Mandated to Disclose, Exposed to Risk: Impact of Mandatory ESG Disclosures on Crash Risk

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Abstract:

In India, since 2012, the regulatory authority overseeing the financial markets, known as the Security and Exchange Board of India (SEBI), has initiated the Environmental, Social, and Governance (ESG) disclosure requirement for certain listed entities. Over the years, SEBI has introduced five such mandates. The latest mandate, Business Responsibility and Sustainability Reporting (BRSR) came in 2021 and aims at broadening the scope of previous mandates. We formally investigate whether mandatory ESG reporting impacts the crash risk of the firms with the passage of these five regulatory events from 2012 to 2021. We employ a difference-in-difference (DID) regression analysis for treated and control firms after propensity score matching of the covariates to observe the effect of events concerning ESG reporting in India on the crash risk of firms. We find that throughout the passage of five events; there is an increase in the crash risk for the treated firms relative to the control firms. We then examine cross-sectional variations among polluting industries and innovative firms based on the argument of the materiality of ESG information. We find a decrease in the crash risk for the treated firms in these industries/firms throughout the passage of five events. The findings of our study carry significant implications for policy formulation. The findings suggest that implementing ESG mandates can serve as a powerful tool for mitigating information asymmetry and lowering crash risk, provided that these mandates are tailored to the materiality of ESG information specific to various industries and firms.

Keywords: ESG disclosure, sustainability reporting, crash risk, difference-in-difference regression, emerging markets

JEL Code: M40, M41, G14, G30, G38

Introduction:

With the rising prominence of ESG (environmental, social, and governance) regulations across economies, the policy debate on the value relevance of the same has also been fuelled. The widely taken stance of market regulators on introducing such mandates is to make markets more transparent. India is one of the pioneers in bringing about sustainability mandates. The Indian regulator, the Securities and Exchange Board of India (SEBI), started mandating sustainability reporting in 2012. Till 2021, there have been five such regulatory announcements around ESG reporting. These mandates came in a phased manner and determined based on market capitalization for each event for the firms listed on the National Stock Exchange (NSE) and Bombay Stock Exchange (BSE). The regulations asked a few firms to comply with the mandatory ESG reporting requirements. In light of the above mandates, we ask whether such mandates improve the information environment of the market and increase market transparency. In this study, we investigate whether the mandates impact the bad news hoarding behaviour in the form of crash risk of the mandated firms.

The bad news hoarding hypothesis states that managers are tempted to hide the bad news (Ball, 2009; Graham et al., 2005; Kothari et al., 2009). The information hoarding obstructs the formation of a transparent financial market. Jin & Myers, (2006), in their work, have pointed out that information asymmetry and agency conflicts have the potential to drive the crash risk. Non-financial disclosures, such as ESG disclosures, can potentially solve the issue of information asymmetry. The extant literature on crash risk is obscure in providing reliable evidence on the impact of ESG disclosure mandates on crash risk. It remains unclear whether ESG disclosure mandates increase or decrease crash risk for the mandated firms, and this is an open empirical question. In this study, we exploit the phased progression of the ESG disclosure mandates in India and ask whether the mandatory ESG reporting regulations impact

the crash risk of firms under the mandate. Such an investigation will aid in making a business case for the policymakers to introduce such regulations.

In a voluntary regime, all firms are assumed to supply an equilibrium level of information, balancing the aforementioned contrasting incentive motives arising from information hoarding and reduction in agency concern. A supply-side exogenous shock is put in motion by the disclosure mandates, which force the mandated firms to supply information related to ESG. Such a shock can induce a departure from the equilibrium path, prompting firms to reassess their disclosure choices. Shareholders of the non-mandated firms may deduce the information of such firms based on the freely available information disclosed by the mandated firm. This might not be warranted by the non-mandated peers, and so they would indulge in some form of voluntary disclosure just enough to neutralize such the substitution effect. This competitive and complementary effect by the comparable non-mandated peers might exacerbate the direct cost as well as proprietary costs for the mandated firms, which had to comply with a formal and specific reporting regulation. Such disclosures by the firms may dilute the information environment as the environment now consists of formal disclosure by the mandated firms and informal voluntary disclosure by the non-mandated peers.

The ESG disclosures entail disclosing mandated firms' proprietary information[2], increased chances of misreporting (Korn & Schiller, 2003), and increased litigation risk, adding to potential financial losses (Hong & Kostovetsky, 2012). In this scenario, shareholder uncertainty may increase, as may their perception of the volatility of future cash flows and crash risk. The negative externalities from the competitive and complementary disclosure behaviour of the comparable non-mandated firms and increased shareholder uncertainty as to future cash flows acting together might increase the crash risk. The intended regulatory effect

[2] Proprietary information/cost is such information that can potentially result in loss of competitive strength of a firm among its competitors.

of making the financial market information rich and building shareholder confidence is muted in such case.

Conversely, investors may perceive a reduction in crash risk if they believe in exogenous disciplining through an ESG disclosure mandate as a mechanism that can mitigate agency conflicts. Scholars such as Larcker et al. (2007) and Xie et al. (2003) propose that a firm's reporting quality is influenced by its corporate governance mechanism. The mandated disclosure of ESG information might push firms to strengthen their internal mechanisms to avoid sending negative signals to the market. Research indicates that robust internal controls can mitigate crash risk (Chen et al., 2017). Consequently, as mandated firms improve their internal control mechanisms in response to disclosure requirements, the elevated quality of internal control and corporate governance can potentially assuage investor perception of crash risk associated with the firm. Also, the comprehensive disclosure of Environmental, Social, and Governance (ESG) factors may furnish shareholders with multidimensional informational content to assess the predictability of future cash flows and the firm's exposure to negative tail-end risk. Any competitive spillover from voluntary disclosures by non-mandated firms would likely be insufficient to erode the agency benefits conferred upon mandated firms through formal ESG reporting. Consequently, investors may perceive the crash risk associated with mandated firms to be diminished. In light of the above arguments, it remains unclear whether an ESG mandate increases or decreases a firm’s crash risk, which calls for an empirical investigation.

In 2012, the Securities and Exchange Board of India (SEBI) commenced the enforcement of Environmental, Social, and Governance (ESG) reporting requirements for a select group of listed companies through the implementation of Business Responsibility Reporting BRR applicable to the top 100 firms determined by their market capitalization. With the most recent announcement of the Business Responsibility and Sustainability Reporting

(BRSR) requirement in 2021, the scope of ESG reporting was further broadened by incorporating quantitative metrics, resulting in up to 300 data points. With the passage of announcement events under the study, we observe that SEBI progressively extended the applicability of the ESG mandate to encompass a growing number of firms over time. These regulatory interventions provide an ideal quasi-natural setting for investigating the causal association between ESG reporting mandates and crash risk.

We undertake a formal causal investigation by employing the *difference-in-difference (DID)* analysis for treated[3] and control firms after propensity score matching of the covariates to observe the effect of events around ESG reporting in India. Our research setting enables us to observe any difference in the crash risk between the mandated and matched non-mandated firms on an aggregate basis with the passage of events. This setting aids in attributing such differences in the crash risk to the events on mandatory ESG regulations.

We test the prediction of whether ESG reporting impacts the crash risk of the treated (mandated) and control (non-mandated) firms around the five ESG regulation announcement dates. We observe an overall increase in crash risk for the treated firms throughout the passage of events at 1% level of significance. We attribute the results to the negative externalities from competitive spillover and increased shareholder uncertainty.

We then investigate the impact of ESG reporting on firm's crash risk on the basis of the characteristics of the industries and firms. ESG disclosure has the potential to mitigate agency costs and enhance transparency, particularly within industries and firms where such

[3] We use treated (control) and mandated (non-mandated) interchangeably in the paper

information holds material significance. We take polluting industries and innovative firms based on the materiality of ESG concerns and heightened agency concerns owing to such materiality. We find on average, mandated firms in these industries/firms experience a decrease in crash risk compared to the non-mandated firms at a 1% significance level. The results suggest that the agency motives are stronger for the polluting industries and innovative firms and drive the crash risk perceived by shareholders downwards.

This study contributes in the following ways: First, to the best of our knowledge, this is the first study to present reliable casual evidence of the impact of ESG disclosure mandates on crash risk and contribute to a pertinent policy debate. Second (Leuz & Wysocki, 2016) points out the lack of evidence on market-wide effects and externalities from regulations, and Hao (2023) presents a theoretical prediction on peer behaviour in a mandatory disclosure regime. This study provides empirical evidence to these theoretical predictions on the externalities arising from peer behaviour for the ESG disclosure mandates.

The remaining paper has been organized into the following sections: Section 2: Related Literature and Hypotheses, Section 3: Institutional Background, Section 4: Data, Section 5: Empirical Strategy, Section 6: Results, and Section 7: Conclusion.

Related Literature & Hypothesis Development:

Stock price crash risk is associated with a sharp fall in stock prices due to the spillage of stockpiled information by the managers (Hutton et al., 2009; Jin & Myers, 2006). Crash risk denotes the investor's subjective assessment of the future crash risk of stock price (Kim et al., 2016). In times of crisis, a steep decline in stock prices could result from negative investor perception. Regulatory mandates advocate increased ESG disclosure as a way to build investor confidence. As economies across the world have started mandating ESG disclosures, an inquiry

whether such information has an impact on the tail-end risk of firms is needed to understand the justification of such regulatory mandates.

A firm's disclosure strategy is based on the potential incentives from hoarding information (Ball, 2009; Graham et al., 2005; Kothari et al., 2009) and incentives from reduced agency conflicts (Downar et al., 2018; Gassen & Muhn, 2018). In a voluntary regime, all firms are assumed to supply an equilibrium level of information, balancing the aforesaid two contrasting incentive motives. A regulatory intervention of the ESG disclosure mandate is an exogenous shock to the information supply in the market. Such a shock can create an off-equilibrium path where firms rebalance their disclosure choice/strategy. In a mandated regime, the shareholders have access to the freely available public disclosures by the firms under the mandate. In such a scenario, the incentives for hoarding information for non-mandated firms may be reduced as shareholders of non-mandated firms may have already analyzed the bad news of the comparable mandated firm (Kim et al., 2016). Such substitution of bad news information may not be in the best interest of the non-mandated firms. It is possible that a non-mandated firm's actual bad news situation is not the same as perceived by the shareholder based on the bad news disclosure by the peer-mandated firm. The non-mandated firms thereby may try to avoid the substitution of bad news disclosed by the mandated firm's ESG disclosure by providing voluntary disclosures. Such firms may want to revise their disclosure strategy to reduce the information asymmetry and chase the benefits of reduced agency conflict and in effect provide voluntary ESG disclosures that are competitive to the disclosures made by the mandated firms. The non-mandated firms however enjoy a free hand as to what extent they wish to disclose as they are not under the purview of the strict and specific regulatory requirements. A mandated firm which is to be under the strict compliance of disclosure will be pushed to even let out the proprietary information whereas the non-mandated firm can pick and choose information to be disclosed that is just enough to get out of the shadows of bad news

disclosure supplied by the mandated firms. Significant proprietary costs may be imposed on the mandated firms due to substitutability/comparability of the information disclosed by the firms in the market (Habib et al., 2018) . The competitive spillover of information can create negative externalities that exacerbate the costs of disclosure (direct and proprietary costs) by the mandated firms, which must formally comply with a specific disclosure format as prescribed by the regulator. As the mandated firms are forced to supply information or bad news, the firms did not have the opportunity to time their information, and so whatever information, good/bad, that was stockpiled was pushed out into the market. The ESG disclosures will bear the mandated firms on a plethora of dimensions. This can make them prone to litigation risks (Cazier et al., 2023), sanctions, and activism and can thus entail potential financial liabilities (Hong & Kostovetsky, 2012). Investors may take note of this heightened watch and scrutiny over the mandated firms as an indication of future unstable cash flows, leading to an increase in the crash risk perceived by investors.

Additionally, a regulatory intervention creates an off-equilibrium path where misreporting may occur (Korn & Schiller, 2003). In the Indian context, there are no set reporting standards for ESG reporting and no specific auditing standards and requirements. In the lack of the same, the information disclosed by the mandated firms may be viewed as unreliable due to non-verifiability of information (Healy & Palepu, 2001). In effect even though the mandated firms will be complying with a mandatory disclosure regulation and supplying more information than a peer firm, that information will be an uninformative information due to lack of verifiability. A signal that is mere noise may not be helpful in reducing the agency conflicts and the crash risk perceived by the investors.

On the other hand, investor's perception of crash risk may decrease if they view the exogenous disciplining in the form of ESG disclosure mandate as a means to reduce agency conflicts. The existing literature on the internal control and corporate governance indicates that

the same impacts a firm's crash risk. Larcker et al. (2007) and Xie et al. (2003) suggest that the corporate governance of a firm affects its reporting quality. ESG disclosure will reveal the state of corporate governance and internal controls set in place in a firm. This may induce firms to straighten these internal mechanisms to avoid generating negative signals. Thus, the mandated firms are expected to improve their internal mechanisms, which in turn ensure the reliability of the firm's financial (Ashbaugh-Skaife et al., 2008; Doyle et al., 2007). Strong internal controls have been found to alleviate crash risk (Chen et al., 2017). As the mandated firms strengthen their internal control mechanisms owing to the disclosure mandate, the high quality of internal control and corporate governance can potentially alleviate the investor's perception of the firm's crash risk.

The mandated firms will be subject to strict compliance of the ESG disclosure mandate. The detailed ESG disclosure may be capable of providing informational (valuable) information that is enough for shareholders to determine the stability of future cashflows and firm's tail-end risk. In such a scenario, the competitive spillover by the non-mandated firms' voluntary disclosure would not be big enough to rob the mandated firms of the agency benefits derived from formally reported ESG information. Consequently, the investors would perceive the crash risk of the mandated firms to be low. As one of the most important measures of firm health, there is a dearth of evidence on the impact of ESG disclosure mandates on crash risk perceived by shareholders. From the above arguments, it remains unclear whether ESG disclosure mandates increase or decrease crash risk for the mandated firms. To investigate the same, we hypothesize the following:

H1: Mandatory ESG regulations affect crash risk perceived by shareholders.

We then hypothesize the scenarios where the ESG regulations can have a differential impact on the crash risk perceived by shareholders. Shareholders of certain industries or firms

may have different perceptions towards ESG reporting mandates depending on how sensitive the industry or firm is to the ESG information. Shareholders may be interested to actively monitor firms with a higher sensitivity to sustainability issues. Materiality plays a crucial role in sustainability reporting, as emphasized by Khan et al. (2016). Kim et al., (2016) find that expected crash risk decreases with financial statement comparability, and this negative relation is more pronounced in an environment where managers are more prone to withhold bad news. The industries or firms where ESG issues are more material will be tempted to withhold such information (Hsu, 2009). This motivates our inquiry into the impact of ESG disclosure mandate on shareholder value in different cross-sections of industries in our sample.

Litigation risk and regulation are believed to jointly affect the disclosure environment (Cazier et al., 2023). Real costs associated with sanctions, litigation, and related activism can make the future cash flows volatile, especially for industries and firms more sensitive to ESG information. The ESG mandatory regime in such cases will be viewed by the shareholders as a device that prevents information hoarding. The exogenous disciplining mechanism imposed by the mandatory regime will induce improvements in internal control and corporate governance. This will in effect instil more shareholder confidence and reduce shareholder uncertainty and their perception of crash risk.

Given the aforementioned context, we investigate differential crash risk in the cross-section of industries and firms. First, we investigate the polluting industries as ESG issues are more material to them and so the information hoarding tendencies could be heightened for such industries. Here, an ESG mandate will reduce the managerial opportunistic concealment of negative information by the firms leading to reduction in crash risk perceived by the investors.

Therefore, we hypothesize the following:

H2a: Mandatory ESG regulations negatively impact the crash risk perceived by the shareholders for the mandated firms in the polluting industries.

For the second cross-section, we take innovative firms. These firms are actively engaged in research and development activities and aim at continuous innovation. High expenditures on research and development (R&D) are associated with highly volatile cash flows (Hochberg et al., 2018). When the cash flows are volatile, shareholder uncertainty and agency concerns increase. An ESG mandate could serve as a device for continuous periodic disclosures that reduce agency costs (Li & Li, 2020) and improve shareholders' perception of crash risk. Therefore, we hypothesize the following:

H2b: Mandatory ESG regulations negatively impact the crash risk perceived by the shareholders for the mandated innovative firms.

The burgeoning literature on crash risk largely talks about the determinants (managerial incentives) and consequences of the same (Habib et al., 2018). Mechanisms that can potentially impact and curb the opportunistic tendencies of managers as to bad news can thus serve to aid in policy making. As non-financial disclosures on ESG take a multidimensional stance on the environment, social, and governance information, such disclosures can potentially impact the crash risk perceived by the shareholders. We add to the literature on crash risk by investigating the impact of the ESG disclosure mandate on crash risk perceived by the shareholders. Such investigation may aid in grasping the economic rationale behind ESG mandates and offer insights for policymakers in other developing nations aiming to enact sustainability disclosure regulations.

As ESG integration extends into the policy sphere worldwide, there is a growing need for reliable evidence on the causal effects of ESG disclosure requirements. Such evidence on

the economic case for ESG disclosures is rare. In the following section, we delve into the Institutional Background of ESG regulation.

Institutional background

On May 10, 2021, the Securities and Exchange Board of India (SEBI), the market regulator in India, introduced the Business Responsibility and Social Reporting mandate, hereafter referred to as the BRSR mandate. The BRSR mandate endeavours to bring the sustainability reporting practices of Indian firms in line with the continually evolving global sustainability reporting standards and trends.

This study delves into the sequence of events leading up to the implementation of the BRSR framework. We outline these events, including regulatory mandates and advisories, in five key events:

The Event#1 was on August 13, 2012, where India introduced sustainability reporting through the Business Responsibility Report (BRR) requirement, which was incorporated into the Annual Reports of the top 100 listed entities by market capitalization (as of March 31, 2012). December 22, 2015, was Event#2, where SEBI expanded the scope of the BRR 2012 mandate to encompass the top 500 listed companies by market capitalization (as of March 31, 2015). February 6, 2017, was Event#3, where a recommendation by SEBI, in discussion with industry associations and stock exchanges, was given to the top 500 listed entities based on market capitalization to voluntarily adopt Integrated Reporting from the fiscal year 2017-18 (market capitalization as of March 31, 2016). December 26, 2019, was Event #4 where SEBI further extended the coverage of the BRR 2012 mandate to include the top 1000 listed companies based on market capitalization (as of March 31, 2019). 10th May 2021, was Event #5 SEBI ceased the requirement for the business responsibility report after the financial year 2021–22

and introduced the BRSR mandate from the financial year 2022–23 onwards. This new mandate applies to the top 1000 listed entities, determined by market capitalization as of March 31, 2022. Additionally, SEBI encouraged voluntary disclosure for the fiscal year 2021–22.

The phased progression of regulatory mandates leading up to the BRSR in 2021 represents SEBI's effort to standardize ESG reporting across companies, sectors, and timeframes and to provide for the previously identified gaps in the accuracy and depth of reporting. The regulatory requirements expanded over time, encompassing a larger pool of firms to comply with the regulations.

Data and Methodology:

Data source and variables:

We primarily source our data from Prowess, a database maintained by the Centre for Monitoring the Indian Economy (CMIE). The CMIE database holds financial and trading information of the Indian listed and unlisted firms and thus is a popular database used across many studies with Indian sample sets. We obtain daily average returns and trading volume data from CMIE Prowess to compute the crash risk.

Dependent variables:

The variable of interest in this study is crash risk. The stock price crash risk measures are estimated from the firm-specific daily returns. Following Hutton et al. (2009), we calculate the firm-specific stock returns as follows:

$$R_{it} = \alpha_i + \beta_{1,i} r_{m,t-1} + \beta_{2,i} r_{i,t-1} + \beta_{3,i} r_{m,t} + \beta_{4,i} r_{i,t} + \beta_{5,i} r_{m,t+1} + \beta_{1,i} r_{i,t+1} + \varepsilon_{i,t} \quad (1)$$

Where R_{it} is the stock return for firm i in day t. R_{mt} is the return of the market index[4] at day t. We have included the lead and lag terms to allow for nonsynchronous trading (Dimson, 1979). The firm-specific return is estimated by taking the natural logarithm of one plus residual, which is obtained in equation (1):

$$W_{it} = \log(1 + \varepsilon_{i,t}) \quad (2)$$

The first measure of crash risk considered under this study is NCSKEW, which is the negative conditional skewness of firm-specific daily returns over the t+1 year

NCSKEW is estimated as the negative of the third moment of firm-specific daily returns for each year normalized by the standard deviation of firm-specific daily returns raised to the third power. The NCSKEW is calculated for each firm i in year t as:

$$NCSKEW_{it} = -\frac{n(n-1)^{3/2}\,\Sigma W^3_{i,t}}{(n-1)(n-2)(\Sigma W^2_{i,t})^{3/2}} \quad (3)$$

where $W_{i,t}$ is the firm-specific return, which is estimated by taking the natural logarithm of one plus residual and n is the number of daily observations. A higher value of the NCSKEW means a more negatively skewed return distribution, indicating a higher stock price crash risk (Chen et al., 2001).

The second measure of crash risk employed in this study is the 'down to up' volatility (DUVOL). Here, down days are calculated as the standard deviation of firm-specific daily returns in days with firm-specific returns below the annual mean, and up days are calculated as the standard deviation of the firm-specific daily returns on days with firm-specific returns

[4] We use Nifty500 index as market index. Nifty 500 is a broader market index maintained by National Stock Exchange of India (NSE). Link to the website: https://www.nseindia.com/products-services/indices-nifty500-index

above the annual mean. DUVOL is calculated as the natural logarithm of the down days divided by the up days. We estimate DUVOL as:

$$\mathrm{DUVOL_{it}} = \mathrm{Log}\left\{\frac{(n_u - 1)\Sigma_{DOWN}W^2_{i,t}}{(n_d - 1)\Sigma_{UP}W^2_{i,t}}\right\} \quad (4)$$

where n_u and n_d are the number of up and down days and $W_{i,t}$ is the firm-specific return is estimated by taking the natural logarithm of one plus residual, respectively. A higher value of DUVOL indicates greater crash risk.

The third proxy of the stock price crash risk, which is COUNT. COUNT is the number stock jumps over the number of the stock crashes. Here, stock jumps (crashes) are the firm-specific daily returns positively (negatively) that exceed the 3.09 standard deviation of the mean value, which is indicative of the tail event (Jin and Myers, 2006; Hutton et al., 2009).

$$COUNT = Number\ of\ stock\ crashes - Number\ of\ stock\ jumps \quad (5)$$

Control variables:

Our sample includes firm-level data obtained from CMIE Prowess for the following control variables: total assets, book-to-market value of the firm, debt-to-asset ratio, and returns on assets. These control variables are taken as of 31st March of the respective event years (year t). We also calculate and include three other control variables, namely: pre-period turnover, pre-period sigma, and pre-period average return. The pre-period turnover is calculated based on the difference between t-1 and t-2, such that, say, for the Event#1 on 13th August, 2012, pre-turnover is the difference between the daily average traded volume of stock of t-1 (i.e., period of 13th August 2011 to 13th August 2012) and t-2 (i.e., period 13th August 2010 to13th August 2011). The pre-period sigma is the standard deviation of daily returns of individual stocks for t-1; the pre-period average return is the daily average return of the stocks for t-1. For a given

event occurring in time-period = t, crash risk is calculated for the t+1 time-period such that for Event#1 on 13th August 2012, we have calculated the crash risk for a period starting from 13th August 2012 to 13th August 2013.

The variable definitions used in the study can be found in Table 1. The sample period under this study is one year prior to the event (t-1) and one year post the event (t+1) for each event under the study.

Construction of full sample:

ESG mandates were applicable for the firms in the order of equity market capitalizations. For example, 13th August 2012 mandate were applicable to the top 100 firms in the order of equity market capitalization. We note that evaluation of the crash risk for the treated and control firms is not straightforward, as the firms vary widely in terms of the market capitalization. To mitigate the concern of the widely varying market capitalization, we choose firms into treated and control category based on the cut-off of market capitalization. For example, for the Event#1, the cut-off of the market capitalization was the 100th firm. We choose firms in a small band of both the sides of the 100th firm to ensure that the market capitalizations of the treated and the control firms are more or less equivalent making the firms comparable. The firms under the sample are categorized into treated and control firms based on the corresponding cut-off variable i.e., the cut-off market capitalization as specified for each event announcement, with the lowest and highest market capitalization bounds for the -0.22 to +0.22. Here, the firms that fall just above and below the cut-off market capitalization for each event are treated as control firms, respectively. The ±0.22 bound for cut-off (c) market capitalization in each event is calculated as follows:

$$-0.22 \leq \frac{\text{Market capitalization of firm}_{i} - \text{Market capitalization of firm}_{cut-off}}{\text{Market capitalization of firm}_{cut-off}} \leq 0.22$$

where, $\text{Market capitalization of firm}_i$ denotes the market capitalization of the i^{th} firm and $\text{Market capitalization of firm}_{cut-off}$ denotes the market capitalization of the firm at cut-off.

For example, for event #1 on 13th August 2013, the event mandated the top 100 firms based on market capitalization. We take the cut-off market capitalization of the 100th firm (in the descending order of the market capitalization) and calculate the bound of ±0.22 according to the market capitalization from the cut-off. The firms that fall under (0, 0.22) of the bound are the treated firms and firms that fall under (0, -0.22) of the bound are the control firms. In the market capitalization bound of +0.22 and -0.22, we have a full sample of 1098 firms across all the five events under the study (Table 2).

Construction of Matched sample: Propensity Score Matching

We investigate the impact of events under the study on the crash risk perceived by the shareholders of the firms that were mandated. To establish causality between the regulatory announcement and the crash risk of the mandated firms, we compare or match the treated firms with the control firms and attribute any significant differences between the crash risk of these firms to the regulatory intervention. We employ propensity score matching (PSM) to construct the control group. The use of PSM allows us to compare the crash risk of the mandated firms to a set of non-mandated firms that are similar in all the observable aspects. This approach helps us attribute any noted impact on crash risk more accurately to the event itself rather than to the characteristics of the firms associated with crash risk (Bowen et al., 2010).

To identify the propensity-score matched control sample, we calculate the propensity score for each firm. For each mandated (treated) firm, we select one control firm with the closest propensity scores (Nearest Neighbour method, caliper =0.25, no replacement) based on

the firm characteristics of size (total asset), book to market value of the firm, leverage (debt-to-asset ratio), return on asset and based on the industry classification based on 2-digit NIC.

Each treated firm is compared with each firm in the control set, and the firm with the closest propensity scores is selected as the control firm. These matched firms constitute the propensity-score matched control sample. Table 2 shows the number of treated and control firm-year observations before and after matching. After matching, we have 410 treated firms and 410 control firms. We then assess the covariate balance by testing if the mean and median of the covariates differ to ensure that the matching has been done satisfactorily. Table 3 and Table 4 report the before-matching and after-matching covariates. After matching the covariates, we see that the mean and median difference values are not significantly different for the control and treatment groups. The results indicate that the propensity-score matched control sample resembles the treated (mandated firms) on the defined dimensions.

Difference-in-Difference (DID)

We employ *difference-in-difference (DID)* analysis for treated and control firms after propensity score matching of the covariates to observe the effect of events around ESG reporting in India. Our research setting enables us to observe any difference in the crash risk between the mandated firms and the matched non-mandated firms on an aggregate basis overall with the passage of events. This setting aids in attributing such differences in the crash risk to the events on mandatory ESG regulations. We estimate the crash risk with the three proxies, NCSKEW, DUVOL, and COUNT, for the regulatory events under the study for the mandated firms and matched control (non-mandated) firms to observe for significant differences in the crash risk estimates.

Results

Crash Risk & ESG mandates:

We undertake a formal investigation to tease out the causal impact of the events on the aggregated crash risk of the treated firms in a DID regression model as follows:

$$Crash_{t+1,i} = \sum_k \varphi_k \times post_t \times event_k \times treated_i + \sum_j \tau_j \times controls_{ij} + \gamma_t + \delta_i + \mu_j + \varepsilon_{ijt+1} \quad (6)$$

In the above equation, the dependent variable $Crash_{(t+1,i)}$is representative of the crash risk for firm *i* for time *t+1*(one year after the event). The differential crash risk for each event has been captured by φ_k for treated firms relative to the control firms for each of the event dates. The overall crash risk for all the events has been captured by $\sum_k \varphi_k$. *Treated* is a dummy variable that takes the value 1 if a firm is subject to the regulation, 0 otherwise. *Event* is dummy variable as shown in Figure 1. We include firm-level control variables and other control variables, as defined in Table 1, that can have an impact on Crash risk. In equation (1), γ_t denotes the event-fixed effect, δ_i denotes the firm-fixed effect, and μ_j denotes the industry-fixed effect.

Table 5 shows the results for the regression model with varying combinations of controls, event fixed-effect, firm fixed-effect, and industry fixed-effect with robust standard errors clustered at the firm and event level. The event fixed-effect is used to absorb time-varying heterogeneity across the events. The firm fixed-effect is used to absorb the time-invariant heterogeneity across firms. The industry fixed-effect absorbs the time-invariant heterogeneity across industries. For all model specifications, the joint hypothesis ($\sum_k \varphi_k$) shows that the overall differential crash risk of the treated firms is positive and significant at a 1% significance level for most of the model specifications. This indicates that

the mandated firms experienced an increase in crash risk measured in NCSKEW, DUVOL and COUNT to the sustainability reporting requirements through the passage of events.

For the events under the study, we observe an overall positive and significant crash risk for the treated firms, i.e., firms under the mandate. We interpret that the increased crash risk faced by the treated firms as compared to the control firms arises out of the competitive spillover of the unregulated matched peer firms. A competitive spillover, where the unregulated control firms increase their disclosures to keep themselves away from being evaluated in the same way as their mandated peer, will impose externalities on the treated firms, which comply with strict and specific mandates. In addition to this negative externality, the shareholders might also feel uncertain about future cash flows owing to increased litigation risks and potential financial liabilities (Hong & Kostovetsky, 2012) under the heightened scrutiny of the regulator. Thus, we note that overall, with the passage of events, due to the negative externalities from competitive spillover and increased shareholder uncertainty, there is an increase in the crash risk perceived by the shareholders for the treated (mandated) firms relative to the control firms.

Cross-sectional variation:

Materiality is crucial in sustainability reporting (Khan et al. 2016). We noted earlier that shareholders might be inclined to afford differential attention to the formal disclosures by the treated firms owing to the materiality of ESG issues in certain industries and firms. Also, expected crash risk is more pronounced in an environment where managers are more prone to withhold bad news Kim et al., (2016), and so materiality can have an impact on the information-hoarding behaviour of managers. To gauge that such differential attention in terms of crash risk perceived by the shareholders is, in fact, given to industries and firms sensitive to ESG information, we carry out a cross-sectional analysis. We divide the sample into two cross

sections: 1.) Polluting Industries and 2.) Innovative firms. Our regression model for the cross-sectional regressions is:

$$Crash_{t+1,i} = \sum_k \varphi_k \times post_t \times event_k \times terated_i * Polluting/Innovative + \sum_j \tau_j \times controls_{ij} + \gamma_t + \delta_i + \mu_j + \varepsilon_{ijt+1} \quad (7)$$

where $Polluting$ or $Innovative$ is a dummy variable that takes a value 1, if the firm is a treated polluting firm or treated innovative firm, 0 otherwise.

1.) Polluting Industries:

As polluting industries are more susceptible to unsustainable practices, it is quite fair to assume that ESG information is more material to them. The firms facing the mandate can also face the potential loss of trade secrets as more and more information is disclosed under the mandate. The exogenous force to supply the ESG information may aid the non-mandated competitor in developing an effective plan to enter the disclosing firm's product market space (Li & Li, 2020). Craswell & Taylor (1992) also point out that detailed information disclosed by firms like the Oil and Gas industry may be used by their industry peers for exploration and production strategy. When peers have an opportunity to use the competitive or proprietary information, it imposes additional costs on the mandated firms in the form of negative externalities. This might also be viewed by the shareholders as a loss of competitive edge in addition to increased risk of litigation and activism, all of which can put the potential financial burden on the mandated firms. This has the potential to increase shareholder uncertainty as to the volatility of future cash flows and, consequently, their perception of future crash risk. Thus, shareholders may be interested in actively monitoring firms more sensitive to sustainability issues.

Our coefficient of interest is φ_k which helps us to observe individual event crash risk and $\sum_k \varphi_k$ to aggregate the overall crash risk through the passage of events, respectively for the

cross-section of Polluting industries. *Polluting* is a dummy variable that takes the value 1 if a firm belongs to the treated firms in polluting industries, otherwise 0.

Like the main analysis, we run a DID regression for treated (mandated) and control (non-mandated firms) in the polluting industries. Firms are categorized as belonging to the polluting industry as per the classification of heavily polluting industries laid down by the Ministry of Environment & Forests; Govt. of India[5]. Table 6 shows the results for the crash risk in the polluting industries for the treatment and control groups. We observe that there is a negative and statistically significant coefficient of the crash risk measures at 1% level. The results signify that there is a decrease in the crash risk for the mandated polluting firms relative to the non-mandated polluting firms with the passage of events.

These results suggest that agency motives are the primary driving force of crash risk in polluting industries such that shareholder uncertainty and perceived crash risk is reduced for mandated firms as against non-mandated firms.

2.) Innovative firms

Innovative firms are firms that are actively engaged in research and development, which makes them more susceptible to financial losses accruing from the loss of trade secrets. Hochberg et al., (2018) find that high expenditures on R&D are associated with higher cash flow volatility, which heightens the agency concerns for these firms. Managerial myopia and agency costs are reduced when firms with high R&D expenditure disclose more (Li & Li, 2020), thus an ESG disclosure mandate may facilitate keeping the manager's information hoarding tendencies at bay. When innovative firms are subject to mandatory disclosure requirements, the shareholders might look forward to such mandate as a source of reduction in

[5] The polluting industries used in this study according to the categorization by the Ministry of Environment & Forests; Govt. of India can be found at:
https://www.cpcbenvis.nic.in/newsletter/pollutingindustries/nepolluting.htm

information asymmetry in order to reduce uncertainty and, thereby, their perception of crash risk.

To investigate the same, we create a dummy variable for the firms that are actively engaged in R&D. The dummy variable *Innovative* takes the value 1 if the R&D expenditure of a firm falls above the median R&D expenditure for all firms each event year, otherwise 0. In Table 7, we witness that there is a decrease in crash risk for the mandated innovative firms relative to non-mandated innovative firms, and the decrease in crash risk is statistically significant at a 1% level for all the crash risk measures. We infer that agency concerns in such firms are strong, and thus the increased ESG reporting by the firms that are active in innovation aids in reducing the crash risk perceived by the shareholders as against the control firms that are active in R&D but do not fall under the reporting requirement.

Conclusion

We investigate the causal impact of mandatory ESG disclosures on crash risk perceived by the shareholders of the firms under the mandate. The regulatory changes came about in India for mandatory dissemination of ESG information on the basis of arbitrarily set market capitalization. Such a regulatory setting enables us to pinpoint the impact of ESG mandates on crash risk. The research design employed in this study allows for isolating the overall average impact of the ESG regulation on the crash risk of the firms under the mandate vis-à-vis similar non-mandated firms.

For the key regulatory events under the study, we find that crash risk, on average, has increased for the mandated or treated firms. Our analysis suggests that treated firms face a heightened crash risk relative to control firms, which we attribute the same to the competitive spillover emanating from similar unregulated peer firms. Unregulated firms can act complementarily and disclose as per their discretion just enough to neutralize the effect of any

bad news on their mandated peers. In this way, the direct costs of a formal disclosure and the indirect costs of a proprietary nature for the mandated firms are exacerbated due to negative externalities. The findings parallel those of Badertscher et al. (2013) and Bernard (2016), who examined information spillover and the consequent imposition of proprietary costs on regulated firms. The implication of the results indicates that firms under the ESG mandate bear substantial disclosure costs, both direct and indirect, due to the presence of negative externalities resulting from the complementary effect. Additionally, shareholders view information exposure of mandated firms as a source of potential financial burdens (litigation and other related risks) and costs of disclosure, which amount to higher volatility in cash flows and, thereby, high perceived crash risk.

In the cross-section of industries, we observe a decrease in crash risk for the mandated polluting industries and innovative firms. For these industries and firms, the ESG information is material, and thus, the strength of agency concerns is expected to be stronger. The results suggest that firms in the cross-section are able to garner the benefit of agency motive, leading to a reduction in information asymmetry and, consequently, in crash risk. Here again, the ESG information is competitive and complementary for the same reasons as noted for the main analysis, but the shareholders' agency motives are stronger in driving the crash risk down.

The rationale behind the ESG mandates put forward in the regulation notifications was to make the market more transparent and enable the market participants to identify and assess risks and opportunities related to sustainability. This study showcases the impact of mandatory ESG regulations on the crash risk for treated firms that fall under the mandate in relation to the non-mandated control firms.

As noted in the findings of the study, the phased progression of ESG reporting mandates in India led to an increase in crash risk for the mandated firms; however, we found contrary results for the cross-sections based on materiality. We interpret that the mandate proved

inadequate in providing an effective tool for reducing information asymmetry, which was the primary intention of the policymakers. The ESG regulations have paid limited attention to taking into account the interaction between the disclosures of the mandated and non-mandated firms and avoided materiality as a critical point of distinction between firms for which such ESG disclosures matter more. Such interaction becomes relevant for policy formulation as it can lead to the unwarranted complementary effect that burdens the mandated firms with negative externalities. Materiality is a critical facet of ESG-related policymaking as materiality can potentially dictate the impact of ESG disclosure of reducing agency concerns.

As ESG mandates take the forefront in the policy sphere across economies, the findings from this study might guide policymaking in emerging markets seeking to adopt ESG reporting mandates. The signal-to-noise ratio with respect to the financial market effects of sustainability mandates can be expected to be better if disclosure requirements can provide nuanced and relevant differentiation in reporting requirements based on materiality (Khan et al., 2016). Sound policy making in the domain of mandatory ESG reporting thus should ideally stem out of a careful examination of industry and firms according to their materiality issues.

References:

Ashbaugh-Skaife, H., Collins, D. W., Kinney, W. R., & LaFond, R. (2008). The effect of SOX internal control deficiencies and their remediation on accrual quality. *Accounting Review*, 83(1), 217–250. https://doi.org/10.2308/accr.2008.83.1.217

Badertscher, B., Shroff, N., & White, H. D. (2013). Externalities of public firm presence: Evidence from private firms' investment decisions. *Journal of Financial Economics*, 109(3), 682–706. https://doi.org/10.1016/j.jfineco.2013.03.012

Ball, R. (2009). Market and Political/Regulatory Perspectives on the Recent Accounting Scandals. *Journal of Accounting Research*, 47(2), 277–323. https://doi.org/10.1111/j.1475-679X.2009.00325.x

Bernard, D. (2016). Is the risk of product market predation a cost of disclosure? *Journal of Accounting and Economics*, 62(2–3), 305–325. https://doi.org/10.1016/j.jacceco.2016.07.001

Bowen, R. M., Call, A. C., & Rajgopal, S. (2010). Whistle-Blowing: Target Firm Characteristics and Economic Consequences. *The Accounting Review*, 85(4), 1239–1271. https://doi.org/10.2308/accr.2010.85.4.1239

Cazier, R. A., Christensen, T. E., Merkley, K. J., & Treu, J. S. (2023). The joint effects of litigation risk and regulation on non-GAAP reporting. *Journal of Business Finance & Accounting*. https://doi.org/10.1111/jbfa.12766

Chen, C., Kim, J.-B., & Yao, L. (2017). Earnings smoothing: Does it exacerbate or constrain stock price crash risk? *Journal of Corporate Finance*, 42, 36–54. https://doi.org/10.1016/j.jcorpfin.2016.11.004

Chen, J., Hong, H., & Stein, J. C. (2001). Forecasting crashes: trading volume, past returns, and conditional skewness in stock prices. *Journal of Financial Economics*, 61(3), 345–381. https://doi.org/10.1016/S0304-405X(01)00066-6

Craswell, A. T., & Taylor, S. L. (1992). Discretionary Disclosure Of Reserves By Oil And Gas Companies: An Economic Analysis. *Journal of Business Finance & Accounting*, 19(2), 295–308. https://doi.org/10.1111/j.1468-5957.1992.tb00626.x

Dimson, E. (1979). Risk measurement when shares are subject to infrequent trading. *Journal of Financial Economics*, 7(2), 197–226. https://doi.org/10.1016/0304-405X(79)90013-8

Downar, B., Ernstberger, J., & Link, B. (2018). The Monitoring Effect of More Frequent Disclosure. *Contemporary Accounting Research*, 35(4), 2058–2081. https://doi.org/10.1111/1911-3846.12386

Doyle, J. T., Ge, W., & McVay, S. (2007). Accruals quality and internal control over financial reporting. *Accounting Review*, 82(5), 1141–1170. https://doi.org/10.2308/accr.2007.82.5.1141

Gassen, J., & Muhn, M. (2018). Financial Transparency of Private Firms: Evidence from a Randomized Field Experiment. SSRN Electronic Journal. https://doi.org/10.2139/ssrn.3290710

Graham, J. R., Harvey, C. R., & Rajgopal, S. (2005). The economic implications of corporate financial reporting. *Journal of Accounting and Economics*, 40(1–3), 3–73. https://doi.org/10.1016/j.jacceco.2005.01.002

Habib, A., Hasan, M. M., & Jiang, H. (2018). Stock price crash risk: review of the empirical literature. *Accounting & Finance*, 58(S1), 211–251. https://doi.org/10.1111/acfi.12278

Hao, J. (2023). Disclosure regulation, cost of capital, and firm values. *Journal of Accounting and Economics*, 101605. https://doi.org/10.1016/j.jacceco.2023.101605

Healy, P. M., & Palepu, K. G. (2001). Information asymmetry, corporate disclosure, and the capital markets: A review of the empirical disclosure literature. *Journal of Accounting and Economics*, 31(1–3), 405–440. https://doi.org/10.1016/S0165-4101(01)00018-0

Hochberg, Y. V., Serrano, C. J., & Ziedonis, R. H. (2018). Patent collateral, investor commitment, and the market for venture lending. *Journal of Financial Economics*, 130(1), 74–94. https://doi.org/10.1016/j.jfineco.2018.06.003

Hong, H., & Kostovetsky, L. (2012). Red and blue investing: Values and finance. *Journal of Financial Economics,* 103(1), 1–19. https://doi.org/10.1016/j.jfineco.2011.01.006

Hsu, G. C. (2009). Impact of earnings performance on price-sensitive disclosures under the Australian continuous disclosure regime. *Accounting & Finance*, 49(2), 317–339. https://doi.org/10.1111/j.1467-629X.2008.00288.x

Hutton, A. P., Marcus, A. J., & Tehranian, H. (2009). Opaque financial reports, R2, and crash risk. *Journal of Financial Economics*, 94(1), 67–86. https://doi.org/10.1016/j.jfineco.2008.10.003

JIN, L., & MYERS, S. (2006). R2 around the world: New theory and new tests. *Journal of Financial Economics,* 79(2), 257–292. https://doi.org/10.1016/j.jfineco.2004.11.003

Khan, M., Serafeim, G., & Yoon, A. (2016). Corporate Sustainability: First Evidence on Materiality. *The Accounting Review*, 91(6), 1697–1724. https://doi.org/10.2308/accr-51383

Kim, J.-B., Li, L., Lu, L. Y., & Yu, Y. (2016). Financial statement comparability and expected crash risk. *Journal of Accounting and Economics*, 61(2–3), 294–312. https://doi.org/10.1016/j.jacceco.2015.12.003

Korn, E., & Schiller, U. (2003). Voluntary Disclosure of Non-proprietary Information: A Complete Equilibrium Characterization. *Journal of Business Finance & Accounting*, 30(9–10), 1327–1339. https://doi.org/10.1111/j.0306-686X.2003.05494.x

Kothari, S. P., Shu, S., & Wysocki, P. D. (2009). Do Managers Withhold Bad News? *Journal of Accounting Research,* 47(1), 241–276. https://doi.org/10.1111/j.1475-679X.2008.00318.x

Larcker, D. F., Richardson, S. A., & Tuna, I. (2007). Corporate governance, accounting outcomes, and organizational performance. *Accounting Review*, 82(4), 963–1008. https://doi.org/10.2308/accr.2007.82.4.963

Leuz, C., & Wysocki, P. D. (2016). The Economics of Disclosure and Financial Reporting Regulation: Evidence and Suggestions for Future Research. *Journal of Accounting Research,* 54(2), 525–622. https://doi.org/10.1111/1475-679X.12115

Li, Y., & Li, Y. (2020). The effect of trade secrets protection on disclosure of forward-looking financial information. *Journal of Business Finance & Accounting*, 47(3–4), 397–437. https://doi.org/10.1111/jbfa.12418

Xie, B., Davidson, W. N., & DaDalt, P. J. (2003). Earnings management and corporate governance: the role of the board and the audit committee. *Journal of Corporate Finance*, 9(3), 295–316. https://doi.org/10.1016/S0929-1199(02)00006-8

Figure 1: Timeline of regulatory announcement dates

Note: Event# is the *event* dummy variable. For example, For Event#1, the dummy variable *event* takes the value 1, and for every other Event# it takes the value 0.

Table 1: Variable definitions

	Definitions
NCSKEW	Defined as the negative skewness of firm-specific daily returns
DUVOL	It is the ‘‘down-to-up volatility’’ measured as the ratio between daily downside and upside volatility
COUNT	Defined as the number of crash days minus the number of jump days over a given year
SIZE	Natural logarithm of total assets
BM	Ratio of book value of equity to the market value of equity at the end of the year
LEV	Ratio of long-term debt (including its current portion) and total assets at the end of year
ROA	Defined as Net income divided by the total assets at the end of year t
Pre- period turnover	Defined as the difference between daily average traded volume of stock of t-1and t-2
Pre-period sigma	Defined standard deviation of daily stock returns at t-1
Pre-period average return	Defined as the daily average stock return at t-1
Polluting industries	Based on the classification as identified by Ministry of Environment & Forests; Govt. of India as heavily Polluting
Innovative firms	Firms with R&D expenditure above the median R&D expenditure of all the firms.

Table 2: Treatment Control of Matched Firms

This table reports the number of firm-year observations for the treated and control firms before and after matching firms by propensity score matching procedure.

	# Treated Firms-year Obv.	# Control Firm-year Obv.
Before Matching	484	614
After Matching	410	410

Table 3: Before Matching covariates

The table reports the results of covariate balance checks on the mean and median differences in the covariates before matching. Variables descriptions are presented in Table 1. The corresponding t-statistics, the p-value for difference in mean, and the Wilcoxon p-value for differences in median are also reported

Variable	Mean (Control)	Mean (Treatment)	Mean Difference	Median Difference	t-Stat (Mean Difference)	p-value (Mean Difference)	Wilcoxon p-Value (Median Difference)
Size	9.0277	8.8812	0.1465	-0.0247	1.0501	0.2939	0.4589
Book to Market ratio	1.0148	0.7717	0.2431	0.1198	2.8704	0.0042	0.0007
Leverage	0.2930	0.2685	0.0244	0.0156	1.5963	0.1107	0.2009
ROA	3.7078	5.0951	-1.3873	-1.2078	-2.8835	0.0040	0.0005
NIC(2-digit)	35.8534	36.4835	-0.6301	0.0000	-0.5266	0.5986	0.6360

Table 4: After Matching covariates

The table reports the results of covariate balance checks on the mean and median difference in the covariates after matching with propensity score matching, used in the DID regression model between the treated (mandated) firms and the matched control firms. Variables descriptions are presented in Table 1. The corresponding t-statistics, the p-value for difference in mean, and the Wilcoxon p-value for differences in median are also reported.

Variable	Mean (Control)	Mean (Treatment)	Mean Difference	Median Difference	t-Stat (Mean Difference)	p-value (Mean Difference)	Wilcoxon p-Value (Median Difference)
Size	8.9576	9.0378	-0.0803	-0.0587	-0.5385	0.5904	0.6333
Book to Market ratio	0.8665	0.7981	0.0684	0.0180	0.8802	0.3790	0.3460
Leverage	0.2899	0.2683	0.0216	0.0069	1.2424	0.2144	0.5131
ROA	3.9101	5.0860	-1.1759	-0.5255	-0.7654	0.2973	0.2924
NIC(2-digit)	35.8976	36.3610	-0.4634	0.0000	-0.3454	0.7299	0.6989

Table 5: ESG disclosure mandates and crash risk

The table reports the difference in the crash risk for the treated (mandated) and control (non-mandated) firms for the regulatory announcement events related to ESG reporting. The crash risk is measured by three proxies, namely NCSKEW, DUVOL, and COUNT, using the firm-specific daily returns data. Crash risk is estimated for *t+1* for an event occurring at time *t.* The estimation is restricted to the DID sample constructed by categorizing firms into treated and control firms with the lowest and highest market capitalization bounds for the -0.22 to +0.22. The categorization of firms in this bound is determined on the basis of the ratio of the difference between the market capitalization of the i^{th} firm and the market capitalization of the mandated firm to the market capitalization of the cut-off mandated firm. Firms with a market capitalization range of -0.22 to +0.22 comprises our DID sample, where market capitalization >0 represents the treated firms and market capitalization <0 represents the control firms. The treated firms are matched with control firms through the propensity score matching procedure. Control variables are as defined in the Table 1. *Treated* is a dummy variable that takes the value 1 if a firm is subject to the regulation, 0 otherwise. *Event* is a dummy variable as shown in the Fig 1. The fixed effects are indicative. The standard error is reported in parenthesis with coefficients. The robust standard errors are clustered at firm and event level. ***, ** and * represent the significance level at 1%, 5% and 10% respectively.

		CRASH RISK					
		NCSKEW		DUVOL		COUNT	
		(s.e)	(s.e)	(s.e)	(s.e)	(s.e)	(s.e)
Post x Treated x Event 1	**φ1**	0.01 (0.0499)	-0.0157* (0.0062)	-0.0438** 0.0162)	-0.0891*** (0.0032)	0.5914*** (0.0429)	0.4444*** (0.0182)
Post x Treated x Event 2	**φ2**	0.5962** (0.1887)	0.7384** (0.2411)	0.2166*** 0.0451)	0.2632*** (0.0570)	-0.2268** (0.0625)	-0.1657 (0.0898)
Post x Treated x Event 3	**φ3**	-0.2696* (0.1283)	-0.1971 (0.2349)	-0.0585 (0.0349)	-0.0429** (0.0579)	-0.0611 (0.0798)	-0.1442 (0.1343)
Post x Treated x Event 4	**φ4**	-0.293** (0.0837)	-0.3883*** (0.0230)	-0.1197*** (0.0264)	-0.1838*** (0.0107)	0.4228*** (0.0616)	0.5040*** (0.0627)
Post x Treated x Event 5	**φ5**	0.316*** (0.0637)	0.4790*** (0.0324)	0.1008*** (0.0176)	0.1592*** (0.0196)	0.2745*** (0.0399)	0.2050* (0.0872)
Size (Log of assets)		0.0259 (0.0370)	0.0992* (0.0395)	0.0029 (0.0113)	0.0462** (0.0135)	0.0178 (0.0355)	-0.0838 (0.0618)
Book to market		-0.0372 (0.0392)	-0.1248* (0.0480)	-0.0005 (0.0220)	-0.0371 (0.0234)	0.0102 (0.0718)	0.2853** (0.0851)
Leverage (debt/total asset)		0.4204 (0.2960)	1.0126 (0.5629)	0.2121** (0.0673)	0.4996 (0.2590)	-0.7784** (0.2453)	-1.7994 (1.5180)
ROA		0.02*** (0.0032)	-0.0165 (0.0092)	0.0079*** (0.0015)	-0.0055 (0.0040)	-0.0395** (0.0121)	0.0145 (0.0192)
Pre- period turnover		0.2243 (0.1945)	0.0620 (0.0777)	0.0601 (0.0670)	0.0288 (0.0254)	-0.0775* (0.1364)	-0.1449 (0.1065)
Pre-period sigma		-4.0817 (5.0705)	-9.5553** (2.6484)	-4.5826 (2.4048)	-5.3455* (2.0375)	1.2805 (9.3139)	11.1742 (8.2144)
Pre-period average return		-0.668 (0.3960)	-0.8411** (0.2618)	-0.3108 (0.2321)	-0.3000 (0.1519)	0.9509 (0.7025)	1.4179 (0.7338)
Event FE		YES	YES	YES	YES	YES	YES
Firm FE		NO	YES	NO	YES	NO	YES
Industry FE		NO	YES	NO	YES	NO	YES
Σ5i=1φi		0.3596	0.6163	0.0955	0.1066	1.0008	0.8436
Test: Σ5i=1φi=0 F-Stat (p-value)		3.8365** (0.0501)	23.788*** (0.000)	4.097** (0.0429)	71.904*** (0.000)	165.14*** (0.000)	85.029*** (0.000)
Obs		820	820	820	820	820	820
R^2		0.0409	0.5088	0.0854	0.5526	0.0999	0.5975

Table 6: ESG disclosure mandates and crash risk of polluting industries

The table reports the difference in the crash risk for the treated (mandated) and control (non-mandated) firms for the regulatory announcement events related to the ESG reporting. The crash risk is measured by three proxies, namely NCSKEW, DUVOL, and COUNT, using the firm-specific daily returns data. Crash risk is estimated for *t+1* for an event occurring at time *t.* The estimation is restricted to the DID sample constructed by categorizing firms into treated and control firms with the lowest and highest market capitalization bounds for the -0.22 to +0.22. The categorization of firms in this bound is determined on the basis of the ratio of the difference between the market capitalization of the i^{th} firm and the market capitalization of cut-off mandated firm to the market capitalization of the cut-off mandated firm. Firms with a market capitalization range of -0.22 to +0.22 comprises our DID sample, where market capitalization >0 represents the treated firms and market capitalization <0 represents the control firms. The treated firms are matched with control firms through the propensity score matching procedure. Control variables are as defined in the Table 1. *Treated* is a dummy variable that takes the value 1 if a firm is subject to the regulation, 0 otherwise. *Event* is a dummy variable as shown in the Fig 1. *Polluting* is a dummy variable that takes the value 1 if a firm belongs to the polluting industry, otherwise 0. The fixed effects are indicative. The standard error is reported in parenthesis with coefficients. The robust standard errors are clustered at firm and event level. ***, ** and * represent the significance level at 1%, 5% and 10% respectively.

		CRASH RISK		
		NCSKEW	**DUVOL**	**COUNT**
		(s.e)	**(s.e)**	**(s.e)**
Post x Treated x Event 1 x Polluting	**φ1**	0.4639*** (0.0658)	0.1890*** (0.0272)	0.7882*** (0.0496)
Post x Treated x Event 2 x Polluting	**φ2**	-0.7421*** (0.1376)	-0.3308*** (0.0426)	-1.1633*** (0.2286)
Post x Treated x Event 3 x Polluting	**φ3**	-0.1287 (0.0836)	-0.1623*** (0.0386)	0.7527** (0.2415)
Post x Treated x Event 4 x Polluting	**φ4**	-0.8837*** (0.0662)	-0.3363*** (0.0295)	-1.5518*** (0.1080)
Post x Treated x Event 5 x Polluting	**φ5**	-0.4103** (0.1335)	0.0001 (0.044)7	-0.0882 (0.0892)
Size (Log of assets)		0.0244 (0.0360)	0.0015 (0.0112)	-0.0263 (0.0352)
Book to market		-0.0349 (0.0361)	0.0013 (0.0201)	-0.0045 (0.0695)
Leverage (debt/total asset)		0.4793 (0.2694)	0.2353** (0.0631)	0.9020** (0.2310)
ROA		0.0214*** (0.0037)	0.0083*** (0.0016)	0.0399** (0.0113)
Pre- period turnover		0.2324 (0.1839)	0.0612 (0.0657)	0.0772 (0.1343)
Pre-period sigma		-3.2416 (4.8994)	-4.1327 (2.3335)	-0.0095 (9.0923)
Pre-period average return		-0.6763 (0.3647)	-0.3073 (0.2231)	-0.9162 (0.6859)
Event FE		YES	YES	YES
Firm FE		NO	NO	NO
Industry FE		NO	NO	NO
$\Sigma 5i=1\varphi i$		-1.7007	-0.6403	-1.2624
Test: $\Sigma 5i=1\varphi i=0$ F-Stat (p-value)		63.473*** (0.000)	119.42*** (0.000)	6.391*** (0.0115)
Obs		820	820	820
R^2		0.0374	0.0817	0.1053

Table 7: ESG disclosure mandates and crash risk of innovative firms

The table reports the difference in the crash risk for the treated (mandated) and control (non-mandated) firms for the regulatory announcement events related to the ESG reporting. The crash risk is measured by three proxies, namely NCSKEW, DUVOL, and COUNT, using the firm-specific daily returns data. Crash risk is estimated for *t+1* for an event occurring at time *t.* The estimation is restricted to the DID sample constructed by categorizing firms into treated and control firms with the lowest and highest market capitalization bounds for the -0.22 to +0.22. The categorization of firms in this bound is determined on the basis of the ratio of the difference between market capitalization of the i^{th} firm and the market capitalization of cut-off mandated firm to the market capitalization of cut-off mandated firm. Firms with a market capitalization range of -0.22 to +0.22 comprises our DID sample, where market capitalization >0 represents the treated firms and market capitalization <0 represents the control firms. The treated firms are matched with control firms through the propensity score matching procedure. Control variables are as defined in the Table 1. *Treated* is a dummy variable that takes the value 1 if a firm is subject to the regulation, 0 otherwise. *Event* is a dummy variable as shown in the Fig 1. Innovative is a dummy variable that takes the value 1 if a firm is an innovative firm, otherwise 0. The fixed effects are indicative. The standard error is reported in parenthesis with coefficients. The robust standard errors are clustered at firm and event level. ***, ** and * represent the significance level at 1%, 5% and 10% respectively**.**

		CARSH RISK		
		NCSKEW	**DUVOL**	**COUNT**
		(s.e)	**(s.e)**	**(s.e)**
Post x Treated x Event 1 x Innovative	**φ1**	-0.4157** (0.1519)	-0.0755 (0.0538)	-2.1759*** (0.2356)
Post x Treated x Event 2 x Innovative	**φ2**	-0.3614** (0.0964)	-0.0796** (0.0266)	-0.6373*** (0.0989)
Post x Treated x Event 3 x Innovative	**φ3**	-0.3712*** (0.0890)	-0.1635*** (0.0277)	0.0553 (0.1370)
Post x Treated x Event 4 x Innovative	**φ4**	-1.1061*** (0.0855)	-0.4483*** (0.0270)	-2.0436*** (0.0927)
Post x Treated x Event 5 x Innovative	**φ5**	-0.1629** (0.0593)	-0.0619* (0.0267)	-0.2476* (0.1154)
Size (Log of assets)		-0.0618 (0.0793)	-0.0265 (0.0289)	0.0749 (0.1542)
Book to market		0.0101 (0.0420)	0.0163 (0.0117)	-0.0561 (0.0448)
Leverage (debt/total asset)		0.4939 (0.2454)	0.2412*** (0.0510)	0.6777** (0.1871)
ROA		0.0170** (0.0045)	0.0072** (0.0019)	0.0452* (0.0197)
Pre- period turnover		0.2319 (0.1972)	0.0641 (0.0686)	0.0974 (0.1365)
Pre-period sigma		-5.0248 (5.7271)	-4.8297 (2.7455)	-1.3972 (10.1208)
Pre-period average return		-0.7352 (0.4306)	-0.3341 (0.2534)	-1.0059 (0.7384)
Event FE		YES	YES	YES
Firm FE		NO	NO	NO
Industry FE		NO	NO	NO
Σ5i=1φi		-2.4172	-0.8287	-5.0490
Test: Σ5i=1φi=0 F-Stat (p-value)		47.811*** (0.000)	64.342*** (0.000)	166.76*** (0.000)
Obs		820	820	820
R^2		0.0355	0.0816	0.1095