



What drives stock market reactions to greenwashing? An event study of European companies[☆]

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ABSTRACT

This study examines stock market reactions in response to 296 greenwashing events involving STOXX Europe 600 companies. The results indicate that companies with the lowest total assets in our sample experience negative cumulative abnormal returns. Financially material cases, which are likely to affect company performance through legal and investor-related consequences, also lead to negative market reactions. Compliance-related allegations trigger the most consistent negative market reactions compared to other types of allegations. We also find evidence of moderating effects, with ESG reputation shaping the extent of market reactions. The findings highlight that market reactions to greenwashing are highly context-dependent, reflecting company size, industry, ESG scores, and the characteristics of the allegation.

1. Introduction

In 2022, the German asset management company DWS Group faced widespread allegations of greenwashing after the claiming of overstating the use of sustainable investment criteria by the former head of sustainability, triggering regulatory investigations in Germany and the United States (Reuters, 2022). These allegations contributed to a significant decline in DWS's share price and raised serious investor concerns about the credibility of companies' environmental claims. Such high-profile cases highlight investors' growing sensitivity to environmental misconduct and raise important questions about its broader financial impact on publicly traded companies.

While empirical evidence on the financial implications of greenwashing remains limited, the few existing studies show mixed results (Lyon and Montgomery, 2015; Walker and Wan, 2012; Du, 2015; European Securities and Markets Authority, 2023; Li et al., 2024; Teti et al., 2024; Xu et al., 2025). Related research highlights that negative CSR events, including environmental controversies, can reduce company value (Krüger, 2015), while companies with stronger CSR reputations are better protected in crises (Lins et al., 2017; Utz, 2018).

This study investigates stock market reactions to greenwashing allegations using an event study approach. We hand-collect 296 greenwashing allegations in the period 2018–2023 for public European companies included in the STOXX Europe 600 index. Our approach builds on recent efforts to empirically identify greenwashing using publicly available sources and ESG signals (Yuan et al.,

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2024), but extends them through manual screening and classification of greenwashing types, severity scores, and financial materiality to account for the heterogeneity of greenwashing practices.

Our analysis is based on two key theoretical channels: information asymmetry and legitimacy theory. First, greenwashing increases information asymmetry between companies and investors by obscuring the true sustainability performance of a company. Investors rely on ESG disclosures to assess risk and future cash flows. Greenwashing allegations undermine this trust, which may result in a price reaction when the truth is revealed (Healy and Palepu, 2001; Krüger, 2015; Walker and Wan, 2012). Second, drawing on legitimacy theory, companies are seen as socially embedded actors whose legitimacy depends on alignment with stakeholder expectations and social norms. Greenwashing accusations may erode this legitimacy, resulting in reputational damage and negative valuation effects (Suchman, 1995; Lyon and Montgomery, 2015; Flammer, 2013).

Our results show that cumulative abnormal returns following greenwashing allegations are not significantly different from zero on average for the full sample. However, there is substantial variation across company, event, and industry characteristics. We observe significant negative market reactions to greenwashing allegations for the companies with the lowest total assets, for compliance-related allegations, and for financially material cases in consumer industries. Social-impact allegations also lead to negative market reactions in consumer industries, especially immediately after disclosure. Market reactions are amplified when allegations are reported by general media outlets, although the effect dissipates quickly. Furthermore, we find that ESG reputation buffers negative reactions in financially material cases. This moderating effect is observed for EU-based consumer companies and in the post-2021 period, i.e., 2022–2023, consistent with the documented increase in greenwashing cases over time (Kathan et al., 2025) and growing investor scrutiny.

Our study makes three key contributions to the growing literature on corporate environmental misconduct and financial performance. First, we build on the dataset of greenwashing allegations introduced by Kathan et al. (2025) and extend it by adding precise event dates and aligning cases with stock return data. The manual case identification combined with a structured severity rating system offers more granularity than previous studies that rely on binary ESG controversy flags or automated news classification (e.g., Du, 2015; Xu et al., 2025). Second, while earlier research often reports mixed or insignificant average valuation effects of greenwashing allegations (e.g., Lyon and Montgomery, 2015; Walker and Wan, 2012; Li et al., 2024; Teti et al., 2024), our findings reveal that stock market reactions are highly conditional on company and event characteristics such as company size, industry, ESG reputation, and the financial materiality of the allegation. Third, we document market reaction heterogeneity, which has received limited attention thus far. We demonstrate that, in certain contexts, ESG scores and prior greenwashing exposure mitigate reputational penalties. Furthermore, we show that compliance-related cases lead to consistent negative market reactions across the full sample, while social impact-related cases trigger particularly negative market reactions in consumer-facing industries. Overall, our results reconcile some of the conflicting findings in the literature by emphasizing the importance of contextual factors in explaining stock price reactions to greenwashing allegations.

2. Sample, data, and methodology

We construct a novel dataset of greenwashing allegations involving companies listed in the STOXX Europe 600 index, covering the period from 2018 to 2023.¹ Greenwashing cases are identified through a structured manual screening of multiple information channels, including web-based news platforms, NGO reports, and social media content (e.g., Twitter/X). To ensure reliability and mitigate source bias, the data collection process was conducted by a trained team of research assistants and guided by a standardized decision protocol (see Table A.1).

Each collected information source is reviewed according to predefined inclusion and exclusion criteria. We retain sources that provide original or materially new allegations of greenwashing tied to identifiable companies. Redundant sources (e.g., syndicated news articles repeating the same allegation without added content), unverifiable accusations, and materials that do not directly reference the target company (e.g., fund-level accusations or sector-wide critiques) are excluded. When sources provide new insights on previously identified cases, they are treated as valid entries for the corresponding publication year.

Each greenwashing case that meets our inclusion criteria is then evaluated by four independent researchers who assign a severity score between 0 (no greenwashing) and 1 (greenwashing). The evaluation follows a structured rating framework that considers factors such as the specificity and credibility of the allegation, its alignment with environmental claims made by the company, and whether the behavior represents deception, omission, or exaggeration (see Table A.2). The final severity score for each case is computed as the average of the four ratings.

To avoid overweighting companies with multiple cases in a given year, we retain only the most severe case per company-year. In total, after applying further filters for data availability and removing cases with confounding events (e.g., earnings or M&A announcements) to isolate company-specific effects in the estimation or event window, our final sample comprises 296 greenwashing events from 128 unique companies. For each event, we define the event date as the earliest credible public disclosure of the allegation.²

¹ An earlier version of this dataset was used in Kathan et al. (2025) to examine the relationship between ESG scores and greenwashing risk. Their findings show that the number of greenwashing allegations in Europe increased substantially in 2021 and 2022, consistent with heightened ESG scrutiny and media attention in recent years.

² Company responses (e.g., clarifications) are not consistently observable or immediate, making this date the most reliable benchmark. The use of daily data and dispersion of events over multiple years helps minimize macroeconomic confounding.

Table 1
Descriptive statistics.

Variable	Mean	Std.	Min	Median	Max
<i>Cumulative abnormal returns</i>					
CAR[0,10]	0.007	0.106	−0.202	−0.006	1.225
CAR[0,20]	0.005	0.121	−0.395	0.004	1.323
CAR[0,40]	0.000	0.171	−0.744	−0.008	1.689
CAR[0,60]	−0.007	0.215	−1.039	−0.016	1.689
<i>Company characteristics</i>					
Market value	10.198	1.358	6.036	10.183	13.487
Smaller size (bottom 5%)	0.071	0.257			
ESG score	0.762	0.124	0.269	0.786	0.954
Current ratio	0.175	0.391	−0.838	0.151	1.823
Leverage	0.638	0.156	0.214	0.654	1.124
<i>Industries</i>					
Communication services	0.034	0.181			
Consumer discretionary	0.172	0.378			
Consumer staples	0.182	0.387			
Energy	0.095	0.293			
Health care	0.034	0.181			
Industrials	0.172	0.378			
Materials	0.166	0.372			
Utilities	0.139	0.346			
Financials & Real estate	0.007	0.082			
<i>Greenwashing categories</i>					
Compliance	0.074	0.263			
Investment	0.014	0.116			
Marketing	0.358	0.480			
Operations	0.368	0.483			
Products	0.132	0.339			
Social impact	0.054	0.227			
<i>Event characteristics</i>					
Source general media	0.122	0.327			
Cases last 5 years	1.764	1.650	0.000	1.000	5.000
GW severity score	0.657	0.277	0.063	0.750	1.000
GW materiality	0.071	0.257			

Notes: This table reports summary statistics on the variables for the full sample. The data is based on 296 company-event observations. CAR denotes cumulative abnormal returns, while [0, 10], [0, 20], [0, 40] and [0, 60] define the event windows, i.e., 11, 21, 41, and 61 trading days after a greenwashing allegation, respectively. The *GW severity score* determines the severity of greenwashing cases based on human judgment, while *GW materiality* captures financial materiality (see Table A.3 for variable definitions). Min, Median, and Max are omitted for binary variables.

Our approach differs from prior studies that rely on binary ESG controversy flags or proprietary incident tagging. By combining manual case identification, human-coded severity scores, and rigorous filtering criteria, we construct a greenwashing dataset with greater transparency and granularity. This enables a more precise analysis of how investors respond to greenwashing events of varying severity and financial materiality.

We apply an event study methodology commonly used in the financial literature (Flammer, 2013; Krüger, 2015; MacKinlay, 1997). We use daily adjusted stock prices from LSEG for companies and the STOXX Europe 600 index to calculate returns. We estimate expected returns based on the Fama-French five-factor model over the 100 trading days preceding the event. Using these expected returns, we calculate abnormal returns (AR) for each company by subtracting the expected returns from the actual returns. We then obtain cumulative abnormal returns (CAR) by summing the ARs over different event windows. We calculate CARs for event windows of up to 61 trading days following the initial disclosure of a greenwashing allegation. For detailed analysis, we focus on shorter windows commonly used in ESG-related event studies. Specifically, we use a [0,10] day window (11 trading days) to capture immediate stock price reactions, while allowing for potential delayed market reactions (e.g., Krüger, 2015). Additionally, we follow Flammer (2013) and use a [0,20] day window (21 trading days) to test whether the market reaction persists or evolves over a longer period.

We collect control variables primarily following Krüger (2015), with data sourced from LSEG. Table A.3 reports the definitions of the variables. *Market value* and *current ratio* are log-transformed to mitigate skewness. *Smaller size (bottom 5%)* is a binary indicator equal to 1 if a company's total assets are below 5 billion EUR (approximately equal to the 5% percentile of total assets), and 0 otherwise. For greenwashing (GW) allegations, we distinguish between two dimensions: the *GW severity score*, a continuous measure (0 to 1) based on human assessments of case severity, and *GW materiality*, a binary variable that captures financial materiality using keyword-based text analysis as a proxy.

Table 1 reports the descriptive statistics for the 296 company-event observations. The mean CAR is slightly positive over the 11- and 21-day event windows, while the 41-day window yields an average close to zero. Extending the horizon to 61 trading days produces a slightly negative but still small average CAR. Across all windows, the substantial variation in CARs indicates that,

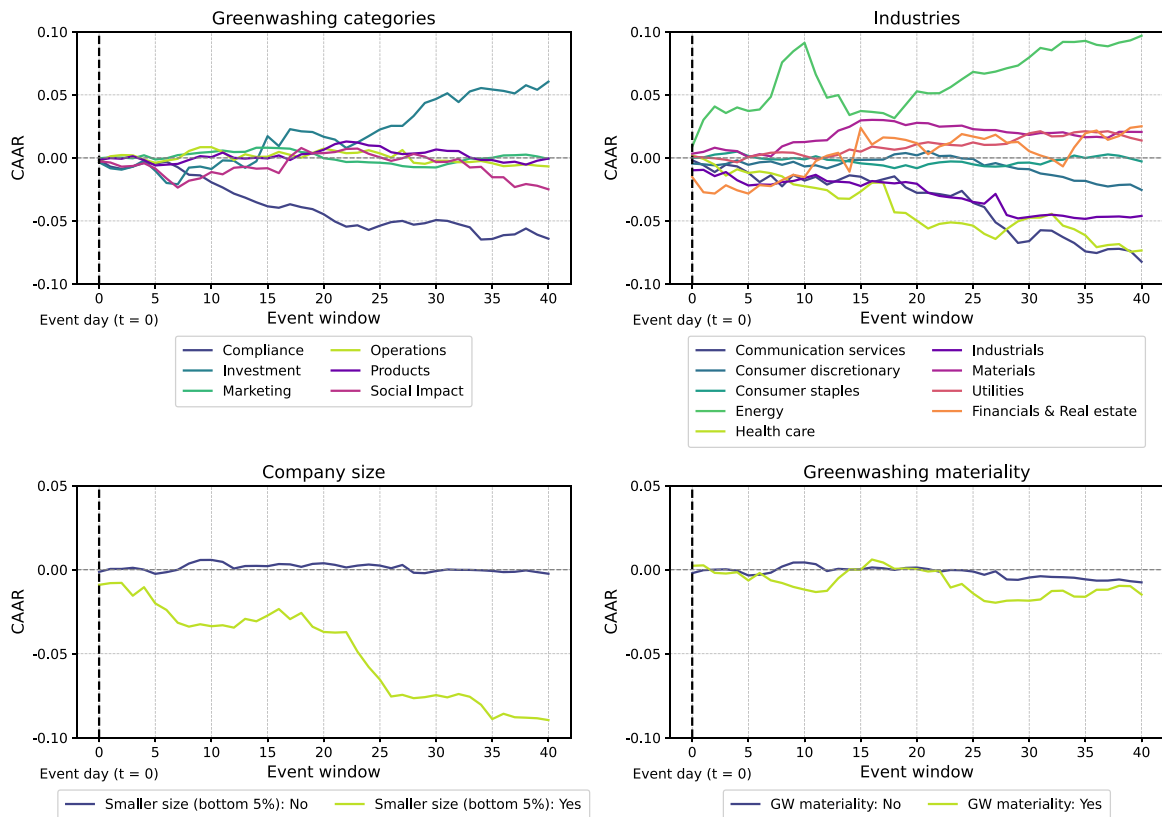


Fig. 1. Cumulative average abnormal returns (CAAR) over the [0,40] event window by greenwashing categories, industries, company size, and greenwashing materiality, based on 296 greenwashing events. CAARs are computed starting from the event date (i.e., day zero), which is marked by the dashed vertical line. *Smaller size (bottom 5%)* is a binary variable equal to 1 if the company's total assets are below 5 billion EUR, and *GW materiality* captures financial materiality (see Table A.3 for variable definitions).

on average, greenwashing allegations do not lead to systematic negative stock market reactions for the full sample. The sample companies exhibit a wide range of market values. Based on total assets, in about 7% of the observations companies are classified as *smaller size (bottom 5%)*, as multiple cases per company are included in the sample. *ESG scores* are relatively high on average (0.76), but the sample also includes companies with comparatively low *ESG scores*, ensuring variation in sustainability ratings. Industries are broadly distributed, with consumer-related sectors (*Consumer staples* and *Consumer discretionary*) prominently represented. In terms of event characteristics, compliance-related and operations-related greenwashing allegations are the most common. Companies faced on average 1.8 different greenwashing cases in the five years prior to the event. The average *GW severity score* is 0.66, indicating moderate to high severity cases overall, while financial materiality (*GW materiality*) is identified in approximately 7% of the observations.

Fig. 1 illustrates the average market reactions to greenwashing allegations by plotting cumulative average abnormal returns (CAAR) over a 40-day event window. The CAARs are disaggregated across the most significant company-, industry-, and event-level characteristics associated with greenwashing allegations. Smaller companies show negative market reactions peaking around day 25, while companies operating within the industries *Industrials*, *Health care*, and *Communication services* exhibit consistently negative trajectories. Compliance-related cases face negative market reactions, particularly within the first 20 days, whereas *GW materiality* does not exhibit systematically more negative CAARs compared to non-material cases.

3. Results

To examine heterogeneity in stock market reactions to greenwashing allegations, we estimate OLS regression models using CAR as the dependent variable and including company- and event-specific characteristics as explanatory variables, following the approach of Flammer (2013) and Krüger (2015).

Table 2 presents results for the [0,10] event window, while Table 3 presents the results for the [0,20] event window. In both tables, Models 1–3 are estimated on the full sample with industry fixed effects, while Models 4–7 focus on the consumer and non-consumer industry subsamples. This distinction allows us to capture industry-level differences, which is relevant because industries with stricter regulatory oversight and greater consumer environmental awareness tend to exhibit different market sensitivities

Table 2

CAR regressions on company and event characteristics – event window [0,10].

	Full sample			Subsample: Industry			
	(1)	(2)	(3)	Consumer		Non-consumer	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
<i>Company characteristics</i>							
Market value	−0.008 (0.006)	−0.009 (0.006)	−0.008 (0.007)	−0.008 (0.006)	−0.007 (0.006)	−0.013 (0.013)	−0.013 (0.013)
Smaller size (bottom 5%)	−0.048** (0.022)	−0.048** (0.022)	−0.048** (0.023)	−0.053** (0.023)	−0.056** (0.022)	−0.037 (0.031)	−0.037 (0.032)
ESG score	0.299 (0.297)	0.256 (0.329)	0.264 (0.332)	−0.124 (0.503)	0.019 (0.489)	0.284 (0.446)	0.285 (0.440)
ESG score × ESG score	−0.231 (0.212)	−0.200 (0.237)	−0.210 (0.241)	0.093 (0.321)	−0.018 (0.311)	−0.162 (0.368)	−0.162 (0.367)
Current ratio	0.012 (0.017)	0.011 (0.017)	0.010 (0.017)	0.022* (0.013)	0.021 (0.013)	0.008 (0.025)	0.008 (0.026)
Leverage	0.101 (0.105)	0.101 (0.108)	0.099 (0.109)	0.005 (0.077)	−0.003 (0.078)	0.030 (0.089)	0.031 (0.090)
<i>Greenwashing categories</i>							
Compliance	−0.040** (0.018)	−0.037** (0.018)	−0.038** (0.018)	−0.002 (0.014)	0.001 (0.014)	−0.047* (0.025)	−0.047* (0.025)
Investment	−0.013 (0.017)	−0.012 (0.016)	−0.012 (0.016)	−0.026* (0.014)	−0.027* (0.014)	−0.041 (0.039)	−0.041 (0.039)
Marketing	−0.009 (0.014)	−0.008 (0.014)	−0.008 (0.014)	0.017 (0.011)	0.015 (0.011)	−0.021 (0.021)	−0.021 (0.021)
Products	0.001 (0.013)	0.000 (0.013)	0.001 (0.013)	0.006 (0.016)	0.007 (0.016)	−0.022 (0.024)	−0.022 (0.024)
Social impact	−0.011 (0.015)	−0.012 (0.015)	−0.009 (0.016)	−0.061*** (0.017)	−0.059*** (0.018)	−0.036 (0.026)	−0.036 (0.029)
<i>Event characteristics</i>							
Source general media	−0.026** (0.013)	−0.027** (0.013)	−0.028** (0.013)	−0.006 (0.011)	−0.006 (0.012)	−0.029* (0.016)	−0.029* (0.016)
Cases last 5 years	−0.000 (0.004)	0.000 (0.004)	0.000 (0.004)	0.007* (0.004)	0.006 (0.004)	0.000 (0.005)	0.000 (0.005)
GW severity score		−0.022 (0.032)	−0.021 (0.033)	0.010 (0.020)	0.016 (0.020)	−0.028 (0.046)	−0.028 (0.046)
GW materiality		−0.004 (0.013)	−0.092 (0.092)	−0.042** (0.016)	−0.295*** (0.109)	−0.009 (0.018)	−0.002 (0.119)
GW materiality × ESG score			0.113 (0.115)		0.311** (0.130)		−0.008 (0.158)
Constant	−0.072 (0.099)	−0.042 (0.110)	−0.043 (0.111)	0.099 (0.160)	0.048 (0.153)	0.043 (0.192)	0.043 (0.188)
Industry	Yes	Yes	Yes	No	No	No	No
N	296	296	296	105	105	191	191
R ²	0.128	0.132	0.132	0.242	0.268	0.054	0.054

Notes: This table presents the results of OLS regressions where the dependent variable is the cumulative abnormal return (CAR), calculated over the [0,10] event window. Models 1–3 use the full sample, while Models 4–5 and 6–7 are estimated separately for consumer and non-consumer industry subsamples, respectively. Consumer industries include Consumer discretionary and Consumer staples. Event-specific variables determine the type of the greenwashing cases, with Operations as the reference category. Robust standard errors are reported in parentheses.

*** Indicate statistical significance at the 1% level.

** Indicate statistical significance at the 5% level.

* Indicate statistical significance at the 10% level.

Table 3

CAR regressions on company and event characteristics – event window [0,20].

	Full sample			Subsample: Industry			
	(1)	(2)	(3)	Consumer		Non-consumer	
				(4)	(5)	(6)	(7)
<i>Company characteristics</i>							
Market value	−0.002 (0.008)	−0.002 (0.008)	−0.001 (0.008)	−0.007 (0.008)	−0.005 (0.008)	−0.004 (0.015)	−0.003 (0.015)
Smaller size (bottom 5%)	−0.064* (0.035)	−0.063* (0.036)	−0.065* (0.037)	−0.067 (0.042)	−0.070 (0.043)	−0.026 (0.044)	−0.030 (0.045)
ESG score	0.632* (0.364)	0.609 (0.377)	0.634* (0.376)	−0.144 (0.799)	0.034 (0.758)	1.174*** (0.407)	1.146*** (0.409)
ESG score × ESG score	−0.507** (0.258)	−0.492* (0.270)	−0.528* (0.270)	0.096 (0.521)	−0.042 (0.492)	−0.874*** (0.296)	−0.866*** (0.296)
Current ratio	−0.001 (0.021)	−0.001 (0.021)	−0.004 (0.021)	0.028 (0.024)	0.028 (0.024)	0.009 (0.032)	0.004 (0.032)
Leverage	0.035 (0.096)	0.038 (0.096)	0.032 (0.096)	0.021 (0.112)	0.010 (0.116)	−0.042 (0.069)	−0.046 (0.070)
<i>Greenwashing categories</i>							
Compliance	−0.062** (0.028)	−0.063** (0.027)	−0.064** (0.027)	−0.057* (0.030)	−0.053* (0.030)	−0.049 (0.037)	−0.051 (0.038)
Investment	0.021 (0.033)	0.022 (0.033)	0.023 (0.034)	−0.034 (0.025)	−0.035 (0.025)	0.015 (0.047)	0.016 (0.048)
Marketing	−0.012 (0.016)	−0.012 (0.016)	−0.013 (0.016)	0.001 (0.020)	−0.001 (0.020)	−0.019 (0.022)	−0.020 (0.022)
Products	0.008 (0.016)	0.008 (0.016)	0.008 (0.016)	0.003 (0.022)	0.005 (0.022)	−0.012 (0.022)	−0.012 (0.022)
Social impact	0.004 (0.025)	0.004 (0.025)	0.013 (0.025)	−0.038** (0.017)	−0.036** (0.017)	−0.022 (0.034)	−0.014 (0.034)
<i>Event characteristics</i>							
Source general media	−0.014 (0.014)	−0.015 (0.014)	−0.017 (0.014)	−0.003 (0.017)	−0.004 (0.017)	−0.023 (0.019)	−0.024 (0.019)
Cases last 5 years	−0.001 (0.005)	−0.001 (0.005)	−0.001 (0.005)	0.011* (0.006)	0.010* (0.006)	−0.003 (0.006)	−0.003 (0.006)
GW severity score		−0.009 (0.029)	−0.006 (0.029)	0.007 (0.037)	0.015 (0.036)	−0.005 (0.041)	−0.005 (0.041)
GW materiality		0.007 (0.022)	−0.283** (0.119)	−0.008 (0.038)	−0.323 (0.284)	0.002 (0.026)	−0.214* (0.126)
GW materiality × ESG score			0.372** (0.152)		0.388 (0.335)		0.284 (0.175)
Constant	−0.188 (0.131)	−0.177 (0.134)	−0.181 (0.133)	0.092 (0.275)	0.029 (0.260)	−0.279 (0.174)	−0.265 (0.175)
Industry	Yes	Yes	Yes	No	No	No	No
N	296	296	296	105	105	191	191
R ²	0.087	0.087	0.094	0.126	0.139	0.055	0.058

Notes: This table presents the results of OLS regressions where the dependent variable is the cumulative abnormal return (CAR), calculated over the [0,20] event window. Models 1–3 use the full sample, while Models 4–5 and 6–7 are estimated separately for consumer and non-consumer industry subsamples, respectively. Consumer industries include Consumer discretionary and Consumer staples. Event-specific variables determine the type of the greenwashing cases, with Operations as the reference category. Robust standard errors are reported in parentheses.

*** Indicate statistical significance at the 1% level.

** Indicate statistical significance at the 5% level.

* Indicate statistical significance at the 10% level.

to greenwashing (Bottega et al., 2024; Ruiz-Blanco et al., 2022). Model 1 in each table serves as the baseline, excluding the greenwashing assessment variables. Models 2 and 3 include *GW severity score* and *GW materiality* to assess their incremental effects. Models 3, 5, and 7 also introduce interaction terms between *GW materiality* and *ESG score* to capture conditional effects. Both linear and quadratic terms of *ESG score* are included in all models to account for potential nonlinear relationships.

3.1. Impact of company size and visibility

Across both event windows, the binary variable *smaller size (bottom 5%)* is consistently and significantly negatively associated with CARs. Specifically, companies classified as small experience average losses of about 5–6 percentage points relative to larger companies across all full-sample models (Models 1–3). In contrast, the continuous measure *market value* (log market capitalization) shows no significant relationship with CARs, suggesting that stock market reactions are not primarily driven by company visibility or investor attention. Subsample results indicate that the negative association between *smaller size (bottom 5%)* and CARs holds in consumer-facing industries (Table 2, Models 4–5).

3.2. Event characteristics and moderating factors

Compliance-related allegations are consistently linked to negative market reactions over both event windows, indicating investor sensitivity to cases involving breaches of formal rules or legal standards. In consumer industries, *social impact* cases trigger negative market reactions.

Media visibility also plays a role. Allegations reported by the *general media* are associated with significantly more negative CARs in the full sample. This effect is concentrated in non-consumer industries and in the immediate aftermath of disclosure (Table 2, Models 1–3 and 6–7).

The *GW severity score* shows no systematic association with CARs. By contrast, *GW materiality* emerges as a central determinant. It is significantly negatively related to CARs in consumer industries in the [0,10] window (Table 2, Models 4–5). In the [0,20] window (Table 3), the relation is significantly negative in the full sample (Model 3) and the non-consumer subsample (Model 7). Moreover, the interaction term *GW materiality* $\times$ *ESG score* shows a positive and significant relation to CARs in consumer industries over the [0,10] window, which extends to the full sample in the [0,20] window. This pattern is consistent with a buffering role of ESG reputation. In addition, a U-shaped effect of *ESG score* emerges in non-consumer industries in the [0,20] window, where moderate ESG levels are associated with the mitigation of negative market reactions (Table 3, Models 6–7).

Finally, the variable *cases last 5 years* shows a positive association with CARs in consumer industries, with marginal effects in the [0,10] window and slightly stronger effects in the [0,20] window. This suggests that repeated exposure to greenwashing reduces informational surprise and weakens market reactions over time.

3.3. Robustness checks

We first conduct a placebo test by randomly reassigning event dates within the 2018–2023 sample period, while ensuring valid estimation and event windows for each observation. The resulting CAAR trajectories (Fig. A.1) fluctuate around zero or are slightly positive, confirming that our findings are not driven by random market fluctuations or methodological artifacts. Using the placebo dataset, we also re-estimate the same regression models as in our main analysis. The untabulated results show no systematic relationships between company or event characteristics and abnormal returns, further supporting the robustness of our findings.

Second, we examine whether temporal and institutional contexts shape market reactions to greenwashing. Using the [0,10] event window,³ we interact our main explanatory variables with a dummy variable for EU headquarters and with a dummy for the *pre-2022* period. The EU interaction models (Table A.4) indicate limited heterogeneity overall, but two patterns emerge. The buffering effect of *ESG scores* in financially material cases on CARs is observed for EU-based companies, particularly in consumer-facing industries. Conversely, the negative effect of *smaller size (bottom 5%)* on CARs is observed among non-EU companies in the non-consumer subsample. The temporal heterogeneity test (Table A.5) shows that the *pre-2022* dummy has a negative and statistically significant coefficient at the 10% level in full-sample models. This indicates that negative market reactions were stronger in earlier years. More importantly, the interaction of *ESG scores* with *pre-2022* yields a positive coefficient and its squared term a negative coefficient, both statistically significant at the 10% level. This suggests that the buffering effect of ESG performance has strengthened after 2021. The effect is particularly visible in the consumer subsample.

Finally, we test the sensitivity of our results to alternative event windows. While our main analysis focuses on [0,10] and [0,20], we extend the horizon to [0,40] and [0,60]. The untabulated results suggest that the significance of the effects on CARs diminishes over longer windows, which supports the interpretation that market reactions to greenwashing allegations are concentrated in the short term.

³ The results for the [0,20] window are consistent and do not reveal any noteworthy additional effects.

4. Discussion

Our results are consistent with two main theoretical mechanisms: (1) a financial channel rooted in information asymmetry, where investors update expectations about future cash flows in light of greenwashing allegations (Akerlof, 1970; Healy and Palepu, 2001; Krüger, 2015; Walker and Wan, 2012), and (2) an ethical/reputational channel linked to legitimacy theory, where perceived hypocrisy or deception leads to reputational damage and stakeholder sanctioning (Suchman, 1995; Ashforth and Gibbs, 1990; Lyon and Montgomery, 2015; Cho et al., 2012; Flammer, 2013).

Evidence for the financial channel is visible in several findings. The consistent negative effect of *smaller size* (bottom 5%) suggests that small companies face greater valuation losses due to limited financial and organizational resources to absorb ESG crises. This aligns with the view that reputational slack buffers larger companies against investor backlash (Flammer, 2013). The absence of a significant effect for the continuous variable, *market value*, indicates that investor attention alone cannot explain market reactions. Rather, the structural vulnerability of small companies may explain the observed effect.

The negative market reaction to *compliance*-related cases also fits the information asymmetry channel. Investors appear to price in heightened expectations of litigation, fines, or regulatory sanctions when allegations involve legal or regulatory breaches. Similarly, the more negative CARs observed for financially material cases reflect investor concern over ESG misconduct that has direct implications for future cash flows. These patterns align with the view that greenwashing is perceived by investors as a financial risk.

Several results highlight the importance of the legitimacy channel. Negative CARs in consumer-facing industries suggest that reputational risks are significant in highly visible sectors, where stakeholder scrutiny and moral outrage tend to be intense (Jo and Na, 2012; Lyon and Montgomery, 2015). Within these industries, allegations related to *social impact* activities trigger legitimacy shocks. This is consistent with evidence that negative CSR events touching core stakeholder concerns such as human rights violations, labor exploitation, and environmental harm elicit reputational penalties and negative stock market reactions (e.g., Krüger, 2015).

Moreover, we find that companies with higher ESG reputations are partially insulated from legitimacy shocks in financially material cases, as shown by the positive and significant interaction term *GW materiality* $\times$ *ESG score*. This supports the “reputational insurance” hypothesis, where strong ESG performance preserves stakeholder trust during controversies (Godfrey et al., 2009; Flammer, 2013). Furthermore, the buffering effect of *ESG scores* strengthens after 2021, which is consistent with the rising awareness of ESG performance, as well as the increased scrutiny of greenwashing by investors and stakeholders. We also find that the moderating role of *ESG scores* is observed for EU-based companies, particularly those in consumer-facing industries. This reflects the influence of stricter regulatory environments and higher normative expectations.

Finally, the positive effect of *cases last 5 years* in consumer industries may reflect legitimacy dynamics. Repeated allegations reduce informational surprise, gradually desensitizing investors and lowering the shock value of new events.

5. Conclusion

This study provides novel evidence on stock market reactions to greenwashing allegations for a comprehensive sample of European companies. While average CARs are close to zero, we find strong heterogeneity: smaller companies and financially material cases are associated with significant negative market reactions. However, ESG reputation can mitigate these reactions under certain conditions. Overall, market reactions to greenwashing appear highly context-dependent, shaped by company characteristics, case features, and the broader institutional environment.

At the same time, our analysis has limitations. Despite a structured rubric and multiple independent raters, our severity variable is based on human coding and may entail some degree of subjectivity. Future work could complement this approach with automated text analysis (e.g., NLP models) and cross-validation using third-party ESG controversy scores. Furthermore, we do not empirically disentangle the theoretical mechanisms underlying investor reactions. Additionally, we do not incorporate company responses to allegations, which can vary considerably in terms of timing and form. Addressing these aspects in future studies would further enhance the understanding of how financial markets respond to greenwashing.

CRedit authorship contribution statement

Gregor Dorfleitner: Writing – original draft, Supervision, Methodology, Conceptualization, Writing – review & editing. **Jens Eckberg:** Writing – original draft, Validation, Methodology, Investigation, Formal analysis, Data curation, Conceptualization, Writing – review & editing. **Sebastian Utz:** Writing – original draft, Supervision, Methodology, Investigation, Conceptualization, Writing – review & editing. **Teresa Brehm:** Formal analysis, Data curation, Conceptualization.

Appendix

See Tables A.1–A.5 and Fig. A.1.

Data availability

The authors do not have permission to share data.

Table A.1

Framework for assessing greenwashing information sources.

Description	Action
Information source provides a new greenwashing case	Assessment in the year of the information source
Greenwashing case of information source is already known from an earlier information source and does not provide new information	Drop information source
Greenwashing case of information source is already known from an earlier information source, but it provides new information	Assessment in the year of the information source
Numerous information sources indicate a pattern of repetitive greenwashing behavior associated with the same accusations/incidents	Assessments of repeated greenwashing behavior across all years, using interpolation where no information source exists between records from different years documenting the same case
Scientific papers and reports addressing the greenwashing behavior of specific companies	Assessments in the publication year of the information source
Collective reports covering multiple companies and multi-year greenwashing behavior	Assessments in the publication year of the information source
Information source accuses parent company and subsidiary	Assessment only for both companies if the greenwashing case can be clearly linked to both companies
Information source accuses sustainable funds of greenwashing for their holdings in companies with questionable environmental practices	Drop information source as it accuses the funds, not the company
Information sources accuse companies of social or governance misconduct	Drop information source
Information source does not directly reference the company	Drop information source
Information sources that cannot be translated into English (e.g., figures)	Drop information source

Notes: This table describes the framework for assessing manually collected information sources relating to greenwashing cases. The framework was initially developed in [Kathan et al. \(2025\)](#).

Table A.2

Assessment of greenwashing severity.

Rating	Assessment	Description
No greenwashing	0.00	The company demonstrates genuine sustainability practices or is a true/silent brown company
Light greenwashing	0.25	The company makes minor claims of sustainability but struggles to meet all stakeholder expectations
Medium greenwashing	0.50	There are vague sustainability claims accompanied by generic accusations of misleading practices
Moderate greenwashing	0.75	Some accusations of greenwashing are present, but they are not fully substantiated; practices may be misleading
Greenwashing	1.00	The company engages in deceptive practices, failing to fulfill sustainability commitments, often confirmed by NGOs

Notes: This table presents the classification framework used to assess the severity of greenwashing cases. Each case is independently rated by four researchers based on standardized criteria. The final *GW severity score* is computed as the average of these four human assessments. The framework was initially developed in [Kathan et al. \(2025\)](#).

Table A.3
Description of variables.

Category	Variable	Description
<i>Company characteristics</i>	Market value	Logarithmic market value of a company's stock expressed in millions of EUR, calculated by multiplying the number of shares by the stock price.
	Smaller size (bottom 5%)	Binary variable equal to 1 if the company's total assets are below 5 billion EUR; 0 otherwise.
	ESG score	LSEG's environmental, social and governance score divided by 100.
	Current ratio	Logarithmic liquidity ratio indicating short-term solvency using current assets vs. liabilities.
	Leverage	Total liabilities of the company divided by total assets.
<i>Industries</i>	Consumer discretionary	Companies offering non-essential goods and services like retail, travel, and entertainment.
	Consumer staples	Companies producing essential goods such as food, beverages, and household products.
	Energy	Companies involved in oil, gas, and renewable energy production and distribution.
	Industrials	Companies in manufacturing, aerospace, transportation, and infrastructure.
	Materials	Companies engaged in mining, chemicals, construction materials, and packaging.
	Utilities	Companies providing essential services like electricity, water, and natural gas.
<i>Greenwashing categories</i>	Others	Companies in the communications services, healthcare, financial, and real estate industries.
	Compliance	Greenwashing cases related to legal compliance and regulatory issues, including misleading claims about meeting environmental standards.
	Investment	Greenwashing cases related to financial investments, green bonds, and ESG funds that mislead on their sustainability impact.
	Marketing	Greenwashing cases related to misleading advertisements or branding with false environmental claims.
	Operations	Greenwashing cases related to production processes, supply chains, or business practices.
	Products	Greenwashing cases related to product sustainability, including misleading claims about environmental benefits and material sourcing.
<i>Event characteristics</i>	Social impact	Greenwashing cases related to corporate social responsibility, the effects on local communities, including human rights violations, labor exploitation, and environmental harm.
	Source general media	Binary variable equal to 1 if the greenwashing case was first reported by a general news media outlet (e.g., Reuters, BBC, The Guardian, Handelsblatt); 0 otherwise.
	Cases last 5 years	Count variable measuring the number of distinct years in which the company faced at least one greenwashing allegation in the five years prior to the focal event.
	GW severity score	Mean severity score of individual human assessments of greenwashing cases, measured on a continuous scale from 0 (no greenwashing) to 1 (most severe greenwashing).
	GW materiality	Binary variable equal to 1 if the case description contains keywords related to financial materiality (deceptive, fined, harmful, lawsuit, sued); 0 otherwise.

Notes: This table provides definitions and measurements of variables.

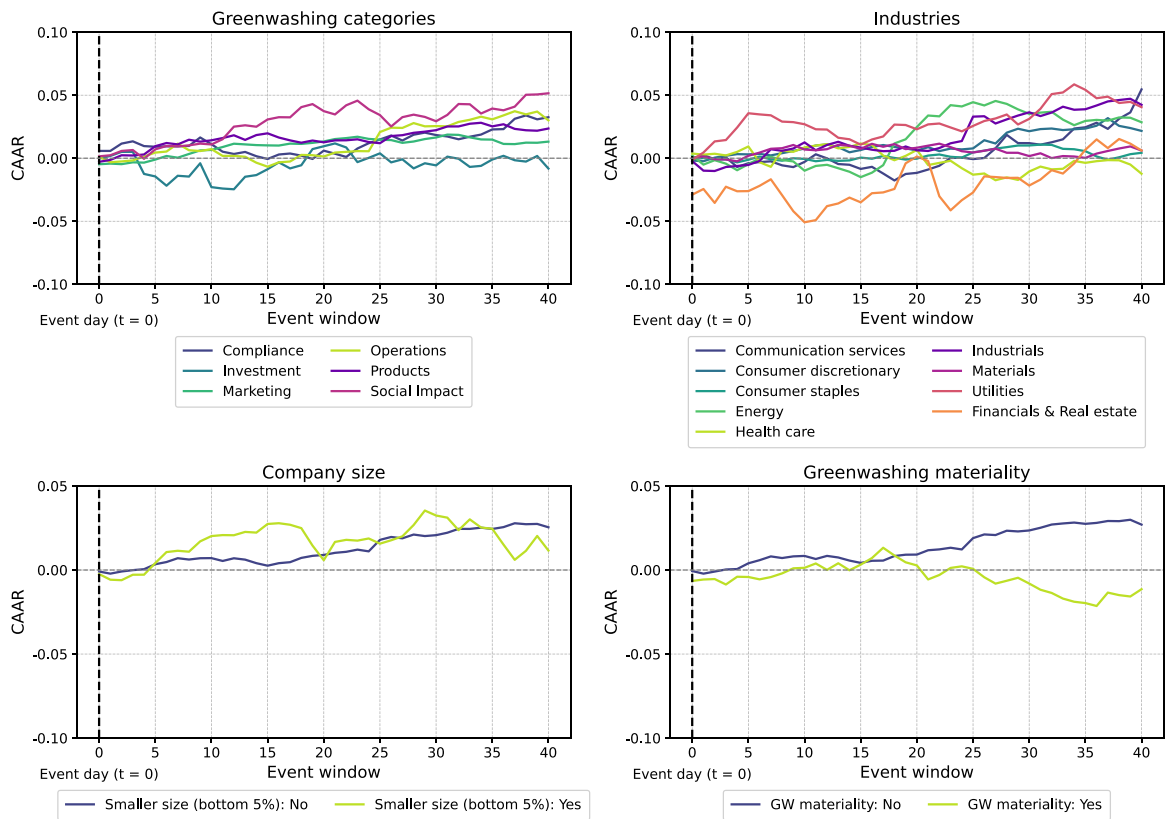


Fig. A.1. Placebo test: Cumulative average abnormal returns (CAAR) over the [0,40] event window by greenwashing categories, industries, company size, and greenwashing materiality. For each greenwashing case, the actual disclosure date is replaced with a randomly assigned trading day within the 2018–2023 sample period, ensuring valid estimation and event windows. CAARs are computed starting from the placebo event date (i.e., day zero), which is marked by the dashed vertical line. *Smaller size (bottom 5%)* is a binary variable equal to 1 if the company's total assets are below 5 billion EUR, and *GW materiality* captures financial materiality (see Table A.3 for variable definitions).

Table A.4

Institutional heterogeneity analysis: CAR regressions on company and event characteristics – event window [0,10].

	Full sample			Subsample: Industry			
	(1)	(2)	(3)	Consumer		Non-consumer	
				(4)	(5)	(6)	(7)
<i>Company characteristics</i>							
EU	0.287 (0.190)	0.328 (0.204)	0.341* (0.204)	0.345 (0.540)	0.173 (0.484)	0.358 (0.292)	0.366 (0.283)
Smaller size (bottom 5%)	−0.080*** (0.025)	−0.082*** (0.027)	−0.082*** (0.027)	−0.085*** (0.031)	−0.088*** (0.031)	−0.107*** (0.034)	−0.108*** (0.034)
Smaller size (bottom 5%) × EU	0.058 (0.040)	0.063 (0.041)	0.062 (0.041)	0.040 (0.055)	0.038 (0.053)	0.153*** (0.059)	0.152** (0.060)
ESG score	0.564* (0.338)	0.579* (0.333)	0.592* (0.339)	−0.405 (0.382)	−0.418 (0.398)	0.484 (0.391)	0.481 (0.393)
ESG score × ESG score	−0.412 (0.255)	−0.423* (0.251)	−0.434* (0.258)	0.317 (0.266)	0.331 (0.279)	−0.336 (0.318)	−0.334 (0.321)
ESG score × EU	−0.843 (0.557)	−0.981* (0.592)	−1.007* (0.596)	−0.751 (1.409)	−0.227 (1.259)	−1.069 (0.881)	−1.086 (0.865)
ESG score × ESG score × EU	0.580 (0.403)	0.682 (0.429)	0.693 (0.434)	0.392 (0.909)	0.012 (0.810)	0.763 (0.653)	0.772 (0.647)

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Table A.4 (continued).

	Full sample			Subsample: Industry			
	(1)	(2)	(3)	Consumer		Non-consumer	
				(4)	(5)	(6)	(7)
<i>Greenwashing categories</i>							
Compliance	−0.058* (0.030)	−0.063* (0.033)	−0.063* (0.033)	−0.017 (0.027)	−0.016 (0.027)	−0.070 (0.046)	−0.070 (0.047)
Compliance × EU	0.018 (0.032)	0.028 (0.033)	0.026 (0.034)	0.013 (0.032)	0.022 (0.030)	0.017 (0.052)	0.016 (0.053)
Investment	−0.015 (0.020)	−0.014 (0.018)	−0.013 (0.019)	−0.029* (0.016)	−0.033** (0.016)	−0.048 (0.046)	−0.047 (0.047)
Marketing	−0.007 (0.014)	−0.006 (0.014)	−0.006 (0.014)	0.014 (0.011)	0.011 (0.011)	−0.017 (0.020)	−0.017 (0.020)
Products	−0.000 (0.013)	−0.000 (0.013)	0.000 (0.013)	0.003 (0.015)	0.001 (0.015)	−0.024 (0.024)	−0.024 (0.025)
Social impact	−0.011 (0.015)	−0.012 (0.015)	−0.008 (0.016)	−0.062*** (0.014)	−0.063*** (0.013)	−0.035 (0.025)	−0.033 (0.028)
<i>Event characteristics</i>							
Source general media	−0.028** (0.013)	−0.029** (0.014)	−0.030** (0.014)	−0.005 (0.012)	−0.001 (0.012)	−0.027 (0.018)	−0.028 (0.018)
Cases last 5 years	−0.001 (0.006)	−0.000 (0.007)	−0.000 (0.007)	0.009* (0.005)	0.009* (0.005)	0.007 (0.009)	0.007 (0.009)
Cases last 5 years × EU	0.000 (0.008)	−0.000 (0.009)	−0.000 (0.009)	−0.003 (0.006)	−0.004 (0.006)	−0.016 (0.013)	−0.016 (0.013)
GW severity score		−0.029 (0.032)	−0.028 (0.032)	0.010 (0.022)	0.019 (0.022)	−0.043 (0.048)	−0.043 (0.049)
GW materiality		−0.018 (0.024)	−0.057 (0.144)	−0.062*** (0.020)	0.006 (0.084)	−0.019 (0.026)	−0.011 (0.156)
GW materiality × EU		0.018 (0.030)	−0.064 (0.162)	0.022 (0.027)	−0.502*** (0.173)	0.021 (0.037)	−0.032 (0.185)
GW materiality × ESG score			0.050 (0.178)		−0.086 (0.104)		−0.009 (0.194)
GW materiality × ESG score × EU			0.105 (0.206)		0.639*** (0.208)		0.070 (0.249)
Constant	−0.151 (0.104)	−0.133 (0.105)	−0.135 (0.106)	0.195 (0.134)	0.217 (0.142)	−0.034 (0.137)	−0.033 (0.136)
Other company characteristic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	No	No	No	No
N	296	296	296	105	105	191	191
R ²	0.138	0.143	0.145	0.280	0.332	0.085	0.085

Notes: This table presents the results of OLS regressions where the dependent variable is the cumulative abnormal return (CAR), calculated over the [0,10] event window. To analyze institutional heterogeneity, we include interaction terms for our main variables of interest, as well as a binary variable, *EU*, which takes the value of 1 if the company is headquartered in the EU and 0 otherwise. Models 1–3 use the full sample, while Models 4–5 and 6–7 are estimated separately for consumer and non-consumer industry subsamples, respectively. Consumer industries include Consumer discretionary and Consumer staples. Event-specific variables determine the type of the greenwashing cases, with Operations as the reference category. Robust standard errors are reported in parentheses.

*** Indicate statistical significance at the 1% level.

** Indicate statistical significance at the 5% level.

* Indicate statistical significance at the 10% level.

Table A.5

Temporal heterogeneity test for CAR regressions on company and event characteristics – event window [0,10].

	Full sample			Subsample: Industry			
	(1)	(2)	(3)	Consumer		Non-consumer	
				(4)	(5)	(6)	(7)
<i>Temporal characteristics</i>							
Pre-2022	−0.322* (0.167)	−0.318* (0.170)	−0.299* (0.172)	−0.411 (0.373)	−0.331 (0.384)	−0.272 (0.214)	−0.274 (0.216)
<i>Company characteristics</i>							
Smaller size (bottom 5%)	−0.054* (0.030)	−0.053* (0.031)	−0.054* (0.031)	−0.058* (0.031)	−0.064** (0.031)	−0.014 (0.062)	−0.014 (0.062)

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Table A.5 (continued).

	Full sample			Subsample: Industry			
	(1)	(2)	(3)	Consumer		Non-consumer	
				(4)	(5)	(6)	(7)
Smaller size (bottom 5%) × pre-2022	0.024 (0.042)	0.020 (0.042)	0.020 (0.042)	0.019 (0.047)	0.022 (0.046)	−0.026 (0.074)	−0.025 (0.074)
ESG score	−0.282 (0.392)	−0.330 (0.427)	−0.259 (0.458)	−0.790 (0.879)	−0.503 (0.885)	−0.240 (0.568)	−0.234 (0.572)
ESG score × ESG score	0.195 (0.289)	0.227 (0.315)	0.171 (0.343)	0.520 (0.555)	0.292 (0.555)	0.225 (0.477)	0.219 (0.481)
ESG score × pre-2022	0.952* (0.501)	0.946* (0.510)	0.884* (0.521)	1.036 (0.976)	0.751 (0.996)	0.844 (0.691)	0.843 (0.695)
ESG score × ESG score × pre-2022	−0.711* (0.377)	−0.706* (0.381)	−0.659* (0.395)	−0.677 (0.626)	−0.447 (0.635)	−0.641 (0.536)	−0.637 (0.540)
<i>Greenwashing categories</i>							
Compliance	−0.046** (0.021)	−0.047** (0.022)	−0.044** (0.022)	−0.005 (0.021)	0.005 (0.020)	−0.065** (0.029)	−0.065** (0.029)
Compliance × pre-2022	0.023 (0.026)	0.025 (0.028)	0.023 (0.028)	0.007 (0.023)	−0.001 (0.022)	0.052 (0.049)	0.052 (0.050)
Investment	−0.010 (0.017)	−0.009 (0.016)	−0.009 (0.016)	−0.022 (0.015)	−0.025 (0.016)	−0.034 (0.035)	−0.034 (0.036)
Marketing	−0.008 (0.014)	−0.007 (0.014)	−0.008 (0.014)	0.018 (0.011)	0.017 (0.011)	−0.019 (0.021)	−0.019 (0.021)
Products	−0.001 (0.014)	−0.000 (0.014)	−0.000 (0.014)	0.008 (0.017)	0.007 (0.017)	−0.023 (0.027)	−0.023 (0.027)
Social impact	−0.009 (0.016)	−0.010 (0.016)	−0.008 (0.016)	−0.058*** (0.018)	−0.059*** (0.018)	−0.035 (0.026)	−0.034 (0.030)
<i>Event characteristics</i>							
Source general media	−0.027** (0.013)	−0.028** (0.013)	−0.028** (0.013)	−0.005 (0.013)	−0.004 (0.013)	−0.036** (0.018)	−0.036** (0.018)
Cases last 5 years	−0.004 (0.007)	−0.003 (0.007)	−0.003 (0.006)	0.004 (0.006)	0.004 (0.006)	−0.002 (0.008)	−0.002 (0.008)
Cases last 5 years × pre-2022	0.005 (0.009)	0.004 (0.009)	0.005 (0.009)	0.007 (0.007)	0.007 (0.007)	0.002 (0.012)	0.002 (0.012)
GW severity score		−0.019 (0.031)	−0.017 (0.032)	0.005 (0.021)	0.013 (0.022)	−0.021 (0.044)	−0.021 (0.044)
GW materiality		0.010 (0.019)	−0.221 (0.181)	−0.041 (0.030)	−0.444*** (0.166)	0.020 (0.030)	−0.291 (0.433)
GW materiality × pre-2022		−0.020 (0.029)	0.181 (0.186)	0.006 (0.031)	0.405* (0.211)	−0.041 (0.046)	0.299 (0.395)
GW materiality × ESG score			0.292 (0.225)		0.498** (0.190)		0.395 (0.562)
GW materiality × ESG score × pre-2022			−0.253 (0.240)		−0.493** (0.247)		−0.435 (0.520)
Constant	0.119 (0.124)	0.146 (0.139)	0.125 (0.144)	0.365 (0.343)	0.295 (0.351)	0.213 (0.236)	0.212 (0.237)
Other company characteristic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	No	No	No	No
N	296	296	296	105	105	191	191
R ²	0.138	0.141	0.142	0.261	0.296	0.061	0.061

Notes: This table presents the results of temporal heterogeneity test OLS regressions where the dependent variable is the cumulative abnormal return (CAR), calculated over the [0,10] event window. To analyze temporal heterogeneity, we include interaction terms for our main variables of interest, as well as a binary variable labeled *pre-2022*, which takes the value of 1 if a greenwashing case was observed between 2018 and 2021, and 0 for later events. Models 1–3 use the full sample, while Models 4–5 and 6–7 are estimated separately for consumer and non-consumer industry subsamples, respectively. Consumer industries include Consumer discretionary and Consumer staples. Event-specific variables determine the type of the greenwashing cases, with Operations as the reference category. Robust standard errors are reported in parentheses.

*** Indicate statistical significance at the 1% level.

** Indicate statistical significance at the 5% level.

* Indicate statistical significance at the 10% level.

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