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Information asymmetry on the link between corporate social responsibility and stock price crash risk

Thuy Cao^{1,2}, Hoang Nguyen³, Khuong Nguyen^{1,2} and Liem Nguyen^{1,2*}

Abstract: Theoretically, corporate social responsibility (CSR) can have both positive and negative effects on stock price crash risk, and the empirical evidence is mixed. CSR can be a useful signal of better informational quality and acts as an effective corporate governance mechanism, both of which serve important roles in emerging markets. Using a sample of 225 listed firms in Vietnam over the period 2014–2019, we examine the impact of corporate social responsibility disclosure (CSRSD) on stock price crash risk, considering the moderating effect of information asymmetry. The research shows that CSRSD lowers the risk of a stock price crash. Importantly, this is the first study to investigate the moderating role of information asymmetry in the relationship between CSR disclosure and stock price crash risk. This is in line with the view that CSRSD decreases information asymmetry, thus lowering the likelihood of stock price crash risk. Based on the results, we provide important implications for corporate governance and investment in the context of developing countries.

Subjects: Economics; Finance; Business, Management and Accounting

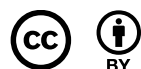
Keywords: corporate social responsibility; Information asymmetry; Stock price crash risk; Moderating effect

Jel classification: G30; G38; M40

1. Introduction

In its course of operations, conflicts are prone to be generated between insiders and outsiders of a firm, and CSR is a tool to mitigate these conflicts (Naqvi et al., 2021). CSR is viewed as a firm's responsibility to maintain and promote the benefits of customers and the society as a whole. CSR mainly revolved around voluntary activities in its early stages. However, the concept of CSR has gradually become multidimensional and more integrated into corporate strategic operations.

The literature on CSRSD has only gained traction recently as a result of the increased mandatory disclosure of non-financial information (Zamil et al., 2021). Nonetheless, the literature offers mixed evidence on whether CSRSD improves firm performance or is simply a self-interest tool for executives (Hao et al., 2018). On the one hand, CSR reports could be used to satisfy regulatory requirements rather than a channel to provide valuable information to investors. According to agency theory, CSR allows managers to create reputation opportunistically at the cost of shareholders (Brammer & Pavelin, 2006).



On the other hand, according to Social impact theory, a firm issues CSR reports to balance the interests of shareholders and other stakeholders, rather than its management. The disclosure of socially responsible activities is expected to enhance information environment and access to finance for firms (Brogi et al., 2022; Cheng et al., 2014; Clarkson et al., 2008; Gelb & Strawser, 2001; Lanis & Richardson, 2012; Lu & Chueh, 2015; Ma et al., 2022). This desirable effect occurs more frequently in organizations that do not participate in tax avoidance, insider trading, or earnings manipulation (Y. Kim et al., 2012; Lanis & Richardson, 2012; Lu & Chueh, 2015). Clearly, CSRD provides signals indicating that managers have stronger ethical standards in protecting the interest of stakeholders and are willing to facilitate internal and external information exchanges (Cui et al., 2018; Y. Kim et al., 2014).

To sum up, CSRD could be either value-enhancing for firms, or a tool for opportunistic managers to pursue their own interests. Consistently, studies on the effect of CSRD on stock price crash risk exhibit mixed results, but considerable volume of research on crash risk is conducted in developed countries (S. Chen et al., 2022). Meanwhile, with weaker corporate governance mechanisms and institutions to protect fund providers and lower transparency in the market, developing countries might serve as a more relevant setting to study the relation between CSRD and crash risk. S. Chen et al. (2022) and Kuang (2022) review the literature on stock price crash risk, and highlight the unfavorable effect of information asymmetry on the former.

Our research's contribution is two-fold. First, previous studies on this link tend to employ CSR scores from third parties (Cho et al., 2013; Cui et al., 2018; Dai et al., 2019; Hao et al., 2018; Y. Kim et al., 2014), but this type of CSR measurement is not available in Vietnam and many other developing countries. Furthermore, Shane and Spicer (1983) argue that third party disclosure conveys new information beyond what is covered in firms' CSR disclosures. Therefore, the results in the previous studies might not be generalized to Vietnamese firms, or firms in other developing countries where third party CSR ratings are unavailable. In addition, our study is the first to examine the moderating role of information asymmetry in the relation between CSRD and stock price crash risk. Wu and Hu (2019) and Hunjdra et al. (2020) have not investigated the channel through which CSR affects crash risk, while Lee (2016), Y. Kim et al. (2014) suggest the involvement of corporate governance factors that affect information asymmetry, thus directly influencing crash risk. Meanwhile, Cui et al. (2018) suggest that CSR helps alleviate information asymmetry. Therefore, we determine to combine these two strands of literature, one on the link between CSR on information asymmetry and the other on information asymmetry and crash risk, to examine if CSR could help to reduce crash risk through reducing information asymmetry. We use the three-step method proposed by Baron and Kenny (1986) to verify the moderating effect of information asymmetry: if CSRD is able to reduce information asymmetry, the effect of CSRD on stock price crash risk should be stronger with firms that are plagued with information asymmetry. This serves as one channel in which CSRD affects stock price crash risk, and this channel has not been investigated before. The findings support the view that CSRD reduces stock price crash risk, and one channel through which it exerts such an impact is due to its ability to mitigate information asymmetry. This emphasizes the importance of non-financial data found in sustainability reports of firms in developing countries.

The rest of this research is structured as follows. Section 2 provides definitions of stock price crash risk and empirical studies on the link between crash risk and CSRD, then establishes the research hypotheses. Section 3 proposes the empirical models and explains the research sample. The results and discussion are presented in Section 4. Finally, Section 5 summarizes the key results and discusses implications for several stakeholders.

2. Literature review and hypothesis development

Stock price crash risk refers to the possibility of a stock experiencing significantly negative returns within a particular period due to a skewed distribution towards losses (Hutton et al., 2009). S. Chen et al. (2022) and Kuang (2022) provide a synthesis of factors affecting crash risk, from macro to

firm-level ones, indicating that most of the studies focused on the U.S context. The two studies highlight factors including corporate governance (in terms of board and managerial characteristics), accounting features and financial reporting quality and information asymmetry/opacity (at country and firm level).

The agency problem, which arises due to information asymmetry between managers and shareholders, can raise the risk of a stock price crash (L. Jin & Myers, 2006). Managers may use their informational advantage to prioritize their own interests, leading to behaviors such as concealing unfavorable news about the firm (Vo, 2020). This information could eventually be released all at once, causing sharp and dramatic drops in stock prices.

To mitigate crash risk, it is crucial to address information asymmetry and agency problems, which can be achieved using CSRD. CSR activities can play a crucial role in reducing the likelihood of stock price crashes. Y. Kim et al. (2014) investigate the relationship between CSR and stock price crash risk for a sample of U.S. firms from 1990 to 2010. The authors find that firms with higher CSR ratings have a significantly lower likelihood of experiencing stock price crashes, even after controlling for various firm-level characteristics. Dai et al. (2019) and Wu and Hu (2019) document a negative relationship between CSR and stock price crash risk for firms in China. Lee (2016) examines the relationship between CSR and stock price crash risk in Taiwan and finds that CSR activities have a significant negative effect on stock price crash risk. Hunjra et al. (2020) document that CSR activities and good corporate governance mechanisms can reduce the risk of stock price crashes in Pakistan and India. Overall, the literature suggests that firms can reduce the risk of stock price crashes by implementing and reporting CSR activities and adopting decent corporate governance practices.

Hypothesis H₁: CSRD is negatively associated with stock price crash risk.

Information asymmetry is emphasized as a key factor that affects stock price crash risk in several papers. Kuang (2022) argues that real earnings smoothing can be used to manipulate earnings and hide negative information from investors, leading to heightened information asymmetry and higher resulting crash risk. S. Chen et al. (2022) investigate the impact of tax enforcement efforts on stock price crash risk in China, and argue that the intensity of tax enforcement affects the level of information asymmetry between managers and investors, as managers may withhold negative information about tax compliance to maintain their reputations and avoid regulatory penalties. The study shows that improved tax enforcement may reduce information asymmetry, thus lowering crash risk.

Overall, the above studies highlight the importance of information asymmetry in facilitating stock price crash risk. When a firm is plagued with information asymmetry, the release of unfavorable news can exert a more severe impact on the stock prices (Kothari et al., 2009). Therefore, companies with high levels of information asymmetry are motivated to hoard bad news. In fact, managers can be inclined to disclose information in a biased manner, such as withholding bad news while promptly sharing good news (Kothari et al., 2009).

CSR disclosure helps enhance information environment and access to finance for firms (Cheng et al., 2014; Clarkson et al., 2008; Gelb & Strawser, 2001; Lanis & Richardson, 2012; Lu & Chueh, 2015). Consistently, Cui et al. (2018) suggest that CSRD helps alleviate negative effects of information asymmetry. Connecting the two strands of literature, we hypothesize that CSR disclosure is especially useful to alleviate stock price crash risk for firms with greater information asymmetry. In other words, information asymmetry might play a moderating role in the relationship between CSRD and crash risk. We, therefore, establish the second testable hypothesis as follows:

Hypothesis H₂: Information asymmetry has a moderating effect on the link between CSRD and stock price crash risk.

3. Research methodology

3.1. Data and sample selection

We use a sample of firms that were listed on the Vietnamese stock exchanges between 2014 and 2019. Due to limited resources, we are not able to collect information from the entire list of non-financial listed firms. Instead, we choose firms whose aggregate assets account for at least 90 percent in a specific industry to ensure the generalizability of the results. In addition, the firms to be chosen need to issue a CSR report or annual reports that contain CSR-related information in the period. The ultimate sample contains 225 businesses registered on Ho Chi Minh Stock Exchange as well as Hanoi Stock Exchange. Financial data (stock price and other variables) are retrieved from Thomson Reuters Eikon. Data on CSR disclosure are manually gathered from CSR reports or annual reports.

3.2. Empirical models

In line with extant studies (Hao et al., 2018; Y. Kim et al., 2014; Wu & Hu, 2019), we propose the model below to examine the influence of CSR disclosure on stock price crash risk (Hypothesis H1):

$$\text{CRASH}_{it} = \delta_0 + \delta_1 \text{CRASH}_{it-1} + \delta_2 \text{CSR}_{it} + \delta_3 \text{CONTROLS}_{it} + \text{INDUSTRY}_i + \varepsilon_{it} \quad (1)$$

We use the following model based on Baron and Kenny (1986) to investigate the moderating effect of information asymmetry on the link between CSR disclosure and stock price crash risk (Hypothesis H2):

$$\text{CRASH}_{it} = \delta_0 + \delta_1 \text{CRASH}_{it-1} + \delta_2 \text{CSR}_{it} + \delta_3 \text{SPREAD}_{it} + \delta_4 \text{INTERACTION}_{it} + \delta_5 \text{CONTROLS}_{it} + \text{INDUSTRY}_i + \varepsilon_{it} \quad (2)$$

Where:

CRASH is the dependent variable that represents stock price crash risk, including CRASH1 and CRASH2. The construction of the two proxies is discussed in Section 3.3.

CSR is the explanatory variable of interest. This is an index representing the magnitude of CSRD. The index is constructed based on a set of GRI criteria (2016) (Martínez-Ferrero et al., 2018). SPREAD is the explanatory variable that proxies for information asymmetry, calculated as the difference between the bid and ask price (Cho et al., 2013; Naqvi et al., 2021). INTERACTION is the product of CSR and SPREAD. CONTROLS is a vector of control variables (Dai et al., 2019; Y. Kim et al., 2014; Lee, 2016). INDUSTRY is a vector of dummy variables, used to control for differences of industries (Hao et al., 2018; Wu & Hu, 2019). ε is the error term. Detailed information on the construction of variables is given in the next section.

3.3. Variable construction

3.3.1. Corporate social responsibility measure

We create CSRD index based on the GRI criteria (Martínez-Ferrero et al., 2018). If each criterion in the list of GRI standards is mentioned in the CSR report or the annual report, that criterion will be awarded a value of 1; otherwise, it will receive a value of 0. We then sum up the scores and divide the total by the number of criteria under GRI standards (33 criteria). Therefore, by construction, the value of this variable ranges from 0 to 1, with higher values indicating a better effort of firms to meet GRI standards.

3.3.2. Stock price crash risk measure

We estimate the following regression model:

$$r_{it} = \alpha_i + \beta_1 r_{mt-2} + \beta_2 r_{mt-1} + \beta_3 r_{mt} + \beta_4 r_{mt+1} + \beta_5 r_{mt+2} + \epsilon_{it} \quad (3)$$

where r_{it} is the weekly return on individual stock i and r_{mt} is the weekly return of Ho Chi Minh Stock Index (VNINDEX).

Because certain securities trade fewer than 51 weeks per year, we build a homogeneous dataset based on the availability of trading weeks in a year (Hutton et al., 2009). Furthermore, the price data used to calculate a stock's weekly returns is the adjusted closing price on Wednesdays to avoid Monday effects and weekend effects in the Vietnam's stock market (J. B. Kim et al., 2016).

The risk-adjusted return for firm i in week t , w_{it} , is calculated by taking the natural logarithm of one plus the residual from the model (3). Then, we calculate the two crash risk measures as follows.

CRASH1 (down-to-up volatility) is the first crash risk proxy. We calculate the standard deviations of firm-specific weekly returns for each stock in each year during up weeks when the firm-specific weekly returns are higher than the annual average and during down weeks when the firm-specific weekly returns are lower than the annual average. CRASH1 is the logarithm of the ratio of the standard deviation on down weeks to the standard deviation on up weeks. In this case, a larger CRASH1 value suggests a more left-skewed distribution of stock returns and, as a result, a greater probability of a crash.

$$CRASH1_i = \ln \left[\frac{(n_{up} - 1) \sum_{down} (w_{it} - \bar{w}_i)^2}{(n_{down} - 1) \sum_{up} (w_{it} - \bar{w}_i)^2} \right] \quad (4)$$

where n_{up} refers to the number of up weeks, whereas n_{down} indicates the number of down weeks, respectively.

The negative skewness of weekly returns for each stock (CRASH2) is the second crash risk indicator. The following equation is used to construct CRASH2 for each firm i in a year.

$$CRASH2_i = - \frac{n(n-1)^{3/2} \sum (w_{i,t} - \bar{w}_i)^3}{(n-1)(n-2) \left(\sum (w_{i,t} - \bar{w}_i)^2 \right)^{3/2}} \quad (5)$$

$w_{i,t}$ are the year's mean weekly returns of firm i , and n denotes the number of weeks in a year.

The negative coefficient of skewness indicates the risk of stock price crash, so an additional multiplier -1 is included in the Equation 5 to change the sign of the degree of skewness. Therefore, higher CRASH2 is associated with greater risk of stock price crashes (J. Chen et al., 2001).

Because the formula to calculate CRASH1 does not take into account the skewness, it is less likely to be affected by extreme weekly returns (J. Chen et al., 2001). This enables the CRASH1 measure to overcome the limitations of CRASH2 measure.

3.3.3. Information asymmetry measure

We employ Bid-Ask spread to proxy for information asymmetry (Cho et al., 2013; Naqvi et al., 2021).

$$\text{SPREAD}_{id} = - \frac{\text{Bid}_{id} - \text{Ask}_{id}}{\text{Price}_{id}} \quad (6)$$

SPREAD_{id} is the difference between the ask and bid prices of stock i on date d . Because the Bid price is smaller than the Ask price, the negative sign is used to ensure that a higher SPREAD value equals a larger information asymmetry and vice versa. Bid and Ask price data are not widely available for all stocks in Vietnam. However, because the firms chosen for this study are typical of the market, we can still obtain sufficient Bid and Ask price data to calculate the SPREAD measure.

Price_{id} is the adjusted close price of stock i on day d .

Bid_{id} is the Bid price disclosed at the end of the trading day for stock i on day d .

Ask_{id} is the Ask price announced at the end of the trading day for stock i on day d .

Information asymmetry of stock i in year t is measured by the average of the daily values of SPREAD of stock i in year t .

3.3.4. Control variables

We further introduce firm-level variables to control for the influence of firm characteristics and industries. SIZE, LEV, GROW, AGE, and BIG4 are variables to control for size, financial leverage, growth potential, listing age, and auditor quality, respectively, and are calculated in line with previous studies (Dai et al., 2019; Y. Kim et al., 2014; Lee, 2016). The natural logarithm of total assets (SIZE) proxies for firm size. The ratio of total debt to total assets (LEV) is used to control for the effect of financial leverage. The revenue growth rate (GROW) is used to control for the effect of growth potential on crash risk. The logarithm of listing age is AGE or listing age. BIG4, audit quality, is a binary variable receiving 1 if the firm utilizes the audit services of one of the top four auditing firms in the world, and a value of 0 otherwise. Industry dummy variables are used to control for the industry-specific factors (Hao et al., 2018; Wu & Hu, 2019).

3.4. Estimation strategy

Endogenous variables are correlated with residuals and can cause bias in the estimation of coefficients if methods such as Ordinary Least Squares, Random Effects model, and/or Fixed Effects model are used. Meanwhile, previous studies have highlighted the potential endogeneity in the relationship between CSR disclosure and stock price crash risk (Hao et al., 2018; Y. Kim et al., 2014). To tackle the endogeneity problem on the association between CSR and stock price crash risk, the System GMM approach is recommended (Hunjra et al., 2020; Y. Kim et al., 2014). In addition to addressing the endogeneity issue, the GMM technique is capable of dealing with other defects, such as heteroskedasticity and autocorrelation with its two-step estimator (Roodman, 2009). The dynamic panel GMM approach is well suited to estimate dynamic models used in this study while accounting for other sources of endogeneity (Y. Kim et al., 2014).

In addition, we use the three-step procedure developed by Baron and Kenny (1986) to examine whether a moderating effect of information asymmetry is present in the relationship between CSR and stock price crash risk (Baron & Kenny, 1986; Hao et al., 2018).

4. Results and discussions

4.1. Descriptive measures

Table 1 shows that both CRASH1 and CRASH2 variables have positive means, suggesting that the risk of stock price crashes for listed firms is quite high, roughly as high as values previously reported for stock markets in the United States, China, and Malaysia (Ben-Nasr & Ghouma, 2018;

X. Jin et al., 2019; Lobo et al., 2020; Tee et al., 2018). Vietnam’s level of CSR disclosure based on GRI guidelines is rather low, compared to the levels documented in previous studies (Y. Kim et al., 2014, Martínez-Ferrero et al.; 2018; Wu & Hu, 2019). This implies that in Vietnam the disclosure of CSR activities is not subject to strict regulations as in other countries.

The value of SPREAD suggests high levels of information asymmetry in Vietnam. Specifically, SPREAD has a mean value of 0.03, consistent with prior works (Cui et al., 2018; Naqvi et al., 2021). LEV has an average value of 0.246, meaning that total debt finances approximately a quarter of total assets. GROW has an average value of 0.191, indicating that the annual revenue growth is rather strong. AGE has an average value of 2,792, or the converted average listing age of firms is between 16 and 17. The average score of BIG4 indicates that the top four auditing firms are employed by around forty percent of the firms in the sample.

Table 2 provides pairwise Pearson correlation coefficients of variables in the models. Because all the coefficients have absolute values lower than 0.9 (Table 2), it is expected that there is no serious multicollinearity in the models. We further conduct the Variance Inflation Factor (VIF) test, which produces the maximum VIF of 1.49 and average VIF of 1.20, ascertaining the view that multicollinearity should not be a concern in our model.

4.2. Main results

Previous research on the effect of CSRD on stock price crash risk suggests that it is crucial to address the potential endogeneity issue; as a result, we use the System GMM approach. From Table 3, the lagged dependent variable is statistically significant, indicating the validity of dynamic models. Both Hansen and autocorrelation of order 2 tests have p-values higher than 10%, indicating the validity of the instruments and reliability of the estimates for statistical inference purposes (Roodman, 2009).

From Table 3, the coefficient of the CSR variable is negative at 1% significance level, or there is an inverse relationship between CSRD and stock price crash risk. The coefficients are quite large (−0.261 in the case of CRASH1 and −1.307 for CRASH2), confirming the significant economic effect of CSRD. This supports the view that CSRD lowers the likelihood of a stock price crash (Hypothesis H1), consistent with the argument that CSRD considerably minimizes stock price crash risk (Dai et al., 2019; Y. Kim et al., 2014; Wu & Hu, 2019). According to signalling theory, CSRD might assist in alleviating information asymmetry, reducing the probability of stock price crashes (Wu & Hu, 2019). This implies that firms can benefit by reporting their CSR initiatives through sustainability reports. Furthermore, the media’s spillover effect enables firms to promote a favorable image with shareholders, investors, and the public with their CSRD. The community tends to appreciate

Table 1. Descriptive statistics

Variable	Observations	Mean	Standard deviation	Minimum	Maximum
CRASH2	1,237	0.192	1.060	−3.252	5.794
CRASH1	1,237	0.006	0.167	−0.582	0.777
CSR	1,340	0.263	0.145	0.000	0.939
SPREAD	1,295	0.030	0.095	−0.797	0.797
SIZE	1,340	28.237	1.298	23.330	32.254
LEV	1,330	0.246	0.188	0.000	0.736
GROW	1,317	0.191	0.705	−0.851	9.203
AGE	1,340	2.792	0.471	0.693	4.787
BIG4	1,170	0.388	0.488	0.000	1.000

Source: Author’s calculations.

Table 2. Correlation coefficient matrix

Variables	CRASH1	CSR	SPREAD	SIZE	LEV	GROW	AGE	BIG4
CRASH1	1.000							
CSR	-0.061*	1.000						
SPREAD	0.063*	-0.110*	1.000					
SIZE	-0.049	0.295*	-0.159*	1.000				
LEV	-0.002	0.004	0.028	0.339*	1.000			
GROW	-0.061*	-0.085*	-0.041	-0.016	-0.031	1.000		
AGE	0.027	0.119*	-0.039	0.013	0.063*	-0.156*	1.000	
BIG4	-0.050	0.328*	-0.074*	0.383*	-0.007	-0.097*	-0.013	1.000

t statistics are in brackets. * indicates significant at 5%. Source: Author's calculations from research sample.

Table 3. The effect of CSR disclosure on stock price crash risk

Model/Variables	(1)	(2)
	CRASH1	CRASH2
CSR	-0.261***	-1.307***
	[-4.02]	[-2.94]
SIZE	0.037*	0.355***
	[1.91]	[2.81]
LEV	-0.072	0.253
	[-0.87]	[0.45]
GROW	-0.052***	-0.422***
	[-4.12]	[-5.04]
AGE	0.194***	1.628***
	[5.68]	[6.66]
BIG4	-0.037*	-0.389***
	[-1.70]	[-2.89]
L.CRASH1	0.097***	
	[3.05]	
L.CRASH2		0.074**
		[2.28]
INDUSTRY	Yes	Yes
_CONS	-1.361**	-13.139***
	[-2.42]	[-3.55]
Number of observations	842	842
NO. OF INSTRUMENTS	80	80
AR2 TEST P-VALUE	0.949	0.881
HANSEN TEST P-VALUE	0.450	0.269

This table presents the regression results of the effect of CSR disclosure on stock price crash risk. t values are in brackets. *, **, and *** indicate significance at 10%, 5% and 1%, respectively. CSR is CSR index; Size is the logarithm of total assets; Lev is the ratio of total debt to total assets; Grow is the annual growth rate of revenue; Age is the listing age of firms; Big4 is a dummy variable, receiving 1 if the auditor is from Big4 firms, and 0 otherwise; Industry is a vector of dummy variables to control for industry-specific effects on crash risk; CRASH1 and CRASH2 are two indicators of CRASH. We perform a robustness test (not tabulated here) by adding year fixed effects for both two models with CRASH1 and CRASH2, the coefficients remain negative and significant for CSR variable.

activities that appear “socially responsible”; hence, CSR may be a lifesaver for firms in dealing with risks and crises.

The explanatory factors in the model are statistically significant and are generally in line with extant research (Dai et al., 2019; Y. Kim et al., 2014; Lee, 2016). SIZE and AGE possess positive and significant associations with crash risk, indicating that the likelihood of a stock price crash is higher in large-scale businesses with a long history of listing. GROW and BIG4 have negative and significant coefficients, suggesting that firms with strong growth potential are more likely to have higher profitability and, as a result, are less likely to experience stock price crashes. Better auditor quality reduces crash risk (Chang et al., 2009), because Big 4 auditors tend to be highly skilled and are able to detect accounting errors and irregularities, leaving fewer opportunities for managers to manipulate earnings or hide bad news (Defond & Jiambalvo, 1994; Fargher et al., 2008). To safeguard their brand and limit liabilities and litigations, Big4 auditors make efforts in uncovering bad news hoarding and enhancing the quality of reporting environment (Deangelo, 1981). Experienced auditors help to reduce agency costs by monitoring the management (Jensen & Meckling, 1976). In other words, higher quality of auditors lowers the likelihood of a stock price crash.

The estimation results on the moderating effect of information asymmetry on the connection between CSR disclosure and crash risk are shown in Table 4. The Hansen’s test for over-identification and the second-order autocorrelation test have p-values greater than 10% (Roodman, 2009). At the same time, the lagged variable of the dependent variable is statistically significant, indicating that the dynamic model used is appropriate, and the regression results are reliable. To verify the moderating effect (Hypothesis H2), the three steps based on Baron and Kenny (1986) are implemented as follows.

In the first step, the variables CSR and CRASH1 and CRASH2 are significantly and negatively related in columns 1 and 4, respectively. In the other columns, the same negative coefficients are also displayed.

In the second step, the variable SPREAD, on the other hand, is positively and significantly associated with CRASH1 and CRASH2 in columns 2, 3, 5 & 6 ($\beta = 0.230$ and $p < 1\%$; $\beta = 0.243$ and $p < 1\%$; $\beta = 1.715$ and $p < 1\%$; $\beta = 1.933$ and $p < 1\%$).

In the third step, we examine if the interaction term (INTERACTION) has a significant effect on stock price crash risk. In columns 3 and 6, INTERACTION is significantly and negatively associated with CRASH1 and CRASH2, indicating that CSR has a more negative effect on the likelihood of a stock price crash when information asymmetry is higher.

To sum up, using the three-step procedure suggested by Baron and Kenny (1986), we find evidence suggesting that information asymmetry has a significant moderating effect on the link between CSR and stock price crash. Information asymmetry is considered as a key factor that affects stock price crash risk in recent papers such as Kuang (2022) and S. Chen et al. (2022), and reducing information asymmetry leads to lowered crash risk. Consistently, Kothari et al. (2009) show that in the context with more severe information asymmetry, the release of unfavorable news could exert a more severe impact on stock prices. Meanwhile, Cui et al. (2018) argue that CSR helps alleviate information asymmetry. Therefore, it can be expected that CSR is more effective in lowering the probability of a stock price crash when there is more information asymmetry. The findings confirm the hypothesis H2.

The control variables in the model have statistical significance, indicating that they have an impact on the dependent variable, generally consistent with previous studies (Dai et al., 2019; Y. Kim et al., 2014; Lee, 2016). The variables SIZE and AGE show positive correlation coefficients and are statistically significant. This result is consistent with the view that firms that are larger

Table 4. The moderating effects of information asymmetry on the link between CSR disclosure and stock price crash risk

Model/ Variables	(1)	(2)	(3)	(4)	(5)	(6)
	CRASH1	CRASH1	CRASH1	CRASH2	CRASH2	CRASH2
CSR	-0.261*** [-4.02]	-0.231*** [-4.20]	-0.207*** [-5.05]	-1.307*** [-2.94]	-1.332*** [-3.54]	-1.020*** [-3.77]
SPREAD		0.230*** [4.71]	0.243*** [9.58]		1.715*** [5.36]	1.933*** [12.11]
INTERACTION			-1.676*** [-3.28]			-7.652** [-2.28]
SIZE	0.037* [1.91]	0.021 [1.63]	0.024** [2.49]	0.355*** [2.81]	0.325*** [3.99]	0.288*** [5.17]
LEV	-0.072 [-0.87]	-0.180*** [-2.96]	-0.180*** [-3.70]	0.253 [0.45]	-0.228 [-0.58]	-0.359 [-1.34]
GROW	-0.052*** [-4.12]	-0.050*** [-4.70]	-0.045*** [-5.52]	-0.422*** [-5.04]	-0.414*** [-5.60]	-0.354*** [-6.50]
AGE	0.194*** [5.68]	0.165*** [5.99]	0.177*** [11.96]	1.628*** [6.66]	1.328*** [6.41]	1.198*** [11.65]
BIG4	-0.037* [-1.70]	-0.016 [-0.98]	-0.020* [-1.69]	-0.389*** [-2.89]	-0.329*** [-3.41]	-0.300*** [-4.06]
L.CRASH1	0.097*** [3.05]	0.047** [2.30]	0.075*** [6.83]			
L.CRASH2				0.074** [2.28]	0.095*** [3.45]	0.091*** [5.23]
INDUSTRY	Yes	Yes	Yes	Yes	Yes	Yes
_CONS	-1.361** [-2.42]	-0.816** [-2.16]	-0.938*** [-3.40]	-13.139*** [-3.55]	-11.449*** [-4.56]	-10.071*** [-6.10]
No of observations	842	833	833	842	833	833
NO. OF INSTRUMENTS	80	99	118	80	99	118
AR2 TEST P-VALUE	0.949	0.670	0.780	0.881	0.927	0.972
HANSEN TEST P-VALUE	0.450	0.261	0.351	0.269	0.187	0.172

This table presents the regression results of the effect of CSRD on stock price crash risk. *t* values are in brackets. *, **, and *** indicate significance at 10%, 5% and 1%, respectively. CSR is CSR index; Size is the logarithm of total assets; Lev is the ratio of total debt to total assets; Grow is the annual growth rate of revenue; Age is the listing age of firms; Big4 is a dummy variable, receiving 1 if the auditor is from Big4 firms, and 0 otherwise; Industry is a vector of dummy variables to control for industry-specific effects on crash risk; CRASH1 and CRASH2 are two indicators of CRASH. We perform a robustness test (not tabulated here) by adding year fixed effects for both two models with CRASH1 and CRASH2, the coefficients remain negative and significant for CSR variable.

and/or more listing age are more likely to accumulate bad news and are more susceptible to reputational risks, thereby having a higher risk of stock price crash.

The variables LEV, BIG4, and GROW all have negative correlation coefficients and are statistically significant, implying that companies with high growth potential, auditor firm being one of the BIG4 and/or high financial leverage are less likely to experience a crash in stock prices. According to the

signaling theory, the growth potential is a positive signal conveyed to investors about the past and future performances of a firm, thereby reducing the likelihood of a stock price crash. In addition, the use of high financial leverage helps companies contain the hoarding behavior of bad news due to stronger supervision from creditors and financial organizations. Finally, the risk of a stock price crash is reduced by audit quality. Since Big 4 auditors have stronger expertise and experience in detecting errors and abnormalities in financial reports, managers have fewer opportunities to manage profits and engage in accounting fraud (Chang et al., 2009; Defond & Jiambalvo, 1994; Fargher et al., 2008). Furthermore, Big 4 auditors have more incentives to protect their brand and limit reputation damage, so they are expected to strive to detect accounting frauds and improve the corporate information environment.

5. Conclusions and contributions

The possibility that managers misuse CSRD for self-serving purposes, such as concealing negative news and increasing risk, is a concern. However, CSRD could enhance firm performance and reduce risk if used to benefit shareholders and other stakeholders. The empirical evidence thus far is mixed, and further research is warranted.

Our study aims to determine the influence of CSRD on stock price crash risk to assess which effect dominates, and to evaluate the moderating role of information asymmetry on the connection of interest. We use a sample of 225 firms listed in Vietnam between 2014 and 2019. The findings support the view that CSRD reduces stock price crash risk, and one channel through which it exerts such an impact is due to its ability to mitigate information asymmetry. This emphasizes the importance of non-financial data found in sustainability reports of firms in developing countries.

The studies of Brogi et al. (2022) and Ma et al. (2022) suggest that socially responsible activities play important role in improving a firm's financial outcomes, including higher credit ratings, lower refinancing risks and corporate bond costs. The authors attribute this outcome to the rising role of green loan policies and the awareness of socially responsible activities. Brogi et al. (2022) also suggest that a borrower's creditworthiness can be determined with its ESG performance, and policymakers and regulators have increasingly required financial institutions to consider these types of activities in their financing decisions. Altogether, regulatory bodies should provide a formal and consistent framework that promote CSR activities and disclosures to protect the interests of all parties.

Our study highlights the importance of information asymmetry and regulatory bodies in providing a consistent framework for CSR activities and disclosures. However, our study is limited as it did not include firms in the financial sector. Future research could look at this link in the financial industry to obtain a better understanding of how CSRD affects stock price crash risk.

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