Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Elsevier hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre - including this research content - immediately available in PubMed Central and other publicly funded repositories, such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active.
Recent trends in economic research

Foreign investors and stock price crash risk: Evidence from China

Zhi-xiong Huang\textsuperscript{a}, Qi Tang\textsuperscript{b}, Siming Huang\textsuperscript{c,}\textsuperscript{*}

\textsuperscript{a} School of Accounting, Zhejiang University of Finance and Economics, China
\textsuperscript{b} School of Economics, Huazhong University of Science and Technology, China
\textsuperscript{c} School of Finance, Taxation and Public Administration, Jiangxi University of Finance and Economics, China

\section{Abstract}

This study examines whether and how foreign investors affect firm-specific crash risk. Based on China's stock market, we show that foreign investors significantly increase stock price crash risk and the positive association is more pronounced in firms with high levels of information asymmetry or efficient internal control. We address endogeneity issue using a quasi-natural experiment, namely, the revision of Foreign Investment Industrial Guidance Catalog in 2011, and results still hold. Overall, this study provides policy implications on the effect of foreign investor in emerging capital markets.

© 2020 Economic Society of Australia, Queensland. Published by Elsevier B.V. All rights reserved.

1. Introduction

Stock price crash risk (hereafter crash risk), defined as an extreme and significant decline in stock price, has drawn increased attention of researchers, investors and regulators in the past decade. Although the literature has well documented various determinants of crash risks, whether and how foreign investors affect crash risk remain unclear. Given the significant association between foreign investors on firm decisions and the significant trend in globalization of finance and investment, an evaluation of the causal effect of foreign investors on crash risk should be of particular interest to economists and regulators, who are concerned with financial market development and stability.

As we know, foreign investors, generally with large shareholdings, have the incentive to collect information and monitor management because they reap greater benefits than smaller investors from listed firms by monitoring and disciplining managers (Shleifer and Vishny, 1986, 1997). Accordingly, we expect that foreign investors will increase the possibility of firms’ disclosing bad news. Once a flood of bad news hoarded in the past is released, thereby increasing crash risk.

To conduct the empirical analysis, we follow Kim et al. (2011a,b) to use the negative coefficient of skewness (Ncskew) and down-to-up volatility (Duvol) to measure crash risk and find that foreign investors significantly increase crash risk in China. One major concern in our baseline findings is that foreign investors and crash risk may be endogenously determined, and thus our estimation may be biased. To solve the potential endogeneity problem, we follow Lu et al.
and use a difference-in-differences (DID) approach that relies on a plausibly exogenous shock to foreign investors, namely, the revision of Foreign Investment Industrial Guidance Catalog in 2011. The baseline findings are robust under the DID approach.

Furthermore, we investigate whether the positive association between foreign investors and crash risk is affected by information asymmetry and internal control. We predict that foreign investors will increase the possibility of firms’ disclosing bad news for firms suffering from serious information asymmetry, and their monitoring role is more prominent in an efficient internal control environment. Therefore, the positive association between foreign investors and crash risk is more significant in these firms.

We make two contributions to the literature. First, we enrich and expand the literature on the determinants of crash risk. Although the literature has well documented the determinants of crash risks, due to data unavailability, however, whether and how the foreign investors affect crash risk remain unclear. On the basis of the manually collected data in the context of China setting, the present work complements the research gap by showing that foreign investors substantially increase crash risk. Moreover, the result is consistent with the notion that foreign investors can lower the threshold at which withholding bad news for managers and helping elicit bad news disclosure from managers become extremely costly or difficult, which is different from other literature.

Second, we evaluate the economic consequences of foreign investors from the aspect of crash risk. Crash risk is an important market feature and has drawn increased attention from researchers, investors, and regulators in the past decade. On the basis of China’s unique setting, we also contribute to the corporate governance literature by showing that the effect of foreign investors is particularly pronounced in firms with serious agency problems. This study also provides policy implications about the market information transmission with an important open-door policy in China’s capital market.

The remainder of this paper is organized as follows. Section 2 reviews prior literature and develops our hypothesis. Section 3 describes the sample, variable measurement, and regression model. Section 4 presents descriptive statistics and primary results. Section 5 shows the cross-sectional analysis. Section 6 is robustness section. Finally, Section 7 draws conclusions and discussions.

2. Hypothesis development

In comparison with external investors, corporate managers often possess higher levels of private information about firm operations, asset values and future prospects, as well as reluctance to report bad news due to concerns about their careers, compensation contracts, personal benefits and other factors (Nagar et al., 2003; Graham et al., 2005; Kothari et al., 2009). When the accumulated bad news finally crosses a tipping point, continuing to withhold such news and all the accumulated unfavorable information will be extremely difficult and costly for managers, which will result in stock price crash (Jin and Myers, 2006; An and Zhang, 2013).

Existing studies have documented that foreign investors improve price efficiency (He and Shen, 2014). Given their superior expertise and sophistication, foreign investors are good at information discovery and gleaning insights from public information, which accelerates the incorporation of firm-specific information into stock prices (Kim and Yi, 2015; Lim et al., 2016). Moreover, increased foreign access to domestic stock markets stimulates research and information production by domestic and foreign analysts, brokerages and other market participants. It also prompts local firms to disclose information further, which improves the information environment.

In addition, foreign investors, especially institutional investors, can be considered an effective external supervisor of a firm that improves corporate governance mechanisms and promotes corporate governance practices (Ferreira and Matos, 2008; Aggarwal et al., 2011; Beuselinck et al., 2017). Their monitoring role increases the private costs of managers suppressing bad news and acts as a strong external discipline to corporate managers.

From the above research, we argue that the value of foreign investors lies in limiting bad news hoarding either by inducing managers to disclose it voluntarily or by directly releasing the bad news that managers have incentives to withhold. Thus, we come up with the following hypothesis:

**H1: A positive relationship exists between foreign ownership and crash risk.**

Prior research suggests that when firm’s financial reports are opaque, firm-specific information is less likely to affect its stock returns, which enables managers to hide adverse information for an extended period of time. However, as the firm-specific information is finally revealed to the market, the firm may face a high likelihood of extreme outcomes, which triggers price crash (Hutton et al., 2008; Kim et al., 2019).

Managers can easily hoard bad news under the cover of information asymmetry, which makes it difficult for market participants to understand the true firm performance; this situation facilitates bad news hoarding and enables managerial resource diversion for an extended period of time (Roychowdhury and Sletten, 2012; Cheng et al., 2020). Hence, we further propose that:

**H2: The effect of foreign investors on increasing crash risk is enhanced in a relatively opaque environment.**

---

1. Crash risks include analyst coverage (Xu et al., 2013; Huang, 2018), managers’ conservatism (Kim and Zhang, 2016), tax avoidance (Kim et al., 2011a,b), internal control weakness (Hong and Lee, 2015), CEO’s overconfidence (Kim et al., 2016), stock liquidity (Chang et al., 2017), and religion (Callen and Fang, 2015).
Finally, as a special corporate management activity to control business risk, internal controls can restrict employees’ moral hazard behavior and irrational decision making, and help limit the ability of corporate insiders to withhold bad news, thereby reducing the behavior of hoarding negative management information (Chen et al., 2017). Foreign investors and internal control complement each other in firms’ governance structures because their goals coincide in enhancing the effective supervision of managers.

With an efficient internal control environment, foreign investors can be better informed and expedite the information transmission from managers to external investors, which increases the private costs of managers suppressing bad news. In this manner, the probability of self-serving information hoarding behavior will objectively be reduced. Thus, we conjecture that:

**H3: The effect of foreign investors on increasing crash risk is enhanced in an efficient internal control environment.**

### 3. Sample, variables, and research design

#### 3.1. Sample

We use three sources to construct our variables: (1) The data of foreign investors are manually collected and sorted. (2) The data of internal control index are from the DIB Internal Control and Risk Management database. (3) Other data are from the China Stock Market and Accounting Research (CSMAR) database.

Our sample covers all nonfinancial firms that are publicly traded on the Chinese A-share market from 2006 to 2016. After removing the samples of special treatment (ST) companies and those missing data for the main variables, we are left with 18,727 firm-year observations.

#### 3.2. Variables

##### 3.2.1. Crash risk

We construct two measures following Kim et al. (2011a,b) to calculate crash risk. First, we estimate firm-specific weekly returns, denoted by $W$, as shown as follows:

$$r_{i,t} = \alpha_i + \beta_1 r_{m, t-2} + \beta_2 r_{m, t-1} + \beta_3 r_{m, t} + \beta_4 r_{m, t+1} + \beta_5 r_{m, t+2} + \varepsilon_{i,t}. \tag{1}$$

where $r_{i,t}$ is the return on stock $i$ in week $t$, and $r_{m, t}$ is the value-weighted A-share market return in week $t$. The firm-specific weekly returns for firm $i$ in week $t$ are represented by $W_{i,t} = \ln(1 + \varepsilon_{i,t})$, where $\varepsilon_{i,t}$ is the residual in Eq. (1).

The first measure of crash risk is the negative coefficient of skewness ($Ncskew$), which is calculated as follows: for each firm $i$ in year $t$,

$$Ncskew_{i,t} = -\frac{n (n-1)^{3/2}}{(n-2)(n-1)} \sum W_{i,t}^3, \tag{2}$$

where $n$ is the number of observations of firm-specific weekly returns of firm $i$ during year $t$. The growth of $Ncskew$ indicates that the firm is experiencing high crash risk.

The second measure of crash risk is down-to-up volatility ($Duvol$), which is calculated as follows. For any stock $i$ in year $t$, we separate the periods whose weekly returns are below the annual mean (down weeks) from those whose weekly returns are above the period mean (up weeks), and calculate the standard deviation of firm-specific weekly returns separately for each group. We then take the log of the ratio of the standard deviation of the down weeks to that of the up weeks. Thus, we have:

$$Duvol_{i,t} = \frac{(n_u - 1) \sum_{down} W_{i,t}^2}{(n_d - 1) \sum_{up} W_{i,t}^2}, \tag{3}$$

where $n_u$ and $n_d$ are the numbers of up and down weeks, respectively. A higher value of $Duvol$ indicates a greater crash risk.

---

2 The index is designed based on the realization of the five internal control goals (Control environment, Risk assessment, Control activities, Information & communication, and Monitoring), and the basic internal control index is constructed to reflect the level of internal controls and the risk control capability of listed firms.

3 We select the fiscal year of 2006 as the beginning of the sample period because foreign investors entered the Chinese market in 2006 and have since become an investment force that cannot be ignored in China. The reason why we stop with 2016 data is the Chinese financial supervision organization issued a series of regulation policies to oversee financial stability and development in 2017, which means 2017 will be a key and turning year to reform and coordinated regulation of the financial sector. As stock markets are more efficient and robust with more transparent information environments, risk characteristics such as stock price crash risk will change accordingly.
Table 1

| Variable   | Definition                                                                 |
|------------|-----------------------------------------------------------------------------|
| Ncskew     | The negative coefficient of skewness. See Eq. (2) for detail.                |
| Duvol      | The down-to-up volatility. See Eq. (3) for detail.                           |
| FIO        | Foreign investors’ ownership, the sum of all foreign investors’ shareholdings from Top 10 shareholders list of the firm. |
| Per_FIO    | Average shareholding of foreign investors                                    |
| Logsize    | Natural logarithm of the firm’s total assets at the end of the year.         |
| Lev        | The ratio of total asset and total liability.                                |
| Tobinq     | Tobin’s Q Ratio.                                                            |
| ROA        | The ratio of net income and total assets.                                    |
| Soe        | Dummy variable equal to 1 for a firm is state-owned enterprise and 0 otherwise. |
| Volatility | Annualized stock volatility.                                                |
| Indep      | The ratio of independent directors on the board.                            |
| Boardsize  | Natural logarithm of board size.                                            |
| Big4       | Dummy variable equal to 1 if auditors are from the big four accounting firms in China and 0 otherwise. |
| Top1       | The shareholding of the controlling shareholder.                            |
| Sigma      | The standard deviation of firm-specific weekly returns(after market adjustment) over the fiscal year. |
| Ret        | The mean of firm-specific weekly returns over the fiscal year.              |

3.2.2. Foreign investors

We collect foreign ownership from the annual reports of the listed A-share firms on the Shanghai Stock Exchange and the Shenzhen Stock Exchange from 2006 to 2016. We investigate whether shareholders with a shareholding percentage of over 5% or the top 10 shareholders are foreign investors. Particularly, we trace the individual shareholders (including corporations) and institutional shareholders by examining their nationalities or country of actual controller. If the shareholders are foreign individuals or institutions, then they are deemed foreign investors. We then take the foreign investors’ ownership (FIO) and average shareholding of foreign investors (Per_FIO) in a listed firm as the proxy variables of foreign investors.

3.3. Research design

To investigate the effect of foreign investors on crash risk, we estimate the regression equation as follows:

\[ crash\_risk_{i,t+1} = \alpha + \beta_1 FIO_{i,t} + \beta_2 Controls_{i,t} + \beta_3 \sum \text{Year} + \beta_4 \sum \text{Firm} + \varepsilon_{i,t}, \]

where Ncskew and Duvol are used as a proxy for crash risk, and FIO is foreign ownership in firm i measured by FIO and Per_FIO. The dependent variable is measured in year \( t + 1 \), whereas all the independent variables are measured in year \( t \). The set of control variables include firm size (Logsize), the ratio of total assets and total liabilities (Lev), Tobin’s Q (Tobinq), and the ratio of net income and total assets (ROA). The detailed definitions are presented in Table 1. We also include firm and year dummies to control for firm and year fixed effects, respectively. If \( H1 \) is valid, then \( \beta_1 \) in Eq. (4) will be positive and significant.

4. Empirical results

4.1. Descriptive statistics

Table 2 presents the sample’s descriptive statistics. The mean values of Ncskew and Duvol are \(-0.214\) and \(-0.126\), respectively. The corresponding standard deviation are 0.734 and 0.496, respectively. The mean values of FIO and Per_FIO are 2.210 and 1.908, respectively. Thus, on average, less than 3% of foreign investors follow a firm in a given year, and a considerably large scope still exist for further opening of the capital market.

4.2. Foreign investors and crash risk

Columns (1) to (2), (4) to (5) of Table 3 report the effect of foreign investors on crash risk to test \( H1 \) and present coefficient estimates for Eq. (4). The estimated coefficients of FIO and Per_FIO are 0.005 and 0.007 in Columns (1) and (2), respectively. Regarding economic significance, a one standard deviation increase of FIO will lead to a 21% \((= 8.952 \times 0.005/0.214)\) increase in Ncskew at the mean, whereas a similar increase of Per_FIO will increase Ncskew by 25% \((= 7.712 \times 0.007/0.214)\) at the mean. Columns (4) and (5) show that the estimated coefficients of FIO and Per_FIO are 0.003 and 0.004. A one standard deviation rise of FIO and Per_FIO will increase Duvol by 21% and 24% at the mean.

These findings suggest that as an effective external supervisor of a firm, foreign investors have the incentive to collect information and monitor management, which increases the private costs of managers suppressing bad news. The interactions between foreign investors and firm management can expedite the information transmission from managers to external investors. As the threshold for disclosure is lowered, a flood of bad news hoarded in the past will be released, thereby increasing crash risk.
Table 2

Descriptive statistics.

| Variable | Mean | Std. Dev | Min | Max | Median | N   |
|----------|------|----------|-----|-----|--------|-----|
| NC skew  | −0.214 | 0.734 | −5.054 | 4.620 | −0.169 | 18,727 |
| Du vol   | −0.126 | 0.496 | −2.778 | 2.384 | −0.124 | 18,727 |
| FIO      | 2.210 | 8.952 | 0 | 88.550 | 0 | 18,727 |
| Per_FIO  | 2.210 | 8.952 | 0 | 88.550 | 0 | 18,727 |
| Logsize  | 15.040 | 1.260 | 12.709 | 18.773 | 14.88 | 18,727 |
| Lev      | 0.460 | 0.211 | 0.073 | 0.941 | 0.463 | 18,727 |
| Tobinq   | 2.159 | 1.862 | 0.212 | 9.248 | 1.601 | 18,727 |
| ROA      | 0.038 | 0.051 | −0.149 | 0.163 | 0.035 | 18,727 |
| Soe      | 0.484 | 0.500 | 0 | 1 | 0 | 18,727 |
| Volatility | 0.505 | 0.148 | 0.268 | 0.871 | 0.476 | 18,727 |
| Indep    | 0.369 | 0.054 | 0.091 | 0.800 | 0.333 | 18,727 |
| Boardsize | 2.279 | 0.179 | 1.792 | 2.773 | 2.303 | 18,727 |
| Big4     | 0.061 | 0.240 | 0 | 1 | 0 | 18,727 |
| Top1     | 35.821 | 15.365 | 0.290 | 89.990 | 33.850 | 18,727 |
| Sigma    | 0.053 | 0.028 | 0.010 | 1.390 | 0.049 | 18,727 |
| Ret      | −0.002 | 0.006 | −0.339 | 0.508 | −0.001 | 18,727 |

Notes. This table presents descriptive statistics for the sample in 2006–2016. The data of foreign investors (FIO and Per_FIO) are manually collected and sorted, and the other data are from the CSMAR database. Variables are defined in Table 1.

4.3. Endogeneity

Foreign investors and crash risk may be endogenously determined, and our estimation may be biased. Therefore, we attempt to solve the potential endogeneity problem by using a DID approach.

On December 24, 2011, the China’s National Development and Reform Commission (NDRC) and the Ministry of Commerce of China (MOFCOM) jointly issued the revised Catalog of Industries for Guiding Foreign Investment, which is to be implemented on January 30, 2012. The policy, which aims to accelerate the construction of a new open economy and improve foreign investment policies, is largely exogenous to firms’ crash risk. In other words, the 2011 Catalog can only affect crash risk by affecting foreign ownership.

Referring to the “Catalog of Statistical Products”, we match the product code for each entry in the catalog to obtain information about changes for each product in the 2007 and 2011 Catalogs. We also match the product codes to the four-digit industry code of the “Standard Industrial Classification Codes” and accordingly map the entries in the catalog to the four-digit industry level.

On the basis of the study of Lu et al. (2017), we then assign each product to one of three possible outcomes: (1) FDI became more welcome; (2) FDI became less welcome; and (3) no change occurs in FDI regulations between 2007 and 2011. Given that different subsectors of the same four-digit industry may face different adjustments to foreign investment controls, all four-digit industries are classified into four categories. (1) Encouraged Industries: All products in an industry are encouraged or partially increased, whereas the rest remain unchanged in FDI regulations. (2) No-change Industries: All products in an industry remain the same in FDI regulations. (3) Restricted Industries: All products in an industry are restricted or partially discouraged, whereas the rest remain unchanged in FDI regulations. (4) Mixed Industries: Some of the possible catalog products experience an improvement, whereas some other products are worsening in FDI regulations.

According to Lu et al. (2017), the latter two groups are excluded from the analysis. The firms in Encouraged Industries are taken as the experimental group, whereas firms in No-Change Industries are considered as the control group. We take the period from 2009 to 2013 as the inspection period and construct two dummy variables, that is, $Treat_i$ and $Post_t$, which takes a value of 1 from 2012 to 2013 and 0 from 2009 to 2011.

$$crash_{risk_{i,t+1}} = \alpha + \beta_1Treat_i \times Post_t + \beta_2Controls_{i,t} + \beta_3 \sum Year + \beta_4 \sum Firm + \epsilon_{i,t},$$ (5)

Fig. 1 shows that after the revision of the 2011 Catalog, the average crash risk of the experimental and control groups no longer showed a common trend, indicating that the DID approach satisfies the parallel trend hypothesis.

Columns (3) and (6) in Table 3 report the results of the DID tests on how a plausibly exogenous shock to foreign investors, due to the revision of Catalog, affects crash risk. Also, it shows that the firms included in the experimental group will bear greater crash risk after the revision of the 2011 Catalog.
5. Cross-sectional analysis

The literature suggests that information asymmetry and corporate governance are factors that influence the effect of foreign investors on bad news withholding behavior. In this section, we further investigate whether these factors affect the association between foreign investors and crash risk.

5.1. Information asymmetry

Information transparency is the core of maintaining the equity and justice of the capital market and an important way to protect investors, and it is thus crucial to the capital market. A lack of information disclosure limits the ability of capital and labor markets to effectively monitor and discipline managers, which leads to bad news accumulation. Managers’ bad news boarding behavior impedes the incorporation of bad news into stock price. Then, once the bad news is rapidly released, a stock price crash occurs. In this regard, we predict that the effect of foreign investors on crash risk is more pronounced when firms are plagued more by information asymmetry.

On the basis of the studies of Hou et al. (2005), for each firm and year, we initially estimate a regression of the return in week $t$ on the value-weighted local index return and its lagged values up to the previous four weeks plus the world index return, as shown as follows:

$$r_{i,t} = \alpha_1 + \beta_1 r_{m,t} + \sum_{n=1}^{4} \delta_n r_{m,t-n} + \epsilon_{i,t},$$  

(6)
where $r_{i,t}$ represents the returns from stock $i$ in week $t$, $r_{m,t-n}$ is the value-weighted local market return in week $t$, and $r_{m,t-n}$ is the corresponding value-weighted local market return in week $t$.

The delay measure $D1$ compares the fraction of variability in stock returns, which is the result of lagged market returns. It compares the value of $R^2$ from the regression above with that obtained when the coefficients on lagged market returns $\delta_{i,n}$ are constrained to zero, as shown as follows:

$$D1_i = 1 - \frac{R^2_{i}}{R^2_{i}}. \tag{7}$$

The larger the $D1$ is, the greater the variation will be in stock returns captured by lagged market returns, which implies a longer price delay in responding to market information. With greater information asymmetry between managers and external investors, investors are less likely to be aware of managers’ privately observed news, which provides managers with greater opportunities to delay the release of bad news. As such, we separate the sample into firms with below- and above-median price efficiency (PE), denoted as Low_PE and High_PE, respectively. For each group, we then examine the effect of foreign investors on crash risk.

Consistent with our expectation, in Table 4, we find significant, positive coefficients on $FIO$ and $Per\_FIO$ in Columns (2) and (4), while coefficients on $FIO$ and $Per\_FIO$ in Columns (1) and (3) are insignificant. These results suggest that managers
Table 4
Foreign investors and price efficiency.

| Variables | ncskew (1) High_PE | ncskew (2) Low_PE | duvol (3) High_PE | duvol (4) Low_PE |
|-----------|-------------------|------------------|------------------|-----------------|
| FIO       | −0.001 (−0.210)   | 0.008*** (3.091) | 0.001 (0.408)    | 0.005*** (2.764) |
| Per_FIO   | −0.003 (−0.909)   | 0.011*** (3.587) | 0.001 (0.405)    | 0.007*** (3.675) |
| Logsize   | −0.022 (−0.775)   | 0.088*** (3.807) | −0.039** (−2.129) | −0.039** (−2.124) |
| Lev       | −0.060 (−0.606)   | −0.049 (−0.555)  | −0.048 (−0.711)  | −0.048 (−0.717)  |
| Tobing    | 0.024** (2.190)   | 0.045*** (5.081) | 0.014* (1.919)   | 0.014* (1.916)   |
| ROA       | 0.264 (0.961)     | 0.307 (1.380)    | 0.028 (0.158)    | 0.028 (0.163)    |
| Soe       | 0.027 (0.384)     | 0.046 (0.737)    | 0.063 (1.130)    | 0.063 (1.131)    |
| Volatility| −0.399** (−2.258) | −0.199 (−1.466)  | −0.162 (−1.357)  | −0.162 (−1.357)  |
| Indep     | 0.251 (0.930)     | 0.219 (0.796)    | 0.002 (0.011)    | 0.002 (0.010)    |
| Boardsize | −0.044 (−0.401)   | 0.077 (0.804)    | 0.018 (0.248)    | 0.018 (0.250)    |
| Big4      | −0.052 (−0.542)   | 0.061 (0.922)    | −0.021 (−0.341)  | −0.021 (−0.342)  |
| Top1      | 0.0002 (0.138)    | −0.003 (−1.918)  | 0.0001 (−1.952)  | 0.0001 (−1.952)  |
| Sigma     | 9.785*** (5.986)  | 2.228*** (3.526) | 5.340*** (4.981) | 5.339*** (4.979) |
| Ret       | 78.141*** (78.113) | 5.890*** (5.327) | 46.433*** (4.981) | 46.420*** (4.979) |
| Constant  | −0.242 (−0.391)   | −2.145*** (−3.012) | 0.173 (0.431)    | 0.172 (0.428) |

| N         | 9,364             | 9,364            | 9,364            | 9,364           |
| Year fixed effects | Yes       | Yes         | Yes         | Yes        |
| Firm fixed effects | Yes       | Yes         | Yes         | Yes        |
| R²        | 0.354            | 0.354          | 0.326          | 0.326          |

Notes. This table presents the results of the impact of foreign investors on crash risk in two groups divided by price efficiency. Columns (1) to (2) and (3) to (4), respectively with ncskew and Duvol as the dependent variables. T-statistics reported in parentheses are clustered at the firm level. *, **, *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Main variables are defined in Table 1.

can easily hoard bad news under the cover of information asymmetry. The increase in the accumulation of bad news can easily cause stock price crash if firms are forced to disclose it, which confirms H2.

5.2. Internal control

Previous studies report that as a special corporate management activity to control business risk, internal controls can restrict employee moral hazard behaviors (i.e., the internal control system will mitigate negative management information hoarding behavior; Hong and Lee, 2015; Chen et al., 2017). Firms with efficient internal control are therefore less likely to withhold bad news. Thus, we predict that the positive association between foreign investors and crash risk is more pronounced in an efficient internal control environment.

Following Chan et al. (2020), we choose internal control index (Index) as our measure of internal control efficiency. High values of internal control index correspond to firms with high internal control efficiency. For each year, we group the sample by the tertiles of internal control index (Index). If a firm’s index equals to or below the first tertile of the industry, then the firm is included in the Low_Index sample; otherwise, it is included in the High_Index sample. The results are reported in Table 5.

Columns (1) and (3) (Columns (2) and (4)) present the results of the firms with Low_Index (High_Index). We find significant, positive coefficients on FIO and Per_FIO in the High_Index group, but insignificant coefficients on FIO and Per_FIO in the Low_Index group. The result is due to the fact that foreign investors may act as an external supervisor and play an important role in an efficient internal control environment, which can speed up the information transmission from managers to external investors and constrain the accumulation of bad news. Our results indicate that the association between foreign investors and crash risk is confined to firms with efficient internal control, which supports H3.

As is mentioned above, foreign investors can expedite the information transmission from managers to outside investors, thereby improving the information environment. Our results suggest there is a complementary relation between the quality of firm’s corporate governance and disclosure. If corporate governance and disclosure are complements, we expect
6. Robustness tests

6.1. Remove the impact of the 2008 financial crisis and the 2015 China’s stock market crash

Considering that the stock market turbulence caused by the financial crisis in 2008 and the stock market crash in 2015 would have an impact on stock price crash risk, thus interfering the test results, we hence exclude the samples of 2008 and 2015 and the results in Table 6 are consistent with our expectations and remain significant.

6.2. Another measure of information asymmetry

Following Hou et al. (2005), we also compute two additional delay measures to measure information asymmetry, they are,

\[ D_2 = \frac{\sum_{n=1}^{4} |\delta_{i,n}|}{|\beta_i| + \sum_{n=1}^{4} |\delta_{i,n}|} \]  

\[ D_3 = \frac{\sum_{n=1}^{4} |\delta_{i,n}| / se(\delta_{i,n})}{|\beta_i| / se(\beta_i) + \sum_{n=1}^{4} |\delta_{i,n}| / se(\delta_{i,n})} \]
Table 6
Robustness tests (foreign investors and stock price crash risk).

| Variable | ncskew | duvol |
|----------|--------|-------|
|          | (1)    | (2)   | (3)    | (4)    |
| FIO      | 0.005** | 0.003** |        |        |
|          | (2.450) | (1.972) |        |        |
| Per_FIO  |        | 0.007***|        | 0.004***|
|          | (2.840) | (2.667) |        |        |
| Logsize  | 0.049***| 0.050***| 0.015  | 0.015  |
|          | (2.708) | (1.74)  | (1.211) |        |
| Lev      | −0.069 | −0.069  | −0.023 | −0.023 |
|          | (−1.054)| (−1.055)| (−0.508)| (−0.501)|
| Tobing   | 0.038***| 0.038***| 0.023***| 0.023***|
|          | (5.126) | (4.648) | (4.648) |        |
| ROA      | −0.041 | −0.038  | −0.103 | −0.101 |
|          | (−1.923)| (−0.785)| (−0.769)|        |
| Soe      | 0.061  | 0.060   | 0.062* | 0.062* |
|          | (1.300) | (1.295) | (1.893) | (1.898) |
| Volatility| −0.221*| −0.222*| −0.218***| −0.219***|
|          | (−2.593)| (−2.629)| (−2.658)| (−2.662)|
| Indep    | 0.446** | 0.447** | 0.215* | 0.214* |
|          | (2.353) | (2.356) | (1.659) | (1.658) |
| Boardsize| 0.043  | 0.042   | 0.052  | 0.051  |
|          | (0.562) | (0.549) | (0.993) | (0.972) |
| Big4     | 0.040  | 0.037   | 0.048  | 0.045  |
|          | (0.623) | (0.579) | (1.088) | (1.033) |
| Top1     | −0.003***| −0.003***| −0.002** | −0.002**|
|          | (−4.953)| (−4.629)| (−2.497)| (−2.552)|
| Sigma    | 3.577***| 3.581***| 2.173***| 2.176***|
|          | (4.152) | (4.151) | (4.327) | (4.325) |
| Ret      | 10.806***| 10.815***| 6.129***| 6.135***|
|          | (3.309) | (3.308) | (3.041) | (3.039) |
| Constant | −1.861***| −1.868***| −0.998***| −1.001***|
|          | (−4.230)| (−4.245)| (−3.433)| (−3.444)|

| N       | 15353  | 15353  | 15353  | 15353  |
| Year fixed effects | Yes | Yes | Yes | Yes |
| Firm fixed effects | Yes | Yes | Yes | Yes |
| R²      | 0.253  | 0.253  | 0.251  | 0.251  |

Notes. This table presents the results of the impact of foreign investors on crash risk after excluding the samples of 2008 and 2015. Columns (1) to (2) and (3) to (4), respectively with Ncskew and Duvo1 as the dependent variable. T-statistics reported in parentheses are clustered at the firm level. *, **, *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Main variables are defined in Table 1.

where \( se(\delta_{i,t}) \) represents the standard error of the coefficient estimate from Eq. (6). These measures capture the magnitude of the lagged coefficients relative to the magnitude of all market return coefficients. We use the absolute values of each coefficient regardless of their estimated signs, because price efficiency is smaller as these measures deviate from zero.

Similar to Section 5.1, we separate the sample into firms with below- and above-median price efficiency (PE), denoted as Low_PE and High_PE, respectively. The regression results in Table 6 show that foreign investors significantly increase crash risk in the group with lower values of PE, while in the group with higher values of PE, foreign investors have no significant effect on crash risk (see Table 7).

6.3. Another measure of internal control

As earnings management has links to internal control quality, the level of internal control can be used to determine the level of earnings management activities in the sampled firms. We choose real earnings management (TREM) as our measure of internal control efficiency. Low values of TREM correspond to firms with better internal control.

To calculate the measures of real earnings management, we follow Dechow et al. (1998), Roychowdhury (2006) to run the following cross-sectional regression for every industry and year:

\[
\frac{\text{CFO}_{i,t}}{A_{i,t-1}} = \alpha_0 + \alpha_1 \frac{1}{A_{i,t-1}} + \alpha_2 \frac{\text{REV}_{i,t}}{A_{i,t-1}} + \alpha_3 \frac{\Delta \text{REV}_{i,t}}{A_{i,t-1}} + \varepsilon_{i,t},
\]

(10)

where \( \text{CFO}_{i,t} \) is net cash flow from operating activities for firm \( i \) in year \( t \), \( A_{i,t-1} \) is the total assets for firm \( i \) in year \( t-1 \), \( \Delta \text{REV}_{i,t} \) represents the difference between the firm’s prime operating revenue in year \( t \).
Table 7
Robustness tests (foreign investors and price efficiency).

Panel A: Delay measure (D2)

| Variables | nskew | duovel |
|-----------|-------|--------|
| FIO       | 0.002 | 0.008*** |
|           | (0.580) | (2.775) |
| Per_FIO   | 0.0001 | 0.00002 |
|           | (0.059) | (2.407) |
| Logsize   | 0.111*** |
|           | (0.609) | (3.538) |
| Lev       | 0.113*** |
|           | (0.1459) | (4.781) |
| Tobing    | 0.112*** |
|           | (0.094) | (0.762) |
| ROA       | 0.011*** |
|           | (1.914) | (5.770) |
| Soe       | 0.021*** |
|           | (0.820) | (1.289) |
| Volatility| 0.026*** |
|           | (0.363) | (0.812) |
| Indep     | 0.050*** |
|           | (0.316) | (0.194) |
| Boardsize | 0.011*** |
|           | (1.109) | (1.317) |
| Big4      | 0.009*** |
|           | (0.060) | (0.051) |
| Top1      | 0.001*** |
|           | (0.024) | (0.012) |
| Sigma     | 2.120*** |
|           | (5.821) | (5.363) |
| Ret       | 6.005*** |
|           | (5.999) | (6.005) |
| Constant  | 0.022*** |
|           | (0.037) | (0.038) |

| N         | 9,364 | 9,364 | 9,363 | 9,363 | 9,364 | 9,364 | 9,363 | 9,363 |
|           |       |       |       |       |       |       |       |       |
| Year fixed effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Firm fixed effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| $R^2$     | 0.354 | 0.354 | 0.326 | 0.326 | 0.361 | 0.361 | 0.329 | 0.330 |

Panel B: Delay measure (D3)

| Variables | nskew | duovel |
|-----------|-------|--------|
| FIO       | 0.001 | 0.009*** |
|           | (0.454) | (3.549) |
| Per_FIO   | 0.001 | 0.012*** |
|           | (0.273) | (3.958) |
| Logsize   | 0.102*** |
|           | (0.791) | (4.304) |
| Lev       | 0.104*** |
|           | (0.011) | (0.008) |
| Tobing    | 0.050*** |
|           | (1.944) | (5.666) |
| ROA       | 0.036*** |
|           | (2.085) | (1.593) |
| Soe       | 0.004*** |
|           | (1.556) | (0.070) |
| Volatility| 0.019** |
|           | (0.166) | (0.429) |
| Indep     | 0.021*** |
|           | (0.262) | (1.623) |
| Boardsize | 0.094*** |
|           | (0.259) | (0.951) |
| Big4      | 0.063*** |
|           | (0.070) | (0.063) |
| Top1      | 0.0003*** |
|           | (0.175) | (0.161) |

(continued on next page)
Abnormal CFO \((A_{\text{CFO}})\) is actual CFO minus the normal level of CFO calculated using the estimated coefficients from Eq. (10). Then, we estimate the normal level of production costs and discretionary expenses as follows:

\[
\frac{\text{PROD}_{i,t}}{A_{i,t-1}} = a_0 + a_1 \frac{1}{A_{i,t-1}} + a_2 \frac{\text{REV}_{i,t}}{A_{i,t-1}} + a_3 \frac{\Delta \text{REV}_{i,t}}{A_{i,t-1}} + a_4 \frac{\Delta \text{REV}_{i,t-1}}{A_{i,t-1}} + \epsilon_{i,t},
\]

\[
\frac{\text{DISEXP}_{i,t}}{A_{i,t-1}} = a_0 + a_1 \frac{1}{A_{i,t-1}} + a_2 \frac{\text{REV}_{i,t-1}}{A_{i,t-1}} + \epsilon_{i,t},
\]

where \(\text{PROD}_{i,t}\) is defined as the sum of cost of goods sold and change in inventory during the year \(t\), \(\text{DISEXP}_{i,t}\) is discretionary expenses for firm \(i\) in year \(t\), defined as the sum of selling expenses and advertising expenses.

Abnormal \(\text{PROD} (A_{\text{PROD}})\) is actual \(\text{PROD}\) minus the normal level of \(\text{PROD}\) calculated using the estimated coefficients from Eq. (11); Abnormal \(\text{DISEXP} (A_{\text{DISEXP}})\) is actual \(\text{DISEXP}\) minus the normal level of \(\text{DISEXP}\) calculated using the estimated coefficients from Eq. (12). Finally, we use \(\text{TREM}_{i,t}\) derived from Eq. (13) to calculate real earnings management:

\[
\text{TREM}_{i,t} = (-1) A_{\text{CFO}_{i,t}} + A_{\text{PROD}_{i,t}} + (-1) A_{\text{DISEXP}_{i,t}}.
\]

For each industry, we separate the sample into firms with below- and above-median value of \(\text{TREM}_{i,t}\), denoted as \(\text{Low}_TREM\) and \(\text{High}_TREM\), respectively. We then examine the effect of foreign investors on crash risk in two groups.

Consistent with our expectation, the regression results in Table 8 show that foreign investors significantly increase crash risk in the group with low level of real earnings management, while in the group with high level of real earnings management, foreign investors have no significant effect on crash risk.

7. Conclusions and discussions

Using a data set of Chinese A-share listed firms from 2006 to 2016, we examine the relationship between foreign investors and crash risk. We find that foreign investors significantly increase crash risk, and the findings remain robust under the DID approach. The results are consistent with the notion that foreign investors can lower the threshold at which withholding bad news becomes extremely costly or difficult. Furthermore, we demonstrate that the positive association between foreign investors and crash risk is more pronounced in firms with higher levels of information asymmetry or efficient internal control.

Foreign investors are more demanding on information disclosure and financial performance indicators. The synergy with corporate governance has squeezed the space for the listed firms to engage in opportunistic behavior, and urge them not only hide or accumulate negative information, but also to release it from time to time, which has a positive effect on the good operation of the market and produces a positive regulatory effect.

In addition, the existence of stock price crash risk does not necessarily mean that a crash will occur. On the contrary, firms exposed to a higher crash risk tend to be more active in sending out real value signals to the outside world or in adopting positive measures, so as to promote optimal allocation of resources, improve operating efficiency, and optimize the governance structure to deal with crash risk.

In order to expand the literature, future research needs to focus on various exogenous shocks in the securities market. For the moment, the exogenous impact of COVID-19 on the economy is a hot issue. As a magnitude outbreak public health incident, COVID-19 has a huge impact on economic development and capital markets in the short term. Since the outbreak of COVID-19, the world economy has been dealt a heavy blow. Financial markets in the US and other countries are experiencing a significant turbulence, and transnational investment has shrunk sharply. For this reason, the importance of foreign investors and stock price crash is to the forefront. Faced with the outbreak situation which is rapidly evolving, foreign investors are still optimistic about the Chinese market, and the inflow of foreign investment into
China has recovered quickly. The situation is owing to China’s effective response to the epidemic and huge advantage in attracting foreign investment.

How foreign investors affect stock price crash risk during the epidemic? In a situation where the epidemic has undermined the real economy and accelerated the spread of market panic, the risk of stock price collapse has generally increased. Whether foreign ownership further increases stock price crash risk, or foreign investors mitigate firms’ crash risk through their active role in corporate governance and information disclosure needs further investigation.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgments

We thank the financial supports from Zhejiang Social Science Fundation (No.: 20NDQN305YB) and Zhejiang Natural Science Fundation (No.: LQ20G02015).

References

Aggarwal, R., Erel, I., Ferreira, M.A., Matos, P., 2011. Does governance travel around the world? J. Financ. Econ. 100 (1), 154–181.
An, H., Zhang, T., 2013. Stock price synchronicity, crash risk, and institutional investors. J. Corp. Finance 21 (21), 1–15.
Beeckes, W., Brown, P., Zhan, W., Zhang, Q., 2016. Corporate governance, companies’ disclosure practices and market transparency: A cross country study. J. Bus. Finance Account. 43 (3), 263–297.
Beuselinck, C., Blanco, B., Lara, J.M., 2017. The role of foreign shareholders in disciplining financial reporting. J. Bus. Finance Account. 558–592.
Callen, J.L., Fang, X., 2015. Religion and stock price crash risk. J. Financial Quant. Anal. 50 (1–2), 169–195.

Table 8

| Variables | ncskew | duvol |
|-----------|--------|-------|
|           | (1) Low_TREM | (2) High_TREM | (3) Low_TREM | (4) High_TREM |
| FIO       | 0.006*** | 0.004*** | 0.006*** | 0.001*** |
|           | (1.931)  | (1.206)  | (3.045)  | (0.286)  |
| Per_FIO   | 0.008**  | 0.006   | 0.007*** | 0.002  |
|           | (2.059)  | (1.415)  | (3.405)  | (0.781)  |
| Logsize   | 0.073*** | 0.075*** | 0.028   | 0.028   |
|           | (2.578)  | (1.070)  | (1.512)  | (1.573)  |
| Lev       | –0.165   | –0.164   | –0.043   | –0.043   |
|           | (–1.511) | (–1.502) | (–0.423) | (–0.429) |
| Tobing    | 0.041*** | 0.042*** | 0.034*** | 0.029*** |
|           | (3.978)  | (4.004)  | (2.976)  | (4.095)  |
| ROA       | –0.105   | –0.102   | 0.327    | 0.326    |
|           | (–0.354) | (–0.344) | (1.158)  | (1.156)  |
| Soe       | 0.008    | 0.009    | 0.050    | 0.051    |
|           | (0.119)  | (0.124)  | (–0.738) | (–0.755) |
| Volatility| –0.350   | –0.353   | –0.448   | –0.448   |
|           | (–1.913) | (–1.932) | (–2.509) | (–2.506) |
| Indep     | 0.217    | 0.213    | 0.291    | 0.292    |
|           | (0.744)  | (0.729)  | (1.050)  | (1.052)  |
| Boardsize | 0.096    | 0.092    | –0.159   | –0.159   |
|           | (0.827)  | (0.878)  | (–1.459) | (–1.459) |
| Big4      | –0.040   | –0.042   | 0.175*   | 0.172*   |
|           | (–0.507) | (–0.535) | (1.815)  | (1.784)  |
| Top1      | –0.001   | –0.001   | –0.001   | –0.001   |
|           | (–0.709) | (–0.754) | (–0.400) | (–0.382) |
| Sigma     | 5.642*** | 5.650*** | 10.945***| 10.960***|
|           | (2.899)  | (2.902)  | (5.787)  | (5.797)  |
| Ret       | 29.216   | 29.355   | 95.539***| 95.811***|
|           | (1.257)  | (1.262)  | (4.085)  | (4.103)  |
| Constant  | –1.770*  | –1.775*  | –0.978   | –0.973   |
|           | (–1.678) | (–1.683) | (–1.621) | (–1.613) |

Notes. This table presents the results of the impact of foreign investors on crash risk in two groups divided by real earnings management. Columns (1) to (2) and (3) to (4), respectively with ncskew and duvol as the dependent variable. T-statistics reported in parentheses are clustered at the firm level. *, **, *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Main variables are defined in Table 1.
Chan, K.C., Chen, Y., Liu, B., 2020. The linear and non-linear effects of internal control and its five components on corporate innovation: Evidence from Chinese firms using the COSO framework. Eur. Account. Rev. http://dx.doi.org/10.1080/09638180.2020.1776626, (in press).

Chang, X., Chen, Y., Zolotoy, L. 2017. Stock liquidity and stock price crash risk. J. Financ. Quant. Anal. 52 (4), 1605–1637.

Chen, J., Chen, K.C., Dong, W., Zhang, F., 2017. Internal control and stock price crash risk: Evidence from China. Eur. Account. Rev. 26 (1), 125–152.

Cheng, C.S., Li, S., Zhang, E.X., 2020. Operating cash flow opacity and stock price crash risk. J. Account. Pub. Policy 39 (3), 106717. http://dx.doi.org/10.1016/j.jaccpubpol.2020.106717.

Dechow, P.M., Kothari, S.P., Watts, R.L., 1998. The relation between earnings and cash flows. J. Account. Econ. 25 (2), 133–168.

Ferreira, M.A., Matos, P., 2008. The colors of investors’ money: The role of institutional investors around the world. J. Financ. Econ. 88 (3), 499–533.

Graham, J.R., Harvey, C.R., Rajgopal, S., 2005. The economic implications of corporate financial reporting. J. Account. Econ. 40 (1/3), 3–73.

He, W., Shen, J., 2014. Do foreign investors improve informational efficiency of stock prices? Evidence from Japan. Pac.-Basin Finance J. 27.

Huang, D., 2018. Do analyst coverage reduce stock price crash risk?—Evidence from China. Am. J. Ind. Bus. Manag. 08 (4), 1–23.

Hutton, A.P., Marcus, A.J., Tehnarian, H., 2006. Opaque financial reports, R-Square, and crash risk. Soc. ence Electr. Publ. 94 (1), 67–86.

Kim, J., Li, Y., Zhang, L. 2011b. CFOs versus CEOs: Equity incentives and crashes. J. Financ. Econ. 101, 713–730.

Kim, J., Li, Y., Zhang, L., 2011a. Corporate tax avoidance and stock price crash risk: Firm-level analysis. J. Financ. Econ. 100 (3), 639–662.

Kim, J.B., Wang, Z., Zhang, L., 2016. CEO overconfidence and stock price crash risk. Contemp. Account. Res. 33 (4), 1720–1749.

Kim, C., Wang, K., Zhang, L., 2019. Readability of 10-K reports and stock price crash risk. Contemp. Account. Res. 36 (2), 1184–1216.

Kim, J.B., Yi, C.H., 2015. Foreign versus domestic institutional investors in emerging markets: Who contributes more to firm-specific information flow? China J. Account. Res. 8 (1), 1–23.

Kim, J., Zhang, L., 2016. Accounting conservatism and stock price crash risk: Firm-level evidence. Contemp. Account. Res. 33 (1), 412–441.

Kothari, S.P., Shu, S., Wysocki, P.D., 2009. Do managers withhold bad news. J. Account. Res. 47 (1), 241–276.

Lim, K.P., Hooy, C.W., Chang, K.B., Brooks, R., 2016. Foreign investors and stock price efficiency: Thresholds, underlying channels and investor heterogeneity. North Am. J. Econ. Finance 36 (apr.), 1–28.

Lu, Y., Tao, Z., Zhu, L., 2017. Identifying FDI spillovers. J. Int. Econ. 75–90.

Nagar, V., Nanda, D., Wysocki, P.D., 2003. Discretionary disclosure and stock-based incentives. J. Account. Econ. 34 (1), 283–309.

Roychowdhury, S., 2006. Earnings management through real activities manipulation. J. Account. Econ. 42 (3), 335–370.

Roychowdhury, S., Sletten, E., 2012. Voluntary disclosure incentives and earnings informativeness. Account. Rev. 87 (5), 1679–1708.

Shleifer, A., Vishny, R.W., 1986. Large shareholders and corporate control. J. Political Econ. 94 (3), 461–488.

Shleifer, A., Vishny, R.W., 1997. A survey of corporate governance. J. Finance 52 (2), 737–781.

Xu, N., Jiang, X., Chan, K.C., Yi, Z., 2013. Analyst coverage, optimism, and stock price crash risk: Evidence from China. Pacific-basin Finance J. 217–223.