
- Bharath, S., P. Pasquariello, and G. Wu. 2009. "Does Asymmetric Information Drive Capital Structure Decisions?" *The Review of Financial Studies* 22: 3211–3243. doi:10.1093/rfs/hhn076.
- Boyer, M. M., and L. H. Stern. 2014. "D&O Insurance and IPO Performance: What Can We Learn from Insurers?" *Journal of Financial Intermediation* 23 (4): 504–540. doi:10.1016/j.jfi.2014.05.001.
- Boyer, M. M., and S. Tennyson. 2015. "Directors' and Officers' Liability Insurance, Corporate Risk and Risk Taking: New Panel Data Evidence on the Role of Directors' and Officers' Liability Insurance." *The Journal of Risk and Insurance* 82 (4): 753–791. doi:10.1111/jori.12107.
- Chen, K. C., Z. Chen, and K. J. Wei. 2009. "Legal Protection of Investors, Corporate Governance, and the Cost of Equity Capital." *Journal of Corporate Finance* 15 (3): 273–289. doi:10.1016/j.jcorpfin.2009.01.001.
- Chen, L., Y. Li, Y. Wang, and B. Zhang. 2019. "The Long-Term Use of Short-Term Debt Around the World." Available at SSRN. doi:10.2139/ssrn.3109327
- Chen, Z., O. Z. Li, and H. Zou. 2016. "Directors' and Officers' Liability Insurance and the Cost of Equity." *Journal of Accounting and Economics* 61 (1): 100–120. doi:10.1016/j.jacceco.2015.04.001.
- Christian, L. 2011. "Tort Law and the Ethical Responsibilities of Liability Insurers: Comments from a Reinsurer's Perspective." *Journal of Business Ethics* 103: 87–94. doi:10.1007/s10551-012-1225-6.
- Chung, H. H., S. Hillegeist, and J. P. Wynn. 2015. "Directors' and Officers' Liability Insurance and Audit Pricing." *Journal of Accounting Public Policy* 34: 551–577. doi:10.1016/j.jaccpubpol.2015.05.009.
- Core, J. E. 1997. "On the Corporate Demand for Directors' and Officers' Insurance." *The Journal of Risk and Insurance* 64: 63–87. doi:10.2307/253912.
- Core, J. E. 2000. "The Directors' and Officers' Insurance Premium: An Outside Assessment of the Quality of Corporate Governance." *Journal of Law Economics and Organization* 16 (2): 449–477. doi:10.1093/jleo/16.2.449.
- D'Mello, R., and P. K. Shroff. 2000. "Equity Undervaluation and Decisions Related to Repurchase Tender Offers: An Empirical Investigation." *The Journal of Finance* 55 (5): 2399–2424. doi:10.1111/0022-1082.00292.
- Darrrough, M., H. Kim, and E. Zur. 2019. "The Impact of Corporate Welfare Policy on Firm-Level Productivity: Evidence from Unemployment Insurance." *Journal of Business Ethics* 159: 795–815.
- Diamond, D. W. 1991. "Debt Maturity Structure and Liquidity Risk." *The Quarterly Journal of Economics* 106 (3): 709–737. doi:10.2307/2937924.
- Fan, P. H. J., S. Titman, and G. Twite. 2012. "An International Comparison of Capital Structure and Debt Maturity Choices." *Journal of Financial and Quantitative Analysis* 47: 23–56. doi:10.1017/S0022109011000597.
- Frank, M. Z., and V. K. Goyal. 2003. "Testing the Pecking Order Theory of Capital Structure." *Journal of Financial Economics* 67 (2): 217–248. doi:10.1016/S0304-405X(02)00252-0.
- Gillan, S. L., and G. A. Panasian. 2015. "On Lawsuits, Corporate Governance, and Directors' and Officers' Liability Insurance." *Journal of Risk Insurance* 82 (4): 793–822. doi:10.1111/jori.12043.
- Gong, G., S. Xu, and X. Gong. 2018. "On the Value of Corporate Social Responsibility Disclosure: An Empirical Investigation of Corporate Bond Issues in China." *Journal of Business Ethics* 150 (1): 227–258. doi:10.1007/s10551-016-3193-8.
- Gutierrez, M. 2003. "An Economic Analysis of Corporate Directors' Fiduciary Duties." *The Rand Journal of Economics* 34 (3): 516–535. doi:10.2307/1593744.
- Hart, O., and J. Moore. 1994. "A Theory of Debt Based on the Inalienability of Human Capital." *The Quarterly Journal of Economics* 109 (4): 841–879. doi:10.2307/2118350.
- Ho, K., S. Lee, C. Lin, and M. Yu. 2017. "A Comparative Analysis of Accounting-Based Valuation Models." *Journal of Accounting, Auditing & Finance* 32 (4): 561–575. doi:10.1177/0148558X15623043.
- Ho, K., J. Ma, L. Yang, and L. Shi. 2019. "Do Anticorruption Efforts Affect Banking System Stability?" *Journal of International Trade & Economic Development* 28 (3): 277–298. doi:10.1080/09638199.2018.1522661.



- Holderiness, C. G. 1990. "Liability Insurers as Corporate Monitors." *International Review of Law and Economics* 10 (2): 115–129. doi:10.1016/0144-8188(90)90018-O.
- Hu, Y., and J. Fang. 2022. "Peer Effects in Directors' and Officers' Liability Insurance: Evidence from China." *Finance Research Letters* 47: 102731. doi:10.1016/J.FRL.2022.102731.
- Hwang, J. H., and B. Kim. 2018. "Directors' and Officers' Liability Insurance and Firm Value." *Journal of Risk Insurance* 82 (2): 447–482. doi:10.1111/jori.12136.
- Jia, N., and X. Tang. 2018. "Directors' and Officers' Liability Insurance, Independent Director Behavior, and Governance Effect." *Journal of Risk Insurance* 85 (4): 1013–1054. doi:10.1111/jori.12193.
- Jia, N., and X. Tang. 2018. "Directors' and Officers' Liability Insurance, Independent Director Behavior, and Governance Effect." *The Journal of Risk and Insurance* 85 (4): 1013–1054.
- Jiang, F., and K. A. Kim. 2015. "Corporate Governance in China: A Modern Perspective." *Journal of Corporate Finance* 32 (3): 190–216. doi:10.1016/j.jcorpfin.2014.10.010.
- Kim, I. Y. 2015. "Directors' and Officers' Insurance and Opportunism in Accounting Choice." *Accounting & Taxation* 7 (1): 51–65.
- Li, K., and Y. Liao. 2014. "Directors' and Officers' Liability Insurance and Investment Efficiency: Evidence from Taiwan." *Pacific-Basin Finance Journal* 29: 18–36. doi:10.1016/j.pacfin.2014.03.001.
- Li, T., T. Yang, and J. Zhu. 2022. "Directors' and Officers' Liability Insurance: Evidence from Independent Directors' Voting." *Journal of Banking & Finance* 138: 106425. doi:10.1016/J.JBANKFIN.2022.106425.
- Lin, C., M. S. Officer, R. Wang, and H. Zou. 2013. "Directors' and Officers' Liability Insurance and Loan Spreads." *Journal of Financial Economics* 110 (1): 37–60. doi:10.1016/j.jfineco.2013.04.005.
- Lin, C., M. S. Officer, and H. Zou. 2011. "Directors' and Officers' Liability Insurance and Acquisition Outcomes." *Journal of Financial Economics* 102 (3): 507–525. doi:10.1016/j.jfineco.2011.08.004.
- McLean, R., and M. Zhao. 2014. "The Business Cycle, Investor Sentiment, and Costly External Finance." *The Journal of Finance* 69 (3): 1377–1409. doi:10.1111/jofi.12047.
- Meng, Q., Z. Zhong, X. Li, and S. Wang. 2022. "What Protects Me Also Makes Me Behave: The Role of Directors' and Officers' Liability Insurance on Empire-Building Managers in China." *SSRN Electronic Journal*. doi:10.2139/SSRN.4157597b.
- Morris, J. R. 1976. "A Model for Corporate Debt Maturity Decisions." *Journal of Financial and Quantitative Analysis* 11 (3): 339–357. doi:10.2307/2330412.
- Myers, S. C. 1977. "Determinants of Corporate Borrowing." *Journal of Financial Economics* 5 (2): 147–175. doi:10.1016/0304-405X(77)90015-0.
- Nance, D. R., C. W. Smith, and C. W. Smithson. 1993. "On the DETERMINANTS of CORPORATE HEDGING." *The Journal of Finance* 48 (1): 267–284. doi:10.2307/2328889.
- Nartea, G. V., D. Kong, and J. Wu. 2017. "Do Extreme Returns Matter in Emerging Markets? Evidence from the Chinese Stock Market." *Journal of Banking and Finance* 76: 189–197. doi:10.1016/j.jbankfin.2016.12.008.
- Pan, L., C. Lin, S. Lee, and K. Ho. 2015. "Information and Ratings and Capital Structure." *Journal of Corporate Finance* 31: 17–32. doi:10.1016/j.jcorpfin.2015.01.011.
- Tang, X., J. Du, and Q. Hou. 2013. "The Effectiveness of the Mandatory Disclosure of Independent Directors' Opinions: Empirical Evidence from China." *Journal of Accounting and Public Policy* 32 (3): 89–125. doi:10.1016/j.jaccpubpol.2013.02.006.
- Wang, Q., S. Lai, S. Pi, and H. Anderson. 2022. "Does Directors' and Officers' Liability Insurance Induce Empire Building? Evidence from Corporate Labor Investment." *Pacific-Basin Finance Journal* 73: 101753. doi:10.1016/J.PACFIN.2022.101753.
- Wang, Y., T. Wang, and L. Chen. 2021. "Maturity Mismatches of Chinese Listed Firms." *Pacific-Basin Finance Journal* 70: 101680. doi:10.1016/j.pacfin.2021.101680.
- Weinstein, D. E., and Y. Yafeh. 1998. "On the Costs of a Bank-centred Financial System: Evidence from the Changing Main Bank Relations in Japan." *The Journal of Finance* 53 (2): 635–672. doi:10.1111/0022-1082.254893.
- Wright, P., M. Kroll, J. A. Krug, and M. Pettus. 2007. "Influences of Top Management Team Incentives on Firm Risk Taking." *Strategic Management Journal* 28 (1): 81–89. doi:10.1002/SMJ.548.
- Xiao, J., and H. Li. 2019. "Competition in Banking Industry and Maturity Mismatch Between Investment and Financing in Micro-Enterprises." *Journal of Nanjing Audit University* 16 (3): 38–45.
- Yu, F. F. 2008. "Analyst Coverage and Earnings Management." *Journal of Financial Economics* 88 (2): 245–271. doi:10.1016/j.jfineco.2007.05.008.
- Yuan, R., J. Sun, and F. Cao. 2016. "Directors' and Officers' Liability Insurance and Stock Price Crash Risk." *Journal of Corporate Finance* 37: 173–192. doi:10.1016/j.jcorpfin.2015.12.015.
- Zardkoohi, A., E. Kang, D. Fraser, and A. A. Cannella. 2018. "Managerial Risk-Taking Behavior: A Too-Big-To-Fail Story." *Journal of Business Ethics* 149 (1): 221–233. doi:10.1007/s10551-016-3133-7.
- Zeng, T. 2017. "Directors' and Officers' Liability Insurance and Aggressive Tax-Reporting Activities: Evidence from Canada." *Accounting Perspectives* 16 (4): 345–369. doi:10.1111/1911-3838.12156.
- Zhong, K., X. K. Chen, and W. H. Zhang. 2016. "The Moderate Adjustment of Monetary Policy and the Phenomenon of Corporate Long-Term Investment with Short-Term Financing." *Management World (In Chinese)* 3: 87–98.
- Zou, H., S. Wong, C. Shum, J. Xiong, and J. Yan. 2008. "Controlling-Minority Shareholder Incentive Conflicts and Directors' and Officers' Liability Insurance: Evidence from China." *Journal of Banking and Finance* 32 (12): 2636–2645. doi:10.1016/j.jbankfin.2008.05.015.

## Appendix

**Table A1.** Variable definitions.

<b>1. Dependent Variables</b>	
<i>MMI</i>	Maturity Mismatch Index, we adopt the capital gap idea to measure enterprises' maturity mismatch degree (Frank and Goyal 2003). To be specific, we take the long-term investment expenditure minus the long-term financing source in the current year as the enterprise's long-term financing gap and then use the long-term assets of the enterprise in the previous year to standardize the above financing gap.
<i>INV</i>	INV is "the cash paid for the purchase and construction of fixed, intangible, and other long-term assets" in the cash flow statement, adjusted by the total assets to eliminate the firm size effect.
<b>2. Independent Variables</b>	
<i>D&amp;O</i>	A dummy variable equals one if a firm purchases D&O insurance and 0 otherwise.
<i>PREMIUM</i>	The natural logarithm of (1+D&O insurance premium).
<i>COVERAGE</i>	The natural logarithm of (1+D&O insurance coverage).
<b>3. Control Variables</b>	
<i>SIZE</i>	Firm size measuring by the natural logarithm of the book value of total assets.
<i>LAGE</i>	Firm age is measured by the natural logarithm of (1+the firm's established period).
<i>INST</i>	Institutional investor ratio measuring by the percentage of shares owned by institutional investors.
<i>LEV</i>	Firm leverage, measuring by the book value of total debt divided by book value of total assets.
<i>F.A.</i>	The fixed assets ratio, measuring by the net fixed assets divided by the total assets at the end of the period.
<i>DUALITY</i>	A dummy variable equals one if the CEO and chairman of the board are the same person and 0 otherwise.
<i>HHI</i>	Concentration ratio, measuring by the sum of the total square of the market share of all enterprises in the relevant market.
<i>INDEP</i>	Independent directors' ratio, measuring by the proportion of independent directors on a board.
<i>VIOLATION</i>	A dummy variable equals one if a firm has a violation record in year <i>t</i> and 0 otherwise.
<i>CROSSLIST</i>	A dummy variable equals one if a firm issues B-share or H-share and 0 otherwise.
<i>MANHOLD</i>	The largest shareholder ratio, measuring by the proportion of shares held by top executives.
<i>BALANCE</i>	The ratio of the sum of the shareholdings held by the second to the fifth largest shareholders divided by the shareholdings held by the largest shareholder.
<i>IndAvg_D&amp;O</i>	The mean incidence of D&O insurance purchase for firms in the same industry in the same year, excluding the firm concerned.
<i>DSLOAN</i>	The short-term loan balance, measuring by the ending balance of short-term loans after total assets standardization minus the initial balance.
<i>SOE</i>	A dummy variable equals one if the ultimate controlling shareholder of a listed firm is the state and 0 otherwise.