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Article

Too Much of a Good Thing? ESG Disclosure, the Social Dimension, and Future Stock Price Crash Risk Evidence of a Nonlinear Effect from an Emerging Market

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Abstract

Whether environmental, social, and governance (ESG) disclosure stabilizes share prices or merely masks bad news remains unsettled, and the evidence is conspicuously weak whenever the relationship is assumed to be linear. This study revisits the question by allowing the effect of ESG disclosure on future stock price crash risk to be nonlinear, and by decomposing disclosure into its environmental, social, and governance components. Using an unbalanced panel of non-financial firms listed on the Ho Chi Minh Stock Exchange over 2018–2024, we estimate firm and year fixed-effects models with firm-clustered standard errors, measuring one-year-ahead crash risk by negative conditional skewness (NCSKEW) and down-to-up volatility (DUVOL). Consistent with prior work, the linear association between overall ESG disclosure and crash risk is statistically insignificant. Once a quadratic term is introduced, however, a U-shaped relationship emerges, and dimension-level tests show that this curvature is driven almost entirely by social disclosure: the linear term is negative and the squared term positive and significant for both crash-risk proxies, with turning points of 0.3316 (NCSKEW) and 0.2918 (DUVOL). The U shape is confirmed by the formal test of Lind and Mehlum (2010) for both proxies, and is robust to additional profitability and valuation controls and most strongly for NCSKEW to panel corrected and feasible GLS estimators. The findings support a “too-much-of-a-good-thing” interpretation: social disclosure improves transparency and reduces crash risk up to a moderate threshold, beyond which incremental, hard-to-verify narrative disclosure becomes consistent with impression management and heightens crash risk. Because the turning point lies below the first quartile of social disclosure, most sample firms already operate where additional disclosure raises crash risk. The study reframes the ESG crash-risk debate around the level and dimension of disclosure rather than its mere quantity.

Keywords: ESG disclosure; social disclosure; stock price crash risk; NCSKEW; DUVOL; nonlinear (U-shaped) relationship; impression management; Vietnam; emerging markets

JEL Classification: G14; G32; M14; M41.

1. Introduction

Extreme negative outliers in firm-specific returns stock price crashes are among the most damaging events investors face, because they are abrupt, idiosyncratic, and difficult to hedge. The dominant explanation, the bad-news-hoarding framework of Jin and Myers (2006) and Hutton, Marcus, and Tehranian (2009), holds that self-interested managers withhold unfavorable information for as long as the firm's information environment permits. Hidden bad news accumulates until it can no longer be concealed; its sudden release produces a crash. Under this logic, anything that shrinks

the space within which managers can hoard bad news greater transparency, stronger monitoring, lower information asymmetry should reduce future crash risk.

Environmental, social, and governance (ESG) disclosure is widely presented as exactly such a mechanism. By supplying non-financial information about environmental practices, labor and community relations, and governance arrangements, ESG disclosure is expected to reduce information asymmetry, broaden the set of stakeholders who scrutinize the firm, and discipline managerial behavior (Kim, Li, and Li, 2014; Xu, Liu, and Dou, 2022). A competing tradition is far less sanguine. Drawing on agency theory and the literature on impression management and greenwashing, it argues that disclosure is a managerial choice that can be used opportunistically: firms may publish lengthy, favorable ESG narratives precisely to build legitimacy, manage impressions, or divert attention from deteriorating fundamentals (Barnea and Rubin, 2010; Prior, Surroca, and Tribó, 2008; Liu et al., 2024). On this view, more disclosure need not mean more transparency, and the volume of ESG reporting may be a poor guide to the quality of a firm's information environment.

These two views are usually treated as rival hypotheses to be confirmed or rejected. Yet they are not mutually exclusive; they may simply describe different regions of the same relationship. A natural reconciliation is the "too-much-of-a-good-thing" (TMGT) effect documented across management research, in which an ordinarily beneficial practice reverses sign once it passes an optimal level because marginal costs eventually overtake marginal benefits (Pierce and Aguinis, 2013; Haans, Pieters, and He, 2016). Applied here, modest ESG disclosure delivers genuine informational value and lowers crash risk, but beyond some threshold additional disclosure becomes increasingly difficult to verify, more vulnerable to selective emphasis, and more likely to serve symbolic ends so the marginal effect on crash risk turns positive. This reasoning implies that the ESG crash-risk relationship is nonlinear, and that imposing linearity, as most prior studies do, would mechanically average opposing effects toward an insignificant coefficient. The weak and inconsistent linear results reported in the literature (Murata and Hamori, 2021) are consistent with precisely this misspecification (Zhou and Nagayasu, 2022).

We pursue this logic in two steps. First, we ask whether overall ESG disclosure exhibits a nonlinear, U-shaped relationship with future crash risk. Second, recognizing that ESG is a composite of conceptually distinct dimensions, we ask which dimension drives any curvature. The environmental, social, and governance pillars differ markedly in verifiability. Environmental disclosure is often anchored to quantifiable indicators (emissions, energy, resource use), and governance disclosure to observable structures (board composition, ownership, audit arrangements). Social disclosure is comparatively narrative and qualitative employee welfare, training, community engagement, customer and supplier relations and therefore harder for outsiders to verify and easier to inflate. We accordingly expect the social dimension to be the most susceptible to symbolic use and the most likely source of any nonlinearity.

Vietnam offers an instructive setting for this question. Sustainability disclosure by listed firms has expanded rapidly under a tightening regulatory framework, yet the comparability, assurance, and credibility of that disclosure remain highly heterogeneous across firms. In such an environment, disclosure can plausibly serve both informative and symbolic purposes, which is exactly the condition under which a nonlinear, dimension-specific effect is most likely to be detectable. Vietnam also broadens an empirical literature that is dominated by China and a handful of developed markets, and that has paid limited attention to whether the ESG crash-risk relationship differs by disclosure dimension.

Using an unbalanced panel of non-financial firms listed on the Ho Chi Minh Stock Exchange (HOSE) from 2018 to 2024, we measure one-year-ahead crash risk with the two standard proxies negative conditional skewness (NCSKEW) and down-to-up volatility (DUVOL) and estimate firm and year fixed-effects models with standard errors clustered by firm. The results are clear. The linear effect of overall ESG disclosure is statistically insignificant for both proxies. Introducing a quadratic term reveals a U-shaped relationship, significant for NCSKEW and signed consistently for DUVOL.

The dimension-level analysis localizes this curvature in the social pillar: social disclosure carries a negative linear coefficient and a positive squared coefficient, both significant for NCSKEW and DUVOL, with turning points of roughly 0.29–0.33. The environmental and governance dimensions do not produce a comparably stable pattern. The social-disclosure result survives the addition of ROE, the replacement of market-to-book with Tobin's Q, and most strongly for NCSKEW panel-corrected standard errors and feasible generalized least squares.

The study makes four contributions. First, it shows that the ESG crash-risk relationship is nonlinear rather than monotonic, and that the widely reported “weak” linear effect is an artifact of imposing linearity on a curved relationship echoing, in an emerging-market accounting setting, the theoretical argument of Zhou and Nagayasu (2022). Second, it demonstrates that ESG dimensions are not interchangeable for crash-risk purposes: the effect is concentrated in social disclosure, which is the dimension theory predicts to be most exposed to impression management. This contrasts with evidence from Korea, where the mitigating effect of ESG is attributed to the environmental and governance pillars (Thompson, 2025), and underscores that dimension-level heterogeneity is institution specific. Third, it provides one of the first dimension-level, nonlinear analyses of disclosure and crash risk for Vietnam, a fast-growing but under-studied frontier market. Fourth, it carries direct implications for investors, regulators, and firms: because the marginal effect of social disclosure reverses sign at a moderate level, the quantity of disclosure is an unreliable risk signal, and attention should shift to its substance, verifiability, and balance.

The remainder of the paper proceeds as follows. Section 2 reviews the relevant literature and develops the hypotheses. Section 3 describes the data, variables, and empirical strategy, including the formal test for a U-shaped relationship. Section 4 reports the results and robustness tests. Section 5 discusses the findings, and Section 6 concludes.

2. Literature Review and Hypothesis Development

2.1. Stock Price Crash Risk and the Bad-News-Hoarding Framework

Stock price crash risk refers to the conditional likelihood of extreme negative firm-specific returns. Its theoretical foundation is the agency based bad-news hoarding framework. Jin and Myers (2006) show that when outside investors cannot fully observe firm-specific fundamentals, managers can absorb and conceal bad news to protect private benefits, career prospects, and compensation; the firm's stock price therefore drifts above its intrinsic value. Because managers face limits on how much bad news they can withhold, accumulated negative information is eventually released all at once, generating a crash. Hutton et al. (2009) operationalize this insight by linking financial-reporting opacity to higher crash risk, and a large subsequent literature confirms that features which extend the bad-news-hoarding window earnings management, weak monitoring, and a poor information environment raise crash risk, whereas mechanisms that force timely disclosure lower it (Kim, Li, and Zhang, 2011; Kim, Li, and Li, 2014).

Following Chen, Hong, and Stein (2001) and Kim et al. (2011), the literature measures firm-specific crash risk with two complementary proxies computed from the residuals of an expanded market model. Negative conditional skewness (NCSKEW) captures the asymmetry of the firm-specific weekly return distribution, with higher values indicating heavier left tails. Down-to-up volatility (DUVOL) compares return volatility in “down” weeks with that in “up” weeks, with higher values indicating that negative returns are relatively more volatile. The two proxies are conceptually related but emphasize different features of the return distribution, so reporting both guards against measure-specific artifacts.

2.2. ESG Disclosure and Crash Risk: The Transparency View

The transparency view rests on information asymmetry theory and stakeholder theory. By disclosing credible non-financial information, firms enlarge the public information set, making it costlier for managers to conceal adverse developments and shortening the bad-news-hoarding

window (Xu et al., 2022). ESG disclosure also widens the circle of monitors: regulators, employees, customers, communities, and socially responsible investors all scrutinize disclosing firms, and this visibility disciplines opportunistic behavior, functioning as an informal governance mechanism (Cheng, Ioannou, and Serafeim, 2014; Eccles, Ioannou, and Serafeim, 2014). Consistent with this view, Kim et al. (2014) find that firms with stronger corporate social responsibility exhibit lower crash risk, Xu et al. (2022) report a negative ESG crash-risk relationship for Chinese listed firms, and Murata and Hamori (2021) document a risk-reducing effect of ESG disclosure in European and Japanese samples. The transparency view thus predicts a negative association between ESG disclosure and future crash risk.

2.3. ESG Disclosure and Crash Risk: The Agency and Symbolic-Disclosure View

The opposing view emphasizes that disclosure is discretionary and can be turned to managerial advantage. Under agency theory, ESG reporting may itself become an instrument of expropriation: Friedman (2007) characterizes discretionary social spending as a potential agency cost, while Barnea and Rubin (2010) and Prior, Surroca, and Tribó (2008) show that managers use social initiatives and disclosure to entrench themselves and to camouflage earnings management. Legitimacy theory points in the same direction: firms facing reputational or stakeholder pressure issue ESG disclosure to secure social license rather than to inform, emphasizing favorable narratives while omitting material negatives (Lokuwaduge and Heenetigala, 2017). The recent greenwashing literature makes the mechanism explicit, linking inflated or decoupled ESG reporting to higher crash risk because symbolic disclosure conceals rather than reveals bad news (Liu et al., 2024). On this view, disclosure volume can move opposite to disclosure quality, so additional ESG reporting may raise rather than lower crash risk.

2.4. Reconciling the Views: The Too-Much-Of-A-Good-Thing Effect and a Nonlinear Hypothesis

The transparency and symbolic-disclosure views are typically tested as competing linear hypotheses, which helps explain why the empirical record is mixed and why estimated linear coefficients are often insignificant (Murata and Hamori, 2021). We argue, with Zhou and Nagayasu (2022), that this is a specification problem rather than a substantive null: if the two forces operate at different disclosure levels, a linear model averages them toward zero. The reconciling mechanism is the too-much-of-a-good-thing effect (Pierce and Aguinis, 2013), grounded in the law of diminishing marginal returns and analogous to the inverted-U relationships documented between corporate environmental and financial performance (Trumpp and Guenther, 2017) and to Kuznets-type curves more broadly (Andreoni and Levinson, 2001; Aghion et al., 2019).

The logic unfolds across the disclosure range. At low levels, ESG disclosure conveys genuinely new information to a market that previously had little; the marginal informational benefit is large, information asymmetry falls, and crash risk declines. At moderate levels, disclosure continues to enhance transparency and stakeholder monitoring, sustaining the risk-reducing effect. Beyond a threshold, however, the marginal informational content of additional disclosure diminishes while its potential for misuse grows: extensive, hard-to-verify narratives can be deployed for impression management, can selectively foreground favorable information, and can crowd out attention from material risks. In this region the symbolic-disclosure channel dominates and the marginal effect on crash risk turns positive. The relationship between ESG disclosure and future crash risk is therefore predicted to be U-shaped decreasing then increasing with an interior minimum at the disclosure level where marginal transparency benefits are exactly offset by marginal symbolic-reporting costs. We note that this U-shaped prediction (negative-then-positive) is the mirror image of the inverted-U reported by Dai, Lu, and Qi (2019) for mandatory CSR disclosure in China, a divergence we return to in the discussion. Formally:

H1. *ESG disclosure has a nonlinear relationship with future stock price crash risk.*

H1a. *The relationship between ESG disclosure and future stock price crash risk is U-shaped: crash risk first decreases and then increases as ESG disclosure rises.*

2.5. *The Social Dimension as the Primary Driver*

Treating ESG as a single index obscures that its three pillars differ in how readily outsiders can verify them, and verifiability is precisely what determines a dimension's exposure to symbolic use. Environmental disclosure is increasingly tied to quantifiable, externally benchmarked indicators emissions, energy and water use, waste that are costly to fabricate and amenable to third-party assurance. Governance disclosure largely describes observable structures board independence, ownership concentration, audit arrangements whose existence is comparatively easy to confirm. Social disclosure is different in kind: it is dominated by qualitative, narrative descriptions of employee welfare, training, diversity, community programs, and customer relations, much of which lacks standardized metrics or external verification.

This narrative, low-verifiability character cuts both ways. At moderate levels, social disclosure communicates the firm's acknowledgment of its responsibilities to employees, customers, and communities, reducing stakeholder uncertainty and strengthening relational trust an informative role that lowers crash risk. At high levels, the same low verifiability makes social disclosure the most convenient vehicle for image-building: firms confronting concealed operational or financial difficulties can expand favorable social narratives at little cost and with little risk of immediate contradiction. The marginal effect of social disclosure is therefore the most likely among the three pillars to reverse sign, making the social dimension the prime candidate to drive any nonlinearity in the overall ESG crash-risk relationship. We therefore hypothesize:

H2. *Social disclosure has a nonlinear relationship with future stock price crash risk.*

H2a. *The relationship between social disclosure and future stock price crash risk is U-shaped: crash risk first decreases and then increases as social disclosure rises.*

3. Research Design

3.1. *Sample and Data*

The sample comprises non-financial firms listed on the Ho Chi Minh Stock Exchange (HOSE) over fiscal years 2018 to 2024. Financial firms are excluded because their reporting, leverage, and regulatory structure differ fundamentally from those of non-financial firms, which would confound the crash-risk and control variables. Because the dependent variable is one-year-ahead crash risk, ESG disclosure and control variables measured in year t are matched to crash-risk measures in year $t+1$; observations in the final year that lack a subsequent crash-risk value are not used in the regressions, and this forward-looking design also mitigates simple reverse-causality concerns.

We apply a consistent set of sample-construction rules. Any firm-year observation missing a required variable is dropped, so that all coefficients within a specification are estimated on the same observations. Firm-years with insufficient weekly return data to compute reliable crash-risk measures are excluded. All continuous variables are winsorized at the 1st and 99th percentiles to limit the influence of outliers, following standard practice in the crash-risk literature (Kim et al., 2011; Xu et al., 2022). The resulting panel is unbalanced, as is typical of firm-level data in emerging markets. The estimation samples vary slightly across specifications because of data availability: the overall-ESG models use 1,017 firm-year observations from 187 firms, and the main social-disclosure models use 993 firm-year observations from 187 firms.

3.2. Measuring Future Stock Price Crash Risk

Following Chen et al. (2001), Hutton et al. (2009), and Kim et al. (2011), we first purge market-wide co-movement from weekly returns by estimating, for each firm-year, the expanded market-model regression

$$R_{it} = \alpha_i + \beta_1 R_{m,t-2} + \beta_2 R_{m,t-1} + \beta_3 R_{m,t} + \beta_4 R_{m,t+1} + \beta_5 R_{m,t+2} + \varepsilon_{it}, \quad (1)$$

where R_{it} is the return on stock i in week t and $R_{m,t}$ is the market return; lead and lag market terms accommodate nonsynchronous trading. The firm-specific weekly return is defined as $W_{it} = \ln(1 + \varepsilon_{it})$. The two crash-risk proxies are then constructed from the firm-specific weekly returns of year $t+1$.

Negative conditional skewness is

$$NCSKEW_{it} = -[n(n-1)^{3/2} \Sigma W_{it}^3] / [(n-1)(n-2)(\Sigma W_{it}^2)^{3/2}], \quad (2)$$

and down-to-up volatility is

$$DUVOL_{it} = \log\{[(n_u-1) \Sigma_DOWN W_{it}^2] / [(n_d-1) \Sigma_UP W_{it}^2]\}, \quad (3)$$

where n is the number of trading weeks in the year, and n_u (n_d) is the number of up (down) weeks, defined relative to the annual mean of W_{it} . Higher values of NCSKEW and DUVOL indicate greater crash risk. Reporting both proxies is important here because, as the results show, the nonlinear social-disclosure effect is uniformly significant in the fixed-effects models for both measures but is more robust for NCSKEW under alternative estimators.

3.3. Measuring ESG Disclosure and Its Dimensions

The independent variable is the firm's ESG disclosure score in year t . The overall score (OverallESG) is decomposed into three pillar scores capturing environmental (OverallE), social (OverallS), and governance (OverallG) disclosure, each scaled to the unit interval so that the scores and their squared terms are directly comparable across pillars. To test for nonlinearity we add the squared disclosure term (for example, OverallS²). A negative coefficient on the linear term combined with a positive coefficient on the squared term, both statistically significant, is consistent with a U-shaped relationship, with an interior turning point at $-\beta_1/(2\beta_2)$.

3.4. Control Variables

We control for the firm-level determinants of crash risk identified in prior research (Chen et al., 2001; Hutton et al., 2009; Kim et al., 2014). Firm size (Size) and the market-to-book ratio (MB) proxy for visibility and growth-driven overvaluation, both associated with greater crash risk. Leverage (LEV) captures the disciplining and distress effects of debt, and profitability (ROA, with ROE used in robustness tests) controls for performance. Firm age (Age) and an indicator for a Big 4 auditor (Big4) proxy for maturity and audit-driven monitoring of the information environment. The trading and return variables past firm-specific return (RET), return volatility (Sigma), share turnover (Turnover), and the change in turnover (DTurnover) follow Chen et al. (2001), who show that differences of opinion and recent return dynamics forecast crashes. Tobin's Q replaces MB in a robustness test. Variable definitions are summarized in Table 1.

3.5. Empirical Models

The baseline nonlinear specification for overall ESG disclosure is

$$CrashRisk_{i,t+1} = \beta_0 + \beta_1 ESG_{it} + \beta_2 ESG_{it}^2 + \gamma \cdot Controls_{it} + \mu_i + \lambda_t + \varepsilon_{it}, \quad (4)$$

where CrashRisk is NCSKEW or DUVOL, μ_i are firm fixed effects, and λ_t are year fixed effects. The social-disclosure model replaces ESG with OverallS and OverallS². Firm fixed effects absorb all time-invariant firm heterogeneity (for example, industry, ownership type, and persistent governance quality), addressing a major source of omitted-variable bias; year fixed effects absorb macroeconomic shocks and regulatory changes common to all firms, including the COVID-19 period. Standard errors are clustered at the firm level to accommodate within-firm serial correlation and heteroskedasticity (Petersen, 2009). Because the regressors are dated at t and the dependent variable at $t+1$, the design further limits contemporaneous reverse causality.

3.6. Testing for a U-Shaped Relationship

A statistically significant quadratic term is necessary but not sufficient evidence of a U shape: a quadratic fitted to a relationship that is in truth monotone but convex over the observed range can produce a spuriously “significant” squared term and an extreme point that lies outside the data (Lind and Mehlum, 2010; Haans, Pieters, and He, 2016). We therefore assess three joint conditions for a genuine U shape. First, the linear coefficient β_1 must be negative and the squared coefficient β_2 positive, both significant. Second, the slope of the relationship must be negative at the lower bound and positive at the upper bound of the observed disclosure range equivalently, the estimated turning point $-\beta_1/(2\beta_2)$ must fall strictly inside that range. Third, we implement the exact test of Sasabuchi, Lind, and Mehlum, whose null hypothesis is a monotone or inverse-U relationship; rejection confirms a U shape. We report the estimated turning point with its Fieller confidence interval, the slopes at the minimum and maximum of the disclosure variable, and the Lind–Mehlum test statistic for the main social-disclosure models in Table 7.

Table 1. Variable definitions.

Variable	Definition	Role
NCSKEW _{t+1}	Negative conditional skewness of firm-specific weekly returns in year $t+1$; higher values indicate greater crash risk (Eq. 2).	Dependent variable
DUVOL _{t+1}	Down-to-up volatility of firm-specific weekly returns in year $t+1$; higher values indicate greater crash risk (Eq. 3).	Dependent variable
OverallESG	Overall ESG disclosure score (unit interval).	Main independent variable
OverallE / OverallS / OverallG	Environmental, social, and governance disclosure scores.	ESG dimensions
OverallS ²	Squared social disclosure score.	Nonlinear term
Size	Natural logarithm of total assets.	Control
LEV	Total liabilities scaled by total assets.	Control
ROA / ROE	Return on assets / return on equity.	Control / robustness
MB / TobinQ	Market-to-book ratio / Tobin's Q.	Control / robustness
Age	Firm age in years.	Control
Big4	Indicator equal to one if audited by a Big 4 firm.	Control
RET	Mean firm-specific weekly return over the year.	Control
Sigma	Standard deviation of firm-specific weekly returns.	Control

Turnover / DTurnover	Average share turnover / change in average turnover.	Control
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Notes: Crash-risk variables are measured in year t+1; ESG disclosure and all control variables are measured in year t.

4. Empirical Results

4.1. Descriptive Statistics and Correlations

Table 2 reports descriptive statistics. The mean of NCSKEW is -0.099 and the mean of DUVOL is -0.105 , both close to values reported for other emerging and developed markets (Kim et al., 2014; Xu et al., 2022), with substantial cross-sectional dispersion in crash risk. Overall ESG disclosure averages 0.522, with environmental disclosure the lowest pillar (mean 0.414) and governance the highest (mean 0.728). Social disclosure averages 0.442 and is tightly concentrated near the top of its range (the first quartile is 0.438 and the median 0.484), with a thin left tail extending to 0.057. This distribution is important for interpreting the nonlinear results: because the estimated turning points lie at roughly 0.29–0.33 below the first quartile of social disclosure the large majority of sample firm-years already operate in the region where the marginal effect of additional social disclosure on crash risk is positive. The control variables take economically reasonable values; firm size (mean 28.4 in logs), leverage (mean 0.45), and the Big 4 indicator (38% of firm-years) are comparable to other HOSE samples.

Table 3 presents the pairwise correlation matrix. The two crash-risk proxies are strongly correlated (0.894), confirming that they capture a common construct while leaving room for the measure-specific differences documented below. Correlations among the explanatory variables are modest: the largest are between ROA and the market-to-book ratio (0.526) and among the trading variables (turnover and change in turnover, 0.517; past return and change in turnover, 0.510), none of which approaches a level that would threaten the regressions. Variance inflation factors confirm this: every VIF for the control variables lies between 1.4 and 2.5, far below conventional thresholds. The only high VIFs attach to social disclosure and its square, which is the mechanical, well-understood consequence of including a variable and its own square and does not bias the coefficients or their standard errors (Haans, Pieters, and He, 2016).

Table 2. Descriptive statistics.

Variable	N	Mean	SD	Min	p25	Median	p75	Max
NCSKEW _{t+1}	1,029	-0.099	0.939	-2.717	-0.603	-0.134	0.345	3.099
DUVOL _{t+1}	1,029	-0.105	0.594	-1.615	-0.506	-0.143	0.269	1.707
OverallESG	1,017	0.522	0.124	0.037	0.492	0.553	0.599	0.683
OverallE	1,013	0.414	0.169	0.033	0.300	0.433	0.533	0.800
OverallS	993	0.442	0.093	0.057	0.438	0.484	0.493	0.500
OverallG	1,011	0.728	0.158	0.231	0.692	0.769	0.846	1.000
Size	1,029	28.432	1.388	25.645	27.515	28.311	29.334	32.582
LEV	1,029	0.453	0.203	0.040	0.300	0.450	0.620	0.860
ROA	1,029	0.063	0.070	-0.088	0.016	0.048	0.094	0.352
ROE	1,029	0.113	0.118	-0.289	0.041	0.100	0.175	0.470
MB	1,029	1.285	0.870	0.223	0.679	1.085	1.652	4.935
TobinQ	1,029	1.098	0.465	0.416	0.816	0.990	1.255	3.009
Age	1,029	12.728	3.134	5.000	11.000	13.000	15.000	21.000
Big4	1,029	0.384	0.487	0.000	0.000	0.000	1.000	1.000
RET	1,029	0.001	0.009	-0.027	-0.003	0.001	0.007	0.025
Sigma	1,029	0.050	0.021	0.016	0.034	0.046	0.063	0.113
Turnover	1,029	0.021	0.028	0.000	0.002	0.009	0.029	0.141
DTurnover	1,029	0.002	0.020	-0.061	-0.004	0.000	0.005	0.080

Notes: The table reports the number of firm-year observations, mean, standard deviation, minimum, 25th percentile, median, 75th percentile, and maximum. Crash-risk variables are measured in year $t+1$; all other variables in year t . Continuous variables are winsorized at the 1st and 99th percentiles.

Table 3. Pairwise correlation matrix.

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
(1) NCSKEW	1.00													
(2) DUVOL	0.89*	1.00												
(3) OverallESG	-0.08*	-0.03	1.00											
(4) Overalls	0.01	0.04	0.49*	1.00										
(5) Size	-0.15*	-0.17*	0.16*	-0.11*	1.00									
(6) LEV	-0.12*	-0.12*	-0.05	0.04	0.38*	1.00								
(7) ROA	0.11*	0.09*	0.08*	0.01	-0.11*	-0.46*	1.00							
(8) MB	0.02	0.05	0.14*	-0.03	0.17*	-0.10*	0.53*	1.00						
(9) Age	-0.05	-0.04	0.07*	0.01	-0.06	-0.22*	-0.05	0.01	1.00					
(10) Big4	-0.02	-0.02	0.16*	-0.12*	0.42*	-0.06	0.12*	0.22*	-0.02	1.00				
(11) RET	0.03	0.06	0.00	0.08*	0.01	-0.01	0.14*	0.30*	0.02	-0.02	1.00			
(12) Sigma	-0.06	-0.05	-0.14*	0.04	-0.14*	0.17*	-0.30*	-0.19*	0.04	-0.22*	-0.02	1.00		
(13) Turnover	-0.14*	-0.12*	0.03	0.04	0.34*	0.21*	-0.16*	-0.06	0.02	0.06*	0.17*	0.28*	1.00	
(14) DTurnover	0.02	0.04	-0.02	0.02	0.06	0.05	0.03	0.12*	-0.01	0.01	0.51*	0.16*	0.52*	1.00

Notes: Pairwise Pearson correlations. * denotes significance at the 5% level. Overalls is shown as the focal disclosure dimension; OverallE and OverallG are omitted for brevity. Variable numbers in the column headers correspond to the row labels.

4.2. The Linear Baseline and the Case for Nonlinearity

Table 4 reports the linear fixed-effects models. The coefficient on overall ESG disclosure is statistically insignificant for both proxies: 0.0704 ($p = 0.828$) for NCSKEW and 0.2910 ($p = 0.172$) for DUVOL. Taken at face value, this would suggest that ESG disclosure is unrelated to future crash risk. The control variables, however, behave as theory predicts and confirm that the models are well specified. Firm size and the market-to-book ratio are positively associated with crash risk (Size: 0.4581 and 0.2630, both significant; MB: 0.2798 and 0.2203, both significant at the 1% level), consistent with greater visibility and overvaluation-driven crashes, while leverage is strongly negative (-1.7542 and -1.1128 , both significant at the 1% level). The change in turnover is positive and highly significant in both models (7.2882 and 3.8950), in line with the differences-of-opinion mechanism of Chen et al. (2001). The contrast between sensible control coefficients and an insignificant ESG term is exactly the pattern a misspecified linear model would generate if the true relationship were curved, motivating the nonlinear specification.

Table 4. Linear ESG disclosure and future crash risk.

Variable	NCSKEW _{t+1}	DUVOL _{t+1}
OverallESG	0.0704 (0.828)	0.2910 (0.172)
Size	0.4581** (0.016)	0.2630** (0.023)
LEV	-1.7542***	-1.1128***

	(0.000)	(0.000)
ROA	0.4101	-0.4542
	(0.670)	(0.471)
MB	0.2798***	0.2203***
	(0.002)	(0.001)
Age	0.1278	0.1079
	(0.374)	(0.339)
Big4	-0.0726	-0.0517
	(0.620)	(0.655)
RET	-1.4952	0.3735
	(0.757)	(0.903)
Sigma	-4.6537*	-2.6690*
	(0.050)	(0.095)
Turnover	-6.2681**	-3.0832*
	(0.015)	(0.062)
DTurnover	7.2882***	3.8950***
	(0.000)	(0.002)
Firm FE / Year FE	Yes / Yes	Yes / Yes
Observations	1,017	1,017
Number of firms	187	187
Within R ²	0.1077	0.1141

Notes: Firm fixed-effects regressions with year fixed effects and firm-clustered standard errors. p-values in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels.

4.3. Nonlinear Overall ESG Disclosure

Table 5 adds the squared ESG term. For NCSKEW, the linear coefficient becomes negative and significant (-2.4502, $p = 0.045$) and the squared coefficient positive and significant (3.3289, $p = 0.041$), the canonical signature of a U shape. The implied turning point is 0.3680, which lies within the observed range of the disclosure score, satisfying the interior-extremum condition for a genuine U. For DUVOL, the signs are identical and the squared term is positive and weakly significant (1.7677, $p = 0.086$), though the linear term is insignificant; the DUVOL evidence is thus directionally consistent but weaker. These results support H1 and, for NCSKEW, H1a: the apparently null linear effect masks a nonlinear relationship in which crash risk first falls and then rises with ESG disclosure.

Table 5. Nonlinear effect of overall ESG disclosure.

Variable	NCSKEW _{t+1}	DUVOL _{t+1}
OverallESG	-2.4502**	-1.0475
	(0.045)	(0.181)
OverallESG ²	3.3289**	1.7677*
	(0.041)	(0.086)
Size	0.4314**	0.2488**
	(0.025)	(0.034)
LEV	-1.6811***	-1.0740***
	(0.000)	(0.001)
ROA	0.4676	-0.4237
	(0.626)	(0.500)
MB	0.2668***	0.2135***
	(0.003)	(0.001)
Turnover	-6.1358**	-3.0129*
	(0.016)	(0.066)
DTurnover	7.1897***	3.8426***

	(0.000)	(0.003)
Turning point	0.3680	0.2963
Firm FE / Year FE	Yes / Yes	Yes / Yes
Observations	1,017	1,017

Notes: Other controls (Age, Big4, RET, Sigma) are included but suppressed for brevity. The turning point equals $-\beta_1/(2\beta_2)$. p-values in parentheses; *, **, *** denote 10%, 5%, 1% significance.

4.4. Which Dimension Drives the Curvature?

Table 6 estimates the nonlinear specification separately for each pillar. The curvature is not shared equally. Environmental disclosure is insignificant for NCSKEW and, for DUVOL, produces a positive linear and negative squared term an inverted-U pattern opposite in sign to the overall result and therefore unresponsive of the transparency-then-symbolism logic. Governance disclosure is insignificant for both proxies. Social disclosure, by contrast, displays a clean and significant U shape for both measures: the linear term is negative (-4.8112 for NCSKEW, -2.9161 for DUVOL) and the squared term positive (7.2535 and 4.9963), all significant at the 5% level. The nonlinearity in overall ESG disclosure is thus driven almost entirely by the social dimension, consistent with H2 and with our argument that low verifiability makes social disclosure the pillar most exposed to symbolic use.

Table 6. Nonlinear ESG dimensions and future crash risk.

Dimension	Dep. var.	Linear	Squared	TP	Pattern
Environmental	NCSKEW	0.8760 (0.248)	-0.6639 (0.495)	-	Not significant
Environmental	DUVOL	1.4449*** (0.005)	-1.3400* (0.051)	-	Inverted U (DUVOL)
Social	NCSKEW	-4.8112** (0.032)	7.2535** (0.034)	0.3316	U-shaped
Social	DUVOL	-2.9161** (0.026)	4.9963** (0.012)	0.2918	U-shaped
Governance	NCSKEW	-1.8156 (0.209)	1.6145 (0.150)	-	Not significant
Governance	DUVOL	-0.3254 (0.710)	0.4472 (0.511)	-	Not significant

Notes: Each row pair reports the linear and squared coefficients (p-values below) on the relevant disclosure dimension from a separate firm and year fixed-effects regression with the full control set. TP denotes the turning point $-\beta_1/(2\beta_2)$. *, **, *** denote 10%, 5%, 1% significance.

4.5. Social Disclosure and the Formal U-Shape Test

Table 7 presents the full social-disclosure models. For NCSKEW, OverallS is -4.8112 ($p = 0.032$) and OverallS² is 7.2535 ($p = 0.034$), implying a turning point of 0.3316 . For DUVOL, OverallS is -2.9161 ($p = 0.026$) and OverallS² is 4.9963 ($p = 0.012$), implying a turning point of 0.2918 . The control coefficients are stable relative to the baseline, indicating that the social-disclosure effect is not an artifact of the other covariates.

Crucially, the U shape survives the formal test of Lind and Mehlum (2010), reported in the lower panel of Table 7, which guards against a spuriously significant quadratic term. For both proxies the estimated turning point lies strictly inside the observed range of social disclosure $[0.057, 0.500]$, and its Fieller 95% confidence interval is narrow and interior (NCSKEW: $[0.270, 0.393]$; DUVOL: $[0.232, 0.352]$). The slope is negative and significant at the lower bound (NCSKEW: -3.98 , $t = -2.15$; DUVOL: -2.35 , $t = -2.16$) and positive at the upper bound (NCSKEW: 2.44 , $t = 1.89$; DUVOL: 2.08 , $t = 2.81$). The joint Lind-Mehlum test rejects the null of a monotone or inverse-U relationship for both proxies

(NCSKEW: $t = 1.89$, $p = 0.030$; DUVOL: $t = 2.16$, $p = 0.016$), confirming a genuine U shape and supporting H2a. Substantively, social disclosure reduces future crash risk up to a level of roughly 0.29–0.33, beyond which additional social disclosure is associated with higher crash risk; because this turning point lies below the first quartile of social disclosure, the majority of sample firm-years already sit on the upward-sloping segment of the curve.

Table 7. Main social-disclosure models and U-shape test.

Variable	NCSKEW _{t+1}	DUVOL _{t+1}
OverallS	-4.8112** (0.032)	-2.9161** (0.026)
OverallS ²	7.2535** (0.034)	4.9963** (0.012)
Size	0.4528** (0.017)	0.2600** (0.022)
LEV	-1.8143*** (0.000)	-1.1715*** (0.000)
ROA	0.3292 (0.737)	-0.5775 (0.364)
MB	0.2462*** (0.007)	0.2014*** (0.002)
Age	0.1386 (0.322)	0.1055 (0.350)
Big4	-0.0725 (0.614)	-0.0471 (0.678)
RET	-1.0887 (0.820)	0.4806 (0.872)
Sigma	-4.3233* (0.074)	-2.4329 (0.137)
Turnover	-6.7280*** (0.009)	-3.1824* (0.053)
DTurnover	7.7883*** (0.000)	4.1518*** (0.002)
Turning point	0.3316	0.2918
Turning point 95% CI	[0.270, 0.393]	[0.232, 0.352]
Slope at min (0.057)	-3.98**	-2.35**
Slope at max (0.500)	2.44*	2.08***
Lind–Mehlum U test (t)	1.89	2.16
U test p-value	0.030	0.016
Firm FE / Year FE	Yes / Yes	Yes / Yes
Observations	993	993
Number of firms	187	187
Within R ²	0.1105	0.1152

Notes: Firm and year fixed-effects regressions with firm-clustered standard errors; p-values in parentheses. The turning point equals $-\beta_1/(2\beta_2)$; its 95% confidence interval is the Fieller interval. Slopes at the minimum and maximum of OverallS are computed by lincom. The Lind and Mehlum (2010) test evaluates H0: monotone or inverse-U against H1: U shape over the interval [0.057, 0.500]. *, **, *** denote 10%, 5%, 1% significance.

4.6. Robustness

We assess robustness along two dimensions: alternative control specifications and alternative estimators. Table 8 shows that the U-shaped social-disclosure effect is unchanged when return-on-equity is added to absorb residual profitability differences (NCSKEW: -4.7747 and 7.2446; DUVOL:

-2.9042 and 4.9934) and when Tobin's Q replaces the market-to-book ratio (NCSKEW: -4.5096 and 6.8788; DUVOL: -2.6996 and 4.7302). In every case the linear term remains negative and the squared term positive, all significant at the 5% level, confirming that the result is not driven by the particular profitability or valuation control chosen.

Table 9 turns to estimators that relax the fixed-effects error structure. Under panel-corrected standard errors with an AR(1) correction, the U shape is preserved for NCSKEW (-3.0532 and 4.7135, both significant at the 10% level), while for DUVOL the squared term remains positive and weakly significant but the linear term loses significance. Under feasible generalized least squares, the NCSKEW result is strongly supported under both AR(1) and independent error structures (linear and squared terms significant at the 5% level), whereas the DUVOL terms become insignificant. The evidence is therefore strongest and most estimator-robust for NCSKEW; DUVOL corroborates the U shape in the fixed-effects models but is more sensitive to estimator choice. This asymmetry is consistent with the conceptual difference between the proxies NCSKEW captures distributional asymmetry directly, the feature most affected by the sudden release of hoarded bad news and does not undermine the central finding.

Table 8. Robustness to alternative control specifications (social disclosure).

Specification	Dep. var.	OverallS	OverallS ²	U shape
Baseline FE	NCSKEW	-4.8112**	7.2535**	Supported
Baseline FE	DUVOL	-2.9161**	4.9963**	Supported
Add ROE	NCSKEW	-4.7747**	7.2446**	Supported
Add ROE	DUVOL	-2.9042**	4.9934**	Supported
Replace MB with TobinQ	NCSKEW	-4.5096**	6.8788**	Supported
Replace MB with TobinQ	DUVOL	-2.6996**	4.7302**	Supported

Notes: All specifications include the full control set with firm and year fixed effects and firm-clustered standard errors. ** denotes 5% significance. Every specification preserves the negative linear and positive squared coefficients.

Table 9. Robustness to alternative estimators (social disclosure)

Estimator	Dep. var.	OverallS	OverallS ²	Conclusion
PCSE, AR(1)	NCSKEW	-3.0532*	4.7135*	Weakly supported
PCSE, AR(1)	DUVOL	-1.1783	2.3208*	Partial support
FGLS, AR(1)	NCSKEW	-1.8851**	3.0487**	Supported
FGLS, AR(1)	DUVOL	-0.5498	1.1430	Not supported
FGLS, independent	NCSKEW	-1.8872**	3.0685**	Supported
FGLS, independent	DUVOL	-0.5473	1.1467	Not supported

Notes: PCSE = panel-corrected standard errors; FGLS = feasible generalized least squares. * and ** denote 10% and 5% significance. The nonlinear social-disclosure effect is strongest and most robust for NCSKEW.

5. Discussion

Five points organize the interpretation of these results. First, the insignificant linear effect of overall ESG disclosure should not be read as evidence that disclosure is irrelevant to crash risk. The control variables behave exactly as the crash-risk literature predicts, yet the linear ESG term is flat the fingerprint of a curved relationship forced through a straight line. When the quadratic term is admitted, a U shape appears. This supports the argument, advanced theoretically by Zhou and Nagayasu (2022), that the "weak" linear results pervading the literature are largely a specification artifact.

Second, the U shape gives empirical content to the too-much-of-a-good-thing logic. At low-to-moderate levels, disclosure conveys new, decision-relevant information, narrows information asymmetry, and reduces crash risk the transparency view. Beyond the turning point, the marginal informational value of further disclosure falls while its scope for symbolic use rises, and the agency or impression-management channel comes to dominate, so the marginal effect turns positive. Both classical views are correct, but each only over its own region of the disclosure range.

Third, the effect is concentrated in social disclosure, and this concentration is theoretically meaningful rather than incidental. Social disclosure is the least verifiable pillar: it consists largely of qualitative narratives about employees, communities, and customers that lack standardized metrics and external assurance. That same property makes it informative when used in good faith at moderate levels and the most convenient vehicle for image management when used opportunistically at high levels. The contrast with Thompson (2025), who attributes the crash-risk-mitigating role of ESG in Korea to the environmental and governance pillars, suggests that which dimension matters and whether its effect is linear or curved depends on the maturity and verifiability of disclosure practice in a given market.

Fourth, the turning point is practically informative, and the formal Lind–Mehlum test puts the U shape on firm statistical footing rather than leaving it to rest on the sign of a quadratic term. Because the marginal effect of social disclosure reverses at a moderate level (approximately 0.29–0.33 on the unit scale) a point that lies below the first quartile of social disclosure in our sample the typical Vietnamese firm already operates on the upward-sloping segment of the curve, where additional social disclosure is associated with higher rather than lower crash risk. The quantity of social disclosure is therefore an unreliable signal of lower risk for most firms. Investors should treat very high social-disclosure intensity, especially when not matched by verifiable substance, as a potential red flag rather than reassurance, and should weigh disclosure against firm fundamentals. The orientation of our U shape (decreasing then increasing) is the mirror image of the inverted-U that Dai, Lu, and Qi (2019) report for mandatory CSR disclosure in China, where crash risk first rises and then falls. The divergence is plausibly institutional: where disclosure is predominantly mandatory and low-quality at the outset, early disclosure may aggravate opacity before maturing; where disclosure is increasingly voluntary and reputational, as in Vietnam over our sample, early disclosure is informative and excess disclosure becomes symbolic. Reconciling these patterns across disclosure regimes is a promising avenue for future work.

Fifth, the asymmetry between NCSKEW and DUVOL is informative rather than troubling. The two proxies capture different features of downside risk distributional asymmetry versus relative volatility and the social-disclosure effect proves strongest for NCSKEW across fixed-effects, panel-corrected, and feasible-GLS estimators. Since the abrupt release of hoarded bad news is precisely what generates left-tail asymmetry, the greater robustness of the NCSKEW result is consistent with the underlying mechanism. The fixed-effects evidence supports the U shape for both proxies; the estimator-sensitivity of DUVOL simply indicates that NCSKEW is the more powerful measure in this setting.

6. Conclusions

Using an unbalanced panel of non-financial firms listed on the Ho Chi Minh Stock Exchange from 2018 to 2024, this study revisits the relationship between ESG disclosure and future stock price crash risk by relaxing the linearity assumption that characterizes most prior work. Overall ESG disclosure has no significant linear effect, but a significant U-shaped effect once nonlinearity is permitted; dimension-level analysis shows that this curvature is driven by social disclosure, which reduces crash risk up to a moderate threshold and is associated with higher crash risk beyond it. The pattern is robust to alternative profitability and valuation controls and is strongest for NCSKEW under alternative estimators.

The findings reframe a long-standing debate. The question is not whether ESG disclosure raises or lowers crash risk, but at what level and through which dimension. More disclosure is not

uniformly better; its credibility, substance, and balance determine whether it stabilizes prices or masks bad news. The study contributes to the crash-risk literature by identifying social disclosure as a non-financial, level-dependent determinant of crash risk in an emerging market, and to the ESG literature by showing that pillar-level heterogeneity and nonlinearity are essential, not optional, features of the relationship.

For investors, the results counsel against reading high social-disclosure intensity as a risk-reducing signal without assessing substance. For regulators, they argue for improving the comparability, verifiability, and assurance of social disclosure, so that reporting volume tracks reporting quality. For firms, they imply that social disclosure should be specific, evidence-based, and proportionate rather than expansive and symbolic.

Several limitations qualify these conclusions and motivate future research. The sample is confined to Vietnamese listed firms, which bounds external validity. The disclosure measure captures the quantity and structure of disclosure but not directly its quality; distinguishing substantive from symbolic disclosure would sharpen the test of the proposed mechanism. The analysis focuses on crash risk and not on other capital-market outcomes such as the cost of capital, liquidity, or analyst forecast accuracy. Promising extensions include textual analysis of annual-report tone following Loughran and McDonald (2011) to proxy for disclosure substance, the use of third-party ESG ratings or assurance indicators, and an instrumental-variables strategy for example, the industry-average disclosure of peer firms to address residual endogeneity, all of which would further discriminate between the transparency and symbolic-disclosure channels that this study shows operate at different points along the disclosure range.

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Appendix A. Estimated specifications

Model A1 (overall ESG):

$$CrashRisk_{i,t+1} = \beta_0 + \beta_1 OverallESG_{it} + \beta_2 OverallESG_{it}^2 + \gamma \cdot Controls_{it} + \mu_i + \lambda_t + \varepsilon_{it}.$$

Model A2 (social disclosure):

$$CrashRisk_{i,t+1} = \beta_0 + \beta_1 OverallS_{it} + \beta_2 OverallS_{it}^2 + \gamma \cdot Controls_{it} + \mu_i + \lambda_t + \varepsilon_{it}.$$

The fixed-effects models are estimated in Stata with the command `xtreg depvar indepvars i.year, fe vce(cluster id)`; panel-corrected standard errors and feasible GLS are estimated with `xtpcse` and `xtgls` under AR(1) and independent error structures. The presence of a U-shaped relationship is tested with the `utest` implementation of Lind and Mehlum (2010). Descriptive statistics and the pairwise correlation matrix for all variables are reported in Tables 2 and 3.

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