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Abstract

This study examines whether the market can recognize the financial materiality of socially impactful corporate disclosures. Using data to demonstrate reactions on social networking sites (SNS) to ESG news in the United States from 2010, our findings reveal a positive correlation between unconditional excess stock returns and the polarity of the financially material ESG events. On the contrary, we observe that stock returns exhibit a short-term reaction rather than a long-term impact towards ESG events that are socially salient but less value-relevant. These tendencies seem more evident in corporations with limited information disclosure with 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 businesses[1]. These assessments challenge investors to make informed ESG-based decisions.

Retail investors, with limited temporal and cognitive resources, are susceptible to attention-grabbing events [2]. As a result, it has been noted that investors are swayed by the popular themes that are prominent on social networking sites (SNS). Although SNS 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 in 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, this paper examines the impact of attention-grabbing ESG events on corporate valuations in the United States from 2010. This study also examines whether the materiality of events, which is their relevance to business performance, influences the relationship

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

[2]This 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 SNS for social attention, we examine corporate events about ESG.

First, our findings demonstrate that cumulative abnormal returns (CAR) of stock exhibit a positive correlation with positive and attention-grabbing ESG events while exhibiting a negative correlation with adverse ESG events. However, the 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 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 upon the extent of 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 compared to 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 upon 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 that there exists 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 the stock return.

It should be observed that not all ESG endeavors culminate in the generation of corporate value [3], even though the importance of ESG in corporate valuation creation has been discussed in many studies[4]. 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 the aspect 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 in 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 criteria for event selection. 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 upon the interpretation and reaction of readers, regardless of the extent of news coverage. If the news contains unexpected or noteworthy information or has considerable social relevance, it will likely generate a stronger response on SNS. Consequently, to

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

[4] For 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

capture the effect of the quality of ESG information on investor behavior, we limit our analysis to ESG information that people acknowledge impact.

The focus of our research departs from existing literature in that we consider the correlation between non-fundamental corporate events and SNS, whereas the majority of existing studies delve into the association between financially relevant events and SNS. The influence of SNS platforms like 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 are able to obtain a clearer understanding of investors' reactions to the fervor that deviates from 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 not only by investors' cognitive limitations but also by the magnitude and diversity of information provided by corporations. Hence, the role of SNS and online forums as a mode of communicating information to investors is gaining increasing prominence. Gu and Kurov (2020) reveal that the sentiment on Twitter constitutes value-relevant information for individual companies that have 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 of 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 SNS may not always be suitable for evaluating companies. Jia, Redigolo et al. (2020) verify that SNS 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 concerning earnings announcements disseminated rapidly through SNS tends to be excessively emotive and lacks vital information, leading to detrimental market effects such as decreased market liquidity and prolonged price formation.

There exists a substantial volume of ESG information that 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 SNS, making it challenging for investors to pinpoint the most pertinent information to their investment choices.

Though 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 SNS, 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. This study endeavors to assess the market's ability to distinguish financially material information from ESG information that garners considerable attention.

Hypothesis 1: *No matter how high the social attention is, stock returns do not respond to ESG events with low materiality.*

There are two main ways of regarding 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) shows that positive ESG initiatives benefiting stakeholders reduce shareholder returns in an event study using large-scale US data. 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 et al. (2022) are event studies on ESG; however, they come to different conclusions on positive events. The difference between these studies and ours is that we control 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 a 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.*

Corporate ESG activities are considered to have an insurance effect; Lins et al. (2017) argue that companies with higher ESG ratings are better able to withstand market-wide negative shocks. 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 leading to a significant hike in share price 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 in stock returns, then stock prices should react symmetrically to negative as well as 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 occurrence is probable 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, stock returns of companies lacking ESG disclosure respond strongly to both bad and good news.*

As pointed out 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 is comprised of institutional investors who have the capability to process ESG information, it is probable that the stock price will not be overly reactive to the news with 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, Gloßner (2019) suggests that companies with a substantial number of long-term investors are likely to undertake ESG activities at an appropriate level. As a result, it is anticipated that the stock return response to ESG events in companies with a significant proportion of ESG-focused investors would be 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 has increased over 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.

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 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 natural language processing in real-time. 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 when 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.

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

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 get a lot of buzz on SNS. To account for cases where a firm of relatively small size 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% 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 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 days[6]. 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.

3.3 Other Data

We evaluate the stock market's reaction to ESG events with cumulative abnormal return (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. Likewise, the Sustainalytics ESG Score is a dataset encompassing analysts' evaluation of a firm's ESG risk, grounded on all available information, 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)) and a ratio of liabilities to total assets to control for the firm size and risk. Financial data, excluding MSCI ESG scores and Sustainalytics ESG Score, is obtained from Refinitiv Eikon. Tables with frequency and correlation are provided in the Appendix, and tables with descriptive statistics are listed in Table 1.

[6]The major corporate events are Earnings Call, 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	3,360	0.792	0.406	0	1	8,747	0.792	0.406	0	1
High Attention	3,360	0.625	0.484	0	1	8,747	0.488	0.500	0	1
Buzz Score	3,360	13.22	36.77	0.500	938.5	8,747	13.92	42.08	0.500	2,632
Relativebuzz	3,360	0.113	0.295	0.00249	5.948	8,747	0.122	0.325	0.00265	15.88
Refinitiv ESG	2,244	54.97	19.35	4.364	92.65	6,348	58.16	18.99	1.604	95.16
ESG Fund	3,188	1.117	2.095	0	35.62	8,354	1.444	2.450	0	43.94
Concentration	3,354	28.94	10.56	0.0100	96.69	8,733	28.16	9.879	0	225.8
Post2015	3,360	0.572	0.495	0	1	8,747	0.603	0.489	0	1
Uncertainty	3,360	0.263	0.440	0	1	8,747	0.317	0.465	0	1
Morningstar	2,855	0.258	0.561	0	10.34	7,671	0.313	0.690	0	10.34
ln(Market Cap)	3,291	23.05	1.729	9.741	27.42	8,588	23.31	1.706	9.093	27.52
CAR	3,360	-0.406	5.178	-81.29	44.69	8,747	0.289	4.496	-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.

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, in which event j happens. The abnormal return is defined as the difference between the actual stock return and the estimated stock return, such as

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

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

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

where $R_{f,t}$ is the risk free rate, $R_{m,t}$ is the value-weighted market index return on date t. We estimate $\hat{\alpha_{i,j}}$ and $\hat{\beta_{i,j}}$ over periods between 210 and 31 days before the event date[8]. Then, we aggregate $CAR_{i,j,t}$ over the event window to obtain the CAR, such that

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

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

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

[8]We 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.

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 model[9]. SASB categorizes ESG issues into five Dimensions: Environment, Social Capital, Human Capital, Business Model & Innovation, and Leadership & Governance[10]. 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 SNS. 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 are 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 CAR on the occurrence of positive events on average across all dimensions is 47 basis points, which is statistically significant at 1% level (t-statistic=5.96). Furthermore, the 11-day CAR is also 54 basis points (t-statistic=4.22) and the 21-day CAR is 42 basis points (t-statistics=2.58), which is both economically and statistically significant at 1% level. The 3-day CARs for the individual dimensions are all statistically significant, however, the long-term impact of events varies from topic to topic. The 11-day and 21-day CAR for environmental and business aspects are lower than the corresponding 3-day CARs and are not statistically significant. Meanwhile, the CARs for social capital and governance aspects over 11 and 21 days surpass their corresponding 3-day CARs and exhibit statistical significance.

Panel B shows that the 3-day CAR for negative events is -66 basis points (t-statistics=-3.90), the 11-day CAR is -89 basis points (t-statistics=-3.36) and the 21-day CAR is -96 basis points (t-statistics=-2.73), respectively. The results suggest that negative events related to environmental and human capital aspects do not lead to statistically significant changes in stock returns. However, for social capital and governance aspects, the corresponding 3-day CARs are -89 basis points (t-statistics=-2.57) and -87 basis points (t-statistics=-2.58), respectively, indicating a significant negative response to such events. The CARs for social capital and governance aspects do not exhibit statistical significance in the long run. On the other hand, the 21-day CAR for business shows a significant decline of 185 basis points (t-statistics=-3.29).

Panels C and D demonstrate that stock returns are less sensitive to events of low materiality, regardless of the magnitude of attention garnered. Furthermore, in most categories, events do not have a long-term impact on stock returns. As Panel C indicates, the CARs for "All", environment, social capital, and business aspects over 3-day are positive. Additionally, the 11-day CARs for "All" and social capital aspects are also positive, while their magnitude is lower compared to material events. For example, the 3-day CAR for "All" demonstrates 34 basis points (t-statistics=3.13) for favorable events and -44 basis points (t-statistics=-2.12) 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 most of the categories are not statistically significant, except for "All" in the negative event.

Thus far, the analysis reveals that material events exhibit a statistically and economically notable impact on CAR compared to events with low 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

[9]We 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.

[10]Environment 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"

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 time 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+. The firms with a grade of B or above are categorized into the high-score group, while the rest are classified as the low-score group. Table 3 of Panel A and B exhibit the CARs for the group with a low ESG grade, whilst Panels C 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 -58 basis points (t-statistics=-2.46), whereas the High Score group is -36 basis points (t-statistics=-2.87). When the event window encompasses a range of [-5, 5], the group with a low score experiences a more substantial CAR decrease in comparison to 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 31 basis points for positive events, as compared to 29 basis points for the high ESG score group. In addition, the negative events result in a CAR of -42 basis points for the low ESG score group and -41 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 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 distinct viewpoint than 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 would not consider investing in a company unless 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 scores[11]. To begin, 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 Panel C and Panel 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 category "All" in the negative event yields a CAR of -137 basis points(t-statistics=-3.65), for the group possessing a limited proportion of ESG funds. Conversely, for the group with a substantial share of ESG funds, the CAR is -23 basis points (t-statistics=-2.17). This pattern also holds true for positive events, where the 3-day CAR for the "All" dimension is 0.99 for the low RI group, as opposed

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

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

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 quater t. $ESG_{i,t}$ is the MSCI ESG score of firm i.

to 0.19 for the high RI group. The findings imply that as investors possess a restricted capacity to comprehend ESG information, the greater the likelihood of an excessive reaction in stock returns to ESG events receiving high levels of SNS attention.

Should the extent of the CAR reaction solely embody disparities in the aptitude to comprehend ESG information and the extent of 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, but no consistent conclusions have been reached. Table 5 displays the CARs that are computed by dividing the sample period into two 5-year segments, 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 15 basis points (t-statistics=1.43) for positive events in "All" dimension prior to 2014 and 68 basis points (t-statistics=6.09) after 2015. Conversely, for adverse events, the mean CAR is -28 basis points (t-statistics=-1.35) before 2014 and -90 basis points (t-statistics=-3.72) 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-days CAR for the "All" category in positive events is 0.32 (t-statistics=2.27) after 2015 and 0.39 (t-statistics=2.22) before 2014. Assuming that the reaction of stock returns to ESG events is an indication of 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 onwards.

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 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 SNS, the difference in stock returns between material and immaterial events may not solely be attributed to the level of materiality. To accomplish this, we begin by establishing four distinct cohorts. Group 1 and Group 2 explore the short-term consequences of the event by assigning the dependent variable to a 3-day CAR, while Group 3 and Group 4 evaluate the long-term effects of the event by assigning the dependent variable to an 11-day CAR. Moreover, Group 1 and Group 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:

$$
\begin{aligned}
CAR_{i,t}[-T,T] &= \beta R\_Buzz_{i,t} + \gamma X + \delta_i + \theta_t + \epsilon_{i,t} && (5)\\
CAR_{i,t}[-T,T] &= \beta Material_{i,t} + \gamma X + \delta_i + \theta_t + \epsilon_{i,t} && (6)\\
CAR_{i,t}[-T,T] &= \beta R\_Buzz_{i,t} + \beta Material_{i,t} + \beta Material\_B_{i,t} + \gamma X + \delta_i + \theta_t + \epsilon_{i,t} && (7)\\
CAR_{i,t}[-T,T] &= \beta R\_Buzz_{i,t} + \beta ESG_{i,t} + \beta ESG\_B_{i,t} + \gamma X + \delta_i + \theta_t + \epsilon_{i,t} && (8)\\
CAR_{i,t}[-T,T] &= \beta R\_Buzz_{i,t} + \beta ESGFund_{i,t} + \beta ESGFund\_B_{i,t} + \gamma X + \delta_i + \theta_t + \epsilon_{i,t} && (9)\\
CAR_{i,t}[-T,T] &= \beta R\_Buzz_{i,t} + \beta Post2015_{i,t} + \beta Post2015\_B_{i,t} + \gamma X + \delta_i + \theta_t + \epsilon_{i,t}. && (10)
\end{aligned}
$$

$CAR_{i,t}[-T,T]$ is the CAR for firm i at time t over a 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

Table 2: Cumulative Abnormal Returns

Panel A: Positive Material	[-1,1]		[-5,5]		[-10,10]		
	CAR	t-Stat	CAR	t-Stat	CAR	t-Stat	N
All	0.47***	5.96	0.54***	4.22	0.42***	2.58	4390
Environment	0.22**	2.08	0.15	0.94	0.01	0.05	1378
Social	0.73***	4.17	1.04***	3.69	0.90***	2.61	1283
Human	0.38**	2.11	0.58**	2.05	0.36	0.95	479
Business	0.28**	2.20	-0.05	-0.23	-0.13	-0.44	1282
Governance	0.86***	3.01	1.11**	2.51	1.13*	1.83	513

Panel B: Negative Material	[-1,1]		[-5,5]		[-10,10]		
	CAR	t-Stat	CAR	t-Stat	CAR	t-Stat	N
All	-0.66***	-3.90	-0.89***	-3.36	-0.96***	-2.73	1433
Environment	-0.28	-1.00	-0.09	-0.19	-0.07	-0.13	290
Social	-0.89**	-2.57	-1.35***	-2.96	-0.86	-1.23	461
Human	0.16	0.33	-0.22	-0.31	-0.40	-0.42	135
Business	-0.43	-1.48	-0.68	-1.61	-1.85***	-3.29	292
Governance	-0.87**	-2.58	-0.91	-1.41	-1.03	-1.32	393

Panel C: Positive Immaterial	[-1,1]		[-5,5]		[-10,10]		
	CAR	t-Stat	CAR	t-Stat	CAR	t-Stat	N
All	0.34***	3.13	0.37**	2.22	0.30	1.35	1860
Environment	0.61**	2.02	0.67	1.50	1.05*	1.79	358
Social	0.43*	1.92	0.72**	2.07	0.48	1.08	392
Human	0.07	0.42	0.07	0.28	0.20	0.59	602
Business	0.71**	2.05	0.42	0.80	0.16	0.20	201
Governance	0.34	1.50	0.34	0.95	-0.08	-0.17	438

Panel D: Negative Immaterial	[-1,1]		[-5,5]		[-10,10]		
	CAR	t-Stat	CAR	t-Stat	CAR	t-Stat	N
All	-0.44**	-2.13	-0.48	-1.53	-0.76*	-1.84	712
Environment	-0.03	-0.08	0.47	0.44	0.31	0.22	72
Social	-0.29	-0.57	-0.80	-1.12	-0.76	-0.79	152
Human	-0.31	-0.81	-0.49	-0.99	-0.70	-1.04	174
Business	0.51	1.18	0.60	0.80	0.86	0.92	65
Governance	-0.69**	-2.13	-0.71	-1.37	-1.34**	-2.04	311

Panel E: Positive Material Low Attention	[-1,1]		[-5,5]		[-10,10]		
	CAR	t-Stat	CAR	t-Stat	CAR	t-Stat	N
All	0.00	-0.08	0.14	1.04	0.20	1.00	2689
Environment	0.03	0.26	0.22	0.79	0.04	0.12	670
Social	-0.08	-0.73	0.08	0.35	0.39	1.10	977
Human	0.01	0.08	0.04	0.12	0.26	0.58	367
Business	0.09	0.73	0.49	1.64	0.15	0.41	664
Governance	0.19	1.10	-0.07	-0.19	-0.09	-0.15	350

Panel F: Negative Material Low Attention	[-1,1]		[-5,5]		[-10,10]		
	CAR	t-Stat	CAR	t-Stat	CAR	t-Stat	N
All	-0.16*	-1.69	-0.42**	-2.15	-0.59**	-2.31	1273
Environment	-0.04	-0.16	-0.61	-1.32	-0.97	-1.64	229
Social	-0.22	-1.49	-0.45	-1.64	-0.28	-0.73	493
Human	-0.29	-0.92	-0.08	-0.15	-0.58	-0.84	154
Business	-0.16	-0.78	-0.16	-0.39	0.11	0.20	210
Governance	-0.07	-0.41	-0.61	-1.29	-0.87	-1.47	298

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 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 3: CAR: Partitioning based on ESG Score

Panel A: Positive Low ESG	[-1,1]		[-5,5]		
	CAR	t-Stat	CAR	t-Stat	N
All	0.41***	3.34	0.37*	1.92	1953
Environment	0.13	0.66	-0.20	-0.63	500
Social	0.44*	1.81	0.55	1.51	607
Human	0.10	0.43	0.08	0.19	250
Business	0.26	1.31	-0.41	-1.20	479
Governance	0.98**	2.39	1.53**	2.22	296

Panel B: Positive High ESG	[-1,1]		[-5,5]		
	CAR	t-Stat	CAR	t-Stat	N
All	0.21***	3.19	0.30***	2.87	1925
Environment	0.21**	2.15	0.35**	2.12	766
Social	0.33***	2.67	0.33	1.64	494
Human	0.52**	2.38	0.96***	2.73	189
Business	0.07	0.55	0.12	0.65	635
Governance	0.29	1.52	0.28	0.78	166

Panel C: Negative Low ESG	[-1,1]		[-5,5]		
	CAR	t-Stat	CAR	t-Stat	N
All	-0.58**	-2.46	-1.14***	-3.21	702
Environment	-0.71**	-2.08	0.11	0.17	113
Social	-0.11	-0.25	-1.15*	-1.75	233
Human	-0.78	-1.54	-1.01	-0.86	63
Business	-0.59	-1.36	-0.69	-1.08	129
Governance	-0.87	-1.62	-1.74**	-2.37	209

Panel D: Negative High ESG	[-1,1]		[-5,5]		
	CAR	t-Stat	CAR	t-Stat	N
All	-0.36***	-2.87	-0.51**	-2.43	495
Environment	-0.24	-1.11	-0.48	-1.45	131
Social	-0.51**	-2.22	-0.09	-0.22	145
Human	-0.26	-0.68	-0.64	-1.28	51
Business	-0.42	-1.61	-0.55	-1.22	121
Governance	-0.46*	-1.74	-0.86*	-1.83	115

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]		
	CAR	t-Stat	CAR	t-Stat	N
All	0.99***	4.74	1.00***	3.06	1353
Environment	0.47	1.40	0.09	0.19	339
Social	1.25***	2.72	2.29***	3.08	412
Human	0.65*	1.77	0.69	1.21	181
Business	0.72**	2.26	-0.52	-0.91	361
Governance	1.71**	2.41	1.90*	1.91	185

Panel B: Positive with High Number of ESG Fund	[-1,1]		[-5,5]		
	CAR	t-Stat	CAR	t-Stat	N
All	0.19***	3.23	0.17*	1.74	2809
Environment	0.17*	1.85	0.19	1.19	979
Social	0.38***	3.28	0.22	1.11	798
Human	0.29	1.54	0.42	1.39	276
Business	0.04	0.40	0.07	0.37	862
Governance	0.31*	1.70	0.20	0.64	294

Panel C: Negative with Low Number of ESG Fund	[-1,1]		[-5,5]		
	CAR	t-Stat	CAR	t-Stat	N
All	-1.37***	-3.65	-1.76***	-3.02	576
Environment	-0.29	-0.43	0.62	0.62	99
Social	-2.10***	-2.66	-3.51***	-3.56	184
Human	0.53	0.57	0.08	0.06	63
Business	-0.91	-1.35	-1.33	-1.38	107
Governance	-1.46**	-1.98	-1.12	-0.78	169

Panel D: Negative with High Number of ESG Fund	[-1,1]		[-5,5]		
	CAR	t-Stat	CAR	t-Stat	N
All	-0.23**	-2.17	-0.30*	-1.66	771
Environment	-0.38**	-2.02	-0.54	-1.55	180
Social	-0.07	-0.32	0.19	0.53	248
Human	-0.31	-1.00	-0.38	-0.75	64
Business	-0.24	-1.12	-0.37	-1.10	172
Governance	-0.48**	-2.20	-0.74**	-2.06	194

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]		
	CAR	t-Stat	CAR	t-Stat	N
All	0.68***	6.09	0.76***	4.36	2667
Environment	0.37***	2.63	0.26	1.18	842
Social	0.76***	3.16	1.11***	3.09	776
Human	0.47**	1.99	0.51	1.37	309
Business	0.54***	2.91	0.21	0.65	756
Governance	1.30***	3.09	1.59**	2.43	326

Panel B: Negative after 2015	[-1,1]		[-5,5]		
	CAR	t-Stat	CAR	t-Stat	N
All	-0.90***	6.09	-1.28***	-3.91	870
Environment	-0.52	-1.32	0.07	0.11	169
Social	-1.25**	-2.40	-1.99***	-3.13	275
Human	-0.31	-0.46	-0.48	-0.48	85
Business	-0.21	-0.53	-0.22	-0.38	179
Governance	-1.12**	-2.32	-1.77**	-2.55	248

Panel C: Positive before 2014	[-1,1]		[-5,5]		
	CAR	t-Stat	CAR	t-Stat	N
All	0.15	1.43	0.19	1.07	1723
Environment	-0.02	-0.14	-0.02	-0.07	536
Social	0.68***	2.78	0.92**	2.05	507
Human	0.21	0.79	-0.41	-1.49	526
Business	-0.09	-0.59	0.71*	1.66	170
Governance	0.08	0.31	0.29	0.69	187

Panel D: Negative before 2014	[-1,1]		[-5,5]		
	CAR	t-Stat	CAR	t-Stat	N
All	-0.28	-1.35	-0.28	-0.64	563
Environment	0.05	0.13	-0.31	-0.42	121
Social	-0.37	-0.94	-0.41	-0.66	186
Human	0.96	1.43	0.23	0.28	50
Business	-0.79*	-1.93	-1.41**	-2.28	113
Governance	-0.46	-1.14	0.55	0.43	145

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.

variable. X 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 the $CAR_{i,t}$, 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 that have 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 has been established to be 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 Group 3 and Group 4 demonstrate that the analysis of 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 with greater materiality evoke a more substantial response from investors and consequently, engender a larger reaction on SNS, 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 upon the MSCI ESG score, as ESG scores could potentially differ across diverse rating organizations. Consequently,

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

Table 6: Regression Results of Group 1

	(1) CAR	(2) CAR	(3) CAR	(4) CAR	(5) CAR	(6) CAR
R_Buzz	0.296***		0.431	0.306**	1.047***	0.244*
	(2.77)		(1.49)	(2.55)	(3.13)	(1.72)
Material		0.056	0.080			
		(0.64)	(0.84)			
Material_B			-0.153			
			(-0.49)			
ESG				0.185**		
				(2.05)		
ESG_B				-0.030		
				(-0.12)		
Fund					0.180*	
					(1.82)	
Fund_B					-0.826**	
					(-2.35)	
Post2015						0.138*
						(1.87)
Post2015_B						0.116
						(0.55)
_cons	2.525***	2.329***	2.508***	3.015***	2.751***	2.465***
	(5.04)	(4.69)	(5.00)	(5.47)	(4.80)	(4.90)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	No
Controls	Yes	Yes	Yes	Yes	Yes	Yes
N	8418	8418	8418	8418	8418	8418
R^2	0.007	0.006	0.007	0.008	0.008	0.007

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 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.

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, that 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 done 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 would 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 determine the ownership structure, we initially compute the aggregate shareholding proportions of each firm's top five shareholders based on the 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 Panel A and B, while those for the dispersed group are presented in Panel C 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 "All" dimension is -42 basis points (t-statistics=-2.07) in Panel C. In contrast, it is -114 basis points (t-statistics=-3.76) in Panel D. Additionally, the 11-day CAR for "All" dimensions is -45 basis points (t-statistics=-1.34) in Panel C. In comparison, it is -176 basis points (t-statistics=-4.16) in Panel D. Hence, concerning adverse events, we observe that the group of firms that are 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 "All" dimension is 52 basis points (t-statistics=5.26) in Panel A, whereas it is 40 basis points (t-statistics=3.00) in Panel B.

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, 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 to be 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, 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 determined 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 43 basis points for "All" in the positive event, whereas the immaterial and positive event shows a 3-day CAR of 23 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-days CAR for the "All" dimension stands for -132 basis points (t-statistics=-3.13), while in Panel B of Table 2, it is recorded as -66 basis points (t-statistics=-3.90). Furthermore, the 3-days CAR of positive immaterial events increases from 34 basis points (t-statistics=3.13) to 46 basis points (t-statistics=2.10). 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 upon the type of event. Comparing Table 2 to Table 11 reveals that the CARs respond more significantly to negative events than positive events as the level of SNS attention increases.

7 Concluding Remark

This study delves 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, while they exhibit 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 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 the information asymmetry regarding ESG information, the greater 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 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

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	0.50***	4.49	0.66***	3.66	1800
Environment	0.34**	2.26	0.22	1.01	671
Social	0.47*	1.81	1.24***	2.71	405
Human	0.29	1.09	0.35	0.75	202
Business	0.37**	2.42	0.23	0.83	540
Governance	1.35***	2.99	1.63**	2.35	230

Panel B: Positive High Morningstar	[-1,1]		[-5,5]		
	CAR	t-Stat	CAR	t-Stat	N
All	0.16**	2.23	0.11	0.90	1954
Environment	0.09	0.69	0.02	0.09	556
Social	0.43***	3.62	0.34	1.52	650
Human	0.47**	2.11	0.69*	1.88	200
Business	-0.18	-1.20	-0.31	-1.26	583
Governance	0.10	0.46	-0.02	-0.06	204

Panel C: Negative Low Morningstar	[-1,1]		[-5,5]		
	CAR	t-Stat	CAR	t-Stat	N
All	-0.69***	-2.77	-0.79**	-2.12	587
Environment	-0.63**	-2.45	0.16	0.32	140
Social	-0.92*	-1.71	-1.22	-1.44	153
Human	-0.11	-0.15	-0.66	-0.79	62
Business	-0.64*	-1.67	-0.63	-1.07	126
Governance	-0.67	-1.14	-0.64	-0.73	170

Panel D: Negative High Morningstar	[-1,1]		[-5,5]		
	CAR	t-Stat	CAR	t-Stat	N
All	-0.42***	-2.72	-0.28	-0.79	553
Environment	-0.15	-0.52	-0.46	-0.90	102
Social	-0.24	-0.94	-0.43	-1.11	206
Human	-0.14	-0.27	0.23	0.29	48
Business	-0.66**	-2.27	-0.56	-1.25	124
Governance	-0.63*	-1.73	0.06	0.05	122

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 a 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 Morningsrar'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]		
	CAR	t-Stat	CAR	t-Stat	N
All	0.52***	5.26	0.74***	4.48	2722
Environment	0.23*	1.67	0.18	0.83	823
Social	0.80***	3.51	1.30***	3.32	768
Human	0.44*	1.89	1.11***	3.06	309
Business	0.15	1.04	-0.28	-1.12	787
Governance	1.34***	3.45	2.19***	3.41	314

Panel B: Positive Dispersed	[-1,1]		[-5,5]		
	CAR	t-Stat	CAR	t-Stat	N
All	0.40***	3.00	0.20	1.00	1661
Environment	0.21	1.23	0.11	0.43	553
Social	0.63**	2.30	0.66*	1.70	514
Human	0.28	1.03	-0.41	-0.93	169
Business	0.49**	2.05	0.32	0.83	495
Governance	0.11	0.27	-0.60	-1.17	196

Panel C: Negative Concentrated	[-1,1]		[-5,5]		
	CAR	t-Stat	CAR	t-Stat	N
All	-0.42**	-2.07	-0.45	-1.34	960
Environment	0.11	0.26	0.85	1.40	181
Social	-0.40	-1.17	-1.07**	-1.97	307
Human	0.71	1.20	0.71	1.01	102
Business	-0.39	-0.98	-0.47	-0.87	182
Governance	-1.04**	-2.31	-0.75	-0.88	270

Panel D: Negative Dispersed	[-1,1]		[-5,5]		
	CAR	t-Stat	CAR	t-Stat	N
All	-1.14***	-3.76	-1.76***	-4.16	472
Environment	-0.93***	-3.25	-1.65**	-2.37	109
Social	-1.86**	-2.40	-1.91**	-2.28	154
Human	-1.52*	-1.96	-3.06*	-1.73	33
Business	-0.50	-1.22	-1.02	-1.50	110
Governance	-0.49	-1.12	-1.22	-1.36	122

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	0.39***	3.16	0.43**	2.27	992
Environment	0.09	0.51	-0.05	-0.16	298
Social	0.66**	2.19	1.08***	2.62	278
Human	0.84**	2.27	1.56***	2.82	107
Business	0.04	0.21	-0.36	-1.21	302
Governance	0.59**	2.27	0.59	1.04	129

Panel B: Positive High Uncertain	[-1,1]		[-5,5]		
	CAR	t-Stat	CAR	t-Stat	N
All	0.15*	1.74	0.27*	1.70	1312
Environment	0.30**	2.33	0.38*	1.71	486
Social	0.08	0.58	0.06	0.25	365
Human	0.25	0.94	0.10	0.22	144
Business	0.18	1.25	0.19	0.75	361
Governance	0.04	0.10	0.93	1.07	132

Panel C: Negative Low Uncertain	[-1,1]		[-5,5]		
	CAR	t-Stat	CAR	t-Stat	N
All	-0.19	-0.90	-0.28	-0.90	313
Environment	-0.76*	-1.70	-0.57	-0.87	64
Social	0.72	1.41	-0.24	-0.39	91
Human	-1.05	-1.58	-0.15	-0.20	23
Business	-0.40	-1.18	0.10	0.17	83
Governance	-0.39	-1.19	-0.67	-1.09	77

Panel D: Negative High Uncertain	[-1,1]		[-5,5]		
	CAR	t-Stat	CAR	t-Stat	N
All	-0.48**	-2.27	-0.57*	-1.66	331
Environment	-0.65**	-2.02	0.38*	1.71	486
Social	-0.26	-0.73	0.05	0.08	114
Human	-0.98**	-2.05	-0.95	-1.19	35
Business	-0.24	-0.41	-0.73	-1.02	66
Governance	-0.91*	-1.77	-1.12	-1.65	79

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	0.43***	5.71	0.47***	3.94	4669
Environment	0.15	1.44	0.14	0.85	1414
Social	0.65***	3.98	0.82***	3.29	1428
Human	0.39**	2.29	0.69**	2.53	533
Business	0.25**	1.98	-0.07	-0.32	1329
Governance	0.84***	3.20	1.04**	2.49	553

Panel B: Negative Material	[-1,1]		[-5,5]		
	CAR	t-Stat	CAR	t-Stat	N
All	-0.59***	-3.84	-0.86***	-3.39	1499
Environment	-0.10	-0.38	-0.21	-0.44	293
Social	-0.78***	-2.69	-1.23***	-2.92	490
Human	0.15	0.32	0.34	0.62	138
Business	-0.50	-1.64	-0.90**	-2.08	295
Governance	-0.83**	-2.56	-1.10*	-1.73	419

Panel C: Positive Immaterial	[-1,1]		[-5,5]		
	CAR	t-Stat	CAR	t-Stat	N
All	0.23**	2.28	0.28*	1.74	2010
Environment	0.37	1.29	0.25	0.57	370
Social	0.37*	1.84	0.61*	1.89	436
Human	-0.03	-0.16	0.06	0.23	643
Business	0.49	1.62	0.55	1.12	212
Governance	0.31	1.47	0.31	0.91	489

Panel D: Negative Immaterial	[-1,1]		[-5,5]		
	CAR	t-Stat	CAR	t-Stat	N
All	-0.35*	-1.76	-0.40	-1.30	753
Environment	-0.03	-0.09	0.36	0.34	75
Social	0.12	0.25	-0.34	-0.46	160
Human	-0.44	-1.14	-0.40	-0.84	184
Business	0.44	0.99	0.23	0.31	73
Governance	-0.64**	-2.06	-0.67	-1.40	326

Panel E: Positive Material Low Attention	[-1,1]		[-5,5]		
	CAR	t-Stat	CAR	t-Stat	N
All	0.04	0.57	0.17	1.14	2396
Environment	0.05	0.44	0.26	0.91	623
Social	0.02	0.17	0.22	0.88	860
Human	0.16	0.91	0.11	0.31	315
Business	0.03	0.21	0.31	0.96	601
Governance	0.11	0.55	-0.11	-0.28	301

Panel F: Negative Material Low Attention	[-1,1]		[-5,5]		
	CAR	t-Stat	CAR	t-Stat	N
All	-0.10	-0.99	-0.24	-1.20	1168
Environment	0.15	0.64	-0.47	-1.02	215
Social	-0.31*	-1.94	-0.24	-1.20	1168
Human	-0.14	-0.34	0.34	0.56	133
Business	0.05	0.27	0.13	0.35	201
Governance	-0.09	-0.46	-0.85*	-1.73	262

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]			[-1,1]		[-5,5]		
	CAR	t-Stat	CAR	t-Stat	N	CAR	t-Stat	CAR	t-Stat	N
All	0.47***	3.00	0.67***	2.75	1383	0.41***	6.63	0.50***	5.01	6488
Environment	0.16	0.81	0.10	0.34	465	0.15*	1.71	0.14	1.00	1905
Social	0.61	1.53	1.00*	1.68	379	0.60***	4.69	0.88***	4.33	2010
Human	1.05**	2.53	1.17**	1.99	141	0.29**	2.02	0.42*	1.83	718
Business	0.11	0.52	-0.15	-0.44	438	0.37***	3.29	0.18	1.02	1864
Governance	1.19**	2.40	2.56***	2.65	154	0.64***	3.19	0.76**	2.42	780

Panel B: Negative Material	Top Decile					Above Median				
	[-1,1]		[-5,5]			[-1,1]		[-5,5]		
	CAR	t-Stat	CAR	t-Stat	N	CAR	t-Stat	CAR	t-Stat	N
All	-1.32***	-3.13	-1.04*	-1.86	417	-0.60***	-4.75	-0.77***	-3.88	2238
Environment	0.14	0.41	1.48*	1.84	79	-0.16	-0.81	-0.34	-0.99	461
Social	-1.80*	-1.94	-2.08*	-1.96	128	-0.96***	-3.68	-1.27***	-3.51	726
Human	0.28	0.26	0.34	0.27	41	0.25	0.65	0.52	0.91	211
Business	-1.07*	-1.98	-0.03	-0.03	69	-0.41*	-1.65	-0.48	-1.47	452
Governance	-2.03**	-2.46	-1.76	-1.45	136	-0.84***	-3.47	-0.96**	-2.04	590

Panel C: Positive Immaterial	Top Decile					Above Median				
	[-1,1]		[-5,5]			[-1,1]		[-5,5]		
	CAR	t-Stat	CAR	t-Stat	N	CAR	t-Stat	CAR	t-Stat	N
All	0.46**	2.10	0.24	0.78	563	0.24***	2.87	0.17	1.26	2853
Environment	0.97*	1.79	0.49	0.66	112	0.35	1.57	0.23	0.63	533
Social	0.61	1.23	0.53	0.85	121	0.32*	1.91	0.46*	1.68	610
Human	-0.32	-1.04	-0.49	-1.11	199	0.12	0.84	0.08	0.36	898
Business	1.49*	1.83	0.57	0.54	59	0.50*	1.92	0.02	0.06	317
Governance	1.28**	2.47	1.42*	1.83	119	0.17	0.99	0.05	0.18	694

Panel D: Negative Immaterial	Top Decile					Above Median				
	[-1,1]		[-5,5]			[-1,1]		[-5,5]		
	CAR	t-Stat	CAR	t-Stat	N	CAR	t-Stat	CAR	t-Stat	N
All	-1.05**	-2.41	-1.03*	-1.67	202	-0.18	-0.18	-0.22	-0.93	1166
Environment	-0.86	-1.60	-0.22	-0.16	15	-0.40	-0.40	0.14	0.17	124
Social	-0.47	-0.61	0.66	0.54	52	0.15	0.15	-0.14	-0.25	249
Human	-1.01	-1.44	-2.13**	-2.53	46	-0.36	-0.36	-0.28	-0.76	300
Business	0.27	0.48	2.13	1.11	17	0.41	0.41	0.16	0.25	103
Governance	-1.46*	-1.85	-2.03**	-2.01	92	-0.27	-0.27	-0.33	-0.85	481

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.

monitoring of stock price trends. Further investigation of these limitations remains 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	461	62	144	31	49	67	108
Administrative Services	238	36	83	15	37	20	47
Agriculture	10	1	5	0	2	1	1
Arts and Entertainment	28	1	11	11	4	1	0
Construction	169	22	71	18	46	4	8
Educational Services	53	14	15	6	13	2	3
Finance and Insurance	1452	190	334	107	349	176	296
Health Care and Social Assistance	131	16	41	12	12	20	30
Information	893	82	270	79	162	89	211
Manufacturing	4420	475	1659	222	643	409	1012
Mining, Quarrying, and Oil and Gas	390	61	146	20	25	56	82
Other Services	34	6	8	6	11	0	3
Professional, Scientific, and Technical	956	119	369	29	113	96	230
Real Estate and Rental and Leasing	195	18	84	22	59	2	10
Retail Trade	732	58	157	60	127	118	212
Transportation and Warehousing	740	107	226	29	90	104	184
Utilities	999	106	582	19	42	60	190
Wholesale Trade	206	28	62	13	35	34	34
Total	12107	1402	4267	699	1819	1259	2661

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	627	94	170	41	57	107	158
2011	808	111	242	48	103	128	176
2012	933	107	312	57	126	113	218
2013	1157	101	450	56	163	122	265
2014	1373	140	493	76	199	132	333
2015	1590	146	554	67	245	151	427
2016	891	95	333	50	129	70	214
2017	1321	188	463	69	207	121	273
2018	1523	177	539	111	274	143	279
2019	1884	243	711	124	316	172	318
Total	12107	1402	4267	699	1819	1259	2661

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: Correlation Table

Panel A: Positive	CAR	Material	High Attention	Buzz Score	RelativeBuzz	Refinitiv ESG	ESG Fund	Concentration	Post2015	Uncertainty	Morningstar	lnmcap
CAR	1											
Material	-0.004	1										
High Attention	0.036***	0.500***	1									
Buzz Score	0.032***	-0.002	0.077***	1								
Relativebuzz	0.033***	-0.002	0.084***	0.958***	1							
Refinitiv ESG	0.009	0.125***	-0.027**	0.061***	0.073***	1						
ESG Fund	-0.01	0.066***	-0.027**	0.043***	0.054***	0.279***	1					
Concentration	-0.011	-0.048***	0.061***	-0.089***	-0.099***	-0.269***	-0.127***	1				
Post2015	0.022**	-0.043***	0.01	-0.041***	-0.007	0.022*	0.131***	0.180***	1			
Uncertainty	-0.027**	0.053***	-0.035***	0.026**	0.037***	0.326***	0.125***	-0.121***	0.028***	1		
Morningstar	0.001	-0.007	0.011	0.021*	0.022**	-0.016	0.447***	-0.009	0.011	-0.045***	1	
ln(Market Cap)	-0.088***	0.107***	-0.145***	0.131***	0.152***	0.491***	0.408***	-0.319***	-0.005	0.277***	0.026**	1

Panel B: Negative	CAR	Material	High Attention	Buzz Score	RelativeBuzz	Refinitiv ESG	ESG Fund	Concentration	Post2015	Uncertainty	Morningstar	lnmcap
CAR	1											
Material	-0.005	1										
High Attention	-0.039**	-0.397***	1									
Buzz Score	-0.038**	-0.025	0.101***	1								
Relativebuzz	-0.046***	-0.028	0.113***	0.966***	1							
Refinitiv ESG	0.03	0.172***	-0.209***	-0.034*	-0.033	1						
ESG Fund	0.029*	0.085***	-0.136***	-0.030*	-0.028*	0.301***	1					
Concentration	0.012	-0.086***	0.159***	-0.029*	-0.028*	-0.293***	-0.133***	1				
Post2015	-0.023	-0.031*	0.082***	-0.068***	-0.048***	-0.014	0.119***	0.164***	1			
Uncertainty	0.001	0.046***	-0.097***	0.036**	0.031*	0.236***	0.111***	-0.093***	0.01	1		
Morningstar	0.01	0.019	-0.025	-0.021	-0.022	0.012	0.580***	-0.039**	0.008	-0.041**	1	
ln(Market Cap)	0.076***	0.153***	-0.327***	0.021	0.023	0.510***	0.400***	-0.276***	-0.073***	0.236***	0.108***	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.4: Regression Results of Group 2

	(1) CAR	(2) CAR	(3) CAR	(4) CAR	(5) CAR	(6) CAR
R_Buzz	-0.454**		-0.877	-0.515*	-1.206***	-0.198
	(-2.12)		(-1.50)	(-1.89)	(-2.66)	(-0.73)
Material		-0.132	-0.200			
		(-0.83)	(-1.13)			
Material_B			0.480			
			(0.77)			
ESG				-0.137		
				(-0.82)		
ESG_B				0.160		
				(0.37)		
Fund					0.152	
					(0.86)	
Fund_B					0.977*	
					(1.91)	
Post2015						-0.084
						(-0.62)
Post2015_B						-0.706
						(-1.62)
_cons	-3.681***	-3.687***	-3.639***	-3.969***	-2.739***	-3.547***
	(-4.20)	(-4.21)	(-4.14)	(-4.12)	(-2.67)	(-4.02)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	No
Controls	Yes	Yes	Yes	Yes	Yes	Yes
N	3231	3231	3231	3231	3231	3231
R^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.5: Regression Results of Group 3

	(1) CAR	(2) CAR	(3) CAR	(4) CAR	(5) CAR	(6) CAR
R_Buzz	0.284		0.414	0.308	1.087*	0.262
	(1.47)		(0.79)	(1.42)	(1.76)	(1.02)
Material		0.110	0.133			
		(0.71)	(0.78)			
Material_B			-0.145			
			(-0.26)			
ESG				0.389**		
				(2.39)		
ESG_B				-0.078		
				(-0.17)		
Fund					0.317*	
					(1.76)	
Fund_B					-0.872	
					(-1.35)	
Post2015						0.028
						(0.21)
Post2015_B						0.094
						(0.25)
_cons	5.009***	4.817***	4.990***	6.029***	5.626***	4.927***
	(5.54)	(5.38)	(5.51)	(6.06)	(5.45)	(5.43)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	No
Controls	Yes	Yes	Yes	Yes	Yes	Yes
N	8418	8418	8418	8418	8418	8418
R^2	0.008	0.007	0.008	0.008	0.008	0.006

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 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 4

	(1) CAR	(2) CAR	(3) CAR	(4) CAR	(5) CAR	(6) CAR
R_Buzz	-0.164		-1.169	-0.019	1.288*	-0.140
	(-0.46)		(-1.23)	(-0.04)	(1.78)	(-0.30)
Material		0.020	-0.129			
		(0.07)	(-0.43)			
Material_B			1.170			
			(1.15)			
ESG				0.141		
				(0.50)		
ESG_B				-0.381		
				(-0.52)		
Fund					0.818***	
					(2.76)	
Fund_B					-1.886**	
					(-2.27)	
Post2015						-0.016
						(-0.07)
Post2015_B						-0.046
						(-0.06)
_cons	-4.914***	-4.915***	-4.789***	-4.694***	-3.280*	-4.872***
	(-3.30)	(-3.30)	(-3.21)	(-2.86)	(-1.88)	(-3.24)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	No
Controls	Yes	Yes	Yes	Yes	Yes	Yes
N	3232	3232	3232	3232	3232	3232
R^2	0.011	0.011	0.012	0.012	0.015	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.