Greenwashing and market value of firms: An empirical study

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A B S T R A C T

In today's business environment, green or sustainable claims are rising as companies strive to strengthen environmental practices in response to climate change and sustainable development challenges. However, with increasing expectations of sustainable performance, companies encounter mounting financial pressure to adopt more efficient sustainable practices, which may lead some to exploit sustainability efforts for their own gain. Many companies make environmentally friendly assertions to conceal or mask their actual activities—a phenomenon known as greenwashing—which fosters public scepticism about the authenticity of their green messaging. This study employs an event study methodology to examine how the stock market values greenwashing news, drawing on 121 global greenwashing news since the 2015 Paris Agreement. Our findings reveal a negative correlation between greenwashing news and stock market reactions. The market reactions to greenwashing news are more negative for firms with greater ESG performance than for weak ESG performance. Additionally, greenwashing news supported by concrete evidence elicits stronger adverse reactions. Companies operating in the manufacturing industry experience more significant market value losses than those in the service sector. The findings also indicate that the Asia-Pacific market demonstrates particularly strong negative responses to greenwashing news compared to other stock markets. This study contributes to the signalling theory and advances the literature on corporate sustainability practices by providing empirical insights in a global context.

1. Introduction

As consumers and stakeholders increasingly voice concerns regarding the environmental footprints of companies, sustainability and environmental stewardship have emerged as prevalent considerations on boardroom agendas, motivating companies to pursue green product development and commercialisation (de Freitas Netto et al., 2020). Not only that, in today's business landscape, intense business competition also compels companies to address environmental issues and green efforts as an effective means of distinguishing themselves from competitors. Therefore, corporate advertising and marketing frequently feature environmental buzzwords and phrases (Chen and Chang, 2013), such as "environmentally friendly", "eco", "eco-friendly", "sustainable", and "green". This choice of language also extends to annual reporting, elevating the visibility of sustainability and social responsibility (Zhang et al., 2024).

In striving for higher levels of sustainable practices and performance, the pressure on companies intensifies (Ding et al., 2022) and presents opportunities for companies to leverage "sustainable efforts" for strategic advantage. However, companies also resort to improper practices and misleading environmental protection claims (de Freitas Netto et al., 2020; Du, 2015). This phenomenon, known as greenwashing, involves the selective disclosure of environmental actions and efforts by companies (Delmas and Burbano, 2011) or the use of "green" public relations and marketing to fraudulently present corporate products or services as environmentally friendly (Parguel et al., 2011; Siano et al., 2017). Corporate greenwashing results in growing scepticism among the public regarding the authenticity of green or sustainable claims (Kim and Lyon, 2015). In other words, there is a concern that some corporations may attempt to conceal environmental misconduct by projecting an image of environmental friendliness.

Several notable examples shed light on the phenomena of

greenwashing. In April 2019, H&M launched its Conscious collection, asserting that each item was made from sustainably sourced materials. However, H&M faced criticism from the Norwegian Consumer Authority, which accused the company of deceptive marketing and lacking transparency about the sustainability of its "Conscious" collection. Variations in sustainable fibre usage across garments raised doubts about H&M's sustainability claims (Hitti, 2019). Another instance occurred in September 2015 when the US Environmental Protection Agency accused Volkswagen of installing illegal emissions-control software in 482,000 diesel-equipped vehicles sold in the US (Ding et al., 2022). This "defeat device" deliberately underreported nitrogen oxide (NOx) emissions during testing to meet federal standards, as Volkswagen manipulated the system to pass US emissions tests (Topham, 2015). The Volkswagen emission scandal is regarded as a form of new-age greenwashing (Siano et al., 2017); the immediate impact on Volkswagen was the ousting of its CEO and a loss of approximately $17 billion in shareholder value within a week (Jacobs and Singhal, 2020).

Interestingly, H&M and Volkswagen had relatively strong environmental, social and governance (ESG) reputations before their greenwashing scandals. However, they suffered significant negative impacts afterwards, likely due to the considerable gap between the positive image they cultivated through branding and their actual practices. In today's investment environment, investors are also increasingly factoring in ESG performance when making investment decisions. Companies that actively engage in substantive sustainable practices create a positive image of the company and foster trust with stakeholders, thereby gaining a competitive edge. While implementing substantive sustainable practices may incur short-term costs, the long-term impact on performance can be considerable (Wang and Sarkis, 2017; Zhou et al., 2022). Despite this increasing emphasis, some companies use greenwashing to create a misleading perception of their environmental efforts. This deceptive practice has garnered significant attention from industry stakeholders and academic researchers, as it often leads to backlash from stakeholders and severe market reactions, resulting in considerable reputational damage and financial losses.

An increasing body of academic research scrutinises the authenticity and credibility of advertising messages wherein companies claim to adopt green practices through environmental products and services (Chen and Chang, 2013; Parguel et al., 2011). Examples include the examination of greenwashing by automotive manufacturers by Wood et al. (2018), Griffin and Lont (2018) and Jacobs and Singhal (2020). Additionally, the current body of research has provided empirical evidence on financial performance to environmental incidents and violations (Lo et al., 2018; Xu et al., 2016), sustainability risk (Kim et al., 2019), and ESG performance (Capelle-Blancard and Petit, 2019; Zhou et al., 2022). However, limited studies have focused on the relationship between greenwashing, ESG performance, and company market value in global contexts (Lee and Raschke, 2023). Thus, this study aims to examine the stock market reactions to greenwashing news and further investigate the financial impacts of ESG performance. We propose the following research questions (RQs).

RQ1. What is the global stock market reaction to corporate greenwashing news?

RQ2. How do ESG performance, geographic regions, and industry types affect the stock market reaction to corporate greenwashing news?

Relying on signalling theory and its application in operations and supply chain management (Xu et al., 2016; Bouzzine and Lueg, 2020), we developed theoretical arguments about the financial effects of corporate greenwashing where a firm's fraudulent and unethical behaviour on green practices might signal broader business practices of misconduct within the industry to the stakeholders. We leveraged the LexisNexis database to identify 121 events related to greenwashing involving 68 listed sample companies. This study employed the event study technique to analyse stock market reactions around the exposure

to greenwashing. The results underscore a negative correlation between greenwashing news and market reactions, with the results being influenced by the sector and stock market location of the company, as well as ESG performance and the strength of evidence. Hence, this study contributes empirical evidence on how the stock market values corporate greenwashing news, enriching the literature on greenwashing and ESG performance. Moreover, it extends the application scope of signalling theory, particularly in the green and sustainable development literature. This study equips business managers with insights into the financial impact of greenwashing, informing prudent decision-making in sustainable practices. Additionally, it serves as a cautionary reminder to stakeholders to scrutinise news disclosures and assess ESG performance or sustainability reports to understand the company's commitment to sustainable practices.

The remainder of this paper is organised as follows: Section 2 reviews the existing literature and develops the hypothesis. Section 3 introduces the methodology, including data collection and research analysis method. The analysis results are presented in Section 4. Section 5 discusses the results, and Section 6 concludes this study and provides the implications and limitations of the study.

2. Literature review and hypothesis development

2.1. Defining greenwashing

Numerous studies have contributed to defining and characterising greenwashing, with the term first coined by environmentalist Jay Westerveld in 1986 (Pearson, 2010), who describes the hypocrite of hotels that began to encourage guests to reuse towels under the guise of a water-saving strategy, while failing to implement more impactful environmental protection measures. The TerraChoice Group has classified product-level greenwashing into "seven sins," encompassing behaviours such as "sins of hidden trade-offs" (implying that a product is environmentally friendly based on a narrow set of attributes without considering broader environmental concerns) to "sins of fibbing" (making false environmental claims) (TerraChoice, 2010). Delmas and Burbano (2011) explore the external (institutional and market), organisational, and individual drivers of greenwashing, offering recommendations for managers, policymakers, and NGOs to mitigate its prevalence. A systematic literature review by de Freitas Netto et al. (2020) discusses the developments of greenwashing, identifying its main concepts and typologies. According to Siano et al. (2017), greenwashing is defined as symbolic actions that "tend to deflect attention to minor issues or lead to creating 'green talk' through statements aimed at satisfying stakeholder requirements in terms of sustainability but without any concrete action".

Due to its multifaceted nature, greenwashing is characterised by various dimensions, including selective disclosure and decoupling. Selective disclosure refers to the strategic presentation of information, where companies emphasise positive environmental actions and information while withholding or omitting negative aspects of their environmental performance (de Freitas Netto et al., 2020). Decoupling, on the other hand, occurs when there is a disconnect between a company's symbolic commitments to sustainability—such as advertising or corporate sustainability reports—and its actual operational practices. In essence, this strategy allows companies to publicly declare environmental goals while maintaining internal practices that are inconsistent with these commitments. Understanding the multifaceted nature of greenwashing, including selective disclosure and decoupling, is crucial for a comprehensive analysis of corporate green behaviour. Hence, this study integrates these two definitions of greenwashing to capture a more holistic view of corporate environmental practices as reflected in the news. A summary of the definitions of greenwashing is presented in Table 1.

Table 1
Definition of greenwashing.

Author(s)	Definitions and interpretation
The Oxford English Dictionary (2022)	Misleading publicity or propaganda disseminated by an organization, etc., so as to present an environmentally responsible public image; a public image of environmental responsibility promulgated by or for an organization, etc., regarded as being unfounded or intentionally misleading.
Greenwashing as selective disclosure	
Baum (2012)	The act of disseminating disinformation to consumers regarding the environmental practices of a company or the environmental benefits of a product or service.
Delmas and Burbano (2011)	The intersection of two firm behaviours: poor environmental performance and positive communication about environmental performance.
TerraChoice (2010)	The act of misleading consumers regarding the environmental practices of a company (firm-level greenwashing) or the environmental benefits of a product or service (product-level greenwashing).
Greenwashing as decoupling	
Siano et al. (2017)	Greenwashing is related with symbolic actions, "which tend to deflect attention to minor issues or lead to create 'green talk' through statements aimed at satisfying stakeholder requirements in terms of sustainability but without any concrete action".
Walker and Wan (2012)	The gap between "symbolic" and "substantive" corporate social actions (CSA).

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2.2. Signalling theory

According to Connelly et al. (2011), signalling theory is applied to the "asymmetric distribution of information between two parties in which certain underlying characteristics or capabilities of one party are unobservable to the other party." In other words, signalling theory fundamentally pertains to diminishing information asymmetry between two parties; usually, one party has an information advantage over the other. This mechanism comprises the sender, the receiver, the signal, and the signalling environment or context. One party (the sender or signaller) determines whether and how to convey (or signal) the information, while the other party (the receiver or recipient) decides how to interpret the signal and respond. Signalling theory also encompasses various signals that convey information about good or bad news (Spence, 2002).

Signalling theory provides a valuable framework to explore the impact of sustainable practices or disclosures on firm performance across various dimensions, such as environmental violations (Bouzzine and Lueg, 2020) and social sustainability (Thomas et al., 2021). Since company insiders (such as executives and managers) usually have better access to information than other stakeholders (such as investors and suppliers), there is an information asymmetry between company insiders and outsiders. Outsiders may observe additional information (such as press releases) in addition to financial reports as observable signals to analyse and evaluate the company's less visible information (such as sustainable practices) (Wong and Zhang, 2022). Access to this information is crucial for stakeholders, particularly investors, to make informed investment decisions. Research by Dhaliwal et al. (2011) highlights the importance of sustainable disclosures in reducing information asymmetry concerning factors that impact corporate value. Positive, sustainable practices enhance organisational image and reputation and attract socially responsible investors while reducing environmental protection and regulation risks. On the contrary, the media coverage of harmful sustainable practices may send adverse signalling effects on investors, signalling a failure to meet societal expectations and potentially leading to additional social pressure and economic costs.

In this study, we incorporated signalling theory into developing our hypotheses and explored how stock markets respond to signals of corporate greenwashing. Specifically, we used signalling theory as an overarching framework and an event study approach to examine whether and how shareholders respond to corporate greenwashing news. In this dynamic, the media acts as the sender, disseminating reports and news regarding corporate greenwashing (signals). At the same time, investors and stakeholders serve as receivers, receiving this information and evaluating whether the company is involved in or highly suspected of greenwashing. For instance, when a company announces its ambitious environmental goals, this acts as a positive signal to investors about its commitment to sustainability. Nonetheless, if subsequent media reveals inconsistencies between these goals and the company's actual practices (i.e., greenwashing), investors may view this as a negative signal, damaging the company's credibility. Should stakeholders conclude that the company is engaged in greenwashing, it can affect its reputation and image, leading investors to exercise caution or alter their investment decisions. Consequently, this can negatively impact the company's financial performance.

2.3. Greenwashing news and market reaction

In their commitment to environmental conservation, companies ideally aim to adopt sustainable measures and policies as a way to improve their reputation and performance (Kim et al., 2018). However, the dedication to environmental conservation and the execution of environmental policies represent separate concepts. Even though many companies have positive attitudes and actions toward protecting the environment and communities, they do not always comply with laws and standards (Nirino et al., 2021; Winn and Angell, 2000). Due to insufficient self-regulation, environmental offenders may use advertising and marketing to project an environmentally friendly image while wreaking havoc on the environment (King and Lenox, 2000). According to Kruse et al. (2020), any event with comprehensive media coverage would not go unnoticed by investors. The media plays a vital role in shaping corporate governance and market dynamics (Bushee et al., 2010) and capturing investors' attention. Previous research has shown that negative news has a more significant impact than positive news (Capelle-Blancard and Petit, 2019; Krüger, 2015). A company's reputation is considered one of its most important intangible assets. A good reputation enables businesses to charge premium prices, increase profitability, and attract more investors, and vice versa (Axjonow et al., 2018; Liu et al., 2024). Nirino et al. (2021) also indicate that scandals and controversies can decrease trust and damage a company's reputation, negatively impacting its performance. For example, in terms of capital effects, customers may no longer purchase the company's products if a company has a bad reputation, affecting product premiums and investment value (Gatzert, 2015).

As mentioned in Section 2.2, some media outlets act as "watchdogs", exposing companies involved in greenwashing. The company's reputation may suffer from the 'backfire effect' phenomenon when individuals are presented with evidence that contradicts their beliefs (Nyhan and Reifler, 2010; Yoon et al., 2006). In other words, when investors witness a company promoting environmental responsibility but engaging in pollution and subsequently being exposed in the media, they will likely maintain their initial negative perception. This implies that the company's sustainability claims may be perceived as mere attempts to conceal environmental violations. Following the signalling theory (Connelly et al., 2011), greenwashing news passively signals risk to investors of the companies involved, which also triggers a learning and evaluation process among investors who may penalise environmental wrongdoers. Hence, we hypothesise that the market will unfavourably respond to instances of greenwashing exposures.

Hypothesis 1. **(H1):** The stock market reacts negatively to greenwashing news.

Drawing on signalling theory (Connelly et al., 2011), signals help explain and drive different market reactions through multi-dimensional and segmented signals. Segmented signals refer to distinct signal

elements (financial performance and industry characteristics) that affect receivers (such as investors or market participants) when conveyed in different contexts. This study analyses stock market reactions to greenwashing news by considering factors such as ESG performance, geographical regions, and industry types. These factors provide diverse insights into corporate sustainability and governance performance, leading to significantly different market reactions.

The concept of ESG was first introduced by the United Nations in 2004 in the report "Who Cares Wins", building on the recognition of corporate social responsibility (CSR) (Chen et al., 2023). The ESG performance is increasingly being used as an indicator to assess a company's commitment to environmental protection and social responsibility. The impact of ESG performance on corporate value has garnered significant attention in research. ESG practices may have a positive, negative or mixed effects on firm value (Capelle-Blancard and Petit, 2019; McWilliams et al., 2006; Xie et al., 2023), which can be observed both in the short and long term. Specifically, Kim and Lyon (2015) argue that ESG initiatives often lead to increased company costs, which may hinder performance. When companies engage in superficial sustainable efforts solely to present a positive image to stakeholders (Kim et al., 2012), they risk losing credibility over time, and such symbolic practices can increase financial costs without yielding meaningful results. Nevertheless, substantive improvements in ESG performance enhance firm value (Zhou et al., 2022). Active engagement in genuinely sustainable practices portrays a positive corporate image and builds stakeholder trust, offering a competitive advantage. Although these initiatives may appear costly in the short term, they tend to deliver more significant long-term benefits (Wang and Sarkis, 2017).

Several studies have also examined the moderating role of ESG performance in determining the economic impact of sustainable commitments or practices. For example, carbon neutrality commitments reflect corporate environmental responsibilities, enhancing a company's market reputation and facilitating stakeholder support (Xie et al., 2023). However, some companies take environmental commitment as a marketing tool rather than pursuing genuine sustainability efforts, resorting to greenwashing when confronted with sustainability and economic pressures. As a result, the high costs associated with environmental commitments and the risk of being identified as greenwashing by stakeholders can erode investor trust and negatively affect firm value (Delmas and Burbano, 2011). Xie et al. (2023) found that stronger ESG performance mitigates the negative effects of adverse stock market reactions to carbon neutrality commitments. Companies with a more significant commitment to environmental and social practices or better ESG performance are more likely to retain stakeholder trust and experience less severe negative reactions to adverse events due to their prior solid implementation of sustainable initiatives (Nirino et al., 2021). In this context, companies with higher ESG ratings are better positioned to manage reputational risks following adverse incidents, supporting more robust financial performance (Park et al., 2014). In contrast, companies with weaker ESG performance suffer from a damaged reputation for sustainability and governance (Oprean-Stan et al., 2020). When such companies are exposed to greenwashing, the reputational damage is more severe, exacerbating stakeholders' doubts and perceptions of superficial and hypocritical sustainability efforts. This erosion of trust may amplify the market's negative reaction. Therefore, previous research suggests superior ESG performance can alleviate the adverse effects of greenwashing on stock market performance, and so we propose the following hypothesis.

Hypothesis 2. **(H2):** The market reactions to greenwashing news are more negative for firms with weak ESG performance than for greater ESG performance.

Differences exist in regulatory intensity and requirements across different geographies, industries and enterprises. This has been termed institutional distance (Kostova, 1999) and is also evident in greenwashing incidents, where geographic regions and industry types play

significant roles in shaping stock market reactions.

Particularly in emerging markets within the Asia-Pacific region, the relatively underdeveloped regulatory environment results in insufficient or restricted oversight and accountability for corporate environmental and social commitments (Yang et al., 2020). This provides greater space for companies to engage in greenwashing without being easily exposed initially. When greenwashing is eventually exposed, the issue may escalate to a more severe level, leading to heightened disappointment among market participants regarding corporate credibility and sustainability efforts and triggering more pronounced negative reactions in the stock market. In contrast, stricter ESG regulation has generally been established in North American and European markets (Lo and Kwan, 2017), where regulatory frameworks are more mature and companies face greater scrutiny. Investors in these regions expect higher transparency and accountability regarding environmental commitments. Thus, North American and European stakeholders tend to hold companies to higher standards when fulfilling their environmental commitments. Therefore, we anticipate that negative market reactions to greenwashing news are more pronounced for Asia-Pacific corporations and manufacturing firms, and propose the following hypothesis.

Hypothesis 3. **(H3):** The market reactions to greenwashing news are more negative for Asian-Pacific firms than North American and European firms.

Furthermore, manufacturing companies tend to have a significantly larger environmental footprint than service-sector firms, particularly in chemicals, energy, and heavy industry sectors. In 2022, the industrial sector was directly responsible for emitting 9.0 Gt of CO_2, accounting for a quarter of global CO_2 emissions from the energy system (IEA, 2024). Under increasing pressure, a growing coalition of countries, cities, businesses, and institutions are pledging to achieve net-zero emissions and drive green transformations. Additionally, manufacturing and industrial firms often exhibit more visible environmental impacts, such as waste production and plant emissions (Berkhout et al., 2009). As a result, these companies face greater scrutiny to prove their environmental responsibility and credentials. When companies in these sectors are exposed to greenwashing, stakeholders perceive the issue as more severe, leading to a loss of public trust and more negative market responses. In contrast, the environmental impacts of service-sector firms are less visible (Carballo-Penela and Castromán-Diz, 2015), and environmental image or green credentials may not be a primary concern for investors when evaluating these companies. As a result, stock market reactions to greenwashing in the service industry are generally less pronounced. Based on these considerations, we propose the following hypothesis.

Hypothesis 4. **(H4):** The market reactions to greenwashing news are more negative for firms operating in manufacturing industries than in service industries.

3. Methodology

There is a growing interest among researchers and academics in the field of OSCM around factors impacting the creation of shareholder and investor value (Ding et al., 2021; Jacobs and Singhal, 2014; Liu et al., 2023; Wood et al., 2017). In this study, the event study was employed to estimate the stock market reaction and investigate how shareholders react to the greenwashing news exposed by the news media. Rooted in finance (MacKinlay, 1997), the event study technique is built on the widely accepted hypothesis that security markets are efficient (Fama, 1991; Fama et al., 1969). This method allows for the estimation of the stock market reaction to a specific event by calculating the abnormal returns (ARs) associated with the identified event and subsequently elucidating the impact of these specific events on the sample stocks (Brown and Warner, 1985). In an event study, there are two critical stages – identifying the event and then analysing the impact. We now outline each of these stages in turn.

3.1. Data collection

A common way to identify events that could affect share prices is to examine media publications for news stories related to the topic being discussed (Ding et al., 2018). To do this, we identified news and announcements with the keyword "greenwash" (or any of its variants) from the LexisNexis database. To ensure that the samples are not missed, this study also searched with "corporate irresponsibility" or "corporate misconduct" OR "environmental irresponsibility" OR "social irresponsibility" as the keywords in a supplementary search for greenwashing news. This study spanned the period from January 01, 2016, to December 31, 2021. The start date reflects the establishment of the Paris Agreement in 2015 as a result of COP21. This agreement and the preceding negotiations were significant events on a global scale as they symbolise the first-ever binding accord that has brought together nations worldwide in a collective and ambitious endeavour and countries committed to addressing climate change (UN, 2022). Kruse et al. (2020) also studied the Paris Agreement to investigate the capital market's response to corporate environmental activities. The end date reflected the last full year of stories and reports available ahead of data collection.

We then carefully read each greenwashing news, applying screening methods by Jacobs and Singhal (2014) and Liu et al. (2023) to identify companies involved in greenwashing. The screening criteria and process is documented in Fig. 1.

First, our initial keyword search identified multiple news articles and announcements related to greenwash-related behaviour. As some incidents were reported multiple times, we retained only the earliest published news from the initial search stage. However, we allowed multiple greenwashing incidents from the same company. This process resulted in 815 greenwashing news that met these conditions. Second, we ensured that the news directly addressed corporate greenwashing, excluding those focused solely on definitions or analyses without specific company behaviour, reducing the count to 182. Third, we restricted our sample to publicly traded companies with available stock prices and financial data around the time of the event on Datastream via Refinitiv Workspace. This reduced the sample to 123 greenwashing news stories, and after excluding two confounding pieces of news made by the same entity within a seven-day event window, we ultimately finalised 121
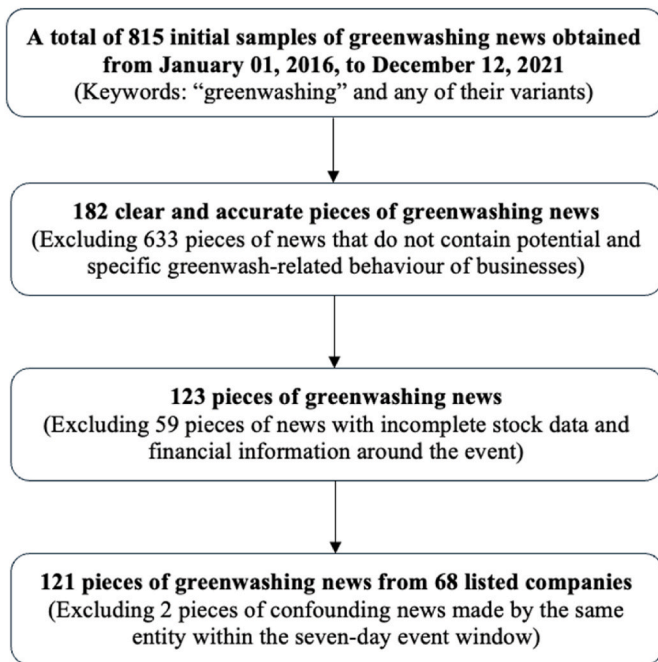
pieces of greenwashing news stories for analysis.

This sample of 121 greenwashing news involved 68 firms suspected or confirmed of engaging in greenwashing across 19 global stock markets. Table 2 presents the distribution of this news across different geographical regions and stock markets. To contextualise market reactions, we employed various regional indices, such as the Nikkei 225 index, which acts as a proxy for the market portfolio of Japanese firms and the FTSE100 index for UK companies.

3.2. Research methods

3.2.1. Event study technique

According to MacKinlay (1997), factor models are considered superior to simple models as they account for changes in market returns when estimating expected returns. The Fama-French factor model, an extension of the Capital Asset Pricing Model (CAPM), is more sophisticated than the market model (Fama and French, 1993). Thus, to estimate the stock market reactions to greenwashing news, we adopted a Fama-French three-factor model (Lo et al., 2018), which assumes a linear relationship between the return of any stock and three factors over time: market capitalisation, book-to-market ratio, and market risk. The mathematical relationship of the Fama-French three-factor model is as follows:

$$R_{it} - R_{ft} = \alpha_i + \beta_{i1}\left[R_{mt} - R_{ft}\right] + \beta_{i2}SMB_t + \beta_{i3}HML_t + \varepsilon_{it} \qquad (1)$$

where α_i represents the intercept of the relationship for stock i; R_{it} is the return on stock i for day t; R_{ft} is the risk-free return on day t; R_{mt} denotes represents the market return on day t; SMB_t is the small minus big portfolio return on day t; and HML_t is the high minus low portfolio return on day t; β_{i1}, β_{i2}, and β_{i3} are the slopes of the relationship for stock i; and ε_{it} is the error term for stock i on day t. Data about the company's stock returns and the Fama-French three factors are collected from Refinitiv Datastream.

Fig. 1. Greenwashing news and data screening process.
Source: created by authors

Table 2
Distribution by geographical regions and stock markets for 121 greenwashing news.

Geographical regions	Exchange markets	Number of news (121)	Proportion
North American markets			
Canada	Toronto Stock Exchange	26	21.49 %
United States	NYSE & Nasdaq Stock Exchange	2	1.65 %
European markets			
Amsterdam	Euronext Amsterdam	21	17.36 %
France	Euronext Paris	3	2.48 %
Germany	Frankfurt Stock Exchange	6	4.96 %
Ireland	Irish Stock Exchange	3	2.48 %
Italy	Borsa Italiana	2	1.65 %
Norway	Oslo Stock Exchange	2	1.65 %
Spain	Bolsa de Madrid	2	1.65 %
Sweden	Stockholm Stock Exchange	2	1.65 %
Switzerland	SIX Swiss Exchange	1	0.83 %
United Kingdom	London Stock Exchange	20	16.53 %
Asian-Pacific markets			
Australia	Australian Stock Exchange	11	9.09 %
HongKong	Hong Kong Stock Exchange	1	0.83 %
India	National Stock Exchange of India	3	2.48 %
Japan	Tokyo Stock Exchange	7	5.79 %
Korea	Korea Stock Exchange	2	1.65 %
New Zealand	New Zealand's Exchange	6	4.96 %
Singapore	Singapore Exchange	1	0.83 %

Source: created by authors

Following Liu et al. (2020), we set the estimation period as 220 to 11 days before the event date. The interval between the estimation period and the announcement date ensures that the validity of the estimate is not affected by the event announcement. The A_{it} for firm i on day t is defined as the difference between the actual and expected returns as follows:

$$A_{it} = (R_{it} - R_{ft}) - (\hat{\alpha}_i + \hat{\beta}_{i1}[R_{mt} - R_{ft}] + \hat{\beta}_{i2}SMB_t + \hat{\beta}_{i3}HML_t) \quad (2)$$

In this study, we used the time stamp on the greenwashing news to convert calendar dates into event dates (Hendricks et al., 2015), designating Day 0 for the announcement date (event date) and Day −1 for the trading day before the announcement. An important assumption in event study is that the event is exogenous; if it is ideally expected, there will be no abnormal returns in the stock markets (Kruse et al., 2020). We analysed the stock market reaction within a seven-day window (−3, +3) around the event date (Girotra et al., 2007; Nicolau and Sellers, 2002). This window accounts for the possibility of information leakage before the announcement (Jacobs and Singhal, 2014) or information getting a lagged reaction (Senchack and Starks, 1993). In this study, we also employed the cross-sectional test, as advocated by Brown and Warner (1985), to adjust for cross-sectional dependence when estimating ARs for multiple companies over the same calendar period. Moreover, mean ARs can be unduly influenced by outliers, especially in a somewhat small sample (Jacobs and Singhal, 2017). To eliminate the influence of outliers on the stock market, we supplemented the *t*-test (a parametric test) with two non-parametric tests (Xia et al., 2016; Jacobs et al., 2022): the Wilcoxon signed rank test to test whether the median of ARs was significantly different from 0 and the Binomial sign test to determine if the per cent negative ARs are significantly different from the null of 50 %.

The mean abnormal return $\overline{A}_t$ for Day t is given by:

$$\overline{A}_t = \frac{1}{N} \sum_{i=1}^{N} AR_{it} \quad (3)$$

The test statistic TS_t for Day t is derived as (Brown and Warner, 1985):

$$TS_t = \frac{1}{\sqrt{N}} \sum_{i=1}^{N} \frac{AR_{it}}{\widehat{S}_{\varepsilon i}} \quad (4)$$

Then, the accumulative abnormal returns (CARs) for period $[t_1, t_2]$ it is calculated as below:

$$CAR(t_1, t_2) = \sum_{t_1}^{t_2} \overline{A}_t \quad (5)$$

3.2.2. Cross-sectional regression analysis

This study adopted a cross-sectional regression model to verify whether the factors outlined in Hypotheses 2 to 4 affect the market reaction to greenwashing news. Following Wood et al. (2018) and Zhan et al. (2021), cumulative abnormal returns (CARs) over the event window (−3, 3) were used as the dependent variable. The independent variables consist of two parts: variables corresponding to the hypotheses and control variables. First, we introduced ESG performance, geographic regions and industry types as the primary independent variables. The event study results are presented through multiple panels to show stock market reactions to greenwashing news. Second, to ascertain whether market reactions are influenced by potential confounding effects from other firm characteristics, the study controlled for factors such as return on asset (ROA), market-to-book (M2B) ratio and financial leverage. Moreover, we applied the Ordinary Least Square (OLS) estimation and constructed the regression model as below:

$$CARs_i = \beta_0 + \beta_1 ESG\ performance_i + \beta_2 stock\ market_i + \beta_3 industry\ types_i$$
$$+ \beta_4 prior\ financial\ performance_i + \beta_5 growth\ prospects_i$$
$$+ \beta_6 financial\ risks_i + \varepsilon_i$$

$$(6)$$

where $CARs_i$ is the cumulative abnormal returns for the firm i on the seven-day window period, β_0 is the intercept, β_1 to β_6 are the coefficients of the independent variable and ε_i is the error term. Table 3 summarises the variable measurements and data sources employed in the cross-section regression analysis.

4. Analysis results

4.1. Event study results

The overall results of ARs and CARs are presented in Table 4. There are indications of marginally negative returns on Day 1, which shows a delayed reaction in the stock prices. The mean ARs are −0.22 %, and the median ARs are −0.43 %, significantly different from 50 % at the 1 % level. Over 57 % of companies experience negative ARs, significant at the 10 % level. For Day 2, the median ARs are −0.15 %, significant at the 5 % level. More than 57 % of firms experience negative ARs, with a significance level of 10 %. One plausible explanation for the delayed impact observed on Day 1 is that investors may not fully process or act on the event's implications immediately on Day 0 due to information processing delays. This delayed response can explain the more significant negative ARs on Day 1, even if the initial reaction on Day 0 is muted.

The CARs are negative and statistically significant for event windows. For example, the mean (median) CARs for Days (0, 2) are −0.92 % (−0.41 %), with a significance level at 10 % (5 %), and over 58 % of companies experience negative CARs, significantly different from 50 % at the 10 % level. For the. For Days (0, 3), the mean and median CARs are −1.58 % and −0.53 %, respectively, which are significant at the 1 % and 5 % levels. 61 % of firms experience negative CARs, significantly different from 50 % at the 5 % level. The mean and median CARs are negative at −1.38 % and −0.28 % over the seven days of Day −3 and Day 3, significant at 10 % and 1 % levels, respectively. To validate our analyses, we conducted robustness checks on the market model (see Appendix). The results indicate that the adverse market reaction is modestly consistent. In our analyses, outliers can unduly influence mean results (Jacobs and Singhal, 2017). Thus, we considered not only mean results but also emphasised median and per cent negative ARs when

Table 3
Variable measurements and data sources.

Variables	Measurements	Data sources
Dependent variable		
CARs	A firm's cumulative abnormal returns of greenwashing on Days (−3, 3)	Refinitiv Datastream
Independent variable		
ESG Performance	A firm's ESG scores and ratings	Refinitiv ESG Database
Asia-Pacific Markets	Dummy variable with value of 1 to indicate the company is in Asia-Pacific markets and otherwise with value of 0	Refinitiv Datastream
Manufacturing Industry	Dummy variable with value of 1 to indicate the company is in manufacturing industry and otherwise with value of 0	Refinitiv Datastream
Control variables		
Return on Asset (ROA)	A firm's prior financial performance	Refinitiv Datastream
Market-to-Book (M2B) Ratio	A firm's growth prospects	Refinitiv Datastream
Financial Leverage	A firm's financial risks	Refinitiv Datastream

Source: created by authors

Table 4

Stock market reactions to greenwashing news.

Event day	Stock market reactions	N	Mean	t-statistic	Median	Wilcoxon signed rank Z-statistic	Negative rates	Binomial sign test Z-statistic
Day −3	ARs	121	−0.40 %	−1.46	−0.06 %	−1.42	55.9 %	1.29
Day −2	ARs	121	0.07 %	0.26	0.02 %	0.31	46.6 %	−0.74
Day −1	ARs	121	0.53 %	1.93*	0.02 %	−0.55	48.3 %	−0.37
Day 0	ARs	121	−0.36 %	−1.30	−0.33 %	−0.46	52.5 %	0.55
Day 1	ARs	121	−0.22 %	−0.78	−0.43 %	−2.66***	57.6 %	1.66*
Day 2	ARs	121	−0.35 %	−1.27	−0.15 %	−1.97**	57.6 %	1.66*
Day 3	ARs	121	−0.66 %	−2.38**	−0.27 %	0.32	53.4 %	0.74
Event window								
Days (0, 1)	CARs	121	−0.57 %	−1.38	−0.38 %	−2.15**	60.2 %	2.21**
Days (0, 2)	CARs	121	−0.92 %	−1.82*	−0.41 %	−2.51**	58.8 %	1.93*
Days (0, 3)	CARs	121	−1.58 %	−2.69***	−0.53 %	−2.23**	61.0 %	2.39**
Day s (−3, 3)	CARs	121	−1.38 %	−1.78*	−0.28 %	−2.19**	56.8 %	1.47

Note: All tests are two-tailed. ***p < 0.01, **p < 0.05, *p < 0.1.

analysing event study results. If non-parametric tests support a hypothesis while parametric tests do not, this still provides evidence supporting the hypothesis. However, the weakest support arises when only the parametric test is significant, while non-parametric tests are not (Jacobs et al., 2022). Thus, H1 is supported, leading us to reject the null hypothesis and accept the alternative hypothesis: the stock market reacts negatively to greenwashing news.

Table 5 presents the stock market reaction (CARs) of different subsets of the greenwashing news data from Day −3 to Day 3. For Panel A, greenwashing news is categorised into two groups: concrete greenwashing – where news provides solid evidence of firms engaging in greenwashing, that is, points out specific selective disclosure or decoupling behaviours of companies. For example, in 2019, Teekay Shuttle Tankers issued a green bond but was exposed by the Financial Times for misusing the funds to purchase fuel tanks rather than investing in renewable energy. This is an example of clear evidence that the company's green bond issuance was intended to deceive stakeholders. Another type is highly suspicious greenwashing – where news raises serious doubts about the authenticity of the company's sustainability strategies, advertising and practices, but it does not identify specific selective disclosure or decoupling behaviour by companies. For example, EasyJet Holidays and Jet2, one of the UK's biggest budget airlines and holiday providers, promised to achieve net-zero carbon emission through their combo sustainability strategies. However, their strategies lack transparency and may potentially lead to fraudulent claims. As shown in Panel A of Table 5, 39 news articles provide solid evidence of greenwashing, while 82 are highly suspicious of greenwashing. The results show that concrete greenwashing damages shareholders' wealth more severely than highly suspicious ones. The mean and median CARs for concrete greenwashing are negative at −1.13 % and −0.68 %, significant at 10 % and 5 %. For highly suspicious news,

although the mean CARs are negative (−1.80 %) and significant (at 5 % level), the magnitude and significance of median CARs and the percentage of negative CARs dissipate.

Panel B of Table 5 displays the stock reaction to greenwashing in various stock markets: European markets (n = 62), North American markets (n = 28), and Asia-Pacific markets (n = 31). The mean and median CARs for the Asia-Pacific market are −3.46 % and −1.59 %, respectively, significant at 5 % and 1 %. Over 70 % of companies experience negative CARs, significantly different from 50 % at the 1 % level. The North American market has marginally negative returns; the mean CARs are negative at −2.50 % and significant at 10 %. However, the CARs are insignificant for the European market.

Panel C of Table 5 shows the stock market reactions to greenwashing news on firms across various industries, particularly manufacturing (n = 98) and service industries (n = 23). Manufacturing firms suffered significant negative CARs from greenwashing news. The mean (median) CARs are −2.30 % (−1.02 %), both significant at the 1 % level. The negative rate of CARs is 62 %, significantly different from 50 % at the 5 % level. However, there is no significant impact of greenwashing news on service firms.

Furthermore, this study also shows the market reaction of companies experiencing greenwashing news with different grades of ESG performance, as presented in Panel D of Table 5. In addition to the missing data on ESG performance, we consider that stock market reactions of small samples may be affected by outliers (Jacobs and Singhal, 2017) and other contemporaneous events (McWilliams and Siegel, 1997; Wang and Ngai, 2020); hence, Grade C and Grade D were removed due to small sample sizes (13 in total) in Panel D. There are indications of marginally negative returns on companies with Grade A ESG performance. Specifically, the mean and median CARs are negative at −1.09 % and −0.72 % over the seven days from Day −3 to Day 3, both significant at 5 % levels.

Table 5

Stock market reactions of sub-samples of greenwashing news (Fama-French model).

	N	% of Sample	Mean	t-statistic	Median	Wilcoxon signed rank Z-statistic	Negative rates	Binomial sign test Z-statistic
Panel A: Sub-samples of news types								
Concrete greenwashing	39	32 %	−1.13 %	−1.90*	−0.68 %	−2.63**	59 %	1.12
Highly suspicious greenwashing	82	68 %	−1.80 %	−2.18**	0.03 %	1.12	49 %	−0.22
Panel B: Sub-samples of geographic regions								
European markets	62	51 %	−0.23 %	−0.51	−0.09 %	−1.16	53 %	0.51
North American markets	28	23 %	−2.50 %	−1.67*	−0.21 %	−0.10	54 %	0.38
Asia-Pacific markets	31	26 %	−3.46 %	−2.09**	−1.59 %	−2.86***	74 %	2.69***
Panel C: Sub-samples of industry types								
Manufacturing	98	81 %	−2.30 %	−3.14***	−1.02 %	−2.71***	62 %	2.42**
Service	23	19 %	1.29 %	1.54	0.06 %	0.49	48 %	−0.21
Panel D: ESG Grades								
Grade A	63	52 %	−1.09 %	−2.01**	−0.72 %	−2.48**	54 %	0.63
Grade B	24	20 %	−0.08 %	−0.07	0.62 %	−0.20	42 %	−0.82

Notes: 1) All tests are two-tailed. ***p < 0.01, **p < 0.05, *p < 0.1; 2) In Panel D, Grade C and Grade D were removed due to small sample sizes.

Nevertheless, greenwashing news does not significantly impact companies with Grade B ESG performance.

4.2. Cross-sectional analysis results

Table 6 presents the correlations among the variables in the regression analysis, while Table 7 provides the regression results on Days (−3, 3). Model (1) is the basic model, encompassing all control variables. Model (2) extends Model (1) by adding one independent variable developed in section 2: ESG performance. Model (3) extends Model (2) by incorporating additional independent variables: stock markets and industry types. The number of observations in Model (1) is 107, but the sample reduces to 94 in Models (2) and (3) due to missing company data. In Table 7, the findings of Model (2) reveal a negative relationship between ESG performance and CARs. Specifically, the coefficient of ESG performance is negative and significant at the 5 % level, which indicates that the market reaction to greenwashing news is more negative for firms with greater ESG performance than weak ESG performance. Model (3) further explains the negative relationships between ESG performance and additional factors with CARs. The coefficient of ESG performance remains significantly negative. Hence, H2 is rejected, leading us to accept the null hypothesis: the market reactions to greenwashing news are not more negative for firms with weak ESG performance than for those with greater ESG performance. Additionally, our findings further reveal that firms with greater ESG performance suffered more negative stock market reactions.

Moreover, the coefficient of the stock market (specifically, the Asian market) is significantly negative in Model (3), suggesting that the market reaction to greenwashing news is more negative for firms operating in the Asian market than in the European market. Model (3) also displays a negative relationship between industry type and CARs, indicating that investors react more adversely to greenwashing news by firms operating in the manufacturing industry. Accordingly, our findings accept H3 and H4, leading us to reject the null hypotheses and accept the alternative hypotheses: the market reactions to greenwashing news are more negative for Asian-Pacific firms and firms operating in manufacturing industries. We also calculate our regression models' variance inflation factors (VIFs). The highest VIF is 2.66, indicating that multicollinearity is not a significant issue in the regression models.

5. Discussions

This study provides empirical evidence on the effect of worldwide greenwashing news on the financial performance of publicly traded firms. The findings reveal a negative association between greenwashing news and stock market reactions. This result is consistent with Du (2015), who provides strong evidence that greenwashing is significantly negatively related to CARs in the Chinese stock market. Capelle-Blancard and Petit (2019) also suggest that undesirable corporate behaviour relating to ESG matters has a detrimental impact on the stock performance of the infringing firms. In line with the signalling theory (Connelly et al., 2011), the media coverage (sender) plays a crucial role in spotlighting information related to greenwashing risks (signals) is brought to light. Greenwashing refers to the practice of selectively

Table 7
Cross-sectional regression results on Days (−3, 3).

Variables	(1) Model 1	(2) Model 2 (-3, 3)	(3) Model 3 (-3, 3)
ROA	−0.001	0.000	0.000
	(0.001)	(0.001)	(0.001)
M2B	0.006**	0.004	−0.001
	(0.003)	(0.003)	(0.003)
Leverage	0.000**	0.000*	0.000
	(0.000)	(0.000)	(0.000)
ESG performance		−0.001**	−0.001**
		(0.000)	(0.000)
Asia-Pacific Market			−0.041***
			(0.011)
Manufacturing Industry			−0.032**
			(0.016)
Constant	−0.026***	0.030	0.079***
	(0.008)	(0.022)	(0.022)
No. of Observations	107	94	94
Model F value	3.37**	3.35**	6.76***
R-squared	0.089	0.131	0.318
Adjusted R-square	0.063	0.092	0.271

Notes: 1) Standard errors in parentheses; 2) ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

disclosing positive environmental claims or decoupling these claims from actual sustainable practices, thereby misleading consumers about the environmental impact of a company's products or services. When greenwashing is exposed—such as through news reports revealing a company's environmental dishonesty—investors notice the discrepancy between its commitments and actions. This mismatch is interpreted by investors as a breach of the company's prior environmental promises, leading them to question the credibility of the company's future sustainability disclosures and initiatives. The resulting erosion of trust raises concerns about potential risks for the company, such as issues related to managerial integrity, regulatory penalties, and reputational harm. Consequently, upon receiving news of a company's greenwashing, investors adjust their investment strategies by reducing their holdings and investments. This adjustment leads to negative stock reactions, reflecting the loss of investor confidence in the company.

Moreover, we find that ESG performance is significantly negatively correlated with the tendencies of stock market reactions to greenwashing news. This result contrasts with previous research, which focuses on the positive effects of ESG and environmental performance on stock market reactions and financial outcomes (Du, 2015; Capelle-Blancard and Petit, 2019; Xie et al., 2023). For instance, Du (2015) systematically demonstrates a significant positive relationship between corporate environmental performance and CARs around the exposure of greenwashing. Capelle-Blancard and Petit (2019) suggest that when a company has previously disclosed more positive ESG information and has a good ESG reputation, the financial losses caused by negative ESG events are mitigated. However, Nirino et al. (2021) present findings similar to ours, indicating that while ESG limits value destruction from corporate controversies, the financial impact of such controversies remains. Additionally, Humphrey et al. (2012) show that investing in companies with strong ESG scores neither results in economic gains nor losses.

Table 6
Correlation coefficient matrix.

Variables	1	2	3	4	5	6	7
1. CARs (−3, 3)	1.000						
2. ROA	0.038	1.000					
3. M2B	0.158	0.522*	1.000				
4. Leverage	0.066	−0.026	0.053	1.000			
5. Asia-Pacific Market	−0.075	0.032	0.032	0.047	1.000		
6. Manufacturing Industry	−0.141	−0.292*	−0.391*	−0.271*	−0.091	1.000	
7. ESG Performance	−0.314*	0.084	−0.129	−0.030	−0.341*	0.451*	1.000

Note: '*' star all correlation coefficients significant at the 5 % level or better.

There are several plausible reasons for our findings. First, companies with higher ESG scores are typically more extensive and resourceful, enabling them to invest more heavily in sustainable development. However, because of their larger size and greater public exposure, these companies face increased scrutiny and pressure from external stakeholders (Humphrey et al., 2012). Despite significant investments in sustainability, once these companies are exposed to greenwashing, the public and investors may begin to question the authenticity of their previous ESG efforts. For instance, doubts may arise about whether their sustainability commitments and investments were genuine, merely "cover-ups" or hypocritical. This severely damages the company's public image and erodes investor confidence in its long-term credibility. Moreover, companies with better ESG performance demonstrate that they have better fundamentals in environmental, social and governance and have reduced costs in environmental protection and carbon footprints (Xie et al., 2023), which accumulates a form of reputational capital through sustained promotion of their sustainability efforts. However, when greenwashing is exposed, this reputational shield may not exist. It may even exacerbate negative market reactions, mainly because the public and investors tend to hold these companies to higher standards, expecting them to be transparent about their sustainability performance. As a result, investors may re-evaluate the company's credibility and ethics and even question its current and future financial performance. Such scepticism may further extend to future performance expectations and the reliability of financial reports, leading to a swift decline in market trust and triggering a more severe negative stock market reaction. Therefore, while companies with stronger ESG performance typically benefit from their sustainable image under normal circumstances, they may face harsher market reactions when greenwashing is exposed, as the public and investors—holding these companies to higher standards—react more strongly when disappointed.

This study also provides evidence regarding the stock market reactions to greenwashing across firms in different industries and markets. Firstly, our findings extend to various stock markets worldwide. The market reaction to greenwashing news is more negative for Asian-Pacific firms than North American and European firms. This disparity can be attributed to the differing positions of European and North American countries in ESG and corporate sustainability, typically characterised by stricter regulations and more transparent environmental and governance standards (Lo and Kwan, 2017), as well as more frequent financial and sustainability disclosures. However, Asia-Pacific countries are increasingly concerned about sustainability issues (Baughn et al., 2007). Hence, when an Asian company is found to have engaged in greenwashing, investors may express heightened concern about the company's actual environmental impacts and governance issues, leading to a more adverse market reaction. Moreover, Asia's rapid industrialisation and manufacturing output pressure the local, regional, and global environment (Berkhout et al., 2009), resulting in more environmental impacts, such as waste emissions, energy consumption, and resource utilisation. This aligns with another key finding of our study, which indicates that manufacturing industries suffer more market losses to greenwashing news than service industries. The manufacturing sector is one of the major contributors to industrial waste generation and environmental pollution, posing a threat to environmental sustainability (Wang and Yang, 2021). Additionally, manufacturing companies face more environmental regulations, regulatory pressures, complex supply chains, and production processes. Consequently, once greenwashing is exposed, manufacturing companies may face increased regulatory scrutiny, and their supply chain transparency may be further doubted.

6. Conclusions and implications

This study delves into understanding how investors react to corporate greenwashing news. To empirically test this, the impact of greenwashing news from 2016 to 2021 is analysed through an event study approach. This method provides insights into how investors' perceptions and reactions to greenwashing impact stock market values. The results show a modest adverse negative stock market reaction to greenwashing news (Supporting H1) and stronger negative impacts on firms with better ESG performance (Not supporting H2). The study also explores additional factors that explain market reactions to greenwashing news, including news types, geographic regions, and industry types. Compared with other markets, the Asia-Pacific market suffered negative reactions to greenwashing (Supporting H3). The companies operating in the manufacturing industry experience more market value loss than those operating in the service industry (Supporting H4). There are more negative reactions to the news, which provides solid evidence of engaging in greenwashing.

This study offers several theoretical implications. First, this study contributes to the literature on corporate green and sustainable development by providing empirical evidence of the negative relationship between corporate greenwashing news and financial performance. This provides valuable insights into how stock markets value greenwashing within a global context. Second, this study adds to the ESG literature streams by investigating whether ESG performance mitigates the adverse impact of greenwashing news on financial performance. Surprisingly, unlike most other studies (Capelle-Blancard and Petit, 2019; Xie et al., 2023), our study reveals that companies with greater ESG performance suffer more market losses. Therefore, our empirical analyses introduce a novel perspective for future research on the impact of sustainable practices. Furthermore, our findings provide empirical evidence on the roles of geographical regions and industry types in greenwashing and stock market reactions. The variation in market response, driven by institutional distance, underscores the significant impact of the institutional environment on corporate sustainability practices and their market consequences across different national or regional contexts.

This study also yields several practical contributions. From a practical point of view, the findings shed light on the interplay between greenwashing, market reactions, and ESG performance (also including geographic regions and industry types), providing valuable insights for investors, corporate managers, and policymakers alike. First, this study helps corporate managers understand the conditions under which greenwashing has a greater or lesser impact on shareholder value, such as enhancing corporate managers' understanding of stock market reactions to greenwashing signals and ESG performance, thereby enabling them to value current corporate sustainable behaviours, promote accountability, and increase transparency in sustainability reporting and claims.

Although the adverse impact of greenwashing on the stock market cannot be mitigated by better ESG performance, this does not mean that these companies should pay less attention to ESG scores and sustainable practices. This is because investors and analysts can access more information about corporate ESG performance and sustainable practices than ever (Capelle-Blancard and Petit, 2019; Wong and Zhang, 2022). Companies have financial incentives to monitor and maintain a corporate reputation on sustainable and ESG matters. Moreover, Nirino et al. (2021) emphasise prevention rather than cure. Managers should pay attention to ESG performance, but more importantly, reduce and eliminate controversy and misconduct by prudent decision-making and adopting responsible and substantive practices. Thus, avoiding greenwashing should be the top priority for business managers rather than focusing on limiting the adverse effects and damage of irresponsible or fraudulent behaviours that give rise to greenwashing. In other words, to improve corporate reputation and reduce financial risks, corporate executives need to focus on their sustainable practices and behaviours. Furthermore, our empirical analysis has also provided implications for institutions such as legal systems, regulatory institutions, and industry groups, as they can play a crucial role in preventing greenwashing and similar unethical behaviours. Compared with suppliers and customers of companies accused of greenwashing that vary in size and capabilities, those institutions may have more power, resources, and capabilities to

monitor and disclose irresponsible corporate behaviour effectively. For example, an essential responsibility of industry groups is to monitor member companies and work to mitigate potential illegal or irresponsible actions by member companies that could negatively impact the industry ecosystem (Jacobs and Singhal, 2020).

While this study makes several research contributions in theory and practice, certain limitations deserve further research. First, the focus on listed companies in this study leaves room for future research to explore the performance of non-listed entities. Investigating how greenwashing impacts non-listed entities can provide a more comprehensive picture. Second, the study primarily examines the financial impacts of greenwashing at the firm level, with ambiguous criteria for identifying greenwashing within the supply chain. Future research can address this by extending the analysis to the supply chain level. Expanding the research scope can provide valuable insights into the broader implications of greenwashing across interconnected business networks. Furthermore, this study delves into the stock market reactions to greenwashing on a global scale. Future research can focus on the nuances of stock market reactions to corporate greenwashing news in various countries and regions. After analysing companies based on specific country contexts, researchers can provide more targeted suggestions to facilitate sustainable development and effectively tackle the challenges of climate change and environmental pollution.

CRediT authorship contribution statement

Mao Xu: Writing – review & editing, Writing – original draft, Resources, Methodology, Formal analysis, Data curation. **Ying Kei Tse:** Writing – review & editing, Supervision, Project administration, Conceptualization. **Ruoqi Geng:** Writing – review & editing, Supervision, Resources, Project administration, Funding acquisition, Conceptualization. **Zhenyuan Liu:** Validation, Software, Methodology, Formal analysis. **Andrew Potter:** Supervision, Project administration, Funding acquisition.

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Appendix

Table 8
Stock market reactions to greenwashing news (Market model)

Event day(s)	N	Mean	t-statistic	Median	Wilcoxon signed rank Z-statistic	Negative rates	Binomial sign test Z-statistic
Day −3	121	−0.23 %	−0.92	−0.50 %	−1.06	66.67 %	1.73*
Day 0	121	−0.48 %	−1.46	−0.21 %	−1.49	66.67 %	1.73*
Day 1	121	−0.15 %	−0.41	−0.34 %	−0.87	59.26 %	0.96
Day 2	121	−1.13 %	−1.95*	−0.38 %	−2.45*	77.78 %	2.89***
Day 3	121	−0.61 %	−0.73	0.24 %	0.94	40.74 %	−0.96
Event window							
Days (0, 1)	121	−0.63 %	−1.48	−0.32 %	−1.66*	66.67 %	1.73*
Days (0, 2)	121	−1.76 %	−2.57**	−0.94 %	−2.74***	77.78 %	2.89***
Days (0, 3)	121	−2.37 %	−1.93*	−1.35 %	−2.04*	66.67 %	1.73*
Day s (−3, 3)	121	−3.02 %	−2.03*	−1.62 %	−1.97*	62.96 %	1.35

Note: All tests are two-tailed. ***p < 0.01, **p < 0.05, *p < 0.1.

Data availability

The data that has been used is confidential.

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