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Corporate Environmental Performance, Accounting Conservatism, and Stock Price Crash Risk: Evidence from China*

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Abstract

Using a sample of 8,173 firm-year observations from the Chinese stock market during the period 2009–14, this study examines the influence of corporate environmental performance on stock price crash risk and further investigates the moderating effect of accounting conservatism. Specifically, based on hand-collected data on environmental performance, the findings show that corporate environmental performance is significantly negatively related to future crash risk, suggesting that environmentally friendly firms face less future crash risk. Moreover, accounting conservatism weakens the negative relationship between corporate environmental performance and future crash risk. These results are robust to different measures of stock price crash risk and corporate environmental performance, and remain valid after controlling for the potential endogeneity between corporate environmental performance and stock price crash risk.

Keywords: Corporate Environmental Performance, Stock Price Crash Risk, Accounting Conservatism, China

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公司环境绩效、会计稳健性与股价崩盘风险*

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摘要

基于中国资本市场 2009 至 2014 年期间 8,173 个公司-年观测值的样本，本文研究了公司环境绩效对股价崩盘风险的影响，进而分析了会计稳健性的调节效应。基于手工搜集的公司环境绩效数据，本文发现公司环境绩效与未来的股价崩盘风险显著负相关，说明环境友好型的企业经历了较低的未来股价崩盘风险。此外，会计稳健性弱化了公司环境绩效对股价崩盘风险的抑制效应。进一步，采纳一系列其他度量股价崩盘风险与环境绩效的变量并不改变本文的主要发现。最后，本文发现在控制了公司环境绩效与股价崩盘风险之间的内生性后上述研究发现依然成立。

关键词：公司环境绩效、股价崩盘风险、会计稳健性、中国

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I. Introduction

In recent years, many studies have focused on corporate environmental performance (responsibility) to examine its determinants and economic consequences. Cormier *et al.* (2004), Du *et al.* (2014), Meng *et al.* (2013), Paillé *et al.* (2014), and Walker *et al.* (2013) investigate the effects of ecological environment, regulatory pressure, top management team turnover, human resource policies, and religion on corporate environmental performance. Cai and He (2014), Cohen *et al.* (1997), Dixon-Fowler *et al.* (2013), Du (2015a), and Guenster *et al.* (2010) examine the impacts of environmental performance on cumulative abnormal returns, operating efficiency, stock returns, and equity prices. Nevertheless, the literature provides insufficient evidence on how the market reacts to corporate environmental performance. In response to this gap, the present study examines the relationship between corporate environmental performance and stock price crash risk.

Studies have found that firms with better environmental performance have higher-quality financial reporting (Du *et al.*, 2017; Ingram and Frazier, 1980; Orlitzky *et al.*, 2003) and engage in fewer bad news hoarding activities (Du *et al.*, 2017). Therefore, this study predicts that corporate environmental performance is significantly negatively associated with stock price crash risk. In addition, Petersen (2004) and Petersen and Rajan (1994) find that hard information (e.g. financial information) and soft information (e.g. voluntary environmental information disclosure) interact with each other (substitute or strengthen). This study predicts that accounting conservatism attenuates the mitigating effect of environmental performance on stock price crash risk.

This study is focused on the Chinese context for two reasons. First, China's rapid economic development has been accompanied by very serious environmental pollution (Du, 2015b). Second, Siegel and Vitaliano (2007) and Zyglidopoulos *et al.* (2012) argue that corporate environmental performance is inclined to bring out negative externalities for stakeholders. In addition, Zyglidopoulos *et al.* (2012) find that firms would rather improve their strengths related to corporate social responsibility (CSR), such as corporate philanthropy, than mitigate their CSR weaknesses, such as environmental pollution. Du (2015b) finds that there is an inherent inconsistency between different CSR dimensions and further documents that corporate philanthropy is habitually used by some firms to offset the negative image created by environmental wrongdoing. These findings, taken together, suggest that CSR-based conclusions may not fit well with corporate environmental performance, especially in emerging markets such as China, where environmental consciousness and business ethics are still far from optimal.

For empirical tests, I hand-collect data on corporate environmental performance and construct a sample of 8,173 firm-year observations from the Chinese stock market during the period 2009–14. Using this sample, this study examines the influence of corporate environmental performance on stock price crash risk, and further investigates the moderating effect of accounting conservatism. In brief, my findings reveal several things. First, corporate environmental performance is significantly negatively associated with stock price crash risk, suggesting that environmentally friendly firms experience less future crash risk. Second, accounting conservatism attenuates the negative relationship between corporate environmental performance and future crash risk. Third, my findings are robust to different measures of crash risk and corporate environmental performance. Finally, my findings are valid after controlling for the endogeneity between corporate environmental performance and future crash risk.

This study contributes to the literature in several ways. First, to the best of my knowledge, this is one of few, if not the first, to investigate empirically the association between corporate environmental performance and stock price crash risk. In recent years, a branch of the existing literature has examined the influence of CSR or corporate philanthropy on stock price crash risk (Kim *et al.*, 2014; Zhang *et al.*, 2016). However, as Chen *et al.* (2008), Du (2015b), and Koehn and Ueng (2010) argue, different dimensions of CSR may be inherently inconsistent. For example, some corporations may use corporate philanthropy to cover their environmentally unfriendly behaviour, low product quality, or poor employee relations (Du, 2015b). Therefore, one can question whether different CSR dimensions similarly or asymmetrically affect stock price crash risk. Using the context of China, this study aims to fill the above gap in the literature by examining whether corporate environmental performance impacts future crash risk.

Second, extending Kim and Zhang's (2016) examination of the effect of accounting conservatism on stock price crash risk, I investigate the moderating effect of accounting conservatism on the association between environmental performance and stock price crash risk. Theoretically, accounting conservatism suggests that managers present a lower level of bad news hoarding, which negatively impacts stock price crash risk. Then, referring to Petersen (2004) and Petersen and Rajan (1994), accounting conservatism, as "hard information", and environmental performance, as "soft information",[3] substitute for each other in mitigating future crash risk. My findings validate the notion that accounting conservatism attenuates the negative association between corporate environmental performance and future crash risk.

Third, this study adopts multiple measures of stock price crash risk to provide more convincing findings regarding the mitigating effect of corporate environmental performance on future crash risk. Specifically, this study employs four measures of stock price crash risk (two for main tests and two for robustness checks), including a dummy variable for whether

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[3] It is Petersen (2004) who classifies information into hard information and soft information. According to Petersen (2004), hard information is more likely to be transmitted, processed, and reduced to numbers. In addition, information that is difficult to summarise completely as a numeric score is called soft information. As such, financial information provided in a firm's financial statements can be classified as hard information due to its numeric nature, while corporate environmental performance is soft information because of its scattered nature in non-financial information in notes or CSR reports.

a firm-year's stock price experiences one or more crash risks (*CRASH*3.09), the negative skewness of firm-specific weekly returns (*NCSKEW*), an ordered variable to capture the number of stock price crashes experienced by a firm (*CRASHN*3.09), and the asymmetric volatility between negative and positive firm-specific weekly returns (*DUVOL*) (i.e. the down-to-up volatility of the likelihood of future stock price crash risk).

Finally, using the context of China, the largest emerging market and second largest economy in the world, this study adds to the literature on the relationship between specific CSR dimensions (environmental performance) and corporate financial behaviour. The majority of the literature focuses on developed markets in which mature business ethics and governance mechanisms bring out stronger pressures motivating firms to fulfil their environmental responsibilities (Sharfman and Fernando, 2008). However, conclusions based on developed markets may not be a good fit with emerging markets such as China, where business ethics are immature, corporate governance is incomplete, and environmental consciousness is weak. As a result, it is necessary for researchers to examine separately the influence of environmental performance on corporate financial behaviour, such as stock price crash risk, in emerging markets. It is expected that the findings relating to emerging markets will provide important supplementary evidence to those regarding developed markets.

The second section reviews the literature and develops the research hypotheses. The third section introduces the empirical models and variables. In the fourth section, I report the sample, data, and descriptive statistics. The fifth section reports main findings; the sixth section conducts a variety of robustness checks, and the seventh section discusses potential endogeneity. The final section summarises the conclusions.

II. Literature Review and Hypotheses Development

2.1 Literature Review

Prior studies have examined whether tax sheltering, accounting conservatism, and opaque financial reporting affect future crash risk (Chen *et al.*, 2001; Hutton *et al.*, 2009; Kim *et al.*, 2011; Kim *et al.*, 2012; Kim and Zhang, 2016). In recent years, a growing branch of research has addressed the association between CSR and corporate financial behaviour, including crash risk (Cui *et al.*, 2015; Deng *et al.*, 2013; El Ghoul *et al.*, 2011; Kim *et al.*, 2014). However, findings regarding the effect of CSR on stock price crash risk may not be applied directly to specific CSR dimensions because different CSR dimensions may be inherently inconsistent (Chen *et al.*, 2008; Du, 2015b; Koehn and Ueng, 2010). Moreover, Zyglidopoulos *et al.* (2012) suggest that researchers should differentiate CSR strengths from CSR weaknesses because firms may increase CSR strengths, such as corporate philanthropy, rather than reducing CSR weaknesses, such as corporate environmental pollution. CSR strengths refer to "the additional benefits beyond those required by law and narrow economic interest that a firm provides to its stakeholders", and CSR weaknesses refer to "the negative effects that a firm's operation has on its stakeholders that remain after a firm's CSR activities" (Zyglidopoulos *et al.*, 2012). As a result, conclusions about the association between CSR (corporate philanthropy) and crash risk may not fit corporate environmental performance. In this context, extant research provides little evidence on the impact of ethical factors embedded in corporate environmental performance on stock price crash risk (Giuli and Kostovetsky, 2014). This study fills the above gaps and contributes to the literature by examining the impact of corporate environmental performance on stock price crash risk.

2.2 The Influence of Corporate Environmental Performance on Stock Price Crash Risk

Environmental concerns have become increasingly prominent in China, because many Chinese enterprises always greedily pursue profit at the cost of environmental destruction (Du, 2015b). Environmental efforts may be expensive, but environmentally responsible firms are likely to build a good reputation through environmental protection (Konar and Cohen, 2001; Murphy, 2002). Due to their good reputation, environmentally friendly firms can obtain support from stakeholders (Russo and Fouts, 1997), which is beneficial to their legitimacy and provides competitive advantages. For example, Heyes (1996) finds that lenders value environmental risk, applaud environmentally responsible firms, and charge environmentally friendly firms lower rates of interest.[4] Thus, environmental performance is negatively related to future operational uncertainty, which results in lower future crash risk.

In addition, environmentally responsible firms face lower litigation risk. In a firm's financial statements, corporate environmental responsibility is classified as contingent liabilities (Keiso *et al.*, 2007). When enterprises fail to take effective measures to control their pollution or environmentally unfriendly activities, they may be statutorily compelled to discontinue their operations (they may even go bankrupt). Environmentally responsible firms convey signals of lower environmental uncertainty—which is associated with lower likelihood of operational discontinuity and distress—to the market, resulting in lower information uncertainty. For example, Toms (2002) finds that firms with advanced environmental management systems can effectively signal to the market that they face significantly lower systemic risk. To sum up, environmentally friendly firms are less likely to experience future crash risk than firms with poor environmental performance.

Furthermore, it is very difficult for investors to assess the reliability of accounting numbers. It is found that environmentally friendly firms have better financial performance

[4] I also provide some supporting evidence. The China Banking Regulatory Commission (CBRC) statutorily requires commercial banks to consider corporate environmental performance as one of the crucial lending criteria. Moreover, central and local governments mandatorily require Chinese enterprises to take corporate environmental responsibility, and urge commercial banks to charge a higher interest rate on debts to environmentally unfriendly firms, and even legitimately prohibit banks from lending to heavily polluting firms.

(Du *et al.*, 2017; Ingram and Frazier, 1980; Orlitzky *et al.*, 2003), are more likely to maintain a higher level of financial reporting quality, and are less likely to engage in bad news hoarding (Du *et al.*, 2017). Moreover, to confirm the validity of financial information, stakeholders must collect "soft information" from other sources of information to judge whether managers are honest and financial reporting is credible (Beaulieu, 2001). In this regard, voluntary environmental information disclosure (environmental performance) can serve as a conduit by which investors obtain incremental information to judge whether managers can be trusted and financial information can be believed. For example, it has been found that socially responsible firms are less likely to engage in unethical activities. Kim *et al.* (2012) show that socially responsible firms place tighter constraints on earnings management. Lanis and Richardson (2012) find a negative association between CSR activity and tax aggressiveness, a socially irresponsible and illegitimate activity. In a nutshell, if stakeholders ensure managers' moral integrity through environmental performance, they may believe managers to be less likely to hoard bad news, and thus believe that environmentally responsible firms are less at risk of crash in the future.

Finally, environmentally friendly firms disclose more (voluntary) non-financial information to upgrade information transparency (Dhaliwal *et al.*, 2011). Therefore, firms with good environmental performance always attract more analyst coverage and experience fewer analyst forecast errors (Dhaliwal *et al.*, 2011; 2012). As a result, information asymmetry between investors and managers is mitigated, and thus managers are less likely to conceal bad news. Investors can also use incremental non-financial information provided by environmentally friendly firms to determine the ethical honesty of managers. The above arguments, taken together, suggest that environmentally friendly firms engage in less bad news hoarding and thus are less likely to experience future crash risk.

Overall, environmentally responsible firms can obtain good reputation and competitive advantage, increase (reduce) the likelihood of going concern (discontinuity), convince investors of managers' moral integrity, improve information transparency, and indicate managers' lower likelihood of hoarding bad news. Ultimately, environmentally friendly firms have lower future crash risk. Based on the above discussion, Hypothesis 1 is proposed as follows:

Hypothesis 1: *Ceteris paribus*, corporate environmental performance is negatively associated with future crash risk.

2.3 The Moderating Effect of Accounting Conservatism

Managers exploit information asymmetry, utilising information advantage over investors to engage in opportunistic behaviour and hoard bad news (Kim *et al.*, 2011), which brings out future crash risk. However, accounting conservatism mitigates the extent of managers' bad news hoarding behaviour and reduces future crash risk (Kim and Zhang, 2016). In response, I further address the moderating effect of accounting conservatism on the negative relationship between corporate environmental performance and future crash risk. According to Petersen (2004), information can be partitioned into hard and soft information. Hard information is numeric in nature and can be transmitted and processed (Petersen, 2004). Accounting conservatism is calculated using data from financial statements and the market, and should be classified as “hard information” because of its numeric nature. However, it is difficult for investors to summarise environmental performance numerically, so corporate environmental performance should be classified as soft information.

According to Petersen (2004), hard and soft information can be substituted for each other in the lending market, although soft information may be hard in some cases. Petersen and Rajan (1994) find that firms can successfully negotiate a lower interest rate through communicating soft information to banks. Analogically, environmental performance as soft information and accounting conservatism as hard information interactively affect a firm’s hoarding of bad news and impact stock price crash risk. Previous studies (e.g. Costello and Wittenberg-Moerman, 2011; Dhaliwal *et al.*, 2011; Petersen and Rajan, 1994) have reported the substitutive effect between hard information in a firm’s financial statement and soft information on corporate behaviour. Based on the literature, I predict that the negative association between corporate environmental performance and stock price crash risk is less pronounced for firms with higher conservatism scores than for those with lower conservatism scores. Based on the above discussion, I formulate Hypothesis 2 in the alternative form as follows:

Hypothesis 2: *Ceteris paribus*, accounting conservatism attenuates the negative association between corporate environmental performance and future crash risk.

III. Empirical Model Specification and Variables

3.1 Multivariate Test Model for Hypothesis 1

To test Hypothesis 1, which predicts that corporate environmental performance is negatively associated with future stock price, I estimate Eq. (1) to link future crash risk with corporate environmental performance and firm-specific control variables (Hutton *et al.*, 2009; Kim *et al.*, 2011):

$$\begin{aligned} CRASH_t = {} & \alpha_0+\alpha_1 CEP_{t-1}+\alpha_2 BLOCK_{t-1}+\alpha_3 NCSKEW_{t-1}+\alpha_4 INST\_SHR_{t-1}+\alpha_5 ANALYST_{t-1} \\ & +\alpha_6 DTURN_{t-1}+\alpha_7 SIGMA_{t-1}+\alpha_8 RET_{t-1}+\alpha_9 SIZE_{t-1}+\alpha_{10} DTE_{t-1}+\alpha_{11} BTM_{t-1} \\ & +\alpha_{12} ROA_{t-1}+\alpha_{13} ACCM_{t-1}+\alpha_{14} TAX_{t-1}+\alpha_{15} PENALTY_{t-1}+\alpha_{16} STATE_{t-1} \\ & +Industry\ Dummies+Year\ Dummies+\varepsilon \end{aligned} \quad (1)$$

In Eq. (1), the dependent variable is stock price crash risk, labelled *CRASH*. In the main tests, this study employs *NCSKEW* and *CRASH3.09* to measure stock price crash risk. *NCSKEW* is the negative skewness of firm-specific weekly returns. *CRASH3.09* is a dummy variable equal to 1 if a firm-year's stock price experiences one or more crashes and 0 otherwise (Hutton *et al.*, 2009; Kim *et al.*, 2011). The independent variable is corporate environmental performance, labelled *CEP*. In Eq. (1), the negative, significant coefficient on *CEP* (α_1) is consistent with Hypothesis 1.

Following the literature (Chen *et al.*, 2001; Hutton *et al.*, 2009; Kim et al., 2011), I include a set of control variables in Eq. (1). First, this study refers to Kim *et al.* (2011) and includes several variables concerning governance mechanism (i.e. $BLOCK_{t-1}$, $INST\_SHR_{t-1}$, $ANALYST_{t-1}$) into Eq. (1). $BLOCK_{t-1}$ is the percentage of shares held by the controlling shareholder in year *t*-1, $INST\_SHR_{t-1}$ is the percentage of shares owned by institutional investors in year *t*-1 (Kim *et al.*, 2011), and $ANALYST_{t-1}$ is the natural logarithm of (1+ the number of analyst coverage) in year *t*-1 (Kim *et al.*, 2011; Chen *et al.*, 2001).

Second, in Eq. (1), I include $NCSKEW_{t-1}$, $DTURN_{t-1}$, $SIGMA_{t-1}$, RET_{t-1}, $SIZE_{t-1}$, DTE_{t-1}, BTM_{t-1}, ROA_{t-1}, and $ACCM_{t-1}$, which are taken from Kim *et al.* (2011) and Chen *et al.* (2001). $NCSKEW_{t-1}$ is the negative skewness of firm-specific weekly returns in year *t*-1. $DTURN_{t-1}$ is the average monthly share turnover over the current calendar year period minus the average monthly share turnover over the previous calendar year period (where monthly share turnover is calculated as the monthly trading volume divided by the total number of shares outstanding during the month) (Kim *et al.*, 2011; Chen *et al.*, 2001). $SIGMA_{t-1}$ is the standard deviation of firm-specific weekly returns over the calendar year period *t*-1 (multiplied by 100) (Kim *et al.*, 2011). RET_{t-1} denotes the arithmetic average of firm-specific weekly returns in year *t*-1 (multiplied by 100) (Kim *et al.*, 2011). $SIZE_{t-1}$ is the natural logarithm of the market value of equity at the end of year *t*-1 (Kim *et al.*, 2011; Hutton *et al.*, 2009). DTE_{t-1} is the ratio of total liabilities at the end of year *t*-1 to the market value of equity at the end of year *t*-1. BTM_{t-1} is the lagged ratio of book-to-market, measured as the book value scaled by the market value of equity at the end of year *t*-1 (Chen *et al.*, 2001; Hutton *et al.*, 2009). ROA_{t-1} is return on total assets in year *t*-1, measured as income before extraordinary items divided by lagged total assets (Kim *et al.*, 2011). $ACCM_{t-1}$ denotes discretional accruals, measured as a three-year moving sum of the absolute value of discretionary accruals based on the modified Jones model (Hutton *et al.*, 2009).

Third, Kim *et al.* (2011) find that tax avoidance is positively related to future crash risk, and thus I include a firm's estimated likelihood of tax sheltering (TAX_{t-1}) (Kim *et al.*, 2011).

Fourth, Eq. (1) includes $PENALTY_{t-1}$ to isolate the influence of managers' moral integrity on environmentally friendly activities. $PENALTY_{t-1}$ is a dummy variable, equal to 1 if a firm is punished by regulators for financial misconduct and 0 otherwise.

Fifth, Eq. (1) includes $STATE_{t-1}$, a dummy variable equal to 1 when the ultimate controlling shareholder of a listed firm is a (central or local) government agency or government-controlled enterprise in year t-1 and 0 otherwise.

Finally, a set of year and industry dummy variables are incorporated into Eq. (1) to control for the year and industry fixed effects. Please refer to Appendix 1 for variable definitions.

3.2 Multivariate Test Model for Hypothesis 2

Hypothesis 2 predicts that accounting conservatism attenuates the negative association between environmental performance and future crash risk. To test Hypothesis 2, I estimate Eq. (2) to link future crash risk (*CRASH*) with environmental performance (*CEP*), accounting conservatism (*C_SCORE*), the interactive item (*CEP*×*C_SCORE*), and a set of firm-specific control variables:

$$CRASH_t=\beta_0+\beta_1 CEP_{t-1}+\beta_2 C\_SCORE_{t-1}+\beta_3 CEP_{t-1}\times C\_SCORE_{t-1}+\beta_4 BLOCK_{t-1} +\beta_5 NCSKEW_{t-1}+\beta_6 INST\_SHR_{t-1}+\beta_7 ANALYST_{t-1}+\beta_8 DTURN_{t-1} +\beta_9 SIGMA_{t-1}+\beta_{10} RET_{t-1}+\beta_{11} SIZE_{t-1}+\beta_{12} DTE_{t-1}+\beta_{13} BTM_{t-1} +\beta_{14} ROA_{t-1}+\beta_{15} ACCM_{t-1}+\beta_{16} TAX_{t-1}+\beta_{17} PENALTY_{t-1} +\beta_{18} STATE_{t-1}+Industry\ Dummies+Year\ Dummies+\delta \quad (2)$$

In Eq. (2), the dependent and independent variables are still stock price crash risk ($CRASH_t$) and corporate environmental performance (CEP_{t-1}), respectively. The moderating variable is accounting conservatism score (C_SCORE_{t-1}). My major concern in Eq. (2) is the interactive item between environmental performance and accounting conservatism score, and thus the significant and positive coefficient (β_3) on *CEP*×*C_SCORE* is consistent with Hypothesis 2. Moreover, according to Hypothesis 1 and theoretical expectations, both *CEP* and *C_SCORE* have significantly negative coefficients. Control variables in Eq. (2) are the same as those in Eq. (1).

3.3 Firm-Specific Stock Price Crash Risk

This study refers to the extant literature (Chen *et al.*, 2001; Hutton *et al.*, 2009; Kim *et al.*, 2011) and measures firm-specific stock price crash risk according to the following procedures. First, this study estimates firm-specific weekly returns for firm j in year t, labelled $W_{j,t}$. This is measured using Eq. (3):

$$W_{j,t}=LN(1+\varepsilon_{j,t}), \quad (3)$$

where $\varepsilon_{j,t}$ is the residual from the expanded market model regression (Kim *et al.*, 2011; Chen *et al.*, 2001):

$$R_{j,t}=\mu_j+\mu_{1j}*R_{m,t-2}+\mu_{2j}*R_{m,t-1}+\mu_{3j}*R_{m,t}+\mu_{4j}*R_{m,t+1}+\mu_{5j}*R_{m,t+2}+\varepsilon_{j,t}, \quad (4)$$

where $R_{j,t}$ is the weekly return of stock j in week t, and $R_{m,t}$ is the weekly return on the value-weighted (A-share) market index in week *t*.

Second, $CRASH3.09_{j,t}$ is the likelihood that firm *j* experiences stock price crash risk in year *t*. $CRASH3.09_{j,t}$ is a dummy variable of stock price crash risk, equal to 1 if a firm-year's stock price experiences one or more firm-specific weekly returns falling by 3.09 or more standard deviations below the mean firm-specific weekly returns ($W_{j,t}$) over the calendar year (3.09 standard deviations being chosen to generate frequencies of 0.1% in the normal distribution during the calendar year), and 0 otherwise (Hutton *et al.*, 2009; Kim *et al.*, 2011). Furthermore, this study defines $CRASHN3.09_{j,t}$ as the number of stock price crashes for firm *j* in year *t*.

Third, following the literature (Kim *et al.*, 2011; Chen *et al.*, 2001), this study also defines a third variable (i.e. $NCSKEW_{j,t}$) to measure the negative conditional return skewness for firm *j* in year *t*. In particular, this study follows Kim *et al.* (2011) and Chen *et al.* (2001) to measure $NCSKEW_{j,t}$ as firm *j* in year *t* by taking the negative of the third moment of firm-specific weekly returns for each sample year and dividing it by the standard deviation of firm-specific weekly returns raised to the third power (Kim *et al.*, 2011). That is, $NCSKEW_{j,t}$ is computed using Eq. (5):

$$NCSKEW_{j,t}=-[n\,(n-1)^{3/2}\Sigma W^{3}_{j,t}]/[(n-1)(n-2)(\Sigma W^{2}_{j,t})^{3/2}] \quad (5)$$

3.4 Corporate Environmental Performance

Clarkson *et al.* (2008) and Du *et al.* (2014) discuss four approaches to measuring environmental performance: (1) proprietary databases; (2) quantifying environmental disclosure in annual reports or a standalone report;[5] (3) using a disclosure-scoring measure based on content analysis (Al-Tuwaijri *et al.*, 2004; Cormier and Magnan, 1999; Wiseman, 1982); and (4) performance-based metrics. In China, there is as yet no proprietary database on environmental performance. The second and the third approaches, used in relatively early studies, result in countervailing arguments because different researchers have different data sources and coding criteria. As a result, recent studies focus on the fourth approach and use publicly available and voluntary environmental disclosures to assess environmental performance. As Ilinitch *et al.* (1998) argue, performance-based metrics enable comparability of environmental performance among different firms and provide stakeholders with more reliable, consistent, and accurate information.

On the basis of Global Reporting Initiative (GRI) sustainability reporting guidelines, Clarkson *et al.* (2008) focus on purely discretionary environmental disclosures to develop a content analysis index. This approach has advantages in terms of breadth, transparency, and

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[5] This approach measures corporate environmental performance by calculating the number of pages (Gray *et al.*, 1995; Guthrie and Parker, 1989; Patten, 1992), sentences (Ingram and Frazier, 1980), and words (Deegan and Gordon, 1996).

validity (Rahman and Post, 2012).[6] In this study, following Clarkson *et al.* (2008) and Du *et al.* (2014), I measure environmental performance as follows. First, I extract environmental information from annual reports, CSR reports, and other disclosures. Second, I use the content analysis approach to evaluate environmental performance. Finally, on the basis of 45 subcomponents, I compute seven aggregates and calculate a firm's total environmental performance (see Panel C of Table 2 for details).

3.5 Accounting Conservatism Score

Following extant studies (Basu, 1997; DeFond *et al.*, 2016; Ettredge *et al.*, 2012; Heflin *et al.*, 2015; Khan and Watts, 2009), accounting conservatism (*C_SCORE*) is computed using models (6)–(8):

$$C\_SCORE=\beta_{4,i,t}=\lambda_1+\lambda_2 SIZE+\lambda_3 M/B+\lambda_4 LEV \quad (6)$$

$$G\_SCORE=\beta_{3,i,t}=\mu_1+\mu_2 SIZE+\mu_3 M/B+\mu_4 LEV \quad (7)$$

$$X_{i,t}=\beta_{1,i,t}+\beta_{2,i,t}D_{i,t}+(\mu_1+\mu_2 SIZE+\mu_3 M/B+\mu_4 LEV)\times R_{i,t}+(\lambda_1+\lambda_2 SIZE +\lambda_3 M/B+\lambda_4 LEV)\times D_{i,t}\times R_{i,t}+(\delta_1 SIZE+\delta_2 M/B+\delta_3 LEV+\delta_4 D_{i,t}SIZE +\delta_5 D_{i,t}M/B+\delta_6 D_{i,t}LEV)+\varepsilon_{i,t}, \quad (8)$$

where i indexes the firm; t indexes time; X is income before extraordinary items (operating profit in the financial statements of Chinese listed firms) scaled by lagged market value; R is annual returns compounded from monthly returns ending four months after calendar year end; D is an indicator variable, equal to 1 for firms with negative returns and 0 otherwise; and ε is the residual. *C_SCORE* is derived from linear functions of three firm-specific characteristics, firm size (*SIZE*, the natural logarithm of market value of equity), market-to-book ratio (*M/B*), and financial leverage (*LEV*, the sum of long-term and short-term debt divided by market value of equity); *G_SCORE* or β_3 denotes the timeliness of good news; and *C_SCORE* or β_4 denotes the incremental timeliness of bad news.

IV. Sample, Data, and Descriptive Statistics

4.1 Identification of Sample

The initial sample consists of all Chinese A-share listed firms during the period 2009–14. Specifically, I select the sample according to the criteria in Panel A of Table 1: (1) eliminating firms pertaining to the banking, insurance, and other financial industries; (2) deleting observations whose data on corporate environmental performance are unavailable; (3) discarding observations whose data on stock price crash risk are unavailable; (4)

[6] "The content analysis index based on GRI can assess the level of discretionary environmental disclosures in environmental responsibility reports provided on the firm's web site or annual reports" (Clarkson *et al.*, 2008, p. 2).

excluding observations with missing data on firm-specific control variables. Finally, I obtain a sample of 8,173 observations covering 1,682 firms. Then I winsorise the top and bottom 1% of each variable's distribution to control for the potential effect of extreme observations.[7]

Panel B of Table 1 reports sample distribution by year and industry. As shown by Panel B, clustering phenomena exist in some industries, such as petroleum, chemicals, plastics and rubber products, and machinery, equipment and instrument manufacturing.

Table 1 Sample Selection

Panel A: Firm-years selection	
Initial observations	16,191
Eliminate observations pertaining to the banking, insurance, and other financial industries	(276)
Eliminate observations whose data on corporate environmental performance are unavailable	(947)
Eliminate observations whose data on computing stock price crash risk are unavailable	(2,474)
Eliminate observations whose data required to measure firm-specific control variables are unavailable	(4,321)
Available firm-year observations	8,173
Unique firms	1,682

Panel B: Sample distribution by year and industry

Industry Code \ Year	2009	2010	2011	2012	2013	2014	Total by industry	%
Agriculture, forestry, husbandry, and fishery	29	28	31	33	29	31	181	2.21
Mining	22	23	27	38	42	43	195	2.39
Food and beverage	54	54	56	64	66	70	364	4.45
Textile, garment manufacturing, and leather and fur products	53	51	54	60	53	55	326	3.99
Wood and furniture	2	4	4	4	5	6	25	0.31
Papermaking and printing	23	21	25	25	26	33	153	1.87
Petroleum, chemical, plastics, and rubber products	128	124	133	141	154	164	844	10.33
Electronics	43	47	50	67	72	79	358	4.38
Metal and non-metal	106	101	105	118	126	135	691	8.45
Machinery, equipment, and instrument manufacturing	184	188	200	223	226	257	1,278	15.64
Medicine and biological products manufacturing	84	84	86	88	92	105	539	6.60
Other manufacturing	15	14	15	19	13	18	94	1.15
Production and supply of electricity, steam, and tap water	61	62	63	62	64	66	378	4.62
Construction	26	23	24	29	30	33	165	2.02
Transportation and warehousing	50	52	57	60	57	61	337	4.12
Information technology	67	66	74	83	81	110	481	5.89
Wholesale and retail	82	89	88	89	101	103	552	6.75
Real estate	68	78	82	92	117	122	559	6.84
Social services	34	33	39	48	50	57	261	3.19
Communication and culture	7	8	8	10	16	18	67	0.82
Conglomerates	65	57	54	56	46	47	325	3.98
Total by year	1,203	1,207	1,275	1,409	1,466	1,613	8,173	
%	14.72	14.77	15.60	17.24	17.94	19.73		100

7 The results are not qualitatively changed by deleting the top or bottom 1% of the sample or without winsorisation.

4.2 Data Source

Following Chen *et al.* (2001) and Kim *et al.* (2011), I calculate and hand-collect data on stock price crash risk, *CRASH3.09*, and *NCSKEW* for the main tests and *DUVOL* and *CRASHN3.09* for robustness checks, respectively. Following Clarkson *et al.* (2008) and Du *et al.* (2014), I compute environmental performance according to GRI (2006). Following Ettredge *et al.* (2012), Heflin *et al.* (2015), Khan and Watts (2009), and DeFond *et al.* (2016), I calculate a firm's accounting conservatism score. Following Chen *et al.* (2001), Hutton *et al.* (2009), I calculate data on *DTURN*, *SIGMA*, *RET*, *TAX*, and *ACCM*. Other data on firm-specific financial characteristics, financial irregularity, and corporate governance are obtained from the China Stock Market and Accounting Research (CSMAR) database, which is frequently used in China studies.

4.3 Descriptive Statistics

Table 2 presents results of descriptive statistics and univariate tests. As shown in Panel A of Table 2, the mean value of *NCSKEW* is -0.3312, which is much larger than the values reported in Chen *et al.* (2001) and Kim *et al.* (2011). This result suggests that my sample of firm-years is more crash-prone than those in Chen *et al.* (2001) and Kim *et al.* (2011). The mean value of *CRASH3.09* is 0.0983, revealing that 9.83% of firm-year observations experience at least one crash event, lower than reported in Kim *et al.* (2011). Nevertheless, the aforementioned mean values are qualitatively similar to those in China-based studies on crash risk (e.g. Xu *et al.*, 2013, 2014; Chen *et al.*, 2017). *CEP* has a mean value of 3.3879, which is quite low compared with the full score of 95, suggesting that Chinese listed firms' environmental performance is poor. Moreover, the mean value of *C_SCORE* is -0.0085.

Panel A of Table 2 shows that the distributions of control variables are qualitatively similar to those in previous studies. On average, the negative conditional return skewness ($NCSKEW_{t-1}$) of lagged control variables in this study is -0.2784, the percentage of shares held by the controlling shareholder (*BLOCK*) is 35.47%, the percentage of shares held by institutional investors (*INST_SHR*) is 17.14%, analyst coverage (*ANALYST*) is 3.65 ($e^{1.5366}$-1), the detrended average monthly share turnover (*DTURN)* is -0.0636, the standard deviation of firm-specific weekly returns (*SIGMA*) is 6.4240, the arithmetic average of firm-specific weekly returns (*RET*) is -0.1168, firm size (*SIZE*) is RMB3.5407 billion, the ratio of debt to equity (*DTE*) is 69.55%, the book-to-market (*BTM*) ratio is 0.5582, the returns on total assets (*ROA*) are 4.68%, discretionary accruals (*ACCM*) are 0.1251, the tax sheltering index (*TAX*) is -3.7245, the percentage of financial irregularity (*PENALTY*) is 8.05%, and 37.35% of firms are state-owned enterprises (*STATE*).

Panel B of Table 2 reports the results of *t*-/*z*-tests for differences in the mean (median) values between the high-CEP subsample (N=2,795) and the low-CEP subsample (N=5,378). The high-CEP subsample has significantly lower negative conditional return skewness

(*NCSKEW*) and is significantly less likely to experience at least one crash event (*CRASH3.09*). These results provide preliminary support for Hypothesis 1.[8]

Panel C of Table 2 displays the procedures for computing environmental performance (*CEP*) according to GRI (2006) and descriptive statistics for seven components and 45 subcomponents. As shown in Panel C, the mean value of *CEP* (the last row) is 3.3879, much lower than the full score of 95. In fact, the major defect of CEP for Chinese enterprises rests on Environmental Performance Indicators (EPI). Furthermore, according to GRI (2006) and Clarkson *et al.* (2008), corporate environmental performance can be classified into two categories: hard environmental performance (I, II, III, and IV in Panel C) and soft environmental performance (V, VI, and VII in Panel C).

Table 2 Descriptive Statistics and Univariate Tests

Panel A: Descriptive statistics

Variable	N	Mean	SD	Min	Q1	Median	Q3	Max
$NCSKEW_{t}$	8,173	-0.3312	0.7211	-3.8571	-0.7214	-0.2818	0.1040	3.5067
$CRASH3.09_{t}$	8,173	0.0983	0.2977	0	0	0	0	1
CEP_{t-1}	8,173	3.3879	5.0022	0	0	1	5	42
C_SCORE_{t-1}	8,173	-0.0085	0.1301	-0.5891	-0.0807	-0.0144	0.0602	0.5146
$NCSKEW_{t-1}$	8,173	-0.2784	0.6987	-3.6438	-0.6438	-0.2448	0.1314	4.0400
$BLOCK_{t-1}$	8,173	0.3547	0.1548	0.0843	0.2299	0.3334	0.4697	0.7702
$INST\_SHR_{t-1}$	8,173	0.1714	0.1788	0.0000	0.0293	0.1068	0.2612	0.8157
$ANALYST_{t-1}$	8,173	1.5366	1.3118	0.0000	0.0000	1.3863	2.7081	5.3132
$DTURN_{t-1}$	8,173	-0.0636	0.2213	-1.4458	-0.1834	-0.0519	0.0444	1.3818
$SIGMA_{t-1}$	8,173	6.4240	2.1200	2.3356	4.8794	6.0109	7.5743	15.3739
RET_{t-1}	8,173	-0.1168	0.0781	-0.5230	-0.1502	-0.0989	-0.0627	-0.0113
$SIZE_{t-1}$	8,173	21.9876	1.0042	19.4033	21.3068	21.8685	22.5493	25.8002
DTE_{t-1}	8,173	0.6955	0.8415	0.0056	0.1826	0.3994	0.8737	6.7323
BTM_{t-1}	8,173	0.5582	0.4097	0.0299	0.2735	0.4574	0.7188	6.6998
ROA_{t-1}	8,173	0.0468	0.0851	-0.4428	0.0075	0.0347	0.0767	0.5066
$ACCM_{t-1}$	8,173	0.1251	0.1558	0.0022	0.0562	0.0878	0.1421	3.6298
TAX_{t-1}	8,173	-3.7245	1.6349	-11.2208	-4.4833	-3.7569	-2.7152	2.7887
$PENALTY_{t-1}$	8,173	0.0805	0.2721	0	0	0	0	1
$STATE_{t-1}$	8,173	0.3735	0.4838	0	0	0	1	1

8 Moreover, compared to the low-CEP subsample, the results of *t*-/*z*-tests show that the high-CEP subsample has significantly higher accounting conservatism (*C_SCORE*), a higher percentage of shares held by the controlling shareholder (*BLOCK*), a higher percentage of shares held by institutional investors (*INST_SHR*), more analyst coverage (*ANALYST*), a lower standard deviation of firm-specific weekly returns (*SIGMA*), a bigger arithmetic average of firm-specific weekly returns (*RET*), larger firm size (*SIZE*), a higher ratio of debt to equity (*DTE*), a higher ratio of book-to-market (*BTM*), better accounting performance (*ROA*), a lower extent of discretionary accruals (*ACCM*), a lower tax sheltering index (*TAX*), a lower likelihood of financial irregularity (*PENALTY*), and a higher likelihood of being state-owned enterprises (*STATE*).

Panel B: *t*- (*z*-) tests for differences in the mean (median) value between high- and low-CEP subsamples

	The high-CEP subsample (N=2,795)			The low-CEP subsample (N=5,378)				
Variable	Mean	Median	SD	Mean	Median	SD	*t*-test	*z*-test
$NCSKEW_t$	-0.3729	-0.3142	0.7172	-0.3095	-0.2648	0.7222	-3.78***	-3.88***
$CRASH3.09_t$	0.0848	0	0.2786	0.1052	0	0.3069	-3.04***	-2.95***
C_SCORE_{t-1}	0.0580	0.0451	0.1286	-0.0431	-0.0383	0.1167	34.81***	33.31***
$NCSKEW_{t-1}$	-0.3091	-0.2660	0.6875	-0.2624	-0.2317	0.7039	-2.87***	-2.94***
$BLOCK_{t-1}$	0.3881	0.3928	0.1581	0.3374	0.3059	0.1503	13.97***	14.28***
$INST\_SHR_{t-1}$	0.1931	0.1290	0.1861	0.1602	0.0938	0.1738	7.75***	10.02***
$ANALYST_{t-1}$	2.1530	2.3979	1.2672	1.2163	1.0986	1.2168	32.13***	30.49***
$DTURN_{t-1}$	-0.0551	-0.0414	0.1983	-0.0681	-0.0587	0.2322	2.64***	3.29***
$SIGMA_{t-1}$	6.1252	5.7074	2.1251	6.5794	6.1436	2.1008	-9.23***	-10.15***
RET_{t-1}	-0.1022	-0.0855	0.0706	-0.1244	-0.1056	0.0807	12.82***	13.59***
$SIZE_{t-1}$	22.5136	22.4195	1.1054	21.7142	21.6733	0.8241	33.68***	31.92***
DTE_{t-1}	0.8404	0.4962	0.9917	0.6202	0.3593	0.7406	10.34***	10.79***
BTM_{t-1}	0.6499	0.5353	0.4538	0.5105	0.4150	0.3761	13.93***	15.31***
ROA_{t-1}	0.0601	0.0431	0.0830	0.0400	0.0305	0.0853	10.28***	10.96***
$ACCM_{t-1}$	0.1124	0.0823	0.1206	0.1318	0.0913	0.1709	-5.94***	-6.36***
TAX_{t-1}	-3.8026	-3.7350	1.7934	-3.6839	-3.7670	1.5448	-2.97***	0.72
$PENALTY_{t-1}$	0.0658	0	0.2480	0.0881	0	0.2835	-3.67***	-3.52***
$STATE_{t-1}$	0.4182	0	0.4934	0.3503	0	0.4771	5.97***	6.02***

Panel C: Procedures for computing corporate environmental performance (CEP)

Item \ Descriptive statistics	Mean	SD
I: Governance structure and management systems (max. score is 6)		
1. Existence of a department for pollution control and/or management positions for environmental management (0–1)	0.1083	0.3108
2. Existence of an environmental and/or a public issues committee in the board (0–1)	0.0064	0.0795
3. Existence of terms and conditions applicable to suppliers and/or customers regarding environmental practices	0.0237	0.1522
4. Stakeholder involvement in setting corporate environmental policies	0.0040	0.0634
5. Implementation of ISO14001 at plant and/or firm level	0.2153	0.4111
6. Executive compensation is linked to environmental performance	0.0221	0.1472
Subtotal	0.3799	0.7024
II: Credibility (max. score is 10)		
1. Adoption of GRI sustainability reporting guidelines or provision of a CERES report (0–1)	0.2680	0.4432
2. Independent verification/assurance about environmental information disclosed in the EP report/web	0.0098	0.0985
3. Periodic independent verifications/audits on environmental performance and/or systems (0–1)	0.0321	0.1762

4. Certification of environmental programmes by independent agencies (0–1)	0.0239	0.1526
5. Product certification relating to environmental impact (0–1)	0.0324	0.1771
6. External environmental performance awards and/or inclusion in a sustainability index (0–1)	0.0814	0.2734
7. Stakeholder involvement in the environmental disclosure process (0–1)	0.0024	0.0494
8. Participation in voluntary environmental initiatives endorsed by the Ministry of Environmental Protection of China (0–1)	0.0144	0.1193
9. Participation in industry-specific associations/initiatives to improve environmental practices (0–1)	0.0053	0.0723
10. Participation in other environmental organisations/associations to improve environmental practices (if not awarded under 8 or 9)	0.0141	0.1178
Subtotal	0.4837	0.8564
III: Environmental performance indicators (EPI) (max. score is 60）		
1. EPI on energy use and/or energy use efficiency (0–6)	0.2509	0.7355
2. EPI on water use and/or water use efficiency (0–6)	0.1274	0.4967
3. EPI on greenhouse gas emissions (0–6)	0.0623	0.3570
4. EPI on other air emissions (0–6)	0.1131	0.4669
5. EPI on TRI (land, water, air) (0–6)	0.0438	0.3145
6. EPI on other discharges, releases, and/or spills (not TRI) (0–6)	0.0521	0.3029
7. EPI on waste generation and/or management (recycling, reuse, reducing, treatment, and disposal) (0–6)	0.1123	0.4514
8. EPI on land and resources use, biodiversity, and conservation (0–6)	0.0376	0.2602
9. EPI on environmental impacts of products and services (0–6)	0.0040	0.0863
10. EPI on compliance performance (e.g. exceedances, reportable incidents) (0–6)	0.0092	0.1108
Subtotal	0.8127	2.3060
IV: Environmental spending (max. score is 3)		
1. Summary of dollar savings arising from environment initiatives (0–1)	0.0136	0.1158
2. Amount spent on technologies, R&D, and/or innovations to enhance environmental performance and/or efficiency (0–1)	0.1608	0.3673
3. Amount spent on fines related to environmental issues (0–1)	0.0033	0.0574
Subtotal	0.1777	0.3992
V: Vision and strategy claims (max. score is 6)		
1. CEO statement on environmental performance in letter to shareholders and/or stakeholders (0–1)	0.2322	0.4223
2. A statement of corporate environmental policy, values and principles, environmental codes of conduct (0–1)	0.4335	0.4956
3. A statement about formal management systems regarding environmental risk and performance (0–1)	0.0706	0.2562
4. A statement that the firm undertakes periodic reviews and evaluations of its environment performance (0–1)	0.0261	0.1593
5. A statement of measurable goals in terms of future environmental performance (if not awarded under A3) (0–1)	0.0130	0.1131
6. A statement about specific environmental innovations and/or new technologies (0–1)	0.2678	0.4429
Subtotal	1.0432	1.1629

VI: Environmental profile (max. score is 4)		
1. A statement about the firm's compliance (or lack thereof) with specific environmental standards (0–1)	0.0728	0.2598
2. An overview of the industry's environmental impact (0–1)	0.0532	0.2245
3. An overview of how business operations and/or products and services impact the environment. (0–1)	0.0925	0.2897
4. An overview of corporate environmental performance relative to industry peers (0–1)	0.0067	0.0818
Subtotal	0.2253	0.5308
VII: Environmental initiatives (max. score is 6)		
1. A substantive description of employee training in environmental management and operations (0–1)	0.1121	0.3155
2. Existence of response plans in event of environmental accident (0–1)	0.0589	0.2354
3. Internal environmental awards (0–1)	0.0097	0.0978
4. Internal environmental audits (0–1)	0.0080	0.0888
5. Internal certification of environmental programmes (0–1)	0.0083	0.0908
6. Community involvement and/or donations related to the environment (if not awarded under A1.4 or A2.7) (0–1)	0.0686	0.2529
Subtotal	0.2655	0.6283
Total	3.3879	5.0022

Notes: ***, **, and * represent the 1%, 5%, and 10% levels of significance, respectively, for two-tailed tests. In Subsection III of Panel C, the scoring scale of environmental performance data ranges from 0 to 6. A point is awarded for each of the following items: (1) performance data is presented; (2) performance data is presented relative to peers/rivals or the industry; (3) performance data is presented relative to previous periods (trend analysis); (4) performance data is presented relative to targets; (5) performance data is presented in both absolute and normalised form; (6) performance data is presented at disaggregate level (i.e. plant, business unit, geographic segment).

4.4 Pearson Correlation Analysis

Table 3 reports Pearson correlation analysis of the variables used in this study, showing that *NCSKEW* and *CRASH3.09*, two dependent variables for the main tests, are significantly negatively related to the independent variable of *CEP* (-0.0408 with *p*-value=0.0002, and -0.0354 with *p*-value=0.0014, respectively). This provides preliminary support for Hypothesis 1. Moreover, *NCSKEW* and *CRASH3.09* are both significantly negatively related to *C_SCORE*, suggesting that accounting conservatism reduces crash risk to some extent. Also, there is a significantly positive association between *CEP* and *C_SCORE*. The above findings, taken together, motivate me to examine whether accounting conservatism can attenuate the negative association between corporate environmental performance and future crash risk.

As for control variables, both *NCSKEW* and *CRASH3.09* display significantly positive (negative) correlations with *ANALYST*, *DTURN*, *SIZE*, and *TAX* (*BLOCK*, *DTE*, and *BTM*). *NCSKEW* is also significantly positively associated with both *INST_SHR* and *ROA*, and significantly negatively associated with *RET*, while *CRASH3.09* is also significantly positively associated with *PENALTY*, and significantly negatively correlated with *SIGMA*

Table 3 Pearson Correlation Matrix

Variable		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)
$NCSKEW_t$	(1)	1																		
$CRASH3.09_t$	(2)	0.4605	1																	
		(<.0001)																		
CEP_{t-1}	(3)	-0.0408	-0.0354	1																
		(0.0002)	(0.0014)																	
C_SCORE_{t-1}	(4)	-0.0654	-0.0324	0.4036	1															
		(<.0001)	(0.0034)	(<.0001)																
$NCSKEW_{t-1}$	(5)	0.0598	-0.0256	-0.0235	-0.0420	1														
		(<.0001)	(0.0207)	(0.0336)	(0.0001)															
$BLOCK_{t-1}$	(6)	-0.0523	-0.0325	0.1874	0.2889	-0.0560	1													
		(<.0001)	(0.0033)	(<.0001)	(<.0001)	(<.0001)														
$INST\_SHR_{t-1}$	(7)	0.0603	-0.0081	0.0681	0.1342	0.0809	0.0007	1												
		(<.0001)	(0.4626)	(<.0001)	(<.0001)	(<.0001)	(0.9488)													
$ANALYST_{t-1}$	(8)	0.0883	0.0182	0.3549	0.5542	0.0953	0.1887	0.2366	1											
		(<.0001)	(0.0992)	(<.0001)	(<.0001)	(<.0001)	(<.0001)	(<.0001)												
$DTURN_{t-1}$	(9)	0.0854	0.0693	0.0251	0.0075	-0.1910	-0.0219	-0.0157	0.0532	1										
		(<.0001)	(<.0001)	(0.0234)	(0.4989)	(<.0001)	(0.0477)	(0.1563)	(<.0001)											
$SIGMA_{t-1}$	(10)	0.0094	-0.0593	-0.1621	-0.0901	-0.0593	-0.0312	-0.0116	-0.1375	0.0493	1									
		(0.3946)	(<.0001)	(<.0001)	(<.0001)	(<.0001)	(0.0048)	(0.2960)	(<.0001)	(<.0001)										
RET_{t-1}	(11)	-0.0694	0.0159	0.1669	0.1855	0.0888	0.0474	-0.0076	0.1219	-0.2064	-0.8292	1								
		(<.0001)	(0.1497)	(<.0001)	(<.0001)	(<.0001)	(<.0001)	(0.4903)	(<.0001)	(<.0001)	(<.0001)									
$SIZE_{t-1}$	(12)	0.0540	0.0309	0.4344	0.6698	-0.0607	0.2100	0.1794	0.6415	0.1486	-0.2734	0.1715	1							
		(<.0001)	(0.0053)	(<.0001)	(<.0001)	(<.0001)	(<.0001)	(<.0001)	(<.0001)	(<.0001)	(<.0001)	(<.0001)								
DTE_{t-1}	(13)	-0.1540	-0.0475	0.1541	0.3443	-0.0608	0.1361	-0.0322	0.0558	-0.0656	-0.1422	0.2032	0.0513	1						
		(<.0001)	(<.0001)	(<.0001)	(<.0001)	(<.0001)	(<.0001)	(0.0036)	(<.0001)	(<.0001)	(<.0001)	(<.0001)	(<.0001)							
BTM_{t-1}	(14)	-0.2027	-0.0880	0.1779	0.4290	-0.0340	0.2381	-0.0117	0.0734	-0.1502	-0.0449	0.2243	-0.0699	0.5350	1					
		(<.0001)	(<.0001)	(<.0001)	(<.0001)	(0.0021)	(<.0001)	(0.2919)	(<.0001)	(<.0001)	(<.0001)	(<.0001)	(<.0001)	(<.0001)						
ROA_{t-1}	(15)	0.0669	0.0064	0.0932	0.2798	0.0428	0.1547	0.1672	0.4299	0.0311	-0.0747	0.0324	0.3557	-0.2015	-0.0512	1				
		(<.0001)	(0.5615)	(<.0001)	(<.0001)	(0.0001)	(<.0001)	(<.0001)	(<.0001)	(0.0050)	(<.0001)	(0.0034)	(<.0001)	(<.0001)	(<.0001)					
$ACCM_{t-1}$	(16)	0.0125	0.0059	-0.0533	-0.0030	0.0199	0.0324	0.0030	-0.0263	-0.0024	-0.0152	-0.0106	-0.0147	0.0363	0.0172	0.1098	1			
		(0.2590)	(0.5908)	(<.0001)	(0.7876)	(0.0724)	(0.0034)	(0.7855)	(0.0175)	(0.8301)	(0.1708)	(0.3362)	(0.1838)	(0.0010)	(0.1209)	(<.0001)				
TAX_{t-1}	(17)	0.1404	0.0444	-0.0555	-0.0854	0.0650	-0.0390	0.0535	0.0877	0.0142	0.1667	-0.1769	0.0865	-0.7201	-0.3847	0.4033	0.0737	1		
		(<.0001)	(0.0001)	(<.0001)	(<.0001)	(<.0001)	(0.0004)	(<.0001)	(<.0001)	(0.2001)	(<.0001)	(<.0001)	(<.0001)	(<.0001)	(<.0001)	(<.0001)	(<.0001)			
$PENALTY_{t-1}$	(18)	0.0165	0.0217	-0.0336	-0.1092	0.0117	-0.0435	-0.0180	-0.0885	0.0198	-0.0456	-0.0127	-0.0657	0.0103	-0.0507	-0.0573	0.0409	-0.0439	1	
		(0.1368)	(0.0501)	(0.0024)	(<.0001)	(0.2887)	(0.0001)	(0.1032)	(<.0001)	(0.0736)	(<.0001)	(0.2505)	(<.0001)	(0.3497)	(<.0001)	(<.0001)	(0.0002)	(0.0001)		
$STATE_{t-1}$	(19)	0.0074	-0.0229	0.0360	0.2023	0.0421	0.1598	0.0264	0.0694	-0.0867	0.2654	-0.1058	0.0490	-0.0019	0.0435	-0.0065	-0.0643	0.1458	-0.1132	1
		(0.5061)	(0.0388)	(0.0011)	(<.0001)	(0.0001)	(<.0001)	(0.0170)	(<.0001)	(<.0001)	(<.0001)	(<.0001)	(<.0001)	(0.8661)	(0.0001)	(0.5579)	(<.0001)	(<.0001)	(<.0001)	

Note: *p*-values are presented in parentheses below the coefficient values. All variables are defined in Appendix I.

and *STATE*, respectively. These results, taken together, suggest a need to control for these variables when I examine the influence of corporate environmental performance (*CEP*) on stock price crash risk. Moreover, as expected, the coefficients of pair-wise correlation among other control variables are generally low, suggesting that there is no serious multicollinearity when these variables are included in the regression simultaneously.

V. Empirical Results

Table 4 reports the results of OLS regression in Section A and the logistic regression in Section B, in which *NCSKEW* and *CRASH3.09* are dependent variables, respectively. To mitigate the potential problem of autocorrelation and clustering in the sample, all reported *t*-values are based on standard errors adjusted for clustering at the firm level (Petersen, 2009). Table 4 reports the step-by-step regression results of stock price crash risk on corporate environmental performance, accounting conservatism, and other determinants. All models are highly significant (*F*-/LR-statistics). Four step-by-step regressions display gradually increasing explanatory power with significantly higher adj_R^2 or $Pseudo\_R^2$ (see $\triangle R^2$ between nearby models and results of *F*-/Chi-squared tests in the second to last row).

5.1 Results Using NCSKEW as the Dependent Variable

Column (1) of Section A in Table 4 reports the regression results of stock price crash risk on all control variables. Those in Column (1) reveal the following:

1. The coefficient on *BLOCK* is negative and significant, implying a negative association between the percentage of shares held by the controlling shareholder and negatively skewed future return distribution.
2. The coefficient on *INST_SHR* is positive and significant, suggesting that a higher proportion of shares held by institutional investors brings out more negatively skewed future return distribution. This result is consistent with the findings of Kim *et al.* (2011).
3. *ANALYST* has a positive and significant coefficient, which is also consistent with Kim *et al.* (2011).
4. The coefficient on *SIGMA* is significantly negative.
5. *RET* has a significantly negative coefficient, revealing that the arithmetical average of firm-specific weekly returns is negatively associated with the extent of a firm's future negative return skewness.
6. *TAX* has a positive and significant coefficient, which suggests that the extent of negatively skewed future returns is positively associated with tax avoidance, echoing the findings in Kim *et al.* (2011).

The sign and significance of *SIGMA*, *RET*, *SIZE*, and *DTE* are different from those reported in Kim *et al.* (2014) and Kim and Zhang (2016). Nevertheless, they are qualitatively similar to those reported in several China-based studies on crash risk (Chen *et* *al.*, 2017; Xu *et al.*, 2013, 2014). These disparities can be explained by the differences in the institutional setting between China and Western economies (markets). For example, in China's stock market, changes in daily prices are not allowed to exceed +/-10% of the previous closing price.

Column (2) of Section A in Table 4 reports the regression results of *NCSKEW* on corporate environmental performance and other determinants. The coefficient on *CEP* is negative and significant at the 1% level (-0.0052 with *t*=-3.15), providing strong support for Hypothesis 1. This suggests that environmentally friendly firms engage in less bad news hoarding and present a higher degree of information transparency than environmentally irresponsible firms, and thus their firm-specific return distributions are less negatively skewed in the future. Also, the coefficient estimate suggests that an increase of one standard deviation in *CEP* reduces firm-specific future negative return skewness by about 2.60%, equal to about 7.85% of the mean value of *NCSKEW*. Clearly, this amount is economically significant, in addition to its statistical significance.

Column (3) of Section A in Table 4 reports the effects of stock price crash risk on corporate environmental performance, accounting conservatism, and all control variables. Consistent with Hypothesis 1, *CEP* has a negative and significant coefficient at the 1% level (-0.0044 and *t*=-2.64). The coefficient on *C_SCORE* is also negative and significant at the 1% level (-0.5572 with *t*=-5.40), suggesting that firms with higher scores for accounting conservatism experience less future negative return skewness. This finding is supported by Kim and Zhang (2016).

Column (4) of Section A in Table 4 reports the regression results of Hypothesis 2. It shows that the coefficient on *CEP×C_SCORE* is positive and significant at the 1% level (0.0308 with *t*=3.14), lending significant support to Hypothesis 2. This result validates that accounting conservatism attenuates the negative association between corporate environmental performance and stock price crash risk. Moreover, both *CEP* and *C_SCORE* have significantly negative coefficients, echoing Hypothesis 1 again and consistent with Kim and Zhang (2016), respectively.

5.2 Results Using CRASH3.09 as the Dependent Variable

Column (5) of Section B in Table 4 reports the effect of all control variables on stock price crash risk. Briefly, the likelihood of future crash risk (*CRASH3.09*) is significantly negatively related to *SIGMA*, *RET*, and *STATE*, but significantly positively related to *ANALYST*, *DTE*, and *PENALTY*. These results are qualitatively similar to those in Chen *et al.* (2001) and Kim *et al.* (2011).

Column (6) of Section B in Table 4 reports the results relating to Hypothesis 1. The coefficient on *CEP* is negative and significant at the 1% level (-0.0288 with *t*=-2.73), providing strong support for Hypothesis 1 again and suggesting that firms with better environmental performance are significantly less likely to experience future crash risk than

Table 4 Regression Results of Stock Price Crash Risk on Corporate Environmental Performance, Accounting Conservatism, and Other Determinants

Variable	Section A								Section B							
	Dependent Variable: $NCSKEW_t$								Dependent Variable: $CRASH3.09_t$							
	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)	
	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value
CEP_{t-1}			-0.0052***	-3.15	-0.0044***	-2.64	-0.0071***	-3.75			-0.0288***	-2.73	-0.0271***	-2.58	-0.0361***	-3.16
C_SCORE_{t-1}					-0.5572***	-5.40	-0.6426***	-5.94					-0.9974*	-1.91	-1.2289**	-2.35
$CEP_{t-1}\times C\_SCORE_{t-1}$							0.0308***	3.14							0.1007*	1.79
$NCSKEW_{t-1}$	0.0573***	4.72	0.0566***	4.66	0.0516***	4.26	0.0508***	4.20	-0.0849	-1.48	-0.0898	-1.55	-0.0997*	-1.71	-0.1025*	-1.76
$BLOCK_{t-1}$	-0.1464**	-2.57	-0.1347**	-2.36	-0.0942*	-1.66	-0.0919	-1.61	-0.4766	-1.63	-0.4215	-1.45	-0.3585	-1.21	-0.3518	-1.19
$INST\_SHR_{t-1}$	0.1636***	3.48	0.1616***	3.45	0.1519***	3.27	0.1522***	3.28	-0.1675	-0.70	-0.1830	-0.76	-0.2059	-0.85	-0.2050	-0.84
$ANALYST_{t-1}$	0.0697***	8.24	0.0718***	8.50	0.0779***	9.15	0.0808***	9.37	0.0997**	2.41	0.1100***	2.65	0.1217***	2.88	0.1311***	3.07
$DTURN_{t-1}$	-0.0726	-1.45	-0.0686	-1.37	-0.0398	-0.79	-0.0430	-0.86	-0.0975	-0.44	-0.0746	-0.34	-0.0125	-0.06	-0.0266	-0.12
$SIGMA_{t-1}$	-0.0188*	-1.72	-0.0199*	-1.81	-0.0190*	-1.74	-0.0163	-1.48	-0.3147***	-4.79	-0.3219***	-4.87	-0.3173***	-4.81	-0.3104***	-4.69
RET_{t-1}	-1.1127***	-5.14	-1.0955***	-5.07	-0.9274***	-4.30	-0.8878***	-4.09	-6.0281***	-4.59	-5.9725***	-4.54	-5.5985***	-4.19	-5.4993***	-4.11
$SIZE_{t-1}$	-0.0405***	-3.48	-0.0308**	-2.54	0.0161	1.09	0.0083	0.56	-0.0738	-1.21	-0.0225	-0.35	0.0621	0.82	0.0387	0.50
DTE_{t-1}	-0.0187	-0.53	-0.0137	-0.39	0.0088	0.25	0.0162	0.46	0.2945*	1.81	0.3200**	1.97	0.3629**	2.23	0.3844**	2.35
BTM_{t-1}	-0.0102	-0.92	-0.0108	-0.97	-0.0073	-0.67	-0.0076	-0.70	-0.1166	-1.54	-0.1213	-1.59	-0.1154	-1.52	-0.1169	-1.55
ROA_{t-1}	-0.0508	-1.21	-0.0574	-1.37	-0.0335	-0.81	-0.0240	-0.58	-0.2829	-1.07	-0.3186	-1.21	-0.2689	-1.03	-0.2394	-0.92
$ACCM_{t-1}$	-0.0325	-0.57	-0.0327	-0.58	-0.0219	-0.39	-0.0258	-0.45	-0.1583	-0.51	-0.1516	-0.50	-0.1354	-0.43	-0.1492	-0.48
TAX_{t-1}	0.0295***	4.59	0.0290***	4.51	0.0224***	3.51	0.0238***	3.70	0.0480	1.59	0.0463	1.53	0.0332	1.06	0.0378	1.21
$PENALTY_{t-1}$	0.0473	1.56	0.0472	1.56	0.0452	1.50	0.0435	1.44	0.2216*	1.69	0.2196*	1.67	0.2156	1.64	0.2089	1.59
$STATE_{t-1}$	-0.0298	-1.43	-0.0280	-1.34	-0.0232	-1.12	-0.0222	-1.08	-0.2784***	-2.72	-0.2673***	-2.62	-0.2569**	-2.52	-0.2534**	-2.48
Constant	0.3487	1.36	0.1551	0.59	-0.8768***	-2.75	-0.7343**	-2.29	-0.6111	-0.44	-1.6291	-1.14	-3.5077**	-2.09	-3.0671*	-1.79
Industry and Year Effects	Control		Control		Control		Control		Control		Control		Control		Control	
Observations	8,173		8,173		8,173		8,173		8,173		8,173		8,173		8,173	
Log Likelihood									-2464.7307		-2460.3215		-2458.4960		-2457.0125	
Adj_R^2/Pseudo-R^2	0.0761		0.0769		0.0800		0.0808		0.0583		0.0600		0.0607		0.0613	
F/LR (p-value)	20.11*** (<.0001)		20.15*** (<.0001)		20.27*** (<.0001)		19.89*** (<.0001)		222.47*** (<.0001)		227.40*** (<.0001)		233.35*** (<.0001)		241.07*** (<.0001)	
ΔR^2			7.97***		28.43***		8.00***				8.82***		3.65*		2.97*	

Notes: ***, **, and * represent the 1%, 5%, and 10% levels of significance, respectively, for two-tailed tests. All reported t-statistics are based on standard errors adjusted for clustering at the firm level (Petersen, 2009). All the variables are defined in Appendix 1.

firms with worse environmental performance.

Column (7) of Section B in Table 4 shows the significantly negative influence of environmental performance on the likelihood of future crash risk after including accounting conservatism (-0.0271 with t=-2.58). Moreover, the coefficient on *C_SCORE* is negative and significant (-0.9974 with t=-1.91), consistent with Hypothesis 1 and the findings of Kim and Zhang (2016).

Column (8) of Section B in Table 4 reports the results relating to Hypothesis 2. The coefficient on $CEP \times C\_SCORE$ is positive and significant at the 10% level (0.1007 with t=1.79), lending significant support to Hypothesis 2. This result validates the moderating role of accounting conservatism and the substitutive effects between corporate environmental performance and accounting conservatism reducing the likelihood of future stock price crash risk.

VI. Robustness Checks

6.1 Robustness Checks Using Alternative Measures of Stock Price Crash Risk

To ensure that the results in Table 4 are robust to other measures of crash risk, I construct a set of additional proxies for crash risk to retest Hypotheses 1 and 2.

First, I compute $DUVOL_{j,t}$ and $CRASHN3.09_{j,t}$ as two additional variables to retest the hypotheses. $DUVOL_{j,t}$ captures asymmetric volatility between negative and positive firm-specific weekly returns and the down-to-up volatility of the likelihood of future stock price crash risk for firm j in year t. $DUVOL_{j,t}$ is measured following Eq. (9):

$$DUVOL_{j,t} = \log\left\{(n_u - 1)\sum_{DOWN} W_{j,t}^2 \Big/ \left[(n_d - 1)\sum_{UP} W_{j,t}^2\right]\right\}, \quad (9)$$

where n_u is the number of weeks in which $W_{j,t}$ is greater than the annual mean value of $W_{j,t}$, and n_d is the number of weeks in which $W_{j,t}$ is lower than the annual mean value of $W_{j,t}$ (Kim *et al.*, 2011).

This study also computes the number of stock price crashes for firm j in year t, labelled $CRASHN3.09_{j,t}$, as another alternative dependent variable with which to conduct robustness checks.

Panel A of Table 5 provides results using $DUVOL_{j,t}$ and $CRASHN3.09_{j,t}$ as dependent variables. In Columns (2) and (6) of Panel A, the coefficients on *CEP* are both negative and significant (-0.0036 with t=-3.19 and -0.0288 with t=-2.73), providing strong additional evidence for Hypothesis 1. In Columns (4) and (8) of Panel A, the coefficients on $CEP \times C\_SCORE$ are both significantly positive (0.0169 with t=2.47 and 0.1011 with t=1.80), lending significant additional evidence for Hypothesis 2. Also, both *CEP* and *C_SCORE* in Columns (4) and (8) of Panel A are negative and significant, consistent with Hypothesis 1

Table 5 Robustness Checks of Hypotheses 1 and 2 Using Alternative Measures of Stock Price Crash Risk (Dependent Variables)

Panel A: Robustness checks of Hypotheses 1 and 2 using $DUVOL_t$ and $CRASHN3.09_t$

Variable	Section A								Section B							
	Dependent Variable: $DUVOL_t$								Dependent Variable: $CRASHN3.09_t$							
	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)	
	Coefficient	*t*-value	Coefficient	*t*-value	Coefficient	*t*-value	Coefficient	*t*-value	Coefficient	*t*-value	Coefficient	*t*-value	Coefficient	*t*-value	Coefficient	*t*-value
CEP_{t-1}			-0.0036***	-3.19	-0.0029***	-2.63	-0.0044***	-3.47			-0.0288***	-2.73	-0.0271***	-2.58	-0.0362***	-3.16
C_SCORE_{t-1}					-0.4151***	-6.01	-0.4619***	-6.34					-1.0077*	-1.93	-1.2396**	-2.37
$CEP_{t-1}\times C\_SCORE_{t-1}$							0.0169**	2.47							0.1011*	1.80
$DUVOL_{t-1}$	0.0418***	3.54	0.0414***	3.50	0.0363***	3.07	0.0355***	3.01								
$NCSKEW_{t-1}$									-0.0847	-1.47	-0.0896	-1.55	-0.0995*	-1.71	-0.1023*	-1.76
$BLOCK_{t-1}$	-0.0791**	-2.13	-0.0711*	-1.91	-0.0407	-1.10	-0.0394	-1.07	-0.4831*	-1.66	-0.4280	-1.48	-0.3647	-1.24	-0.3583	-1.22
$INST\_SHR_{t-1}$	0.1108***	3.43	0.1094***	3.40	0.1022***	3.19	0.1024***	3.20	-0.1699	-0.71	-0.1854	-0.77	-0.2088	-0.86	-0.2078	-0.85
$ANALYST_{t-1}$	0.0472***	8.24	0.0486***	8.47	0.0531***	9.19	0.0547***	9.38	0.0981**	2.38	0.1084***	2.61	0.1203***	2.85	0.1297***	3.04
$DTURN_{t-1}$	-0.0529	-1.61	-0.0501	-1.53	-0.0288	-0.88	-0.0306	-0.93	-0.1096	-0.49	-0.0867	-0.38	-0.0241	-0.10	-0.0387	-0.17
$SIGMA_{t-1}$	-0.0204***	-2.75	-0.0211***	-2.84	-0.0204***	-2.76	-0.0190**	-2.54	-0.3147***	-4.78	-0.3219***	-4.87	-0.3170***	-4.79	-0.3102***	-4.68
RET_{t-1}	-0.7735***	-5.24	-0.7617***	-5.16	-0.6363***	-4.33	-0.6147***	-4.16	-6.0347***	-4.58	-5.9792***	-4.54	-5.5971***	-4.18	-5.4990***	-4.10
$SIZE_{t-1}$	-0.0343***	-4.39	-0.0277***	-3.39	0.0072	0.72	0.0029	0.29	-0.0730	-1.20	-0.0217	-0.34	0.0638	0.84	0.0402	0.52
DTE_{t-1}	-0.0087	-0.37	-0.0052	-0.22	0.0115	0.49	0.0156	0.66	0.3021*	1.85	0.3277**	2.01	0.3713**	2.27	0.3930**	2.40
BTM_{t-1}	-0.0037	-0.52	-0.0041	-0.57	-0.0016	-0.22	-0.0018	-0.25	-0.1166	-1.54	-0.1212	-1.59	-0.1153	-1.52	-0.1169	-1.55
ROA_{t-1}	-0.0554*	-1.80	-0.0599*	-1.95	-0.0422	-1.39	-0.0370	-1.22	-0.2837	-1.07	-0.3193	-1.21	-0.2695	-1.03	-0.2396	-0.91
$ACCM_{t-1}$	-0.0282	-0.73	-0.0284	-0.74	-0.0205	-0.53	-0.0227	-0.58	-0.1610	-0.52	-0.1544	-0.50	-0.1379	-0.44	-0.1518	-0.49
TAX_{t-1}	0.0199***	4.68	0.0195***	4.60	0.0146***	3.42	0.0153***	3.57	0.0477	1.58	0.0459	1.52	0.0327	1.05	0.0373	1.19
$PENALTY_{t-1}$	0.0273	1.36	0.0272	1.36	0.0255	1.28	0.0246	1.24	0.2181*	1.66	0.2161*	1.65	0.2120	1.62	0.2052	1.56
$STATE_{t-1}$	-0.0226	-1.60	-0.0214	-1.51	-0.0178	-1.27	-0.0173	-1.23	-0.2785***	-2.72	-0.2674***	-2.62	-0.2568**	-2.52	-0.2532**	-2.48
Constant	0.3441**	1.96	0.2119	1.17	-0.5567**	-2.54	-0.4783**	-2.17	0.6341	0.46	1.6523	1.16	3.5522**	2.11	3.1083*	1.81
Constant1									5.2698***	3.70	6.2894***	4.28	8.1900***	4.80	7.7465***	4.45
Industry and Year Effects	Control		Control		Control		Control		Control		Control		Control		Control	
Observations	8,173		8,173		8,173		8,173		8,173		8,173		8,173		8,173	
Log Likelihood									-2513.9629		-2509.5424		-2507.6776		-2506.1819	
Adjusted R^2/Pseudo-R^2	0.0758		0.0766		0.0805		0.0810		0.0573		0.0589		0.0596		0.0602	
F/LR (*p*-value)	19.83*** (<.0001)		19.80*** (<.0001)		20.31*** (<.0001)		19.98*** (<.0001)		222.90*** (<.0001)		227.88*** (<.0001)		234.02*** (<.0001)		241.86*** (<.0001)	
ΔR^2			8.85***		34.66***		5.34**				8.84***		3.73*		2.99*	

Panel B: Robustness checks using $CRASH2.90_t$ and $CRASH3.00_t$

Variable	Section A								Section B							
	Dependent Variable: $CRASH2.90_t$								Dependent Variable: $CRASH3.00_t$							
	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)	
	Coefficient	*t*-value	Coefficient	*t*-value	Coefficient	*t*-value	Coefficient	*t*-value	Coefficient	*t*-value	Coefficient	*t*-value	Coefficient	*t*-value	Coefficient	*t*-value
CEP_{t-1}			-0.0218***	-2.61	-0.0199**	-2.38	-0.0234***	-2.59			-0.0262***	-2.77	-0.0239**	-2.54	-0.0291***	-2.89
C_SCORE_{t-1}					-1.1499***	-2.64	-1.2506***	-2.82					-1.3665***	-2.85	-1.5096***	-3.11
$CEP_{t-1} \times C\_SCORE_{t-1}$							0.0438*	1.68							0.0650**	2.08
$NCSKEW_{t-1}$	-0.0445	-0.90	-0.0478	-0.96	-0.0593	-1.18	-0.0603	-1.21	-0.0581	-1.09	-0.0623	-1.16	-0.0763	-1.41	-0.0779	-1.43
$BLOCK_{t-1}$	-0.6547***	-2.66	-0.6105**	-2.48	-0.5349**	-2.16	-0.5309**	-2.14	-0.5420**	-2.08	-0.4904*	-1.88	-0.4012	-1.53	-0.3965	-1.51
$INST\_SHR_{t-1}$	0.0321	0.16	0.0213	0.11	-0.0029	-0.01	-0.0020	-0.01	-0.0612	-0.28	-0.0752	-0.35	-0.1062	-0.48	-0.1050	-0.48
$ANALYST_{t-1}$	0.0735**	2.14	0.0817**	2.37	0.0955***	2.72	0.0993***	2.80	0.0847**	2.28	0.0945**	2.53	0.1111***	2.93	0.1168***	3.05
$DTURN_{t-1}$	0.0469	0.23	0.0638	0.31	0.1329	0.63	0.1274	0.61	-0.0191	-0.09	0.0010	0.00	0.0840	0.39	0.0754	0.35
$SIGMA_{t-1}$	-0.2921***	-5.25	-0.2973***	-5.32	-0.2924***	-5.25	-0.2895***	-5.18	-0.2951***	-4.92	-0.3015***	-5.01	-0.2954***	-4.91	-0.2910***	-4.84
RET_{t-1}	-5.5237***	-5.00	-5.4767***	-4.96	-5.0521***	-4.53	-5.0111***	-4.48	-5.7609***	-4.83	-5.7119***	-4.79	-5.1963***	-4.30	-5.1376***	-4.25
$SIZE_{t-1}$	-0.0893*	-1.81	-0.0508	-0.99	0.0468	0.77	0.0360	0.57	-0.1017*	-1.87	-0.0561	-0.99	0.0603	0.89	0.0444	0.64
DTE_{t-1}	0.1074	0.77	0.1267	0.91	0.1769	1.26	0.1865	1.32	0.2869*	1.92	0.3098**	2.08	0.3701**	2.48	0.3838**	2.56
BTM_{t-1}	-0.0645	-1.05	-0.0676	-1.09	-0.0616	-1.01	-0.0624	-1.02	-0.0701	-1.05	-0.0739	-1.10	-0.0665	-1.01	-0.0677	-1.03
ROA_{t-1}	-0.2791	-1.28	-0.3048	-1.41	-0.2471	-1.15	-0.2343	-1.09	-0.3885*	-1.67	-0.4188*	-1.81	-0.3472	-1.50	-0.3287	-1.42
$ACCM_{t-1}$	-0.2388	-0.90	-0.2335	-0.89	-0.2158	-0.81	-0.2225	-0.83	-0.1680	-0.61	-0.1625	-0.59	-0.1394	-0.50	-0.1483	-0.53
TAX_{t-1}	0.0312	1.24	0.0294	1.17	0.0141	0.54	0.0162	0.62	0.0424	1.57	0.0406	1.50	0.0225	0.80	0.0255	0.90
$PENALTY_{t-1}$	0.1917*	1.72	0.1902*	1.71	0.1855*	1.67	0.1828	1.64	0.2025*	1.70	0.2008*	1.68	0.1952	1.64	0.1913	1.60
$STATE_{t-1}$	-0.1255	-1.42	-0.1173	-1.33	-0.1048	-1.19	-0.1032	-1.17	-0.2324**	-2.47	-0.2223**	-2.36	-0.2077**	-2.21	-0.2055**	-2.18
Constant	0.6209	0.55	-0.1466	-0.13	-2.3132*	-1.71	-2.1099	-1.53	0.2551	0.21	-0.6514	-0.51	-3.2371**	-2.16	-2.9381*	-1.92
Industry and Year Effects	Control		Control		Control		Control		Control		Control		Control		Control	
Observations	8,173		8,173		8,173		8,173		8,173		8,173		8,173		8,173	
Log Likelihood	-3211.6456		-3208.0286		-3204.5691		-3203.1869		-2825.8588		-2821.5174		-2817.3205		-2815.2216	
Pseudo-R^2	0.0535		0.0546		0.0556		0.0562		0.0579		0.0594		0.0608		0.0640	
LR (*p*-value)	274.05*** (<.0001)		276.27*** (<.0001)		286.97*** (<.0001)		289.92*** (<.0001)		238.42*** (<.0001)		242.85*** (<.0001)		255.76*** (<.0001)		260.90*** (<.0001)	
ΔR^2			7.23***		6.92***		2.76*				8.68***		8.39***		4.20**	

Panel C: Robustness checks using firm-specific weekly returns below -10%, -15%, and -20% as thresholds

Variable	Dependent Variable: $CRASH0.10_t$		Dependent Variable: $CRASH0.15_t$		Dependent Variable: $CRASH0.20_t$		Dependent Variable: $CRASH\_Avg0.10_t$		Dependent Variable: $CRASH\_Avg0.15_t$		Dependent Variable: $CRASH\_Avg0.20_t$	
	(1)		(2)		(3)		(4)		(5)		(6)	
	Coefficient	*t*-value	Coefficient	*t*-value	Coefficient	*t*-value	Coefficient	*t*-value	Coefficient	*t*-value	Coefficient	*t*-value
CEP_{t-1}	-0.0199***	-3.25	-0.0192*	-1.93	-0.0655***	-2.92	-0.0205***	-3.37	-0.0198*	-1.94	-0.0688***	-2.89
$NCSKEW_{t-1}$	0.1044***	2.80	0.0267	0.51	-0.0129	-0.12	0.1076***	2.87	0.0181	0.34	-0.0505	-0.48
$BLOCK_{t-1}$	0.2528	1.51	0.0438	0.18	0.1843	0.38	0.2858*	1.71	0.0467	0.19	0.0599	0.12
$INST\_SHR_{t-1}$	0.2825**	1.99	-0.1118	-0.53	-0.1254	-0.32	0.2160	1.53	-0.1662	-0.77	-0.0858	-0.21
$ANALYST_{t-1}$	-0.0125	-0.50	0.0176	0.47	0.0146	0.20	-0.0116	-0.46	0.0203	0.53	0.0220	0.30
$DTURN_{t-1}$	-0.1078	-0.72	0.0047	0.02	-0.3444	-0.96	-0.1290	-0.86	-0.0479	-0.24	-0.5495	-1.54
$SIGMA_{t-1}$	0.0010	0.03	-0.1248**	-2.20	-0.3441***	-2.88	0.0129	0.36	-0.1363**	-2.35	-0.3277***	-2.67
RET_{t-1}	-4.6499***	-5.99	-5.7273***	-5.36	-9.4941***	-4.52	-4.2235***	-5.48	-5.8563***	-5.30	-9.3793***	-4.36
$SIZE_{t-1}$	-0.3518***	-8.99	-0.3596***	-5.85	-0.2772**	-2.18	-0.3526***	-9.06	-0.3428***	-5.45	-0.2830**	-2.13
DTE_{t-1}	-0.1745*	-1.70	-0.1060	-0.70	0.1516	0.56	-0.1705	-1.64	-0.1422	-0.91	0.1563	0.56
BTM_{t-1}	0.0703*	1.92	0.0042	0.08	-0.1812*	-1.73	0.0501	1.37	0.0129	0.25	-0.1650	-1.62
ROA_{t-1}	-0.3969**	-2.55	-0.5380***	-2.71	0.2434	0.61	-0.4252***	-2.73	-0.4978**	-2.40	0.1768	0.44
$ACCM_{t-1}$	0.1759	0.97	0.3289	1.63	0.2640	0.55	0.1665	0.97	0.2851	1.33	0.3465	0.74
TAX_{t-1}	0.0052	0.28	0.0282	0.96	0.0478	0.84	0.0124	0.67	0.0228	0.75	0.0530	0.93
$PENALTY_{t-1}$	0.0100	0.11	0.1972*	1.70	0.0174	0.08	0.0126	0.14	0.1852	1.55	0.0365	0.16
$STATE_{t-1}$	-0.1657**	-2.50	-0.2144**	-2.21	-0.4552**	-2.34	-0.1646**	-2.48	-0.2300**	-2.32	-0.4610**	-2.34
Constant	6.9069***	8.03	5.0993***	3.88	2.9178	1.07	6.8350***	8.03	4.8307***	3.59	2.9510	1.05
Industry and Year Effects	Control		Control		Control		Control		Control		Control	
Observations	8,173		8,173		8,173		8,173		8,173		8,173	
Pseudo-R^2	0.0992		0.0853		0.0802		0.0963		0.0836		0.0800	
LR (*p*-value)	870.97***(<.0001)		451.66***(<.0001)		222.47***(<.0001)		850.44***(<.0001)		434.34***(<.0001)		216.74***(<.0001)	

Notes: ***, **, and * represent the 1%, 5%, and 10% levels of significance, respectively, for two-tailed tests. All reported *t*-statistics are based on standard errors adjusted for clustering at the firm level (Petersen, 2009). All the variables are defined in Appendix 1.

and Kim and Zhang's (2016) findings, respectively.

Second, it is well-known that daily price changes cannot exceed +/-10% of the previous closing prices for Chinese stocks, and thus the mean value of $NCSKEW_{j,t}$ ($CRASH3.09_{j,t}$) is much larger (smaller) than those in Chen *et al.* (2001) and Kim *et al.* (2011). These differences suggest that the limit of 3.09 standard deviations below the mean value of firm-specific weekly return ($W_{j,t}$) over the calendar year may be too large for determining a crash week. In response, Panel B of Table 5 uses $CRASH2.90_{j,t}$ and $CRASH3.00_{j,t}$ as independent variables to retest Hypotheses 1 and 2. $CRASH2.90_{j,t}$ is a dummy variable of stock price crash risk, equal to 1 if a firm-year's stock price experiences one or more firm-specific weekly returns falling 2.90 standard deviations below the mean value of firm-specific weekly returns ($W_{j,t}$) over the calendar year, and 0 otherwise. $CRASH3.00_{j,t}$ is a dummy variable of stock price crash risk, equalling 1 if a firm-year's stock price experiences one or more firm-specific weekly returns falling 3.00 standard deviations below the mean value of firm-specific weekly returns ($W_{j,t}$) over the calendar year, and 0 otherwise. The results in Panel B of Table 5 provide additional support for Hypothesis 1 (Columns (2) and (6)) and Hypothesis 2 (Columns (4) and (8)).

Finally, in Panel C of Table 5, $CRASH\_P_t\%$ and $CRASH\_Avg\_P_t\%$ (p=10, 15, 20) are used as independent variables to examine whether the mitigating effect of environmental performance on crash risk is still valid. $CRASH\_P_t\%$ is a dummy variable, equal to 1 if firm-specific weekly returns are equal to or below -*P*% (p=10, 15, 20) and 0 otherwise. $CRASH\_Avg\_P_t\%$ is a dummy variable, equal to 1 if firm-specific weekly returns are equal to or below -*P*% of the mean value (p=10, 15, 20) and 0 otherwise. As expected, the results in Panel C of Table 5 further validate the negative relationship between environmental performance and crash risk using $CRASH\_P_t\%$ and $CRASH\_Avg\_P_t\%$ (p=10, 15, 20), providing additional support to Hypothesis 1.

Overall, the results in Table 5 using alternative measures of stock price crash risk suggest that my findings are qualitatively similar to those presented in Table 4.

6.2 Robustness Checks Using Hard Environmental Performance

As shown in Panel C of Table 2, hard environmental performance accounts for about 83.16% of environmental performance (79/95). Thus, I refer to Clarkson *et al.* (2008) to adopt hard environmental performance (items of I, II, III, and IV in Panel C of Table 2) to re-examine Hypotheses 1 and 2.

As shown in Columns (1) and (4) of Table 6, in which the dependent variables are *NCSKEW* and *CRASH3.09*, respectively, the coefficients on *CEP_HARD* are both negative and significant (-0.0086 with t=-3.28 and -0.0403 with t=-2.59), providing strong additional support to Hypothesis 1.

In Columns (3) and (6) of Table 6, the coefficients on *CEP_HARD*×*C_SCORE* are both positive and significant (0.0537 with t=3.24 and 0.1989 with t=2.13), which is again

Table 6 Robustness Checks of Hypotheses 1 and 2 Using Hard Environmental Performance

Variable	Section A						Section B					
	Dependent Variable: $NCSKEW_t$						Dependent Variable: $CRASH3.09_t$					
	(1)		(2)		(3)		(4)		(5)		(6)	
	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value
CEP_HARD_{t-1}	-0.0086***	-3.28	-0.0075***	-2.85	-0.0124***	-4.15	-0.0403***	-2.59	-0.0380**	-2.46	-0.0578***	-3.21
C_SCORE_{t-1}			-0.5573***	-5.41	-0.6394***	-5.95			-1.0221*	-1.96	-1.2699**	-2.44
$CEP\_HARD_{t-1} \times C\_SCORE_{t-1}$					0.0537***	3.24					0.1989**	2.13
$NCSKEW_{t-1}$	0.0566***	4.66	0.0516***	4.26	0.0509***	4.21	-0.0889	-1.54	-0.0991*	-1.70	-0.1020*	-1.75
$BLOCK_{t-1}$	-0.1340**	-2.35	-0.0932	-1.64	-0.0908	-1.60	-0.4259	-1.47	-0.3611	-1.22	-0.3530	-1.20
$INST\_SHR_{t-1}$	0.1613***	3.45	0.1516***	3.27	0.1502***	3.24	-0.1817	-0.75	-0.2054	-0.84	-0.2093	-0.86
$ANALYST_{t-1}$	0.0714***	8.46	0.0776***	9.13	0.0806***	9.36	0.1064**	2.57	0.1187***	2.82	0.1299***	3.04
$DTURN_{t-1}$	-0.0680	-1.36	-0.0391	-0.78	-0.0413	-0.82	-0.0754	-0.34	-0.0116	-0.05	-0.0238	-0.11
$SIGMA_{t-1}$	-0.0197*	-1.80	-0.0188*	-1.72	-0.0161	-1.46	-0.3200***	-4.85	-0.3153***	-4.78	-0.3066***	-4.64
RET_{t-1}	-1.0926***	-5.06	-0.9243***	-4.29	-0.8813***	-4.06	-5.9665***	-4.54	-5.5828***	-4.18	-5.4430***	-4.07
$SIZE_{t-1}$	-0.0301**	-2.48	0.0170	1.16	0.0097	0.65	-0.0271	-0.43	0.0601	0.79	0.0356	0.46
DTE_{t-1}	-0.0139	-0.40	0.0088	0.25	0.0166	0.47	0.3151*	1.94	0.3593**	2.21	0.3854**	2.36
BTM_{t-1}	-0.0108	-0.98	-0.0074	-0.68	-0.0077	-0.71	-0.1209	-1.58	-0.1149	-1.52	-0.1167	-1.55
ROA_{t-1}	-0.0588	-1.41	-0.0349	-0.84	-0.0246	-0.60	-0.3205	-1.22	-0.2693	-1.03	-0.2337	-0.89
$ACCM_{t-1}$	-0.0331	-0.58	-0.0222	-0.39	-0.0256	-0.44	-0.1529	-0.50	-0.1362	-0.44	-0.1506	-0.48
TAX_{t-1}	0.0289***	4.48	0.0222***	3.48	0.0235***	3.66	0.0460	1.52	0.0326	1.04	0.0375	1.20
$PENALTY_{t-1}$	0.0468	1.54	0.0448	1.49	0.0420	1.39	0.2193*	1.67	0.2153	1.64	0.2050	1.56
$STATE_{t-1}$	-0.0274	-1.31	-0.0226	-1.09	-0.0216	-1.04	-0.2658***	-2.60	-0.2551**	-2.50	-0.2504**	-2.46
Constant	0.1358	0.51	-0.8994***	-2.82	-0.7678**	-2.39	-1.5558	-1.09	-3.4894**	-2.07	-3.0411*	-1.78
Industry and Year Effects	Control		Control		Control		Control		Control		Control	
Observations	8,173		8,173		8,173		8,173		8,173		8,173	
Log Likelihood							-2460.9838		-2459.0633		-2456.7507	
Adjusted R^2/Pseudo-R^2	0.0771		0.0802		0.0812		0.0597		0.0605		0.0614	
F/LR (p-value)	20.05*** (<.0001)		20.17*** (<.0001)		19.88*** (<.0001)		225.46*** (<.0001)		231.67*** (<.0001)		240.85*** (<.0001)	
ΔR^2	9.74***		28.43***		9.78***		7.49***		3.84*		4.63**	

Notes: ***, **, and * represent the 1%, 5%, and 10% levels of significance, respectively, for two-tailed tests. All reported t-statistics are based on standard errors adjusted for clustering at the firm level (Petersen, 2009). ΔR^2 is computed on the basis of the differences in ΔR^2 between the specified models in Columns (1) and (5) of Table 4, respectively. All the variables are defined in Appendix 1.

consistent with Hypothesis 2. Both *CEP_HARD* and *C_SCORE* in Columns (3) and (6) also have significantly negative coefficients, providing support to Hypothesis 1 and consistent with theoretical expectations.

In a nutshell, the results in Table 6 suggest that my findings are qualitatively similar to those presented in Table 4 after adopting hard environmental performance as the independent variable.

VII. The Endogeneity Issue

To mitigate potential endogeneity between corporate environmental performance and future crash risk, this study follows the literature (e.g. El Ghoul *et al.*, 2011) to employ both the instrumental variable approach and two-stage regression procedures.

7.1 Using the Instrumental Variable Approach to Mitigate Endogeneity

This study uses the average environmental performance of other firms in the same industry as the instrumental variable, labelled *CEP_HAT*, to re-examine Hypotheses 1 and 2. As shown in Columns (1) and (4) of Table 7, the coefficients on *CEP_HAT* (i.e. the fitted values of *CEP*) are negative and significant (-0.0054 with t=-3.20 and -0.0284 with t=-2.69), suggesting that the negative association between corporate environmental performance and future crash risk is still valid after controlling for endogeneity using the instrumental variable approach. These results also validate Hypothesis 1. In Columns (3) and (6), the coefficients on *CEP_HAT×C_SCORE* are both positive and significant (0.0288 with t=2.79 and 0.0866 with t=2.23), validating Hypothesis 2 by indicating that accounting conservatism attenuates the negative relationship between corporate environmental performance and future crash risk.

7.2 Using Two-Stage Tobit-OLS (Logistic) Regression Procedures to Mitigate Endogeneity

For two-stage Tobit-OLS (Logistic) regression procedures, I must identify exogenous variables for the first stage in which corporate environmental performance (*CEP*) is the dependent variable. Following Du *et al.* (2014), I employ eight exogenous variables as follows: FIN_{t-1} is the amount of equity or debt financing in year t-1 scaled by total assets at the beginning of the year (Clarkson *et al.*, 2008); $CAPINV_{t-1}$ is the amount of capital spending (property, plant and equipment, intangible assets and other long-term assets) in year t-1 divided by total sales at the beginning of the year (Clarkson *et al.*, 2008; Du *et al.*, 2014); $LISTAGE_{t-1}$ is the number of years from a firm's IPO; $TRANS_{t-1}$ is the natural logarithm of the total mileages of provincial highways and railways (in kilometres) in year t-1; TAX_PRO_{t-1} is the natural logarithm of provincial tax (in million RMB) in year t-1; POP_{t-1} is the natural logarithm of the number of provincial populations in year t-1; UNV_{t-1} is

Table 7 Results of Hypotheses 1 and 2 Using Industrial Instrumental Variables to Control for Endogeneity between Corporate Environmental Performance and Crash Risk

Variable	Section A						Section B					
	Dependent Variable: $NCSKEW_t$						Dependent Variable: $CRASH3.09_t$					
	(1)		(2)		(3)		(4)		(5)		(6)	
	Coefficient	*t*-value	Coefficient	*t*-value	Coefficient	*t*-value	Coefficient	*t*-value	Coefficient	*t*-value	Coefficient	*t*-value
CEP_HAT_{t-1}	-0.0054***	-3.20	-0.0046***	-2.73	-0.0069***	-3.66	-0.0284***	-2.69	-0.0268**	-2.54	-0.0339***	-3.05
C_SCORE_{t-1}			-0.5573***	-5.41	-0.5341***	-5.20			-1.0030*	-1.92	-0.8993	-1.57
$CEP\_HAT_{t-1} \times C\_SCORE_{t-1}$					0.0288***	2.79					0.0866**	2.23
$NCSKEW_{t-1}$	0.0565***	4.65	0.0515***	4.25	0.0510***	4.21	-0.0902	-1.56	-0.1001*	-1.72	-0.1020**	-1.97
$BLOCK_{t-1}$	-0.1343**	-2.35	-0.0937*	-1.65	-0.0901	-1.58	-0.4215	-1.45	-0.3580	-1.21	-0.3489**	-2.45
$INST\_SHR_{t-1}$	0.1616***	3.45	0.1519***	3.27	0.1516***	3.26	-0.1822	-0.76	-0.2054	-0.84	-0.2075	-0.68
$ANALYST_{t-1}$	0.0719***	8.50	0.0780***	9.16	0.0805***	9.34	0.1097***	2.64	0.1215***	2.88	0.1291*	1.85
$DTURN_{t-1}$	-0.0687	-1.38	-0.0398	-0.79	-0.0427	-0.85	-0.0758	-0.34	-0.0133	-0.06	-0.0245	-0.10
$SIGMA_{t-1}$	-0.0199*	-1.81	-0.0190*	-1.74	-0.0170	-1.54	-0.3219***	-4.87	-0.3173***	-4.81	-0.3130***	-4.97
RET_{t-1}	-1.0955***	-5.07	-0.9272***	-4.30	-0.8975***	-4.15	-5.9801***	-4.55	-5.6040***	-4.19	-5.5429***	-9.13
$SIZE_{t-1}$	-0.0306**	-2.52	0.0164	1.12	0.0092	0.61	-0.0230	-0.36	0.0622	0.82	0.0418	0.30
DTE_{t-1}	-0.0135	-0.38	0.0091	0.26	0.0161	0.45	0.3203**	1.97	0.3635**	2.23	0.3821**	2.15
BTM_{t-1}	-0.0107	-0.97	-0.0073	-0.67	-0.0075	-0.69	-0.1211	-1.59	-0.1152	-1.52	-0.1162**	-2.14
ROA_{t-1}	-0.0576	-1.38	-0.0338	-0.82	-0.0277	-0.67	-0.3187	-1.21	-0.2687	-1.03	-0.2513	-1.07
$ACCM_{t-1}$	-0.0329	-0.58	-0.0221	-0.39	-0.0280	-0.49	-0.1532	-0.50	-0.1369	-0.44	-0.1554	-0.40
TAX_{t-1}	0.0290***	4.51	0.0224***	3.51	0.0235***	3.66	0.0465	1.53	0.0333	1.07	0.0370	1.21
$PENALTY_{t-1}$	0.0470	1.55	0.0449	1.49	0.0429	1.42	0.2186*	1.66	0.2147	1.64	0.2076*	1.76
$STATE_{t-1}$	-0.0280	-1.35	-0.0232	-1.12	-0.0227	-1.10	-0.2680***	-2.62	-0.2574**	-2.52	-0.2556***	-3.60
Constant	0.1430	0.54	-0.8892***	-2.78	-0.7556**	-2.34	-1.6526	-1.16	-3.5417**	-2.10	-3.1507	-0.99
Industry and Year Effects	Control		Control		Control		Control		Control		Control	
Observations	8,173		8,173		8,173		8,173		8,173		8,173	
Log Likelihood							-2460.4421		-2458.5940		-2457.6053	
Adjusted R^2/Pseudo-R^2	0.0769		0.0800		0.0806		0.0599		0.0607		0.0610	
F/LR (*p*-value)	20.17*** (<.0001)		20.28*** (<.0001)		19.86*** (<.0001)		226.91*** (<.0001)		232.96*** (<.0001)		319.48*** (<.0001)	
ΔR^2	8.85***		28.43***		6.22**		8.58***		3.70*		1.98	

Notes: ***, **, and * represent the 1%, 5%, and 10% levels of significance, respectively, for two-tailed tests. All reported *t*-statistics are based on standard errors adjusted for clustering at the firm level (Petersen, 2009). ΔR^2 is computed on the basis of the differences in ΔR^2 between the specified models in Columns (1) and (5) of Table 4, respectively. All the variables are defined in Appendix 1.

Table 8 Results of Hypotheses 1 and 2 Using Two-Stage Tobit-OLS (Logistic) Regression to Control for Endogeneity between Corporate Environmental Performance and Crash Risk

Variable	Section A		Section B						Section C					
	Dependent Variable: CEP_{t-1}		Dependent Variable: $NCSKEW_t$						Dependent Variable: $CRASH3.09_t$					
	(1)		(2)		(3)		(4)		(5)		(6)		(7)	
	Coefficient	*t*-value	Coefficient	*t*-value	Coefficient	*t*-value	Coefficient	*t*-value	Coefficient	*t*-value	Coefficient	*t*-value	Coefficient	*t*-value
FIN_{t-1}	-0.1734	-1.10												
$CAPINV_{t-1}$	1.3463***	3.69												
$LISTAGE_{t-1}$	-0.6867	-1.54												
$TRANS_{t-1}$	-15.4584	-1.26												
TAX_PRO_{t-1}	-0.0309***	-2.58												
POP_{t-1}	-0.0009	-0.02												
UNV_{t-1}	-0.2136*	-1.70												
GDP_PC_{t-1}	-0.2239***	-12.32												
CEP^*_{t-1}			-0.0176**	-2.22	-0.0083*	-1.73	-0.0292***	-2.95	-0.0688**	-2.05	-0.0511*	-1.71	-0.1389***	-3.27
C_SCORE_{t-1}					-0.5464***	-5.16	-0.7437***	-6.37			-0.9587*	-1.80	-1.6476**	-2.34
$CEP^*_{t-1} \times C\_SCORE_{t-1}$							0.0783***	3.79					0.3114***	3.07
$NCSKEW_{t-1}$			0.0560***	4.60	0.0515***	4.24	0.0498***	4.11	-0.0871	-1.55	-0.0961*	-1.66	-0.1036*	-1.95
$BLOCK_{t-1}$	2.6991***	5.51	-0.1242**	-2.15	-0.0952*	-1.66	-0.0837	-1.46	-0.4089***	-2.81	-0.3649	-1.22	-0.3249**	-2.34
$INST\_SHR_{t-1}$	-0.5630	-1.36	0.1574***	3.34	0.1512***	3.23	0.1439***	3.09	-0.2118	-0.71	-0.2269	-0.93	-0.2543	-0.86
$ANALYST_{t-1}$	0.5459***	7.01	0.0775***	8.67	0.0798***	8.95	0.0923***	9.53	0.1269*	1.69	0.1313***	2.87	0.1835**	2.38
$DTURN_{t-1}$	1.2202***	2.79	-0.0562	-1.11	-0.0333	-0.65	-0.0302	-0.59	-0.0322	-0.12	0.0162	0.07	0.0199	0.08
$SIGMA_{t-1}$	-0.0307	-0.30	-0.0212*	-1.90	-0.0193*	-1.74	-0.0158	-1.42	-0.3194***	-5.41	-0.3135***	-4.74	-0.3007***	-5.12
RET_{t-1}	10.3780***	4.81	-1.0378***	-4.78	-0.9099***	-4.20	-0.7631***	-3.47	-5.6892***	-7.65	-5.4001***	-4.04	-4.8430***	-8.81
$SIZE_{t-1}$	2.7062***	25.18	-0.0113	-0.62	0.0204	1.08	0.0273	1.44	0.0453	0.41	0.1003	1.04	0.1318	1.25
DTE_{t-1}	2.0153***	6.56	-0.0186	-0.53	0.0027	0.08	0.0138	0.39	0.2901*	1.66	0.3288**	2.01	0.3701*	1.93
BTM_{t-1}	-0.1172	-1.03	-0.0087	-0.78	-0.0059	-0.54	-0.0060	-0.55	-0.1133**	-2.10	-0.1090	-1.45	-0.1106**	-2.05
ROA_{t-1}	-1.6106***	-3.37	-0.0699	-1.63	-0.0371	-0.87	-0.0399	-0.93	-0.3646	-1.54	-0.2992	-1.12	-0.3169	-1.51
$ACCM_{t-1}$	-0.0313	-0.06	-0.0380	-0.66	-0.0261	-0.46	-0.0330	-0.58	-0.1548	-0.40	-0.1382	-0.44	-0.1696	-0.44
TAX_{t-1}	-0.1197**	-2.19	0.0276***	4.25	0.0220***	3.41	0.0244***	3.75	0.0417	1.07	0.0303	0.95	0.0436	1.35
$PENALTY_{t-1}$	-0.0552	-0.21	0.0506*	1.65	0.0474	1.56	0.0461	1.50	0.2428*	1.95	0.2368*	1.81	0.2302*	1.92
$STATE_{t-1}$	1.0825***	5.39	-0.0246	-1.17	-0.0219	-1.04	-0.0157	-0.75	-0.2647***	-4.12	-0.2592**	-2.51	-0.2344***	-3.74
Constant	-57.6234***	-10.53	-0.2202	-0.60	-0.9535**	-2.45	-1.0863***	-2.79	-2.9115	-1.12	-4.2033**	-2.06	-4.7974*	-1.89
Industry and Year Effects	Control		Control		Control		Control		Control		Control		Control	
Observations	8,123		8,123		8,123		8,123		8,123		8,123		8,123	
Log Likelihood	-17806.67								-2458.4005		-2456.8054		-2452.0478	
Adj_R^2/Pseudo-R^2	0.0822		0.0763		0.0791		0.0806		0.0586		0.0592		0.0610	
F/LR (*p*-value)	3187.95*** (<.0001)		19.63*** (<.0001)		19.70*** (<.0001)		19.54*** (<.0001)		305.81*** (<.0001)		309.00*** (<.0001)		318.51*** (<.0001)	
ΔR^2			5.28***		25.58***		15.02***		2.95*		3.19*		9.52***	

Notes: ***, **, and * represent the 1%, 5%, and 10% levels of significance, respectively, for two-tailed tests. All reported *t*-statistics are based on standard errors adjusted for clustering at the firm level (Petersen, 2009). ΔR^2 is computed on the basis of the differences in ΔR^2 between the specified models in Columns (1) and (5) of Table 4, respectively. All the variables are defined in Appendix 1.

the percentage of provincial universities in year *t*-1, measured as the number of universities in a province scaled by the total number of universities in mainland China; and GDP_PC_{t-1} is provincial GDP per capita (in thousand RMB) in year *t*-1.[9]

The results of the first stage, presented in Column (1) of Section A in Table 8, show that corporate environmental performance is significantly positively associated with $BLOCK_{t-1}$, $ANALYST_{t-1}$, $DTURN_{t-1}$, RET_{t-1}, $SIZE_{t-1}$, DTE_{t-1}, $STATE_{t-1}$, and $CAPINV_{t-1}$, but is significantly negatively related to ROA_{t-1}, TAX_{t-1}, TAX_PRO_{t-1}, UNV_{t-1}, and GDP_PC_{t-1}.

As shown by the results in Columns (2) and (5) of Table 8, the coefficients on *CEP** (the fitted values of *CEP*) are both negative and significant, suggesting a negative association between corporate environmental performance and future crash risk, providing significant support for Hypothesis 1. In Columns (4) and (7), the coefficients on *CEP**×*C_SCORE* are significantly positive, again validating Hypothesis 2. Moreover, in Columns (4) and (7), both *CEP** and *C_SCORE* have significantly negative coefficients, consistent with Hypothesis 1 and the findings presented in Table 4.

7.3 Using the Propensity Score Matching Approach to Mitigate Endogeneity

Extending instrumental variables and the findings in Table 8, the propensity score matching (PSM) approach is adopted to further address the endogeneity concern. Panel A of Table 9 reports the results of the first stage of PSM. The full sample is partitioned into two subsamples: a *CEP_DUM* subsample (*CEP_DUM*=1) and a non-*CEP_DUM* subsample (*CEP_DUM*=0). *CEP_DUM* is an indicator variable equal to 1 if corporate environment performance is greater than zero, and 0 otherwise. Panel A of Table 9 shows that, as expected, *CEP_DUM* is significantly positively (negatively) associated with $ANALYST_{t-1}$, RET_{t-1}, $SIZE_{t-1}$, DTE_{t-1}, $TOBINQ_{t-1}$, and $STATE_{t-1}$ (FIN_{t-1} and $LISTAGE_{t-1}$). Panel B of Table 9 presents univariate tests (*t*-tests) of differences in all variables used in the first stage of PSM. There are significant differences in most variables between the two subsamples in the context of the full sample. However, the differences in all variables between two subsamples are insignificant in the matched sample, suggesting a relatively good matching job in the first stage of PSM.

Panel C of Table 9 shows the results of retesting Hypotheses 1 and 2 using the matched sample. Columns (2) and (6) of Panel C show significantly negative coefficients on CEP_{t-1}, consistent with Hypothesis 1. In addition, in Columns (4) and (8) of Panel C, positive and significant coefficients on $CEP_{t-1}\times C\_SCORE_{t-1}$ further validate Hypothesis 2. Overall, Panel C of Table 9 presents results indistinguishable from those in Table 4 (revised version) after using the PSM approach to further address the endogeneity concern.

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9 The results of the second-stage regression depend closely on the appropriateness of the instruments in the first stage. Following Sargan (1958) and Wooldridge (1995), I conduct overidentification tests, and find that Sargan χ^2 statistics and Wooldridge χ^2 statistics are both insignificant, suggesting that there is no serious overidentification in the first-stage regression.

Table 9 Endogeneity Tests Using the Propensity Score Matching Approach

Panel A: The first stage of the propensity score matching approach

Variable	Dependent Variable: CEP_DUM_{t-1}	
	Coefficient	t-value
FIN_{t-1}	-0.0122**	-2.38
$CAPIN_{t-1}$	-0.0427	-1.23
$BLOCK_{t-1}$	0.2183	1.16
$INST\_SHR_{t-1}$	0.0463	0.33
$ANALYST_{t-1}$	0.1197***	4.74
$DTURN_{t-1}$	0.0738	0.90
$SIGMA_{t-1}$	0.0286	1.10
RET_{t-1}	1.6413***	3.12
$SIZE_{t-1}$	0.3075***	8.93
DTE_{t-1}	0.2854***	2.59
$TOBINQ_{t-1}$	0.0533**	2.48
ROA_{t-1}	0.2319	0.82
$STATE_{t-1}$	0.1044*	1.66
$LISTAGE_{t-1}$	-0.0519***	-7.63
Constant	-6.5738***	-8.88
Industry and Year Effects	Control	
Observations	8,173	
Pseudo-R^2	0.1983	
LR (p-value)	790.38*** (<.0001)	

Panel B: Univariate tests using the full sample and matched sample

Variable	Full sample					Matched sample				
	CEP_DUM subsample (N=5,020)		Non-*CEP_DUM* subsample (N=3,153)			*CEP_DUM* subsample (N=2,207)		Non-*CEP_DUM* subsample (N=2,207)		
	(1)		(2)			(3)		(4)		
	Mean	SD	Mean	SD	t-test	Mean	SD	Mean	SD	t-test
$NCSKEW_t$	-0.3424	0.7201	-0.3134	0.7225	-1.77*	-0.3422	0.7180	-0.3171	0.7290	-0.70
$CRASH3.09_t$	0.0924	0.2897	0.1075	0.3098	-2.20**	0.0983	0.2978	0.1047	0.3062	-0.84
FIN_{t-1}	0.3743	1.6344	0.3995	4.0344	-0.33	0.3768	2.3401	0.3337	0.5858	0.34
$CAPIN_{t-1}$	0.1415	0.5739	0.1376	0.5852	0.29	0.1369	0.8284	0.1441	0.5689	-0.54
$BLOCK_{t-1}$	0.3691	0.1559	0.3319	0.1504	10.71***	0.3393	0.1483	0.3418	0.1522	-0.37
$INST\_SHR_{t-1}$	0.1790	0.1808	0.1594	0.1749	4.88***	0.1612	0.1753	0.1632	0.1744	-1.37
$ANALYST_{t-1}$	1.8114	1.3213	1.0991	1.1704	25.47***	1.2729	1.1893	1.3225	1.2055	-0.59
$DTURN_{t-1}$	-0.0594	0.2049	-0.0704	0.2449	2.09**	-0.0671	0.2373	-0.0713	0.2338	0.55
$SIGMA_{t-1}$	6.1260	2.0229	6.8985	2.1840	-16.01***	6.6658	2.1205	6.6309	2.0799	0.65
RET_{t-1}	-0.1069	0.0727	-0.1325	0.0837	14.14***	-0.1245	0.0798	-0.1230	0.0777	-0.96
$SIZE_{t-1}$	22.2114	1.0480	21.6311	0.8115	28.06***	21.7674	0.8505	21.7914	0.7957	-1.28
DTE_{t-1}	0.4468	0.2554	0.3754	0.2626	12.09***	0.4001	0.2504	0.4099	0.2611	-1.01
$TOBINQ_{t-1}$	1.8460	1.2190	2.1940	1.6124	-10.40***	2.0277	1.4059	1.9873	1.2517	0.40
ROA_{t-1}	0.0703	0.1451	0.0517	0.2244	4.12***	0.0589	0.1676	0.0611	0.1923	-0.03
$STATE_{t-1}$	0.3442	0.4752	0.4202	0.4937	-6.87***	0.4092	0.4918	0.4096	0.4919	-0.17
$LISTAGE_{t-1}$	13.0428	4.5176	14.3996	4.0641	-14.07***	13.8514	4.5546	13.8731	4.1928	-0.70

Panel C: The second stage of the propensity score matching approach

Variable	Section A								Section B							
	Dependent Variable: $NCSKEW_t$								Dependent Variable: $CRASH3.09_t$							
	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)	
	Coefficient	*t*-value	Coefficient	*t*-value	Coefficient	*t*-value	Coefficient	*t*-value	Coefficient	*t*-value	Coefficient	*t*-value	Coefficient	*t*-value	Coefficient	*t*-value
CEP_{t-1}			-0.0054*	-1.91	-0.0050*	-1.77	-0.0072**	-2.41			-0.0364**	-2.10	-0.0357**	-2.05	-0.0515***	-2.77
C_SCORE_{t-1}					-0.5982***	-4.09	-0.6791***	-4.45					-1.2669*	-1.76	-1.6884**	-2.42
$CEP_{t-1} \times C\_SCORE_{t-1}$							0.0482*	1.90							0.2912**	2.21
$NCSKEW_{t-1}$	0.0550***	3.25	0.0541***	3.20	0.0476***	2.83	0.0472***	2.81	-0.0780	-0.89	-0.0853	-0.97	-0.0982	-1.11	-0.0977	-1.10
$BLOCK_{t-1}$	-0.0989	-1.37	-0.0934	-1.29	-0.0530	-0.73	-0.0473	-0.65	-0.5176	-1.31	-0.4998	-1.27	-0.4187	-1.05	-0.4018	-1.01
$INST\_SHR_{t-1}$	0.1527**	2.40	0.1504**	2.36	0.1347**	2.12	0.1366**	2.15	-0.0263	-0.08	-0.0437	-0.13	-0.0912	-0.27	-0.0745	-0.22
$ANALYST_{t-1}$	0.0796***	6.80	0.0805***	6.87	0.0873***	7.37	0.0885***	7.43	0.0566	0.99	0.0676	1.17	0.0839	1.43	0.0914	1.54
$DTURN_{t-1}$	-0.0619	-0.98	-0.0599	-0.95	-0.0269	-0.42	-0.0316	-0.50	-0.2795	-0.96	-0.2719	-0.93	-0.1932	-0.65	-0.2127	-0.72
$SIGMA_{t-1}$	-0.0344**	-2.19	-0.0345**	-2.20	-0.0335**	-2.14	-0.0321**	-2.06	-0.4215***	-4.63	-0.4254***	-4.67	-0.4197***	-4.62	-0.4159***	-4.57
RET_{t-1}	-1.3924***	-4.57	-1.3755***	-4.52	-1.1922***	-3.92	-1.1882***	-3.91	-8.5294***	-4.89	-8.5020***	-4.89	-8.0762***	-4.60	-8.1238***	-4.63
$SIZE_{t-1}$	-0.0419**	-2.26	-0.0365*	-1.93	0.0128	0.58	0.0062	0.28	-0.0186	-0.21	0.0119	0.13	0.1192	1.11	0.0840	0.75
DTE_{t-1}	-0.0430	-0.89	-0.0420	-0.87	-0.0197	-0.41	-0.0166	-0.34	0.3440	1.51	0.3509	1.53	0.4082*	1.78	0.4310*	1.87
BTM_{t-1}	0.0043	0.29	0.0032	0.21	0.0077	0.52	0.0078	0.52	-0.0272	-0.30	-0.0339	-0.37	-0.0224	-0.25	-0.0256	-0.29
ROA_{t-1}	0.0423	0.65	0.0393	0.61	0.0647	1.00	0.0693	1.08	-0.3758	-0.93	-0.4089	-1.02	-0.3473	-0.88	-0.3280	-0.83
$ACCM_{t-1}$	-0.0587	-0.83	-0.0566	-0.80	-0.0382	-0.54	-0.0514	-0.70	-0.3554	-0.77	-0.3692	-0.80	-0.3282	-0.70	-0.3070	-0.64
TAX_{t-1}	0.0047	0.55	0.0052	0.61	-0.0001	-0.01	0.0008	0.09	0.0104	0.22	0.0147	0.31	-0.0017	-0.04	0.0041	0.08
$PENALTY_{t-1}$	0.0603	1.46	0.0593	1.43	0.0524	1.27	0.0505	1.23	0.3131*	1.73	0.3093*	1.71	0.2925	1.62	0.2803	1.55
$STATE_{t-1}$	-0.0782***	-2.96	-0.0756***	-2.86	-0.0730***	-2.77	-0.0729***	-2.77	-0.2773**	-2.04	-0.2616*	-1.92	-0.2574*	-1.89	-0.2525*	-1.85
Constant	0.3369	0.85	0.2340	0.58	-0.8366*	-1.78	-0.7110	-1.50	-1.4109	-0.69	-1.9865	-0.96	-4.3686*	-1.81	-3.6812	-1.47
Industry and Year Effects	Control		Control		Control		Control		Control		Control		Control		Control	
Observations	4,414		4,414		4,414		4,414		4,414		4,414		4,414		4,414	
Log Likelihood									-1219.7884		-1217.4991		-1216.0203		-1213.5622	
Adj $\_R^2$/Pseudo-R^2	0.0826		0.0831		0.0865		0.0873		0.0812		0.0829		0.0840		0.0859	
F/LR (*p*-value)	12.43*** (<.0001)		12.30*** (<.0001)		12.26*** (<.0001)		12.05*** (<.0001)		160.78*** (<.0001)		168.28*** (<.0001)		169.38*** (<.0001)		173.10*** (<.0001)	
ΔR^2			3.23*		17.49***		4.68**				4.58**		2.96*		4.92**	

Notes: ***, **, and * represent the 1%, 5%, and 10% levels of significance, respectively, for two-tailed tests. All reported *t*-statistics are based on standard errors adjusted for clustering at the firm level (Petersen, 2009). All the variables are defined in Appendix 1.

VIII. Conclusion, Managerial Implications, and Limitations

This study examines the influence of corporate environmental performance on stock price crash risk and further investigates the interactive effect between environmental performance and accounting conservatism on stock price crash risk. Using a sample of Chinese listed firms, this study finds a negative relationship between environmental performance and future crash risk, as well as substitutive effects between environmental performance and accounting conservatism on mitigating crash risk.

My findings also have several managerial implications. First, it motivates two branches of future research: (1) the association between corporate environmental performance and stock market reactions and (2) market efficiency in incorporating and identifying environmental reputation as an intangible asset. Stock price crash risk can be viewed as a special and negative market reaction to bad news hoarding (Hanlon and Slemrod, 2009). Because environmentally responsible firms can attract environmentally sensitive stakeholders, firms with better environmental performance can distinguish themselves from their counterparts, and thus the impact of corporate environmental performance on stock market reactions and market efficiency is worthy of further research.

Second, this study suggests that environmentally responsible firms face fewer future price crashes due to their reputation, fewer future risks, managers' better moral integrity, and greater information transparency. Thus, environmental performance can be viewed as an important conduit for communicating "soft information" and managers' moral integrity to the market. Environmentally friendly firms can actually shape their reputation and build positive moral capital, thus mitigating future crash risk. In this regard, my study identifies a specific benefit of corporate environmental performance.

Finally, my study reveals that accounting conservatism mitigates future crash risk and validates the moderating effect of accounting conservatism. These findings can motivate future studies to further focus on other characteristics of accounting information and examine their impacts on stock price crash risk. More importantly, this study shows that accounting conservatism weakens the negative effect of environmental performance on future crash risk, suggesting that accounting information and business ethics can substitute each other in affecting corporate behaviour.

Of course, this study has its limitations. First, due to the fact that there is as yet no CSR database in China, I follow GRI (2006) and Clarkson *et al.* (2008) to hand-collect data on environmental performance. As suggested by Rahman and Post (2012), it would be better to construct a multidimensional measure of environmental performance, and then address its influence on future crash risk and other financial behaviour. Second, due to data limitations, my sample covers only six years, a relatively short period, and thus my findings need validation by additional examinations based on longer sample periods. Finally, this study is conducted in the context of China, and thus my findings may not be generalisable to developed markets. Future research can further address the influence of corporate environmental performance on stock price crash risk in international settings.

As a **logical extension of this study,** researchers should distinguish CSR strengths from CSR weaknesses to address whether these have similar or asymmetric impacts on future crash risk and other corporate financial behaviours. Moreover, it would be very interesting for researchers to examine how different CSR dimensions and accounting information jointly impact corporate financial behaviours.

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Appendix 1 Variable Definitions

Variable	Definitions	Data Source
Variables for main tests		
$NCSKEW_t$	=the negative conditional return skewness for firm *j* in year *t*, measured as $NCSKEW_{j,t}$=-[n $(n-1)^{3/2}\Sigma W^3_{j,t}$]/[$(n-1)(n-2)(\Sigma W^2_{j,t})^{3/2}$] (Kim *et al.*, 2011; Chen *et al.*, 2001), where $W_{j,t}=LN(1+\varepsilon_{j,t})$ and $\varepsilon_{j,t}$ is the residual based on the following expanded market model regression (Kim *et al.*, 2011): $R_{j,\tau}=\mu_j+\mu_{1j}*R_{m,\tau-2}+\mu_{2j}*R_{m,\tau-1}+\mu_{3j}*R_{m,\tau}+\mu_{4j}*R_{m,\tau+1}+\mu_{5j}*R_{m,\tau+2}+\varepsilon_{j\tau}$ ($R_{j,\tau}$ is weekly return of stock *j* in week τ; $R_{m,\tau}$ is weekly return on the value-weighted [A-share] market index in week τ).	Author's calculation
$CRASH3.09_t$	=a dummy variable of stock price crash risk, equal to 1 if a firm-year's stock price experiences one or more firm-specific weekly returns falling 3.09 standard deviations below the mean firm-specific weekly returns ($W_{j,t}$) over the calendar year (3.09 being chosen to generate frequencies of 0.1% in the normal distribution during the calendar year period), and 0 otherwise (Kim *et al.*, 2011).	Author's calculation
CEP_{t-1}	=corporate environmental performance in the last year based on the Global Reporting Initiative (2006, please refer to the procedures for calculating CEP), involving seven components (i.e. governance structure and management systems, credibility, environmental performance indicators, environmental spending, vision and strategy claims, environmental profile, and environmental initiatives) and 45 subcomponents (Clarkson *et al.*, 2008; Du *et al.*, 2014).	Author's calculation based on GRI (2006)
C_SCORE_{t-1}	=a firm's conservatism score in year *t*-1, which is computed on the basis of Basu (1997) and the following three models (Ettredge *et al.*, 2012; Heflin *et al.*, 2015; Khan and Watts, 2009; DeFond *et al.*, 2016): (1) $C\_SCORE=\beta_{4,i,t}=\lambda_1+\lambda_2SIZE+\lambda_3M/B+\lambda_4LEV$, (2) $G\_SCORE=\beta_{3,i,t}=\mu_1+\mu_2SIZE+\mu_3M/B+\mu_4LEV$, and (3) $X_{i,t}=\beta_{1,i,t}+\beta_{2,i,t}D_{i,t}+(\mu_1+\mu_2SIZE+\mu_3M/B+\mu_4LEV)\times R_{i,t}+(\lambda_1+\lambda_2SIZE+\lambda_3M/B+\lambda_4LEV)\times D_{i,t}\times R_{i,t}+(\delta_1SIZE+\delta_2M/B+\delta_3LEV+\delta_4D_{i,t}SIZE+\delta_5D_{i,t}M/B+\delta_6D_{i,t}LEV)+\varepsilon_{i,t}$, where *i* indexes the firm, *t* indexes time, *X* is income before extraordinary items (operating profit in the financial statements of Chinese listed firms) scaled by lagged market value, *R* is annual returns compounded from monthly returns ending four months after calendar year end, *D* is an indicator variable equal to 1 for firms with negative returns and 0 otherwise, and ε is the residual. *C_SCORE* is derived from linear functions of three firm-specific characteristics including firm size (*SIZE*, the natural logarithm of market value of equity), market-to-book ratio (*M/B*), and leverage (*LEV*, the sum of long-term and short-term debt divided by market value of equity). *G_SCORE* or β_3 denotes the timeliness of good news, and *C_SCORE* or β_4 denotes the incremental timeliness of bad news.	Author's calculation
$BLOCK_{t-1}$	=the percentage of shares held by the controlling shareholder in year *t*-1.	CSMAR
$NCSKEW_{t-1}$	=the negative conditional return skewness for firm *j* in year *t* in year *t*-1.	Author's calculation
$INST\_SHR_{t-1}$	=the percentage of shares owned by institutional investors in year *t*-1 (Kim *et al.*, 2011).	CSMAR
$ANALYST_{t-1}$	=the natural log of (1+ the number of analyst coverage) in year *t*-1 (Kim *et al.*, 2011; Chen *et al.*, 2001).	Author's calculation

DTURN$_{t-1}$	=average monthly share turnover over the current calendar year period minus the average monthly share turnover over the previous calendar year period (monthly share turnover is calculated as the monthly trading volume divided by the total number of shares outstanding during the month) (Chen *et al.*, 2001).	Author's calculation based on CSMAR
SIGMA$_{t-1}$	=the standard deviation of firm-specific weekly returns over the calendar year period *t*-1 (multiplied by 100) (Kim *et al.*, 2011).	Author's calculation
RET$_{t-1}$	=the arithmetic average of firm-specific weekly returns in year *t*-1 (multiplied by 100) (Kim *et al.*, 2011).	Author's calculation
SIZE$_{t-1}$	=the natural logarithm of the market value of equity at the end of year *t*-1 (Kim *et al.*, 2011).	Author's calculation
DTE$_{t-1}$	=the lagged ratio of total liabilities at the end of year *t*-1 to the market value of equity at the end of year *t*-1.	CSMAR
BTM$_{t-1}$	=the lagged ratio of book-to-market, measured as book value scaled by the market value of equity at the end of year *t*-1 (Kim *et al.*, 2011; Chen *et al.*, 2001).	CSMAR
ROA$_{t-1}$	=returns on total assets in year *t*-1, measured as income before extraordinary items divided by lagged total assets (Kim *et al.*, 2011).	CSMAR
ACCM$_{t-1}$	=the extent of discretionary accruals, measured as a three-year moving sum of absolute discretionary accruals based on the modified Jones model (Kim *et al.*, 2011).	Author's calculation
TAX$_{t-1}$	=a firm's estimated likelihood of tax sheltering (Kim *et al.*, 2011), measured as "$TAX=-4.86+5.20\times BTD+4.08\times\lvert DAP\rvert-1.41\times LEV+0.076\times TA+3.51\times ROA+1.72\times FOREIGN+2.43\times R\&D$", where *BTD* is book-tax difference, *DAP* is the absolute value of discretionary accruals, *LEV* is the ratio of total liabilities to total assets, *TA* is the natural log of total assets (unit: billion), *ROA* is return on total assets, *FOREIGN* is an indictor variable that equals 1 when a firm reports foreign revenues, and *R&D* denotes the ratio of the amount of research and development costs scaled by total assets at the beginning of the year.	Author's calculation
PENALTY$_{t-1}$	=a dummy variable equal to 1 if a firm is punished by regulators for financial misconduct in year *t*-1, and 0 otherwise.	CSMAR
STATE$_{t-1}$	=a dummy variable equal to 1 for state-owned enterprises in year *t*-1, and 0 otherwise.	CSMAR

Variables for robustness checks

DUVOL$_t$	=the index of "down-to-up volatility" which captures asymmetric volatility between negative and positive firm-specific weekly returns, measured as $DUVOL = \log\left\{(n_u-1)\sum_{DOWN} W_{j,t}^2 \Big/ \left[(n_d-1)\sum_{UP} W_{j,t}^2\right]\right\}$, where n_u is the number of weeks in which $W_{j,t}$ is greater than the annual mean value of $W_{j,t}$ and n_d is the number of weeks in which $W_{j,t}$ is lower than the annual mean value of $W_{j,t}$, respectively (Chen *et al.*, 2001; Kim *et al.*, 2014).	Author's calculation
CRASHN3.09$_t$	=the number of stock price crashes that a firm-year's stock price experiences, measured as the number of firm-specific weekly returns falling 3.09 standard deviations below the mean firm-specific weekly returns ($W_{j,t}$) over the calendar year, with 3.09 chosen to generate frequencies of 0.1% in the normal distribution during the calendar year period (Kim *et al.*, 2011).	Author's calculation

$CRASH\_M_t$	=a dummy variable of stock price crash risk, equal to 1 if a firm-year's stock price experiences one or more firm-specific weekly returns falling M standard deviations (M=2.90, 3.00) below the mean firm-specific weekly returns ($W_{j,t}$) over the calendar year, and 0 otherwise.	Author's calculation
$CRASH\_P_t$	=a dummy variable equal to 1 if firm-specific weekly returns are equal to or below -P% (*p*=10, 15, 20), and 0 otherwise.	Author's calculation
$CRASH\_Avg\_P_t$	=a dummy variable equal to 1 if firm-specific weekly returns are equal to or below -P% of mean value (*p*=10, 15, 20), and 0 otherwise.	Author's calculation
CEP_HARD_{t-1}	=a firm's hard environmental performance in the last year based on Global Reporting Initiative (2006), involving four components (i.e. governance structure and management systems, credibility, environmental performance indicators, and environmental spending).	Author's calculation
Variables for the endogeneity issue		
CEP_HAT	=the average environmental performance among all other firms besides the specified firm in an industry.	Author's calculation
$TRANS_{t-1}$	=the natural logarithm of the total mileages of provincial highways and railways (in kilometres) in year *t*-1.	China Statistical Yearbook
TAX_PRO_{t-1}	=the natural logarithm of total provincial tax (in million RMB) in year *t*-1.	China Statistical Yearbook
POP_{t-1}	=the natural logarithm of the number of provincial population in year *t*-1.	China Statistical Yearbook
UNV_{t-1}	=the percentage of provincial universities in year *t*-1, measured as the number of universities in a province scaled by the total number of universities in mainland China.	China Statistical Yearbook
GDP_PC_{t-1}	=provincial GDP per capita (in thousand Yuan) in year *t*-1.	China Statistical Yearbook
FIN_{t-1}	=The amount of equity or debt financing in year *t*-1 scaled by total assets at the beginning of the year (Clarkson *et al.*, 2008; Du *et al.*, 2014).	CSMAR
$CAPINV_{t-1}$	=The amount of capital spending (including property, plant and equipment, intangible assets and other long-term assets) in year *t*-1 divided by total sales at the beginning of the year (Clarkson *et al.*, 2008; Du *et al.*, 2014).	CSMAR
$LISTAGE_{t-1}$	=the number of years between a firm's IPO and year *t*-1.	CSMAR