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Tanaka, Yoshitaka and Managi, Shunsuke

Faculty of Commerce, Fukuoka University, Urban Institute School
of Engineering, Kyushu University

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Attention-Grabbing ESG

Yoshitaka Tanaka* and Shunsuke Managi†

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Abstract

This study examines whether the market can recognize the financial materiality of socially impactful corporate actions. We use data that demonstrate reactions on social networking sites (SNSs) to ESG news in the United States from 2010. Our findings reveal a positive correlation between unconditional excess stock returns and the polarity of financially material ESG events. We also observe that stock returns exhibit a short-term reaction rather than a long-term impact to ESG events that are socially salient but less value-relevant. These tendencies seem more evident in corporations with limited information disclosures to investors concerning ESG. Moreover, conditional on the social impact of the event and the level of transparency in the company’s ESG information, our findings suggest that the association between materiality and stock returns is not particularly substantial.

JEL classification: G14; G30; M14; D22

Keywords: ESG; Corporate Social Responsibility; Materiality; Social Media; Market Efficiency.

1 Introduction

Engagement with stakeholders is increasingly recognized as a critical component of intangible assets in shaping corporate value. A growing trend in investing is to focus on companies that sustain amicable relationships with stakeholders through environmental, social, and governance (ESG) endeavors. However, assessing the impact of ESG activities on corporate value remains challenging due to factors such as inconsistent evaluation metrics and variations in the relevance of different ESG activities to businesses¹. These assessments challenge investors to make informed ESG-based decisions.

Retail investors, with limited temporal and cognitive resources, are susceptible to attention-grabbing events². As a result, investors are swayed by the popular themes that are prominent on social networking sites (SNSs). Although SNSs offer a channel for disseminating complex information, they may also disseminate irrelevant and erroneous information under certain circumstances. ESG investing gives us a testing ground for examining whether investors can distinguish relevant information from the irrelevant or misleading information (noise) often found on social networking sites. This is because some ESG information, having little relevance to financial value, can be disseminated widely, which may impact stock prices.

Our main objective is to demonstrate how markets filter relevant corporate value information from SNS-disseminated information. Therefore, in this paper, we examine the impact of attention-grabbing ESG events on corporate valuations in the United States from 2010. We also show whether the materiality of events, which is their relevance to business performance, influences the relationship

*Faculty of Commerce, Fukuoka University, yoshitaka.0707@fukuoka-u.ac.jp

†Urban Institute, Kyushu University, managi@doc.kyushu-u.ac.jp

¹For instance, inconsistent evaluation metrics may hinder investors’ understanding of ESG information (Berg et al. 2022). Moreover, the degree of relevance to businesses and the consequent impact on corporate value can vary significantly among ESG activities (Khan et al. 2016)

²This theme has been discussed by Merton (1987), Barber and Odean (2008), Gu and Kurov (2020)

between social attention and stock returns. Utilizing the materiality criteria of the Sustainability Accounting Standards Board (SASB) and the ESG score based on responses from SNSs for social attention, we examine corporate events related to ESG.

First, our findings demonstrate that the cumulative abnormal returns (CAR) of stocks exhibit a positive correlation with positive and attention-grabbing ESG events while exhibiting a negative correlation with adverse ESG events. However, stock returns do not respond uniformly to these events. Our second finding is that stock returns exhibit an insignificant response in the long run to immaterial ESG events, even when they receive substantial social attention. Conversely, we observe that stock returns react little to events of high materiality but with low attention.

Next, to explore the sources of the correlation between social reactions and stock returns, our sample is stratified based on ESG ratings and the proportion of ESG-oriented funds investing in sample companies. As discussed in Section 2, the extent to which a stock responds to an event is linked to the level of uncertainty surrounding the company's information. Companies with low ESG disclosure scores or those not invested in ESG funds are more likely to face significant information asymmetry concerning ESG issues. This is why we see the response of stock returns conditioned by ESG scores and the investment behavior of ESG funds. Our findings reveal that companies with meager ESG ratings and those without investment from ESG funds exhibit a more pronounced stock price response to both adverse and favorable events. The results suggest that the market's evaluation of ESG events can be associated with social impressions contingent on the extent of the information asymmetry.

The event study reveals that events with a high degree of financial materiality exert a more significant influence on stock returns and have a more long-lasting effect than those without materiality. However, it is unclear whether the difference between these two is due to differences in materiality. The correlation between CAR and ESG event characteristics may also be contingent on the company's characteristics in which the event took place. Therefore, we test whether we still find an association between CAR and event characteristics even after controlling for firm attributes. The results suggest a positive association between short-term CAR and the magnitude of SNS response as well as ESG information asymmetry, whereas the relationship between materiality and CAR is statistically insignificant. Therefore, the regression indicates that the response of stock returns to ESG events is impacted by asymmetries in the firm's ESG information rather than by the materiality of the events. Of course, it is conceivable that high materiality is associated with the potency of the SNS response. Hence, additional testing is imperative to ascertain the presence of any relationship between materiality and stock returns.

It should be observed that not all ESG endeavors culminate in the generation of corporate value³, even though the importance of ESG in corporate valuation creation has been discussed in many studies⁴. Our conclusions concur with those of Serafeim and Yoon (2022) in that unconditional stock returns respond to ESG events with high materiality. Nevertheless, our study diverges from theirs in that we demonstrate that stock returns also respond to high-attention and immaterial events in the short term. Moreover, conditional on the social significance of the event and the level of transparency of the ESG information of the company, our findings suggest that the association between materiality and stock returns is not particularly substantial.

While Kruger (2015) assesses ESG practices through event studies akin to ours, his results arrive at partially divergent conclusions. Kruger (2015) posits that unfavorable ESG events reduce shareholder value, whereas agency problems result in reduced shareholder value due to positive ESG activities. One of the disparities between our study and theirs lies in the event selection criteria. While their study bases event selection on news coverage, our study selects events based on SNS responses. The influence of news on behavior is contingent on the interpretation and reaction of readers, regardless of the extent of news coverage. If the news contains unexpected or noteworthy information or has

³In fact, Khan et al. (2016) demonstrate that shareholders assess ESG activities that are significantly germane to financial value.

⁴For example, Edmans (2011) shows that the stock returns of firms that are a great place to work beat the market, and Flammer (2015) argues that ESG activities cause improvements in financial performance

considerable social relevance, it will likely generate a stronger response on SNSs. Consequently, to capture the effect of the quality of ESG information on investor behavior, we limit our analysis to ESG information that people acknowledge as having an impact.

The focus of our research departs from the literature in that we consider the correlation between nonfundamental corporate events and SNSs, whereas the majority of existing studies delve into the association between financially relevant events and SNSs. The influence of SNS platforms such as Twitter and SeekingAlpha on investors has recently garnered attention. Bartov et al. (2018) reveal that Twitter posts foreshadow the substance of quarterly earnings announcements, with greater prominence for firms for which investors possess less information. Nonetheless, most studies concentrate on events with considerable financial relevance, such as quarterly reports and analyst recommendations. By focusing on immaterial ESG information, we obtain a clearer understanding of investors' reactions to the fervor that deviates from the fundamentals.

Section 2 reviews the literature and develops hypotheses. Section 3 describes the data. Section 4 presents the event study outcomes. Section 5 investigates the influence of social attention on stock returns via a panel regression analysis. Section 6 verifies the robustness of the results. Section 7 concludes the paper.

2 Literature Review and Hypothesis Development

Barber and Odean (2008) show that, due to their confined information processing ability, individual investors use attention as a criterion for selecting specific equities from a vast array of stocks. The challenge of effectively communicating corporate information is exacerbated by not only investors' cognitive limitations but also the magnitude and diversity of the information provided by corporations. Hence, the role of SNSs and online forums as a mode of communicating information to investors is gaining increasing prominence. Gu and Kurov (2020) reveal that sentiment on Twitter constitutes value-relevant information for individual companies that has yet to be reflected in stock prices, particularly for those with low analyst coverage and inadequate information. Bartov et al. (2018) also assert that Twitter posts encompass information regarding fundamentals, which is more pronounced in firms operating in weaker information environments. Our work implicitly assumes that social media is the primary means for disseminating ESG information and that investors rely heavily on social media for their investment decisions. This assumption is supported by studies such as those listed above.

However, the information disseminated through SNSs may not always be suitable for evaluating companies. Jia et al. (2020) verify that SNSs can perpetuate incorrect information, hindering market price discovery, as evidenced by disseminating incorrect information about mergers through Twitter. Campbell et al. (2022) reveal that the information on earnings announcements that is disseminated rapidly through SNSs tends to be excessively emotive and lacks vital information, leading to detrimental market effects such as decreased market liquidity and prolonged price formation.

A substantial volume of ESG information encompasses not only the disclosures made by corporations but also evaluations from multiple stakeholders. However, as Berg et al. (2022) noted, ESG information lacks consistency, even among information utilized by institutional investors. Moreover, companies' ESG performance is dispersed through a multitude of media, including SNSs, making it challenging for investors to pinpoint the most pertinent information for their investment choices.

Although ESG practices have garnered considerable attention, it must be noted that not all ESG initiatives result in value creation for corporations. Research by Khan et al. (2016) demonstrates that stock returns and financial performance are only correlated with ESG practices of substantial financial significance. Serafeim and Yoon (2022) also posit that financial materiality is crucial in determining the short-term impact of ESG events on stock returns.

The intricate nature of ESG information accentuates the significance of attention in investment decision-making processes. Should ESG information be swiftly disseminated via SNSs, stock prices may fluctuate, even if the information holds limited financial materiality. This is because the cost of access to information and the ability of investors to process information is not uniform, which in turn

may result in more varied investment behavior. Conversely, if the cost of processing ESG information in the market is low, the response of stock returns should be unaffected by social attention. We endeavor to assess the market’s ability to distinguish financially material information from ESG information that garners considerable attention.

Hypothesis 1: *Regardless of how high social attention is, stock returns do not respond to ESG events with low materiality.*

Our study evaluates the impact of ESG on shareholder value, controlling for societal perceptions. There are two main ways to consider the impact of ESG on shareholder value. The first perspective is that the promotion of ESG ensures stakeholder benefits at the expense of shareholder value (Friedman 1970). Kruger (2015), in an event study using large-scale US data, shows that positive ESG initiatives benefiting stakeholders reduce shareholder returns. The second perspective is that the promotion of ESG can increase shareholder value by reducing friction with stakeholders. Lins et al. (2017) argue that good relationships with stakeholders as a result of a company’s engagement in ESG activities can serve as insurance against negative shocks. Edmans (2011) demonstrates that risk-adjusted returns tend to be higher for groups of firms with higher levels of employee satisfaction. Flammer (2013) shows that eco-friendly events increase stock returns, whereas eco-harmful events decrease stock returns.

Not all investors have the same perception of ESG events disclosed by companies or reported in the media, due to the limited cognitive capacity of investors and the complexity of ESG information. Flammer (2013), Kruger (2015), Capelle-Blancard et al (2019), and Serafeim and Yoon (2022a) conduct event studies on ESG but reach different conclusions on positive events. The difference between these studies and ours is that we control for society’s perception of ESG events. Of course, news coverage is taken into account in these studies; however, even if the amount of news coverage is high, there is still the possibility that people may not absorb the information contained in that coverage. Hence, we categorize events according to SNS reactions to ESG events. It is conceivable that a socially unrecognized ESG event, even if financially relevant, may not impact shareholder value. On the other hand, an opposing hypothesis is that, if investors’ cognitive abilities were unconstrained, events with high materiality should be reflected in share prices, regardless of the degree of attention to the event.

Hypothesis 2: *ESG events with high materiality and high social attention have a greater impact on shareholder value.*

Flammer (2013) and Capelle-Blancard et al. (2019) mention that high ESG reputation moderates the degree to which stock returns decline in response to negative ESG events. Furthermore, Serafeim and Yoon (2022b) demonstrate that ESG ratings shape investors’ expectations of a company’s ESG practices, thereby potentially causing a significant hike in share prices following a positive ESG event for a company with a previously low rating.

If the lack of information is the cause of the significant reaction of stock returns, then stock prices should react symmetrically to negative and to positive news. However, prior research reveals that the reaction of stock returns to unanticipated news is asymmetrical with respect to its polarity. The response of a stock price to an unanticipated event is likely to comprise a response to the novel information it embodies and an evaluation of that information. Controlling for the latter effect using SNS responses, we show that unexpected information influences stock returns. Stock returns of companies lacking ESG disclosure are then expected to respond strongly to both negative and positive news.

Hypothesis 3: *Given the degree of attention, the stock returns of companies lacking ESG disclosure are strongly related to both negative and positive news.*

As noted by Gu et al. (2020) and Campbell et al. (2022), retail investors tend to be susceptible to the influence of social media in their investment decisions. Conversely, if a greater share of shareholders comprises institutional investors who have the capability to process ESG information, it is probable that the stock price will not be overly reactive to news receiving high attention, as ESG information is already factored into their investment decisions.

Brockman and Yan (2009) contend that blockholders can acquire company-specific information at a low cost. Hence, institutional investors with a superior information advantage are less susceptible to the influence of fleeting information in their investment decision making. Cella et al. (2013) suggest that companies with a significant proportion of short-term investors are likely to experience substantial declines in their share prices during periods of market turmoil. Furthermore, in the literature on sustainable finance, Gloßner (2019) suggests that companies with a substantial number of long-term investors are likely to undertake ESG activities at an appropriate level. Chen et al. (2020) show that a higher institutional holding leads to an increase in material, but not immaterial, CSR activities.

Two major relationships have been pointed out between investments by socially responsible investors and the ESG performance of the companies in which they invest. Hong and Kacperczyk (2009), Nofsinger et al. (2019), and Chava (2014) demonstrate that institutional investors tend to eschew investments in corporations with low ESG scores. Conversely, Dimson et al. (2015) and Chen et al. (2020) reveal that institutional investors actively engage with firms to ameliorate their ESG performance. When comparing the information asymmetry hypothesis with the two hypotheses just mentioned, the reaction of equity returns to particular events should exhibit distinct behaviors. If socially responsible investors abstain from investing in companies with inferior ESG performance, the CAR for adverse events should be more pronounced in the cohort of companies in which they maintain a significant proportion of their investments. If the risk of adverse events is controlled by fund engagement, then the response of equity returns to positive events should not depend on the investment behavior of ESG funds.

In light of these discussions, it is anticipated that the stock return response to ESG events in companies with a significant proportion of ESG-focused investors is limited, as these investors are presumed to have the aptitude to effectively process ESG information disseminated through SNS.

Hypothesis 4: *Companies with a larger proportion of investors who are better able to process ESG information have smaller stock return responses to ESG events.*

Market sentiment is an alternative mechanism for elucidating the reaction of stock returns to ESG events, alongside the aforementioned factors of high materiality and information asymmetry. Naughton et al. (2019) contend that market sentiment toward ESGs influences the stock return response to a company’s CSR activities. Market interest in ESG increased during the second half of the 2010s. Then, if the market response to corporate ESG activities depends on materiality rather than sentiment, there should be no difference in the response of stock returns in the late 2010s and earlier, since market valuations for ESG activities with high materiality are time-independent as Khan et al. (2016) implied.

Hypothesis 5: *There is no difference in the response of stock returns to ESG events in the late 2010s and earlier.*

3 Data

3.1 Data for ESG Event Selection

Our primary data sources are Refinitiv MarketPsych ESG Analytics (RM-ESG) and TruValue Labs (TVL), which we utilize to evaluate the level of public attention and the materiality of ESG events.

RM-ESG sources and assesses ESG-related articles from a diverse array of news and social media sites worldwide through the application of real-time natural language processing. RM-ESG aggregates information from over 2000 social media sites, incorporating Twitter data since 2010. RM-ESG provides various metrics; this paper specifically utilizes the buzz score and the RM-ESG score on a daily basis. The buzz score is a compilation of ESG-related terms appearing in each company’s news and social networking articles. Thus, we utilize the buzz score as a surrogate for the level of attention accorded to the ESG event in each SNS outlet. The RM-ESG score is calculated by determining the positive or negative orientation of each ESG term in the article and aggregating them. The RM-ESG score ranges from -1 to 1, with lower values signifying more negative content. Given that RM-ESG

has utilized Twitter data as a reference in constructing scores since 2010, this paper focuses on the period from 2010 to 2019, prior to the advent of the COVID-19 pandemic ⁵.

TVL continuously monitors corporate ESG news and employs natural language processing techniques to assess each firm’s ESG efforts. TVL aggregates information from a diverse range of sources globally and selects content that is of utmost relevance to ESG. Subsequently, TVL classifies the extracted ESG articles into 26 categories established by the SASB. TVL calculates an Insight score, which assesses each company’s long-term ESG trends, and a Pulse score, a real-time score evaluating events. Our research identifies the date on which the Pulse score changes as the date of the event. Serafeim and Yoon (2022) focus on the effect of material ESG events on stock valuations, utilizing TVL’s ESG score to evaluate materiality.

3.2 Event Selection Criteria

This research merges the RM-ESG score with the TVL ESG score. In accordance with Jiao et al. (2020), we designate the relative buzz score as the quotient of a company’s buzz score on a given day to the buzz score of all stocks on that day. However, it is important to note that a company’s size may influence relative buzz scores since large companies are always likely to receive substantial buzz on SNS. To account for cases where a relatively small firm has garnered significant attention at some point in its history, we stratify a company’s relative buzz scores in a given month into deciles. Ultimately, we categorize the top 30% of RelativeBuzz scores in a given month for a given company as popular events that attract attention, while the bottom 50% of events are unpopular events that do not attract attention.

Before merging these two sets of ESG data and proceeding with the analysis, the events to be analyzed are limited according to the following criteria. TVL calculates both an all-category score that encompasses immaterial themes and a material score that solely evaluates material themes. Then, we classify an event in which the all-category score fluctuates while the material score remains unchanged as an immaterial event; otherwise, it is a material event. When significant corporate events, such as earnings announcements and ESG events, coincide with close days, it poses a challenge to disentangle the effects of these events on stock returns. Hence, in selecting events, we exclude those that had a major corporate event occurring within two days⁶. Both TVL and RM-ESG determine the content’s polarity in each of the categories, such as environment, gender, and work environment. For instance, in cases where an event has a favorable impact on the environmental domain but an unfavorable impact on the human rights domain, it becomes arduous to identify the specific event to which the stock returns are responsive. Hence, we eliminate events that exhibit negative content in one category while possessing a positive connotation in another on the same day. If another ESG event transpires within a three-day span of an event’s occurrence, it becomes challenging to ascertain the event to which stock returns are reacting; thus, such events are also omitted. Finally, we exclude companies with share prices below five dollars and with missing data such as stock returns.

3.3 Other Data

We evaluate the stock market’s reaction to ESG events using CAR, whose derivation is described in the next section. The paper examines the impact of ex-ante corporate ESG information known to investors on the reaction of stock returns to ESG events. Hence, we use the MSCI ESG score, the Refinitiv ESG score, and the Sustainalytics ESG Score. The MSCI ESG Score assigns a score from 0 to 10 based on a comprehensive evaluation of ESG-related company disclosures, third-party reports, geographical areas of activity, and other data. Similarly, the Sustainalytics ESG Score is a dataset encompassing

⁵MarketPsych has already provided services that do not target ESG information, as referenced in Eierle et al. (2022) and Jiao et al. (2020)

⁶The major corporate events are earnings calls, earnings release, annual meetings, ex-dividend, stock splits, conference presentations, M&A call, IPO filing, brokerage analyst calls, guidance calls, sales and trading statement calls, sales and trading statement release, company visits, corporate analyst meetings, brokerage analyst meetings, and roadshows. We obtain these event dates from Refinitiv Eikon.

Table 1: Summary Statistics

	Negative Events					Positive Events				
	N	mean	sd	min	max	N	mean	sd	min	max
Material	3,631	0.799	0.401	0	1	9,568	0.804	0.397	0	1
High Attention	3,631	0.614	0.487	0	1	9,568	0.676	0.468	0	1
Buzz Score	3,631	13.73	37.21	0.500	938.5	9,568	14.57	42.43	0.500	2,632
Relativebuzz	3,631	0.117	0.303	0.00249	5.905	9,568	0.128	0.343	0.00265	15.88
Refinitiv ESG Score	2,446	55.39	19.31	4.364	92.65	7,011	58.85	19.01	1.604	95.16
ESG Fund	3,446	1.165	2.317	0	36.53	9,145	1.514	2.618	0	43.94
Concentration	3,625	28.89	10.48	0.0100	96.69	9,554	27.95	9.799	0	225.8
Post2015	3,631	0.576	0.494	0	1	9,568	0.605	0.489	0	1
Uncertainty	3,631	0.269	0.444	0	1	9,568	0.327	0.469	0	1
Morningstar	3,101	0.264	0.623	0	10.34	8,447	0.317	0.732	0	10.34
ln(Market Cap)	3,557	23.10	1.723	9.741	27.53	9,404	23.40	1.715	9.093	27.52
CAR	3,631	-0.375	5.098	-81.29	44.69	9,568	0.270	4.378	-56.21	69.67

Table 1 provides the descriptive statistics. Material is a dummy variable indicating material ESG events, calculated on the basis of the TVL ESG score. High Attention is a dummy variable for high attention on SNS, calculated based on the RM-ESG score. Buzz Score indicates attention to the company on the event date, which is provided by RM-ESG. Relative Buzz is a measure of the relative level of the target company’s buzz score on the event date. Refinitiv ESG is an ESG score provided by Refinitiv. ESG Fund is the percentage of ESG active funds investing in each company for which the MSCI ESG score is used to calculate the percentage. Concentration stands for the level of concentrated institutional shareholdings. Post2015 is a dummy variable indicating ESG events that take place after 2015. Uncertainty is the standard deviation of the three ESG scores - MSCI, Refinitiv, and Sustainalytics. Morningstar is the percentage of ESG active funds investing in each company for which the Morningstar Rating is used to calculate the percentage. ln(Market Cap) is the logarithm of market capitalization. CAR shows cumulative abnormal returns for ESG events when the event window is 3 days.

analysts’ evaluation of a firm’s ESG risk grounded on all available information and comprising the disclosure information. Finally, the Refinitiv ESG Score evaluates a company’s ESG stance based on its disclosures and assigns a score from 1 to 100. “Uncertainty” stands for the standard deviation of these three scores and is utilized as a gauge of the asymmetry of a firm’s ESG information.

Three variables- “ESG Fund”, “Concentration”, and “Morningstar”- show the impact of ownership structure on the response of stock returns to events. The former indicates the percentage of ESG-active funds invested in each company, while the latter indicates the minority shareholding. The creation of these variables is described in the next section. Finally, we create a logarithm of market capitalization (log(Market Cap)) to control for firm size. Financial data, excluding MSCI ESG scores and the Sustainalytics ESG Score, are obtained from Refinitiv Eikon. Tables with frequency, correlation, and sample selection are provided in the Appendix, and descriptive statistics are listed in Table 1.

4 Univariate Analysis

4.1 Baseline Model

To gauge the effect of ESG events on stock returns, we employ event study methodology. First, we use the Capital Asset Pricing Model(CAPM)⁷ to estimate the stock return at time t for firm i to which event j happens. The abnormal return is defined as the difference between the actual and the estimated stock return, such as

$$AR_{i,j,t} = R_{i,j,t} - E[R_{i,j,t}], \quad (1)$$

where $R_{i,j,t}$ is the stock return of firm i on day t and $E[R_{i,j,t}]$ is the estimated stock return of the company to which event j happens. $E[R_{i,j,t}]$ is derived from

⁷We also analyze the case where stock returns are estimated as in Carhart (1997), which yields qualitatively similar results to those of the CAPM model.

$$E[R_{i,j,t}] - R_{f,t} = \alpha_{i,j} + \beta_{i,j}(R_{i,j,t} - R_{m,t}), \quad (2)$$

where $R_{f,t}$ is the risk-free rate and $R_{m,t}$ is the value-weighted market index return on date t . We estimate $\alpha_{i,j}$ and $\beta_{i,j}$ over periods between 210 and 31 days before the event date⁸. Then, we aggregate $CAR_{i,j,t}$ over the event window to obtain the CAR, such that

$$CAR_{i,j,t}[n_1, n_2] = \sum_{t=n_1}^{t=n_2} AR_{i,j,t}, \quad (3)$$

where n_i specifies the event window. We consider three event windows [-1,1], [-5,5], and [-10,10], taking into account scenarios where information is leaked in advance or there is a delay in responding to information. Finally, the cumulative average abnormal return (CAAR) is obtained by averaging the ARs of the firms for which event j occurs.

Table 2 presents the CAR of the benchmark model⁹. SASB categorizes ESG issues into five dimensions: Environment, Social Capital, Human Capital, Business Model & Innovation, and Leadership & Governance¹⁰. We focus our analysis on six dimensions: these five dimensions and the dimension called “All”, which is the aggregate of these events. The results are classified into six sub-categories based on the event’s polarity, the theme’s materiality, and the extent of attention garnered on SNSs. Panels A through D encompass the outcomes of events with substantial SNS impact, wherein Panels A and B correspond to events of high materiality, and Panels C and D encompass the results with low materiality. Meanwhile, Panels E and F report the outcomes of events with high materiality but low SNS attention.

Panel A reveals that the 3-day average CAR on the occurrence of positive events across all dimensions is 45 basis points and statistically significant at the 1% level (t-statistic=6.09). Furthermore, the 11-day CAR is also 51 basis points (t-statistic=4.18), and the 21-day CAR is 38 basis points (t-statistics=2.41); both are economically and statistically significant. The 3-day CARs for most individual dimensions are statistically significant, however, the long-term impact of events varies from topic to topic. The 11-day and 21-day CARs for environmental and business aspects are lower than the corresponding 3-day CARs and are not statistically significant. Meanwhile, the CARs for social capital over 11 and 21 days surpass 3-day CAR and exhibit statistical significance.

Panel B shows that the 3-day CAR for negative events is -64 basis points (t-statistics=-3.95), the 11-day CAR is -97 basis points (t-statistics=-3.74) and the 21-day CAR is -96 basis points (t-statistics=-2.91). The results suggest that negative events related to environmental, human capital, and business aspects do not lead to statistically significant changes in stock returns. However, for social capital and governance aspects, the corresponding 3-day CARs are -101 basis points (t-statistics=-3.06) and -71 basis points (t-statistics=-2.19), respectively, indicating a significant negative response to such events. The CAR for governance does not exhibit statistical significance in the long run. On the other hand, the 21-day CAR for business shows a significant decline of 167 basis points (t-statistics=-3.04).

⁸We also follow Kruger (2015) with an estimated window of [-250,-50] and Capelle-Blancard and Petit (2019) with an estimated window of [-70,-11]. The results are qualitatively almost the same.

⁹We observe that in the majority of cases, the CAR does not demonstrate statistically significant values when the event window encompasses pre-event dates such as [-5,-3] or [-5,-1]. These results suggest that post-event CARs are not influenced by irrelevant trends around the event date.

¹⁰Environment is further broken down into six categories: “GHG Emissions”, “Air Quality”, “Energy Management”, “Water & Wastewater Management”, “Waste & Hazardous Materials Management”, and “Ecological Impacts”. Social Capital comprises seven sections, “Human Rights & Community Relations”, “Customer Privacy”, “Data Security”, “Access & Affordability”, “Product Quality & Safety”, “Customer Welfare”, and “Selling Practices & Product Labelling”. Human Capital consists of the following three areas: “Labour Practices”, “Employee Health & Safety”, and “Employee Engagement, Diversity & Inclusion”. Business Model & Innovation comprises five sections, “Product Design & Lifecycle Management”, “Business Model Resilience”, “Supply Chain Management”, “Materials Sourcing & Efficiency”, and “Physical Impacts of Climate Change”. Leadership & Governance is composed of five sections, “Business Ethics”, “Competitive Behavior”, “Management of the Legal & Regulatory Environment”, “Critical Incident Risk Management”, and “Systemic Risk Management”

Panels C and D demonstrate that stock returns are less sensitive to events of low materiality, regardless of the magnitude of attention garnered. Although there are cases of short-term stock return responses to events, they are smaller in magnitude than material events. Especially, in most categories, events do not have a long-term impact on stock returns. As Panel C indicates, the CARs for “All” and environment over 3 days are positive and statistically significant. Additionally, the 11-day CARs for “All” and social capital aspects are positive, while their magnitude is lower compared to that of material events. For example, the 3-day CAR for “All” demonstrates 27 basis points (t-statistics=2.61) for favorable events and -37 basis points (t-statistics=-1.81) for unfavorable incidents.

Finally, Panels E and F demonstrate that even if an event is material, it has a negligible impact on stock returns if the associated social impact is small. It is evident that all of the categories are not statistically significant.

Thus far, the analysis reveals that material events exhibit a statistically and economically notable impact on CAR compared to events with high materiality. However, it is also evident that events with low materiality display a statistically significant response in the short term if there is a sufficiently large response on SNS. We will further examine in a later section whether differences in materiality and SNS attention lead to differences in CAR.

Next, to explore factors causing the CAR to vary, we split our sample based on key ESG scores, the percentage of ESG-active funds investing in sample companies, the percentage of institutional investors’ holdings, and periods.

4.2 Subsample Analyses

Table 3 presents the CARs computed for groups with high materiality and attention, dividing the sample into groups with high and low Refinitiv ESG scores. Refinitiv ESG classifies each company into 12 grades based on its ESG score, ranging from D- to A+. Firms with a grade of B or above are categorized into the high-score group, while the rest are classified into the low-score group. Table 3 of Panels A and C exhibits the CARs for the group with a low ESG grade, while Panels B and D depict the outcomes for the group with a high ESG grade. Table 3 demonstrates that companies with low ESG scores tend to exhibit statistically significant larger stock return responses to events. Among the negative events, the 3-day CAR of the “All” in the Low Score group is -73 basis points (t-statistics=-2.93), whereas it is -41 basis points (t-statistics=-3.43) in the High Score group. When the event window encompasses a range of [-5, 5], the group with a low score experiences a more substantial CAR decrease than does the group with a high score. While the table of results for immaterial events is not presented, it is worth noting that the low ESG score group exhibits a 3-day CAR of 27 basis points for positive events compared to 23 basis points for the high ESG score group. In addition, the negative events result in a CAR of -41 basis points for the low ESG score group and -35 basis points for the high ESG score group. Because Refinitiv ESG scores are based on company disclosures, companies with low scores can be interpreted as exhibiting greater information asymmetries with investors. The observation that the sharing of knowledge through SNS leads to larger stock return responses in cohorts with significant information asymmetry is aligned with the results presented by Bartov et al. (2018). Additionally, we demonstrate that this phenomenon is more pronounced in the material ESG topics.

Next, we evaluate the influence of information asymmetries from a viewpoint distinct from that of the volume of ESG information disclosed. While the quantity of information disclosed by corporations is essential to address information asymmetries, the resolution of such asymmetries is contingent upon providing information that satisfies investors’ information needs. We evaluate information asymmetries by analyzing the proportion of investment made by responsible investors under the assumption that responsible investors do not consider investing in a company unless the information asymmetries related to ESG have been addressed.

Table 4 showcases the outcomes of the CARs for the groups with high materiality and attention,

dividing the sample according to the percentage of funds with high ESG scores¹¹. First, for each corporation, we compute the ratio of the total holdings of funds with high ESG scores to the total holdings of all shareholders of that corporation. Corporations whose ratio exceeds the median for all corporations in the study are categorized as those with a high share of ESG fund investments. As evidenced by Panels C and D in Table 4, the reaction of stock returns to ESG events is more modest for the group of companies with a larger proportion of ESG funds. The 3-day event window of the category “All” in the negative event yields a CAR of -137 basis points (t-statistics=-3.55), for the group possessing a limited proportion of ESG funds. Conversely, for the group with a substantial share of ESG funds, the CAR is -29 basis points (t-statistics=-2.84). This pattern also holds true for positive events, where the 3-day CAR for the “All” dimension is 88 basis points for the low ESG fund group, as opposed to 19 basis points for the high ESG fund group. The findings imply that as investors possess restricted capacity to comprehend ESG information, the greater is the likelihood of an excessive reaction in stock returns to ESG events receiving high levels of SNS attention. Furthermore, the smaller stock return response to adverse events in firms with a higher proportion of ESG fund investments suggests that ESG funds are not avoiding investing in firms with poor ESG performance, at least in the short term.

Should the extent of the CAR reaction solely embody disparities in the aptitude to comprehend ESG information and the extent of the ESG information disclosure, then there should be no variation in the CAR response over different intervals of analysis. Some of the results support this inference; however, no consistent conclusions have been reached. Table 5 displays the CARs computed by dividing the sample period into two 5-year segments of 2010-2014 and 2015-2019. In the latter half of the 2010s, as social interest in ESG rose, the response of stock returns to ESG events became both economically and statistically significant. The 3-day mean CAR is 23 basis points (t-statistics=2.39) for positive events in the “All” dimension prior to 2014 and 57 basis points (t-statistics=5.52) after 2015. Conversely, for adverse events, the mean CAR is -35 basis points (t-statistics=-1.82) before 2014 and -88 basis points (t-statistics=-3.58) after 2015 for the same three-day event windows. Meanwhile, there is no large difference between pre-2015 and post-2015 CARs with regard to immaterial events. Although the results table is untabulated, the 3-day CAR for the “All” category in positive events is 0.27 (t-statistics=2.02) after 2015 and 0.38 (t-statistics=2.26) before 2014. Assuming that the reaction of stock returns to ESG events indicates investors’ sentiment, there should be a distinction between the periods before and after 2015 concerning immaterial events. However, the results show that the response of stock returns to immaterial events is consistent over time, whereas the response of stock returns to material events is greater from 2015 onward.

5 Multivariate Analysis

This section performs a panel regression analysis to show that the correlation between CAR and attention is determined independent of the firm’s attributes. In addition, we analyze the impact of corporate ESG scores and ESG funds on the relationship between attention and CAR, as suggested in the previous section.

Section 4 illustrates that ESG events with high materiality have a larger and long-lasting impact on stock returns than do those without materiality. However, the results presented in the univariate analysis do not control for the effects of industry and firm attributes. Moreover, if there is a high correlation between events of high financial materiality and events with a greater response on SNSs, the difference in stock returns between material and immaterial events may not solely be attributed to

¹¹We follow El Ghoul and Karoui (2017) to measure Fund j ’s ESG score, $ESG_{j,t}$, as follows:

$$ESG_{j,t} = \sum_{i=1}^{N_{j,t}} \omega_{i,j,t} \times ESG_{i,t} \quad (4)$$

where $\omega_{i,j,t}$ is the weight of stock i in fund j at the end of quarter t . $N_{j,t}$ stands for the number of companies that fund j holds at quarter t . $ESG_{i,t}$ is the MSCI ESG score of firm i .

Table 2: Cumulative Abnormal Returns

Panel A: Positive Material							
	[-1,1]		[-5,5]		[-10,10]		N
	CAR	t-Stat	CAR	t-Stat	CAR	t-Stat	
All	0.45***	6.09	0.51***	4.18	0.38**	2.41	4599
Environment	0.23**	2.36	0.18	1.09	0.05	0.21	1501
Social	0.75***	4.43	1.02***	3.73	0.94***	2.80	1320
Human	0.27	1.54	0.45	1.63	0.21	0.59	499
Business	0.27**	2.35	-0.02	-0.09	-0.13	-0.49	1357
Governance	0.81***	2.99	0.91**	2.27	0.80	1.39	540
Panel B: Negative Material							
	[-1,1]		[-5,5]		[-10,10]		N
	CAR	t-Stat	CAR	t-Stat	CAR	t-Stat	
All	-0.64***	-3.95	-0.97***	-3.74	-0.96***	-2.91	1501
Environment	-0.26	-0.97	-0.18	-0.41	0.02	-0.04	306
Social	-1.01***	-3.06	-1.52***	-3.47	-1.21*	-1.92	488
Human	-0.32	-0.73	-0.62	-0.99	-1.02	-1.15	149
Business	-0.25	-0.86	-0.53	-1.27	-1.67***	-3.04	304
Governance	-0.71**	-2.19	-1.05	-1.63	-0.66	-0.89	418
Panel C: Positive Immaterial							
	[-1,1]		[-5,5]		[-10,10]		N
	CAR	t-Stat	CAR	t-Stat	CAR	t-Stat	
All	0.27***	2.61	0.30*	2.22	0.37*	1.66	1871
Environment	0.51*	1.82	0.30	1.50	0.93	1.52	368
Social	0.32	1.56	0.55*	2.07	0.56	1.22	395
Human	0.08	0.52	0.17	0.28	0.31	0.92	616
Business	0.50	1.55	0.21	0.80	0.01	0.01	200
Governance	0.24	1.17	0.10	0.95	-0.10	-0.22	442
Panel D: Negative Immaterial							
	[-1,1]		[-5,5]		[-10,10]		N
	CAR	t-Stat	CAR	t-Stat	CAR	t-Stat	
All	-0.37*	-1.81	-0.39	-1.21	-0.66	-1.61	730
Environment	-0.10	-0.28	0.33	0.31	0.09	0.06	74
Social	-0.27	-0.54	-0.27	-0.37	-0.24	-0.26	158
Human	-0.25	-0.68	-0.42	-0.86	-0.38	-0.57	179
Business	0.61	1.41	0.50	0.68	0.68	0.74	66
Governance	-0.70**	-2.09	-0.57	-1.08	-1.37**	-2.06	324
Panel E: Positive Material Low Attention							
	[-1,1]		[-5,5]		[-10,10]		N
	CAR	t-Stat	CAR	t-Stat	CAR	t-Stat	
All	0.00	0.08	0.19	1.53	0.21	1.21	3098
Environment	0.01	0.11	0.22	0.90	-0.01	-0.02	795
Social	-0.02	-0.21	0.23	1.08	0.41	1.31	1137
Human	-0.02	-0.18	0.16	0.52	0.27	0.71	432
Business	0.10	0.94	0.39	1.53	0.21	0.65	796
Governance	0.15	0.96	0.00	-0.01	-0.04	-0.08	405
Panel F: Negative Material Low Attention							
	[-1,1]		[-5,5]		[-10,10]		N
	CAR	t-Stat	CAR	t-Stat	CAR	t-Stat	
All	-0.10	-1.20	-0.26	-1.42	-0.30	-1.23	1400
Environment	0.04	0.17	-0.38	-0.87	-0.62	-1.09	259
Social	-0.13	-0.99	-0.21	-0.82	0.13	0.35	558
Human	-0.17	-0.57	0.04	0.07	-0.69	-1.06	168
Business	-0.14	-0.76	-0.13	-0.36	0.21	0.40	232
Governance	-0.11	-0.65	-0.57	-1.32	-0.73	-1.33	329

Table indicates the cumulative abnormal returns (CAR) around the ESG event dates. The sample period is between 2010 and 2019. Event dates are set based on the relative height of the buzz score of the RM-ESG. [-1,1],[-5,5], and [-10,10] represent the event windows. N denotes the number of events, and t-stat stands for t-statistic. Events are categorized into six groups according to polarity, attention span, and materiality. Panel A and B represent events with high attention, while Panel E and F indicate events with low attention. Panel A shows positive events with high materiality, Panel B shows negative events with high materiality, Panel C shows positive events with low materiality, Panel D shows negative events with low materiality, Panel E shows positive events with high materiality and Panel F shows negative events with high materiality and low attention. Events are categorized into five dimensions in each group, which are defined by SASB - Environment, Social Capital (Social), Human Capital (Human), Business Model & Innovation (Business), and Leadership & Governance (Governance). ***, **, and * are statistically significant at 1%, 5%, and 10 % levels, respectively.

Table 3: CAR: Partitioning based on ESG Score

Panel A: Positive Low ESG	[-1,1]		[-5,5]		N
	CAR	t-Stat	CAR	t-Stat	
All	0.34***	2.86	0.22	1.18	1995
Environment	0.15	0.78	-0.23	-0.77	522
Social	0.42*	1.71	0.39	1.08	611
Human	-0.03	-0.13	-0.17	-0.39	256
Business	0.11	0.64	-0.41	-1.29	504
Governance	0.83**	2.09	1.10*	1.73	304

Panel B: Positive High ESG	[-1,1]		[-5,5]		N
	CAR	t-Stat	CAR	t-Stat	
All	0.18***	3.00	0.31***	3.08	2081
Environment	0.14*	1.70	0.31**	2.02	856
Social	0.35***	2.96	0.40**	2.10	527
Human	0.48**	2.35	0.94***	2.81	205
Business	0.07	0.70	0.11	0.64	688
Governance	0.22	1.23	0.29	0.89	184

Panel C: Negative Low ESG	[-1,1]		[-5,5]		N
	CAR	t-Stat	CAR	t-Stat	
All	-0.73***	-2.93	-1.47***	-3.95	739
Environment	-0.69**	-2.14	-0.14	-0.22	121
Social	-0.41	-1.00	-1.52**	-2.39	249
Human	-1.18**	-2.53	-1.40	-1.27	65
Business	-0.42	-0.96	-0.61	-0.93	133
Governance	-1.10*	-1.82	-2.35***	-2.81	224

Panel D: Negative High ESG	[-1,1]		[-5,5]		N
	CAR	t-Stat	CAR	t-Stat	
All	-0.41***	-3.43	-0.56***	-2.82	529
Environment	-0.21	-1.02	-0.39	-1.19	140
Social	-0.68***	-3.07	-0.15	-0.38	156
Human	-0.59	-1.51	-0.93**	-2.06	61
Business	-0.36	-1.43	-0.64	-1.48	128
Governance	-0.38	-1.56	-0.84**	-1.98	123

Table indicates the cumulative abnormal returns (CAR) around the ESG event dates. The sample period is between 2010 and 2019. Event dates are set based on the relative height of the buzz score of the RM-ESG. [-1,1] and [-5,5] represent the event windows. N denotes the number of events, and t-stat stands for t-statistic. Events are categorized into four groups according to polarity and Refinitiv ESG score. Panel A to Panel D summarize groups with high attention and materiality. Panel A presents results for positive events that occurred in companies with low ESG scores. Panel B shows positive events with high ESG scores, Panel C shows negative events with low ESG scores, and Panel D shows negative events with high ESG scores. Events are categorized into five dimensions in each group, which are defined by SASB - Environment, Social Capital (Social), Human Capital (Human), Business Model & Innovation (Business), and Leadership & Governance (Governance). ***, **, and * are statistically significant at 1%, 5%, and 10 % levels, respectively.

Table 4: CAR: Partitioning based on ESG Fund Investment

Panel A: Positive with Low Number of ESG Fund	[-1,1]		[-5,5]		N
	CAR	t-Stat	CAR	t-Stat	
All	0.88***	4.35	0.91***	2.77	1368
Environment	0.61*	1.93	0.47	0.91	351
Social	1.14**	2.46	2.10***	2.82	407
Human	0.38	1.03	0.25	0.42	177
Business	0.49*	1.70	-0.56	-1.01	372
Governance	1.54**	2.20	1.53	1.58	190
Panel B: Positive with High Number of ESG Fund	[-1,1]		[-5,5]		N
	CAR	t-Stat	CAR	t-Stat	
All	0.19***	3.54	0.21**	2.20	2984
Environment	0.13	1.55	0.17	1.18	1084
Social	0.42***	3.77	0.31	1.61	834
Human	0.23	1.28	0.33	1.18	296
Business	0.09	0.99	0.12	0.72	913
Governance	0.33*	1.93	0.32	1.13	317
Panel C: Negative with Low Number of ESG Fund	[-1,1]		[-5,5]		N
	CAR	t-Stat	CAR	t-Stat	
All	-1.37***	-3.55	-1.97***	-3.33	593
Environment	-0.28	-0.43	0.30	0.30	102
Social	-2.05***	-2.66	-3.54***	-3.66	188
Human	0.08	0.09	-0.28	-0.23	67
Business	-0.48	-0.72	-1.30	-1.37	109
Governance	-1.69**	-2.07	-1.66	-1.12	177
Panel D: Negative with High Number of ESG Fund	[-1,1]		[-5,5]		N
	CAR	t-Stat	CAR	t-Stat	
All	-0.29***	-2.84	-0.39**	-2.19	821
Environment	-0.32*	-1.78	-0.44	-1.32	192
Social	-0.32	-1.59	-0.14	-0.41	269
Human	-0.62*	-1.93	-0.74	-1.57	74
Business	-0.21	-1.05	-0.36	-1.01	181
Governance	-0.21	-1.04	-0.62*	-1.88	211

Table indicates the cumulative abnormal returns (CAR) around the ESG event dates. The sample period is between 2010 and 2019. Event dates are set based on the relative height of the buzz score of the RM-ESG. [-1,1] and [-5,5] represent the event windows. N denotes the number of events, and t-stat stands for t-statistic. Events are categorized into four groups according to polarity and the percentage of ESG fund holdings. Panel A to Panel D summarize groups with high attention and materiality. Panel A shows positive events with a limited proportion of ESG fund investments., Panel B shows positive events with high ESG fund holdings, Panel C shows negative events that are associated with companies possessing a relatively low proportion of ESG fund investments, and Panel D shows negative events with high ESG fund holdings. Events are categorized into five dimensions in each group, which are defined by SASB - Environment, Social Capital (Social), Human Capital (Human), Business Model & Innovation (Business), and Leadership & Governance (Governance). ***, **, and * are statistically significant at 1%, 5%, and 10 % levels, respectively.

Table 5: CAR: Partitioning based on 2015

Panel A: Positive after 2015	[-1,1]		[-5,5]		N
	CAR	t-Stat	CAR	t-Stat	
All	0.57***	5.52	0.66***	3.98	2823
Environment	0.34***	2.67	0.38	1.63	915
Social	0.59**	2.55	0.94***	2.71	808
Human	0.27	1.20	0.33	0.92	327
Business	0.48***	2.94	0.18	0.61	813
Governance	1.24***	3.09	1.19**	2.00	342

Panel B: Negative after 2015	[-1,1]		[-5,5]		N
	CAR	t-Stat	CAR	t-Stat	
All	-0.88***	-3.58	-1.39***	-4.17	920
Environment	-0.42	-1.10	-0.01	-0.02	179
Social	-1.29***	-2.62	-2.02***	-3.35	295
Human	-0.71	-1.23	-0.95	-1.08	96
Business	0.05	0.11	0.09	0.15	185
Governance	-1.07**	-2.00	-2.13***	-2.77	264

Panel C: Positive before 2014	[-1,1]		[-5,5]		N
	CAR	t-Stat	CAR	t-Stat	
All	0.23**	2.39	0.28	1.64	1771
Environment	0.03	0.21	-0.07	-0.33	567
Social	0.89***	3.81	1.19***	2.68	507
Human	0.25	1.01	-0.29	-1.11	533
Business	-0.02	-0.16	0.59	1.46	170
Governance	0.03	0.11	0.37	0.92	195

Panel D: Negative before 2014	[-1,1]		[-5,5]		N
	CAR	t-Stat	CAR	t-Stat	
All	-0.35*	-1.82	-0.33	-0.77	590
Environment	-0.07	-0.20	-0.32	-0.43	127
Social	-0.46	-1.26	-0.43	-0.71	193
Human	0.41	0.63	-0.13	-0.16	52
Business	-0.64	-1.56	-1.29**	-2.15	118
Governance	-0.44	-1.25	0.30	0.25	153

Table indicates the cumulative abnormal returns (CAR) around the ESG event dates. The sample period is between 2010 and 2019. Event dates are set based on the relative height of the buzz score of the RM-ESG. [-1,1] and [-5,5] represent the event windows. N denotes the number of events, and t-stat stands for t-statistic. Events are categorized into four groups according to polarity and time period. Panel A to Panel D summarize groups with high attention and materiality. Panel A shows positive events after 2015, Panel B shows negative events after 2015, Panel C shows positive events before 2014, and Panel D shows negative events before 2014. Events are categorized into five dimensions in each group, which are defined by SASB - Environment, Social Capital (Social), Human Capital (Human), Business Model & Innovation (Business), and Leadership & Governance (Governance). ***, **, and * are statistically significant at 1%, 5%, and 10 % levels, respectively.

the level of materiality. To accomplish this, we begin by establishing four distinct cohorts. Groups 1 and 2 explore the short-term consequences of the event by assigning the dependent variable to a 3-day CAR, while Groups 3 and 4 evaluate the long-term effects of the event by assigning the dependent variable to an 11-day CAR. Moreover, Groups 1 and 3 encompass positive events, while adverse events are included in the analysis for the remaining groups. Then, in each group, we winsorize events with CARs above the 99th percentile and below the 1st percentile.

The regression model is defined as follows:

$$CAR_{i,t}[-T, T] = \beta_b R_Buzz_{i,t} + \gamma Size_{i,t} + \delta_i + \theta_t + \epsilon_{i,t} \quad (5)$$

$$CAR_{i,t}[-T, T] = \beta_m Material_{i,t} + \gamma Size_{i,t} + \delta_i + \theta_t + \epsilon_{i,t} \quad (6)$$

$$CAR_{i,t}[-T, T] = \beta_b R_Buzz_{i,t} + \beta_m Material_{i,t} + \beta_{mb} Material_B_{i,t} + \gamma Size_{i,t} + \delta_i + \theta_t + \epsilon_{i,t} \quad (7)$$

$$CAR_{i,t}[-T, T] = \beta_b R_Buzz_{i,t} + \beta_{esg} ESG_{i,t} + \beta_{esg_b} ESG_B_{i,t} + \gamma Size_{i,t} + \delta_i + \theta_t + \epsilon_{i,t} \quad (8)$$

$$CAR_{i,t}[-T, T] = \beta_b R_Buzz_{i,t} + \beta_f ESGFund_{i,t} + \beta_{f_b} ESGFund_B_{i,t} + \gamma Size_{i,t} + \delta_i + \theta_t + \epsilon_{i,t} \quad (9)$$

$$CAR_{i,t}[-T, T] = \beta_b R_Buzz_{i,t} + \beta_{2015} Post2015_{i,t} + \beta_{2015_b} Post2015_B_{i,t} + \gamma Size_{i,t} + \delta_i + \theta_t + \epsilon_{i,t} \quad (10)$$

$CAR_{i,t}[-T, T]$ is the CAR for firm i at time t over event window $[-T, T]$. For Groups 1 and 2, T is set to 1, while for the remaining groups, T is set to 5. β and γ are the coefficients of each independent variable. $Size_{i,t}$ contains the firm level control variable, $Ln(MarketCap)$. δ_i and θ_t are industry and year-fixed effects, respectively. $\epsilon_{i,t}$ is the error term.

The initial model scrutinizes the association between the RelativeBuzz score, $R_Buzz_{i,t}$, and $CAR_{i,t}$, after adjusting for industry and year-fixed effects. The second model evaluates the link between the dummy variable $Material_{i,t}$ and $CAR_{i,t}$, with the Material event as 1. The third model then examines the CAR of events with high Buzz scores and materiality, $Material_B_{i,t}$. The fourth model appraises the consequences of events in companies with high Refinitiv ESG scores, $ESG_{i,t}$, and those transpiring in firms with high Refinitiv ESG and Buzz scores, $ESG_B_{i,t}$. The fifth model delves into the correlation between CARs and events in firms with a considerable proportion of investments from ESG funds. Finally, Model 6 investigates the impact on CAR of events that have occurred since 2015 and those that have occurred in companies with high Buzz scores.

Table 6 presents the results of Group 1, namely the 3-day CAR for positive events. For brevity, the Group 2 to Group 4 tables are listed in the Appendix ¹². The results for Models 1, 4, 5, and 6 show a positive correlation between the RelativeBuzz score and CAR, indicating that an increase in the RelativeBuzz score leads to a corresponding increase in CAR. The outcomes of Model 5 suggest that within firms possessing high Buzz scores, those with a significant proportion of ESG fund investments tend to display a comparatively lower CAR than those without, which is consistent with Section 4. Although Section 4 concludes that firms with high ESG scores do not react significantly to stock returns, we expected $ESG_B_{i,t}$ to have a statistically significant negative value in Model 4. However, this result is not observed. The results of Model 6 show that stock returns tend to respond more strongly to events occurring after 2015. In the case of negative events in Group 2, it is observable that the stock returns decline for events with high Buzz scores. In contrast, the decline is limited for firms with a considerable proportion of ESG funds invested and those possessing high ESG scores.

More importantly, Model 2 and Model 3 imply that the impact of materiality on CAR is statistically insignificant. The results in Section 4 lead to the conclusion that stock returns respond significantly to events with not only high Buzz scores but also high materiality. However, the findings from the regression analysis imply that the impact of materiality is comparatively limited when accounting for fixed effects and firm size. In addition, it should be noted that the findings in Groups 3 and 4 demonstrate that the analysis of the 11-day CAR does not find a significant correlation between Buzz scores and CAR for most of the models, which is also inconsistent with the findings of Section 4 that the effect of high materiality events on stock returns remains significant over time. From this result, we cannot conclude that financial materiality does not influence investor behavior. For instance, if events

¹²The results for Group 2 are shown in Table A.4, Group 3 in Table A.5, and Group 4 in Table A.6.

with greater materiality evoke a more substantial response from investors and consequently, engender a larger reaction on SNSs, it can be posited that the influence of materiality is subsumed by the effect of social media. On the other hand, the results suggest that asymmetrical ESG information, as manifested in social networking reactions, is a salient factor that cannot be disregarded when accounting for stock returns in response to ESG events.

6 Robustness Checks and Further Analyses

6.1 Measure of Information Asymmetry

Section 4 discusses how the relationship between the magnitude of social attention and stock returns relates to information asymmetry regarding ESG information. In Section 4, two indicators are utilized to gauge information asymmetry concerning ESG: the Refinitiv ESG score and the percentage of ESG funds invested. Additionally, this section employs various indicators to ensure the validity of the results.

Section 4 computes the ESG score of the fund at the portfolio level based on the MSCI ESG score. It is noteworthy, however, that the results obtained in that section might be contingent on the MSCI ESG score, as ESG scores could differ across diverse rating organizations. Consequently, we determine the ESG performance of funds by assessing them from a different perspective. This section classifies funds based on the Morningstar Sustainability Rating. Morningstar assesses the fund’s proficiency in addressing ESG risks based on its Sustainalytics ESG score. The sustainability rating of the fund is graded on a scale of five points, where a superior rating connotes a higher ESG performance. We select 3,470 open-end funds, excluding index funds, which encompass the US in their investment universe and hold a sustainability rating of 5 points. After selecting the funds, we calculate the proportion of ESG funds with a high rating in each company, as in Section 4. Subsequently, we measure the ratios across companies each year and designate those in the top 40% as the “High Morningstar” group, while the remaining are classified as the “Low Morningstar” group. Table 7 presents evidence suggesting that firms exhibiting higher levels of information asymmetry concerning ESG issues tend to experience more pronounced stock return reactions to events that trigger more significant SNS responses. Notably, this relationship appears to hold irrespective of the specific methodology employed to evaluate ESG funds.

If institutional investors possess a superior capacity to decipher ESG information compared to retail investors, we anticipate a lower CAR for ESG events in companies with a higher share of institutional ownership. Table 8 portrays the influence of ownership structure on the CARs. To define the ownership structure, we initially compute the aggregate shareholding proportions of each firm’s top five shareholders based on 13F filings. The group of firms whose quarterly aggregate shareholding proportion exceeds the median of all analyzed companies constitutes the “Concentrated” group. The group whose quarterly aggregate shareholding proportion is less than the median constitutes the “Dispersed” group. The outcomes for the concentrated group are displayed in Panels A and C, while those for the dispersed group are presented in Panels B and D.

The results partially support our conjecture. Panels C and D suggest that the response of stock returns to adverse events is amplified when the proportion of retail investors is substantial. For instance, the 3-day CAR for the “All” dimension is -46 basis points (t-statistics=-2.26) in Panel C. In contrast, it is -114 basis points (t-statistics=-3.94) in Panel D. Additionally, the 11-day CAR for the “All” dimensions is -62 basis points (t-statistics=-1.84) in Panel C. In comparison, it is -176 basis points (t-statistics=-4.30) in Panel D. Hence, concerning adverse events, we observe that the group of firms considered to have higher information asymmetry resulting from a more diffuse ownership structure experience a more significant reduction in their stock returns. Conversely, favorable events elicit a larger CAR for the group with greater institutional ownership. The 3-day CAR for the “All” dimension is 49 basis points (t-statistics=5.18) in Panel A, whereas it is 39 basis points (t-statistics=3.26) in Panel B. This result could be attributed to the fact that institutional investors do not always share the same orientation. Consequently, the difference in results from Section 4 may be ascribed to the premise that

Table 6: Regression Results of Group 1

	(1)	(2)	(3)	(4)	(5)	(6)
	CAR	CAR	CAR	CAR	CAR	CAR
R_Buzz	0.251*** (2.71)		0.366 (1.28)	0.289*** (2.61)	0.956*** (3.01)	0.249* (1.91)
Material		0.098 (1.20)	0.117 (1.30)			
Material_B			-0.125 (-0.42)			
ESG				0.213*** (2.61)		
ESG_B				-0.114 (-0.58)		
Fund					0.138 (1.49)	
Fund_B					-0.763** (-2.31)	
Post2015						0.122* (1.79)
Post2015_B						0.006 (0.03)
_cons	2.152*** (4.66)	1.963*** (4.30)	2.138*** (4.62)	2.688*** (5.27)	2.275*** (4.34)	2.094*** (4.51)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	No
Controls	Yes	Yes	Yes	Yes	Yes	Yes
<i>N</i>	9264	9264	9264	9264	9264	9264
<i>R</i> ²	0.006	0.005	0.006	0.007	0.007	0.006

This table presents the regression results of the 3-day CAR on several variables indicative of firm characteristics for the group of positive events. “R_Buzz” indicates the Relative Buzz Score, “Material” is a dummy variable indicating the material event determined based on the TVL ESG score, and “Material_B” indicates the cross term between “R_Buzz” and “Material”. “ESG” indicates companies with a Refinitiv ESG Grade of B or higher; “ESG_B” indicates the cross term between “ESG” and “R_Buzz”. “Fund” is a dummy variable indicating companies with a high proportion of funds with a high average ESG score in their portfolio holdings, and “Fund_B” is the cross term between “Fund” and “R_Buzz”. “Post2015” is a dummy variable indicating events that occurred after 2015; “Post2015_B” is the cross term between “Post2015” and “R_Buzz”. “Industry FE” denotes industry-fixed effects and “Year FE” denotes year-fixed effects. *t* statistics in parentheses. ***, **, and * are statistically significant at 1%, 5%, and 10 % levels, respectively.

enterprises attracting substantial ESG fund investments exhibit diminished information asymmetry concerning ESG information.

The last indicator for ESG information asymmetry is the standard deviation of the ESG score. As already noted, ESG scores are said to vary between assessment organizations. Considering that ESG scores are one of the key criteria utilized in making ESG investments, the greater the degree of variation observed between agencies in a company’s ESG score is, the more challenging it is expected to become for investors to decipher and comprehend the company’s ESG information. Henceforth, we compute the standard deviation for each company’s three ESG scores derived from MSCI, Refinitiv, and Sustainalytics. Subsequently, we categorize the top 30% of companies exhibiting higher standard deviation in their ESG scores in each year as the “High Uncertain” group. In comparison, the bottom 30% of companies with lower standard deviation are classified as the “Low Uncertain” group. Table 9 indicates that CARs decrease more prominently for negative events in the cohort of enterprises with more significant information asymmetry. In contrast, CARs for positive events exhibited a significant rise in firms with lower information asymmetry.

6.2 Criteria for Event Selection

Thus far, we have employed the ratio of a company’s buzz score to the aggregate of all analyzed corporations as a gauge of attention. Although the aforementioned indicator appears appropriate concerning our goal of evaluating the overall degree of market attention, it is plausible that firms that are constantly in the limelight, independent of their ESG performance, might have a higher likelihood of being selected for analysis. Thus, this section concentrates on the relative magnitude of a corporation’s buzz score over time instead of relying on cross-sectional analysis.

Initially, we compute the mean buzz score for each firm over the preceding 60 days and then determine the difference between each day’s buzz score and the mean buzz score. Subsequently, the calculated disparity is partitioned into deciles for each month. The uppermost 30% is then designated as the abnormal buzz for each month. Table 10 exhibits the CARs computed from the attention scores defined through this method. Table 10 attests that the results obtained are qualitatively consistent regardless of the methodology employed to create the attention score. For example, the high materiality group exhibits a 3-day CAR of 41 basis points for “All” in the positive event, whereas the immaterial and positive event shows a 3-day CAR of 20 basis points. The results are qualitatively and quantitatively consistent with Table 2, which results from an analysis based on the high level of attention in the cross-section.

The baseline model employs the top 30% of relative buzz scores per month as the criterion for event selection. To comprehend the influence of variations in the magnitude of SNS responses on the results, we present the analysis outcomes by limiting the sample to the top decile and the sample comprising the median and above. Table 11 exhibits the outcomes. Compared to the baseline model’s outcomes depicted in Table 2, the qualitative property remains unchanged, yet the CARs in Table 11 show an increase in magnitude. In Panel B of Table 11, for example, the 3-day CAR for the “All” dimension stands for -143 basis points (t -statistics=-3.20), while in Panel B of Table 2, it is recorded as -64 basis points (t -statistics=-3.95). Furthermore, the 3-day CAR of positive immaterial events increases from 27 basis points (t -statistics=2.61) to 47 basis points (t -statistics=2.24). Moreover, we can observe from the right-hand side of Table 11 that the qualitative attributes of the analysis outcomes persist in tandem with those presented in Table 2, despite including a slightly reduced SNS response in the sample with a relative buzz score surpassing the median. These findings suggest that altering the criteria for selecting events does not result in qualitative changes in the association between SNS reactions and stock returns. Conversely, variations in the magnitude of reactions can be discerned contingent on the type of event. Comparing Table 2 to Table 11 reveals that the CARs respond more significantly to negative events than to positive events as the level of SNS attention increases.

Table 7: CAR: Partitioning based on the ESG Funds Rated by Morningstar

Panel A: Positive Low Morningstar					
	[-1,1]		[-5,5]		
	CAR	t-Stat	CAR	t-Stat	N
All	0.46***	4.34	0.61***	3.40	1905
Environment	0.29**	2.18	0.33	1.38	737
Social	0.50*	1.92	1.23***	2.69	415
Human	0.32	1.27	0.27	0.61	208
Business	0.34**	2.37	0.14	0.54	575
Governance	1.17***	2.80	1.27**	2.02	256
Panel B: Positive High Morningstar					
	[-1,1]		[-5,5]		
	CAR	t-Stat	CAR	t-Stat	N
All	0.20***	2.96	0.18	1.55	2046
Environment	0.12	1.06	0.11	0.53	595
Social	0.44***	3.88	0.39*	1.85	677
Human	0.42*	1.96	0.53	1.52	210
Business	-0.07	-0.52	-0.10	-0.42	615
Governance	0.20	0.95	0.14	0.42	212
Panel C: Negative Low Morningstar					
	[-1,1]		[-5,5]		
	CAR	t-Stat	CAR	t-Stat	N
All	-0.79***	-2.96	-1.01***	-2.73	626
Environment	-0.53***	-2.15	0.11	0.21	147
Social	-1.02**	-2.02	-1.36*	-1.76	165
Human	-0.17	-0.25	-0.72	-0.94	69
Business	-0.44	-1.14	-0.76	-1.32	133
Governance	-0.99	-1.44	-1.07	-1.18	185
Panel D: Negative High Morningstar					
	[-1,1]		[-5,5]		
	CAR	t-Stat	CAR	t-Stat	N
All	-0.46***	-3.32	-0.37	-1.09	581
Environment	-0.25	-0.96	-0.60	-1.13	111
Social	-0.45*	-1.78	-0.73*	-1.92	218
Human	-0.53	-1.01	-0.05	-0.07	54
Business	-0.67**	-2.45	-0.63	-1.47	128
Governance	-0.31	-1.22	-0.06	-0.05	129

Table indicates the cumulative abnormal returns (CAR) around the ESG event dates. The sample period is between 2010 and 2019. Event dates are set based on the relative height of the buzz score of the RM-ESG. [-1,1] and [-5,5] represent the event windows. N denotes the number of events, and t-stat stands for t-statistic. Here, we classify events based on the mutual fund performance by Morningstar. Events are categorized into four groups according to polarity and materiality. Panel A shows positive events that occurred in companies with small percentages of ESG fund investments. Panel B presents positive events that occurred in companies with a high percentage of ESG fund investments. Panel C shows positive events that occurred in companies with a small percentage of ESG fund investments. Finally, Panel D exhibits negative events that have taken place in companies with a significant proportion of ESG fund investments. Here, ESG funds are determined based on Morningsar's rating. Events are categorized into five dimensions in each group, which are defined by SASB - Environment, Social Capital (Social), Human Capital (Human), Business Model & Innovation (Business), and Leadership & Governance (Governance). ***, **, and * are statistically significant at 1%, 5%, and 10 % levels, respectively.

Table 8: CAR: Partitioning Based on the Ownership Structure

Panel A: Positive Concentrated	[-1,1]		[-5,5]		N
	CAR	t-Stat	CAR	t-Stat	
All	0.49***	5.18	0.71***	4.37	2797
Environment	0.23*	1.82	0.33	1.40	856
Social	0.78***	3.53	1.21***	3.14	782
Human	0.26	1.16	0.90**	2.52	320
Business	0.17	1.33	-0.20	-0.80	812
Governance	1.15***	3.07	1.81***	3.10	326

Panel B: Positive Dispersed	[-1,1]		[-5,5]		N
	CAR	t-Stat	CAR	t-Stat	
All	0.39***	3.26	0.23	1.25	1790
Environment	0.22	1.46	0.08	0.37	636
Social	0.72***	2.77	0.75**	2.02	538
Human	0.23	0.88	-0.43	-1.03	180
Business	0.41**	1.96	0.31	0.88	536
Governance	0.16	0.43	-0.33	-0.70	211

Panel C: Negative Concentrated	[-1,1]		[-5,5]		N
	CAR	t-Stat	CAR	t-Stat	
All	-0.46**	-2.26	-0.62*	-1.86	1004
Environment	0.06	0.15	0.67	1.10	188
Social	-0.48	-1.46	-1.07**	-2.07	328
Human	0.14	0.26	0.17	0.26	108
Business	-0.02	-0.05	-0.31	-0.59	193
Governance	-1.17**	-2.33	-1.33	-1.51	283

Panel D: Negative Dispersed	[-1,1]		[-5,5]		N
	CAR	t-Stat	CAR	t-Stat	
All	-1.14***	-3.94	-1.76***	-4.30	492
Environment	-0.82***	-3.04	-1.43**	-2.19	117
Social	-2.03***	-2.74	-2.20***	-2.70	160
Human	-1.59**	-2.41	-2.87*	-1.95	40
Business	-0.46	-1.10	-1.06	-1.55	110
Governance	-0.32	-0.74	-0.88	-1.01	127

Table indicates the cumulative abnormal returns (CAR) around the ESG event dates. The sample period is between 2010 and 2019. Event dates are set based on the relative height of the buzz score of the RM-ESG. [-1,1] and [-5,5] represent the event windows. N denotes the number of events, and t-stat stands for t-statistic. Events are categorized into four groups according to polarity and ownership structure. Panel A to Panel D summarize groups with high attention and materiality. Panel A shows positive events with concentrated institutional shareholdings, Panel B shows positive events with dispersed minority shareholdings, Panel C shows negative events with concentrated institutional shareholdings, and Panel D shows negative events with dispersed minority shareholdings. Events are categorized into five dimensions in each group, which are defined by SASB - Environment, Social Capital (Social), Human Capital (Human), Business Model & Innovation (Business), and Leadership & Governance (Governance). ***, **, and * are statistically significant at 1%, 5%, and 10 % levels, respectively.

Table 9: CAR: Partitioning Based on the ESG Score Uncertainty

Panel A: Positive Low Uncertain					
	[-1,1]		[-5,5]		
	CAR	t-Stat	CAR	t-Stat	N
All	0.40***	3.48	0.46**	2.53	1025
Environment	0.13	0.78	0.02	0.09	328
Social	0.47*	1.70	0.98**	2.43	283
Human	0.80**	2.31	1.35**	2.57	110
Business	0.24	1.30	-0.16	-0.54	309
Governance	0.70***	2.78	0.78	1.42	133
Panel B: Positive High Uncertain					
	[-1,1]		[-5,5]		
	CAR	t-Stat	CAR	t-Stat	N
All	0.16**	1.98	0.32**	2.18	1404
Environment	0.21*	1.88	0.36*	1.67	530
Social	0.21	1.28	0.27	0.99	381
Human	0.33	1.35	0.33	0.75	154
Business	0.07	0.55	0.09	0.38	398
Governance	0.24	0.59	0.77	1.02	144
Panel C: Negative Low Uncertain					
	[-1,1]		[-5,5]		
	CAR	t-Stat	CAR	t-Stat	N
All	-0.32	-1.62	-0.42	-1.43	326
Environment	-0.73*	-1.83	-0.52	-0.87	72
Social	0.28	0.60	-0.76	-1.24	93
Human	-1.39**	-2.24	-0.50	-0.75	26
Business	-0.42	-1.32	-0.21	-0.36	85
Governance	-0.29	-0.94	-0.53	-0.92	81
Panel D: Negative High Uncertain					
	[-1,1]		[-5,5]		
	CAR	t-Stat	CAR	t-Stat	N
All	-0.52***	-2.60	-0.72**	-2.16	354
Environment	-0.63*	-1.98	-0.49	-0.78	85
Social	-0.43	-1.28	-0.40	-0.63	126
Human	-1.23**	-2.47	-1.19	-1.67	40
Business	-0.17	-0.30	-0.68	-1.00	68
Governance	-0.85*	-1.74	-1.11	-1.61	84

Table indicates the cumulative abnormal returns (CAR) around the ESG event dates. The sample period is between 2010 and 2019. Event dates are set based on the relative height of the buzz score of the RM-ESG. [-1,1] and [-5,5] represent the event windows. N denotes the number of events, and t-stat stands for t-statistic. Events are categorized into four groups according to the polarity and uncertainty of the ESG score. ESG score uncertainty is determined based on the standard deviation of three scores - Refinitiv, MSCI, and Sustainalytics. Panel A to Panel D summarize groups with high attention and materiality. Panel A shows positive events with low uncertainty of ESG scores, Panel B shows positive events with high uncertainty of ESG scores, Panel C shows negative events with low uncertainty of ESG scores, and Panel D shows negative events with high uncertainty of ESG scores. Events are categorized into five dimensions in each group, which are defined by SASB - Environment, Social Capital (Social), Human Capital (Human), Business Model & Innovation (Business), and Leadership & Governance (Governance). ***, **, and * are statistically significant at 1%, 5%, and 10 % levels, respectively.

Table 10: CAR: Selecting Events Based on the Time-series Data of Buzz Scores

Panel A: Positive Material					
	[-1,1]		[-5,5]		
	CAR	t-Stat	CAR	t-Stat	N
All	0.41***	5.72	0.46***	4.00	4951
Environment	0.18*	1.86	0.20	1.23	1551
Social	0.63***	4.06	0.82***	3.41	1487
Human	0.28	1.61	0.54**	1.98	561
Business	0.23**	2.01	0.02	0.08	1406
Governance	0.75***	2.99	0.79**	2.08	585
Panel B: Negative Material					
	[-1,1]		[-5,5]		
	CAR	t-Stat	CAR	t-Stat	N
All	-0.53***	-3.64	-0.89***	-3.60	1604
Environment	-0.12	-0.46	-0.23	-0.52	311
Social	-0.78***	-2.86	-1.26***	-3.12	531
Human	-0.27	-0.67	-0.37	-0.73	157
Business	-0.18	-0.61	-0.65	-1.55	313
Governance	-0.67**	-2.23	-1.22*	-1.95	450
Panel C: Positive Immaterial					
	[-1,1]		[-5,5]		
	CAR	t-Stat	CAR	t-Stat	N
All	0.20**	2.13	0.22	1.40	2040
Environment	0.30	1.12	0.04	0.10	379
Social	0.26	1.41	0.55*	1.71	438
Human	0.03	0.18	0.06	0.27	662
Business	0.31	1.15	0.36	0.77	213
Governance	0.23	1.21	0.20	0.58	492
Panel D: Negative Immaterial					
	[-1,1]		[-5,5]		
	CAR	t-Stat	CAR	t-Stat	N
All	-0.27	-1.37	-0.27	-0.87	786
Environment	-0.09	-0.26	0.18	0.18	79
Social	0.19	0.40	0.09	0.12	169
Human	-0.40	-1.07	-0.39	-0.82	194
Business	0.42	0.93	0.13	0.17	73
Governance	-0.52*	-1.69	-0.52	-1.04	339
Panel E: Positive Material Low Attention					
	[-1,1]		[-5,5]		
	CAR	t-Stat	CAR	t-Stat	N
All	0.07	1.04	0.21	1.61	2730
Environment	-0.04	-0.36	0.24	0.94	728
Social	0.10	0.83	0.28	1.21	980
Human	0.17	1.07	0.07	0.22	365
Business	0.10	0.92	0.37	1.36	713
Governance	0.11	0.64	-0.01	-0.03	347
Panel F: Negative Material Low Attention					
	[-1,1]		[-5,5]		
	CAR	t-Stat	CAR	t-Stat	N
All	-0.08	-0.84	-0.22	-1.13	1280
Environment	0.13	0.62	-0.42	-1.00	238
Social	-0.25*	-1.67	-0.22	-1.13	1280
Human	-0.10	-0.27	0.33	0.58	145
Business	0.05	0.28	0.17	0.48	218
Governance	-0.10	-0.56	-0.74*	-1.67	296

Table indicates the cumulative abnormal returns (CAR) around the ESG event dates. The sample period is between 2010 and 2019. Event dates are set based on the relative height of the buzz score of the RM-ESG. [-1,1] and [-5,5] represent the event windows. N denotes the number of events, and t-stat stands for t-statistic. Events are categorized into six groups according to polarity, attention span, and materiality. Panel A to Panel B represents events with high attention, and Panel E and F indicate events with low attention. Panel A shows positive events with high materiality, Panel B shows negative events with high materiality, Panel C shows positive events with low materiality, Panel D shows negative events with low materiality, Panel E shows negative events with high materiality and Panel F shows positive events with high materiality and low attention. Events are categorized into five dimensions in each group, which are defined by SASB - Environment, Social Capital (Social), Human Capital (Human), Business Model & Innovation (Business), and Leadership & Governance (Governance). ***, **, and * are statistically significant at 1%, 5%, and 10 % levels, respectively.

Table 11: CAR: Selecting Events Based on the size of the Buzz Scores

Panel A: Positive Material	Top Decile					Above Median				
	[-1,1]		[-5,5]		N	[-1,1]		[-5,5]		N
CAR	t-Stat	CAR	t-Stat	CAR		t-Stat	CAR	t-Stat	CAR	
All	0.42***	2.71	0.59**	2.44	1351	0.39***	6.96	0.47***	5.13	7197
Environment	0.14	0.75	0.11	0.36	465	0.13*	1.72	0.14	1.04	2207
Social	0.50	1.21	0.86	1.39	366	0.59***	5.01	0.83***	4.40	2184
Human	0.58	1.34	0.65	1.07	137	0.24*	1.71	0.40*	1.77	778
Business	0.19	0.93	-0.05	-0.15	424	0.35***	3.61	0.19	1.17	2089
Governance	1.12**	2.29	2.03**	2.37	155	0.60***	3.29	0.64**	2.33	866

Panel B: Negative Material	[-1,1]		[-5,5]		N	[-1,1]		[-5,5]		N
	CAR	t-Stat	CAR	t-Stat		CAR	t-Stat	CAR	t-Stat	
All	-1.43***	-3.20	-1.40**	-2.31	418	-0.58***	-4.81	-0.84***	-4.44	2485
Environment	0.19	0.55	1.62**	2.04	79	-0.16	-0.85	-0.37	-1.13	513
Social	-1.97**	-2.20	-2.24**	-2.15	131	-0.87***	-3.70	-1.26***	-3.75	819
Human	-0.05	-0.05	-0.12	-0.11	44	-0.15	-0.44	-0.11	-0.22	243
Business	-1.06**	-2.03	0.03	0.03	69	-0.22	-0.94	-0.35	-1.14	491
Governance	-2.12**	-2.18	-2.70*	-1.87	135	-0.85***	-3.43	-1.23***	-2.70	665

Panel C: Positive Immaterial	[-1,1]		[-5,5]		N	[-1,1]		[-5,5]		N
	CAR	t-Stat	CAR	t-Stat		CAR	t-Stat	CAR	t-Stat	
All	0.47**	2.24	0.38	1.31	550	0.19**	2.48	0.13	0.99	2987
Environment	0.75	1.45	0.32	0.45	111	0.26	1.26	-0.02	-0.07	574
Social	0.83*	1.69	0.77	1.23	116	0.22	1.43	0.42	1.56	644
Human	-0.19	-0.64	-0.05	-0.12	197	0.12	0.96	0.18	0.90	942
Business	1.01	1.47	0.13	0.13	54	0.38	1.60	-0.14	-0.35	331
Governance	1.19**	2.37	1.29*	1.71	118	0.11	0.66	-0.04	-0.16	721

Panel D: Negative Immaterial	[-1,1]		[-5,5]		N	[-1,1]		[-5,5]		N
	CAR	t-Stat	CAR	t-Stat		CAR	t-Stat	CAR	t-Stat	
All	-1.00**	-2.37	-0.64	-1.09	205	-0.11	-0.11	-0.15	-0.63	1248
Environment	-0.86	-1.60	-0.22	-0.16	15	-0.42	-0.42	0.01	0.02	132
Social	-0.46	-0.62	1.05	0.87	54	0.16	0.16	0.15	0.28	272
Human	-1.04	-1.57	-1.62*	-1.92	50	-0.31	-0.31	-0.22	-0.59	319
Business	0.20	0.32	1.97	0.92	15	0.36	0.36	-0.33	-0.47	106
Governance	-1.30*	-1.69	-1.45	-1.55	92	-0.14	-0.14	-0.13	-0.32	517

Table indicates the cumulative abnormal returns (CAR) around the ESG event dates. The sample period is between 2010 and 2019. Event dates are set based on the relative height of the buzz score of the refinitiv marketpsych. Here, we change the level of event selection from the baseline model. The events with RelativeBuzz scores in the top 10th percentile or higher for a given month are classified as "Top Decile" and the events with RelativeBuzz scores in the median or higher are classified as "Above Median". [-1,1] and [-5,5] represent the event windows. N denotes the number of events and t-stat stands for t-statistic, respectively. Events are categorized into four groups according to polarity and materiality. Panel A shows positive events with high materiality, Panel B shows negative events with high materiality, Panel C shows positive events with low materiality, and Panel D shows negative events with low materiality. Events are categorized into five dimensions in each group, which are defined by SASB - Environment, Social Capital (Social), Human Capital (Human), Business Model & Innovation (Business), and Leadership & Governance (Governance). ***, **, and * are statistically significant at 1%, 5%, and 10 % levels, respectively.

7 Concluding Remarks

We delve into the ramifications of socially salient ESG events on corporate value. Initially, we find that unconditional excess stock returns exhibit a positive correlation with positive and attention-grabbing ESG events and a negative correlation with negative ESG events. Our findings also indicate that events with low financial materiality, despite their high social prominence, do not have a lasting effect on stock returns. These conclusions are consistent with Khan et al. (2016) and Serafeim and Yoon (2022), who argue that financial materiality affects firm value. On the other hand, this is a different conclusion from Kruger (2015), who finds that positive ESG efforts reduce stock returns. The difference between this study and previous studies is our focus on SNS reactions to ESG events. This focus enables us to examine the correlation between social reactions to ESG events and stock returns, which has been challenging to observe in prior studies concentrating on news coverage. As a result, we find that the greater is the information asymmetry regarding ESG information, the greater is the stock return response.

On the other hand, when we control for firm attributes, we find no correlation between materiality and stock returns. The regression results suggest that the response of stock returns to ESG events may be attributed to market inefficiencies arising from information asymmetries rather than fundamental factors. However, to further test these inferences, it is necessary to clarify how materiality and information asymmetry contribute to the surprises reflected in SNS responses.

Despite the robustness of the results irrespective of the event selection methodology, a limitation of this study lies in the lack of assurance that events garnering high SNS attention as gauged by RM-ESG are synonymous with those exhibiting high materiality as measured by TVL. Another limitation is the potential for companies to manipulate the timing of favorable event announcements based on their monitoring of stock price trends. Further investigations into these limitations remain a topic of future research.

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A Tables

Table A.1: Frequency by Sector

Sector	All	N.Mat	P.Mat	N.Immat	P.Immat	N.Latt	P.Latt
Accommodation and Food Services	511	71	148	36	48	83	125
Administrative Services	254	36	87	16	39	24	52
Agriculture	10	1	5	0	2	1	1
Arts and Entertainment	28	1	11	11	4	1	0
Construction	182	24	77	20	48	4	9
Educational Services	53	14	15	6	13	2	3
Finance and Insurance	1539	203	353	114	363	183	323
Health Care and Social Assistance	135	15	44	12	13	20	31
Information	983	87	283	82	165	107	259
Manufacturing	4820	500	1785	227	656	450	1202
Mining, Quarrying, and Oil and Gas	421	68	154	21	25	58	95
Other Services	34	6	8	6	11	0	3
Professional, Scientific, and Technical	1046	130	393	29	112	107	275
Real Estate and Rental and Leasing	206	18	91	25	60	2	10
Retail Trade	800	60	165	62	130	132	251
Transportation and Warehousing	824	116	255	31	100	118	204
Utilities	1133	119	660	19	45	72	218
Wholesale Trade	220	32	65	13	37	36	37
Total	13199	1501	4599	730	1871	1400	3098

Table denotes the frequency by NAICS sector. N.Mat denotes the negative event with high materiality, while P.Mat signifies positive events with high materiality, N.Immat represents the negative events with low materiality, and P.Immat corresponds to positive events with low materiality. N.LAtt refers to negative events with a low degree of attention, and P.LAtt indicates positive events with low attention, respectively.

Table A.2: Frequency by Year

year	All	N.Mat	P.Mat	N.Immat	P.Immat	N.Latt	P.Latt
2010	677	99	180	42	57	116	183
2011	862	118	256	51	104	135	198
2012	1015	116	330	57	130	125	257
2013	1261	105	483	58	164	136	315
2014	1485	149	530	78	201	148	379
2015	1735	157	584	69	250	170	505
2016	956	101	352	53	130	75	245
2017	1434	197	501	71	216	135	314
2018	1662	197	592	115	285	157	316
2019	2112	262	791	136	334	203	386
Total	13199	1501	4599	730	1871	1400	3098

Table indicates the frequency by year from 2010 to 2019. N.Mat denotes the negative event with high materiality, while P.Mat signifies positive events with high materiality, N.Immat represents the negative events with low materiality, and P.Immat corresponds to positive events with low materiality. N.LAtt refers to negative events with a low degree of attention, and P.LAtt indicates positive events with low attention, respectively.

Table A.3: Sample Selection

	N.Mat	P.Mat	N.Immat	P.Immat	N.Latt	P.Latt
Keep the days when the buzz score is positive after merging RM-ESG and TVL	187872	187872	171891	171891	187872	187872
Keep only events whose relativebuzz scores are in the top 30% or below median of each company's respective months	73404	73404	65046	65046	71448	71448
Drop non-ESG-related corporate events	68245	68245	60743	60743	67696	67696
Keep only material or immaterial events	34461	33783	15881	14434	33509	34187
Drop the event if opposite polarity events occurs within 3 days	17320	17091	8568	7976	13508	13749
Drop events that are positive for one ESG category but negative for another category	2334	6415	1294	2924	2167	4418
Drop stocks with missing stock return data and penny stocks	1501	4599	730	1871	1400	3098

The table shows how each selection process reduces the number of events to be analyzed. N.Mat denotes the negative event with high materiality, while P.Mat signifies positive events with high materiality, N.Immat represents the negative events with low materiality, and P.Immat corresponds to positive events with low materiality. N.LAtt refers to negative events with a low degree of attention, and P.LAtt indicates positive events with low attention, respectively.

Table A.4: Correlation Table

Panel A: Positive	CAR	Material	High Attention	Buzz Score	RelativeBuzz	Refinitiv ESG	ESG Fund	Concentration	Post2015	Uncertainty	Morningstar	lmcap
CAR	1											
Material	-0.001	1										
High Attention	0.041***	-0.341***	1									
Buzz Score	0.034***	0.009	0.078***	1								
Relativebuzz	0.034***	0.009	0.084***	0.953***	1							
Refinitiv ESG Score	0	0.132***	-0.151***	0.069***	0.079***	1						
ESG Fund	-0.005	0.067***	-0.087***	0.053***	0.071***	0.268***	1					
Concentration	-0.007	-0.057***	0.124***	-0.096***	-0.104***	-0.285***	-0.126***	1				
Post2015	0.019*	-0.045***	0.052***	-0.038***	-0.002	0.014	0.139***	0.183***	1			
Uncertainty	-0.021**	0.058***	-0.096***	0.038***	0.049***	0.334***	0.107***	-0.127***	0.015	1		
Morningstar	0.003	-0.006	0.013	0.028**	0.038***	-0.014	0.511***	-0.011	0.024**	-0.053***	1	
lmcap	-0.080***	0.124***	-0.278***	0.145***	0.165***	0.501***	0.402***	-0.339***	-0.008	0.277***	0.046***	1
Panel B: Negative	CAR	Material	High Attention	Buzz Score	RelativeBuzz	Refinitiv ESG	ESG Fund	Concentration	Post2015	Uncertainty	Morningstar	lmcap
CAR	1											
Material	-0.002	1										
High Attention	-0.043***	-0.397***	1									
Buzz Score	-0.041**	-0.023	0.106***	1								
Relativebuzz	-0.049***	-0.025	0.119***	0.968***	1							
Refinitiv ESG Score	0.03	0.172***	-0.208***	-0.019	-0.021	1						
ESG Fund	0.023	0.087***	-0.134***	-0.023	-0.021	0.282***	1					
Concentration	0.01	-0.094***	0.164***	-0.038**	-0.037**	-0.288***	-0.128***	1				
Post2015	-0.019	-0.033**	0.080***	-0.079***	-0.058***	-0.004	0.122***	0.175***	1			
Uncertainty	-0.001	0.050***	-0.102***	0.032**	0.025	0.240***	0.092***	-0.094***	0.012	1		
Morningstar	0.006	0.022	-0.033*	-0.01	-0.01	0.014	0.650***	-0.040**	0.024	-0.040**	1	
lmcap	0.069***	0.169***	-0.332***	0.031*	0.033**	0.510***	0.396***	-0.291***	-0.073***	0.234***	0.132***	1

Table indicates the correlation between main variables from 2010 to 2019. ***, **, and * are statistically significant at 1%, 5%, and 10 % levels, respectively.

Table A.5: Regression Results of Group 2

	(1)	(2)	(3)	(4)	(5)	(6)
	CAR	CAR	CAR	CAR	CAR	CAR
R_Buzz	-0.554*** (-2.80)		-0.439 (-0.80)	-0.622** (-2.49)	-0.993** (-2.31)	-0.379 (-1.54)
Material		-0.125 (-0.81)	-0.120 (-0.70)			
Material_B			-0.138 (-0.23)			
ESG				-0.056 (-0.35)		
ESG_B				0.179 (0.44)		
Fund					0.201 (1.21)	
Fund_B					0.565 (1.17)	
Post2015						-0.092 (-0.72)
Post2015_B						-0.510 (-1.25)
_cons	-3.196*** (-3.83)	-3.200*** (-3.83)	-3.232*** (-3.86)	-3.278*** (-3.56)	-2.277** (-2.33)	-3.086*** (-3.67)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	No
Controls	Yes	Yes	Yes	Yes	Yes	Yes
<i>N</i>	3514	3514	3514	3514	3514	3514
<i>R</i> ²	0.017	0.015	0.017	0.017	0.018	0.013

This table presents the regression results of the 3-day CAR on several variables indicative of firm characteristics for the group of negative events. “R_Buzz” indicates the RelativeBuzz Score, “Material” is a dummy variable indicating the material event determined based on the TVL ESG score, and “Material_B” indicates the cross term between “R_Buzz” and “Material”. “ESG” indicates companies with a Refinitiv ESG Grade of B or higher; “ESG_B” indicates the cross term between “ESG” and “R_Buzz”. “Fund” is a dummy variable indicating companies with a high proportion of funds with a high average ESG score in their portfolio holdings, and “Fund_B” is the cross term between “Fund” and “R_Buzz”. “Post2015” is a dummy variable indicating events that occurred after 2015; “Post2015_B” is the cross term between “Post2015” and “R_Buzz”. “Industry FE” denotes industry-fixed effects and “Year FE” denotes year-fixed effects. *t* statistics in parentheses. ***, **, and * are statistically significant at 1%, 5%, and 10 % levels, respectively.

Table A.6: Regression Results of Group 3

	(1)	(2)	(3)	(4)	(5)	(6)
	CAR	CAR	CAR	CAR	CAR	CAR
R_Buzz	0.299 (1.61)		0.373 (0.73)	0.325 (1.55)	1.155* (1.92)	0.219 (0.89)
Material		0.128 (0.84)	0.144 (0.86)			
Material_B			-0.080 (-0.15)			
ESG				0.385** (2.49)		
ESG_B				-0.084 (-0.19)		
Fund					0.360** (2.09)	
Fund_B					-0.926 (-1.47)	
Post2015						0.015 (0.12)
Post2015_B						0.225 (0.62)
_cons	4.663*** (5.43)	4.473*** (5.25)	4.659*** (5.41)	5.692*** (6.00)	5.367*** (5.49)	4.611*** (5.34)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	No
Controls	Yes	Yes	Yes	Yes	Yes	Yes
<i>N</i>	8863	8863	8863	8863	8863	8863
<i>R</i> ²	0.008	0.007	0.008	0.008	0.008	0.006

t statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

This table presents the regression results of the 11-day CAR on several variables indicative of firm characteristics for the group of positive events. “R_Buzz” indicates the Relative Buzz Score, “Material” is a dummy variable indicating the material event determined based on the TVL ESG score, and “Material_B” indicates the cross term between “R_Buzz” and “Material”. “ESG” indicates companies with a Refinitiv ESG Grade of B or higher; “ESG_B” indicates the cross term between “ESG” and “R_Buzz”. “Fund” is a dummy variable indicating companies with a high proportion of funds with a high average ESG score in their portfolio holdings, and “Fund_B” is the cross term between “Fund” and “R_Buzz”. “Post2015” is a dummy variable indicating events that occurred after 2015; “Post2015_B” is the cross term between “Post2015” and “R_Buzz”. “Industry FE” denotes industry-fixed effects and “Year FE” denotes year-fixed effects. *t* statistics in parentheses. ***, **, and * are statistically significant at 1%, 5%, and 10 % levels, respectively.

Table A.7: Regression Results of Group 4

	(1)	(2)	(3)	(4)	(5)	(6)
	CAR	CAR	CAR	CAR	CAR	CAR
R_Buzz	-0.265 (-0.79)		-1.067 (-1.14)	-0.234 (-0.55)	1.055 (1.49)	-0.148 (-0.35)
Material		-0.033 (-0.12)	-0.152 (-0.52)			
Material_B			0.915 (0.91)			
ESG				0.141 (0.52)		
ESG_B				-0.083 (-0.12)		
Fund					0.787*** (2.77)	
Fund_B					-1.666** (-2.08)	
Post2015						0.035 (0.16)
Post2015_B						-0.236 (-0.34)
_cons	-5.302*** (-3.71)	-5.299*** (-3.71)	-5.203*** (-3.63)	-4.972*** (-3.16)	-3.676** (-2.20)	-5.274*** (-3.66)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	No
Controls	Yes	Yes	Yes	Yes	Yes	Yes
<i>N</i>	3473	3473	3473	3473	3473	3473
<i>R</i> ²	0.011	0.011	0.011	0.011	0.014	0.007

This table presents the regression results of the 11-day CAR on several variables indicative of firm characteristics for the group of negative events. “R_Buzz” indicates the RelativeBuzz Score, “Material” is a dummy variable indicating the material event determined based on the TVL ESG score, and “Material_B” indicates the cross term between “R_Buzz” and “Material”. “ESG” indicates companies with a Refinitiv ESG Grade of B or higher; “ESG_B” indicates the cross term between “ESG” and “R_Buzz”. “Fund” is a dummy variable indicating companies with a high proportion of funds with a high average ESG score in their portfolio holdings, and “Fund_B” is the cross term between “Fund” and “R_Buzz”. “Post2015” is a dummy variable indicating events that occurred after 2015; “Post2015_B” is the cross term between “Post2015” and “R_Buzz”. “Industry FE” denotes industry-fixed effects and “Year FE” denotes year-fixed effects. *t* statistics in parentheses. ***, **, and * are statistically significant at 1%, 5%, and 10 % levels, respectively.