Why do firms purchase directors' and officers' liability insurance? – perspective from economic policy uncertainty

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Abstract

Purpose – This study aims to investigate whether firms purchase directors' and officers' liability (D&O) insurance when the country-level economic policy uncertainty (EPU) is high.

Design/methodology/approach – This study uses D&O insurance data from Chinese listed firms between 2003 and 2019 to conduct regression analyses to examine the association between D&O insurance and EPU.

Findings – The results show that government EPU, despite being an exogenous factor, increases the likelihood of firms' purchasing D&O insurance, and this effect is more pronounced when firms are exposed to great share price crash risk and high litigation risk, suggesting that firms intend to purchase D&O insurance possibly due to the accentuated stock price crash risk and litigation risk associated with EPU. In addition, the results indicate that the effect of EPU on the D&O insurance purchase decision is moderated by the provincial capital market development and internal control quality.

Practical implications – The study highlights the role of uncertain economic policies in shareholder approval of D&O insurance purchases.

Originality/value – The study enriches the literature on the determinants of D&O insurance purchases by documenting novel evidence that country-level EPU is a key institutional factor shaping firms' decisions to purchase D&O insurance.

Keywords Economic policy uncertainty, Directors' and officers' liability (D&O) insurance, Stock price crash risk, Litigation risk, China

Paper type Research paper

1. Introduction

Burgeoning recent literature focuses on how economic policy uncertainty (hereinafter EPU) affects stock markets (e.g. Liu & Zhang, 2020; Arouri, Estay, Rault & Roubaud, 2016) and corporate investment, financing and innovation decisions (e.g. Baker, Bloom & Davis, 2016; Bhattacharya, Hsu, Tian & Xu, 2017; Bonaime, Gulen & Ion, 2018; Nguyen & Phan, 2017). A research issue that remains unexplored is whether EPU influences firms' decision to purchase directors' and officers' liability insurance (hereinafter D&O insurance). This study aims to

examine this issue using data from firms listed on Chinese stock exchanges. D&O insurance is an important mechanism that firms use to shield their directors and officers from personal liability that may arise from lawsuits brought by stakeholders (e.g. shareholders and creditors) alleging directors' and officers' wrongdoing in executing their duties. The extant literature on D&O insurance investigates the consequences of D&O insurance, shedding light on the benefits or problems resulting from firms' purchase of D&O insurance. Collectively, these studies demonstrate a profound impact of D&O insurance on firms' financial reporting quality, tax reporting, auditing, cost of equity, firm value and so on (e.g. Lin, Officer, Wang & Zou, 2013; Boyer & Tennyson, 2015; Chan, Chang, Chen & Wang, 2019; Li & Liao, 2014; Wang, Zhang, Huang & Zhang, 2020).

Compared with the consequences of D&O insurance, the reason for firms' commitment to D&O insurance is less understood. A few factors that influence firms' decision to purchase D&O insurance are identified as increased litigation risk and large agency conflicts between shareholders and managers (Park, 2018; Zou, Wong, Shum, Xiong & Yan, 2008), political connections (Jia, Mao & Yuan, 2019) and managerial overconfidence (Lai & Tai, 2019). Following this line of research, we propose that firms' decision to purchase D&O insurance is dependent on the level of EPU in the country.

EPU captures the economic uncertainty caused by government policies because the policies are related to uncertainty regarding fiscal, regulatory or monetary issues. When the economic policies are uncertain, firms face substantial operating, financing and investing risks because possible changes in policies increase the difficulty of management forecasting and planning. The level of information asymmetry between investors and firms and among firms' stakeholders, such as suppliers and customers, due to uncertainty is also high. Stock prices fall when policies change, and the price decline is greater when the policy uncertainty is high (Pástor & Veronesi, 2012). For the US economy, Baker *et al.* (2016) (hereinafter BBD) develop an index to measure uncertainty about government economic policies arising from several unclear issues, including (1) who will make economic policy decisions; (2) what economic policy actions will be undertaken and when; and (3) what the economic effects of policy actions (or inaction) will be – including uncertainties related to the economic ramifications of "non-economic" policy matters, for example, military action. BBD's EPU index captures both near-term concerns (e.g. when the government will adjust its policy rate) and longer-term concerns (e.g. how to fund long-term investment projects), as reflected in newspaper articles. In later research, Baker's research team develops EPU indices for 24 more countries globally, including China.

We posit that a positive effect of EPU on the likelihood of firms purchasing D&O insurance occurs for at least two reasons. First, Jin, Chen and Yang (2019) demonstrate that the level of EPU that firms face has a positive effect on the one-year-ahead stock price crash risk in China because of accentuated information asymmetry and investors' disagreement about stock values. When the share price plummets, disgruntled shareholders may initiate a lawsuit against directors and executives or pressurize the board of directors to change the management team. Hence, to avoid the potential risks associated with a decline in shareholders' value, litigation and scrutiny from shareholders, firms have strong incentives to purchase D&O insurance when the economic uncertainty level is high. Meanwhile, the high level of EPU may reduce firms' performance and increase operational risk (e.g. Cui, Wang, Liao, Fang & Cheng, 2021). Suboptimal firm performance exposes directors and officers to great chances of lawsuits that threaten their job safety and reputation. Hence, when firms face uncertain economic policies, risk-averse directors and officers perceive a heightened litigation risk and may pressurize their firms to purchase D&O insurance. Kao, Chen and Krishnamurti (2020) find that firms purchase D&O insurance during initial public offerings (IPOs) because of directors' and officers' conservatism, i.e. risk-averse managers and directors try to mitigate the litigation risk associated with issuing IPOs. Taken together,

we posit that EPU influences directors' and executives' perception of risks and thereby motivates them to request firms to pursue D&O insurance as a shield against the potential litigation risk and shareholders' scrutiny.

Using a sample of Chinese listed firms over the period from 2003 to 2019, we find a positive effect of EPU on firms' likelihood of purchasing D&O insurance. Since EPU is unlikely to be influenced by firms' managers and investors, we provide evidence that firms modify their D&O insurance purchase decisions in response to an exogenous factor. Our analyses also uncover that firms' concerns about the stock price crash risk and litigation risk are the mechanisms driving the positive effect of EPU on D&O insurance. Further, cross-sectional analyses demonstrate that the positive effect of EPU is conditional on the capital market development of the province where the firm resides and the strength of firms' internal control. In addition, our main results are robust to a batch of sensitivity tests, including an instrumental variable regression and a difference-in-differences (DiD) test utilizing the China–US trade war as a natural experiment where the EPU is exogenously imposed on firms in certain industries exposed to the tariff sanctions – the treatment sample, but not on other firms. Our main findings and conclusion remain qualitatively unchanged.

This study contributes to the literature in the following ways. First, despite the rich evidence on the consequences of D&O insurance, we know little about the determinants of the purchase of the insurance. A few studies examining the determinants of D&O insurance purchase decisions focus mainly on firms' industry affiliation and corporate governance features (e.g. Park, 2018; Jia *et al.*, 2019) rather than the institutional environment. The finding of our study suggests that country-level EPU is a key institutional factor shaping firms' decisions to purchase D&O insurance. Second, our findings suggest that it is important for firms and their stakeholders to understand and to support directors' and officers' requests for D&O insurance due to uncertain economic policies. This understanding is crucial because D&Os' demand for insurance can be driven by opportunistic motives and managerial moral hazard (Lin, Hsu, Chou, Chao & Li, 2020; Park, 2018) or by justifiable economic conditions, and the motives are often unobservable. Given the beneficial effect of D&O insurance on firms' incentives to take on projects that are risky but with a positive net present value (NPV) (Cortenraad, 2000) and on firms' innovations (Wang *et al.*, 2020), our finding indicates that facing uncertain economic policies, stakeholders can be more receptive and supportive to D&Os' request for the insurance so that D&Os do not shun value-enhancing investment activities.

Lastly, our study enriches the literature on D&O insurance policies, which are gaining popularity in both developed and emerging markets. Even though D&O insurance is a comparatively new phenomenon in China, Chinese firms have increasingly adopted it in recent years [1]. Because of the availability of D&O insurance data, China is becoming an important testing ground for the determinants and consequences of the insurance, evidenced by the burgeoning literature on D&O insurance using Chinese data (e.g. Zou *et al.*, 2008; Jia *et al.*, 2019; Jia & Tang, 2018; Wang *et al.*, 2020; Yuan, Sun & Cao, 2016). Research on D&O insurance requires manual data collection in other countries because of the lack of readily downable data, which restricts empirical investigations and leads to a relatively small stream of literature on D&O insurance, mainly in Canada (e.g. Lin, Officer & Zou, 2011; Lin *et al.*, 2013; Chung, Hillegeist & Wynn, 2015), Taiwan (e.g. Chang & Chen, 2018; Chen & Keung, 2018; Lai & Tai, 2019) and in the USA (Donelson, Hopkins & Yust, 2018; Lin *et al.*, 2020). Evidence on D&O insurance from emerging markets would be a valuable addition to the international literature.

The remainder of the paper proceeds as follows. Section 2 provides a literature review and develops the hypotheses. Section 3 describes the data and presents descriptive statistics. Section 4 reports the empirical results. Section 5 concludes the paper.

2. Directors' and officers' liability insurance in China and hypothesis development

2.1 Literature survey on directors' and officers' liability insurance and economic policy uncertainty

Since the 1980s, D&O insurance has commonly been used by corporations in developed countries to shield their directors and executives from litigation-related compensation claims. Whether D&O insurance is beneficial is a contentious issue. Proponents of D&O insurance argue that, by shifting the risk of claims against directors and officers to the insurance company, D&O insurance protects directors and officers from potential loss of wealth in litigation, lowers the transaction costs of bankruptcy and provides claim administration service efficiency (Lai & Tai, 2019). Meanwhile, the insurance company serves as an alternative monitor to deter opportunistic managerial actions because, prior to issuing an insurance policy, D&O insurers perform a thorough examination of the D&Os for whom the insurance policy is to cover, thus ensuring D&Os' pursuit of shareholders' interest (Baker & Griffith, 2007; Cao & Narayanamoorthy, 2014). The insurer's monitoring also occurs during the process of litigation, when the insurer undertakes a comprehensive investigation into the claims made against specific aspects of the directors' administration (O'Sullivan, 1997). Empirical studies provide corroborative evidence for this argument, indicating that firms that purchase D&O insurance tend to take on risky but positive NPV projects (Cortenraad, 2000), conduct innovations (Wang *et al.*, 2020), have lower future stock price crash risk, have a lower likelihood of financial restatements and more corporate social responsibility reports among Chinese listed firms (Yuan *et al.*, 2016) and avoid costly real earnings management by Taiwanese listed firms (Chang & Chen, 2018).

Nevertheless, opponents contend that protecting D&Os from litigation risk by providing them with D&O insurance entices managerial opportunism and potentially decreases their due diligence and accountability (Baker & Griffith, 2010; Lin *et al.*, 2011). The inadequate behaviors resulting from moral hazards could eventually erode the intended benefits of D&O insurance. Empirically, it is reported that US firms are charged more for D&O insurance coverage if they have lower earnings quality or prior accounting restatements (Cao & Narayanamoorthy, 2014). In Taiwan, firms with D&O insurance are positively associated with overinvestment but negatively associated with investment efficiency (Li & Liao, 2014), and D&O insurance increases the likelihood of restating financial statements (Weng, Chen & Chi, 2017), internal control weakness (Chen & Keung, 2018) and the number of key audit matters (KAMs) disclosed by auditors (Lin *et al.*, 2020), and it also weakens the sensitivity of directors' compensation to firm performance (Wang & Chen, 2016). Canadian listed firms with D&O insurance have experienced an increase in the cost of equity and a negative market reaction to increased insurance coverage (Chen, Li & Zou, 2016), increased loan spread (Lin *et al.*, 2013), higher audit fees (Chung *et al.*, 2015), aggressive tax reporting activities (Zeng, 2017) and lower earnings conservatism (Chung & Wynn, 2008), as well as lower announcement period abnormal stock returns during merger and acquisition transactions with significantly higher acquisition premiums but lower post-acquisition business synergies (Lin *et al.*, 2011).

In China, using a sample of 53 approvals for the purchase of D&O insurance by shareholders' meetings from 2000 to 2004 and a matched control sample, Zou *et al.* (2008) find that Chinese firms with more intensified controlling-minority shareholders' interest conflicts tend to purchase the insurance, and that these firms have more representatives of large shareholders on the board of directors and engage in earnings management and/or tunneling-related party transactions. As a result of opportunism, the D&O insurance purchase tends to have a negative wealth effect. Jia *et al.* (2019) report that politically connected firms are less likely to purchase D&O insurance because political connections provide firms with legal protection from the risk of litigation against D&Os. Jia and Tang (2018) state that D&O

insurance purchased by Chinese listed firms encourages independent directors to behave less responsibly, thus reducing their personal board meeting attendance and taking on too many directorships. However, Yuan et al. (2016) find a negative effect of D&O insurance on stock price crash risk, fewer financial restatements and more disclosure of corporate social responsibility reports in their sample of Chinese listed firms, suggesting a conducive effect of D&O insurance on corporate governance.

Collectively, the literature suggests that the D&O insurance purchase decision can be motivated by either opportunistic or economically justifiable reasons. Driven by different motives, we may observe distinct consequences. The advancement in this literature made by Chang, Ren and Yeh (2018) reconciles the controversies. They show that the governance-enhancing effect of D&O insurance surmounts the moral hazard effect when firms have high-quality information that is used to monitor and inform D&Os of their responsibilities, whereas D&O insurance accentuates moral hazard problems when firms' information asymmetry is high and directors are not well informed.

Compared with the D&O insurance literature on the consequences, fewer studies examine the determinants. Prior studies identify the determinants of firms' insurance purchase decisions, such as the proportion of independent directors (Core, 1997; O'Sullivan, 1997), a lower level of managerial share ownership (O'Sullivan, 1997), firms' litigation risk and the conflicts between shareholders and managers (Park, 2018; Zou et al., 2008), managerial overconfidence (Lai & Tai, 2019) and political connections (Jia et al., 2019). These studies on the determinants of D&O insurance focus exclusively on firm-level characteristics in their inquiries while leaving the external factors of firms' institutional environment largely unaddressed. Hence, we intend to investigate whether firms' D&O insurance purchase decisions are sensitive to the risks associated with EPU, which is exogenous to managerial control.

Stakeholders' and firms' perception of the uncertainty about government policies has a profound impact on firms' decision-making. For instance, the uncertainty about fiscal and monetary policies and regulatory changes in the USA and the European Union contributed to the global financial crisis in 2008–2009 and the subsequent slow recovery because of businesses' reluctance to commit to higher capital spending when they face uncertainties about healthcare, tax and environmental policies (Baker et al., 2016). Using their index developed for the USA, BBD report that EPU is positively associated with stock price volatility and reduced investment and employment. They also find a strong causal impact of policy uncertainty on investment and employment in sectors that rely heavily on government spending, such as healthcare, and in sectors with strong exposure to major shifts in regulatory policy. In subsequent research, Baker's research team develops EPU indices for more than 24 countries globally, including China.

Concerning government policy uncertainty, recent studies on EPU provide rich insights into the effect of EPU on capital investment (Gulen & Ion, 2016; Julio & Yook, 2012), merger and acquisition activities (Bonaime et al., 2018; Nguyen & Phan, 2017), innovation (Bhattacharya et al., 2017), corporate transparency (Bird, Karolyi & Ruchti, 2017), information asymmetry and management disclosure (Nagar, Schoenfeld & Wellman, 2019) and equity prices and risk premia (Brogaard & Detzel, 2015; Pástor & Veronesi, 2012, 2013). In addition, EPU affects audit pricing (Zhang, Xu, Tong & Ye, 2018) and financial analysts' forecast accuracy and dispersion (Chourou, Purda & Saadi, 2021). Collectively, these studies indicate that higher levels of EPU can result in a decline in firms' real economic activities and an increase in information asymmetry, thus having negative long-term consequences for firms, investors and eventually the economy. Furthermore, using BBD's EPU, studies contend that the index is a direct reflection of the economic environment because it correlates at 0.42 with the indicators of macroeconomic uncertainty developed by Jurado, Ludvigson and Ng (2015)

and is a suitable proxy for government policy uncertainty related to economics (e.g. Wang, Chen & Huang, 2014; Gulen & Ion, 2016; Duong, Nguyen, Nguyen & Rhee, 2020).

Adopting BBD's EPU index, developed for China, as the proxy for EPU, recent Chinese studies on EPU provide insightful evidence. For instance, Wang *et al.* (2014) report that EPU and corporate investment are inversely related, but that this relationship is mitigated if firms have a higher return on invested capital, can invest with internal finance and are not state-owned. Liu and Zhang (2020) find that EPU significantly impedes real investment and reduces net debt issuance for private firms, but that such an effect does not exist in state-owned enterprises (SOEs), while they report no effect of EPU on the cash-holding decisions of Chinese listed firms over their sample period from 2013 to 2017. Jin *et al.* (2019) highlight a positive effect of EPU on stock price crash risk, and this relationship is more prominent in SOEs and firms with considerable information asymmetry and disagreement among investors. Studying the stock return effect of EPU, Chen, Jiang and Tong (2017) find lower future stock market returns because high uncertainty amplifies investors' behavioral biases and generates speculative mispricing under short-selling constraints. Using sample observations of commercial banks, Chi and Li (2017) investigate the effect of EPU on banks' credit risk and lending decisions. They demonstrate positive associations among EPU, non-performing loan ratios, loan concentrations and the normal loan migration rate, suggesting that EPU accentuates banks' credit risk and reduces loan size. All in all, the Chinese literature on EPU concurs with the international evidence that EPU deteriorates businesses' information environment, causes disagreement about firms' performance and value, and creates risks for firms' operations.

2.2 The background of directors' and officers' liability insurance policies in China
With the increase in securities lawsuits in China spurred by the Chinese Company Law (Article 111) and Securities Law (revised in 2005) [2], corporate D&Os are exposed to greater personal legal risks (Jia & Tang, 2018). D&Os of a number of Chinese listed firms have been sued alongside their firms by investors for failing to carry out their due diligence and responsibilities, and material fines have been issued to the firms and the D&Os involved (Jia *et al.*, 2019) [3]. Besides monetary loss, litigation against D&Os may cost them in the long run because international research on corporate litigations widely recognizes the significant impact on D&Os, including impaired re-employment prospects of the offending CEOs (Liu, Aharony, Richardson & Yawson, 2016), an increased probability of D&Os' turnover and a reduction in CEO compensation (Aharony, Liu & Yawson, 2015).

Anticipating the increased civil lawsuits, Article 39 of Code of Corporate Governance issued by the China Securities Regulatory Commission permits listed firms in China to purchase D&O insurance protecting D&Os' personal assets from compensation in the case of a lawsuit. In 2002, China Ping An Insurance Co. Ltd. and Chubb Insurance Group jointly launched the first D&O policy (Jia & Tang, 2018). Since then, D&O insurance has been gaining popularity in China, particularly among publicly listed firms with potential litigation risks (Zou *et al.*, 2008). Nevertheless, D&O insurance is still a relatively new concept at its developing stage (Wang *et al.*, 2020). Obstacles exist to its wide adoption at this stage. Some D&O insurance contracts, as simple replicas of the US D&O insurance clauses, are not designed to meet the realities of China in some instances [4]. Meanwhile, the D&O insurance coverage is still narrow, which may limit the enthusiasm of Chinese firms to purchase the D&O insurance. For instance, although China's Securities Law stipulates several joint liabilities of corporate and individual D&Os for misrepresentations and negligence, some D&O insurers only cover D&Os' personal liability but not the corporate liabilities (Tan, 2011). Despite these difficulties, we have seen promising advancements made by insurers and firms in designing appropriate contracts tailored to suit the specific circumstances.

2.3 The development of the hypotheses
Extending the literature on the determinants of D&O insurance, we focus on EPU as an exogenous factor that determines firms' D&O insurance decisions. We posit that there is a great likelihood of purchasing D&O insurance when firms experience high EPU for the following two reasons.

First, in a period with a high level of EPU, D&Os may perceive substantial risks associated with uncertain economic policies and the risk of failing to realize the targeted performance. Unexpected economic events can exert a negative impact on firms' earnings due to increased inventory costs and reduced sales, which are beyond managerial control (Chen, 2004). When managers fail to meet or beat analysts' earnings forecasts, the market reacts negatively (Skinner, 1997), threatening CEOs' job security (Farrell & Whidbee, 2003). Since D&Os are savvy about the economic conditions and regulatory changes, they should be fully aware of the great risks of deteriorated financial performance and the ensuing negative market reaction resulting from EPU. Adams, Lin and Zou (2011) demonstrate that CEOs' incentives to protect job security is positively associated with firms' D&O insurance purchase decisions, highlighting managers' concern for job safety as a reason for their request for the insurance. Therefore, we posit that when the level of EPU is high, D&Os are more likely to pressurize firms to protect their interest with D&O insurance.

Furthermore, an uncertain economic environment increases the litigation risks of firms, and D&O insurance is essential to mitigate the D&Os' concern about litigation risk. That is, although EPU is negatively related to investment (Baker *et al.*, 2016; Wang *et al.*, 2014), merger and acquisition activities (Bonaime *et al.*, 2018; Nguyen & Phan, 2017), innovation (Bhattacharya *et al.*, 2017) and risk-taking (Wen, Li, Sha & Shao, 2020), resulting in poor firm performance and increased litigation risks, D&O insurance can offset their concerns about lawsuits. Therefore, we propose that firms intend to provide D&O insurance to mitigate D&Os' concern about litigation risks. Retaining a group of talented D&Os is crucial for firms to continue with innovation and value-increasing investments, thus providing D&O insurance in a period of high EPU can be a means for firms to offset the adverse impacts of EPU and to overcome the agency conflicts caused by moral hazard effectively. Taken together, we expect the purchase of D&O insurance to be positively associated with the level of EPU, resulting in the following hypothesis:

H1. EPU is positively associated with the corporate purchase of D&O liability insurance in China.

Next, we intend to investigate the channels through which the effect of EPU on D&O insurance takes place. We identify two channels, namely, stock price crash risk and litigation risk. First, stock price crash risk captures the extreme negative returns of a firm (Callen & Fang, 2015; Kim & Zhang, 2014) and can be highly detrimental to shareholders' wealth (Habib, Hasan & Jiang, 2018). Jin *et al.* (2019) show that, when the uncertainty about economic policies is high, Chinese listed firms are more likely to experience stock price crashes, and this effect occurs because of the increased information asymmetry and increased disagreement among investors. We posit that firms that are prone to stock price crash risk are more likely to acquire D&O insurance because heightened stock price crash risk could spur disgruntled shareholders to impose pressure on firms to dismiss incompetent D&Os, and CEOs' incentives to protect job security is one of the determinants of firms' D&O insurance purchase decisions (Adams *et al.*, 2011).

Second, we conjecture that EPU increases the risk of poor economic performance by firms and the incentive for managers to cover up the suboptimal performance through misreporting, which in turn increases the litigation risk faced by D&Os, triggering their demand for insurance coverage. Uncertain economic policies increase firms' difficulties in making an investment, budgeting and operating, which is thus related to a large-scale

reduction in innovation (Xu, 2020), a decrease in corporate investment (Baker *et al.*, 2016; Gulen & Ion, 2016), fluctuations in cash flows and increased financial distress (e.g. Cui *et al.*, 2021). Consequently, uncertainty can adversely affect a firm's financial performance (Chen, 2004). To cover up potential suboptimal performance during the period of a high level of EPU, Chinese firms conduct earnings management due to the impact of EPU on financial distress (Cui, Yao, Fang & Wang, 2021). The loss in shareholders' value and firms' misconduct can trigger shareholder-initiated lawsuits. Because of the tightened legal enforcement in recent years, securities lawsuits in China are on the rise, and Chinese D&Os find themselves increasingly subject to greater exposure to personal legal risks (Jia & Tang, 2018) [5].

Furthermore, prior studies demonstrate that D&Os' concern about litigation risk is a major driver of firms' decision to purchase D&O insurance (e.g. Park, 2018; Zou *et al.*, 2008). Kao *et al.* (2020) report that D&Os are conservative and risk-averse, and therefore, firms purchase D&O insurance during IPOs to mitigate the litigation risk associated with issuing IPOs. Also, the premium charged by insurers on the insurance reflects their assessment of a firm's litigation risk, particularly as it relates to the financial reporting problems (Boyer & Tennyson, 2015; Cao & Narayanamoorthy, 2014). Taken together, we posit that firms' decision to purchase D&O insurance in an uncertain economic environment is driven by firms' concern about the potential stock price crash risk and the litigation risk, leading to the following hypothesis:

H2. The positive effect of EPU on the decision to purchase D&O insurance is more pronounced when firms have great stock price crash risk or high litigation risk.

To provide additional insights, we also investigate whether the effect of EPU on the decision to purchase D&O insurance varies with regional capital market development and the strength of firms' internal governance. Wang *et al.* (2014) find that EPU has a negative effect on firms' investment in China, and that firms in economic markets with a high level of marketization may be more sensitive to EPU. They argue that firms in developed markets are more sensitive to the changes in economic policies due to their exposure to international trade, financial capital supply and securities markets. Calomiris, Love and Pería (2012) report that financial capital supply shocks and liquidity shocks during economic crisis periods have a more profound impact on developed economies than on emerging markets. This is evident from the 2007 financial crisis, which had a minor impact on less developed/emerging economies, such as China, Brazil, Romania, North Korea, Iran, Armenia and the UAE, in comparison with the developed nations. China's provinces show uneven development in their economy and capital market (Fan, Wong & Zhang, 2013) and thus provide a setting for empirical investigation. We conjecture that EPU has a greater impact on D&O insurance purchase decisions in provinces with a high level of marketization.

In addition to firms' external institutional environment, their internal corporate governance plays an important role in the decision to buy D&O insurance (e.g. Core, 1997; O'Sullivan, 1997; Zou *et al.*, 2008). Therefore, we consider whether EPU has an asymmetrical impact on the decision to purchase D&O insurance in firms with different strengths of internal control. Weak internal control is an indicator of feeble corporate governance, an incompetent management team and suboptimal audit quality (Ashbaugh-Skaife, Collins & Kinney, 2007; Krishnan & Visvanathan, 2007). Therefore, firms with weak internal control are prone to corporate failure. Furthermore, firms with weak internal controls tend to conduct opportunistic reporting to disguise distressed financial situations and potential bankruptcy (Jiang, Rupley & Wu, 2010). Specifically, we posit that firms are likely to purchase D&O insurance in an uncertain economic condition when they have strong internal control because strong governance facilitates corporate transparency and shareholders' scrutiny. Taken together, we develop the third hypothesis as follows:

H3. The effect of EPU on the D&O insurance purchase decision is conditional on the provincial market development and the strength of internal control.

3. Methodology and variables
3.1 Main variables
3.1.1 Directors' and officers' liability insurance. Following prior studies on D&O insurance (e.g. Zou *et al.*, 2008; Yuan *et al.*, 2016), we employ a dummy variable (*D&O*) to measure the D&O insurance purchase and collect D&O insurance data from the Chinese Research Data Services (CNRDS) platform, which are used in an increasing number of business studies (e.g. Yang, Chen, Jia & Xu, 2019; Zhang, Zi, Shao & Xiao, 2020). CNRDS collects information on the purchase of D&O insurance through minutes of the board and shareholders' meetings, annual reports and media platforms such as cninfo.com.cn. Approximately 7% of public firms in China currently have D&O insurance coverage. However, the demand for D&O insurance among Chinese listed firms is on the rise, jumping from 3% in 2002 to 8% in 2019. The growth trend is also evident in our sample, in which the number of firms with D&O insurance increased approximately seven times from 2004 (42 firms) to 2019 (285 firms). This then raises an interesting question regarding why Chinese listed firms purchase D&O insurance and whether EPU has played a role in the increase in the volume of D&O insurance.

3.1.2 Economic policy uncertainty. We employ BBD's EPU index, developed for China by Baker *et al.* (2016), which runs from 1995 to the present. The authors first flag all the articles of *South China Morning Post* (SCMP), Hong Kong's leading English newspaper, that contain information about *China* or *Chinese*, *economy* or *economic*, and *uncertain* or *uncertainty*. They then count the number of SCMP articles containing the words "policy," "spending," "budget," "political," "interest rates," "reform," "government," "Beijing" or "authorities," "tax," "regulations" or "regulatory," "central bank," "People's Bank of China" or "PBOC," "deficit," and "WTO." Afterward, they scale the raw EPU counts by the total number of SCMP articles in the same month and normalize the resulting series to a mean value of 100 by applying a multiplicative factor [6].

We also use the alternative EPU index of China, developed by Davis, Liu and Sheng (2019), as a robustness check. Davis *et al.* divide their sample into three periods – the years of central planning (1949–1978), the reform and opening-up period (1979–1999) and the globalization years (2000 onward), and use the daily counts of newspaper articles. They find that the proportion of newspaper articles that address economics rises from the first period to the second period and further from the second period to the third period. Davis *et al.*'s (2019) EPU index is constructed by considering the frequency of the words "*economics,*" "*policy*" and "*uncertainty*" appearing in two mainland Chinese newspapers, namely, *People's Daily* and *Guangming Daily*. They then scale the raw monthly EPU counts by the total number of articles for the same newspaper and month. In addition, we employ Davis *et al.*'s trade policy uncertainty (TPU) index as our second alternative measure of EPU. The TPU index is constructed in the same way as Davis *et al.*'s EPU index but with a focus on TPU [7].

3.1.3 Stock price crash risk. Following the extant crash risk literature (e.g. Chen, Hong & Stein, 2001), we employ two firm-specific measures of stock price crash risk in this study to ensure that the measures reflect firm-specific factors rather than broad market movements. We first estimate firm-specific residual weekly returns for each firm and year from the following expanded market model regression:

$$r_{j,\tau} = \alpha_j + \beta_{1,j} r_{m,\tau-2} + \beta_{2,j} r_{m,\tau-1} + \beta_{3,j} r_{m,\tau} + \beta_{4,j} r_{m,\tau+1} + \beta_{5,j} r_{m,\tau+2} + \varepsilon_{j,\tau} \tag{1}$$

where $r_{j,\tau}$ is the return of firm j in week τ, and $r_{m,\tau}$ is the return on the CRSP value-weighted market index in week τ. We correct for non-synchronous trading by including lead and

lag terms for the market index return (Dimson, 1979). We define the firm-specific weekly return, $W_{j,\tau}$, as the natural logarithm of one plus the residual return from equation (1). In estimating equation (1), a minimum of 26 weekly stock returns per firm-year is required.

The first firm-specific measure of crash risk is the negative conditional skewness of firm-specific weekly returns over the fiscal year (NCSKEW), calculated as the negative of the third moment of the firm-specific weekly returns for each year, normalized by the standard deviation of the firm-specific weekly returns raised to the third power. Thus, for each firm j in year τ, NCSKEW is computed as:

$$NCSKEW = -\left[n(n-1)^{3/2}\sum w_{j,\tau}^3\right]\bigg/\left[(n-1)(n-2)\left(\sum w_{j,\tau}^2\right)^{3/2}\right] \qquad (2)$$

The second measure of firm-specific crash risk is called "down-to-up volatility" (DUVOL), calculated as:

$$DUVOL_{j,\tau} = \log\left\{(n_u-1)\sum_{Down} w_{j,\tau}^2 \bigg/ (n_d-1)\sum_{Up} w_{j,\tau}^2\right\} \qquad (3)$$

where n_u and n_d are the number of up and down weeks over the fiscal-year period τ, respectively. For each firm j over a fiscal-year period, we divide the firm-specific weekly returns into two groups: "down" weeks, when the returns are below the annual mean, and "up" weeks, when the returns are above the annual mean. We further compute the standard deviation of the firm-specific weekly returns for each of these two groups separately. We then calculate the natural logarithm ratio of the standard deviation of "down" weeks to the standard deviation of "up" weeks. Similar to NCSKEW, the higher the DUVOL value, the more likely the stock is to crash. Since DUVOL does not involve third moments, it is less likely to be overly affected by extreme weekly returns (Chen et al., 2001).

3.1.4 Firm-specific litigation risk. To examine whether heightened litigation risk is a channel through which EPU influences a firm's decision to purchase D&O insurance, we employ a firm-level measure of the probability of litigation following Rogers and Stocken (2005). Although literature pragmatically measures firms' litigation risk using the industry-based proxy that is based on the memberships of a few industries exposed to high litigation risks, such as biotechnology, computers, electronics and retail industries (e.g. Francis, Philbrick & Schipper, 1994), the industry-based proxy "likely captures industry characteristics that are unrelated to litigation risk but that affect managers' decisions, creating a potential correlated omitted variables problem" (Kim & Skinner, 2012, p. 291). By contrast, Rogers and Stocken (2005) develop an *ex ante* measure of litigation as the probability of firm-level lawsuits. The measure is estimated using a probit specification where the incidence of a lawsuit is regressed on firm-specific characteristics and high-litigation industry membership, and then (Lit) is the probability of litigation obtained from the probit model. A detailed explanation of the probit model is provided in Appendix 2.

3.2 Research design
To examine the effect of EPU on the likelihood of purchasing D&O insurance, we estimate a multivariate probit regression, as shown in equation (4), selecting a set of control variables that strictly follow prior studies.

$$\begin{aligned}
\Pr(D\&O_{j,t}=1)={} & \alpha_0+\alpha_1 EPU_{j,t-1}+\alpha_2 SIZE_{j,t-1}+\alpha_3 LEV_{j,t-1}+\alpha_4 ROA_{j,t-1}\\
& +\alpha_5 STDDEV_{j,t-1}+\alpha_6 TMTSHARE_{j,t-1}+\alpha_7 CROSSLIST_{j,t-1}\\
& +\alpha_8 TOP1_{j,t-1}+\alpha_9 MTB_{j,t-1}+\alpha_{10} SOE_{j,t-1}+\alpha_{11} CEOPOLI_{j,t-1}\\
& +\alpha_{12} BRDINDEP_{j,t-1}+\alpha_{13} CLI_{t-1}+\alpha_{14} GDP_{t-1}\\
& +Industry\ and\ Year\ Fixed\ Effects+\varepsilon_{j,t-1}
\end{aligned} \quad (4)$$

where *D&O* is a dummy variable that equals one if a firm purchases D&O insurance in year *t*, and zero otherwise. *EPU* is the natural logarithm of the raw EPU index in year $t-1$, where the raw EPU index is developed by BBD for China, as described above. If EPU is positively associated with the likelihood of purchasing D&O insurance, we will observe a positive coefficient for *EPU*, providing supportive evidence for H1. We also use alternative measures of EPU as robustness checks in Section 4.4.

Following prior literature on D&O insurance (e.g. Core, 1997; Zou *et al.*, 2008; Jia & Tang, 2018; Jia *et al.*, 2019), we control for the following firm characteristics affecting the D&O insurance purchase decision. Firm size (*SIZE*) is measured using the natural logarithm of total assets. Leverage (*LEV*) is the ratio of total liabilities to total assets. Firm performance (*ROA*) is measured as the ratio of net income to total assets. *STDDEV* is the standard deviation of daily stock returns. *TMTSHARE* is the number of shares held by top management as a percentage of the total shares issued. *CROSSLIST* is a dummy variable that equals one if a firm is cross-listed on an overseas stock exchange, and zero otherwise. We measure the largest shareholding (*TOP1*) as the percentage of shares owned by the largest shareholder. *MTB* is the market-to-book ratio of a firm, measured as the market value of equity to the book value of equity. *SOE* is a dummy variable that equals one if a firm's ultimate controlling shareholder is the state, and zero otherwise. *CEOPOLI* is a dummy variable that equals one if the CEO of a firm is politically connected, and zero otherwise [8]. Board independence (*BRDINDEP*) is the percentage of independent directors on a board. We add industry dummies to control for industry fixed effects. The standard errors are clustered by firm to control for potential heteroskedasticity and autocorrelation problems and to provide robust standard error estimation with reliable *t*-statistics (Gow, Ormazabal & Taylor, 2010; Petersen, 2009). Furthermore, since the EPU index may capture the impact of other general macroeconomic uncertainties, i.e. an increase in EPU is usually associated with an increase in economic uncertainty (Gulen & Ion, 2016), we also control for other macroeconomic factors. Following Sha, Kang and Wang (2020), we include two proxies for macroeconomic conditions, specifically the real gross domestic product (*GDP*) growth and the composite leading indicator (*CLI*). The variables' definitions are provided in Appendix 1.

To test whether the effect of EPU on D&O insurance purchase takes place because of stock price crash risk and litigation risk, H2 is tested with an expanded equation (4) with stock price crash risk (*CRASH*) and an interactive term, *EPU * CRASH*, and then with an expanded equation (4) with litigation risk (*LIT*) and an interactive term, *EPU * LIT*. A statistically positive and significant coefficient for *EPU * CRASH* or *EPU * LIT* will lend support to H2. *CRASH* is measured using *NCSKEW* and *DUVOL*, as described in the section above. Following Rogers and Stocken (2005), *LIT* is a dummy variable that measures whether a firm is involved in lawsuit(s) in the year. As proposed in H3, we then investigate whether the effect of EPU on D&O insurance purchase is conditional on regional market development (as measured by the marketization index, *MKT*) and the strength of internal control (*IC*). Next, we include the interaction term *EPU * MKT*, or *EPU * IC*, in equation (4) and perform analyses for each interaction term separately. We expect to observe a significant and positive coefficient for *EPU * MKT*, or *EPU * IC*, in support of H3.

3.3 Sample and data

Our data are collected from three main sources. We obtain the D&O data from the Chinese CNRDS and the firm financial data from the China Stock Market and Accounting Research Database (CSMAR). The EPU data are retrieved from the Global EPU Indices developed by Baker's research team. Our sample consists of all Chinese public listed firms on the Shanghai and Shenzhen stock exchanges from 2003 to 2019 [9]. We choose 2003 as the starting year because it is the first year in which some control variables (e.g. ownership concentration) become available. Since we lag the independent and control variables by one period, our D&O data start in 2004 and end in 2019. After removing missing data, our final sample comprises 31,302 firm-year observations from 3,281 firms.

Table 1 provides the descriptive statistics. To minimize the effect of outliers, all the continuous variables are winsorized at 1% at both tails. Panel A shows that the mean EPU, a natural logarithm of the raw EPU index, is 4.72, with a low standard deviation because the log transformation has reduced the variation caused by extreme values. In addition to EPU, the standard deviations of *SIZE*, *LEV*, *MTB* and *MARKETIZATION* are relatively high, reflecting the wide variations in firm size, leverage, market value and market development across provinces. Nearly half of the sample are SOEs, 8% of the firms are cross-listed and 23% of the firms are politically connected. Panel B shows that 2,145 firms have purchased D&O insurance coverage, representing approximately 7% of our sample. Panel B also reports the distribution of insured firms by year over our sample period. It is evident that the number of firms with D&O insurance increases each year over the sample period, from 3.7% in 2004 to 9% in 2019, indicating increasing awareness of the importance of D&O insurance.

4. Empirical results

4.1 The effect of economic policy uncertainty on directors' and officers' liability insurance – baseline regressions

Table 2 reports the baseline regression results of using equation (4) to test the effect of EPU on the likelihood of purchasing D&O insurance. Following Wang *et al.* (2014), we use the geometric mean method to transform the original monthly EPU data into annual data, and divide the numbers by 100. Then, we use the natural logarithm of the EPU index in all regression analyses. To mitigate the concern for potential reverse causality, we regress the D&O dummy variable in year t on EPU and other control variables in year $t-1$. Then, we estimate equation (4) with various model specifications to check whether the results are sensitive [10]. Column (1) of Table 2 reports our results in the absence of control variables, and Column (2) reports the results with all control variables but the macroeconomic factors. Column (3) shows the results controlling for firm characteristics, macroeconomic factors as well as industry fixed effects. We cluster the standard error at the firm level following a few prominent studies on EPU (e.g. Baker *et al.*, 2016; Duong *et al.*, 2020; El Ghoul, Guedhami, Kim & Yoon, 2021). We then estimate equation (4) controlling for industry fixed effects and cluster robust standard errors by year. Column (5) shows the regression estimation results by controlling for industry fixed effect and clustering the standard error by firm and year.

We find that EPU_{t-1} significantly explains the D&O insurance purchase decision for all model specifications as reported in Columns (1) to (5), suggesting that firms are more likely to purchase D&O insurance when the degree of EPU is higher. In all, the baseline regression analyses support H1's prediction on the positive effect of EPU on firms' D&O insurance purchase decisions. To interpret the economic significance of the effect, we compute the marginal effect as shown in Table 2. The marginal effect suggests a sizable economic effect, in that the chance of a firm purchasing D&O insurance increases by 3.19% (6.65% × 0.48),

Panel A: Descriptive statistics of the variables

Variable	Mean	Std dev	Lower quartile	Median	Upper quartile
D&O	0.07	0.25	0.00	0.00	0.00
EPU	4.72	0.48	4.52	4.71	4.86
SIZE	21.94	1.48	20.94	21.72	22.65
LEV	0.52	5.11	0.29	0.46	0.62
ROA	0.03	0.07	0.01	0.03	0.06
STDDEV	0.03	0.02	0.02	0.03	0.04
TMTSHARE	0.07	0.16	0.00	0.00	0.10
CROSSLIST	0.08	0.27	0.00	0.00	0.00
TOP1	0.36	0.16	0.24	0.34	0.47
MTB	4.06	4.01	1.86	2.89	4.74
SOE	0.48	0.50	0.00	0.00	1.00
CEOPOLI	0.23	0.39	0.00	0.00	0.00
BRDINDEP	0.16	0.09	0.11	0.18	0.21
CLI	100.15	1.21	99.78	100.23	100.85
GDP	0.09	0.02	0.07	0.08	0.10
NCSKEW(N = 13,995)	−0.28	0.74	−0.67	−0.23	0.12
DUVOL (N = 13,995)	−0.20	0.50	−0.52	−0.18	0.10
LIT (N = 27,352)	0.27	0.06	0.23	0.27	0.31
Marketization index (N = 18,931)	7.51	1.81	6.25	7.73	9.14
IC (N = 13,662)	6.16	2.16	6.07	6.77	7.17

Panel B: Statistics of firm-year observations with a D&O insurance policy

Year	Firms with a D&O insurance policy	Total listed firms in the year	Proportion of firms with the policy out of total listed firms in the year (%)
2004	42	1,129	0.037
2005	44	1,224	0.036
2006	49	1,229	0.040
2007	61	1,260	0.048
2008	87	1,335	0.065
2009	100	1,449	0.069
2010	106	1,548	0.068
2011	118	1,864	0.063
2012	138	2,137	0.065
2013	155	2,286	0.068
2014	163	2,265	0.072
2015	170	2,308	0.074
2016	174	2,381	0.073
2017	212	2,693	0.079
2018	241	3,074	0.078
2019	285	3,120	0.091
Total	2145	31,302	0.069

Table 1.
Descriptive statistics

when the level of EPU increases by one standard deviation. Based on the mean of EPU as reported in Table 1, this stands for a 45.6% (3.19% ÷ 7%) increase in the possibility of purchasing D&O insurance. Therefore, we conclude that EPU has a significant impact on the purchase of D&O insurance both statistically and economically, thus lending support to H1.

On the basis of the results reported in Column (3), we can observe that the coefficients for firm size ($SIZE_{t-1}$) and firms' listing overseas ($CROSSLIST_{t-1}$) are significant and positive, suggesting that large and cross-listed firms are more inclined to seek D&O insurance coverage. These findings are broadly consistent with the prior studies (e.g. Zou et al., 2008; Jia et al., 2019).

	(1) DV: $D\&O_{j,t}$	(2) DV: $D\&O_{j,t}$	(3) DV: $D\&O_{j,t}$	(4) DV: $D\&O_{j,t}$	(5) DV: $D\&O_{j,t}$
$Constant_{t-1}$	-2.574*** (-4.83)	-6.502*** (-7.56)	-7.294*** (-6.29)	-7.294*** (-4.16)	-7.294*** (-5.11)
EPU_{t-1}	0.259*** (7.82)	0.173*** (2.75)	0.171** (2.50)	0.171** (2.59)	0.171** (2.32)
Marginal effect	0.0685***	0.0665***	0.0665***	0.0665***	0.0665***
$SIZE_{t-1}$	–	0.210*** (6.63)	0.207*** (6.17)	0.207*** (20.31)	0.207*** (6.30)
LEV_{t-1}	–	0.011 (1.09)	0.011 (1.10)	0.011 (1.59)	0.011 (1.11)
ROA_{t-1}	–	0.004 (1.06)	0.005 (1.08)	0.005** (2.58)	0.005 (1.09)
$STDDEV_{t-1}$	–	-0.091** (-2.40)	-0.083** (-1.96)	-0.083*** (-2.63)	-0.083** (-2.04)
$TMTSHARE_{t-1}$	–	-2.021*** (-3.89)	-2.040*** (-3.89)	-2.040*** (-15.21)	-2.040*** (-4.20)
$CROSSLIST_{t-1}$	–	0.707*** (6.31)	0.710*** (6.28)	0.710*** (8.69)	0.710*** (5.29)
$TOP1_{t-1}$	–	-0.351 (-1.45)	-0.348 (-1.43)	-0.348*** (-4.86)	-0.348 (-1.47)
MTB_{t-1}	–	-0.006 (-0.46)	-0.005 (-0.43)	-0.005 (-1.26)	-0.005 (-0.48)
SOE_{t-1}	–	0.094 (0.89)	0.097 (0.91)	0.097*** (3.25)	0.097 (0.91)
$CEOPOLI_{t-1}$	–	0.011 (0.16)	0.014 (0.19)	0.014 (0.51)	0.014 (0.20)
$BRDINDEP_{t-1}$	–	0.514 (1.20)	0.505 (1.16)	0.505*** (8.42)	0.505 (1.22)
CLI_{t-1}	–	–	0.009 (0.88)	0.009 (0.61)	0.009 (0.76)
GDP_{t-1}	–	–	-0.645 (-0.60)	-0.645 (-0.58)	-0.645 (-0.54)
Industry FE	Yes	Yes	Yes	Yes	Yes
Firm cluster	Yes	Yes	Yes	No	No
Year cluster	No	No	No	Yes	No
Firm and year cluster	No	No	No	No	Yes
Observations	31,302	31,302	31,302	31,302	31,302
Pseudo R^2	0.12	0.23	0.23	0.23	0.23

Note(s): This table reports the results from the probit regressions regressing D&O insurance purchase (D&O) in year t on EPU in year $t-1$ and other control variables in year $t-1$. EPU is measured using BBD's EPU index for China, and its natural logarithm is used for the analysis. Continuous variables are winsorized at their 1st and 99th percentiles. ***, ** and * represent statistical significance at the 1, 5 and 10% levels, respectively (two-tailed test). The variables' definitions are provided in Appendix 1

Table 2.
The effect of EPU on
the likelihood of firms
purchasing D&O
insurance

4.2 Why does the effect of economic policy uncertainty on the directors' and officers' liability insurance purchase decision take place? The channel analysis

As argued in H2, we posit that stock price crash risk and litigation risk are the channels through which EPU affects firms' decisions to purchase D&O insurance. First, since EPU is positively associated with the future stock price crash risk of Chinese listed firms and a stock price crash is often an antecedent of litigation risk, we posit that the effect of EPU on D&O insurance is more pronounced for firms that are susceptible to stock price crash risk. To validate this argument, we conduct analyses by employing the interaction term EPU_{t-1} $*CRASH_{t-1}$ and present the results in Table 3 Panel A. We adopt two measures of stock price crash risk, *NSCKEW* and *DUVOL*. The results show that the coefficient for EPU_{t-1} $*CRASH_{t-1}$ is significantly positive for both *NSCKEW* (coefficient 0.037, z-stat 1.99, p-value < 0.05) and *DUVOL* (coefficient 0.093, z-stat 2.08, p-value < 0.05). The findings suggest that the positive effect of EPU on the likelihood of D&O insurance purchase is greater when firms have a higher risk of stock price crash.

Second, since it is well established that D&Os' concern about firms' litigation risk prompts them to pressure firms to purchase D&O insurance, we conjecture that the heightened litigation risk in an uncertain economic environment strongly motivates D&Os to request the insurance. To this end, we test whether the interactive term $EPU_{t-1} * LIT_{t-1}$ expanded to

Pane A: Stock price crash risk

Variable	DV: D&O_t (1) NCSKEW	DV: D&O_t (2) DUVOL
$Constant_{t-1}$	-6.788^{***} (-4.34)	-6.848^{***} (-4.94)
$EPU_{t-1} * CRASH_{t-1}$	0.037^{**} (1.99)	0.093^{**} (2.08)
EPU_{t-1}	0.154^{***} (2.89)	0.157^{***} (2.74)
$CRASH_{t-1}$	-0.181^* (-1.81)	-0.430^* (-1.86)
Controls included	Yes	Yes
Industry FE	Yes	Yes
Firm cluster	Yes	Yes
Observations	13,955	13,955
Pseudo R^2	0.18	0.18

Panel B: Litigation risk

Variable	DV: D&O_t (1)
$Constant_{t-1}$	-7.308 (-4.39)
$EPU_{t-1} * LIT_{t-1}$	0.316^{**} (2.01)
EPU_{t-1}	0.073^* (1.67)
LIT_{t-1}	1.045 (0.66)
Controls included	Yes
Industry FE	Yes
Firm cluster	Yes
Observations	27,352
Pseudo R^2	0.23

Note(s): Panel A reports the results from the probit regressions regressing D&O insurance purchase (D&O) in year t on lagged EPU, lagged *EPU * CRASH* and other control variables in year $t-1$. Panel B reports the results from the probit regressions regressing D&O insurance purchase (D&O) in year t on lagged EPU, lagged *EPU * LIT* and other control variables in year $t-1$. EPU is measured using BBD's EPU index for China, and its natural logarithm is used for the analysis. Continuous variables are winsorized at their 1st and 99th percentiles. ***, ** and * represent statistical significance at the 1, 5 and 10% levels, respectively (two-tailed test). The variables' definitions are provided in Appendix 1

Table 3.
EPU, D&O insurance, stock price crash risk and litigation risk – channel analysis

equation (4) is significantly positive. Panel B of Table 3 reports the results of the second channel – the litigation risk. The results, as expected, show that the positive effect of EPU on firms' likelihood of purchasing the insurance for their D&Os is accentuated, evidenced by the significantly positive coefficient for $EPU_{t-1}*LIT_{t-1}$ (coefficient 0.316, z-stat 2.01, p-value < 0.05). Collectively, our empirical results are supportive of H2, providing possible explanations for firms' tendency to purchase D&O insurance when economic policies are uncertain.

4.3 The effect of economic policy uncertainty on the directors' and officers' liability insurance purchase decision conditional on provincial marketization and the strength of internal control – cross-sectional analysis

The prior literature provides evidence that Chinese firms located in regions with a higher level of market development are more sensitive to EPU (Wang *et al.*, 2014). Given the uneven levels of market development across Chinese provinces, it is important to determine whether the effect of EPU on the likelihood of purchasing D&O insurance varies with the level of marketization of the province where a firm operates. To this end, we estimate an expanded equation (4) by adding MKT_{t-1} and the interactive term $EPU_{t-1}*MKT_{t-1}$, where MKT_{t-1} is a dummy variable taking the value of one if a firm is from a province with a marketization index that is above the sample median, and zero otherwise. The results, as reported in Panel A of Table 4, show that the coefficient for the variable of interest, EPU_{t-1}, is positive and significant (coefficient 0.075, z-stat 3.12, p-value < 0.05), and the coefficient for the interactive

Variable	(1) DV: $D\&O_t$
Panel A: Provincial marketization index	
$Constant_{t-1}$	-5.061^{***} (-4.50)
$EPU_{t-1} * MKT_{t-1}$	0.242^{***} (3.52)
EPU_{t-1}	0.075^{**} (3.12)
MKT_{t-1}	1.061 (1.11)
Controls included	Yes
Industry FE	Yes
Firm cluster	Yes
Observations	18,931
Pseudo R^2	0.23
Panel B: The strength of internal control	
$Constant_{t-1}$	-5.957^{***} (-3.60)
$EPU_{t-1} * IC_{t-1}$	0.023^{**} (1.98)
EPU_{t-1}	0.048^{*} (1.83)
IC_{t-1}	-0.104 (-1.18)
Controls included	Yes
Industry FE	Yes
Firm cluster	Yes
Observations	13,662
Pseudo R^2	0.18

Table 4.
Does the effect of EPU on D&O insurance vary with the external capital market development and strength of internal control? Cross-sectional analyses

Note(s): This table reports the results from the probit regressions regressing D&O insurance purchase (D&O) in year t on lagged EPU and lagged $EPU * MKT$, lagged $EPU * IC$ and other control variables in year $t-1$. EPU in this table is measured using BBD's EPU index for China, and its natural logarithm is used for the analysis. Continuous variables are winsorized at their 1st and 99th percentiles. ***, ** and * represent statistical significance at the 1, 5 and 10% levels, respectively (two-tailed test). The variables' definitions are provided in Appendix 1

term, $EPU_{t-1}*MKT_{t-1}$, is positive and significant (coefficient 0.242, z-stat 3.52, p-value < 0.01).

In addition to a firm's external environment, corporate governance can influence a firm's decision to buy D&O insurance (e.g. Core, 1997; Zou *et al.*, 2008). As conjectured in H3, we expect the effect of EPU on the D&O insurance purchase decision to be conditional on the strength of internal control. Internal control is a dummy variable taking the value of one if a firm has an internal control index that is above the sample median, and zero otherwise. Then, we estimate an expanded equation (4) with IC_{t-1} and $EPU_{t-1}*IC_{t-1}$. Our analysis, reported in Panel B of Table 4, shows that the positive effect of EPU on the purchase of D&O insurance is amplified in firms with a high level of internal control index (coefficient 0.023, z-stat 1.98, p-value < 0.05). In conclusion, the results provide corroborative evidence that the positive effect of EPU on the D&O insurance purchase decision is more pronounced when firms are from a province with advanced capital market development and when firms have strong internal control, lending support to H3.

4.4 Robustness tests

Even though we use the lagged independent variable, EPU_{t-1}, in equation (4) to overcome the possible concern about reverse causality, there is also a likelihood that firms' decision to purchase D&O insurance foretells the macroeconomic conditions and government policy uncertainty because managers have private information about the directions of the economy and thus may front-run the media in predicting the risks associated with the future economic condition. If this is the case, managers can pressurize firms to protect them by purchasing D&O insurance. Meanwhile, we cannot rule out the possibility that other unobservable characteristics may influence the purchase of D&O insurance or have an impact on the firm and EPU simultaneously, for example, a country's political forces. To alleviate such concerns, we conduct endogeneity tests using a two-stage least squares (2SLS) regression approach and report the results of our main analysis in Table 5 [11].

For the 2SLS analysis, we use the US EPU index (lagged by two periods) as an instrumental variable for China's EPU (lagged by one period) following Wang *et al.* (2014). Wang *et al.* (2014) argue that the US's and China's EPU are closely related. Mackowiak (2007) also shows that macroeconomic fluctuations, including interest rates and exchange rates, in emerging markets, are strongly influenced by changes in US monetary policy. Panel A of Table 5 reports the 2SLS analysis results. The first-stage regression analysis shows that the instrumental variable, the Chinese EPU, comoves with *US_EPU*, being consistent with the literature. The second-stage analysis results confirm the main finding that firms experiencing a high level of EPU are more likely to purchase D&O insurance in the coming year, as predicted by H1. The Wu–Hausman F test indicates that the potential endogeneity problem is effectively controlled by using the US EPU as an instrumental variable.

In addition, we complement our analysis with a DiD test in the backdrop of the China–US trade war over the period 2018–2019 [12]. The trade war between China and the USA presents a natural setting to test whether the heightened policy uncertainty resulting from the trade war affects the treatment firms' risk awareness and thus their D&O insurance purchase decision. First, we identify treatment sample firms using two criteria, including (1) whether a firm belongs to the industry subject to tariff sanction on the basis of the list of industries affected by the trade war [13] and (2) whether a firm is exposed to imports or exports. Using these criteria, 99 listed firms in our sample are identified as being affected by the trade war. We select 2018 and 2019 as the policy years on the basis of information collectively reported on media [14]. As our sample period ends in 2019, both 2018 and 2019 are set as the post-treatment period for the trade war sanction to be effective [15]. By contrast, our early sample years from 2003 to 2017 serve as the pre-treatment period. Panel B of Table 5 reports the DiD

Pane A: 2SLS regression approach

Variable	(1) Stage 1 DV: EPU_{t-1}	(2) Stage 2 DV: $D\&O_t$
US_EPU_{t-2}	0.128*** (6.18)	
EPU_{t-1}		1.173*** (2.98)
Controls included	Yes	Yes
Industry FE	Yes	Yes
Firm cluster	Yes	Yes
Observations	31,302	31,302
Wu–Hausman F test		0.112

Panel B: The DiD test based on China–US trade war

Variable	(1) DV: $D\&O_t$
$Constant_{t-1}$	−5.350*** (−5.67)
Post * Treatment	0.122*** (2.62)
Post	0.087* (1.70)
Treatment	−0.069 (−0.52)
Controls included	Yes
Industry FE	Yes
Firm cluster	Yes
Observations	31,302
Pseudo R^2	0.23

Panel C: Validating parallel trend assumption for the DiD test

Variable	(1) DV: $D\&O_t$
$Constant_{t-1}$	1.298 (0.67)
2018 * Treatment	0.141** (2.01)
2017 * Treatment	0.075 (0.86)
2016 * Treatment	0.027 (0.34)
2015 * Treatment	0.007 (0.10)
Treatment	−0.087 (−0.61)
Controls included	Yes
Year FE	Yes
Industry FE	Yes
Firm cluster	Yes
Observations	31,302
Pseudo R^2	0.23

Note(s): Panel A: This table shows the 2SLS regression analysis results to address the potential concern about endogeneity. US_EPU$_{t-2}$ is the natural logarithm of EPU index developed by BDD for the USA as an instrumental variable used in the first-stage regression. Continuous variables are winsorized at their 1st and 99th percentiles. ***, ** and * represent statistical significance at the 1, 5 and 10% levels, respectively (two-tailed test). The variables' definitions are provided in Appendix 1

Panel B: This table shows the DiD test results using the China–US trade war as an exogenous shock. *Treatment* is equal to one if a firm is affected by the trade war, and zero otherwise. Control sample firms are identified if they have not been affected by the trade war. Since we use the lagged independent and control variable in our investigation of the impact of EPU on the D&O insurance purchase decision, our DiD test also regresses *DOI* on the lagged policy shock (*POST*) and the lagged control variables. Given year 2019 is the last year of our sample period, *POST* take value of 1 for 2018, and 0 otherwise, for prior sample years. Continuous variables are winsorized at their 1st and 99th percentiles. ***, ** and * represent statistical significance at the 1, 5 and 10% levels, respectively (two-tailed test). The variables' definitions are provided in Appendix 1

Panel C: This table shows the results of the test to validate the parallel trend assumption that is the underlying assumption of the DiD test reported in Panel B. *Treatment* is equal to one if a firm is affected by the trade war, and zero otherwise. Control sample firms are identified if they have not been affected by the trade war. *2015*, *2016*, *2017* and *2018* are dummy variables that take the value of one for the respective years, and zero for other sample years. Continuous variables are winsorized at their 1st and 99th percentiles. ***, ** and * represent statistical significance at the 1, 5 and 10% levels, respectively (two-tailed test). The variables' definitions are provided in Appendix 1

analysis results. It shows that the coefficient for *Post * Treatment* is significantly positive (coefficient 0.122, *z*-stat 2.62, *p*-value < 0.01), suggesting that treatment sample firms tend to take on D&O insurance as a result of the exogenous shock brought about by the tariff sanction in comparison to the control sample firms. Hence, the DiD test lends support to our argument that EPU changes firms' assessment of risk exposures, and thereby motivates firms to purchase insurance for their D&Os.

The validity of the DiD test depends on the validity of the parallel trend assumption (Bertrand, Duflo & Mullainathan, 2004). To validate the assumption, we further examine whether there is a significant difference in *DOI* between the treatment and the control groups before the trade war. Panel C of Table 5 reports the analysis result of this test. It shows that the coefficients on *2015 * Treatment*, *2016 * Treatment* and *2017 * Treatment* are not statistically significant, indicating no significant difference in terms of D&O insurance purchase decision between the treatment and control firms in the years immediately before the treatment firms are severely affected by the trade war. Nevertheless, the results show that the positive coefficient on *2018 * Treatment* becomes significant, suggesting that the effect of an exogenous shock on the D&O insurance purchase decision for those firms occurs in 2018.

Then, we use three alternative measures of EPU for additional robustness tests and report the results in Panel A of Table 6. In our main regressions, we adopt the EPU index developed by BBD. The drawback of this EPU index is that it relies on one newspaper – SCMP, because BBD believe that SCMP is less subject to government scrutiny in Mainland China. Davis *et al.* (2019) develop an alternative measurement of EPU for China based on the frequency of keywords related to policy uncertainty appearing in two mainland Chinese newspapers. This alternative measure of EPU is employed by some recent studies on EPU in China (e.g. Sha *et al.*, 2020). Hence, as a robustness test, we re-estimate equation (4) by replacing BBD's EPU index with Davis *et al.*'s EPU index. Column (1) of Panel A in Table 6 shows the results. The coefficient for $Davis\_EPU_{t-1}$ remains significant and positive (coefficient 0.108, *z*-stat 4.24, *p*-value < 0.01) – a result that is highly consistent with the main finding using BDD's EPU index. The second alternative measure of EPU is the TPU index constructed by Davis *et al.* (2019). The TPU index is highly similar to Davis *et al.*'s EPU index, except that it focuses on the uncertainty pertinent to trade policy. We re-estimate equation (4) using the TPU index and find similar results, which are presented in Column (2) (coefficient 0.040, *z*-stat 2.38, *p*-value < 0.05).

Last but not least, the above empirical analyses only consider how EPU affects firms' likelihood of purchasing D&O insurance in the year immediately after the current fiscal year. However, the impact of uncertainty brought about by economic policies on D&O insurance purchases may last for a longer period. To examine this possibility, we lag the main variable of interest, EPU, and all control variables by two and three periods, and use these periods in equation (4) analysis – an approach that follows Wang *et al.* (2014). The results presented in Panel B of Table 6 show that the EPU effect only lasts for two years, with a 5% significance on EPU_{t-2}.

5. Conclusion
This study investigates the effect of EPU on the likelihood of firms purchasing D&O insurance for their directors and officers to relieve their concern about liability at the time of litigation. Using a sample of Chinese listed firms over the period 2003–2019, our findings show that the EPU in the preceding year increases the likelihood of firms purchasing D&O insurance in the current year, and that this effect is more pronounced when firms have high stock price crash risk and high probability of lawsuits, indicating two channels through which the effect of EPU takes place. That is, uncertain economic policies deteriorate firms' operational and informational environment, heightening firms' stock price crash risk and litigation risk, which prompts firms to purchase D&O insurance. The findings also reveal that

Panel A: Alternative measures of EPU

Variable	DV: D&O$_t$ (1) Davis_EPU$_{t-1}$	DV: D&O$_t$ (2) TPU$_{t-1}$
Constant$_{t-1}$	−5.794*** (−6.05)	−5.809*** (−5.60)
Davis_EPU$_{t-1}$	0.108*** (4.24)	−
TPU$_{t-1}$	−	0.040** (2.38)
Controls included	Yes	Yes
Industry FE	Yes	Yes
Firm cluster	Yes	Yes
Observations	31,302	31,302
Pseudo R^2	0.23	0.23

Panel B: A longer time lag effect of policy uncertainty

Variable	DV: D&O$_t$ (1) EPU$_{t-2}$	DV: D&O$_t$ (2) EPU$_{t-3}$
Constant	−7.673*** (−6.72)	−6.630*** (−6.23)
EPU$_{t-2}$	0.169** (2.56)	−
EPU$_{t-3}$	−	0.106 (1.59)
Controls included	Yes	Yes
Industry FE	Yes	Yes
Firm cluster	Yes	Yes
Observations	28,070	24,993
Pseudo R^2	0.22	0.22

Note(s): Panel A: This table estimates equation (4) using two alternative measures of EPU in China. *Davis_EPU$_{t-1}$* is an alternative EPU measure for China constructed by Davis *et al.* (2019) based on two leading mainland newspapers: the Renmin Daily and the Guangming Daily. TPU is the trade policy uncertainty developed by Davis *et al.* (2019). The natural logarithm of both measures is used for analysis. Continuous variables are winsorized at their 1st and 99th percentiles. Robust *t*-statistics are in brackets. ***, ** and * represent statistical significance at the 1, 5 and 10% levels, respectively (two-tailed test). The variables' definitions are provided in Appendix 1
Panel B: This table estimates equation (4) by replacing EPU$_{t-1}$ with EPU$_{t-2}$, EPU$_{t-3}$, to investigate the long-term effect of EPU on the likelihood of purchasing D&O insurance. All control variables, either in $t-2$ in Column (1) or $t-3$ in Column (2), are consistent with the year of the EPU measure. Continuous variables are winsorized at their 1st and 99th percentiles. Robust *t*-statistics are in brackets. ***, ** and * represent statistical significance at the 1, 5 and 10% levels, respectively (two-tailed test). The variables' definitions are provided in Appendix 1

Table 6.
Sensitivity tests

the positive effect of EPU on D&O insurance purchase is stronger for firms operating in provinces with a high level of capital marketization and for firms with strong internal control. Additional tests, including the 2SLS test and a DiD test, to alleviate the concern for potential endogeneity and a batch of sensitivity tests using alternative measures of EPU provide consistent findings on our main proposition.

Motivated by the paucity of research on the determinants of firms' decision to purchase D&O insurance, our study enquires whether a country-level institutional factor shapes corporate decisions to engage in D&O insurance, which is so far an uninvestigated research issue. Given the controversy around the motives for purchasing D&O insurance and the functions of the insurance, i.e. the purchase can be an opportunistic or a justifiable economic decision, we find that uncertain economic policies explain firms' decision to provide the insurance, which is informative for shareholders to approve the insurance purchase. Providing D&O insurance is an essential means of retaining capable D&Os and encouraging them to engage in risk-taking and make investments under uncertain economic conditions. Last but not least, our empirical evidence on Chinese listed firms' D&O insurance purchase

decision enriches the D&O insurance literature by providing evidence from a large and emerging market, serving as an important complement to the extant D&O studies, which mainly focus on developed markets.

Notes

1. Starting in 2002, when the first batch of 28 listed firms started purchasing D&O insurance, the number of firms buying the insurance reached 307 in 2019 – an increase of ten times.

2. According to Article 111 of the Chinese Company Law, "when a resolution of the shareholders' general meeting or of the board of directors violates the law or administrative rules and regulations or infringes the lawful rights and interests of the shareholders, the shareholders concerned shall have the right to bring a lawsuit in a people's court demanding that such illegal or infringing action be stopped." In addition, under the Securities Law (revised in 2005), all corporate D&Os are subject to joint and liability compensation if they are directly accountable for corporate wrongdoings, and exemption clauses are not applicable.

3. A few examples include Daqing Lianyi Petro-Chemical Co., Ltd. (Ticker: 600065), Guangdong Kelon Electrical Holdings Co., Ltd. (Ticker: 000921), Fujian Jiuzhou Group Co., Ltd. (Ticker: 000653), among others.

4. For example, in the USA, the D&O insurance often includes corporate indemnity where a D&O insurer indemnifies a firm after the firm has indemnified its D&Os for litigation expenses. Corporate indemnity does not apply in China because the Chinese Company Law does not define corporate indemnity (Du, 2017).

5. The Chinese Company Law and Securities Law (revised in 2005) stipulate D&Os' direct responsibility for shareholders' economic loss as a result of corporate misconduct. A few examples of the listed firms whose directors were sued over recent years include Guangdong Yorkpoint Science and Technology Co., Ltd. (Ticker: 000008), Fujian Jiuzhou Group Co., Ltd. (Ticker: 000653), Shanghai Dongfang Electronics Co., Ltd. (Ticker: 000682), Chongqing Changjiang River Water Transport Co., Ltd. (Ticker: 600369), Guangdong Kelon Electrical Holdings Co., Ltd. (Ticker: 000921), and Daqing Lianyi Petro-Chemical Co., Ltd. (Ticker: 600065). Those firms' executives and directors have incurred substantial financial costs from the lawsuits. For instance, after Daqing Lianyi Petro-Chemical Co., Ltd. (Ticker: 600065) lost its case, the court ordered the firm and its directors to pay over RMB8m as compensation for their investors (Jia & Tang, 2018).

6. The EPU index for China can be retrieved from http://www.policyuncertainty.com/. For the detailed methodology of BBDD's EPU index, please refer to https://www.policyuncertainty.com/scmp_monthly.html.

7. For the detailed methodology of Davis *et al.*'s EPU index and TPU index, please refer to Davis *et al.* (2019) and http://www.policyuncertainty.com/china_monthly.

8. A firm has political connections if its CEO has served or is currently serving as a member of the National People's Congress of China (NPC) or the Chinese People's Political Consultative Conference (CPPCC).

9. Following Jia and Tang (2019), our sample includes financial firms as they have more knowledge of and exposure to D&O insurance. We repeat our main analysis excluding financial firms as a robustness test. The unreported results are qualitatively consistent with those reported in the main test.

10. Studies on EPU have used different model specifications to investigate their respective research questions. Although Baker *et al.* (2016), the study that developed the EPU index, as well as Duong *et al.* (2020) and El Ghoul *et al.* (2021) estimate their equations by clustering the standard error at the firm level, others have used different types of model specifications. For instance, Nguyen and Phan (2017) cluster robust standard error by year, and Bonaime *et al.* (2018) cluster the standard error by firm and year, whereas Brogaard and Detzel (2015) use the heteroskedasticity and serial correlation robust standard errors. However, some studies do not control for industry, year and firm fixed effects without clustering standard errors for their model specification (Zhang *et al.*, 2018).

11. Given the nature of the concern about endogeneity, we employ only the instrumental approach in this study, despite our knowledge of other endogeneity tests, such as the Heckman test and the propensity score matching methodology, which mainly deal with concerns about endogeneity related to self-selection bias.

12. We appreciate the anonymous reviewer for the suggestion about this analysis.

13. Six industries affected include transportation (aeronautics and rail), information technology, machinery, metals, textiles and electronics. Please see https://www.cls.cn/detail/228126.

14. Please see https://en.wikipedia.org/wiki/China%E2%80%93United_States_trade_war#cite_note-Report-2.

15. Since we use the lagged independent and control variables in our investigation of the impact of EPU on the D&O insurance purchase decision, our DiD test also regresses *DOI* on the lagged policy shock and the lagged control variables. Given that year 2019 is the last year of our sample period, *POST* takes the value of 1 for 2018, and 0 otherwise for prior sample years.

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EPU and D&O
insurance

51

Variable	Definition
Dependent variable	
D&O	A dummy variable. 1 = firms with D&O insurance, 0 = otherwise
Independent variable	
EPU	Economic policy uncertainty index developed by Baker *et al.* (2016). We use the natural logarithm of EPU index for analysis
Davis_EPU	Economic policy uncertainty index developed by Davis *et al.* (2019). Its natural logarithm is used for analysis
TPU	Trade policy uncertainty index developed by Davis *et al.* (2019). Its natural logarithm is used for analysis
Control variables	
SIZE	Natural logarithm of the total assets
LEV	Ratio of the book value of debts divided by the book value of the total assets
ROA	Net profit divided by total assets
STDDEV	Standard deviation of the daily stock return
TMTSHARE	Number of shares held by the top management team as a percentage of total shares issued
CROSSLIST	A dummy variable. 1 = firms cross-listed on an overseas stock exchange, 0 = otherwise
TOP1	Percentage of shares owned by the largest shareholder
MTB	Market-to-book ratio of a firm
SOE	A dummy variable. 1 = SOEs, 0 = otherwise
CEOPOLI	A dummy variable. 1 = firms with political connections, 0 = otherwise
BRDINDEP	Percentage of independent directors on a board
CLI	The composite leading indicator. It is extracted from the OECD at https://data.oecd.org/leadind/composite-leading-indicator-cli.htm
GDP	The real gross domestic product growth (GDP). Data are retrieved from the World Bank at https://data.worldbank.org/country/CN
NCSKEW	Stock price crash risk, measured as the negative conditional skewness of firm-specific weekly returns over the fiscal year. Please refer to Section 3.1 for more details
DUVOL	Stock price crash risk, measuring down-to-up volatility. Please refer to Section 3.1 for more details
LIT	The *ex ante* measure of litigation risk, measured as the probability of lawsuit following Rogers and Stocken (2005). The detailed explanation of the model used to estimate the probability of lawsuit is provided in Section 3.1 and Appendix 2
MARKETIZATION INDEX	Provincial market development index developed by Wang, Fan and Hu (2019)
IC	The strength of internal control, measured as Dibo internal control index. It is developed by the Shenzhen Dibo Internal Control Database. The index is available from http://irmd.dibcn.com:8082/irmd/common/login.jsp

Table A1.
Variable definitions

Appendix 2
Estimation of the probability of litigation
We estimate the litigation probability model following Rogers and Stocken (2005) using the following probit model:

$$\Pr(Lawsuit = 1) = \alpha_0 + \alpha_1 SIZE + \alpha_2 Turn + \alpha_3 Beta + \alpha_4 Returns + \alpha_5 STDDEV$$

$$+ \alpha_6 Skewness + \alpha_7 MinRet + \sum High\ Risk\ Industries + \varepsilon \qquad (A.1)$$

where *Lawsuit* is a dummy variable, taking the value of 1 for firm-years with one lawsuit at least, and 0 otherwise. Data about lawsuit are retrieved from CSMAR. *SIZE* is the firm size; *Turn* is the average daily share volume divided by the average share outstanding; *Beta* is stock risk, measured as the stock volatility in relation to overall market; *Returns* is defined as buy and hold returns. *STDDEV* is the standard deviation of the daily returns. *Skewness* is the skewness of the daily turns, measured as the difference between mean of daily return and the mode of daily return deflated by the standard deviation of daily returns. *MinRet* is the minimum of the daily returns. The high-risk industry fixed effects are controlled where high-risk industries are defined as technology, computer hardware and software, electronics and retailing following prior studies on litigation risk (e.g. Francis *et al.*, 1994). Using all firm-year observations over our sample period, we estimate equation (A.1). Then, based on the estimated parameters, we calculate the fitted value of *Lawsuit*, which is the probability of litigation for each firm-year.

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