Ownership structure, audit quality, board structure, and stock price crash risk: Evidence from China

Wing Him Yeung, Camillo Lento

PII: S1044-0283(17)30402-7
DOI: doi:10.1016/j.gfj.2018.04.002
Reference: GLOFIN 426

To appear in:

Received date: 13 October 2017
Revised date: 1 April 2018
Accepted date: 2 April 2018

Please cite this article as: Wing Him Yeung, Camillo Lento , Ownership structure, audit quality, board structure, and stock price crash risk: Evidence from China. The address for the corresponding author was captured as affiliation for all authors. Please check if appropriate. Glofin(2017), doi:10.1016/j.gfj.2018.04.002

Ownership structure, audit quality, board structure, and stock price crash risk: Evidence from China

Wing Him Yeung[a,*], Camillo Lento[b]

[a,b] *Faculty of Business Administration, Lakehead University, Thunder Bay, Ontario, Canada*

[a,*] Corresponding author. Faculty of Business Administration, Lakehead University, 955 Oliver Road, Thunder Bay, Ontario, Canada, P7B 5E1; Tel.: +1 807 343 8419; E-mail: whyeung@lakeheadu.ca
[b] Faculty of Business Administration, Lakehead University, 955 Oliver Road, Thunder Bay, Ontario, Canada, P7B 5E1; Tel.: +1 807 343 8387; E-mail: clento@lakeheadu.ca

Ownership structure, audit quality, board structure, and stock price crash risk: Evidence from China

ABSTRACT

This paper explores whether or not a Chinese firm's ownership structure, audit quality, and board structure are associated with its future stock price crash risk. We find that stronger ownership structure and higher audit quality are associated with lower stock price crash risk, and the association is stronger since the IFRS and split-share reforms than before them. The results are consistent across two different measures of crash risk, as well as robust to endogeneity tests. We also find that board structure is not significantly associated with stock price crash risk.

JEL classifications:

G01

G11

G18

Keywords:

Future stock price crash risk

Chinese-listed firms

Ownership structure

Board structure

Audit quality

1. Introduction

Stock price crash risk has become increasingly important to regulators, academics, and investors. Research on stock price crash risk has intensified since the 2008 financial crisis. So far, most of the studies have focused on the U.S. setting, where the potential correlates investigated have included corporate governance (Andreou, Antoniou, Horton, & Louca, 2016), financial reporting quality (Francis, Hasan, & Li, 2016; Kim & Zhang, 2016), management style and compensation (Kim, Wang, & Zhang, 2016), and informal institutions, such as religion (Callen & Fang, 2015). Research in the Chinese setting is much more limited, even though the Chinese capital markets have grown to become among the largest in the world. The rapid growth of the Chinese equity markets has come with its own set of unique regulatory challenges and market volatility. Formal institutions, such as investor protection systems, corporate governance, and accounting standards are still considered to be less developed in China (Allen, Qian, & Qian, 2005), with stock markets experiencing large bubbles and crashes (Piotroski & Wong, 2012).

This study investigates the relation between crash risk in Chinese-listed firms and corporate governance attributes. Specifically, we jointly consider three dimensions of governance mechanisms: *ownership structure*, *board structure*, and *audit quality*, which comprise 15 individual attributes. Each of these governance attributes is intended to enhance management monitoring, promote effective decision making, and constrain opportunistic behavior (Andreou et al., 2016; Ashbaugh-Skaife, Collins, & LaFond, 2006). Accordingly, we expect that the better a firm's corporate governance is, the lower will be the information asymmetry between shareholders and management, and thus the lower the likelihood of future stock price crashes.

Following previous researchers (Chen, Hong, & Stein, 2001; Hutton, Marcus, & Tehranian, 2009; Jin & Myers, 2006), we proxy for crash risk using two measures, negative coefficient of skewness and down-to-up volatility, and a sample of 11,427 firm-year observations from 2000 to 2014. We control for firm-year and industry fixed effects (Cronqvist & Nilsson, 2003; Linck, Netter, & Yang, 2008), financial reporting opacity, firm size, and other firm-specific determinants of crash risk. We also estimate our main models with different aggregate measures of audit quality and ownership structure, as well as with the individual elements of audit quality and ownership structure, and control for endogeneity.

Our study contributes to the literature in several ways. First, the effects of ownership structure, board structure, and audit quality on crash risk have not been investigated in the Chinese setting, although other investigators have looked at the relationships between crash risk and religion (Li & Cai, 2016), analyst coverage (Xu, Jiang, Chan, & Yi, 2013), excess perks (Xu, Li, Yuan, & Chan, 2014), and management controls (Chen, Chan, Dong, & Zhang, 2017). Most of the early literature in this domain focused on the impact of a single governance characteristic on firm value and performance (Qi, Wu, & Zhang, 2000). Recently, researchers have begun developing composite measures of corporate governance unique to Chinese-listed firms (Sami, Wang, & Zhou, 2011). Our study extends this literature by using broad measures of formal corporate governance.

Second, we deepen our understanding of effective governance by analyzing the distinct impacts of our 15 corporate governance attributes on crash risk. To the best of our knowledge, this is the first study to offer firm-level insights into these relationships for Chinese-listed companies.

Third, we also enrich the audit quality literature. To the authors' best knowledge, this is the first study to explore the relationship between different elements of audit quality and crash risk. This is a significant contribution to the audit quality literature, especially that on China, which has tended to focus on the auditors' ability to restrain earnings management (Chen, Chen, Lobo, & Wang, 2011) or issue modified audit opinions (Chen, Su, & Zhao, 2000). Our investigation is especially important now, as the Chinese audit markets are at a crossroads with the expiration of the Big 4's Sino-Foreign Joint-Venture (JV) agreements (Deng & Macve, 2015).

Fourth, we contribute to the literature on the relationship between ownership structure and board structure. Understanding this relationship is important not only for investors, but also for Chinese regulators, who continue to put substantial effort into restructuring both the ownership and the boards of Chinese-listed companies. Regulators will find this study useful in considering future reforms, as well as evaluating the reforms already adopted concerning both ownership structure (e.g., the split-share reform, which shifted ownership from highly concentrated state ownership to a more dispersed domestic and foreign shareholder base) and board structure (e.g., the 2002 Code of Corporate Governance for Listed Firms).

The rest of this paper is organized as follows. Section 2 discusses the background literature and develops the hypotheses. Section 3 summarizes the data. Section 4 outlines the research design. Sections 5 and 6 present the empirical results and robustness checks, respectively. Section 7 provides a brief conclusion and implications for future research.

2. Background and hypothesis development

2.1. Stock price crash risk

A stock price crash is a large negative movement in a firm's adjusted stock return (Hutton et al., 2009). Such movements not only dampen portfolio returns but also increase the portfolio's risk profile. Crash risk became the focus of investors and regulators after a large number of high-profile corporate scandals took place in the early 2000s, and the credit crisis in 2008 has provided a strong impetus for further research into the determinants of stock price crashes.

Research to date suggests that stock price crashes are more likely to occur with companies that have higher agency risks (Callen & Fang, 2015; Kim & Zhang, 2016). In such companies, managers have many opportunities to shirk their responsibilities towards shareholders without being monitored. They can exploit information asymmetry to conceal negative information, as in using opaque discretionary accruals to manage earnings (Kothari, Shu, & Wysocki, 2009), or undertake investments that accommodate market sentiments with less concern for long-term prospects, to maximize their own stock-based compensation (Bebchuk & Stole, 1993; Stein, 1989). However, negative information can be withheld or delayed only temporarily. Eventually, it will become too significant to be withheld, or fundamental information about the firm's true operating performance will conflict with reported information. At this point, the market will be flooded with negative information and the stock price will crash (Bleck & Liu, 2007; Callen & Fang, 2013; Kim & Zhang, 2016).

Both academic and anecdotal evidence support the linkage between crash risk and agency costs. Studies have shown relationships between crash risk and corporate governance (Andreou et al., 2016), financial reporting quality (Kim & Zhang, 2016), internal control environment (Chen et al., 2017), and management style (Kim et al., 2016), all of which are associated with agency costs. In addition, Chen and colleagues (2017) provide some anecdotal evidence about

the stock price crashes of Chongqing Brewer and the Yili Group in 2011 and 2008, respectively, which occurred after hidden bad news moved into the public domain. We extend this literature by being the first, to the best of our knowledge, to explore the effects of board structure, external audit quality, and firm owners in reducing agency costs and bad news hoarding, and thus crash risk, for Chinese-listed companies.

2.2. Corporate governance in the Chinese context

Over the past 20 years, major regulatory reforms in China have addressed three key governance elements: ownership structure, board structure, and audit quality. The role of ownership structure in corporate governance varies significantly across countries, and is thought to be closely tied to the development of a country's stock market, the nature of state intervention, and regulations (La Porta, López-de-Silanes, Shleifer, & Vishny, 1998). Ownership structure is much more diverse for firms listed in the U.S. and the U.K. than in Continental Europe (La Porta et al., 1999) and China, where controlled and state ownership are dominant. However, from 2005 to 2007 Chinese regulators implemented market reforms in an attempt to reduce the percentage of state ownership and increase liquidity of shares by eliminating nontradable shares (Beltratti & Bortolotti, 2007). Before 2005, shares issued by Chinese corporations to state-owned enterprises or state-owned financial institutions could not be publicly traded, so financial markets were illiquid, and since most of the outstanding shares at that time were nontradable, most voting power in listed companies rested in the hands of the government.

The board of directors is an extension of a corporation's owners. The Chinese Company Law enacted in 1994 stated that the main function of the board of directors was to provide financial supervision of a corporation and to protect the interest of shareholders. Subsequent reforms have aimed at further developing the role of the board for Chinese-listed companies. For

example, reforms in 2000 sought to separate the roles of board chair and chief executive officer, and in 2002 implemented the Code of Corporate Governance for Listed Firms ("the Code"). The Code provided guidance on board characteristics such as board size, director backgrounds, and frameworks for effective decision making. The Code relied heavily on best practices from North American and European nations, but questions remain regarding the usefulness of Western prescriptions for effective corporate governance in the Chinese setting, given the different regulatory and cultural environments (Yu & Ashton, 2015).

Chinese regulators have also exerted significant effort toward developing their external audit market. Historically, China operated in a planned economic system in which the government controlled most enterprises. During this era, the external audit market was essentially nonexistent. The audit market began to develop during the early 1980s, when China implemented economic reforms with the intent of moving towards a more open market. Various reforms have since been adopted, such as the establishment of joint ventures between domestic Chinese audit firms and the international Big 4 in the early 1990s, the reformation of certain audit standards to model them more closely after the International Standards on Auditing (ISA) in 1995, and the separation of local audit firms from their government or university sponsors in 1998. More recent regulatory reform has focused on enhancing reporting and auditing standards. In 2005, regulators issued the Accounting Standards for Business Enterprises (ASBE), which covered nearly all of the topics of the International Financial Reporting Standards (IFRS), and in 2007 they announced the adoption of 48 ISAs for listed companies, which would begin the movement towards full convergence.

2.3. Hypothesis development

The unique regulatory structure in China, combined with the rapid growth in equity markets and foreign investment, makes crash risk an important concept to investigate. Currently, Chinese market capitalization is among the top five in the world. The value of Chinese stocks surged past $10 trillion for the first time in 2015 (compared with $25 trillion and $5 trillion, respectively, for U.S. and Japanese equities)—but then a third of the market capitalization of A-shares on the Shanghai Stock Exchange vanished during a one-month period. Yet there is much less academic research on crash risk in China than in the United States.

Corporate governance systems have been shown to alleviate agency risks, mitigating managerial actions that lessen shareholders' wealth (Karamanou & Vafeas, 2005; Klein, 2002; Masulis, Wang, & Xie, 2007; Xie, Davidson, & DaDalt, 2003). Thus an effective corporate governance system should reduce crash risk. Preliminary research on China has supported this conclusion. For example, Chen and colleagues (2017) find that crash risk is negatively associated with internal control and monitoring, and that the relationship is more pronounced for firms with poor external governance.

The three key governance mechanisms focused on by Chinese regulators are ownership structure, board structure, and audit quality. Different ownership structures have different strengths and weaknesses in terms of governance effectiveness. Historically, Chinese-listed firms have tended to have high levels of ownership concentration and state ownership, but recent regulations have moved to counteract this tendency. Two opposing arguments are presented regarding the effect of ownership concentration on corporate governance (Morck, Wolfenzon, & Yeung, 2005). One argument is that concentrated ownership can reduce the need for monitoring, as large, active shareholders have both the incentive and the ability to hold management accountable. The other is that concentrated ownership tends to separate the interests of

controlling and minority shareholders. In general, however, the literature suggests that a strong, well-functioning owner group can monitor management's behavior, whereas transient, short-term investors have a myopic perspective. As a result, we expect an effective ownership structure, represented by a concentrated and active owner group, to be negatively associated with crash risk.

An extension of a firm's owners is the board of directors, which is charged with monitoring management to protect the interests of shareholders (Klein, 2002; Shleifer & Vishny, 1997). The composition, structure, subcommittees, and overall size of the board have all been shown to be important to this function. A well-functioning board of directors should have characteristics that are unique to the company and its regulatory environment. The literature on board monitoring has focused heavily on board composition. The "agency perspective" suggests that boards should be dominated by independent directors, but empirical studies provide mixed support for this perspective (Dalton, Daily, Certo, & Roengpitya, 1998; Dalton, Daily, Ellstrand, & Johnson, 2003). In the "resource dependence perspective," the board should provide diverse expertise that will allow the firm to deal successfully with internal and external operating uncertainties (Boyd, 1990). For example, Hillman and colleagues (2000) have argued that boards should include business experts, field experts (e.g., lawyers), and influential community members. Regardless of the perspective adopted, the literature suggests that a properly functioning board should reduce agency risks, which are inversely related with crash risk (Kim & Zhang, 2016). In sum, we expect an effective board, composed of independent and diverse directors, to be negatively associated with crash risk.

External auditors can help enforce investors' rights by detecting expropriation by insiders (Newman, Patterson, & Smith, 2005) and should benefit management by signaling the reliability

of financial statement information. High-quality audits are expected to prevent and detect debatable accounting practices, disclose bad news at the earliest possible stage, and identify material errors and irregularities. Good auditors can differentiate the information and noise components of discretionary accruals, thereby enhancing the informativeness of earnings (Krishnan, 2003). In general, the literature suggests that a high-quality external audit discloses unfavorable information while simultaneously limiting management's ability to disclose unverifiable favorable information (Ball, Jayaraman, & Shivakumar, 2012). As a result, we expect high-quality auditing to be negatively associated with stock price crash risk.

Together, ownership structure, board structure, and audit quality should enhance shareholders' ability to monitor management, promote effective decision making, restrain opportunistic behaviors, and reduce information asymmetry (Ashbaugh-Skaife et al., 2006; Andreou et al., 2016). Therefore,

Hypothesis 1. Chinese-listed firms with stronger corporate governance will have lower risk of future stock price crash.

Hypothesis 1a. Higher levels of ownership concentration and activism will be negatively associated with future stock price crash risk for Chinese-listed firms.

Hypothesis 1b. Higher levels of board independence and diversity will be negatively associated with future stock price crash risk for Chinese-listed firms.

Hypothesis 1c. Higher levels of audit quality will be negatively associated with future stock price crash risk for Chinese-listed firms.

As we note above, Chinese regulators have made significant efforts at strengthening the function of these three corporate governance mechanisms. But scholars have yet to investigate the impact of these reforms on the corporate governance of Chinese-listed firms. We therefore hypothesize that

Hypothesis 2. The relationship between corporate governance attributes and future stock price crash risk after the IFRS and split-share reforms is stronger than that before the reforms.

Hypothesis 2a. The negative relationship of ownership concentration and activism with future stock price crash risk is more pronounced after the IFRS and split-share reforms for Chinese-listed firms.

Hypothesis 2b. The negative relationship of board independence and diversity with future stock price crash risk is more pronounced after the IFRS and split-share reforms for Chinese-listed firms.

Hypothesis 2c. The negative relationship between audit quality and future stock price crash risk is more pronounced after the IFRS and split-share reforms for Chinese-listed firms.

3. Data

The sample used in this paper consists of firms listed on the Shanghai Stock Exchange and the Shenzhen Stock Exchange from 2000 to 2014. In 2007, Chinese-listed firms were required by the Chinese government to adopt the ASBE, which covered most of the standards under the IFRS. In addition, the Chinese stock market reform that was put in place to eliminate nontradable shares was completed in the same year. These two major changes (hereafter

simplified to "the IFRS reforms") motivate us to compare the impact of corporate governance attributes on crash risk before and after 2007. To ensure that we have two subperiods comparable in length, we select 2000 and 2014 as the start and the end of the sample period, respectively. We obtain stock return, financial statement, audit function, board function, and ownership function data from the China Stock Market and Accounting Research (CSMAR) database. After we exclude observations with missing or incomplete data, our final sample consists of 11,427 firm-year observations. We winsorize the variables at the 0.5% level.

4. Variable measurement and research design

4.1. Measurement of firm-specific stock price crash risk

Following Chen et al. (2001), Jin and Myers (2006), and Hutton et al. (2009), we define two crash risk measures: the "negative coefficient of skewness" and "down-to-up volatility." Calculating the two measures requires firm-specific residual daily returns, which can be estimated as follows:

$$r_{i,t} = \alpha_i + \beta_{1,i} R_{M,t-1} + \beta_{2,i} R_{M,t} + \beta_{3,i} R_{M,t+1} + \varepsilon_{i,t} , \quad (1)$$

where $r_{i,t}$ is the return of stock *i* on day *t*, while $R_{M,t-1}$, $R_{M,t}$, and $R_{M,t+1}$ are the value-weighted market return on day *t-1*, day *t*, and *t+1*, respectively. We then define firm-specific daily return for stock *i* on day *t*, $R_{i,t}$, as the natural logarithm of one plus firm-specific residual daily return, $\varepsilon_{i,t}$:

$$R_{i,t} = ln(1 + \varepsilon_{i,t}) . \quad (2)$$

The first crash risk measure, the "negative coefficient of skewness" of stock *i* during year *T*, $NCSKEW_{i,T}$, can be calculated as follows:

$$NCSKEW_{i,T} = \frac{-\left(n(n-1)^{3/2}\sum R_{i,t}^{3}\right)}{\left((n-1)(n-2)(\sum R_{i,t}^{2})^{3/2}\right)}, \quad (3)$$

where *n* refers to the number of observations of firm-specific daily returns during year *T*. A higher value of NCSKEW implies a higher crash risk. The second crash risk measure, the "down-to-up volatility" of stock *i* during year *T*, $DUVOL_{i,T}$, can be computed as

$$DUVOL_{i,T} = log\left[\frac{(n_u-1)\sum_{Down} R_{i,t}^{2}}{(n_d-1)\sum_{Up} R_{i,t}^{2}}\right], \quad (4)$$

where n_u and n_d represent the number of "up days" and "down days" during year *T*, respectively. For any stock *i* during year *T*, firm-specific daily returns are categorized into two groups: "up days" if the daily return is above the mean of year *T*, and "down days" if the daily return is below the mean of year *T*. A higher DUVOL value indicates a higher level of crash risk. As this paper focuses on the impact of audit quality, board structure, and ownership structure on future crash risk, we employ one-year lead "negative coefficient of skewness" ($NCSKEW_{i,T+1}$) and one-year lead "down-to-up volatility" ($DUVOL_{i,T+1}$) as the dependent variables in the regression analysis.

4.2. Ownership structure variables

We use five variables to capture ownership structure, all of them directly related to the split-share reform. One of the major purposes of the reform was, in general, to reduce ownership concentration and the extent of state ownership, which had historically led to related-party transactions and insider trading, as well as tenuous corporate governance. We therefore include various proxies of these phenomena. First, we include measures of ownership concentration ($OWNER_{i,T}$, the percentage of shares owned by the top 10 shareholders of firm *i* at the end of year *T*) and management ownership ($MGT\_OWNERSHIP_{i,T}$, the percentage of shares owned by

managers of firm *i* at the end of year *T)*. Given the intentions of the split-share reform (Beltratti & Bortolotti, 2007), we expect crash risk to be positively associated with both of these variables.

We also include a variable for state ownership ($SOE_{i,T}$, a dummy variable that equals 1 if firm *i* is a state-owned enterprise at the end of year *T* and 0 otherwise). Although the split-share reform sought to reduce the extent of state ownership of various firms, it did not intend to eliminate state ownership altogether. We expect crash risk to be negatively associated with $SOE_{i,T}$, for various reasons. First, state ownership is usually reserved for China's largest and most important companies, such as the Bank of China and China National Petroleum. Second, large owners, such as state owners, have more incentive to gather information and monitor management (Shivdasani, 1993). Lastly, unlike short-term investors, stable institutional owners, such as state owners, influence managerial behavior in a manner that is negatively associated with crash risk (Callen & Fang, 2013).

Our fourth and fifth variables are related to the split-share reform intention of broadening the shareholder base of listed companies. First, we rely upon attendance at a corporation's annual general meeting to gauge owners' active involvement in monitoring management ($AGM_{i,T}$, the percentage of shares owned by shareholders of firm *i* who attend the annual general meeting during year *T*). Second, relying upon research (e.g., Zhou, Zhang, & Cui, 2011) that suggests that cross-listed Chinese firms have stronger governance, we use a variable for cross-listing ($CL_{i,T}$, a dummy variable that equals 1 if firm *i* is cross-listed in both China and Hong Kong at the end of year *T* and 0 otherwise). We expect crash risk to be negatively associated with $AGM_{i,T}$ and $CL_{i,T}$.

4.3. Board structure variables

Five variables proxy aspects of board structure. To represent the agency perspective, we use the separation between general manager and board chair ($DUALITY_{i,T}$, a dummy variable that

equals 1 if the same person is serving as CEO and chair of the board of firm *i* at the end of year *T* and 0 otherwise) and the percentage of independent directors ($INDEPENDENCE_{i,T}$, the percentage of independent directors on the board of firm *i* at the end of year *T).* We expect that crash risk is positively associated with $DUALITY_{i,T}$ and negatively associated with $INDEPENDENCE_{i,T}$. To represent the resource dependence perspective, we use board size ($BOARD\_SIZE_{i,T}$, the total number of directors on the board of firm *i* at the end of year *T*), gender diversity ($GENDER_{i,T}$, the percentage of executives who are male in firm *i* at the end of year *T*), and the average age of executives ($AGE_{i,T}$, the average age of executives in firm *i* at the end of year *T*). We expect that crash risk is negatively associated with all three of these variables.

4.4. Audit quality variables

We employ five individual measures of audit quality. Our first variable, $BIG4_{i,T}$ (a dummy variable that equals 1 if firm *i* is audited by a Big 4 audit firm during year *T* and 0 otherwise), relies upon DeAngelo's (1981) argument that larger firms provide better audits. Our second variable, $LN\_AUDIT\_FEES_{i,T}$ (the natural log of audit fees for firm *i* during year *T*), is based upon arguments that higher audit fees are a reasonable proxy for audit quality (Dye, 1993; Simunic & Stein, 1996). Our third variable, $EXPERT_{i,T}$ (a dummy variable that equals 1 if firm *i* is audited by an audit expert during year *T* and 0 otherwise) relies upon arguments and research suggesting that audit expertise is associated with audit quality (Andreou et al., 2016; Christensen, Olson, & Omer, 2015). We define an audit expert as an auditing firm that has more than one-third of the client's industry market share, measured by audit fees, during a particular year. Lastly, we use $MIDTERM_{i,T}$ (a dummy variable that equals 1 if firm *i* has a midterm audit during year *T* and 0 otherwise) and $AO_{i,T}$ (a dummy variable that equals 1 if firm *i* has an unqualified

audit opinion during year *T* and 0 otherwise). We expect that crash risk is negatively associated with all five proxies of audit quality.

4.5. Control variables

We include a number of control variables to capture the potential impact of other factors on crash risk (cf. Andreou et al., 2016; Callen & Fang, 2015;): market capitalization ($LN\_SIZE_{i,T}$), defined as the natural log of market value of equity of firm *i* at the end of year *T*; market-to-book ($MB_{i,T}$), defined as the ratio of the market value of equity to the book value of equity of firm *i* at the end of year *T*; leverage ($LEV_{i,T}$), defined as the ratio of the total liabilities to the total assets of firm *i* at the end of year *T*; return on equity ($ROE_{i,T}$), defined as the return on equity of firm *i* at the end of year *T*; earnings management ($EM_{i,T}$), defined as the three-year moving sum of absolute discretionary accruals of firm *i* at the end of year *T*; stock turnover ($DTURNOVER_{i,T}$), defined as the average monthly stock turnover of firm *i* during year *T* minus the average monthly stock turnover during year *T – 1*; $NCSKEW_{i,T}$, defined as the "negative coefficient of skewness" of firm *i* at the end of year *T*; $DUVOL_{i,T}$, defined as the "down-to-up volatility" of firm *i* at the end of year *T*; standard deviation ($STDEV_{i,T}$), defined as the standard deviation of daily returns of firm *i* for year *T*; kurtosis ($KUR_{i,T}$), defined as the kurtosis of daily returns of firm *i* for year *T*; and returns ($RET_{i,T}$), defined as the cumulative daily returns of firm *i* over year *T*.

4.6. Model specifications

Our first hypothesis postulates that there is a negative association between crash risk and firms with stronger ownership structure, board structure, and audit quality. We use the following equations to test this hypothesis:

$$NCSKEW_{i,T+1} = \alpha_i + \beta_1 OWNER_{i,T} + \beta_2 SOE_{i,T} + \beta_3 CL_{i,T} + \beta_4 AGM_{i,T} + \beta_5 MGT\_OWNERSHIP_{i,T} +$$

$$\beta_6 INDEPENDENCE_{i,T} + \beta_7 BOARD\_SIZE_{i,T} + \beta_8 DUALITY_{i,T} + \beta_9 GENDER_{i,T} + \beta_{10} AGE_{i,T} + \beta_{11} BIG4_{i,T} + \beta_{12} MIDTERM_{i,T} + \beta_{13} LN\_AUDIT\_FEES_{i,T} + \beta_{14} AO_{i,T} + \beta_{15} EXPERT_{i,T} + \beta_{16} LN\_SIZE_{i,T} + \beta_{17} MB_{i,T} + \beta_{18} LEV_{i,T} + \beta_{19} ROE_{i,T} + \beta_{20} EM_{i,T} + \beta_{21} EM_{i,T} + \beta_{22} DTURNOVER_{i,T} + \beta_{23} NCSKEW_{i,T} + \beta_{24} STDEV_{i,T} + \beta_{25} KUR_{i,T} + \beta_{26} RET_{i,T} + \beta \sum_T YEAR + \beta \sum_T IND + \varepsilon_{i,T} \quad (5)$$

and

$$DUVOL_{i,T+1} = \alpha_i + \gamma_1 OWNER_{i,T} + \gamma_2 SOE_{i,T} + \gamma_3 CL_{i,T} + \gamma_4 AGM_{i,T} + \gamma_5 MGT\_OWNERSHIP_{i,T} + \gamma_6 INDEPENDENCE_{i,T} + \gamma_7 BOARD\_SIZE_{i,T} + \gamma_8 DUALITY_{i,T} + \gamma_9 GENDER_{i,T} + \gamma_{10} AGE_{i,T} + \gamma_{11} BIG4_{i,T} + \gamma_{12} MIDTERM_{i,T} + \gamma_{13} LN\_AUDIT\_FEES_{i,T} + \gamma_{14} AO_{i,T} + \gamma_{15} EXPERT_{i,T} + \gamma_{16} LN\_SIZE_{i,T} + \gamma_{17} MB_{i,T} + \gamma_{18} LEV_{i,T} + \gamma_{19} ROE_{i,T} + \gamma_{20} EM_{i,T} + \gamma_{21} EM_{i,T} + \gamma_{22} DTURNOVER_{i,T} + \gamma_{23} DUVOL_{i,T} + \gamma_{24} STDEV_{i,T} + \gamma_{25} KUR_{i,T} + \gamma_{26} RET_{i,T} + \gamma \sum_T YEAR + \gamma \sum_T IND + \varepsilon_{i,T} , \quad (6)$$

where the two crash risk measures, $NCSKEW_{i,T+1}$ and $DUVOL_{i,T+1}$, serve as the dependent variables in the two regressions respectively. The ownership structure attributes ($OWNER_{i,T}$, $SOE_{i,T}$, $CL_{i,T}$, $AGM_{i,T}$, and $MGT\_OWNERSHIP_{i,T}$), board structure attributes ($INDEPENDENCE_{i,T}$, $BOARD\_SIZE_{i,T}$, $DUALITY_{i,T}$, $GENDER_{i,T}$, and $AGE_{i,T}$), and audit quality attributes ($BIG4_{i,T}$, $MIDTERM_{i,T}$, $LN\_AUDIT\_FEES_{i,T}$, $AO_{i,T}$, and $EXPERT_{i,T}$) serve as the explanatory variables, while the remaining ones are control variables. We also include year and industry dummy variables to control for year and industry fixed effects.

As a robustness test, we employ alternative variables to measure ownership structure, board structure, and audit quality. Instead of using five individual variables, we create a composite variable for each of ownership structure, board structure, and audit quality. To create the composite variables, we convert each of the 15 explanatory variables into a dummy variable. As the 15 variables differ in predicted signs, we modify the definitions of the variables so that after the conversion all 15 have negative predicted signs, meaning that stronger ownership structure, board structure, and audit quality are believed to lessen crash risk.

For ownership structure, $OWNER\_D_{i,T}$ is a dummy variable that equals 1 if the percentage of shares owned by the top 10 shareholders of firm *i* is below the mean among all firms during year *T* and 0 otherwise; $SOE\_Di_{,T}$ is a dummy variable that equals 1 if firm *i* is a state-owned enterprise at the end of year *T* and 0 otherwise; $CL\_D_{i,T}$ is a dummy variable that equals 1 if firm *i* is cross-listed in both China and Hong Kong at the end of year *T* and 0 otherwise; $AGM\_D_{i,T}$ is a dummy variable that equals 1 if the percentage of shares owned by shareholders of firm *i* who attended the annual general meeting is above the mean among all firms during year *T* and 0 otherwise; and $MGT\_OWNERSHIP\_D_{i,T}$ is a dummy variable that equals 1 if the percentage of shares owned by management of firm *i* is below the mean among all firms at the end of year *T* and 0 otherwise.

For board structure, $INDEPENDENCE\_D_{i,T}$ is a dummy variable that equals 1 if the percentage of independent directors on the board of firm *i* is higher than the mean among all firms at the end of year *T* and 0 otherwise; $BOARD\_SIZE\_D_{i,T}$ is a dummy variable that equals 1 if the total number of directors on the board of firm *i* is higher than the mean among all firms at the end of year *T* and 0 otherwise; $DUALITY\_D_{i,T}$ is a dummy variable that equals 1 if the same person served as general manager and chair of the board of firm *i* at the end of year *T* and 0 otherwise; $GENDER\_D_{i,T}$ is a dummy variable that equals 1 if firm *i*'s percentage of executives who are male is lower than the mean among all firms at the end of year *T* and 0 otherwise; and $AGE\_D_{i,T}$ is a dummy variable that equals 1 if the average age of executives in firm *i* is lower than the mean among all firms at the end of year *T* and 0 otherwise.

For audit quality, $BIG4\_D_{i,T}$ is a dummy variable that equals 1 if firm *i* is audited by a Big 4 audit firm during year *T* and 0 otherwise; $MIDTERM\_D_{i,T}$ is a dummy variable that equals 1 if firm *i* has a midterm audit during year *T* and 0 otherwise; $LN\_AUDIT\_FEES\_D_{i,T}$ is a

dummy variable that equals 1 if the natural log of audit fees for firm *i* is higher than the mean among all firms during year *T* and 0 otherwise; $AO\_D_{i,T}$ is a dummy variable that equals 1 if firm *i* has an unqualified audit opinion during year *T* and 0 otherwise; and $EXPERT\_D_{i,T}$ is a dummy variable that equals 1 if firm *i* is audited by an audit expert during year *T* and 0 otherwise.

For each of ownership structure, board structure, and audit quality, the five associated dummy variables are summed to form the composite measure:

$$OWNER\_COMP_{i,T} = OWNER\_D_{i,T} + SOE\_D_{i,T} + CL\_D_{i,T} + AGM\_D_{i,T} + MGT\_OWNERSHIP\_D_{i,T} \quad (7)$$

$$BOARD\_COMP_{i,T} = INDEPENDENCE\_D_{i,T} + BOARD\_SIZE\_D_{i,T} + DUALITY\_D_{i,T} + GENDER\_D_{i,T} + AGE\_D_{i,T} \quad (8)$$

$$AUDIT\_COMP_{i,T} = BIG4\_D_{i,T} + MIDTERM\_D_{i,T} + LN\_AUDIT\_FEES\_D_{i,T} + AO\_D_{i,T} + EXPERT\_D_{i,T} . \quad (9)$$

$OWNER\_COMP_{i,T}$, $BOARD\_COMP_{i,T}$, and $AUDIT\_COMP_{i,T}$ take a value from 0 to 5 for firm *i* at the end of year *T*. A value of 0 refers to the weakest ownership structure, board structure, or audit quality, while a value of 5 signifies the strongest ownership structure, board structure, or audit quality. We test the first hypothesis again by using the three composite measures instead of the 15 individual measures:

$$NCSKEW_{i,T+1} = \alpha_i + \beta_1 OWNER\_COMP_{i,T} + \beta_2 BOARD\_COMP_{i,T} + \beta_3 AUDIT\_COMP_{i,T} + \beta_4 LN\_SIZE_{i,T} + \beta_5 MB_{i,T} + \beta_6 LEV_{i,T} + \beta_7 ROE_{i,T} + \beta_8 EM_{i,T} + \beta_9 EM_{i,T} + \beta_{10} DTURNOVER_{i,T} + \beta_{11} NCSKEW_{i,T} + \beta_{12} STDEV_{i,T} + \beta_{13} KUR_{i,T} + \beta_{14} RET_{i,T} + \beta \sum_T YEAR + \beta \sum_T IND + \varepsilon_{i,T} . \quad (10)$$

and

$$DUVOL_{i,T+1} = \alpha_i + \gamma_1 OWNER\_COMP_{i,T} + \gamma_2 BOARD\_COMP_{i,T} + \gamma_3 AUDIT\_COMP_{i,T} + \gamma_4 LN\_SIZE_{i,T} + \gamma_5 MB_{i,T} + \gamma_6 LEV_{i,T} + \gamma_7 ROE_{i,T} + \gamma_8 EM_{i,T} + \gamma_9 EM_{i,T} + \gamma_{10} DTURNOVER_{i,T} + \gamma_{11} DUVOL_{i,T} + \gamma_{12} STDEV_{i,T} + \gamma_{13} KUR_{i,T} + \gamma_{14} RET_{i,T} +$$

$$\gamma \sum_T YEAR + \gamma \sum_T IND + \varepsilon_{i,T} \ . \quad (11)$$

Our second hypothesis postulates that the relationship between the three corporate governance attributes and crash risk is stronger before the IFRS and split-share reforms than after them. We believe that the latter period represents a stronger regulatory environment, so better ownership structure, board structure, and audit quality should more strongly reduce crash risk. We test this second hypothesis by rerunning (5), (6), (10), and (11) for the two subperiods and comparing the results.

5. Empirical results

5.1. Descriptive statistics

Table 1 presents the descriptive statistics for all variables used in our regressions for the entire sample. The means (standard deviations) of the two crash risk measures, $NCSKEW_{i,T+1}$ and $DUVOL_{i,T+1}$, are -0.568 (0.836) and -0.387 (0.462), respectively, and the values are consistent with those reported in previous studies in the Chinese setting (Li & Cai, 2016; Xu et al., 2013; Xu et al., 2014).

Insert Table 1 Here

The average percentage of shares owned by the top 10 shareholders is 54.40%, while an average of 3.60% of the shares are owned by managers. Fifty-four percent of our sample firms are state-owned enterprises, and 2.7% have their shares cross-listed in both China and Hong Kong. On average, 36.30% of the board members are independent, and 16.30% of the firms have the same person serving as chair and general manager. The average age of the executives is around 48, and 84.70% of them are males. With regard to audit quality, 6.40% and 5.00% of the

firms are audited by Big 4 firms and have midterm audits, respectively. Also, 94.00% of the audit opinions are unqualified.

5.2. Correlation analysis

We report Pearson correlation coefficients among the variables in Table 2. As other studies suggest for both the U.S. and China (Andreou et al., 2016; Callen & Fang, 2015), the two crash risk measures, $NCSKEW_{i,T+1}$ and $DUVOL_{i,T+1}$, are significantly and positively correlated with each other, with a correlation of 0.84. This suggests that both measures should generate similar results in the univariate and multivariate analyses.

Insert Table 2 Here

In accord with our hypotheses, Table 2 suggests that certain corporate governance attributes are associated with crash risk. For ownership structure, firms that are cross-listed in both China and Hong Kong tend to have less crash risk, and those that have a higher percentage of shares owned by managers have more. Correlations between board structure variables and crash risk are relatively less significant. Higher audit fees and unqualified audit opinions are negatively associated with crash risk. Significant correlations exist among other variables, but untabulated results of the variance inflation factor (VIF) analysis suggest that multicollinearity should not be a concern.

5.3. Corporate governance attributes and crash risk

Our first hypothesis postulates that there is a negative association between crash risk and stronger ownership structure, board structure, and audit quality. Table 3 presents the results of the ordinary least square regression that tests this hypothesis. Model 1 for each of the two crash risk measures is based on equations (10) and (11), which use only one composite variable for each of ownership structure, board structure, and audit quality. Model 2, in contrast, is based on

equations (5) and (6), which use five individual variables for each of the three corporate governance attributes.

Insert Table 3 Here

We start with model 1 for the two crash risk measures, $NCSKEW_{i,T+1}$ and $DUVOL_{i,T+1}$. The results in Table 3 show that, across both measures, the estimated coefficients for the ownership structure composite variable ($OWNER\_COMP_{i,T}$) are negative and statistically significant (t = -2.82 and -2.45). These results are consistent with hypothesis 1a, suggesting a negative relationship between ownership structure and crash risk. Table 3 further shows that the estimated coefficients for the audit quality composite variable ($AUDIT\_COMP_{i,T}$) are negative and statistically significant for both crash risk measures as well (t = -3.44 and -4.59). These results are consistent with hypothesis 1c; that is, there is a negative association between audit quality and crash risk. Hypothesis 1b, however, is not supported by the results in Table 3. The estimated coefficient of the composite variable for board structure is statistically significant only at the 10 percent level (t = -1.86) for the first crash risk measure (i.e.: $NCSKEW_{i,T+1}$) and not statistically significant (t = -0.08) for the second crash risk measure (i.e.: $DUVOL_{i,T+1}$), implying that board structure is not associated with crash risk.

We follow previous researchers (e.g., Callen & Fang, 2015; Hutton et al., 2009) in examining the economic significance of the result. Specifically, we individually set $OWNER\_COMP_T$, $BOARD\_COMP_T$, and $AUDIT\_COMP_T$ to their 25th and 75th percentile values, and calculate the crash risk measures according to the estimation results presented in Table 3 at those two percentile values while holding all other variables at their mean values. On average, the drop in crash risk in any year corresponding to a shift from the 25th to the 75th percentile of the distribution of $AUDIT\_COMP_T$ ($OWNER\_COMP_T$) is 3.65% (1.85%) of the

sample mean (across alternative measures of crash risk). The specific drop percentages for $NCSKEW_{T+1}$ and $DUVOL_{T+1}$ are 4.3% and 3.0%, respectively, for $AUDIT\_COMP_T$, and 2.5% and 1.2%, respectively, for $OWNER\_COMP_T$.

In model 2 of Table 3, we test hypothesis 1 again by using individual attribute variables associated with ownership structure, board structure, and audit quality, instead of using the composite variables. The results suggest that, among the ownership structure variables, the estimated coefficients of $OWNER_{i,T}$ and $MGT\_OWNERSHIP_{i,T}$ are positive and statistically significant for both the first crash risk measure (t = 2.63 and 2.50) and the second (t = 3.42 and 2.14). Higher percentages of shares owned by the top 10 shareholders and the firm's managers imply a weaker ownership structure and corporate governance, and as we expected, the results suggest that they are associated with a higher level of crash risk. In contrast, the estimated coefficients of $AGM_{i,T}$ are negative and statistically significant across both measures of crash risk (t = -2.59 and -3.96). These results are consistent with our expectation as well, as a higher percentage of shares owned by shareholders who attend annual general meetings signals stronger corporate governance, lowering crash risk. The estimated coefficients of the other two ownership structure variables, $SOE_{i,T}$ and $CL_{I,T}$, are statistically insignificant across both crash risk measures. Nevertheless, the results from the ownership structure variables are largely consistent with hypothesis 1a, suggesting that stronger ownership structure is associated with less crash risk.

With respect to the board structure individual variables, Table 3 shows that the results are consistent with those from using the composite variable. The estimated coefficients of all five board structure variables are statistically insignificant; hence, the results fail to support hypothesis 1b, meaning that there is not a relationship between board structure and crash risk.

For audit quality variables, the estimated coefficients of $MIDTERM_{i,T}$, $LN\_AUDIT\_FEES_{i,T}$, and $AO_{i,T}$ are negative and statistically significant for both the first crash risk measure (t = -2.24, -3.20, and -3.21) and the second (t = -2.27, -3.01, and -4.54). The existence of a midterm audit, higher audit fees, and an unqualified audit opinion can all be seen as signs of higher audit quality, which is negatively associated with crash risk. Although the estimated coefficients for the other two audit quality variables are not statistically significant, the results from the audit quality attributes, for the most part, support hypothesis 1c; that is, a higher audit quality has a negative association with crash risk.

In general, the results in Table 3 support hypotheses 1a and 1c but are not consistent with hypothesis 1b: firms with stronger ownership structure and higher audit quality have less chance of experiencing stock price crashes, while board structure does not seem to have much association with crash risk. The findings are consistent across both crash risk measures.

5.4. Crash risk before and after the IFRS reforms

Our second hypothesis postulates that the association between corporate governance and crash risk is stronger after the IFRS reforms (years 2008–2014) than before them (years 2000–2007). Panels A and B of Table 4 present the results of equations (5), (6), (10), and (11) when we divide the full sample period into two subperiods for the two crash risk measures. As in Table 3, model 1 is based on equations (10) and (11), which use composite variables for ownership structure, board structure, and audit quality. Model 2, on the other hand, reflects equations (5) and (6), which use the individual variables that make up these corporate governance attributes.

Insert Table 4 Here

Starting with the composite variables (model 1), the results in Panels A and B of Table 4 suggest that ownership structure ($OWNER\_COMP_{i,T}$) is not associated with crash risk before the

IFRS reforms but has a negative and statistically significant association with crash risk afterwards. The results are consistent across the two crash risk measures, although the before/after change is more significant for the first crash risk measure, $NCSKEW_{i,T+1}$.

For board structure, the results are rather inconsistent between the two crash risk measures. For the first crash risk measure, $NCSKEW_{i,T+1}$, the impact of board structure ($BOARD\_COMP_{i,T}$) on crash risk appears to be negative before the IFRS reforms, and the relationship disappears after the reforms. However, the same does not hold for the second crash risk measure, $DUVOL_{i,T+1}$. For this measure, there seems to be no relationship between board structure and crash risk either before or after the reforms. Despite the inconsistency in results between the two crash risk measures, we still consider the results to be in line with the full sample results in Table 3; that is, the relationship between board structure and crash risk is not significant.

With respect to the impact of audit quality, although there are some minor inconsistencies between the two crash risk measures, the estimated coefficients of $AUDIT\_COMP_{i,T}$ are not very different before and after the IFRS reforms. They are largely negative and statistically significant in both periods, suggesting that the relationship between audit quality and future crash risk remains largely consistent through the entire sample period. The results are consistent with hypotheses 2a and 2c, particularly hypothesis 2a, but inconsistent with hypothesis 2b.

Panels A and B of Table 4 present further results from using variables representing individual attributes rather than composite variables (model 2). Among the individual ownership structure attributes, three of the five variables, $OWNER_{i,T}$, $CL_{i,T}$, and $AGM_{i,T}$, are not statistically significant before the IFRS reforms but become so, with the correct predicted signs, afterwards. In accord with the results above, the board structure individual attributes are not significantly

related to crash risk. Among the audit quality individual attributes, the estimated coefficients for two of the five variables, $LN\_AUDIT\_FEES_{i,T}$ and $AO_{i,T}$, remain statistically significant before and after the IFRS reforms, while the estimated coefficients of $MIDTERM_{i,T}$ change from statistically insignificant before the IFRS reforms to significant after them. The results, once again, are consistent with hypotheses 2a and 2c, but not with hypothesis 2b.

In sum, across the two crash risk measures, the effects of ownership structure and audit quality on crash risk are stronger after the IFRS reforms than before them. The adoption of IFRS and the completion of stock reform created a stronger regulatory environment, in which stronger corporate governance in the form of ownership structure and audit quality add more value and thus have a stronger tendency to reduce crash risk.

6. Robustness tests

6.1. Eliminating financial firms

Our first test assesses the robustness of our results to excluding financial firms. We follow Hutton and colleagues (2009) and eliminate financial firms from our sample. Table 5 presents the results of estimating equations (5), (6), (10), and (11) after eliminating financial firms, and our findings remain robust. In particular, the relationships between ownership structure and crash risk and between audit quality and crash risk remain negative. Hence, as in the earlier findings, hypotheses 1a and 1c are supported, while hypothesis 1b is not. Table 5 also presents the results from using the individual attribute variables after eliminating financial firms, and our findings still remain robust.

Insert Table 5 Here

6.2. Substituting PCA-generated factors for composite variables

The second robustness test focuses on the way in which the composite variables are generated. Equations (5) and (6) use five individual attribute variables for each of ownership structure, board structure, and audit quality. In equations (10) and (11) those variables are converted into dummy variables, and the values of the dummy variables are summed separately for each of the three corporate governance attributes to form composite variables. In this robustness test, we use principal component analysis (PCA) to generate factors that replace the composite variables. The idea of PCA is to reduce the 15 individual corporate governance attributes into a smaller number of factors that capture most of their variance. We follow Kaiser (1960) and retain factor loadings with an eigenvalue of 1.0 or above. In total, seven PCA factors are generated: two PCA ownership structure variables (*OWNER1*$_T$ and *OWNER2*$_T$), two PCA board structure variables (*BOARD1*$_T$ and *BOARD2*$_T$), and three PCA audit quality variables (*AUDIT1*$_T$, *AUDIT2*$_T$, and *AUDIT3*$_T$). We then run the following regressions as a robustness check:

$$NCSKEW_{i,T+1} = \alpha_i + \beta_1 OWNER1_{i,T} + \beta_2 OWNER2_{i,T} + \beta_3 BOARD1_{i,T} + \beta_4 BOARD2_{i,T} + \beta_5 AUDIT1_{i,T} + \beta_6 AUDIT2_{i,T} + \beta_7 AUDIT3_{i,T} + \beta_8 LN\_SIZE_{i,T} + \beta_9 MB_{i,T} + \beta_{10} LEV_{i,T} + \beta_{11} ROE_{i,T} + \beta_{12} EM_{i,T} + \beta_{13} EM_{i,T} + \beta_{14} DTURNOVER_{i,T} + \beta_{15} NCSKEW_{i,T} + \beta_{16} STDEV_{i,T} + \beta_{17} KUR_{i,T} + \beta_{18} RET_{i,T} + \beta \sum_T YEAR + \beta \sum_T IND + \varepsilon_{i,T} \quad (12)$$

and

$$DUVOL_{i,T+1} = \alpha_i + \gamma_1 OWNER1_{i,T} + \gamma_2 OWNER2_{i,T} + \gamma_3 BOARD1_{i,T} + \gamma_4 BOARD2_{i,T} + \gamma_5 AUDIT1_{i,T} + \gamma_6 AUDIT2_{i,T} + \gamma_7 AUDIT3_{i,T} + \gamma_8 LN\_SIZE_{i,T} + \gamma_9 MB_{i,T} + \gamma_{10} LEV_{i,T} + \gamma_{11} ROE_{i,T} + \gamma_{12} EM_{i,T} + \gamma_{13} EM_{i,T} + \gamma_{14} DTURNOVER_{i,T} + \gamma_{15} DUVOL_{i,T} + \gamma_{16} STDEV_{i,T} + \gamma_{17} KUR_{i,T} + \gamma_{18} RET_{i,T} + \gamma \sum_T YEAR + \gamma \sum_T IND + \varepsilon_{i,T} . \quad (13)$$

Insert Table 6 Here

Table 6 presents the results of equations (12) and (13). The results are consistent across the two measures of crash risk. One of the two PCA ownership structure factors has negative and

statistically significant estimated coefficients (t = -3.89 and -3.64), and two of the three PCA audit quality factors have negative and statistically significant estimated coefficients (t = -3.22 and -3.96; -3.49 and -4.72). None of the PCA board structure factors, on the other hand, has a statistically significant estimated coefficient. The results are consistent with the earlier findings, supporting hypotheses 1a and 1c. They also show that our findings are robust to different ways of generating composite variables and different ways of measuring the corporate governance attributes.

6.3. Addressing issues related to endogeneity

Like other scholars who have focused on corporate governance, we acknowledge the potential existence of endogeneity between crash risk and our measures of corporate governance attributes (Coles, Lemmon, & Meschke, 2012). To address the endogeneity issue related to omitted variables, we follow Kim, Li, and Zhang (2011) and Chen and colleagues (2017) and include firm fixed effects in our main regression models to capture unobservable, firm-specific factors that may be associated with crash risk. Table 7 demonstrates that our results are robust after the inclusion of firm fixed effects to address endogeneity.

Insert Table 7 Here

Reverse causality can potentially be a concern as well, as one may argue that crash risk can affect a firm's current ownership structure, board function, and audit quality. Our research design mitigates this problem by using lagged corporate governance attributes to predict future stock price crash risk (Kim, Li, & Li, 2014; Kim et al., 2016), as well as by using lagged crash risk measures as control variables (Kim et al., 2016). Nevertheless, the reverse causality issue remains a concern. We therefore attempt to further mitigate the endogeneity and reverse causality issues by using two-stage least squares (2SLS) regression and adding instrumental

variables when estimating the relationship between crash risk and our measures of corporate governance attributes.

We follow Kim et al. (2014), Xu et al. (2014), and Chen et al. (2017) and, for each year of our sample period, use the average $OWNER\_COMP_{i,T}$, the average $BOARD\_COMP_{i,T}$, and the average $AUDIT\_COMP_{i,T}$ of other firms in the same industry as instrumental variables. The industry averages of our corporate governance attributes are likely to be correlated with the corporate governance attributes of the focal firm, potentially satisfying the relevance criterion for instrumental variables. Simultaneously, the industry averages of the corporate governance measures are not likely to be associated with future stock price crash risk of the focal firm, potentially satisfying the exclusion criterion for instrumental variables.

In the first stage of the 2SLS regression, we estimate the predicted values of the three composite indices:

$$OWNER\_COMP_{i,T} = \alpha_i + \beta_1 AVE\_OWNER\_COMP_{i,T} + \varphi CONTROLS_{i,T} + \varepsilon_{i,T} \quad (14)$$

$$BOARD\_COMP_{i,T} = \alpha_i + \beta_1 AVE\_BOARD\_COMP_{i,T} + \varphi CONTROLS_{i,T} + \varepsilon_{i,T} \quad (15)$$

$$AUDIT\_COMP_{i,T} = \alpha_i + \beta_1 AVE\_AUDIT\_COMP_{i,T} + \varphi CONTROLS_{i,T} + \varepsilon_{i,T}\ , \quad (16)$$

where $AVE\_OWNER\_COMP_{i,T}$, $AVE\_BOARD\_COMP_{i,T}$, and $AVE\_AUDIT\_COMP_{i,T}$ represent, for each year of the sample period, the industry average ownership composite index, the industry average board composite index, and the industry average audit composite index, respectively, and $CONTROLS_{i,T}$ refers to the same control variables as the ones used in regressions (10) and (11). After obtaining the predicted values of the composite indices ($PREDICTED\_OWNER\_COMP_{i,T}$, $PREDICTED\_BOARD\_COMP_{i,T}$, and $PREDICTED\_AUDIT\_COMP_{i,T}$), we use those predicted values to replace the values of the composite indices in the second stage of the 2SLS regression:

$$NCSKEW_{i,T+1} = \alpha_i + \beta_1 PREDICTED\_OWNER\_COMP_{i,T} + \beta_2 PREDICTED\_BOARD\_COMP_{i,T} + \beta_3 PREDICTED\_AUDIT\_COMP_{i,T} + \varphi CONTROLS_{i,T} + \varepsilon_{i,T} \quad (17)$$

$$DUVOL_{i,T+1} = \alpha_i + \beta_1 PREDICTED\_OWNER\_COMP_{i,T} + \beta_2 PREDICTED\_BOARD\_COMP_{i,T} + \beta_3 PREDICTED\_AUDIT\_COMP_{i,T} + \varphi CONTROLS_{i,T} + \varepsilon_{i,T} . \quad (18)$$

Insert Table 8 Here

Table 8 presents the results of regressions (14) through (18) and reveals that the negative association between crash risk and ownership structure remains robust across the two measures of crash risk. The negative relationship between crash risk and audit quality remains robust for the second crash risk measure ($DUVOL_{i,T+1}$); for the first measure ($NCSKEW_{i,T+1}$), although the coefficient of the audit quality composite measure is no longer statistically significant, it remains negative. Despite this minor inconsistency, our main results remain mostly robust after we use the industry average composite index values as instrumental variables to control for endogeneity and reverse causality. We acknowledge, however, the limitation of using industry average composite index values as instrumental variables, as all firms in the same industry may be affected by the same common unobservable factors. Future research can be designed to deal with similar issues.

7. Conclusion

Using a sample of 11,427 firm-year observations for Chinese firms from 2000 to 2014, we find that stronger ownership structure and audit quality are negatively associated with stock price crash risk. The findings are consistent across two different crash risk measures, as well as with different aggregate and component measures of ownership structure and audit quality, and these relationships are stronger after the IFRS reforms than before them. Board structure, on the

other hand, does not seem to be significantly associated with crash risk. These findings imply that two of our three broad measures of corporate governance reduce agency costs and information asymmetry. The difference in predictive value between ownership structure and board structure echoes findings for U.S. listed companies (Andreou et al., 2016) and provides some evidence to support Desender's (2009) suggestion that ownership structure is a higher-order feature of governance than the board of directors.

Our findings are of particular importance to Chinese regulators and investors. Stock price crashes have significant effects on shareholder welfare and the Chinese economy, so Chinese regulators should continue to improve and reform the audit profession and capital markets to reduce the risk of future stock crashes. Low crash risk is important to the stability of the capital markets, and investors, especially those who are more risk averse, prefer capital markets with lower uncertainty. With the international capital markets becoming more global and integrated, a lessened risk of stock price crash in China may help stabilize capital markets in other countries as well. The results of this paper may have similar implications for markets in other developing countries.

References

Allen, F., Qian, J., & Qian, M. (2005). Law, finance, and economic growth in China. *Journal of Financial Economics*, *77*, 57–116.

Andreou, P. C., Antoniou, C., Horton, J., & Louca, C. (2016). Corporate governance and firm-specific stock price crashes. *European Financial Management*, *22*, 916–956.

Ashbaugh-Skaife, H., Collins, D., & LaFond, R. (2006). The effects of corporate governance on firms' credit ratings. *Journal of Accounting and Economics*, *4*, 203–243.

Ball, R., Jayaraman, S., & Shivakumar, L. (2012). Audited financial reporting and voluntary disclosure as complements: A test of the confirmation hypothesis. *Journal of Accounting and Economics*, *53*, 136–166.

Bebchuk, L. A, & Stole, L. (1993). Do short-term managerial objectives lead to under- or overinvestment in long-term projects? *Journal of Finance*, *48*, 719–729.

Beltratti, A., & Bortolotti, B. (2007). *The nontradable share reform in the Chinese stock market: The role of fundamentals.* SSRN working paper.

Bleck, A., & Liu, X. (2007). Market transparency and the accounting regime. *Journal of Accounting Research*, *45*, 229–256.

Boyd, B. (1990). Corporate linkages and organizational environment: A test of the resource dependence model. *Strategic Management Journal*, *11*, 419–430.

Callen, J. L., & Fang, X. (2013). Institutional investors and crashes: Monitoring or expropriation? *Journal of Banking and Finance*, *43*, 1–13.

Callen, J. L., & Fang, X. (2015). Religion and stock price crash risk. *Journal of Financial and Quantitative Analysis*, *50*, 169–195.

Chen, C. J. P., Su, X., & Zhao, R. (2000). An emerging market's reaction to initial modified audit opinions: Evidence from the Shanghai Stock Exchange. *Contemporary Accounting Research*, *17*, 429–455.

Chen, H., Chen, J. Z., Lobo, G. J., & Wang, Y. (2011). Effects of audit quality on earnings management and cost of equity capital: Evidence from China. *Contemporary Accounting Research*, *28*, 892–925.

Chen, J., Chan, K. C., Dong, W., & Zhang, F. (2017). Internal control and stock price crash risk: Evidence from China. *European Accounting Review*, *26*, 125–152.

Chen, J., Hong, H., & Stein, J. C. (2001). Forecasting crashes: Trading volume, past returns, and conditional skewness in stock prices. *Journal of Financial Economics*, *61*, 345–381.

Christensen, B. E., Olson, A. J., & Omer, T. C. (2015). The role of audit firm expertise and knowledge spillover in mitigating earnings management through the tax accounts. *Journal of the American Taxation Association*, *37*, 3–36.

Coles, J. L., Lemmon, M. L., & Meschke, J. F. (2012). Structural models and endogeneity in corporate finance: The link between managerial ownership and corporate performance. *Journal of Financial Economics*, *103*, 149–168.

Cronqvist, H., & Nilsson, M. (2003). Agency costs of controlling minority shareholders. *Journal of Financial and Quantitative Analysis*, *38*(4), 695–719.

Dalton, D., Daily, C., Certo, T., & Roengpitya, R. (2003). Meta-analyses of financial performance and equity: Fusion or confusion? *Academy of Management Journal*, *46*, 13–26.

Dalton, D., Daily, C., Ellstrand, A., & Johnson, J. (1998). Metaanalytic reviews of board composition, leadership structure and financial performance. *Strategic Management Journal*, *19*, 269–290.

DeAngelo, L. E. (1981). Auditor size and audit quality. *Journal of Accounting and Economics*, *3*, 183–199.

Deng, S., & Macve, R. H. (2015, January 6). *The development of China's auditing profession: Globalizing translation meets self-determination in identity construction*. SSRN working paper. Retrieved from http://dx.doi.org/10.2139/ssrn.2562226.

Desender, K. A. (2009). *The relation between the ownership structure and the role of the board of directors*. Working paper, V. K. Zimmerman Center for International Education and Research in Accounting.

Dye, R. A. (1993). Auditing standards, legal liabilities, and auditor wealth. *Journal of Political Economy*, *101*, 887–914.

Francis, B., Hasan, I., & Li, L. (2016). Abnormal real operations, real earnings management, and subsequent crashes in stock prices. *Review of Quantitative Finance and Accounting*, *46*, 217–260.

Hillman, A., Cannella, A., & Paetzold, R. (2000). The resource dependence role of corporate directors: Strategic adaptation of board composition in response to environmental change. *Journal of Management Studies*, *37*, 235–256.

Hutton, A. P., Marcus, A. J., & Tehranian, H. (2009). Opaque financial reports, R^2, and crash risk. *Journal of Financial Economics*, *94*, 67–86.

Jin, L., & Myers, S. C. (2006). R^2 around the world: New theory and new tests. *Journal of Financial Economics*, *79*, 257–292.

Kaiser, H. F. (1960). The application of electronic computers to factor analysis. *Educational and Psychological Measurement*, *20*, 141–151.

Karamanou, I., & Vafeas, N. (2005). The association between corporate boards, audit committees, and management earnings forecasts: An empirical analysis. *Journal of Accounting Research*, *43*, 453–486.

Kennedy, P. (2008). *A guide to econometrics* (6th ed.). Malden: Blackwell.

Kim, Y., Li, H., & Li, S. (2014). Corporate social responsibility and stock price crash risk. *Journal of Banking & Finance*, *43*, 1–13.

Kim, J. B., Li, Y., & Zhang, L. (2011). Corporate tax avoidance and stock price crash risk: Firm-level analysis. *Journal of Financial Economics*, *100*, 639–662.

Kim, J. B., Wang, Z., & Zhang, L. (2016). CEO overconfidence and stock price crash risk. *Contemporary Accounting Research*, *33*, 1720–1749.

Kim, J. B., & Zhang, L. (2016). Accounting conservatism and stock price crash risk: Firm-level evidence. *Contemporary Accounting Research*, *33*, 412–441.

Klein, A. (2002). Audit committee, board of director characteristics and earnings management. *Journal of Accounting and Economics*, *33*, 375–400.

Kothari, S. P., Shu, S., & Wysocki, P. (2009). Do managers withhold bad news? *Journal of Accounting Research*, *47*, 241–276.

Krishnan, G. V. (2003). Audit quality and the pricing of discretionary accruals. *Auditing: A Journal of Practice & Theory*, *22*, 109–126.

La Porta, R., López-de-Silanes, F., Shleifer, A., & Vishny, R. (1998). Law and finance. *Journal of Political Economy*, *106*, 1113–1155.

La Porta, R., López-de-Silanes, F., Shleifer, A., & Vishny, R. (1999). Corporate ownership around the world. *Journal of Finance*, *54*, 471–517.

Li, W., & Cai, G. (2016). Religion and stock price crash risk: Evidence from China. *China Journal of Accounting Research*, *9*, 235–250.

Linck, J. S., Netter, J. M., & Yang, T. (2008). The determinants of board structure. *Journal of Financial Economics*, *87*, 308–328.

Masulis, R., Wang, C., & Xie, F. (2007). Corporate governance and acquirer returns. *Journal of Finance*, *62*, 1851–1889.

Morck, R., Wolfenzon, D., & Yeung, B. (2005). Corporate governance, economic entrenchment and growth. *Journal of Economic Literature*, *43*, 655–720.

Newman, D. P., Patterson, E. R., & Smith, J. R. (2005). The role of auditing in investor protection. *Accounting Review*, *80*, 289–313.

Piotroski, J. D., & Wang, T. J. (2012). Institutions and information environment of Chinese listed firms. In J. Fan & R. Morck (Eds.), *Capitalizing China*. Chicago: University of Chicago Press, 201–242.

Qi, D., Wu, W., & Zhang, H. (2000). Shareholding structure and corporate performance of partially privatized firms: Evidence from listed Chinese companies. *Pacific-Basin Finance Journal*, *8*, 587–610.

Sami, H., Wang, J., & Zhou, H. (2011). Corporate governance and operating performance of Chinese listed firms. *Journal of International Accounting, Auditing and Taxation*, *20*, 106–114.

Shivdasani, A. (1993). Board composition, ownership structure and hostile takeovers. *Journal of Accounting and Economics*, *16*, 167–198.

Shleifer, A., & Vishny, R. W. (1997). A survey of corporate governance. *Journal of Finance, 52*, 737–783.

Simunic, D. A., & Stein, M. T. (1996). The impact of litigation risk on audit pricing: A review of the economics and evidence. *Auditing: A Journal of Practice & Theory*, *15*, 119–134.

Stein, J. (1989). Efficient capital markets, inefficient firms: A model of myopic corporate behavior. *Quarterly Journal of Economics, 104*, 655–669.

Xie, B., Davidson III, W. N., & DaDalt, P. J. (2003). Earnings management and corporate governance: The roles of the board and the audit committee. *Journal of Corporate Finance*, *9*, 295–316.

Xu, N., Jiang, X., Chan, K. C., & Yi, Z. (2013). Analyst coverage, optimism, and stock price crash risk: Evidence from China. *Pacific-Basin Finance Journal*, *25*, 217–239.

Xu, N., Li, X., Yuan, Q., & Chan, K. C. (2014). Excess perks and stock price crash risk: Evidence from China. *Journal of Corporate Finance*, *25*, 419–434.

Yu, M., & Ashton, J. K. (2015). Board leadership structure for Chinese public listed companies. *China Economic Reform*, *34*, 236–248.

Zhou, J., Zhang, T., & Cui, S. (2011). Cross listing, corporate governance and corporate performance: Empirical evidence of Hong-Kong listed Chinese companies. *Nankai Business Review International*, *2*, 275–288.

Table 1
Descriptive statistics.[a]

Variable	N	Mean	Standard Deviation	5th Percentile	25th Percentile	Median	75th Percentile	95th Percentile
$NCSKEW_{T+1}$	11,427	-0.568	0.836	-1.611	-0.912	-0.535	-0.157	0.485
$DUVOL_{T+1}$	11,427	-0.387	0.462	-1.070	-0.658	-0.389	-0.109	0.322
$OWNER_T$	11,427	0.544	0.156	0.282	0.434	0.550	0.655	0.791
SOE_T	11,427	0.540	0.498	0.000	0.000	1.000	1.000	1.000
CL_T	11,427	0.027	0.162	0.000	0.000	0.000	0.000	0.000
AGM_T	11,427	0.471	0.162	0.213	0.347	0.475	0.587	0.735
$MGT\_OWNERSHIP_T$	11,427	0.036	0.114	0.000	0.000	0.000	0.001	0.323
$INDEPENDENCE_T$	11,427	0.363	0.053	0.333	0.333	0.333	0.375	0.444
$BOARD\_SIZE_T$	11,427	9.164	1.892	6.000	9.000	9.000	9.000	13.000
$DUALITY_T$	11,427	0.163	0.369	0.000	0.000	0.000	0.000	1.000
$GENDER_T$	11,427	0.847	0.104	0.647	0.790	0.864	0.929	1.000
AGE_T	11,427	47.972	3.192	42.571	45.864	48.040	50.105	53.111
$BIG4_T$	11,427	0.064	0.244	0.000	0.000	0.000	0.000	1.000
$MIDTERM_T$	11,427	0.050	0.218	0.000	0.000	0.000	0.000	0.000
$LN\_AUDIT\_FEES_T$	11,427	13.393	0.731	12.506	12.899	13.305	13.710	14.728
AO_T	11,427	0.940	0.237	0.000	1.000	1.000	1.000	1.000
$EXPERT_T$	11,427	0.002	0.049	0.000	0.000	0.000	0.000	0.000
LN_SIZE_T	11,427	21.526	1.210	19.520	20.793	21.517	22.254	23.559
MB_T	11,427	2.404	2.639	0.343	0.912	1.687	2.989	7.021
LEV_T	11,427	0.517	0.230	0.151	0.362	0.515	0.655	0.843
ROE_T	11,427	0.061	0.180	-0.164	0.024	0.068	0.121	0.247
EM_T	11,427	0.248	0.268	0.048	0.105	0.172	0.281	0.696
$DTURNOVER_T$	11,427	0.275	0.210	0.042	0.120	0.220	0.375	0.696
$NCSKEW_T$	11,427	-0.555	0.941	-1.579	-0.883	-0.509	-0.137	0.524
$DUVOL_T$	11,427	-0.372	0.489	-1.020	-0.636	-0.369	-0.094	0.339
$STDEV_T$	11,427	0.024	0.011	0.013	0.019	0.023	0.028	0.036
KUR_T	11,427	3.715	8.037	0.284	1.237	2.317	3.983	8.876
RET_T	11,427	-0.079	0.348	-0.626	-0.306	-0.104	0.133	0.541

Notes: This table presents the descriptive statistics of the main regression variables.
[a] Variable definitions:

NCSKEW	=	Negative coefficient of skewness for firm-specific daily returns of the company
DUVOL	=	Down-to-up volatility of the company
OWNER	=	Percentage of shares owned by top 10 shareholders
SOE	=	1 if the company was a state-owned enterprise, and 0 otherwise
CL	=	1 if the company was cross-listed in China and Hong Kong, and 0 otherwise
AGM	=	Percentage of shares owned by shareholders attending the annual general meeting
MGT_OWNERSHIP	=	Percentage of shares owned by management of the company
INDEPENDENCE	=	Percentage of independent directors on the board
BOARD_SIZE	=	Total number of directors on the board
DUALITY	=	1 if the same person served as the CEO and chair of the board, and 0 otherwise

GENDER	=	Percentage of executives who were male in the company
AGE	=	Average age of executives in the company
BIG4	=	1 if the company was audited by a Big Four audit firm, and 0 otherwise
MIDTERM	=	1 if the company had a midterm audit, and 0 otherwise
LN_AUDIT_FEES	=	Natural log of total audit fees
AO	=	1 if the company had an unqualified audit opinion, and 0 otherwise
EXPERT	=	1 if the auditor was an audit expert, and 0 otherwise
LN_SIZE	=	Natural log of market value of equity of the company
MB	=	Market-to-book ratio of equity of the company
LEV	=	Total liabilities divided by total assets of the company
ROE	=	Return on equity of the company
EM	=	Three-year moving sum of absolute discretionary accruals of the company
DTURNOVER	=	Average monthly stock turnover for current year minus average monthly stock turnover for previous year
STDEV	=	Standard deviation of firm-specific daily returns of the company
KUR	=	Kurtosis of firm-specific daily returns of the company
RET	=	Cumulative firm-specific daily returns of the company

Table 2
Correlation matrix.[a,b]

Variable		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
$NCSKEW_{T+1}$	1	**1.00**														
$DUVOL_{T+1}$	2	**0.84**	**1.00**													
$OWNER_T$	3	-0.00	0.01	**1.00**												
SOE_T	4	**-0.03**	**-0.02**	**0.12**	**1.00**											
CL_T	5	**-0.04**	**-0.03**	**0.26**	**0.12**	**1.00**										
AGM_T	6	-0.01	-0.01	**0.88**	**0.14**	**0.14**	**1.00**									
$MGT\_OWNERSHIP_T$	7	**0.03**	**0.03**	**0.11**	**-0.32**	**-0.05**	**0.08**	**1.00**								
$INDEPENDENCE_T$	8	**-0.02**	**-0.03**	-0.01	**-0.06**	**0.06**	**-0.04**	**0.09**	**1.00**							
$BOARD\_SIZE_T$	9	0.01	0.01	**0.10**	**0.21**	**0.11**	**0.12**	**-0.13**	**-0.31**	**1.00**						
$DUALITY_T$	10	**0.03**	0.01	**-0.05**	**-0.18**	**-0.03**	**-0.06**	**0.17**	**0.08**	**-0.14**	**1.00**					
$GENDER_T$	11	-0.01	-0.00	**0.10**	**0.19**	**0.07**	**0.11**	**-0.09**	**-0.03**	**0.13**	**-0.09**	**1.00**				
AGE_T	12	**-0.05**	-0.02	**0.06**	**0.24**	**0.16**	**0.09**	**-0.09**	**0.02**	**0.17**	**-0.07**	**0.16**	**1.00**			
$BIG4_T$	13	-0.02	-0.02	**0.20**	**0.11**	**0.38**	**0.20**	**-0.06**	**0.03**	**0.14**	**-0.05**	**0.07**	**0.14**	**1.00**		
$MIDTERM_T$	14	0.01	0.01	**0.06**	0.01	-0.00	**0.05**	**-0.04**	-0.02	**0.04**	-0.01	0.02	**-0.07**	-0.01	**1.00**	
$LN\_AUDIT\_FEES_T$	15	**-0.05**	**-0.03**	**0.21**	**0.14**	**0.48**	**0.19**	**-0.06**	**0.09**	**0.21**	**-0.07**	**0.10**	**0.33**	**0.49**	-0.01	**1.00**
AO_T	16	**-0.02**	**-0.04**	**0.09**	**0.08**	0.00	**0.12**	**0.05**	-0.00	**0.03**	**-0.02**	**0.03**	**0.09**	**0.04**	0.01	**0.09**
$EXPERT_T$	17	-0.00	-0.01	0.01	-0.01	**0.04**	0.01	0.02	**0.05**	0.01	-0.00	0.01	**0.02**	**0.05**	**0.05**	**0.06**
LN_SIZE_T	18	**0.07**	**0.09**	**0.05**	**0.12**	**0.17**	**0.05**	**-0.03**	**0.12**	**0.14**	**-0.05**	**0.08**	**0.34**	**0.22**	0.01	**0.55**
MB_T	19	**0.11**	**0.10**	**-0.19**	**-0.11**	**-0.08**	**-0.20**	**-0.02**	**0.05**	**-0.10**	**0.06**	**-0.07**	**-0.02**	**-0.10**	-0.01	**-0.14**
LEV_T	20	**-0.02**	-0.02	**-0.06**	**0.08**	**0.03**	**-0.07**	**-0.20**	0.01	**0.06**	**-0.06**	**0.05**	**-0.03**	0.00	**0.03**	**0.13**
ROE_T	21	**0.02**	**0.03**	**0.14**	0.00	0.02	**0.12**	**0.02**	0.00	0.02	-0.01	**-0.02**	**0.02**	**0.06**	**0.06**	**0.09**
EM_T	22	-0.00	-0.01	**0.06**	**-0.09**	**-0.02**	**0.04**	-0.01	**0.05**	**-0.08**	0.01	**-0.07**	**-0.07**	**-0.03**	**0.04**	-0.01
$DTURNOVER_T$	23	**0.06**	**0.04**	**-0.49**	**-0.09**	**-0.15**	**-0.44**	0.00	**0.02**	**-0.13**	**0.03**	**-0.04**	**-0.07**	**-0.19**	**-0.05**	**-0.24**
$NCSKEW_T$	24	**0.05**	**0.07**	0.00	**0.02**	**-0.03**	-0.01	0.01	-0.01	**0.02**	0.01	**0.02**	**-0.03**	0.01	**-0.03**	**-0.03**
$DUVOL_T$	25	**0.03**	**0.06**	-0.01	**0.03**	-0.01	-0.01	-0.01	**-0.02**	**0.03**	-0.00	**0.03**	**-0.02**	0.02	**-0.06**	**-0.02**
$STDEV_T$	26	**0.05**	**0.02**	-0.01	**-0.05**	**-0.06**	**-0.02**	-0.00	**-0.02**	**-0.06**	**0.02**	**-0.03**	**-0.14**	**-0.09**	**0.10**	**-0.16**
KUR_T	27	**-0.04**	**-0.05**	**0.02**	-0.02	**0.03**	**0.04**	**-0.02**	-0.01	0.00	0.01	**-0.02**	0.01	0.00	**0.03**	**0.03**
RET_T	28	**0.12**	**0.13**	**0.02**	**-0.05**	**-0.03**	0.00	**0.08**	0.02	**-0.02**	**0.03**	**-0.05**	0.00	**-0.04**	**0.07**	-0.02

Table 2 (continued)
Correlation matrix.[a]

Variable		16	17	18	19	20	21	22	23	24	25	26	27	28
$NCSKEW_{T+1}$	1													
$DUVOL_{T+1}$	2													
$OWNER_T$	3													
SOE_T	4													
CL_T	5													
AGM_T	6													
$MGT\_OWNERSHIP_T$	7													
$INDEPENDENCE_T$	8													
$BOARD\_SIZE_T$	9													
$DUALITY_T$	10													
$GENDER_T$	11													
AGE_T	12													
$BIG4_T$	13													
$MIDTERM_T$	14													
$LN\_AUDIT\_FEES_T$	15													
AO_T	16	**1.00**												
$EXPERT_T$	17	-0.00	**1.00**											
LN_SIZE_T	18	**0.20**	**0.03**	**1.00**										
MB_T	19	**-0.04**	-0.01	**0.24**	**1.00**									
LEV_T	20	**-0.33**	**0.02**	**-0.08**	**-0.03**	**1.00**								
ROE_T	21	**0.17**	0.01	**0.22**	**-0.08**	**-0.07**	**1.00**							
EM_T	22	**-0.06**	0.01	**0.05**	**0.09**	**0.11**	**0.11**	**1.00**						
$DTURNOVER_T$	23	0.01	**-0.02**	**0.08**	**0.30**	-0.01	**-0.07**	0.02	**1.00**					
$NCSKEW_T$	24	**-0.04**	-0.01	**-0.08**	**-0.07**	-0.00	**-0.04**	**-0.05**	**-0.09**	**1.00**				
$DUVOL_T$	25	**-0.07**	0.01	**-0.17**	**-0.16**	**0.02**	**-0.08**	**-0.05**	**-0.20**	**0.86**	**1.00**			
$STDEV_T$	26	**-0.07**	-0.01	**-0.09**	**0.16**	**0.07**	0.01	**0.11**	**0.31**	**-0.41**	**-0.49**	**1.00**		
KUR_T	27	-0.01	0.01	**-0.05**	**-0.03**	**0.02**	0.02	**0.06**	**-0.07**	**-0.70**	**-0.42**	**0.42**	**1.00**	
RET_T	28	**0.09**	**-0.03**	**0.23**	**0.26**	**-0.08**	**0.16**	**0.05**	**0.24**	**-0.33**	**-0.55**	**0.33**	**0.04**	**1.00**

Notes: This table presents the correlations among the main regression variables. Correlations that are statistically significant at the 5% level are highlighted in bold.
[a] Variable definitions:

NCSKEW	=	Negative coefficient of skewness for firm-specific daily returns of the company
DUVOL	=	Down-to-up volatility of the company
OWNER_COMP	=	Composite measure for ownership function
BOARD_COMP	=	Composite measure for board function
AUDIT_COMP	=	Composite measure for audit function
OWNER	=	Percentage of shares owned by top 10 shareholders
SOE	=	1 if the company was a state-owned enterprise, and 0 otherwise

CL	=	1 if the company was cross-listed in China and Hong Kong, and 0 otherwise
AGM	=	Percentage of shares owned by shareholders attending the annual general meeting
MGT_OWNERSHIP	=	Percentage of shares owned by management of the company
INDEPENDENCE	=	Percentage of independent directors on the board
BOARD_SIZE	=	Total number of directors on the board
DUALITY	=	1 if the same person served as the CEO and chair of the board, and 0 otherwise
GENDER	=	Percentage of executives who were male in the company
AGE	=	Average age of executives in the company
BIG4	=	1 if the company was audited by a Big Four audit firm, and 0 otherwise
MIDTERM	=	1 if the company had a midterm audit, and 0 otherwise
LN_AUDIT_FEES	=	Natural log of total audit fees
AO	=	1 if the company had an unqualified audit opinion, and 0 otherwise
EXPERT	=	1 if the auditor was an audit expert, and 0 otherwise
LN_SIZE	=	Natural log of market value of equity of the company
MB	=	Market-to-book ratio of equity of the company
LEV	=	Total liabilities divided by total assets of the company
ROE	=	Return on equity of the company
EM	=	Three-year moving sum of absolute discretionary accruals of the company
DTURNOVER	=	Average monthly stock turnover for current year minus average monthly stock turnover for previous year
STDEV	=	Standard deviation of firm-specific daily returns of the company
KUR	=	Kurtosis of firm-specific daily returns of the company
RET	=	Cumulative firm-specific daily returns of the company

Table 3
Regression analysis on the relationship between crash risk and ownership, board, and audit functions.[a]

		$NCSKEW_{T+1}$				$DUVOL_{T+1}$			
		Model 1		Model 2		Model 1		Model 2	
Variable	Predicted sign	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat
Intercept		-2.320***	-6.51	-1.833***	-4.64	-1.751***	-9.26	-1.609***	-7.67
Composite variables									
$OWNER\_COMP_T$	-	-0.025***	-2.82			-0.012**	-2.45		
$BOARD\_COMP_T$	-	-0.013*	-1.86			0.000	-0.08		
$AUDIT\_COMP_T$	-	-0.043***	-3.44			-0.030***	-4.59		
Ownership variables									
$OWNER_T$	+			0.303***	2.63			0.210***	3.42
SOE_T	-			-0.023	-1.31			-0.019**	-2.07
CL_T	-			-0.158***	-2.76			-0.057*	-1.88
AGM_T	-			-0.271***	-2.59			-0.220***	-3.96
$MGT\_OWNERSHIP_T$	+			0.190**	2.50			0.086**	2.14
Board variables									
$INDEPENDENCE_T$	-			-0.189	-1.23			-0.114	-1.40
$BOARD\_SIZE_T$	-			0.002	0.38			0.001	0.45
$DUALITY_T$	+			0.035	1.64			0.004	0.37
$GENDER_T$	-			0.006	0.08			0.013	0.31
AGE_T	-			-0.004	-1.50			0.002	1.47
Audit variables									
$BIG4_T$	-			0.047	1.26			0.000	0.01
$MIDTERM_T$	-			-0.079**	-2.24			-0.043**	-2.27
$LN\_AUDIT\_FEES_T$	-			-0.055***	-3.20			-0.028***	-3.01
AO_T	-			-0.113***	-3.21			-0.085***	-4.54
$EXPERT_T$	-			-0.015	-0.10			-0.020	-0.24
Control variables									
LN_SIZE_T		0.063***	6.79	0.083***	7.91	0.047***	9.49	0.054***	9.69
MB_T		0.014***	4.13	0.012***	3.47	0.002	0.86	0.001	0.41
LEV_T		-0.025	-0.73	-0.018	-0.47	0.001	0.07	-0.007	-0.37
ROE_T		-0.048	-1.07	-0.056	-1.23	-0.046*	-1.94	-0.044*	-1.85
EM_T		-0.058*	-1.77	-0.064**	-1.96	-0.047***	-2.69	-0.046***	-2.64
$DTURNOVER_T$		-0.017	-0.37	0.002	0.04	-0.020	-0.80	-0.014	-0.47
$NCSKEW_T$		0.121***	9.42	0.116***	9.01				
$DUVOL_T$						0.231***	18.64	0.224***	18.05
$STDEV_T$		5.376***	5.38	4.926***	4.82	5.583***	10.21	5.351***	9.55
KUR_T		0.003**	1.97	0.003**	2.12	0.000	0.37	0.000	0.59
RET_T		0.287***	10.47	0.277***	10.00	0.302***	19.07	0.296***	18.53
$\sum INDUSTRY$		*Yes*		*Yes*		*Yes*		*Yes*	
$\sum YEAR$		*Yes*		*Yes*		*Yes*		*Yes*	
N		11,427		11,427		11,427		11,427	
F-Sig		25.68***		20.69***		51.50***		40.57***	
R^2		8.08%		8.49%		14.99%		15.39%	

Notes: ***, **, and * indicate significance at the levels of 0.01, 0.05, and 0.10, respectively (2-tailed).

This table presents the results of the regression analysis on the relationship between crash risk and ownership, board, and audit functions. Model 1 is associated with equations (10) and (11), while Model 2 is based on equations (5) and (6).

[a] Variable definitions:

NCSKEW	=	Negative coefficient of skewness for firm-specific daily returns of the company
DUVOL	=	Down-to-up volatility of the company
OWNER_COMP	=	Composite measure for ownership function
BOARD_COMP	=	Composite measure for board function
AUDIT_COMP	=	Composite measure for audit function
OWNER	=	Percentage of shares owned by top 10 shareholders
SOE	=	1 if the company was a state-owned enterprise, and 0 otherwise
CL	=	1 if the company was cross-listed in China and Hong Kong, and 0 otherwise
AGM	=	Percentage of shares owned by shareholders attending the annual general meeting
MGT_OWNERSHIP	=	Percentage of shares owned by management of the company
INDEPENDENCE	=	Percentage of independent directors on the board
BOARD_SIZE	=	Total number of directors on the board
DUALITY	=	1 if the same person served as the CEO and chair of the board, and 0 otherwise
GENDER	=	Percentage of executives who were male in the company
AGE	=	Average age of executives in the company
BIG4	=	1 if the company was audited by a Big Four audit firm, and 0 otherwise
MIDTERM	=	1 if the company had a midterm audit, and 0 otherwise
LN_AUDIT_FEES	=	Natural log of total audit fees
AO	=	1 if the company had an unqualified audit opinion, and 0 otherwise
EXPERT	=	1 if the auditor was an audit expert, and 0 otherwise
LN_SIZE	=	Natural log of market value of equity of the company
MB	=	Market-to-book ratio of equity of the company
LEV	=	Total liabilities divided by total assets of the company
ROE	=	Return on equity of the company
EM	=	Three-year moving sum of absolute discretionary accruals of the company
DTURNOVER	=	Average monthly stock turnover for current year minus average monthly stock turnover for previous year
STDEV	=	Standard deviation of firm-specific daily returns of the company
KUR	=	Kurtosis of firm-specific daily returns of the company
RET	=	Cumulative firm-specific daily returns of the company
$\sum$*INDUSTRY*	=	Fixed effects dummy variable for industry groups
$\sum$*YEAR*	=	Fixed effects dummy variable for year groups

Table 4

Subperiod (pre- and post-IFRS/reform periods) regression analysis on the relationship between crash risk and ownership, board, and audit functions.[a]

Panel A (crash risk measure = $NCSKEW_{T+1}$)

		$NCSKEW_{T+1}$							
		Year ≤ 2007 (pre-IFRS/reform period)				Year > 2007 (post-IFRS/reform period)			
		Model 1		Model 2		Model 1		Model 2	
Variable	Predicted sign	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat
Intercept		-3.277***	-5.38	-1.679**	-2.24	-1.894***	-6.24	-1.697***	-4.94
Composite variables									
$OWNER\_COMP_T$	-	0.037	1.51			-0.033***	-3.89		
$BOARD\_COMP_T$	-	-0.045**	-2.40			-0.002	-0.35		
$AUDIT\_COMP_T$	-	-0.051*	-1.72			-0.037***	-3.00		
Ownership variables									
$OWNER_T$	+			-0.265	-0.88			0.459***	4.15
SOE_T	-			-0.006	-0.14			-0.022	-1.33
CL_T	-			-0.052	-0.33			-0.166***	-3.09
AGM_T	-			0.094	0.36			-0.366***	-3.60
$MGT\_OWNERSHIP_T$	+			-0.389	-0.83			0.122*	1.90
Board variables									
$INDEPENDENCE_T$	-			-0.043	-0.10			-0.157	-1.10
$BOARD\_SIZE_T$	-			0.000	0.02			0.003	0.60
$DUALITY_T$	+			0.031	0.53			0.027	1.37
$GENDER_T$	-			0.196	0.94			-0.019	-0.26
AGE_T	-			-0.007	-1.09			-0.003	-1.08
Audit variables									
$BIG4_T$	-			0.205**	2.25			-0.012	-0.34
$MIDTERM_T$	-			0.023	0.33			-0.119***	-3.02
$LN\_AUDIT\_FEES_T$	-			-0.107**	-2.45			-0.039**	-2.32
AO_T	-			-0.167**	-2.08			-0.081**	-2.21
$EXPERT_T$	-			-0.139	-0.47			0.082	0.43
Control variables									
LN_SIZE_T		0.136***	5.19	0.145***	5.09	0.045***	5.21	0.063***	6.24
MB_T		0.029**	2.34	0.025**	1.99	0.009***	3.13	0.008***	2.65
LEV_T		0.065	0.72	0.019	0.19	-0.002	-0.05	0.011	0.30
ROE_T		-0.115	-1.13	-0.112	-1.07	-0.035	-0.78	-0.046	-1.02
EM_T		-0.223**	-2.02	-0.222**	-1.98	-0.025	-0.84	-0.035	-1.18
$DTURNOVER_T$		-0.023	-0.14	-0.130	-0.69	-0.061	-1.43	-0.016	-0.33
$NCSKEW_T$		-0.040	-1.28	-0.040	-1.27	0.182***	14.56	0.177***	14.09
$STDEV_T$		2.142	0.60	1.706	0.47	6.126***	6.84	5.645***	6.14
KUR_T		-0.001	-0.28	-0.001	-0.26	0.003*	1.95	0.003**	2.15
RET_T		-0.177**	-2.57	-0.166**	-2.38	0.465***	17.25	0.452***	16.64
$\sum INDUSTRY$		*Yes*		*Yes*		*Yes*		*Yes*	
$\sum YEAR$		*Yes*		*Yes*		*Yes*		*Yes*	
N		3,128		3,128		8,299		8,299	
F-Sig		8.30***		6.17***		32.76***		25.33***	
R^2		7.67%		7.92%		11.88%		12.37%	

Notes: ***, **, and * indicate significance at the levels of 0.01, 0.05, and 0.10, respectively (2-tailed).

Panel B (crash risk measure = $DUVOL_{T+1}$)

		$DUVOL_{T+1}$ Year ≤ 2007 (pre-IFRS/reform period)				Year > 2007 (post-IFRS/reform period)			
		Model 1		Model 2		Model 1		Model 2	
Variable	Predicted sign	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat
Intercept		-1.430***	-5.33	-0.757**	-2.29	-1.706***	-9.13	-1.696***	-8.02
Composite variables									
$OWNER\_COMP_T$	-	0.001	0.07			-0.010*	-1.86		
$BOARD\_COMP_T$	-	-0.011	-1.34			0.003	0.78		
$AUDIT\_COMP_T$	-	-0.046***	-3.52			-0.019**	-2.53		
Ownership variables									
$OWNER_T$	+			-0.003	-0.02			0.245***	3.59
SOE_T	-			-0.038*	-1.93			-0.006	-0.63
CL_T	-			0.075	1.07			-0.088***	-2.66
AGM_T	-			-0.134	-1.17			-0.229***	-3.67
$MGT\_OWNERSHIP_T$	+			-0.206	-1.01			0.072*	1.82
Board variables									
$INDEPENDENCE_T$	-			0.022	0.12			-0.134	-1.52
$BOARD\_SIZE_T$	-			0.001	0.25			0.001	0.44
$DUALITY_T$	+			0.006	0.25			0.001	0.11
$GENDER_T$	-			0.101	1.10			-0.005	-0.11
AGE_T	-			0.002	0.71			0.002	1.38
Audit variables									
$BIG4_T$	-			0.037	0.91			-0.007	-0.31
$MIDTERM_T$	-			-0.001	-0.02			-0.049**	-2.01
$LN\_AUDIT\_FEES_T$	-			-0.058***	-3.00			-0.021**	-2.03
AO_T	-			-0.118***	-3.33			-0.055**	-2.45
$EXPERT_T$	-			-0.085	-0.66			0.001	0.00
Control variables									
LN_SIZE_T		0.057***	4.95	0.058***	4.63	0.044***	8.24	0.053***	8.51
MB_T		0.013**	2.33	0.011**	2.04	-0.001	-0.38	-0.001	-0.70
LEV_T		0.106***	2.65	0.059	1.31	-0.023	-1.11	-0.019	-0.84
ROE_T		-0.079*	-1.76	-0.068	-1.48	-0.038	-1.37	-0.041	-1.46
EM_T		-0.091*	-1.86	-0.083*	-1.68	-0.030*	-1.66	-0.032*	-1.74
$DTURNOVER_T$		-0.098	-1.41	-0.145*	-1.75	-0.019	-0.73	-0.007	-0.23
$DUVOL_T$		0.072**	2.55	0.067**	2.38	0.276***	20.46	0.270***	19.93
$STDEV_T$		3.451**	2.19	3.110*	1.94	5.977***	10.45	5.746***	9.77
KUR_T		0.001	0.82	0.001	0.71	0.000	-0.51	0.000	-0.21
RET_T		0.026	0.77	0.032	0.91	0.410***	23.01	0.401***	22.31
$\sum INDUSTRY$		*Yes*		*Yes*		*Yes*		*Yes*	
$\sum YEAR$		*Yes*		*Yes*		*Yes*		*Yes*	
N		3,128		3,128		8,299		8,299	
F-Sig		14.80***		11.09***		52.68***		39.91***	
R^2		12.91%		13.39%		17.81%		18.20%	

Notes: ***, **, and * indicate significance at the levels of 0.01, 0.05, and 0.10, respectively (2-tailed).

This table presents the results of the regression analysis on the relationship between crash risk and ownership, board, and audit functions for the pre- and post-IFRS/reform subperiods. Panel A presents the results for the NCSKEW crash risk measure, while Panel B presents the results for the DUVOL crash risk measure. Model 1 is associated with equations (10) and (11), while Model 2 is based on equations (5) and (6).

[a] Variable definitions:

NCSKEW	=	Negative coefficient of skewness for firm-specific daily returns of the company
DUVOL	=	Down-to-up volatility of the company
OWNER_COMP	=	Composite measure for ownership function
BOARD_COMP	=	Composite measure for board function
AUDIT_COMP	=	Composite measure for audit function
OWNER	=	Percentage of shares owned by top 10 shareholders
SOE	=	1 if the company was a state-owned enterprise, and 0 otherwise
CL	=	1 if the company was cross-listed in China and Hong Kong, and 0 otherwise
AGM	=	Percentage of shares owned by shareholders attending the annual general meeting
MGT_OWNERSHIP	=	Percentage of shares owned by management of the company
INDEPENDENCE	=	Percentage of independent directors on the board
BOARD_SIZE	=	Total number of directors on the board
DUALITY	=	1 if the same person served as the CEO and chair of the board, and 0 otherwise
GENDER	=	Percentage of executives who were male in the company
AGE	=	Average age of executives in the company
BIG4	=	1 if the company was audited by a Big Four audit firm, and 0 otherwise
MIDTERM	=	1 if the company had a midterm audit, and 0 otherwise
LN_AUDIT_FEES	=	Natural log of total audit fees
AO	=	1 if the company had an unqualified audit opinion, and 0 otherwise
EXPERT	=	1 if the auditor was an audit expert, and 0 otherwise
LN_SIZE	=	Natural log of market value of equity of the company
MB	=	Market-to-book ratio of equity of the company
LEV	=	Total liabilities divided by total assets of the company
ROE	=	Return on equity of the company
EM	=	Three-year moving sum of absolute discretionary accruals of the company
DTURNOVER	=	Average monthly stock turnover for current year minus average monthly stock turnover for previous year
STDEV	=	Standard deviation of firm-specific daily returns of the company
KUR	=	Kurtosis of firm-specific daily returns of the company
RET	=	Cumulative firm-specific daily returns of the company
$\sum$*INDUSTRY*	=	Fixed effects dummy variable for industry groups
$\sum$*YEAR*	=	Fixed effects dummy variable for year groups

Table 5

Subsample (after the elimination of financial firms) regression analysis on the relationship between crash risk and ownership, board, and audit functions.[a]

		$NCSKEW_{T+1}$				$DUVOL_{T+1}$			
		Model 1		Model 2		Model 1		Model 2	
Variable	Predicted sign	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat
Intercept		-2.274***	-6.42	-1.747***	-4.44	-1.738***	-9.34	-1.532***	-7.41
Composite variables									
$OWNER\_COMP_T$	-	-0.025***	-2.81			-0.010**	-2.19		
$BOARD\_COMP_T$	-	-0.014*	-1.89			-0.001	-0.27		
$AUDIT\_COMP_T$	-	-0.042***	-3.35			-0.031***	-4.76		
Ownership variables									
$OWNER_T$	+			0.317***	2.77			0.216***	3.58
SOE_T	-			-0.018	-1.06			-0.015*	-1.67
CL_T	-			-0.158***	-2.77			-0.059**	-1.97
AGM_T	-			-0.271***	-2.61			-0.210***	-3.84
$MGT\_OWNERSHIP_T$	+			0.185**	2.46			0.083**	2.09
Board variables									
$INDEPENDENCE_T$	-			-0.186	-1.21			-0.114	-1.42
$BOARD\_SIZE_T$	-			0.001	0.31			0.001	0.41
$DUALITY_T$	+			0.034*	1.63			0.007	0.64
$GENDER_T$	-			0.010	0.13			0.018	0.45
AGE_T	-			-0.004*	-1.62			0.001	1.03
Audit variables									
$BIG4_T$	-			0.050	1.35			0.012	0.61
$MIDTERM_T$	-			-0.067*	-1.88			-0.038**	-2.07
$LN\_AUDIT\_FEES_T$	-			-0.059***	-3.44			-0.032***	-3.58
AO_T	-			-0.119***	-3.38			-0.096***	-5.20
$EXPERT_T$	-			-0.031	-0.19			-0.036	-0.43
Control variables									
LN_SIZE_T		0.061***	6.60	0.082***	7.88	0.046***	9.52	0.055***	9.99
MB_T		0.013***	4.00	0.011***	3.31	0.001	0.48	0.000	-0.01
LEV_T		-0.025	-0.74	-0.018	-0.48	0.008	0.47	-0.001	-0.04
ROE_T		-0.045	-1.01	-0.054	-1.19	-0.034	-1.47	-0.033	-1.40
EM_T		-0.055*	-1.70	-0.063*	-1.93	-0.046***	-2.72	-0.047***	-2.74
$DTURNOVER_T$		-0.018	-0.38	0.007	0.13	-0.020	-0.82	-0.007	-0.23
$NCSKEW_T$		0.123***	9.61	0.117***	9.20				
$DUVOL_T$						0.236***	19.34	0.229***	18.71
$STDEV_T$		5.353***	5.28	4.790***	4.61	5.612***	10.26	5.282***	9.41
KUR_T		0.003*	1.93	0.003**	2.12	0.000	0.24	0.000	0.57
RET_T		0.300***	10.99	0.289***	10.49	0.312***	20.00	0.305***	19.38
$\sum INDUSTRY$		*Yes*		*Yes*		*Yes*		*Yes*	
$\sum YEAR$		*Yes*		*Yes*		*Yes*		*Yes*	
N		11,359		11,359		11,359		11,359	
F-Sig		26.36***		21.15***		53.58***		42.10***	
R^2		8.13%		8.55%		15.24%		15.69%	

Notes: ***, **, and * indicate significance at the levels of 0.01, 0.05, and 0.10, respectively (2-tailed).

This table presents the results of the regression analysis on the relationship between crash risk and ownership, board, and audit functions after the elimination of financial firms from the sample. Model 1 is associated with equations (10) and (11), while Model 2 is based on equations (5) and (6).

[a] Variable definitions:

NCSKEW	=	Negative coefficient of skewness for firm-specific daily returns of the company
DUVOL	=	Down-to-up volatility of the company
OWNER_COMP	=	Composite measure for ownership function
BOARD_COMP	=	Composite measure for board function
AUDIT_COMP	=	Composite measure for audit function
OWNER	=	Percentage of shares owned by top 10 shareholders
SOE	=	1 if the company was a state-owned enterprise, and 0 otherwise
CL	=	1 if the company was cross-listed in China and Hong Kong, and 0 otherwise
AGM	=	Percentage of shares owned by shareholders attending the annual general meeting
MGT_OWNERSHIP	=	Percentage of shares owned by management of the company
INDEPENDENCE	=	Percentage of independent directors on the board
BOARD_SIZE	=	Total number of directors on the board
DUALITY	=	1 if the same person served as the CEO and chair of the board, and 0 otherwise
GENDER	=	Percentage of executives who were male in the company
AGE	=	Average age of executives in the company
BIG4	=	1 if the company was audited by a Big Four audit firm, and 0 otherwise
MIDTERM	=	1 if the company had a midterm audit, and 0 otherwise
LN_AUDIT_FEES	=	Natural log of total audit fees
AO	=	1 if the company had an unqualified audit opinion, and 0 otherwise
EXPERT	=	1 if the auditor was an audit expert, and 0 otherwise
LN_SIZE	=	Natural log of market value of equity of the company
MB	=	Market-to-book ratio of equity of the company
LEV	=	Total liabilities divided by total assets of the company
ROE	=	Return on equity of the company
EM	=	Three-year moving sum of absolute discretionary accruals of the company
DTURNOVER	=	Average monthly stock turnover for current year minus average monthly stock turnover for previous year
STDEV	=	Standard deviation of firm-specific daily returns of the company
KUR	=	Kurtosis of firm-specific daily returns of the company
RET	=	Cumulative firm-specific daily returns of the company
$\sum$*INDUSTRY*	=	Fixed effects dummy variable for industry groups
$\sum$*YEAR*	=	Fixed effects dummy variable for year groups

Table 6

Regression analysis using alternative composite measures of ownership, board, and audit function.[a]

		$NCSKEW_{T+1}$		$DUVOL_{T+1}$	
Variable	Predicted sign	Coefficient	t-stat	Coefficient	t-stat
Intercept		-2.710***	-7.38	-1.889***	-9.70
PCA composite variables					
$OWNER1_T$	-	-0.008	-0.86	-0.009*	-1.66
$OWNER2_T$	-	-0.034***	-3.89	-0.017***	-3.64
$BOARD1_T$	-	-0.004	-0.53	0.007	1.52
$BOARD2_T$	-	-0.016*	-1.91	-0.001	-0.13
$AUDIT1_T$	-	-0.031***	-3.22	-0.020***	-3.96
$AUDIT2_T$	-	-0.012	-1.50	-0.006	-1.51
$AUDIT3_T$	-	-0.028***	-3.49	-0.020***	-4.72
Control variables					
LN_SIZE_T		0.074***	7.63	0.050***	9.72
MB_T		0.013***	3.82	0.001	0.68
LEV_T		-0.040	-1.11	-0.017	-0.87
ROE_T		-0.043	-0.96	-0.038	-1.59
EM_T		-0.063*	-1.92	-0.045**	-2.57
$DTURNOVER_T$		-0.019	-0.35	-0.031	-1.07
$NCSKEW_T$		0.118***	9.20		
$DUVOL_T$				0.227***	18.31
$STDEV_T$		5.181***	5.10	5.516***	9.91
KUR_T		0.003*	1.94	0.000	0.33
RET_T		0.285***	10.31	0.301***	18.96
$\sum INDUSTRY$		*Yes*		*Yes*	
$\sum YEAR$		*Yes*		*Yes*	
N		11,427		11,427	
F-Sig		23.98***		47.60***	
R^2		8.31%		15.24%	

Notes: ***, **, and * indicate significance at the levels of 0.01, 0.05, and 0.10, respectively (2-tailed).

This table presents the results of the regression analysis on the relationship between crash risk and ownership, board, and audit functions using the PCA composite variables. The regressions are based on equations (12) and (13).

[a] Variable definitions:

NCSKEW	=	Negative coefficient of skewness for firm-specific daily returns of the company
DUVOL	=	Down-to-up volatility of the company
OWNER1	=	Factor 1 for ownership function generated from PCA
OWNER2	=	Factor 2 for ownership function generated from PCA
BOARD1	=	Factor 1 for board function generated from PCA
BOARD2	=	Factor 2 for board function generated from PCA
AUDIT1	=	Factor 1 for audit function generated from PCA
AUDIT2	=	Factor 2 for audit function generated from PCA
AUDIT3	=	Factor 3 for audit function generated from PCA
LN_SIZE	=	Natural log of market value of equity of the company
MB	=	Market-to-book ratio of equity of the company
LEV	=	Total liabilities divided by total assets of the company
ROE	=	Return on equity of the company
EM	=	Three-year moving sum of absolute discretionary accruals of the company
DTURNOVER	=	Average monthly stock turnover for current year minus average monthly stock turnover for previous year
STDEV	=	Standard deviation of firm-specific daily returns of the company
KUR	=	Kurtosis of firm-specific daily returns of the company
RET	=	Cumulative firm-specific daily returns of the company
$\sum INDUSTRY$	=	Fixed effects dummy variable for industry groups
$\sum YEAR$	=	Fixed effects dummy variable for year groups

Table 7
Regression analysis with firm fixed effect on the relationship between crash risk and ownership, board, and audit functions.[a]

		$NCSKEW_{T+1}$				$DUVOL_{T+1}$			
		Model 1		Model 2		Model 1		Model 2	
Variable	Predicted sign	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat
Intercept		-2.375***	-6.77	-1.934***	-4.97	-1.759***	-9.42	-1.626***	-7.86
Composite variables									
$OWNER\_COMP_T$	-	-0.025***	-2.83			-0.011**	-2.30		
$BOARD\_COMP_T$	-	-0.013*	-1.84			0.000	-0.04		
$AUDIT\_COMP_T$	-	-0.040***	-3.24			-0.029***	-4.37		
Ownership variables									
$OWNER_T$	+			0.323***	2.82			0.222***	3.64
SOE_T	-			-0.026	-1.50			-0.019**	-2.11
CL_T	-			-0.159***	-2.79			-0.056*	-1.84
AGM_T	-			-0.294***	-2.83			-0.232***	-4.19
$MGT\_OWNERSHIP_T$	+			0.205***	2.72			0.086**	2.15
Board variables									
$INDEPENDENCE_T$	-			-0.194	-1.27			-0.126	-1.54
$BOARD\_SIZE_T$	-			0.001	0.21			0.000	0.14
$DUALITY_T$	+			0.035*	1.66			0.004	0.34
$GENDER_T$	-			0.019	0.25			0.014	0.35
AGE_T	-			-0.004	-1.61			0.002	1.36
Audit variables									
$BIG4_T$	-			0.035	0.95			-0.007	-0.34
$MIDTERM_T$	-			-0.086**	-2.43			-0.046**	-2.45
$LN\_AUDIT\_FEES_T$	-			-0.052***	-3.05			-0.027***	-2.93
AO_T	-			-0.111***	-3.17			-0.084***	-4.52
$EXPERT_T$	-			-0.014	-0.09			-0.027	-0.34
Control variables									
LN_SIZE_T		0.062***	6.74	0.084***	8.07	0.046***	9.37	0.055***	9.82
MB_T		0.015***	4.43	0.012***	3.62	0.002	1.08	0.001	0.43
LEV_T		-0.033	-0.97	-0.019	-0.51	-0.004	-0.25	-0.009	-0.45
ROE_T		-0.041	-0.93	-0.050	-1.11	-0.040*	-1.68	-0.039	-1.63
EM_T		-0.042	-1.43	-0.044	-1.50	-0.037**	-2.40	-0.035**	-2.23
$DTURNOVER_T$		0.006	0.14	0.021	0.38	-0.011	-0.43	-0.007	-0.25
$NCSKEW_T$		0.125***	9.79	0.119***	9.28				
$DUVOL_T$						0.237***	19.21	0.229***	18.47
$STDEV_T$		5.422***	5.47	4.878***	4.81	5.569***	10.27	5.266***	9.47
KUR_T		0.003**	2.07	0.003**	2.22	0.000	0.47	0.000	0.73
RET_T		0.290***	10.57	0.278***	10.04	0.305***	19.30	0.297***	18.66
$\sum YEAR$		*Yes*		*Yes*		*Yes*		*Yes*	
$\sum FIRM$		*Yes*		*Yes*		*Yes*		*Yes*	
N		11,427		11,427		11,427		11,427	
F-Sig		39.99***		28.39***		80.68***		55.72***	
R^2		7.76%		8.23%		14.52%		14.97%	

Notes: ***, **, and * indicate significance at the levels of 0.01, 0.05, and 0.10, respectively (2-tailed).

This table presents the results of the regression analysis with firm fixed effect on the relationship between crash risk and ownership, board, and audit functions using the PCA composite variables. Model 1 is associated with equations (10) and (11), while Model 2 is based on equations (5) and (6) with firm fixed effect.

[a] Variable definitions:

NCSKEW	=	Negative coefficient of skewness for firm-specific daily returns of the company
DUVOL	=	Down-to-up volatility of the company
OWNER_COMP	=	Composite measure for ownership function
BOARD_COMP	=	Composite measure for board function
AUDIT_COMP	=	Composite measure for audit function
OWNER	=	Percentage of shares owned by top 10 shareholders
SOE	=	1 if the company was a state-owned enterprise, and 0 otherwise
CL	=	1 if the company was cross-listed in China and Hong Kong, and 0 otherwise
AGM	=	Percentage of shares owned by shareholders attending the annual general meeting
MGT_OWNERSHIP	=	Percentage of shares owned by management of the company
INDEPENDENCE	=	Percentage of independent directors on the Board
BOARD_SIZE	=	Total number of directors on the Board
DUALITY	=	1 if the same person served as the CEO and Chair of the Board, and 0 otherwise
GENDER	=	Percentage of executives who were male in the company
AGE	=	Average age of executives in the company
BIG4	=	1 if the company was audited by a Big Four audit firm, and 0 otherwise
MIDTERM	=	1 if the company had a midterm audit, and 0 otherwise
LN_AUDIT_FEES	=	Natural log of total audit fees
AO	=	1 if the company had an unqualified audit opinion, and 0 otherwise
EXPERT	=	1 if the auditor was an audit expert, and 0 otherwise
LN_SIZE	=	Natural log of market value of equity of the company
MB	=	Market-to-book ratio of equity of the company
LEV	=	Total liabilities divided by total assets of the company
ROE	=	Return on equity of the company
EM	=	Three-year moving sum of absolute discretionary accruals of the company
DTURNOVER	=	Average monthly stock turnover for current year minus average monthly stock turnover for previous year
STDEV	=	Standard deviation of firm-specific daily returns of the company
KUR	=	Kurtosis of firm-specific daily returns of the company
RET	=	Cumulative firm-specific daily returns of the company
$\sum YEAR$	=	Fixed effects dummy variable for year groups
$\sum FIRM$	=	Fixed effects dummy variable for firm groups

Table 8

2SLS regression analysis on the relationship between crash risk and ownership, board, and audit functions (using industry averages as instrumental variables).[a]

First stage

Variable	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat
Intercept	-1.541***	-8.08	-1.176**	-5.38	-3.578***	-23.68
$AVE\_OWNER\_COMP_T$	0.422***	9.60				
$AVE\_BOARD\_COMP_T$			0.317***	4.84		
$AVE\_AUDIT\_COMP_T$					-0.149**	-2.09
Control variables						
LN_SIZE_T	0.128***	17.59	0.140***	15.11	0.259***	49.11
MB_T	-0.011***	-3.39	-0.019***	-4.70	-0.053***	-21.80
LEV_T	0.320***	9.08	0.226***	5.20	0.081***	3.16
ROE_T	-0.260***	-5.58	-0.098*	-1.69	0.099***	2.92
EM_T	-0.163***	-5.36	-0.046	-1.23	-0.181***	-8.17
$DTURNOVER_T$	-0.194***	-4.52	-0.346***	-6.49	-0.651***	-20.75
$NCSKEW_T$	-0.014	-1.11	0.015	0.91	0.019**	1.97
$STDEV_T$	0.532	0.56	-2.266*	-1.92	4.056***	5.85
KUR_T	0.001	0.77	0.003*	1.82	0.001	0.75
RET_T	-0.180***	-6.50	-0.017	-0.51	0.014	0.69
N	11,427		11,427		11,427	
F-Sig	52.90***		38.68***		320.71***	
R^2	4.85%		3.59%		23.61%	

Second stage

		$NCSKEW_{T+1}$		$DUVOL_{T+1}$	
Variable	Predicted Sign	Coefficient	t-stat	Coefficient	t-stat
Intercept		-3.506	-0.80	-9.330***	-5.19
$PREDICTED\_OWNER\_COMP_T$	-	-0.687**	-2.20	-0.371**	-2.25
$PREDICTED\_BOARD\_COMP_T$	-	-0.845*	-1.76	-0.644**	-2.69
$PREDICTED\_AUDIT\_COMP_T$	-	-0.145	-0.13	-1.889***	-4.08
Control variables					
LN_SIZE_T		0.287	0.92	0.664***	5.28
MB_T		-0.016	-0.26	-0.114***	-4.59
LEV_T		0.388**	2.34	0.415***	5.50
ROE_T		-0.288**	-2.36	-0.017	-0.31
EM_T		-0.217	-0.96	-0.473***	-4.89
$DTURNOVER_T$		-0.509	-0.66	-1.534***	-4.96
$NCSKEW_T$		0.125***	4.71		
$DUVOL_T$				0.291***	16.03
$STDEV_T$		4.414	0.93	12.504***	5.60
KUR_T		0.007***	2.69	0.002***	2.82
RET_T		0.153***	2.62	0.260***	8.29
$\sum INDUSTRY$		*YES*		*YES*	
$\sum YEAR$		*YES*		*YES*	
N		11,427		11,427	
F-Sig		25.36***		51.67***	
R^2		7.99%		15.04%	

Notes: ***, **, and * indicate significance at the levels of 0.01, 0.05, and 0.10, respectively (2-tailed).

This table presents the results of the 2SLS regression analysis on the relationship between crash risk and ownership, board, and audit functions. *AVE_OWNER_COMP*, *AVE_BOARD_COMP*, and *AVE_AUDIT_COMP* are used as instrumental variables in the first stage of the 2SLS model. The regressions are based on equations (14) to (18).

[a] Variable definitions:

NCSKEW	=	Negative coefficient of skewness for firm-specific daily returns of the company
DUVOL	=	Down-to-up volatility of the company
AVE_OWNER_COMP	=	Average composite measure for ownership function of firms in the same industry
AVE_BOARD_COMP	=	Average composite measure for board function of firms in the same industry
AVE_AUDIT_COMP	=	Average composite measure for audit function of firms in the same industry
PREDICTED_OWNER_COMP	=	Predicted value of the composite measure for ownership function as estimated in the first stage of 2SLS
PREDICTED_BOARD_COMP	=	Predicted value of the composite measure for board function as estimated in the first stage of 2SLS
PREDICTED_AUDIT_COMP	=	Predicted value of the composite measure for audit function as estimated in the first stage of 2SLS
LN_SIZE	=	Natural log of market value of equity of the company
MB	=	Market-to-book ratio of equity of the company
LEV	=	Total liabilities divided by total assets of the company
ROE	=	Return on equity of the company
EM	=	Three-year moving sum of absolute discretionary accruals of the company
DTURNOVER	=	Average monthly stock turnover for current year minus average monthly stock turnover for previous year
STDEV	=	Standard deviation of firm-specific daily returns of the company
KUR	=	Kurtosis of firm-specific daily returns of the company
RET	=	Cumulative firm-specific daily returns of the company
$\sum$*INDUSTRY*	=	Fixed effects dummy variable for industry groups
$\sum$*YEAR*	=	Fixed effects dummy variable for year groups