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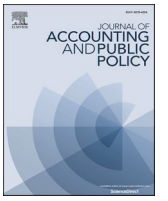

Full length article

Press freedom and stock price crash risk

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ABSTRACT

This paper examines the impact of press freedom, an important institutional factor, on stock price crash risk. Using a large international sample of firms across 52 economies between 2002 and 2021, we find that firms in economies with higher degrees of press freedom are associated with lower levels of future stock price crash risk. Our analysis further shows that press freedom helps to deter the hoarding of bad news by increasing the intensity of reporting, extending the reporting period, and broadening local media coverage. Firms operating in economies with press freedom demonstrate stronger corporate governance and lower levels of firm-specific and long-term overvaluation, which are likely mechanisms through which press freedom mitigates crash risk. The negative impact of press freedom on crash risk is weakened by corruption but strengthened for firms facing higher short interest and less analyst coverage. Additional tests reveal that this negative relationship is driven by a collective influence from multiple dimensions of press freedom. Our results survive a battery of robustness checks. In sum, our findings suggest that press freedom enhances the stability of the global stock market by discouraging the concealment of negative information.

1. Introduction

Stock price crash risk concerns the sudden unexpected collapse of stock prices, which is complex to forecast (Chen et al., 2001) and cannot be hedged through portfolio diversification (Y. Kim et al., 2014). Although the causal factors leading to stock price crashes remain speculative, literature generally attributes stock price crashes to bad news hoarding behavior (Jin and Myers, 2006). Such behavior involves managers taking advantage of non-transparent environments to conceal unfavorable information from the public for their own interests. When it reaches a given threshold, the sudden release of the hoarded unfavorable information triggers a large decline in the stock price. It has been documented that a shortage of channels for learning firms' internal information facilitates managers' bad news hoarding behavior. For example, previous studies have investigated the crash risk caused by opaque financial reports (Hutton et al., 2009), a lack of attention to the media (An et al., 2020), and the incident of Google's withdrawal from China (Xu et al., 2021).

Press freedom, characterized by the unhindered dissemination of information and journalistic independence, plays a pivotal role in ensuring the public's access to accurate and timely information—a core element essential for the efficient functioning of financial markets. When the press is free, it can report on financial performance, corporate governance issues, and market conditions without censorship or fear of repercussion. A good flow of information is crucial in order for investors to make informed decisions. Moreover, a

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free press contributes to market and corporate transparency by enhancing the monitoring or watchdog function of the media. The "free" environment encourages journalists and media to identify market manipulations and corporate misconduct, and disseminate information about actual situations freely. While a few studies suggest that press freedom can impact firm activities (e.g., Nguyen, 2021; Berlinger et al., 2022), the role of press freedom in the financial market has not been well explored in the literature. Given the substantial variation in press freedom across countries and its global decline,[1] some important research question arises: Does the level of press freedom in an economy affect stock market stability, particularly in terms of stock price crash risk? Whether press freedom can signal the reliability of financial disclosures, reducing the perceived risks associated with investing in a particular country? Our study aims to fill this research gap by examining this question empirically with a global sample. We believe our results offers insights into the stability and attractiveness of various markets for international investors and policymakers.

We conjecture that restricted press freedom facilitates bad news hoarding behavior and increases stock price crash risk for three reasons. First, in environments where the press is restricted, the media loses the independence and functioning needed to serve as a watchdog. With media control concentrated in the hands of select political and business elites, vulnerability to bribery, censorship, and manipulation increases. This situation significantly hampers the media's ability to uncover and report corporate wrongdoings, financial improprieties, and other detrimental information. Moreover, the lack of press freedom leads to a broader decline in the media sector. The vitality and diversification of the media rot, due to threats, harassment, and pervasive corruption. Journalists, facing such adversities, often shy away from investigating and revealing the darker aspects of society and corporate practices. When negative news is hoarded, it tends to accumulate over time, rather than being released in a gradual, manageable manner. Second, publicly reporting corporate malfeasance serves as a corrective mechanism that enables perpetrators to learn from mistakes and avoid reoffending. Exposed scandals serve as cautionary tales for other firms, deterring opportunistic behaviors and prompting policymakers to establish preventative regulations. This, in turn, mitigates the likelihood of misconduct that could precipitate stock price crashes. Third, in an environment without a free press, investors may become skeptical about the reliability and authenticity of available information, eroding their confidence and increasing pessimistic sentiment. Consequently, when adverse news, even if minor, emerges, investors may overreact, triggering a stock price crash.

To test this hypothesis, we use the press freedom index for each country, released by Reporters Without Borders. This index comprises seven components that make up the overall press freedom score, including pluralism, media independence, environment and self-censorship, legislative framework, transparency, infrastructure, and abuse. In addition, we construct five proxies to comprehensively measure stock price crash risk: *NCSKEW*, *DUVOL*, the number of weeks featuring crashes, the ratio of weeks featuring crashes to the total trading weeks, and the first principal component of the above four variables. Our empirical results show that firms in economies with higher degrees of press freedom are associated with lower future stock price crash risk, both statistically and economically significantly. For example, a one-standard-deviation increase in press freedom corresponds to a 36 % reduction in *NCSKEW* and a 19 % reduction in *DUVOL*.

A potential concern in interpreting our results is the possibility of omitted variables, unobserved heterogeneity, and nonrandom selection of headquarters location. To address these endogeneity concerns, we first employ a two-stage least squares (2SLS) regression analysis using two instrumental variables (IVs). The first IV is the number of requests that Google received, asking it to remove critical content about a country's government, which reflects the degree of censorship in a country. The second IV is the number of publicly listed media firms per capita, which indicates the prosperity and diversification of a country's media sector. The first-stage regression shows that our IVs are significantly associated with press freedom. The second-stage regressions confirm that press freedom significantly reduces stock price crash risk. To further address concerns regarding the nonrandom selection of headquarters location, we conduct a placebo test by randomly assigning firms in our baseline sample to different economies. In this scenario, we find no significant relationship between the press freedom of the pseudo economy and the firms' crash risk. In addition, we employ propensity score matching (PSM) to address the selection bias associated with the observable firm and deal characteristics. The findings, in line with our main results, support the view of a causal relation between press freedom and stock price crash risk.

Next, we explore how press restrictions contribute to stock price crash risk. One direct mechanism could be that restricted press freedom alters news dissemination patterns, enabling firms to more easily conceal unfavorable information. Our results provide evidence supporting this conjecture. In press-restricted economies, we find that adverse events regarding firms receive fewer news reports, experience shorter reporting duration, have lower media coverage intensity on the day of peak reporting, are quickly disregarded by the media after reaching the maximum reporting level, and attract more coverage from foreign media than from local outlets.

Theoretically, if the bad news about a firm can be concealed for an extended period, investors may overvalue the firm due to mistakenly believing it is well-managed. This overvaluation creates the potential for sharp declines in stock prices when the hidden issues eventually surface. Therefore, if firms in economies with press freedom struggle to suppress negative information, we should observe lower overvaluation in these firms. To test this, we construct three proxies to measure firm-specific overvaluation based on the methodologies of Hoberg and Phillips (2010), Pástor and Pietro (2003), and Rhodes-Kropf et al. (2005) and a proxy for long-run overvaluation based on Rhodes-Kropf et al. (2005). Consistent with our expectation, we find that press freedom is negatively associated with both firm-specific and long-run overvaluation.

Another way press freedom may reduce crash risk could be through enhanced corporate governance mechanisms. Media scrutiny exerts pressure on corporate boards to adopt better governance practices, pushing companies to maintain their market position and

[1] See United Nations News on "Freedom of the press under attack worldwide" at https://news.un.org/en/story/2023/05/11362722.

meet public and investor expectations. Thus, we argue that press freedom mitigates crash risk by improving corporate governance. Using governance indices suggested by Bebchuk et al. (2009), we find that firms in economies with greater press freedom are associated with better corporate governance practices.

To strengthen our interpretation that press restriction facilitates bad news hoarding, we present additional results investigating whether the relation between press freedom and crash risk varies across different groups of firms and economies. High levels of corruption signify defective legal frameworks and judicial systems, fostering a culture of bribery while undermining press independence (Lambsdorff, 2007). Thus, news manipulation tends to be more severe in economies with higher corruption. Our findings support this argument, showing that the effect of press freedom in reducing crash risk is weakened by the presence of corruption. Moreover, short sellers, who profit by identifying and publicizing firms' malpractices, often trigger crash events (Karpoff and Lou, 2010; Callen and Fang, 2015a). Firms exposed to high levels of short-selling interest are more likely to hide negative news, which increases their risk of a crash. In this context, press freedom limits the ability of these companies to conceal adverse information, making it harder for short sellers to exploit information asymmetry. As a result, press freedom reduces the room for speculation-driven short selling and more effectively limits the volatility associated with stock price crashes. Consistent with this view, we find that the negative relationship between press freedom and stock price crashes is strengthened for firms facing high levels of short interest. Lastly, analysts serve as external monitors, similarly to the media. When press freedom is weakened, the role of analysts becomes more prominent, and vice versa. Therefore, we expect that the influence of press freedom on stock price crash risk will be stronger in firms with limited analyst coverage. Our empirical results confirm this and show that the impact of press freedom on crash risk is more pronounced when analyst coverage is limited.

This article makes several contributions to the existing literature. First, this study adds to the literature on the determinants of stock price crash risk around the world. Prior research has primarily focused on internal factors such as the opaqueness of accounting information and operations (Hutton et al., 2009; Kim and Zhang, 2016), corporate governance (Kim et al., 2011b; Yuan et al., 2016), and financial arbitrage (Callen and Fang, 2015a), and country-level institutional/cultural factors including religion (Callen and Fang, 2015b), economic freedom (Blau et al., 2014), and judicial independence (Liu, 2023). Our research highlights the importance of media environments, particularly press freedom, for the stability of the capital market.

Second, our study contributes to the growing literature on the economic consequences of press freedom. While press freedom is an important topic in political science and economics, with research highlighting its impact on corruption (Brunetti and Weder, 2003; Binhadab et al., 2021), various social outcomes (Djankov et al., 2003), and political knowledge and participation (Leeson, 2008), it has received limited attention in the finance literature. The scarce literature in this area generally suggests that press freedom is a beneficial institutional factor for financial markets and investors. It helps reduce the frequency and severity of corporate operational losses (Berlinger et al., 2022), firms' earnings management (Nguyen, 2021), tax aggressiveness (Kanagaretnam et al., 2018), and analyst forecast errors (Kim et al., 2017). Our study extends this strand of studies by showing that press freedom can curb bad news hoarding, which in turn mitigates stock price crash risk. It offers new insights into understanding the role of press freedom in investor welfare and corporate behavior. Furthermore, we explore the impacts of different dimensions of press freedom on the stock market, an area that has not been empirically examined. We find that the negative effect of press freedom on future crash risk is mainly driven by components such as the information infrastructure, transparency, and environment and self-censorship. These factors are more closely related to the ability to produce and disseminate information, as well as its credibility.

Third, we strengthen the causal link between press freedom and stock price crash risk by providing insights into news patterns and direct evidence of how firms manipulate information in economies with weaker press freedom. Some studies suggest that firms often have incentives to influence the media for their own interests. For example, Ahern and Sosyura (2014) found that acquirers in stock-based mergers strategically increase favorable news coverage between the start of merger negotiations and public announcements to boost share prices. Similarly, Solomon (2012) showed how investor relations firms actively shape media narratives by increasing the number of favorable press releases. We find that the patterns of news coverage for adverse corporate events—such as the amount of coverage, duration of reporting, and attention decay—vary significantly based on the degree of press freedom.

There are two papers that are closely related to our study. J. B. Kim et al. (2014) find that high press freedom is associated with lower stock price synchronicity. While both stock price crash risk and stock synchronicity relate to stock price movements, they focus on different aspects, which distinguishes our study from J. B. Kim et al. (2014). First, crash risk emphasizes the potential for sudden, large negative stock price movements (i.e. downside risk), whereas stock synchronicity captures the co-movement of stock prices in the broader market and does not necessarily indicate crash potential. Second, price crashes are typically triggered by the delayed release of negative news about a company, while synchronicity reflects how much firm-specific information—positive, negative, or neutral—is incorporated into stock prices, contributing to market volatility. Third, when constructing synchronicity measures, prior studies, including J. B. Kim et al. (2014), typically exclude observations with returns beyond $\pm$ 25 %. As a result, these synchronicity measures fail to account for extreme stock price movements.

Our paper is also related to An et al. (2020), who document a negative relationship between U.S. firms' attraction of media coverage and stock price crash risk. While their work highlights how increased media coverage can mitigate crash risk for individual firms, our paper differs by focusing on a broader, cross-country perspective, through the lens of press freedom. Unlike firm-level media coverage, which can be influenced by firm-specific characteristics and audience interests,[2] press freedom influences not only the volume of media coverage but also its scope, tone, depth, angle and potential bias in reporting and journalistic practices. Moreover, it is

[2] For examples, firms with "superstar" CEOs (Malmendier and Tate, 2009), higher advertising expenses (Gurun and Butler, 2012; Gambaro and Puglisi, 2015), and media management (Baloria and Heese, 2018; Hossain and Javakhadze, 2020) tend to receive more media attention.

closely intertwined with the legal and political environment (Van Belle, 2000). It represents a long-term, exogenous condition that varies significantly across economies, making it a systemic risk factor for international investors. Press freedom, or its restriction, shapes the broader informational environment in which firms operate. Specifically, it influences the ability and opportunity of media (firms) within an economy to expose (hidden) the darker aspects of corporate practices and information, ultimately affecting market transparency and the stability of stock prices. While studies like An et al. (2020) suggest that media coverage can enhance transparency, others (e.g., Fang and Peress, 2009; Malmendier and Tate, 2009) show that media attention can be biased. These mixed findings highlight the importance of focusing on press freedom, as a more stable and exogenous factor that better explains variations in stock price crash risk across different institutional settings.[3]

The paper proceeds as follows. In Section 2, we review the literature and develop a testable hypothesis. Section 3 describes our data and methodology. Section 4 reports baseline regression results. Section 5 accounts for endogeneity concerns. Section 6 explores the economic mechanisms that link press freedom and stock price crash risk. Section 7 reports cross-sectional analyses. Section 8 provides further tests and robustness evidence. Section 9 concludes.

2. Literature and hypothesis

Previous studies investigate the determinants of stock price crash risk mainly through two routes. The first route identifies several factors leading to higher levels of risk taking. For instance, the crashes are associated with CEO overconfidence (Kim et al., 2016), exploration-oriented innovation (Jia, 2018), customer concentration (Lee et al., 2020), and CEO risk tolerance (Chen et al., 2021). The second route involves certain factors that provide convenience or motivation for firms to conceal negative news that can lead to a crash risk. From the perspective of agency theory, managers have incentives to manage the disclosure of negative information to further their own interests, including performance-based compensation (Burns and Kedia, 2006), career development (Baginski et al., 2018), and their professional reputation (Jiang et al., 2020). In addition, firms that fail to meet earnings expectations are prone to delaying the release of bad news to avoid a severe market reaction (Graham et al., 2005). Kothari et al. (2009) find that managers tend to accumulate unfavorable information and release it only when it reaches a threshold, while they quickly disseminate good news to maintain positive investor sentiment. The literature following the second route finds that conservative accounting policies (Kim and Zhang, 2016), the coalition between the CEO and top executives (Xu et al., 2020), pay-performance pressure faced by early-career CEOs (Andreou et al., 2017), and a lack of religious belief (Callen and Fang, 2015b) may induce managers to withhold bad news.

Building on this foundation, our study investigates stock price crash risk through the lens of press freedom, an important factor that is closely linked to bad news hoarding behavior but has largely been ignored in the literature. Press freedom reflects the ability of the media to gather, investigate, report, and publish news without fear of restriction, censorship, or retaliation. In economies with restricted press freedom, the lack of effective media oversight provides opportunities for firms to conceal negative news. Over time, the accumulation of these hidden issues does not resolve the underlying problems but instead worsens the associated risks. When the firm can no longer maintain the cover-up, the sudden release of accumulated negative information triggers a significant stock price crash as investors react to the unanticipated risks.

We argue that press freedom plays an important role in reducing stock price crash risk through several mechanisms. First, as we discussed before, stock price crashes are often driven by the hoarding of bad news. When the press operates as a watchdog, it can uncover early signs of financial distress or corporate mismanagement, preventing these issues from escalating into more significant problems. In a free and rich media environment, firms are less able to conceal negative information for extended periods (Kim et al., 2011a; An et al., 2018). Instead, negative news is released incrementally through routine reporting, which allows the market to absorb the news gradually, thus reducing the likelihood of a sudden stock price crash.

Second, press freedom can mitigate managerial opportunism by acting as an external monitoring mechanism for corporate behavior. In environments where media oversight is free and strong, managers face greater scrutiny, which discourages them from engaging in unethical or high-risk behaviors. The constant threat of media exposure acts as a powerful deterrent, limiting opportunities for corporate malfeasance. In contrast, in press-restricted economies, effective and extensive media scrutiny is limited and such economies are also often associated with high levels of bureaucracy and corruption (Kalenborn and Lessmann, 2013, Apergis et al., 2023). Politicians and bureaucrats may have shared interests with local firms in terms of protecting their reputations and economic contributions (Piotroski et al., 2015). This kind of environment provides managers with more chances to engage in opportunistic behavior, as they believe that their unethical practices will be covered up instead of coming to light (Dyck et al., 2008; Joe et al., 2009). Moreover, publicly exposed corporate scandals, uncovered by news reporting, not only lead to market corrections but also serve as cautionary examples for other firms, incentivizing them to strengthen their governance practices and avoid similar outcomes. Therefore, environments with high media independence and active investigative journalism help curb managerial opportunism and foster a culture of transparency and accountability, which in turn reduces the likelihood of future stock price crashes.

Another reason we believe press freedom reduces future stock price crash risk is that it can strengthen investor confidence by ensuring a well-informed and fair market environment. Investors are more likely to invest in markets in which they believe they have access to accurate and timely information. This increased confidence can stabilize stock prices and reduce the likelihood of panic selling or market overreactions, which are common triggers for stock price crashes. In addition, a free press is better able to detect stock

[3] Our untabulated results show that the Pearson correlation between average firm-level media coverage in an economy and its press freedom index is only 0.187 over the period 2002–2021. This weak linear relationship suggests that press freedom and firm-level media coverage reflect distinct dimensions of media influence. The results are available upon request.

market manipulation and insider trading activities in a timely fashion, which leads to fairer and more stable markets. However, in markets where media oversight is less effective, manipulation and insider trading can occur more often and persist for longer, which in turn damages investor confidence and exerts more devastating effects on stock prices when eventually uncovered.

Based on the above considerations, we state our hypothesis as below:

Hypothesis 1 Firms in economies with greater press freedom are associated with lower levels of stock price crash risk.

3. Data and empirical design

3.1. Sample selection

The data used in this study are collected from multiple sources. To construct our sample, we start with all public firms in the universe of the Compustat North America and Compustat Global databases during the period 2002–2021. The sample period starts in 2002, as this is the inaugural year for which press freedom data are available from Reporters Without Borders. The Compustat databases provide daily stock prices and market index data, as well as annual accounting data for firms in the United States, Canada, and other countries. Given that press freedom in an economy is mostly likely to exert an influence on local firms, we require that firms are listed, incorporated, and headquartered in the same economy when determining to which economy a firm belongs. To avoid including less mature and small stock markets, we require each economy in our sample to have at least 10 years of consecutive observations, with a minimum of 30 publicly listed firms in each year. After excluding firms with less than 26 weeks of stock returns available in a year, firm-year observations with insufficient financial data for calculating the relevant variables for the analysis, and those with negative total assets or negative equity, our final sample comprises 164,162 firm-year observations, which can be aggregated into 977 economy-year observations from 2002 to 2021.

Panel A of Table 1 presents the distribution of the sample across 52 economies of the world. The stock markets of 38 economies have data for the full sample period of 20 years, while the remaining economies have a shorter sample period due to their later availability of stock market data. Column (4) reports the average number of firms over the years for each economy. The USA has the largest number of public firms, followed by Japan and China. Column (5) shows that European economies generally rank well in press freedom, with Norway, the Netherlands, Denmark, and Sweden standing out as notable examples. Columns (6) through (9) present the average values of the stock price crash risk measures for each economy. It is important to note that the relationship between press freedom and crash risk is not always straightforward and may be influenced by a number of additional factors. For example, economies with greater press freedom often have more open and dynamic stock markets, which could explain why some economies with press freedom exhibit relatively high crash risks, as shown by the static data in Panel A. To capture the real impact of time-varying changes in press freedom on crash risk, we employ panel data with firm- and time-fixed effects in the baseline regressions.

Panel B presents the sample distribution over the years. Columns (1) and (2) show the total number of economies and firms featured in each year, respectively. As global stock markets continue to develop and evolve, we observe an increase in the number of firm-year and economy-year observations over the period. In line with the outbreak of the global financial crisis, 2008 saw an exceptionally high level of stock price crash risk.

3.2. Measuring stock price crash risk

Following Jin and Myers (2006), Kim et al. (2011a), Andreou et al. (2017), and An et al., (2020), we employ five firm-specific cash risk proxies in our analyses. To construct these stock price crash risk measures, we first estimate firm-specific weekly returns using the following expanded market model:

$$\begin{aligned} r_{i,t,j} = {} & \alpha_i + \beta_{1,i} r_{m,j,t} + \beta_{2,i}\left[r_{US,t} + EX_{j,t}\right] + \beta_{3,i} r_{m,j,t-2} + \beta_{4,i}\left[r_{US,t} + EX_{j,t-2}\right] + \beta_{5,i} r_{m,j,t-1} + \beta_{6,i}\left[r_{US,t} + EX_{j,t-1}\right] + \beta_{7,i} r_{m,j,t+1} \\ & + \beta_{8,i}\left[r_{US,t} + EX_{j,t+1}\right] + \beta_{9,i} r_{m,j,t+2} + \beta_{10,i}\left[r_{US,t} + EX_{j,t+2}\right] + \varepsilon_{i,t} \end{aligned} \tag{1}$$

where $r_{i,t,j}$ is the stock return of firm i in week t in economy j; $r_{m,j,t}$ is the return on the value-weighted market index in week t in economy j; $r_{US,t}$ is the U.S. weekly return on the CRSP value-weighted market index, used as a proxy for the global market; and $EX_{j,t}$ is the change in the exchange rate between economy j's currency and the U.S. dollar. The model includes leading (*t-1* and *t-2*) and lagged ($t + 1$ and $t + 2$) terms to correct for nonsynchronous trading, as suggested by Dimson (1979). Following Jin and Myers (2006), the firm's weekly return is measured from Wednesday to Wednesday. The firm-specific weekly return, $W_{i,t}$, is defined as the natural logarithm of one plus the residual return, estimated from Eq. (1), i.e., $W_{i,t} = \ln(1 + \varepsilon_{i,t})$.

The first crash risk measure is the negative conditional coefficient of skewness (*NCSKEW*), which is calculated by taking the negative of the third moment of the firm-specific weekly returns for each year and dividing it by the standard deviation of the firm-specific weekly returns raised to the third power. Specifically, *NCSKEW* is computed as follows:

$$NCSKEW_{i,t} = -\left[n(n-1)^{3/2}\sum W_{i,t}^3\right] \Big/ \left[(n-1)(n-2)\left(\sum W_{i,t}^2\right)^{3/2}\right] \tag{2}$$

where n is the number of observations of firm-specific weekly returns for firm i each year t. To enhance the interpretability of the construct, we multiply it by negative one so that a higher value of *NCSKEW* indicates greater stock price crash risk.

The second crash risk measure, *DUVOL*, is the down-to-up volatility of firm-specific weekly returns. It captures the degree of

Table 1
Sample distribution. This table reports the sample distribution by economy (Panel A) and year (Panel B), as well as summary statistics of key variables. The sample is composed of public firms covered by Compustat Global, Compustat North America, and CRSP. Firms should be listed, incorporated, and headquartered in the same economy. The final sample consists of 18,028 firms from 52 economies with 164,162 firm-year observations during 2002–2021. All continuous variables are winsorized at the 1% and 99% levels. Detailed variable definitions are provided in Appendix A.

Panel A: Sample distribution by economy

Economies	Sample period	# Years	# Firms	Press freedom	NCSKEW	DUVOL	# Crash event per firm	% Crash firm
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Africa								
Egypt	2002–2021	20	134	0.153	−0.156	−0.105	0.050	0.049
Kenya	2008–2021	14	43	0.489	0.065	0.034	0.050	0.050
Morocco	2006–2021	16	54	0.276	−0.194	−0.076	0.067	0.067
Nigeria	2002–2021	20	56	0.328	0.001	−0.047	0.029	0.029
South Africa	2002–2021	20	235	0.801	−0.040	−0.078	0.086	0.085
Asia								
Bangladesh	2004–2021	18	201	0.202	−0.290	−0.183	0.067	0.067
China	2002–2021	20	2,293	0.029	−0.203	−0.198	0.069	0.068
Hong Kong	2002–2021	20	198	0.680	−0.195	−0.166	0.064	0.064
India	2002–2021	20	2,063	0.282	−0.286	−0.225	0.030	0.029
Indonesia	2002–2021	20	285	0.330	−0.263	−0.217	0.043	0.042
Japan	2002–2021	20	3,542	0.740	−0.112	−0.107	0.105	0.103
Kuwait	2004–2021	18	110	0.506	−0.088	−0.072	0.063	0.063
Malaysia	2002–2021	20	728	0.275	−0.114	−0.110	0.055	0.054
Pakistan	2002–2021	20	272	0.153	−0.164	−0.171	0.040	0.040
Philippines	2002–2021	20	157	0.237	−0.232	−0.192	0.053	0.053
Saudi Arabia	2003–2021	19	136	0.080	−0.082	−0.102	0.082	0.080
Singapore	2003–2021	19	361	0.170	−0.140	−0.145	0.055	0.054
South Korea	2002–2021	20	1,779	0.730	−0.306	−0.150	0.047	0.047
Taiwan	2002–2021	20	1,419	0.736	−0.288	−0.222	0.043	0.042
Thailand	2002–2021	20	802	0.295	−0.211	−0.160	0.077	0.075
Turkey	2002–2021	20	344	0.238	−0.158	−0.121	0.070	0.068
UAE	2007–2021	15	51	0.390	−0.204	−0.145	0.067	0.061
Vietnam	2009–2021	13	544	0.037	−0.030	−0.036	0.029	0.029
Europe								
Austria	2002–2021	20	54	0.927	−0.075	−0.039	0.086	0.085
Belgium	2002–2021	20	116	0.927	−0.118	−0.086	0.115	0.110
Denmark	2002–2021	20	140	0.965	−0.135	−0.092	0.103	0.101
Ireland	2002–2021	20	31	0.948	−0.021	−0.040	0.071	0.065
Italy	2002–2021	20	292	0.720	−0.322	−0.177	0.069	0.067
Finland	2002–2021	20	126	0.996	−0.054	−0.043	0.115	0.111
France	2002–2021	20	591	0.809	−0.133	−0.107	0.084	0.083
Germany	2002–2021	20	739	0.917	0.012	0.151	0.082	0.081
Greece	2002–2021	20	203	0.673	−0.112	−0.113	0.040	0.039
Netherlands	2002–2021	20	123	0.980	−0.078	−0.042	0.126	0.122
Norway	2002–2021	20	151	0.995	−0.077	−0.080	0.078	0.075
Poland	2002–2021	20	414	0.767	−0.148	−0.151	0.064	0.062
Portugal	2002–2021	20	36	0.883	−0.199	−0.116	0.049	0.049
Romania	2008–2021	14	65	0.738	−0.067	−0.067	0.041	0.041
Russia	2011–2021	11	222	0.181	−0.372	0.119	0.084	0.082
Spain	2002–2021	20	153	0.800	−0.162	−0.110	0.071	0.070
Sweden	2002–2021	20	447	0.963	−0.081	−0.090	0.087	0.085
Switzerland	2002–2021	20	224	0.954	−0.082	−0.057	0.098	0.095
UK	2002–2021	20	1,188	0.836	−0.090	−0.121	0.110	0.106
North America								
Canada	2002–2021	20	1,573	0.915	0.010	−0.041	0.037	0.080
Croatia	2008–2021	14	63	0.647	−0.128	−0.100	0.035	0.057
Mexico	2002–2021	20	82	0.235	−0.174	−0.097	0.032	0.068
USA	2002–2021	20	5,676	0.824	0.067	−0.016	0.030	0.119
South America								
Brazil	2002–2021	20	287	0.498	0.026	−0.025	0.050	0.080
Chile	2002–2021	20	73	0.734	−0.133	−0.108	0.057	0.057
Colombia	2010–2021	12	31	0.260	−0.067	−0.061	0.076	0.097
Peru	2007–2021	15	33	0.450	−0.127	−0.084	0.049	0.048
Oceania								
Australia	2002–2021	20	1,113	0.851	−0.049	−0.107	0.016	0.056
New Zealand	2003–2021	19	92	0.944	−0.141	−0.137	0.033	0.099

Panel B: Sample distribution by year

Year	# Economies	#Firms	NCSKEW	DUVOL	# Crash event per firm	% Crash firm
(1)	(2)	(3)	(4)	(5)	(6)	(7)
2002	38	19,539	−0.021	−0.011	0.068	0.066
2003	41	20,795	−0.139	−0.109	0.073	0.072
2004	43	22,486	−0.112	−0.082	0.072	0.072
2005	43	23,826	−0.110	−0.109	0.079	0.076
2006	44	24,974	−0.143	−0.124	0.061	0.060
2007	46	25,991	−0.131	−0.114	0.055	0.055
2008	49	26,553	0.082	0.044	0.103	0.101
2009	50	28,737	−0.165	−0.138	0.046	0.045
2010	51	31,540	−0.195	−0.127	0.059	0.058
2011	52	32,500	−0.108	−0.063	0.077	0.075
2012	52	32,030	−0.117	−0.086	0.060	0.058
2013	52	33,468	−0.158	−0.114	0.066	0.063
2014	52	34,399	−0.080	−0.090	0.078	0.076
2015	52	34,598	−0.167	−0.106	0.080	0.077
2016	52	35,136	−0.154	−0.109	0.075	0.074
2017	52	36,008	−0.145	−0.112	0.095	0.091
2018	52	33,678	−0.027	−0.046	0.071	0.069
2019	52	36,026	−0.102	−0.070	0.080	0.078
2020	52	36,697	−0.220	−0.178	0.071	0.070
2021	52	38,868	−0.268	−0.193	0.060	0.059

asymmetry in the volatilities between negative and positive stock returns. For each stock, firm-specific returns in a given year are divided into two groups, "down" and "up" weeks, based on whether they fall below or above the annual mean, respectively. The standard deviation of the firm-specific returns is then calculated separately for the "down" and "up" groups. Specifically, *DUVOL* is calculated as the natural logarithm of the ratio of the standard deviation of the "down" group to the standard deviation of the "up" group, as shown below:

$$DUVOL_{j,t} = \log\left\{\left[(n_{up}-1)\sum_{DOWN} W_{i,t}^2\right] \Big/ \left[(n_{down}-1)\sum_{UP} W_{i,t}^2\right]\right\} \tag{3}$$

where n_{up} and n_{down} are the number of "up'' and "down'' weeks over the fiscal year t, respectively. A higher value of *DUVOL* suggests a greater crash risk.

Our third crash risk measure, *Ln # Crash week*, is the natural logarithm of one plus the number of weeks in which the firm experienced stock price crashes within a given year. Following Kim et al. (2011a), we define a crash week as any week in which the firm-specific weekly return is 3.2 standard deviations below the mean return over the fiscal year. The threshold of 3.2 standard deviations is chosen to generate a frequency of 0.1 % in the normal distribution.[4] The fourth measure, *Crash week ratio*, is defined as the ratio of weeks during which the firm experienced stock price crashes to the total trading weeks of the firm in a given fiscal year. A higher value of either measure corresponds to a higher frequency of price crashes.

Although there is a large body of literature that has investigated stock price crash risk, consensus on the optimal measure of crash risk remains elusive. Each of the previously discussed measures—*NCSKEW*, *DUVOL*, *Ln # Crash week*, and *Crash week ratio*—captures different aspects and information. To integrate these insights, we employ principal component analysis (PCA) to condense the information from these four measures into a single index. Specifically, we use the first principal component derived from our set of original variables as an alternative proxy for crash risk, which is denoted be *Crash FPC*.

3.3. Measuring press freedom

Consistent with Faccio (2006), Y. Kim et al. (2014), Wang and Li (2019), and Berlinger et al. (2022), we use the World Press Freedom (WPF) index reported by Reporters Without Borders to measure a country's level of press freedom. The index, published since 2002, initially covered 139 countries and has now been expanded to 180. It is constructed based on seven dimensions of media freedom so as to rank countries according to survey data collected from media professionals, lawyers, and sociologists. In 2013, Reporters Without Borders significantly expanded its country coverage and modified the methodology and dimensions of the press freedom index. As a result, the raw index scores before and after 2013 are not fully comparable.[5] To address this issue, we measure our main test variable, *Press Freedom*, as the annual percentile rank of each economy's press freedom index, where zero indicates the lowest level of

[4] Our results are robust to using alternative criteria to define extremely negative returns, such as 3.09 standard deviations below the average firm-specific weekly returns (Hutton et al., 2009).

[5] From 2002 to 2012, a lower raw score indicated better press freedom. However, starting in 2013, a higher raw score reflected improved press freedom.

press freedom and one represents the highest. In unreported tests, we find that our results are robust when using raw WPF scores to measure press freedom across two subsamples: 2002–2012 and 2013–2021.

In 2013, when Reporters Without Borders refined their methodology, they constructed an aggregated press freedom index based on seven sub-indicators: (1) pluralism: the degree to which opinions are represented in the media; (2) media independence: the ability of media to function independently from political, governmental, business, and religious power and influence; (3) environment and self-censorship: the environment in which news and information providers operate; (4) legislative framework: the impact of the legislative framework governing news and information activities; (5) transparency: the transparency of institutions and procedures that affect the production of news and information; (6) infrastructure: the quality of the infrastructure that supports the production of news and information; and (7) abuse: the level of abuse and violence, based on data about attacks and violence against journalists and media during the evaluated period. Each sub-indicator captures different dimensions of press freedom and they are likely to exert varying impacts on financial markets. Therefore, we conduct a further analysis based on the decomposed press freedom factors.

3.4. Baseline regression model

To investigate the impact of press freedom on stock price crash risk, we use the following baseline regression model:

$$Crashrisk_{i,j,t} = \alpha + \beta \times Pressfreedom_{j,t-1} + \lambda \times FirmControls_{i,t-1} + \boldsymbol{\mu} \times EconomyControls_{j,t-1} + FirmFE + YearFE + \varepsilon_{i,j,t} \quad (4)$$

The dependent variable is one of the crash risk measures for firm i in economy j in year t. The main explanatory variable of interest is *Press freedom* in economy j in year $t-1$. We control for a set of economy- and firm-specific characteristics that have been suggested by literature to affect stock price crash risk. To better capture the potential serial correlation of stock price crash risk, we include the lagged value of *NCSKEW* (*NCSKEW lag*) in the regressions (Kim et al., 2011b; Jia, 2018). Another control variable is the firm size (*Ln Asset*), defined as the natural logarithm of the firm's total assets (Chen et al., 2001; Y. Kim et al. (2014)). We include *Tobin Q* to control for the effects of firm growth opportunities on stock price crash risk (Jia, 2018). Previous studies have also suggested that volatile stocks and high-leverage firms tend to be more crash-prone (Callen and Fang, 2015b; Jia, 2018). We thus control for stock volatility (*SIGMA*) and firm leverage (*Leverage*). In addition, abundant free cash flows in a firm may encourage executives' empire building and lead to a higher future crash risk (Jensen, 1986; Xu et al., 2014). Hence, we control for the free cash flows (*Free cash*), calculated as the operating income before depreciation minus interest expenses, income taxes, and capital expenditures, divided by total assets.

Our model also controls for several economy-level characteristics, including market size, the annual return of the market index, GDP per capita, population, inflation rate, exchange rate to USD, and unemployment rate (see Morelli, 2002; Beltratti and Morana, 2006; Paye, 2012; Engle et al., 2013). To mitigate the positive skew, we apply a logarithmic transformation to the original monetary and population variables. All of the above variables are defined in Appendix A. We further include firm- and year-fixed effects to capture unobserved time-invariant firm characteristics and heterogeneity across years. Standard errors are adjusted for heteroscedasticity and firm clustering.[6] We winsorize all continuous variables at the 1 % and 99 % levels to mitigate the effect of outliers.

3.5. Summary statistics

Table 2 presents the summary statistics of the variables used in our analysis. The mean values of two firm-level crash risk variables, *NCSKEW* and *DUVOL*, are −0.150 and −0.118, with standard deviations of 1.055 and 0.49, respectively. These figures are consistent with those reported in the literature investigating stock price crash risk using global data (e.g., An et al., 2018; Hu et al., 2020).[7] On average, firms in our sample experience stock price crash events in 0.078 weeks per year, accounting for 0.2 % of the average total number of trading weeks. The mean of the first principal component of the crash risk measures (*Crash FPC*) is 0.008. The average press freedom measure is 0.557. The median value of press freedom is skewed to the right because economies with greater press freedom generally have more public firms. In terms of firm characteristics, the average firm in our sample has total assets of $2,062 million, a *Tobin Q* of 1.773, and *Leverage* of 0.197. The average economy has 1,583 public firms, a total stock market capitalization of $35,443 billion, a GDP per capita of $25,838, a population of 306 million, an inflation rate of 2.174 %, and an unemployment rate of 5.472 %.

4. Baseline regression

Table 3 presents our baseline regression results. The dependent variable is one of our measures of stock price crash risk, and the key explanatory variable is press freedom. Across columns (1) to (5), the estimated coefficients for *Press freedom* are negative and statistically different from zero at the 5 % level or better. Since a higher value of *Press freedom* indicates a freer media environment, our

[6] The standard errors are clustered at the firm level because we believe that some factors (e.g., lack of necessary fundamental or stock information) impede the randomized sample assignment at the firm level. Since there is no evidence to show that firms are not randomly selected in a particular year(s), clustering the standard errors at the year level may be inappropriate and result in unnecessarily conservative estimates (Abadie et al., 2023).

[7] The stock price crash risk measures for individual economies shown in Table 1 are also consistent with prior literature. For example, the average *NCSKEW* of the USA is 0.067, which is similar to the figures reported by Ben-Nasr and Ghouma (2018) and Li and Zeng (2019); the average *DUVOL* of the USA is −0.016, which is comparable to Deng et al. (2020) and Kim et al. (2019). Additionally, the average *NCSKEW* (−0.203) and *DUVOL* (−0.198) for China are consistent with the results of Chen et al. (2018) and Xu et al. (2021).

Table 2
Summary statistics. This table reports the summary statistics of the variables. All continuous variables are winsorized at the 1% and 99% levels. Detailed variable definitions are provided in Appendix A.

Variable	N	Mean	Sd.	Min.	25 %	Median	75 %	Max.
Stock price crash risk and press freedom measures								
NCSKEW	164,162	−0.150	1.055	−2.801	−0.827	−0.165	0.500	2.744
DUVOL	164,162	−0.118	0.490	−1.232	−0.434	−0.152	0.145	1.502
# Crash week	164,162	0.078	0.271	0.000	0.000	0.000	0.000	2.000
Ln # Crash week	164,162	0.053	0.184	0.000	0.000	0.000	0.000	0.693
Crash week ratio	164,162	0.002	0.006	0.000	0.000	0.000	0.000	0.025
Crash FPC	164,162	0.008	1.656	−2.562	−0.883	−0.330	0.257	6.834
Press freedom	164,162	0.557	0.341	0.008	0.202	0.725	0.816	1.000
Others								
Ln Asset	164,162	5.802	1.862	0.393	4.519	5.667	6.955	10.662
Asset ($ million)	164,162	2,062	6,099	1	92	289	1,049	42,596
Tobin Q	164,162	1.773	1.960	0.456	0.961	1.249	1.842	20.833
Leverage	164,162	0.197	0.175	0.000	0.047	0.156	0.306	0.704
Free cash	164,162	0.000	0.117	−0.658	−0.028	0.017	0.056	0.236
Sigma	164,162	0.026	0.011	0.010	0.017	0.023	0.032	0.069
NCSKEW lag	164,162	−0.139	1.057	−2.744	−0.820	−0.162	0.506	2.796
Ln # Listed firm	164,162	6.855	1.148	3.258	6.089	7.132	7.649	8.700
# Listed firm	164,162	1,583	1,456	20	441	1,252	2,099	6,001
Ln Market size	164,162	7.012	1.523	0.462	6.077	6.994	7.948	18.106
Market size ($ billion)	164,162	35,443	1,378,766	2	436	1,090	2,830	73,000,000
Market return	164,162	0.004	0.005	−0.011	0.001	0.004	0.006	0.018
Ln GDP per capita	164,162	9.824	0.917	6.880	9.156	10.081	10.553	11.388
GDP per capita ($)	164,162	25,838	18,304	797	9,473	23,883	38,278	88,588
Ln Population	164,162	4.363	1.652	0.504	3.161	4.085	5.488	7.253
Population (million)	164,162	306	505	2	24	59	242	1,412
Inflation rate (%)	164,162	2.174	2.434	−2.093	0.981	1.763	2.756	29.507
Exchange rate (/100)	164,162	6.239	29.676	0.003	0.011	0.066	0.317	232.084
Exchange rate	164,162	623.936	2,967.587	0.285	1.058	6.644	31.742	23,208.370
Unemployment rate (%)	164,162	5.472	3.243	0.250	3.780	4.530	6.360	27.470
Google removal	114,845	1.267	1.978	0.000	0.000	0.000	1.946	6.019
Media per capita	114,845	0.344	0.257	0.000	0.152	0.275	0.523	0.848
Firm-specific error: PV	171,768	0.016	0.765	−1.810	−0.480	−0.039	0.458	2.276
Firm-specific error: RK	168,634	0.036	0.546	−1.330	−0.306	0.000	0.348	1.643
Firm-specific error: HP	171,006	0.011	0.634	−1.557	−0.3800	0.000	0.358	1.897
Long-run error	168,634	0.643	0.775	−2.195	0.136	0.657	1.189	2.644
Corruption	148,007	0.280	0.190	0.010	0.120	0.220	0.450	0.930
Democracy	148,007	0.340	0.298	0.010	0.120	0.200	0.530	0.980
Governance	191,840	0.406	0.083	0.140	0.397	0.410	0.419	0.760
Governance_overall	191,840	0.393	0.078	0.140	0.379	0.399	0.409	0.732
Analyst coverage	162,500	0.581	0.730	0.000	0.120	0.280	0.698	3.045
Media coverage	142,366	1.074	1.707	0.000	0.000	0.000	1.946	5.799
Financial dev. index	142,366	0.048	1.511	−1.615	−0.867	−0.192	0.657	20.204
Economic dev. index	142,366	0.111	2.170	−4.280	−2.003	0.439	1.945	4.514
Legal/political dev. index	142,366	6.303	2.060	1.000	5.000	7.000	8.000	10.000

results support *Hypothesis 1* in implying that firms in economies with higher degrees of press freedom have lower levels of stock price crash risk. The effect of press freedom on the crash risk is also economically meaningful. Ceteris paribus, a one-standard-deviation increase in press freedom leads to a reduction of 36 % in *NCSKEW* and 19 % in *DUVOL*. Moreover, a 1 % increase in the rank of press freedom performance is associated with a 2 % reduction in the number of crash events per year. These findings are consistent with the view that press freedom effectively increases information symmetry and restricts managerial incentives to hoard bad news, thus reducing future stock price crash risk.

The estimated coefficients for the control variables align closely with previous studies (e.g. Jia, 2018; Xu et al., 2020). For instance, firms with lower leverage and more free cash are less at risk of experiencing stock price crashes. High market index returns and GDP per capita are also associated with a lower crash risk.

5. Identification concern

5.1. Instrumental variable approach

Our results may have alternative explanations due to potential endogeneity issues. Unobserved or unmeasurable local conditions associated with both press freedom and stock price crash risk could influence our findings. For example, certain cultural and social factors such as collectivism (Boubakri et al., 2016) and individualism (An et al., 2018) might affect firms' risk levels and people's tolerance of press restrictions. To address endogeneity driven by potentially omitted variables, we adopt an IV approach.

Table 3
Baseline: Effect of press freedom on crash risk. This table reports results of OLS regressions of stock price crash risk on press freedom and control variables for global firm-year observations during 2002–2021. The dependent variables are stock price crash risk proxies measured in year $t + 1$, and all independent variables are measured in year t. All continuous variables are winsorized at the 1 % and 99 % levels. Detailed variable definitions are provided in Appendix A. Robust p-statistics adjusted for firm clustering are reported in parentheses. ***, **, and * stand for statistical significance at the 1 %, 5 %, and 10 % level, respectively.

	NCSKEW	DUVOL	Ln # Crash week	Crash week ratio	Crash FPC
	(1)	(2)	(3)	(4)	(5)
	(1)	(2)	(3)	(4)	(5)
Press freedom	−0.157***	−0.067***	−0.021**	−0.001**	−0.261***
	(0.007)	(0.010)	(0.028)	(0.013)	(0.003)
NCSKEW lag	−0.115***	−0.047***	−0.008***	−0.000***	−0.142***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Ln Asset	0.077***	0.048***	0.007***	0.000***	0.120***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Tobin Q	−0.060***	−0.006***	−0.004***	−0.000***	−0.058***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Leverage	0.874***	0.084***	0.035***	0.001***	0.688***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Free cash	−1.108***	−0.261***	−0.060***	−0.002***	−1.103***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Sigma	0.523	0.123	−0.473***	−0.015***	−2.400***
	(0.200)	(0.530)	(0.000)	(0.000)	(0.000)
Ln # Listed firm	−0.042*	−0.024**	0.014***	0.000***	0.040
	(0.069)	(0.023)	(0.000)	(0.000)	(0.251)
Ln Market size	0.080***	0.018***	0.005***	0.000***	0.084***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Market return	−3.170***	−7.543***	−0.916***	−0.028***	−13.712***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Ln GDP per capita	−0.595***	−0.282***	−0.075***	−0.003***	−0.983***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Ln Population	0.071	−0.065	−0.050**	−0.002***	−0.335
	(0.609)	(0.316)	(0.017)	(0.008)	(0.103)
Inflation rate	−0.007***	0.003***	−0.002***	−0.000***	−0.009***
	(0.002)	(0.006)	(0.000)	(0.000)	(0.001)
Exchange rate	0.003**	0.001**	−0.000	−0.000	0.001
	(0.019)	(0.025)	(0.195)	(0.162)	(0.370)
Unemployment rate	−0.012***	−0.005***	−0.001***	−0.000***	−0.018***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	4.729***	2.756***	0.870***	0.030***	9.878***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Firm FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Obs.	164,162	164,162	164,162	164,162	164,162
Adj-R^2	0.068	0.115	0.037	0.035	0.065

Our first IV is *Google removal*, defined as the natural logarithm of one plus the number of requests that Google received from a country each year to remove content criticizing the government. This IV meets both the relevance condition and the exclusion restriction required for a valid instrument. Specifically, the number of government requests to Google to remove critical content is an indicator of a government's tolerance toward criticism and control over information dissemination. Government censorship suppresses media information, restricts the dissemination of news, manipulates public perceptions, and undermines press freedom. It is worth noting that governments worldwide frequently request that Google removes unwanted content from search results, and these requests are reported dynamically.[8] This practice is prevalent globally and is not unique to certain economies. In our sample period, 43 out of 52 economies requested that Google withdrew government-criticizing content, to varying degrees. This widespread practice demonstrates global efforts to control information and manage public perceptions, reflecting broader trends in digital censorship and freedom of expression. Therefore, we expect that a higher number of such requests would be significantly related to lower press freedom. On the other hand, these government requests are generally aimed at suppressing criticism of the government rather than targeting specific firms. Therefore, they are unlikely to directly influence individual firms' operations, financial performance, or manager behaviors, which could affect crash risks.

The second IV, *Media per capita*, is the ratio of the number of domestic publicly listed media companies to the population of the economy, which serves as an indicator of the media industry's prosperity. In economies where press freedom is restricted, governments often exert tight control over both the media industry and its content. This control can involve direct ownership of media outlets and the imposition of stringent regulations that create significant entry barriers for new media companies, while also limiting what can be published or broadcast. Such environments suppress independent journalism and discourage the establishment of media organizations. Moreover, restrictions on media content can reduce audience engagement and advertising revenue, which makes the media industry less profitable and less attractive to investment. As a result, we expect that economies with limited press freedom will have less developed media industries, characterized by a smaller number of profit-oriented, publicly listed media companies. Meanwhile, the density of publicly listed media companies per capita is unlikely to directly influence individual stock price movements independently of press freedom. We define media firms based on SIC codes suggested by Hossain and Javakhadze (2020) (see Appendix A for details). Considering that the demand for information tends to increase and diversify in large-population countries, we scale the number of domestic public media firms by the national population.

We collect information on each economy's requests to remove government criticism from Google, and on public media companies from Compustat Global. In our 2SLS models, press freedom is regressed on *Google removal* and *Media per capita*. The predicted values from this first-stage regression are then used in the second-stage regression to analyze stock price crash risk. Table 4 presents the results. In column (1), consistent with our expectation, the number of removal requests sent to Google is negatively related to the degree of press freedom, while the media companies per capita is positively related to press freedom, both at the 1 % significance level.[9] The second-stage results, shown in columns (2) through (6), consistently demonstrate a significant and negative association between press freedom and crash risk, which supports our main finding that greater press freedom leads to lower crash risk.

5.2. Placebo test

The impact of press freedom on firms may be influenced by their choice of headquarters location. While some firms choose to locate in economies with fewer press restrictions because those economies usually have well-developed social norms, others may deliberately choose economies with poor press freedom to exploit institutional loopholes for their own benefit. Thus, we employ a placebo test to address the potential issue of nonrandom location selection. Specifically, we randomly assign each firm in our baseline sample to an economy and construct a pseudo press freedom variable based on the randomly assigned economy. We then re-estimate our baseline models using the pseudo press freedom variable to determine whether this variable also has explanatory power for stock price crash risk. We repeat this procedure 500 times, generating 500 estimated coefficients of the pseudo press freedom variable for each of the five crash risk measures.

The results of this analysis are presented in Table 5. Following Chen et al. (2021), we report a range of percentiles from the empirical distribution of the pseudo press freedom coefficient estimates for each of the five crash risk measures. For comparison, we also include the real baseline press freedom coefficient estimates from Table 3. The results show that the real press freedom coefficient estimates are positioned in the extreme upper tail of the empirical distributions of the pseudo coefficients, suggesting that the baseline results are unlikely to be driven by spurious correlations.

5.3. Propensity score matching

A potential concern regarding the association between press freedom and crash risk is that firms may have different underlying fundamentals depending on the level of press freedom in their respective economies. In this case, variations in firm characteristics, rather than press freedom itself, could be driving the observed relationship between press freedom and crash risk. We conduct a PSM analysis to address this concern. We classify firms into the treatment group if they are from economies with a high press freedom index in a given year (above the 50th percentile, coded as 1), and into the control group if they are from economies with a low press freedom

[8] See https://transparencyreport.google.com/government-removals/overview for more information.

[9] In the presence of heteroscedasticity, the traditional Cragg-Donald *F*-statistic is invalid (Cheng et al., 2014). Therefore, we report the Kleibergen-Paap Wald (KPW) *F*-statistic, which indicates that our model passes the weak identification test.

Table 4
Instrumental variable approach. This table reports the regression results of the two-stage least squares (2SLS) analysis. Column (1) reports the first-stage regression results, where *Google removal* and *Media per capita* are IVs of *Press freedom*. The results from the second-stage regressions are reported in columns (2) through (6), with *NCSKEW*, *DUVOL*, *Ln # Crash week*, *Crash week ratio*, and *Crash FPC* as the dependent variables, respectively. The independent variable of interest in the second stage is the predicted value of *Press freedom* from the first-stage regression. All continuous variables are winsorized at the 1% and 99% levels. Detailed variable definitions are provided in Appendix A. Robust *p*-statistics adjusted for firm clustering are reported in parentheses. ***, **, and * stand for statistical significance at the 1%, 5%, and 10% level, respectively.

	First stage	Second stage				
	Press freedom	NCSKEW	DUVOL	Ln # Crash week	Crash week ratio	Crash FPC
	(1)	(2)	(3)	(4)	(5)	(6)
Google removal	−0.005***					
	(0.000)					
Media per capita	0.106***					
	(0.000)					
Press freedom		−0.718**	−0.475***	−0.120*	−0.004**	−1.502***
		(0.034)	(0.001)	(0.056)	(0.033)	(0.006)
NCSKEWL lag	−0.000	−0.119***	−0.050***	−0.009***	−0.000***	−0.155***
	(0.403)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Asset	0.000	0.100***	0.051***	0.011***	0.000***	0.153***
	(0.789)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Tobin Q	−0.015***	−0.056***	−0.011***	−0.005***	−0.000***	−0.064***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Leverage	0.002	0.919***	0.112***	0.037***	0.001***	0.744***
	(0.429)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Free cash	−0.005***	−1.135***	−0.290***	−0.073***	−0.002***	−1.213***
	(0.008)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Sigma	−0.063***	1.673***	1.392***	−0.086	−0.003	1.568*
	(0.000)	(0.004)	(0.000)	(0.409)	(0.392)	(0.086)
Ln # Listed firm	0.004***	−0.056**	−0.020*	−0.002	−0.000	−0.058
	(0.000)	(0.017)	(0.062)	(0.695)	(0.486)	(0.120)
Ln Market size	−0.003	0.079***	0.029***	0.005***	0.000***	0.096***
	(0.972)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Market return	0.099**	−1.997	−5.974***	−0.675***	−0.023***	−10.486***
	(0.012)	(0.105)	(0.000)	(0.001)	(0.001)	(0.000)
Ln GDP per capita	0.117***	0.163**	−0.058*	−0.002	−0.000	0.009
	(0.000)	(0.019)	(0.062)	(0.855)	(0.819)	(0.933)
Ln Population	−0.003***	−0.158	−0.088	−0.019	−0.001	−0.272
	(0.000)	(0.238)	(0.149)	(0.399)	(0.362)	(0.189)
Inflation rate	0.001***	−0.003	0.003**	−0.000	−0.000	−0.000
	(0.000)	(0.195)	(0.023)	(0.568)	(0.659)	(0.938)
Exchange rate	−0.003***	−0.000	0.000	−0.000	−0.000	−0.000
	(0.000)	(0.683)	(0.684)	(0.629)	(0.670)	(0.771)
Unemployment rate	−0.000	0.000	−0.001	−0.001*	−0.000*	−0.005
	(0.403)	(0.996)	(0.384)	(0.067)	(0.057)	(0.150)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
KPW F-statistics	1,403					
Hansen J *p*-value	0.566					
Observations	113,158	113,158	113,158	113,158	113,158	113,158
Adjust R^2/Centered R^2	0.964	0.039	0.019	0.005	0.005	0.018

Table 5
Placebo test. This table presents the results of a placebo test based on randomly assigning firms to different economies 500 times. The coefficients are generated using the same baseline regression model used in Table 3.

	NCSKEW	DUVOL	No. crash week	Crash week ratio	Crash FPC
	(1)	(2)	(3)	(4)	(5)
mean β for pseudo-Press freedom	0.000	0.000	0.000	0.000	−0.001
min β for pseudo-Press freedom	−0.029	−0.011	−0.005	0.000	−0.039
1 % β for pseudo-Press freedom	−0.018	−0.008	−0.003	0.000	−0.030
5 % β for pseudo-Press freedom	−0.013	−0.006	−0.002	0.000	−0.021
25 % β for pseudo-Press freedom	−0.005	−0.003	−0.001	0.000	−0.009
50 % β for pseudo-Press freedom	0.000	0.000	0.000	0.000	−0.001
75 % β for pseudo-Press freedom	0.005	0.002	0.001	0.000	0.008
95 % β for pseudo-Press freedom	0.012	0.005	0.002	0.000	0.019
99 % β for pseudo-Press freedom	0.016	0.008	0.003	0.000	0.026
max β for pseudo-Press freedom	0.030	0.010	0.004	0.000	0.036
Coefficient of actual Press freedom in Table 3	−0.157	−0.067	−0.021	−0.001	−0.261

Table 6
PSM analysis. This table presents the after-matching difference in the propensity score and stock price crash risk measures of the PSM analysis. Firms are classified as belonging to the treatment group if they are in economies with press freedom above the 50th percentile in a year, and as belonging to the control group if they are in economies with press freedom below the 50th percentile in a year.

Propensity score
Average of treatment firms: 0.619
Average of control firms: 0.642
Diff (treatment minus control) propensity score (*p*-value): −0.005 (0.134)
Number of pairs: 25,214
Stock price crash risk measures:
Diff (treatment minus control) *NCSKEW* (*p*-value): −0.042 (0.000)
Diff (treatment minus control) *DUVOL* (*p*-value): −0.020 (0.000)
Diff (treatment minus control) *Ln # Crash week* (*p*-value): −0.008 (0.000)
Diff (treatment minus control) *Crash week ratio* (*p*-value): −0.001 (0.000)
Diff (treatment minus control) *Crash FPC* (*p*-value): −0.034 (0.000)

index in a given year (below the 50th percentile, coded as 0). We then run a probit regression in which the likelihood of a firm being in a high press freedom country (i.e., the propensity score) is linked to firm-level and economy-level controls used in the baseline regression. Finally, we apply a one-to-one nearest neighbor matching method with a caliper of 0.05 to pair each treatment firm with a control firm.

Table 6 presents the results of the PSM analysis. We find that there is no significant difference in propensity scores between the treatment and control groups in the post-matching sample. However, the treatment group exhibits lower levels of *NCSKEW*, *DUVOL*, *Ln # Crash week*, *Crash week ratio*, and *Crash FPC* than the control group, and these differences are significant at the 1 % level. In untabulated results, we repeat the baseline regression using the post-matching sample. We find that press freedom has a significantly negative relationship with crash risk.

6. Economic mechanisms

Our results thus far show that firms operating in economies with restricted press freedom tend to experience higher stock price crash risk. In this section, we conduct further analysis to explore the underlying mechanisms through which press freedom impacts the crash risk.

6.1. News patterns regarding adverse events

If news hoarding is prevalent in economies where journalists and media organizations face significant restrictions, we would expect the patterns of news coverage of adverse corporate events to vary significantly with the degree of press freedom. Based on this premise, we propose five conjectures. First, firms in economies with greater press freedom are likely to receive more media coverage, especially of negative events. Second, in the absence of obstruction, media in freedom-of-press economies would be able to report adverse events over a longer period of time. Third, the volume of news reports on the peak day will be higher in economies with a free press than in press-restricted economies. Fourth, based on the concept of half-life in radioactive decay, we expect that the time it takes for the volume of news reports to decline to half its peak level will be longer in economies with freedom of the press than in press-restricted economies. Fifth, when adverse events occur in press-restricted economies, foreign media are likely to provide more coverage than local media, as they will tend to operate with greater independence from domestic pressures.

We use news reports data from the RavenPack database, which tracks and analyzes daily news about over 40,000 global companies from 3,400 media outlets.[10] For each news report, RavenPack provides detailed information on the involved entity(ies), the relevance of the news to the entity(ies), the publication time, location, and topic, and the media outlet that was the source of the news. Each event is assigned a unique ID, with additional IDs for related news items reported over time. Given that news regarding a single event can be covered by various media outlets over an extended period, these data allow us to monitor both the start and end times of the news coverage, as well as the evolution of media attention over time. Moreover, RavenPack undertakes sentiment analysis for each news item based on a machine learning algorithm. We begin by identifying all firms included in our baseline regression and linking their news items recorded in RavenPack between 2002 and 2021 using ISIN codes. Following An et al. (2020), we exclude firm-initiated news and focus only on press-initiated news. To ensure that the firm is the central subject of the news event, we require a relevance score of over 90.[11]

We create five variables to measure the news patterns of each of these events. First, we calculate the number of news items reported about an event, *# News*, to capture the extent of media coverage and public awareness of the event. The second variable, *Life span*, is calculated as the difference between the publication times of the first and last news items related to the event, to measure the length of time (in days) over which the event was reported on. The third variable, *# News* max *day*, measures the number of news items

[10] RavenPack has been widely used in recent studies, such as Da et al. (2021) and Dai et al. (2021).

[11] RavenPack assigns a relevance score between 0 and 100 to indicate the extent to which a news item pertains to an entity. According to RavenPack, scores above 75 indicate significant relevance, while scores over 90 suggest that the entity is mentioned in the main title or headline.

Table 7
Press freedom and news patterns of adverse events. This table reports the results of the impact of press freedom on news patterns of adverse events. Panel A provides the summary statistics of the variables used to measure news patterns. Panel B provides the regression results. Observations in the regression are at the event level. All continuous variables are winsorized at the 1% and 99% levels. Detailed variable definitions are provided in Appendix A. Robust *p*-statistics adjusted for firm clustering are reported in parentheses. ***, **, and * stand for statistical significance at the 1%, 5%, and 10% level, respectively.

Panel A: Summary statistics

Variable	N	Mean	Sd.	Min.	25 %	Median	75 %	Max.
# News	928,541	47.359	121.485	1.000	3.000	11.000	38.000	7480.000
Ln # News	928,541	2.399	1.713	0.000	1.099	2.398	3.638	8.920
Life span	928,541	18.693	34.838	0.000	0.000	0.265	28.968	1202.025
Ln Life span	928,541	1.461	1.763	0.000	0.000	0.235	3.400	7.093
# News max day	928,541	5.669	14.831	1.000	1.000	2.000	4.000	1436.000
Ln # News max day	928,541	0.932	1.066	0.000	0.000	0.693	1.386	7.270
Half-life	928,541	10.255	45.133	0.000	0.000	0.000	0.000	782.800
Ln Half-life	928,541	0.494	1.318	0.000	0.000	0.000	0.000	6.664
% Local	928,541	0.511	0.438	0.000	0.000	0.609	1.000	1.000

Panel B: News pattern of adverse events

	Ln # News	Ln Life span	Ln # News max day	Ln Half-life	% Local
	(1)	(2)	(3)	(4)	(5)
Press freedom	1.367***	1.356***	0.966***	0.401***	0.523***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Asset	−0.095***	−0.022**	−0.042***	−0.014***	−0.012***
	(0.000)	(0.021)	(0.000)	(0.008)	(0.000)
Tobin Q	0.001	−0.001	−0.003	−0.002	0.001
	(0.812)	(0.844)	(0.180)	(0.262)	(0.482)
Leverage	−0.036	−0.032	0.073**	0.074***	0.033***
	(0.522)	(0.535)	(0.021)	(0.001)	(0.001)
Free cash	0.143***	0.043	−0.031	−0.106***	−0.010
	(0.000)	(0.193)	(0.112)	(0.000)	(0.237)
Sigma	−0.640**	0.183	0.468**	0.043	−0.688***
	(0.042)	(0.526)	(0.014)	(0.778)	(0.000)
Ln # Listed firm	0.813***	0.658***	0.361***	0.114***	0.225***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Ln Market size	−0.254***	−0.178***	−0.107***	−0.040***	−0.098***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Market return	1.699	−2.710*	−2.837***	−0.837	3.366***
	(0.330)	(0.091)	(0.006)	(0.333)	(0.000)
Ln GDP per capita	−0.113	−0.268*	−0.059	0.099	0.147***
	(0.446)	(0.058)	(0.479)	(0.157)	(0.000)
Ln Population	−4.245***	−3.530***	−2.932***	−0.717***	−0.500***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Inflation rate	−0.030***	−0.018***	−0.022***	−0.011***	−0.016***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Exchange rate	0.006*	0.003	−0.000	0.001	0.001
	(0.075)	(0.263)	(0.808)	(0.630)	(0.113)
Unemployment rate	0.019***	0.010***	−0.003	−0.002	0.004***
	(0.000)	(0.005)	(0.187)	(0.218)	(0.000)
Constant	85.021***	70.564***	57.203***	13.173***	9.263***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Firm FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Observations	928,541	928,541	928,541	928,541	928,541
Adj-R^2	0.132	0.109	0.099	0.044	0.579

published on the day when the event received its maximum daily coverage, to capture the peak level of media attention. Fourth, we introduce a variable to measure how soon the reporting on an event decays, denoted by *Half-life*. It is defined as the time between the day when the event reaches its peak coverage and the day when the number of news items has dropped to half its peak level. The last measure, *% Local*, is the proportion of news items reported by domestic media relative to the total news coverage of the event. To reduce positive skew and ensure symmetry, we log-transform the raw measures of the number of news reports (*Ln # News*, *Ln # News Max Day*) and the reporting duration (*Ln Life Span*, *Ln Half-Life*). We define an adverse event as one for which the ratio of negative news reports to total news reports is equal to or exceeds 95 %.[12]

Panel A of Table 7 reports the summary statistics of the news patterns. Our sample includes 928,541 adverse events reported on companies worldwide. On average, an adverse event in our sample generates 47.359 news reports and has a life span of 18.7 days. The average number of news items reported on the peak day is 5.7, and it takes an average of 10.255 days for the number of news reports to decay to half of its peak. Panel B presents regression results analyzing the relationship between news patterns of adverse events and press freedom at the event level. Consistent with our conjectures, the results in columns (1) through (5) show that adverse events in economies with a free press are associated with more news reports, longer reporting periods, greater intensity of reporting on the peak day, a slower decay of news coverage after reaching the peak, and a higher likelihood of being reported by local media. Taken together, our results suggest that adverse corporate events are less likely to be concealed from public attention in freedom-of-the-press economies, which could lead to a lower risk of stock price crashes.[13]

6.2. Overvaluation

In this subsection, we further explore the impact of press freedom on overvaluation. As previously discussed, poor press freedom enables firms to withhold unfavorable news more easily, thereby increasing the stock price crash risk. If this is the case, we expect that firms in economies with restricted press freedom will exhibit higher levels of overvaluation. This is because, in the absence of negative news, external investors are likely to mistakenly perceive these firms as well-managed and financially sound, leading to an overvaluation of their stocks. As a result, inflated stock prices become more vulnerable to sharp declines once adverse information is eventually revealed, potentially triggering a significant price crash. To examine this potential mechanism, we focus on firm-specific overvaluation.

We employ three approaches to capture the firm-specific valuation error. First, following Pástor and Pietro (2003), we estimate the following regression model cross-sectionally in each economy j and year t:

$$\log(M/B)_{i,j,t} = \alpha + \beta_1 Age_{i,j,t} + \beta_2 Ifdividend_{i,j,t} + \beta_3 Size_{i,j,t} + \beta_4 Leverage_{i,j,t} + \beta_5 ROE_{i,j,t} + \beta_6 Volatility_{i,j,t} + \varepsilon_{i,j,t} \quad (5)$$

The dependent variable is the natural logarithm of the market-to-book ratio (*M/B*), where M/B is the ratio of the product of the CRSP price (item 199) and shares outstanding (item 25) to book equity (item 60). *Age* is the negative of the reciprocal of one plus the firm age, which is the difference between the given year and the year of the initial public offering (IPO); *Ifdividend* is a dummy variable that takes a value of one if the firm pays dividends, and zero otherwise; *Size* is the natural logarithm of total assets; *Leverage* is the ratio of debt (item 9 + item 34) to total assets (item 6); *ROE* is measured as the ratio of income before extraordinary items (item 20) to average equity in the prior fiscal year ($(\text{item}\,60_t + \text{item}\,60_{t-1})/2$); *Volatility* is the standard deviation of daily raw returns over the prior fiscal year. The residuals ($\varepsilon_{i,j,t}$) obtained from the regression (Eq. (5) provide our first overvaluation measure for each firm *i*.

The second overvaluation measure is based on Rhodes-Kropf et al. (2005), who decompose log(M/B) into three components, firm-specific error, sector error, and long-run error, as shown below:

$$\log\left(\frac{M}{B}\right)_{i,t} = \underbrace{\log(Marketequity)_{i,t} - v(\theta_{i,t};\beta_{s,t})}_{\text{firm-specific error}} + \underbrace{v(\theta_{i,t};\beta_{s,t}) - v(\theta_{i,t};\beta_s)}_{\text{sector error}} + \underbrace{v(\theta_{i,t};\beta_s) - \log(Bookequity)_{i,t}}_{\text{long-run error}} \quad (6)$$

The firm-specific error indicates a firm's idiosyncratic deviations from the valuations that are implied by the accounting fundamentals at the time. The sector error indicates to what extent the sector is overvalued. The long-run error captures the deviation of the firm's long-run market value from the book value, indicating long-run growth opportunities. To obtain $v(\theta_{i,t};\widehat{\beta}_{s,t})$ and $v(\theta_{i,t};\widehat{\beta}_s)$, we estimate the following model cross-sectionally for each sector-year-economy group:

[12] According to RavenPack's algorithm, news reports with an event sentiment score above (below) 50 are considered positive (negative). Our results are robust to using 100% or 90% negative news as the criterion.

[13] In an untabulated analysis, we examine the relationship between press freedom and news sentiment to offer insights into how media environments shape the narrative about firms. Using data from the RavenPack database, we construct three event-level sentiment measures: the average event sentiment score (*ESS*), the average composite sentiment score (*CSS*), and the proportion of positive news. Our regression results show a negative association between press freedom and all three sentiment measures, with significance at the 1% level. This relation may arise because, in economies with a free press, heightened media scrutiny may act as a counterbalance to executive influence, making it harder for firms to control the narrative around negative events and reducing their ability to selectively withhold negative information. Conversely, in press-restricted environments, executives have greater control over the dissemination of information. In such settings, the ability to suppress or downplay adverse events can lead to inflated positive sentiment in the news.

$$\log(Marketequity)_{i,t} = \beta_{0,s,t} + \beta_{1,s,t}\log(Bookequity)_{i,t} + \beta_{2,s,t}\log\left(Netincome^{+}_{i,t}\right) + \beta_{3,s,t}I_{(<0)}\log\left(Netincome^{+}_{i,t}\right) + \beta_{4,s,t}Leverage_{i,t} + \varepsilon_{i,t} \quad (7)$$

where the dependent variable is the natural logarithm of the market value of equity; $\log(Bookequity)$ is the natural logarithm of book equity; $\log(Netincome^{+})$ is the natural logarithm of the absolute value of net income (item 172); $I_{(<0)}$ is an indicator that equals one if the net income is negative and zero otherwise; $I_{(<0)}\log(Netincome^{+})$ is an interaction term between the indicator and log net income; *Leverage* is the leverage ratio. After obtaining the coefficients from the regression ($\widehat{\beta}_{0,s,t}$, $\widehat{\beta}_{1,s,t}$, $\widehat{\beta}_{2,s,t}$, $\widehat{\beta}_{3,s,t}$, $\widehat{\beta}_{4,s,t}$), the estimated $v(\theta_{i,t};\beta_{s,t})$ in Eq. (6) is calculated as:

$$v(\theta_{i,t};\widehat{\beta}_{s,t}) = \widehat{\beta}_{0,s,t} + \widehat{\beta}_{1,s,t}\log(Bookequity)_{i,t} + \widehat{\beta}_{2,s,t}\log\left(Netincome^{+}_{i,t}\right) + \widehat{\beta}_{3,s,t}I_{(<0)}\log\left(Netincome^{+}_{i,t}\right) + \widehat{\beta}_{4,s,t}Leverage_{i,t} \quad (8)$$

To estimate $v(\theta_{i,t};\beta_{s})$ in Eq. (6), we take the average value over time to obtain $\sum\widehat{\beta}_{s,t}/T = \overline{\beta}_{s}$ for $\widehat{\beta}_{k}$, $k = 1, 2, 3, 4$, and then calculate

$$v(\theta_{i,t};\widehat{\beta}_{s}) = \overline{\beta}_{0,s} + \overline{\beta}_{1,j,s}\log(Bookequity)_{i,t} + \overline{\beta}_{2,s}\log\left(Netincome^{+}_{i,t}\right) + \overline{\beta}_{3,s}I_{(<0)}\log\left(Netincome^{+}_{i,t}\right) + \overline{\beta}_{4,s}Leverage_{i,t} \quad (9)$$

The firm-specific error is calculated as $\log(Marketequity)_{i,t} - v(\theta_{i,t};\beta_{s,t})$, and the long-run error is calculated as $v(\theta_{i,t};\beta_{s}) - \log(Bookequity)_{i,t}$.

The third measure follows Hoberg and Phillips (2010). We run the same regression model (Eq. (5), but estimated cross-sectionally for each economy, year, and industry (Fama-French 12) group. We utilize the residuals obtained from these regressions as our third

Table 8

Press freedom and overvaluation. This table reports the results of the impact of press freedom on overvaluation. The dependent variables in columns (1)-(3) are firm-specific errors defined by Pástor and Pietro (2003), Rhodes-Kropf et al. (2005), and Hoberg and Phillips (2010), respectively. The dependent variable in column (4) is the long-run error defined by Rhodes-Kropf et al. (2005). All continuous variables are winsorized at the 1% and 99% levels. Detailed variable definitions are provided in Appendix A. Robust p-statistics adjusted for firm clustering are reported in parentheses. ***, **, and * stand for statistical significance at the 1%, 5%, and 10% level, respectively.

	Firm-specific error			Long-run error
	Pástor & Pietro (2003)	Rhodes-Kropf et al. (2005)	Hoberg & Phillips (2010)	Rhodes-Kropf et al. (2005)
	(1)	(2)	(3)	(4)
Press freedom	−0.132***	−0.084***	−0.107***	−0.053**
	(0.001)	(0.006)	(0.002)	(0.034)
Ln Asset	0.039***	0.076***	0.026***	−0.086***
	(0.000)	(0.000)	(0.000)	(0.000)
Leverage	−1.830***	0.238***	−1.323***	−1.754***
	(0.000)	(0.000)	(0.000)	(0.000)
Free cash	−0.042**	−0.228***	−0.029**	−0.244***
	(0.042)	(0.000)	(0.023)	(0.000)
Tobin Q	0.000	0.100***	−0.000	0.024***
	(0.658)	(0.000)	(0.202)	(0.000)
Sigma	0.486***	0.093*	0.408***	−0.235***
	(0.002)	(0.082)	(0.003)	(0.000)
Ln # Listed firm	0.050***	0.054***	0.040**	−0.008
	(0.007)	(0.000)	(0.012)	(0.440)
Ln Market size	−0.144***	−0.116***	−0.111***	0.006
	(0.000)	(0.000)	(0.000)	(0.452)
Market return	−2.137***	−1.003***	−1.576***	1.155***
	(0.000)	(0.000)	(0.000)	(0.000)
Ln GDP per capita	0.345***	0.263***	0.250***	−0.187***
	(0.000)	(0.000)	(0.000)	(0.000)
Ln Population	0.708***	0.107	0.600***	−0.123
	(0.000)	(0.200)	(0.000)	(0.137)
Inflation rate	0.005***	−0.007***	0.003***	0.002**
	(0.000)	(0.000)	(0.009)	(0.023)
Exchange rate	0.003***	0.002***	0.001**	−0.005***
	(0.000)	(0.001)	(0.040)	(0.000)
Unemployment rate	−0.003	−0.004***	−0.001	−0.002
	(0.114)	(0.007)	(0.707)	(0.231)
Constant	−5.476***	−3.447***	−4.326***	4.422***
	(0.000)	(0.000)	(0.000)	(0.000)
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Obs.	169,627	166,509	168,855	166,509
Adj-R2	0.686	0.580	0.595	0.837

Table 9
Press freedom and corporate governance. This table reports the results of OLS regressions of corporate governance on press freedom and control variables for global firm-year observations from 2002 to 2021. The dependent variables are corporate governance measures measured in year $t+1$, and all independent variables are measured in year t. The corporate governance information is collected from the Refinitiv ESG database. *Governance* is five minus the sum of the scores for staggered board structure, limits to shareholder bylaw amendments, poison pills, golden parachutes, and supermajority requirements for charter amendments. Each of the above five categories of governance issues is assigned a score of one. We use five minus the sum of the scores so that the higher is the index, the better is the governance performance. *Governance_overall* is the overall corporate governance score in the database, which measures a company's effectiveness towards the equal treatment of shareholders and the use of anti-takeover devices. All continuous variables are winsorized at the 1 % and 99 % levels. Detailed variable definitions are provided in Appendix A. Robust *p*-statistics adjusted for firm clustering are reported in parentheses. ***, **, and * stand for statistical significance at the 1 %, 5 %, and 10 % level, respectively.

	Governance	Governance_overall
	(1)	(2)
Press freedom	0.004**	0.004**
	(0.035)	(0.043)
Ln Asset	−0.002***	−0.001***
	(0.000)	(0.000)
Tobin Q	−0.000	−0.000*
	(0.125)	(0.054)
Leverage	0.002**	0.002*
	(0.017)	(0.081)
Free cash	−0.001	−0.001
	(0.295)	(0.306)
Sigma	−0.001	−0.001
	(0.315)	(0.288)
Ln # Listed firm	−0.001	−0.000
	(0.586)	(0.844)
Ln Market size	−0.001***	−0.001***
	(0.000)	(0.001)
Market return	0.070***	0.063***
	(0.000)	(0.000)
Ln GDP per capita	−0.006***	−0.005***
	(0.000)	(0.000)
Ln Population	−0.013**	−0.012**
	(0.016)	(0.016)
Inflation rate	0.000	0.000
	(0.601)	(0.830)
Exchange rate	0.000**	0.000**
	(0.029)	(0.020)
Unemployment rate	−0.000	−0.000
	(0.238)	(0.287)
Constant	0.536***	0.504***
	(0.000)	(0.000)
Firm FE	Yes	Yes
Year FE	Yes	Yes
Obs.	191,840	191,840
Adj-R^2	0.741	0.736

firm-specific evaluation error measure.

Table 8 presents the results. The dependent variables in columns (1) through (4) are firm-specific error measures from Pástor and Pietro (2003), Rhodes-Kropf et al. (2005), and Hoberg and Phillips (2010), and the long-run error from Rhodes-Kropf et al. (2005), respectively. In all columns, we find a significant negative relationship between press freedom and the overvaluation measures. These results suggest that firms operating in economies with a free press are less prone to experiencing significant overvaluation. Press freedom acts as a mitigating factor, reducing the likelihood that unfavorable information about a firm's performance or prospects will be withheld from the public. Consequently, the market is better informed, leading to more accurate pricing of firms' stocks. On the other hand, in economies with restricted press freedom, firms are more able to suppress the release of negative news, causing investors to overprice such firms, and thus increasing the potential for a stock price crash.

6.3. Corporate governance

Another possible channel through which press freedom can influence crash risk is by strengthening corporate governance. Media scrutiny can place pressure on corporate boards to adopt better governance practices. Bednar (2012) highlights that media attention on corporate governance issues often drives reforms in areas such as board composition, executive compensation, and shareholder rights.

For example, companies receiving negative news coverage about governance practices frequently respond by increasing the independence of their boards and enhancing their disclosure practices. In addition, a free and transparent media environment can push companies to improve their reporting and disclosure standards. Solomon (2012) finds that the media influences public perceptions of corporate ethics and governance, which in turn affects consumer behavior and investor decisions. Fombrun and Shanley (1990) also argue that the desire to maintain a positive public image encourages firms to adopt more transparent and accountable governance structures. Furthermore, press freedom has an indirect effect by influencing regulatory bodies to strengthen corporate governance regulations. Reuter and Zitzewitz (2006) show that media exposure of corporate scandals often triggers regulatory attention and action, resulting in tighter governance rules and more robust enforcement mechanisms. For example, the Sarbanes-Oxley Act of 2002 was partly a response to widespread media coverage of corporate scandals in the early 2000 s. In this way, companies are motivated or forced to improve their governance practices to align with investors' and the public's expectations so as to maintain their market position. Meanwhile, firms' corporate governance mechanisms are closely related to future stock price crash risk (Xu et al., 2014; Andreou et al., 2016; Li and Zeng, 2019). Therefore, we propose that improving corporate governance is a mechanism through which press freedom reduces crash risk.

To test this channel, we construct two corporate governance measures based on the governance information collected from the Refinitiv ESG database. The first, *Governance*, follows the framework suggested by Bebchuk et al. (2009) and focuses on five specific governance components: staggered board structure, limits to shareholder bylaw amendments, poison pills, golden parachutes, and supermajority requirements for charter amendments. Each governance issue in the above five categories is assigned a score of one. *Governance* equals five minus the sum of the individual scores. The second measure, *Governance_overall*, is a comprehensive composite score provided by the database, which offers an aggregate evaluation of corporate governance performance across a wide range of indicators. Higher values for both measures indicate stronger corporate governance performance. Table 9 presents the regression results from examining the impact of press freedom on corporate governance. The estimated coefficients for *Press freedom* are positive and significant at the 5 % level. The results indicate that firms operating in economies with greater freedom of the press are associated with better governance performance. These findings align with our conjecture that press freedom plays a significant role in fostering better corporate governance practices and reinforce the idea that well-functioning institutions, such as independent media, are critical to maintaining sound corporate governance and reducing corporate crash risk.[14]

7. Cross-sectional analyses

To further support the causal interpretation that press restrictions lead to greater stock price crash risk, we conduct three additional analyses to explore whether the relationship between press freedom and crash risk exhibits any variations across firms or economies.

7.1. Corruption

We first examine whether variations in local corruption influence the impact of press freedom on crash risk. Corruption reflects weak legal frameworks and judicial systems, fosters a culture of bribery, and undermines press freedom (Lambsdorff, 2007). In the media sector, corruption leads to practices such as "cash for editorial", institutional profit seeking, and personal businesses benefiting from the identity of a reporter (Li, 2013). Firms may offer cash payments to journalists, the media, and other authorities in exchange for favorable coverage or the suppression of negative news. Besides direct bribery, firms can engage in indirect unethical practices, such as offering advertising deals, sponsored trips, or perks, to manipulate the media's reporting. Using samples from China, Chen et al. (2018) and Cao et al. (2019) find that combating corruption reduces firms' stock price crash risk. Therefore, we expect that the effect of press freedom in reducing crash risk will be weakened in economies with higher levels of corruption.

In this study, we use the corruption perception index published by Transparency International as a proxy for an economy's corruption level. To ensure comparability across years and independence from changes in the publisher's methodology, we use the percentile value of the index for each economy in a given year, where zero represents the least corrupt economy and one represents the most corrupt.

Columns (1) and (2) of Table 10 present the regression results. We find that the coefficients of the interaction term, *Press freedom* × *Corruption*, are both significantly and positively associated with stock price crash risk.[15] These findings support the idea that, in highly corrupt economies, firms can more easily exploit a weakened media system to conceal unfavorable information, which increases future stock price crash risk.

7.2. Industries heavily targeted by activist short sellers

Bao et al. (2019) suggest that managers have a general tendency to disclose or withhold bad news, leading to accumulated short interest. Short sellers, acting as speculators in the market, often conduct thorough research to identify firms with elevated short interest. They take short positions and profit when the stock price eventually declines after the hidden bad news is revealed. Callen and

[14] In an untabulated investigation, we find that the impact of press freedom on the reduction of crash risk is less obvious for firms that implement strong governance. This is consistent with the view that corporate governance also provides a framework for protecting investors and enhances the quality of information disclosure, which complements the role of the press in safeguarding market integrity.

[15] Our results are robust to using *Ln # Crash week*, *Crash week ratio*, or *Crash FPC* to measure stock price crash risk.

Table 10
Cross-sectional analysis. This table examines how corruption, industries heavily targeted by activist short sellers, and analyst coverage affect the relation between press freedom and stock price crash risk. The dependent variables are stock price crash risk measures: *NCSKEW* and *DUVOL*. The interaction items of interest are *Corruption* in columns (1) and (2), the industries heavily targeted by activist short sellers (*Short-selling target indus.*) in columns (3) and (4), and *Analyst coverage* in columns (5) and (6). All continuous variables are winsorized at the 1% and 99% levels. Detailed variable definitions are provided in Appendix A. Robust *p*-statistics adjusted for firm clustering are reported in parentheses. ***, **, and * stand for statistical significance at the 1%, 5%, and 10% level, respectively.

Interaction item =	Corruption		Short-selling target indus.		Analyst coverage	
	NCSKEW	DUVOL	NCSKEW	DUVOL	NCSKEW	DUVOL
	(1)	(2)	(3)	(4)	(5)	(6)
Press freedom	−0.339***	−0.104***	−0.038**	−0.041***	−0.155**	−0.063**
	(0.000)	(0.005)	(0.033)	(0.000)	(0.010)	(0.017)
Press freedom interaction	0.951***	0.184*	−0.254***	−0.094***	0.062***	0.018***
	(0.000)	(0.093)	(0.000)	(0.000)	(0.000)	(0.001)
Interaction	0.135	0.008	0.027**	0.020***	−0.035*	−0.017**
	(0.327)	(0.897)	(0.028)	(0.003)	(0.062)	(0.045)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	No	No	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	No	No	Yes	Yes	No	No
Obs.	146,032	146,032	152,924	152,924	162,500	162,500
Adj-R^2	0.072	0.119	0.032	0.064	0.081	0.122

Fang (2015a) show that short sellers are adept at detecting concealed bad news. They also find a positive relationship between short interest and future crash risk. Firms in industries that are frequently targeted by short sellers have greater potential to engage in the concealment of adverse information, which has become a primary source of profit for short sellers. The presence of short sellers, therefore, acts as a signal of potential stock price crashes. As we discussed previously, a free and independent press can act as an external watchdog, bringing transparency to corporate activities and making it more difficult for companies to suppress unfavorable information. We thus conjecture that the role of press freedom in reducing stock price crash risk is more significant for firms in industries where short sellers are active.

Several studies have highlighted an industry-clustering effect in short interest. For example, Molk and Partnoy (2022) analyzed 825 reports of activist short selling that targeted 573 public companies between 2009 and 2016. Among the 20 industries classified by the first two digits of the NAICS codes, the *Manufacturing* industry was the most frequently targeted for short selling, accounting for 194 firms (33.86 %). This was followed by *Professional, Scientific, and Technical Services* (91 firms; 15.88 %), *Information* (63 firms; 10.99 %), and *Finance and Insurance* (43 firms; 7.5 %). Given that almost half of the targeted firms are from the *Manufacturing* and *Professional, Scientific, and Technical Services* industries, we argue that these industries are more likely to be targeted by short sellers. In our analysis, this vulnerability is captured by a dummy variable, which identifies firms from industries that are heavily targeted by activist short sellers.[16] To test our prediction, we introduce an interaction item between press freedom and this dummy variable in our baseline regression model. The results are reported in columns (3) and (4) of Table 10.

The coefficients of press freedom remain negative and significant at 5 % or better. Firms from industries heavily targeted by short sellers are significantly associated with higher stock price crash risk. Most notably, the interaction item between press freedom and the dummy has a negative coefficient that is statistically significant at the 1 % level. This finding suggests that press freedom has a more pronounced effect on reducing crash risk for firms in industries that are more exposed to short selling.

7.3. Analyst coverage

Previous studies suggest that firms with higher analyst coverage tend to have more transparent information environments (e.g., Hong et al., 2000; Hong and Kacperczyk, 2010). This transparency helps reduce information asymmetry between management and investors, thereby mitigating future stock price crash risk. Similarly, a free and independent media plays a crucial role in uncovering corporate misconduct and promoting ethical business practices. Thus, it is reasonable to conjecture that analyst coverage and press freedom can complement and counterbalance each other. When the role of one is limited, the other becomes more prominent. Therefore, the influence of press freedom on stock price crash risk is likely more pronounced in companies with limited analyst coverage.

[16] Our results are robust to defining *Manufacturing* alone or *Manufacturing, Professional, Scientific, and Technical Services*, and *Information* as the industries heavily targeted by activist short sellers.

To test this conjecture, we collect data on analyst coverage from the I/B/E/S database, which is widely used in existing research. For each fiscal year, we calculate the average number of analysts covering firms in the same 4-digit SIC industry for each economy as the raw measure of analyst coverage. We then use the natural logarithm of one plus this raw measure as a proxy for industry-level analyst coverage.[17] Columns (5) and (6) of Table 10 present the regression results. The estimated coefficients for analyst coverage are negative and significant at the 10 % level or better, supporting the view that greater analyst scrutiny reduces managerial opportunism and promotes more accurate and timely disclosure of negative information, thereby reducing the likelihood of sudden price drops. In addition, the coefficients on the interaction items between analyst coverage and press freedom are positive and significant at the 1 % level. These results suggest that the overall negative impact of press freedom on crash risk diminishes as analyst coverage increases. In other words, the mitigating effect of press freedom is stronger when analyst coverage is limited and weaker when analyst coverage is high. Our findings indicate that free media can serve as a substitute for the role played by financial analysts. Specifically, in cases where analyst coverage is limited, a free press becomes a crucial mechanism for uncovering negative corporate news and potential misconduct, thereby filling the gap left by insufficient analyst monitoring.

8. Further analyses and robustness

8.1. Decomposed press freedom index

As Section 3.3 discussed, the overall press freedom index from Reporters Without Borders covers several dimensions of press freedom, including pluralism, media independence, environment and self-censorship, legislative framework, transparency, infrastructure, and the prevalence of abuse. These factors capture both the availability and quality of information flowing to the market and the extent to which that information can be trusted. We expect that each of the dimensions of press freedom may have a different impact on stock price crash risk due to their distinct effects on information flow, information reliability, market perception, and investor confidence. For example, while abuse and violence against journalists pose a significant threat to press freedom, their direct impact on stock price crash risk may be less pronounced than that of other institutional dimensions of press freedom. Abuse often targets journalists investigating political corruption, human rights issues, or controversial social topics, rather than those focused on business or finance. Therefore, the information flows relevant to business, investors, and stock markets may not be significantly disrupted by abuse.

A key challenge for this empirical analysis is data availability. Although the index is constructed based on these dimensions, Reporters Without Borders did not publicly disclose the decomposed information until recently. In 2015, they started to publish aggregated values for six institutional factors affecting press freedom (i.e., pluralism, media independence, environment and self-censorship, legislative framework, transparency, and infrastructure) and the abuse factor.[18] Using the subsample covering the period 2015–2021, we assess the individual effects of the aggregated institutional factors and abuse factor on stock price crash risk. The untabulated regression results show that the aggregated institutional factor has a negative and significant impact on the stock price crash risk measures and the effect of the abuse factor is negative but loses significance in the subsample.[19] These results support our conjecture that the business information ecosystem may remain resilient enough to function even in environments where abuses occur, and that the impact of abuse on stock price crash risk is less pronounced.

Having identified the institutional factors of press freedom as the main driver of the reduction of crash risk, we further explore the impact of each of the six institutional factors on crash risk, using a subsample from 2017 to 2021. The results are presented in Table 11. We find that, with the exception of the *pluralism* factor, each of the institutional factors (i.e., *media independence, environment and self-censorship, legislative framework, transparency,* and *infrastructure*) is significantly associated with at least one crash risk measure. In particular, the coefficients of *environment and self-censorship*, *transparency* and *infrastructure* are negative and significant at the 1 % level in the *DUVOL* models, which highlights the critical role these factors play in mitigating stock price crash risk.

The environment in which news providers operate determines their ability to report freely without undue interference, which in turn affects the accuracy and completeness of the information available to the market. Transparency in institutions ensures that the processes behind news production are open and trustworthy, reducing biases in the news. Moreover, a well-developed infrastructure is essential for ensuring that news and information are delivered in a timely and efficient manner. All these factors directly influence the quality, timeliness, and effectiveness of information available to the public and investors, which is crucial in mitigating the withholding of negative news and thereby reducing future stock price crash risk. Overall, our analysis highlights the multifaceted nature of

[17] Using industry-level financial analyst coverage is based on two key considerations. First, analysts not only conduct firm-specific analyses but also provide border insights into the industry and competitive landscape (Crawford et al., 2012; Martens and Sextroh, 2021). As a result, information is likely to spill over and flow more freely within the industry with greater analyst coverage. Second, although I/B/E/S includes analyst data for firms globally, a significant portion of our sample, particularly firms from smaller and emerging markets, lacks sufficient coverage. By using economy/industry annual averages, we can mitigate this missing data issue.

[18] Reporters Without Borders did not publish the individual values of each of the seven decomposed indicators on their website. Instead, they released only the aggregated values of the six institutional factors and the abuse factor during the period 2015–2021. However, we are very grateful to Reporters Without Borders for providing us with the individual values for each institutional factor following our request. Unfortunately, this information is only available for the years 2017–2021.

[19] We also confirm that our main press freedom measures remain statistically significant and negatively associated with the crash risk measures at least at the 5% level in this subsample analysis.

Table 11
Decomposed press freedom index. This table examines the relations between stock price crash risk and press freedom, indicated by the decomposed institutional factors released by Reporters Without Borders during 2017–2021. The decomposed factors are pluralism (columns (1) and (2)), media independence (columns (3) and (4)), environment and self-censorship (columns (5) and (6)), legislative framework (columns (7) and (8)), transparency (columns (9) and (10)), and infrastructure (columns (11) and (12)). All continuous variables are winsorized at the 1% and 99% levels. Detailed variable definitions are provided in Appendix A. Robust *p*-statistics adjusted for firm clustering are reported in parentheses. ***, **, and * stand for statistical significance at the 1%, 5%, and 10% level, respectively.

Panel A: Decomposed index by Reporters Without Borders (2017–2021)												
Press freedom =	Pluralism		Media independence		Environment and self-censorship		Legislative framework		Transparency		Infrastructure	
	NCSKEW	DUVOL	NCSKEW	DUVOL	NCSKEW	DUVOL	NCSKEW	DUVOL	NCSKEW	DUVOL	NCSKEW	DUVOL
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Press freedom	−0.032	−0.019	−0.001	−0.022*	−0.027	−0.035***	−0.052*	−0.0003	−0.025	−0.033***	−0.121***	−0.063***
	(0.320)	(0.176)	(0.978)	(0.052)	(0.366)	(0.008)	(0.083)	(0.979)	(0.390)	(0.010)	(0.000)	(0.000)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	55,469	55,472	55,469	55,472	55,469	55,472	55,469	55,472	55,469	55,472	55,469	55,472
Adj-R^2	0.113	0.160	0.113	0.160	0.113	0.160	0.113	0.160	0.113	0.160	0.113	0.160

press freedom: its impact is not driven by a single dimension but by a collective influence from multiple components.

8.2. Press freedom index by freedom House

To ensure that our findings are not reliant solely on the press freedom index published by Reporters Without Borders, we also collect the press freedom index from another source, Freedom House, and repeat the baseline regressions. To create a consistent measure that remains independent of sample size and comparable across different years, we use the percentile ranking of this index for each economy/year as our primary explanatory variable, where zero denotes the lowest level of press freedom, and one the highest. Because Freedom House stopped publishing the press freedom index after 2017, we lose four years of our sample and restrict our sample period to 2002–2017. In untabulated results, we find that the coefficients estimated on the press freedom index are significantly and negatively correlated with *NCSKEW* (at the 1 % level), *DUVOL* (at the 10 % level), and *Crash FPC* (at the 5 % level). This is consistent with our baseline results: firms in economies with better press freedom enjoy lower stock price crash risk levels.[20]

Furthermore, we conduct additional tests to examine the impact of varying levels of press freedom based on the Freedom House's data. Freedom House categorizes nations into three distinct groups based on aggregate press freedom scores: *Free* (0–30), *Partly Free* (31–60), and *Non-Free* (61–100). To incorporate these classifications into our analysis, we constructed dummy variables representing the three levels of press freedom. We replace the overall *Freedom of the Press Index* with the *Free* and *Partly Free* dummy variables in the regression model, designating *Non-Free* as the reference category. Our untabulated results suggest that the estimated coefficients for *Free* and *Partly Free* are negatively associated with *NCSKEW* (at the 1 % level), *DUVOL* (at the 1 % level), *Crash Week Ratio* (at the 10 % level), and *Crash FPC* (at the 1 % level). These findings suggest that the negative impact of press freedom is more pronounced in *Free* and *Partly Free* countries compared to *Non-Free* countries. Moreover, the coefficients for *Free* are larger in magnitude than those for *Partly Free*, indicating that the effect relative to the *Non-Free* category is stronger in *Free* countries than in *Partly Free* countries. These results further confirm that press freedom has a significant negative (linear) impact on stock price crash risk.

8.3. Media coverage and other additional control variables

To further mitigate the omitted variable concern, we control for several additional variables, including media coverage, a financial development index, an economic development index, and a legal/political development index, that may also affect the crash risk.

Frist, to address the concern that the impact of press freedom on crash risk is potentially driven by firm level media coverage, we conduct robustness tests by further controlling for the potential effect of media coverage. Following An et al. (2020), firm level media coverage is measured by the natural logarithm of one plus the amount of news published around a firm within a specific year. We include media coverage as an additional control variable in the baseline regression. The results are presented in the Panel A of Table 12. We find that the main explanatory variable of interest, *Press freedom*, continues to show negative coefficients with respect to the crash risk measures, significant at the 5 % level or better across all regressions. However, media coverage does not have a significant impact on stock price crash risk. This might be due to the complex nature of media coverage and the challenges of analyzing its impact using a global sample. In addition, we conduct an additional test by including an interaction term between media coverage and press freedom to examine potential interactive effects. The results, reported in the Panel B of Table 12, show that while the coefficients of the interaction term are positive, they are not statistically significant. This suggest that high media coverage neither substitutes for nor enhance the effect of press freedom. Overall, these findings reinforce our confidence that press freedom's influence on stock price crash risk is not driven by any potential relationship between media coverage and stock price crash risk.

Furthermore, to isolate the impact of press freedom from other institutional factors or social norms, we further construct three indices to measure financial, economic, and legal/political development and incorporate them into the baseline model. Following J. B. Kim et al. (2014), each index is derived as the first principal component from a series of annual indices using principal component analysis, and is normalized so that a higher score indicates better development (see Appendix A for detailed definitions). The results in Panel A of Table 12 suggest that firms in economies with more developed financial and economic systems tend to experience higher levels of crash risk, which might be attributed to a more dynamic stock market and increased sophistication. Firms in economies with flawless legal/political systems are exposed to lower crash risk. Our findings suggest that other legal and political institutional factors also play an important role in controlling crash risk. However, they cannot erase the efficacy of press freedom.

8.4. Economy-level evidence

To further confirm the effect of press freedom on stock price crash risk, we run a series of regressions at the economy level. The first two dependent variables are the mean values of the firm-level *NCSKEW* and *DUVOL* for each economy-year. The third dependent variable used to measure the crash risk is the average number of crash events experienced by firms in the economy in a given year. The fourth is the ratio of firms experiencing stock price crash events to the total number of firms in the economy. The last dependent variable is the first principal component of the above four economy-level crash risk measures.

After controlling economy characteristics, economy fixed effect, and year fixed effect, we find that higher *Press freedom* is

[20] We admit that the coefficients on the press freedom index by Freedom House are not significant with respect to *Ln # Crash week* and *Crash week ratio*. Possible explanations include that (1) the sample period is restricted and (2) the criteria and methodologies used by Freedom House and Reporters Without Borders to measure press freedom are different.

Table 12
Control for media coverage and other institutional factors. This table reports the regression results when additional control variables, including *Media coverage* and its interaction with press freedom (*Media coverage* × *Press freedom*), *Financial dev. index*, *Economic dev. index*, and *Legal/political dev. index*, are added to the baseline regression. Panel A (Panel B) presents the result without (with) the interaction term. *Media coverage* is the natural logarithm of one plus the number of news published about a firm within a specific year in the RavenPack database. *Financial dev. index* is the first principal component from a series of financial development indices, including (A1) stock market capitalization/GDP, (A2) number of listed firms/populations, (A3) total value of traded shares/GDP, and (A4) total value of traded shares/market. *Economic dev. index* is the first principal component from a series of economic development indices, including (B1) GDP per Capita, (B2) tax revenue/GDP, (B3) human development index, (B4) economic openness index, (B5) state-owned enterprises, (B6) state ownership of banks, and (B7) cost of starting a new business. *Legal/political dev. index* is the first principal component from a series of legal/political development indices, including (C1) creditor rights, (C2) voice and accountability, (C3) judicial independence, (C4) rule of law, (C5) control of corruption, (C6) political stability and absence of violence, and (C7) protecting minority investors: extent of shareholder rights. A1, A2, A3, A4, B1, and B2 are collected from World Bank World Development Indicators; B3 is collected from United Nations Development Program: Human Development Report; B4, B5, B6, and C3 are collected from Economic Freedom of the World; B7 and C7 are collected from World Bank World Doing Business Indicators; C1 is collected from Porta et al. (1998); C2, C4, C5, C6 are collected from World Bank World Governance Indicators. All continuous variables are winsorized at the 1 % and 99 % levels. Detailed variable definitions are provided in Appendix A. Robust *p*-statistics adjusted for firm clustering are reported in parentheses. ***, **, and * stand for statistical significance at the 1 %, 5 %, and 10 % level, respectively.

	NCSKEW	DUVOL	Ln # Crash week	Crash week ratio	Crash FPC
	(1)	(2)	(3)	(4)	(5)
Panel A					
Press freedom	−0.132**	−0.070**	−0.028***	−0.001***	−0.299***
	(0.050)	(0.014)	(0.006)	(0.001)	(0.002)
Media coverage	−0.003	−0.007	0.000	0.000	−0.005
	(0.861)	(0.390)	(0.903)	(0.896)	(0.844)
Financial dev. index	0.014	0.002	0.003***	0.000***	0.025**
	(0.129)	(0.577)	(0.007)	(0.003)	(0.023)
Economic dev. index	0.015	0.006	0.010***	0.000***	0.072**
	(0.506)	(0.500)	(0.002)	(0.001)	(0.019)
Legal/political dev. index	−0.039***	−0.027***	−0.008***	−0.000***	−0.090***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Baseline controls	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Obs.	142,366	142,366	142,366	142,366	142,366
Obs.	142,366	142,366	142,366	142,366	142,366
Adj-R^2	0.074	0.108	0.034	0.033	0.062
Obs.	142,366	142,366	142,366	142,366	142,366
Panel B					
	NCSKEW	DUVOL	Ln # Crash week	Crash week ratio	Crash FPC
	(1)	(2)	(3)	(4)	(5)
Press freedom	−0.128*	−0.069**	−0.027***	−0.001***	−0.290***
	(0.058)	(0.016)	(0.008)	(0.002)	(0.002)
Press freedom × Media coverage	0.072	0.024	0.016	0.001	0.150
	(0.266)	(0.452)	(0.165)	(0.158)	(0.150)
Media coverage	−0.054	−0.024	−0.011	−0.000	−0.113
	(0.268)	(0.321)	(0.200)	(0.195)	(0.150)
Controls	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Obs.	142,366	142,366	142,366	142,366	142,366
Adj-R^2	0.074	0.108	0.034	0.033	0.062

associated with lower stock price crash risk (untabulated results), consistent with our baseline results.

8.5. Financial media vs non-financial media

The influence of press freedom on financial media versus general media may differ in how it shapes their ability to inform, investigate, and hold power accountable. To test this conjecture, we conducted an additional test to examine whether press freedom has a differential impact on the news patterns reported by financial versus non-financial media. The analysis follows a similar approach to the News Patterns analysis in Section 6.1, but is conducted separately on two subsamples: financial media and non-financial media. To classify financial and non-financial media, we followed a three-step methodology. First, we identified well-known and widely recognized financial media sources commonly used in existing research (e.g., Griffin et al., 2011; Ahern and Sosyura, 2014; Guldiken et al., 2017), such as *The Wall Street Journal*, *Reuters*, *Bloomberg*, *CNBC*, *Forbes*, and *The Financial Times*. Second, we conducted a keyword-based screening of media names for terms related to finance and economics, such as "Economic/Economy," "Finance/

Financial," "Business," and "Banking," to identify additional media sources with a potential financial focus. Finally, we manually reviewed the official websites of the remaining media sources, analyzing their content—including column topics, article focus, and editorial coverage—to further refine our classification.

Based on the classification steps outlined above, we identified 379 financial media outlets, which collectively account for over 80 % of the total articles, while 2,467 non-financial media outlets contribute approximately 20 % of the coverage. We then replicate those regressions in Table 7, which examine the impact of press freedom on news patterns of adverse events, based on each subsample. The untabulated results (available upon request) suggest that the impact of press freedom on news patterns is similar across financial and non-financial media in several key dimensions. Specifically, press freedom does not appear to differentially affect the extent of media coverage, the duration (in days) over which an event is reported, the peak level of media attention, or the proportion of domestic media coverage relative to total news coverage.

9. Conclusion

Consistent with the bad news hoarding explanation, this paper shows that firms in economies with higher degrees of press freedom are associated with lower levels of stock price crash risk. To address endogeneity issues, we use an IV approach, adopt placebo and PSM tests, and control for additional variables. We identify three possible economic mechanisms through which press freedom might influence crash risk. First, we find that news patterns in economies with press freedom discourage bad news hoarding behavior. Second, we find that press freedom leads to a lower degree of firm-specific and long-run overvaluation. Lastly, press freedom encourages firms to improve corporate governance.

Our study is unique in three respects. First, we focus on institutional restrictions on the transparency of firms' daily news instead of accounting information with lagged calculations. Second, press freedom focuses on externally generated institutional transparency rather than firms' internally generated openness and clarity. Third, cross-economy data enables us to extend the knowledge of crash risk to the global scale.

Our study aims to raise public awareness about the economic implications of press freedom and its role in maintaining the stability of the financial markets. We show the critical role of press freedom in preventing bad news hoarding. The potential beneficiaries of this research include investors and shareholders, policymakers, and the press.

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.

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Appendix A

Variable	Definition
Stock price crash risk measures	
NCSKEW	The negative conditional skewness of firm-specific weekly returns. The negative of the third moment of firm-specific weekly returns for each firm and year divided by the standard deviation of firm-specific weekly returns raised to the third power. A higher value of *NCSKEW* indicates higher crash risk. See Eq. (2) for details. Source: Compustat
DUVOL	The down-to-up volatility. Natural logarithm of the ratio of the standard deviation of firm-specific weekly returns for the "down week" sample to the standard deviation of firm-specific weekly returns for the "up week" sample over the fiscal year. A higher value of *DUVOL* indicates higher crash risk. See Eq. (3) for details. Source: Compustat
Ln # Crash week	The natural logarithm of one plus the number of weeks the firm experiences stock price crashes in a given fiscal year. Source: Compustat
Crash week ratio	The ratio of weeks during which the firm experienced stock price crashes to the total trading weeks of the firm in a given fiscal year. Source: Compustat
Crash FPC	The first principal component of *NCSKEW*, *DUVOL*, *Ln # Crash week*, and *Crash week ratio* extracted by principal component analysis.
News pattern measures	
Ln # News	The natural logarithm of the total number of news items reported around an adverse event. Adverse events are those having 95 % or more negative news items. Source: RavenPack
Ln Life span	The natural logarithm of the number of days between the first and last news items reported around an adverse event. Source: RavenPack
Ln # News max day	The natural logarithm of the number of news items on the day when the adverse event reaches its maximum daily number of reports. Source: RavenPack
Ln Half-life	The natural logarithm of the days between the day when the event reaches its maximum daily number of reports and the day by which the number of news items has dropped to half of its peak amount. Source: RavenPack

(*continued on next page*)

(*continued*)

Variable	Definition
% Local	The ratio of news items reported by the local media to the total number of news items reported around the adverse event. Source: RavenPack
Overvaluation measures	
Firm-specific error: PP	Firm-specific valuation error measure from Pástor and Pietro (2003). The residual of the regression model in Eq (5). See Eq. (5) in Section 6.2 for details. Source: Compustat
Firm-specific error: RK	Firm-specific valuation error measure from Rhodes-Kropf et al. (2005). The difference between the observed price and a valuation measure that reflects time-*t* fundamentals. See Eq. (6) through (9) in Section 6.2 for details. Source: Compustat
Firm-specific error: HP	Firm-specific valuation error measure from Hoberg and Phillips (2010). The residual of the same regression model from Eq (5) suggested by Pástor and Pietro (2003), but separately for each year and industry (Fama-French 12 industry classification) as in Rhodes-Kropf et al. (2005).
Long-run error	Long-run valuation error measure from Rhodes-Kropf et al. (2005). The difference between the valuation-based long-run value and the book value. See Eq. (6) through (9) in Section 6.2 for details. Source: Compustat
Other variables	
Press freedom	The percentile of the rank of the press freedom index of the economy in a given year (varies from 0 to 1). A value of zero indicates the lowest degree of freedom; a value of one indicates the highest degree of freedom. Source: Reporters Without Borders
Google removal	The natural logarithm of one plus the number of requests Google received to remove government-criticizing content in the economy in a given year. Source: Google
Media per capital	The ratio of the number of public media firms to the population (in millions) of the economy in a given year. A firm is defined as a media firm if its SIC code is 2711 (Newspapers: Publishing, or Publishing and Printing), 2721 (Periodicals: Publishing, or Publishing and Printing), 2731 (Books: Publishing, or Publishing and Printing), 2832 (Book Printing), 2741 (Miscellaneous Publishing), 4832 (Radio Broadcasting Stations), 4833 (Television Broadcasting Stations), or 4841 (Cable and Other Pay Television Services) (Hossain and Javakhadze, 2020). Source: Compustat
Corruption	The percentile value of the corruption perceptions index of the economy in a given year (varies from 0 to 1). A value of zero indicates the lowest degree of corruption; a value of one indicates the highest degree of corruption. Source: Transparency International
NCSKEW lag	One-year-lagged *NCSKEW*. Source: Compustat
Ln Asset	The natural logarithm of the book value of total assets ($ million) (item 6). Source: Compustat and CRSP
Tobin Q	The ratio of the market value of assets to the book value of assets (item 6 − item 60 + item 25* item 199)/item 6. Source: Compustat and CRSP
Leverage	The ratio of the book value of debts (item 34 + item 9) to the market value of total assets (item 6 − item 60 + item 25* item 199)/item 6. Source: Compustat and CRSP
Free cash	Operating income before depreciation (item13) – interest expenses (item15) – income taxes (item16) – capital expenditures (item128), divided by the book value of total assets (item6). Source: Compustat and CRSP
Sigma	The standard deviation of the weekly stock returns over a fiscal year. Source: Compustat
Ln # Listed firm	The natural logarithm of the number of listed firms in the economy in a given year. Source: Compustat
Ln Market size	The natural logarithm of the total market value of public firms ($ million) in the economy in a given year. Source: Compustat
Market return	The average weekly return of the market index of the economy in a given year. Source: Compustat
Ln GDP per capita	The natural logarithm of the GDP per capita of the economy in a given year. Source: The World Bank
Ln Population	The natural logarithm of the population of the economy in a given year. Source: The World Bank
Inflation rate	The inflation rate (%) of the economy in a given year. Source: The World Bank
Exchange rate	The average exchange rate at which one U.S. dollar is exchanged for the domestic currency of the economy in a given year. *Exchange rate* is divided by 100 to amplify its coefficients in regressions. Source: The World Bank
Unemployment rate	The unemployment rate of the economy in a given year. Source: The World Bank
Governance	Five minus the sum of the scores for staggered board structure, limits to shareholder bylaw amendments, poison pills, golden parachutes, and supermajority requirements for charter amendments. Each of the above five categories of governance issues is assigned a score of one. Source: Refinitiv ESG database.
Governance_overall	The overall corporate governance score. Source: Refinitiv ESG database.
Analyst coverage	The natural logarithm of one plus the average number of analysts covering firms in the same 4-digit SIC industry in an economy. Source: I/B/E/S database.
Media coverage	The natural logarithm of one plus the number of news items published about a firm within a specific year. Source: RavenPack
Financial dev. index	The first principal component of (A1) stock market capitalization/GDP, (A2) number of listed firms/populations, (A3) total value of traded shares/GDP, and (A4) total value of traded shares/market using principal component analysis. Source: (A1), (A2), (A3), and (A4) are collected from World Bank World Development Indicators.
Economic dev. index	The first principal component of (B1) GDP per Capita, (B2) tax revenue/GDP, (B3) human development index, (B4) economic openness index, (B5) state-owned enterprises, (B6) state ownership of banks, and (B7) cost of starting a new business, using principal component analysis. Source: (B1) and (B2) are collected from World Bank World Development Indicators; (B3) is collected from United Nations Development Program: Human Development Report; (B4), (B5), and (B6) are collected from Economic Freedom of the World; (B7) is collected from World Bank World Doing Business Indicators.
Legal/political dev. index	The first principal component of (C1) creditor rights, (C2) voice and accountability, (C3) judicial independence, (C4) rule of law, (C5) control of corruption, (C6) political stability and absence of violence, and (C7) protecting minority investors: extent of shareholder rights, using principal component analysis. Source: (C1) is collected from La Porta et al. (1998); (C2), (C4), (C5), and (C6) are collected from World Bank World Governance Indicators; (C7) is collected from World Bank World Doing Business Indicators.

Data availability

Data will be made available on request.

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