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The agency of greenwashing

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Abstract
As climate change increasingly challenges business models, the disclosure of firm environmental performance casts growing attention by corporate stakeholders. This creates wider opportunities and incentives for greenwash behaviors. We propose a novel set of measures to capture greenwashing and we investigate the association between greenwashing and corporate governance features that traditionally mitigate agency problems. We show that board characteristics are variously associated with the apparent degree of corporate greenwashing. Firms with more independent directors tend to greenwash more, the presence of female board directors seems to have a positive impact on the degree of greenwashing, while the effect of board size on greenwashing remains ambiguous. Importantly, we find that greenwashing reduces firm value.

Keywords Greenwashing · ESG · Corporate governance · Board · Valuation · Climate change · Firm value

JEL Classification G32 · M14 · Q56

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1 Introduction

As climate change and global warming are addressed by tougher regulation, new emerging technologies, and shifts in consumer behaviors, companies are increasingly acknowledging climate resilience as a key aspect of their strategy (Aldy & Gianfrate, 2019). Investors (Du, 2015; Dyck et al., 2019), customers (Nyilasy et al., 2014; Szabo & Webster, 2021), and other stakeholders (Pizzetti et al., 2021; Sutantoputra, 2022) are exerting growing pressure on firms to disclose the exposure to climate risks as well as on the actions taken to manage those risks. However, the greater the role for sustainability performance disclosure, the greater the opportunities and incentives for firms to greenwash their behaviors (Laufer, 2003; Lyon & Maxwell, 2011; Marquis et al., 2016). While many scholars have initially defined greenwashing as a deliberate decision to provide false information, more recent contributions (Bowen, 2014; Bowen & Aragon-Correa, 2014) highlight that greenwashing is a complex process that cannot be treated too simplistically by dichotomizing firms' behavior. Because all corporate environmental practices have both material and symbolic implications (Bowen, 2014), scholarly investigations should embrace the complexity of evaluating the dynamic and non-linear relationships between environmental performance and firms' green commitments (Bowen & Aragon-Correa, 2014).

Assuming this broader perspective, the empirical challenge of capturing quantitatively greenwashing is further heightened. In fact, by its very definition, greenwashing is hard to measure (Delmas & Burbano, 2011; Marquis et al., 2016; Szabo & Webster, 2021). Several strategies have been proposed empirically but each approach while presenting advantages also bears limitations. Some scholars have focused on the concept of selective disclosure (Marquis et al., 2016) as a proxy of greenwashing. According to this approach, companies are assumed to greenwash when they do not fully disclose environmental metrics. However, companies might disclose partially just for lack of internal data at the time they release the information; also, this approach overlooks the potential greenwashing associated with overstating or over-promising on the disclosed metrics. Other scholars try to detect greenwashing by looking at the components of ESG rating and by estimating the misalignment between KPIs related to green practices and KPIs related to green communication (Testa et al., 2018). However, the two groups of KPIs are strongly overlapped and are based mostly on self-reported information that all too often lacks third-party verification.

We contribute to the methodological debate about greenwashing measurement by proposing a novel approach to estimate greenwashing contrasting *ex-ante* intentions with *ex-post* outcomes on environmental policies. To quantify the distance (if any) between "talking" and "walking" (Schoeneborn et al., 2020), we construct a set of metrics that matches the (self-reported) *ex-ante* degree of greenness with the presence and intensity of (verified) *ex-post* environmental controversies and sanctions. If there is a discrepancy between green intentions and green outcomes, we conclude that such discrepancy is a proxy for greenwashing. Such a measure of greenwashing does not necessarily imply a deliberate decision

to provide false information but also encompasses the symbolic component and (constructive) intentionality of corporate environmentalism (Bowen, 2014).

As an alternative empirical strategy, we also consider that different providers of environmental ratings adopt different measures to establish the degree of greenness and such measures are rather complementary (Ferrón et al., 2022). If for a company the environmental scores are consistent across different sustainability rating providers, then the company is likely to be "walking the talk". On the contrary, we posit that if the environmental scores provided by different sustainability raters for the same company diverge significantly, then such divergence is an *indirect* indication of greenwashing.

Second, we investigate whether greenwashing is affected by corporate governance elements and, specifically, by board characteristics. While the nexus between corporate governance and corporate environmental performance has received robust attention over the last years (Miroshnychenko et al., 2019; Walls et al., 2012), there is still an open theoretical and empirical question that has received scant attention so far: which corporate governance mechanisms can *specifically* foster, or hinder greenwashing? Our results point towards the existence of a relationship between certain corporate governance characteristics and greenwashing behaviors. For board size we are not able to identify a univocal link between number of directors and greenwashing intensity therefore our results do not support that view that larger board do perform a more efficient monitoring activity (Bebchuk, 2005; Chakraborty & Yilmaz, 2017). On the contrary, board independence appears to be positively associated with greenwash behaviors. At a first glance, this may sound counter intuitive because environmental and social disclosure is often unaudited and the presence of independent directors should improve scrutiny over environmental policies and thus reduce greenwashing attitudes (Yu et al., 2020). Yet, from a corporate governance perspective, such an apparent paradox is consistent with the idea that insiders-controlled boards can be more beneficial to the financial performance of companies than the boards with many independent directors (Harris & Raviv, 2005, 2008, 2010), even when it comes to environmental performance (Lu & Wang, 2021). In fact, independent directors might have a strong incentive to project greener credentials for the company on whose board they sit in order to improve their green reputation with stakeholders, creating opportunities for further board appointments. Similarly, we find that the percentage of women on the board is positively associated (although not in statistically significant way for all the specifications) to the extent to which firms practice greenwashing.

Third, we also examine the relationship between the degree of greenwashing and market value of firms. Importantly, we find that greenwashing affects negatively firm value, thus showing that not "walking the talk" on environmental performance is penalized by financial markets (Du, 2015). Greenwashing importantly affects trust between companies and investors. Yet, the impact of greenwashing on financial market valuation is understudied (Bowen & Aragon-Correa, 2014; Testa et al., 2018). The literature has documented that corporate governance has an impact on firm value (Chen et al., 2011; Harris & Raviv, 2008) and that the environmental performance is positively associated with firm value (Konar & Cohen, 2001), although a significant market punishment for greenwashing does not emerge (Testa et al.,

2018). We contribute to this literature by finding that greenwashing is associated with a lower market value of firms. Our results suggest that not "walking the talk" on environmental performance is recognized by financial markets, consistently with the view that markets are efficient in detecting wrongdoers that use greenwashing (e.g., Du, 2015; Malkiel, 2005).

The rest of the paper is organized as follows. Section 2 reviews the definition of greenwashing, examines the relationship with agency and information asymmetry theories, and presents the hypothesis that we test empirically. Section 3 describes our methodology to measure greenwashing, discusses the data collection, and introduces the models used. Section 4 presents the results of the empirical analysis. Finally, Sect. 5 discusses our contribution and Sect. 6 concludes.

2 Literature review and hypothesis development

2.1 Defining greenwashing

Despite the spread of the word "greenwashing" in business and policymaking, academia has not yet converged on an unambiguous definition. Greenwashing encompasses many firm activities and choices (Lyon & Montgomery, 2015). The general use of the term, and even the academic debate about it, seems to be broad and vague. International scholars and experts have found different definitions of greenwashing in different fields. The Oxford English Dictionary defines greenwashing as the "*disinformation disseminated by an organisation so as to present an environmentally responsible public image*" (Gillespie, 2008; Mitchell & Ramey, 2011; Ramus & Montiel, 2005; Wang & Sarkis, 2017). Others have used the definition of greenwashing proposed by Greenpeace, as "*the act of misleading consumers regarding the environmental practices of a company or the environmental benefits of a product or service*" (Romero, 2008). Delmas and Burbano (2011) define the term as poor environmental performance and positive communication about this performance, assuming that both performance and its communication can be either positive or negative.

Selective disclosure to stakeholders is another form of greenwashing documented in the literature (Kim & Lyon, 2011; Linder, 2010; Lyon & Maxwell, 2011; Mitchell & Ramey, 2011). In particular, Lyon and Maxwell (2011) support that greenwashing refers to the selective disclosure of positive information about a company's social or environmental actions, without a complete negative revelation, to produce an overall positive corporate image. In this light, Mitchell and Ramey (2011) claim that greenwashing must be a deliberate act. These definitions relate to hard disclosure on environmental performance but ignore phenomena such as image advertising, and vague claims. Walker and Wan (2012) define greenwashing as a gap between symbolic and substantive corporate social actions.

In summary, the early contributions about greenwashing were focused on the various forms of distorted and/or selective disclosure aimed at manipulating stakeholders' perception of the environmental performance of the company (Laufer, 2003; Lyon & Maxwell, 2011; Lyon & Montgomery, 2015; Palazzo & Scherer,

2006). These forms have been classified according to different perspectives. De Freitas Netto et al. (2020) identify four kinds of greenwashing activities, by separating corporate from product levels and *ex-post* from *ex-ante* performance: firm-level executional, firm-level claim, product-level executional, and product-level claim. Yang et al. (2020) proposes a taxonomy of greenwashing based on a survey of the last twenty years of academic literature in the field that include six families: selective disclosure, decoupling, attention deflection, deceptive manipulation, dubious authorizations and labels, and inefficient public voluntary programs. Torelli et al. (2020) distinguish types of greenwashing according to the level of environmental misleading: reporting-level greenwashing and dark-level greenwashing. The former concerns deceptive environmental-related communication, while the latter is about concealing illegal activities by using environmental-friendly projects. Recently, Ferrón-Vílchez et al. (2021) summarize that greenwashing involves the voluntary disclosure of misleading or false environmental information that must be planned, be initiated by the company, and be understood as misleading by the public.

Therefore, the common denominators of greenwashing in mainstream literature are: (1) an information disclosure decision, (2) deliberate, (3) initiated by companies, and (4) beneficial to firms while costly to society (Bowen, 2014). A different stream of literature is proposing to move beyond limited all-negative-connotated conceptions of greenwashing and to enlarge the definition of greenwashing to encompass "*symbolic corporate environmentalism*" (Bowen & Aragon-Correa, 2014) that has a more positive connotation. "Symbolic corporate environmentalism" is defined as "*the shared meanings and representations surrounding changes made by managers inside organizations for environmental reasons*" (Bowen, 2014).

2.2 Greenwashing under theory of agency

Beyond the relationship between firm characteristics and greenwashing, certain corporate governance factors are deemed to have an impact on sustainable reporting. Fama and Jensen (1983) maintain that a good corporate governance structure can reduce agency costs for corporate disclosure. It is proven that agency conflicts can arise also around CSR activities (Masulis & Reza, 2015) and managers consider greenwashing when they take decisions (Ferrón-Vílchez et al., 2021). Dyck et al. (2023) suggest that a renewal of the mind-set of the board improves companies' environmental performances. Besides, common internal corporate governance best practices are linked to better environmental performance (Naciti, 2019) and more disclosure of CSR information (Lu & Wang, 2021). In some instances, director interlocks are the channel that can transfer CSR expertise and thus enhance environmental performance (Ortiz-de-Mandojana et al., 2015).

Yet, there is little to no evidence about the relationship of firm governance features with greenwashing. The connection of greenwashing to corporate governance characteristics is thus a key contribution of our study. We focus on some key corporate governance practices at the board-level that affect environmental performance: (i) the size of the board of directors, (ii) the board independence, and (iii) the presence of women in the board (Lu & Wang, 2021; Naciti, 2019). We investigate

specifically the association of our greenwashing indicator with such corporate governance practices.

2.3 Hypotheses development

Building on the existing literature on the nexus of corporate governance and environmental performance (Miroshnychenko et al., 2019; Walls et al., 2012), the relationship between board size and greenwashing can appear controversial. Some scholars argue that larger boards entail larger inefficiencies in the interaction of firm's insiders with outsiders (Raheja, 2005). Some others, instead, argue the opposite, due to the better monitoring and thus the lower influence that single members exercise on the rest of the board (Bebchuk, 2005; Chakraborty & Yilmaz, 2017). For instance, a larger board might include committees specifically appointed to focus on sustainability topics (Rao et al., 2012). Besides, board size seems positively related to environmental performance (De Villiers et al., 2011; Lu & Wang, 2021). This suggests the existence of a negative relation between the size of the board and greenwashing. For the empirical testing, we therefore state the following hypothesis:

HP 1: Board size is negatively associated with greenwashing.

Board independence should be a driver of increase in the amount, transparency, and quality of environmental disclosure (Haque & Ntim, 2017; Zhang et al., 2013). The general view is that independent board members are better at monitoring CEOs, are less likely to be influenced by the management and tend to act in the shareholders' best interest (Fama & Jensen, 1983; Guo & Masulis, 2015; Rao et al., 2012). Nevertheless, it is sometimes optimal to have insiders in control of the board, partly because insider-control better exploits private information (Harris & Raviv, 2005, 2008, 2010). Investors have generally moved beyond the traditional request for board independence, given the incentives nominally independent directors may have to side with insiders (Bebchuk & Hamdani, 2017; Coles et al., 2014). This may explain the existence of a negative relation between the independence of the board and corporate voluntary disclosure (Eng & Mak, 2003; Leung & Gul, 2004), as well as environmental performance (Lu & Wang, 2021; Naciti, 2019). On the other hand, Ortiz-de-Mandojana et al. (2016) contrast regulations versus normative pressure in encouraging independent directors to enhance firm sustainability performance: regulatory pressures discourage independent directors to promote environmental sustainability whereas normative pressures have the opposite effect. In this light, greenwashing could be positively correlated with board independence, because a non-specific outsider-director monitoring can increase the chances of greenwashing practices. Therefore, we assume the following hypothesis:

HP 2: Board independence is positively associated with greenwashing.

Another board characteristic studied in relation to environmental disclosure and performance is gender diversity. In general, diversity is considered to be beneficial, as

gender-diverse boards allocate more effort to monitoring (Adams & Ferreira, 2009; Perrault, 2015). Post et al. (2011) show that firms with boards composed of three or more female directors received better environmental scores. More women in the board have a positive impact on CSR disclosure and environmental performance (Lu & Wang, 2021; Naciti, 2019; Rao et al., 2012). Post et al. (2015) posit that the presence of women and of independent directors on boards of directors is associated with higher corporate environmental performance, because women are more able to forge alliances with stakeholders to address sustainability matters. Similarly, a very recent paper by Dyck et al. (2023) argues that board renewal with the addition of female members causally enhances sustainable performance, because the renewal is the occasion to reduce the mismatch between investors' desires and firms' choices regarding environmental performance. On the other hand, the most recent evidence shows that in the context of US companies a higher number of female directors in the board is associated with lower sustainability performance because of the extreme "busyness" of women with board appointments (Tonetto, 2022). In line with these finding we therefore formulate the following hypothesis:

HP 3: The presence of female board directors is positively associated with greenwashing.

2.4 Greenwashing and firm value

Several studies have investigated the possible implications of the greenwashing behavior on corporate reputation (Aji & Sutikno, 2015; Ioannou et al., 2018), brand value (Parguel et al., 2015) and customer loyalty (Guo et al., 2017; Ioannou et al., 2018). CSR generates stronger trust among stakeholders, which are more likely to help high-social-capital firms in periods of crises (Lins et al., 2017). CSR activities are even positively related to firm value (Brooks & Oikonomou, 2018; Ferrell et al., 2016; Jiao, 2010).

Similar considerations should apply to greenwashing as it importantly affects trust between companies and investors. Yet, the impact of greenwashing on financial market valuation is understudied (Testa et al., 2018). Scholars have documented that corporate governance has an impact on firm value (Chen et al., 2011; Harris & Raviv, 2008) and that the environmental performance is positively associated with firm value (Konar & Cohen, 2001). We posit that greenwashing, as a deviation from the genuine environmental performance of firms, should be penalized by investors. Therefore, empirically test the following hypothesis:

HP 4: Greenwashing is negatively associated with firm value.

3 Methodology

This study focuses on exploring what board-level governance characteristics are linked to the level of greenwashing. Then we investigate the association between greenwashing proxies and firm value, to verify if investors penalize companies that seem to be

"greenwashing active". Therefore, our analysis requires to first measure greenwashing and then to relate our measurement of greenwashing to board characteristics and firm value.

We introduce our novel measures of greenwashing first assuming a broader definition of greenwashing. Our measures contrast (i) *ex-post* and externally validated environmental and social performance, with (ii) the environmental and social scores commonly available to stakeholders but that include also *ex-ante* commitments, and that are measured without an independent external check. Also, we quantify the discrepancies across external environmental ratings as an indication of a wedge between commitments to be green and effective green behavior.

3.1 Greenwashing measurement

The literature has shown that measuring greenwashing is not an easy task (see Sect. 2). We take a specific angle to assess greenwashing, because we want to investigate if corporate governance characteristics that traditionally mitigate agency problems have also an impact on greenwashing activity. Our specific aim is to assess the distance between (*ex-ante*) intention of being green and (*ex-post*) effectiveness in being environmental responsible, under the assumption that a better governance should reduce the room for greenwashing potential.

Specifically, to measure greenwashing (*GW*), we move along three different dimensions. First, we exploit heterogeneity across difference ESG score providers as a proxy for greenwashing. The construction of ESG ratings is not regulated, and methodologies can be proprietary and opaque, leading to relevant divergence across data providers (Avramov et al., 2022; Berg et al., 2022; Mackintosh, 2018). The dispersion in ESG ratings stem from differences in scope, measurement, and weights of different data providers (Berg et al., 2022). We take advantage of this dispersion, disentangling the perspective that each rating provider takes to assess environmental activities. We proxy greenwashing as the difference between ESG ratings more oriented to the *ex-ante* commitment on environmental issues and ratings focused on the *ex-post* environmental performance. In this way, we aim to capture divergence between green commitments and actions. Second, we contrast the ESG rating with actual environmental violations that firms commit. Firms can claim to be environmentally and socially responsible, while damaging the environment (Raghunandan & Rajgopal, 2022). We thus proxy greenwashing by tracking firms that present a high ESG score but that, at the same time, are sanctioned more for violations of the environmental regulation. Third, following Avramov et al. (2022), we use the level of disagreement across ESG rating providers as a proxy for greenwashing. The assumption here is that the larger the dispersion of ESG ratings, the lower the consensus on firms' actual environmental behavior and thus the more likely the presence of greenwashing.

3.1.1 Greenwashing measurement with differences in ESG ratings

The first method we adopt to capture greenwashing is to measure the difference between (i) *ex-ante* inclined ESG ratings and (ii) *ex-post* oriented and externally

validated ESG ratings. The assumption is that the larger the difference between "*ex-ante*" and "*ex-post*" performance, the higher the greenwashing activity. Following this method, we construct two proxies of greenwashing using ESG ratings from Refinitiv and Newsweek.

Refinitiv is a widely renowned ESG data provider. The ESG score that is part of the Refinitiv database evaluates firms' environmental and social performance at annual frequency by acquiring information from a variety of sources—including NGOs and news. ESG scores are sold via Refinitiv. The Refinitiv scores are designed to also provide a measure of companies' environmental commitments rather than being focused primarily on their actual performance. ESG achievements are assessed across ten main categories. The category scores are rolled up into three pillar scores—environmental, social, and corporate governance. The environmental pillar score is identified through several data points for each of its three environmental sub-pillars (emission reduction, product innovation and resource reduction). Each data point is normalized relative to the industry, converted into a key performance indicator, and receives a weight into the overall environmental score. Amongst largest ESG data providers, Refinitiv has the most individual indicators with 282 (Berg et al., 2022). Amongst these indicators, there are forty-two indicators that are not used by other raters, almost all of which stem from Refinitiv's economic dimension. This dimension contains indicators, such as net income growth or capital expenditure that other rating providers do not consider (Berg et al., 2022). This evidence suggests that Refinitiv ESG scores primary focus is not *ex-post* environmental performance. Refinitiv itself implicitly recognizes to adopt an *ex-ante* rating approach. Indeed, it discloses two ESG scores: a raw score, known as ESG score, and a score adjusted downward for the environmental and social controversies that a firm experience, commonly known as ESG Controversy score. Given these characteristics, our study considers the Refinitiv as an *ex-ante* oriented ranking system (Billio et al., 2021; Dyck et al., 2019).

The Newsweek Sustainability Rankings is a project that assesses the environmental performances of the 500 largest U.S. public companies, assigning a score (the NWG score) to each of them.[1] With this project, Newsweek aims to estimate the effective firm's involvement in sustainable environmental policies. NWG is focused on the effective green performance of a firm, rather than on its commitments. Importantly, the primary aim of NWG is not the sale of data about environmental performance. The whole ranking process aims to guarantee transparency and to be understandable and replicable by third parties. Crucially, NWG is audited and externally validated by a panel of independent global experts in the field, who review and comment on all aspects of the NWG methodology. Compared to Refinitiv, this suggests that the NWG rating scheme is more oriented to measure whether firms are

[1] A time span of five years—from 2012 to 2017—is considered, with the objective of capturing changes in greenwashing. The time span used is the one for which the NWG data are available. Years 2013 and 2018 are omitted since their sustainability scores have not been made public. The Newsweek sustainability project has been discontinued in 2019 and then substituted by the America's Most Responsible Companies ranking.

effectively operating in line with given sustainability goals and climate limits, rather than to compare them with peers.[2]Therefore, our study considers the NWG as an *ex-post* oriented ranking system consistently with other literature contributions that have used the Newsweek Sustainability Rankings (Amato & Amato, 2012; Cordeiro & Tewari, 2015; Gao & Tran, 2021).

Our first proxy of greenwashing (*GW—NWG*) is defined as difference between Refinitiv ESG Controversy score and Newsweek Green score (NWG). Greenwashing is deemed to occur when *GW—NWG* takes positive values. The larger the difference between the two scores, the higher *GW—NWG*.[3] This means that a company is active in greenwashing when it receives a higher score in the *ex-ante* ranking than in the *ex-post* one. For instance, if firm *i* displays a score of 40 according to NWG versus a score of 60 according to Refinitiv, *GW—NWG* will have a value of 20 and will signal a greenwashing attitude. We consider Refinitiv ESG rating as an *ex-ante* ranking system, while NWG as an *ex-post* one.

Our second proxy of greenwashing exploits variation in scores within Refinitiv. As described, Refinitiv provides a raw ESG score and a ESG Controversy score. The latter adjusts downward the raw ESG to take into account the actual environmental and social controversies that a firm faces. Specifically, the ESG Controversy score is calculated based on 23 ESG controversy topics. During the year, if a scandal occurs, the company involved is penalized and this affects the overall ESG Controversy score and grading, relative to the ESG score. The impact of the event may still be seen in the following year if there are new developments related to the negative event, such as lawsuits, disputes, or fines. All new media materials are captured as the controversy progresses. Consequently, the ESG Controversy score captures an *ex-post* dimension of environmental performance, that is not reflected in the raw ESG score. We thus defined our second proxy of greenwashing (*GW—Refinitiv*) as the difference between the raw (*ex-ante*) ESG score and the (*ex-post*) ESG Combined score. Again, the larger the difference, the higher the greenwashing measure.

Environmental and social ranking systems usually take a comparative-only approach (although having the potential to be converted into a "limits-based" system), thus displaying the problems characterizing comparative ranking systems: if green indicators and performances are mapped against other companies rather than against proper and objective goals, even if a firm appears to be best performer relative to its peers, that does not mean that its behavior is truly in line with the targets (Rekker et al., 2021). By contrasting *ex-post* and externally validated environmental

[2] Each NWG score is a weighted average of eight clearly defined key performance indicators. These indicators are assigned to firms based on six core principles: transparency, objectivity, the use of public data, comparability, engagement, and the consideration of stakeholders' feedback. Data is obtained from primary sources—such as annual and sustainability reports, proxy statements and audited financial statements—as well as secondary sources like Bloomberg and the Carbon Disclosure Project (available via Bloomberg itself). A description of the methodology is available on the Newsweek website. For 2017, for instance, see: https://www.newsweek.com/newsweek-green-rankings-2017-methodology-739761

[3] We measure greenwashing relative to the Refinitiv ESG Controversy score, to be as conservative as possible. By construction, the Refinitiv ESG score is larger than the corresponding ESG Controversy score. Therefore, if we had used the raw ESG score the magnitude of our results would have been larger.

ranking with *ex-ante* rankings, we measure greenwashing within the same firm in absolute terms, thus mitigating the weaknesses of comparative rankings.

3.1.2 Greenwashing measurement with effective environmental violations

The second method we implement to measure greenwashing aims to capture inconstancies between *ex-ante* ESG ratings and firm's actual environmental violation(s). In theory, if there were no (or little) greenwashing, we should see that companies with higher *ex-ante* ESG ratings occur less in violations of environmental regulation. On the contrary, if a firm is "greenwashing active", we should see inconsistencies between its ESG ratings and its environmental violations. Under this method, we construct a set of indicator variables that track if a company is "greenwashing active". We consider a company "greenwashing active" if it has a high ESG rating relative to its industry and, at the same time, it experiences more environmental violations than its peers. We capture violations in different ways, using their existence, their number and the fines amount inflicted to a firm because of violations.

In order to track actual violations of the environmental rules, we take advantage of Violation Tracker data. Violation Tracker is a database compiled by the non-profit organization Good Jobs First. It is a wide-ranging database on corporate misconduct. It covers banking, consumer protection, false claims, environmental, wage and hour, safety, discrimination, price-fixing, and other cases resolved by US federal regulatory agencies and all parts of the Justice Department since 2000, plus cases from state attorneys general and selected state and local regulatory agencies. In all, the database contains 546,000 civil and criminal cases from more than 400 agencies with total penalties of $860 billion. These data have been already validated by the literature (e.g., Raghunandan, 2021). Although Violation Tracker contains comprehensive information on fines, we focus on environmental-related violations.

In detail, we construct three proxies of greenwashing using Refinitiv ESG Controversy score and violation tracker data.[4] The first, *GW—VTE*, is an indicator variable equal to one if the Refinitiv ESG Controversy score is above the industry-year median and the firm is sanctioned for at least one environmental violation in that year, and equal to zero otherwise. The idea is that if a company is perceived as better than its peers but, at the same time, it is sanctioned for environmental violations, there is evidence of potential greenwashing. However, some firms may be more exposed to environmental risks simply because of their activity (e.g., mining), despite their good will and environmental commitment. We thus construct a second proxy for greenwashing that account for the abnormal number of violations. We introduce the *GW—VTE Number*, an indicator variable equal to one if the Refinitiv ESG Controversy score is above the industry-year median and the firm is sanctioned for a number of environmental violations larger than the industry-year median, and zero otherwise. Finally, our third proxy of greenwashing considers the fines amount that firms incur following environmental violations, to capture not only the number but also the relevance of the violations. We measure the variable *GW—VTE Penalty*

[4] Again, we use the Refinitiv ESG Controversy score to be as conservative as possible in our estimates.

with an indicator equal to one if the Refinitiv ESG Controversy score is above the industry-year median and the firm is sanctioned with a total amount of fines due to environmental violations larger than the industry-year median, and zero otherwise.

As it can be better seen in the summary statistics (Sect. 3.2.3), the cases where a company is highly ranked in ESG relative to its peers but at the same time is more inclined to violations are not infrequent. In terms of environmental violations, we find 203 companies that were sanctioned at least for one environmental violation in the sample period. The number of violations per firm-year ranges from 1 to 45, and the penalty amount goes from 5000 to 5 billion USD.

3.1.3 Greenwashing measurement with ESG disagreement

The third method we implement to capture greenwashing is based on ESG disagreement. The uncertainty about ESG corporate profile that stems from different ESG ratings is priced by investors (Avramov et al., 2022). The differences among ESG ratings are largely due to the lack of consensus on the scope and measurement of ESG performance (Berg et al., 2022), and, as a result, outsiders cannot reliably observe the firm's true ESG profile. We assume that the higher the uncertainty about the ESG profile of a firm, the larger the room for greenwashing. The assumption is that the larger the dispersion of ESG ratings, the lower the consensus on company's environmental behavior and thus the more likely the presence of greenwashing.

We measure greenwashing based on disagreement in ESG (*GW—Disagreement*) following the methodology proposed by Avramov et al. (2022). We exploit the differences in ESG ratings across three rating providers: NWG, Refinitiv, and S&P. Specifically, in each year we obtain 3 rating pairs for each firm from the three data providers. For each rating pair-year, we sort firms according to the original rating scale of the respective data provider and calculate the percentile rank (scaled from 0 to 1). Then, for each firm, we compute the pairwise rating uncertainty as the sample standard deviation of the ranks provided by the two raters in the pair. For example, let $c_{i,t,NWG}$ and $c_{i,t,Refinitiv}$ denote the ESG rank for company i in year t from NWG and Refinitiv, respectively. The pairwise rating uncertainty is computed as $\frac{|c_{i,t,NWG}-c_{i,t,Refinitiv}|}{\sqrt{2}}$. For instance, if a company is ranked from two data providers at the 25th and 45th percentile, rating uncertainty would be 0.14. Finally, we compute the firm-level ESG disagreement (*GW—Disagreement*) as the average pairwise rating uncertainty across all rater pairs. According to our assumption, the larger the ESG disagreement the higher the propensity to greenwash.

3.2 Sample composition and data

The empirical analysis starts from the 500 largest U.S. public companies by revenue, mentioned by Newsweek Sustainability Rankings from 2012 to 2017. The U.S. market provides an ideal environment for running our empirical tests, thanks to the market size of the companies being involved, their global relevance, the industry coverage, and data availability. A within country approach allows also to avoid spurious effects due to differences in regulation. Besides, this ensures that all the firms adopt

the same accounting standards (U.S. GAAP) and report under the same functional currency; thus, no adjustment for accounting differences is needed.

We merge NWG data with Refinitiv ESG ratings first, and then with S&P ESG ratings. We retrieve financial statement and market data from WRDS—Compustat. Finally, we use Compustat identifiers to merge our data with the Violation Tracker database. Section 3.2.3 provides the summary statistics and Table 6 in the Appendix 1 provides a detailed description of each variable used and its source.

3.2.1 Output variables

The main output variables are our six proxies to measure greenwashing, namely: *GW—NWG*, *GW—Refinitiv*, *GW—VTE*, *GW—VTE Number*, *GW—VTE Penalty*, and *GW—Disagreement*, defined as above. For robustness purposes, we also bound *GW—NWG* at zero (*GW—NWG Adj.*), because a possible argument could be that a company is either greenwashing to a given extent or is not greenwashing at all. Consequently, greenwashing should either have positive values ("greenwashing active") or be equal to zero ("anti greenwashing").

The second output variable of interest is the Tobin's Q ratio ($Excess\ Value_{i,t}$), which we analyze to capture the effect of greenwashing on firm value. This variable is computed as follows:

$$ExcessValue_{i,t} = Tobin^{'}sQ_{i,t} = \frac{MVE_{i,t} + BVL_{i,t}}{BVE_{i,t} + BVL_{i,t}} \quad (1)$$

where $MVE_{i,t}$ is the market value of equity, $BVE_{i,t}$ is the book value of equity and $BVL_{i,t}$ is the book value of total liabilities for firm i in year t.

3.2.2 Independent variables

Independent variables are classified into three categories: governance, financial and sustainability characteristics of a firm. All variables are measured for company i in year t.

The first and most important set of independent variables is related to corporate governance characteristics. We employ three board of directors features that are traditionally associated to mitigation of agency problems. Specifically, we track: first, the size of the board, measured as the number of members in the board (*BoardSize*); second, the board independence, measured as the percentage of independent directors (*BoardInd*); and third, the gender representativeness, equal to the share of women directors in the company board (*FemBoard*). These variables are obtained from Thomson Reuters ASSET4 database. In case of unavailability, data have been hand collected.

In the empirical analysis, we control for the financial firm-specific factors that the literature relates to greenwashing (e.g., Delmas & Burbano, 2011; Mateo-Márquez et al., 2022). These factors are: firm size (*FirmSize*) measured as the natural logarithm of the market capitalization; firm profitability (*ROA*), computed as the ratio of the company's earnings before interest and taxes (EBIT) and total assets;

leverage (*Lev*), equal to total debt divided by total assets; market-to-book ratio (*MB*), equal to market capitalization over book value of equity. Appendix 2 provides a brief literature review about the relationships of these financial characteristics and greenwashing.

The last and third set of independent variables capture sustainability controls. First, we include a dummy variable (*GRI*) taking the value of one if a company is adopting the GRI Standards for sustainable reporting, and zero otherwise (Willis, 2003). Second, our robustness specification controls for firm's change in CO_2 emissions over time (ΔCO_2). Finally, in the robustness section we control for the political party ruling in the US state where a company is headquartered *(State*), as democrats are traditionally keener on environmental issues.

3.2.3 Summary statistics

Our final sample contains 2201 observations for the greenwashing variables, but for *GW—Disagreement* that reports 1486 observations as S&P ESG ratings are available only from 2013.

Table 1 exhibits the summary statistics of the variables used. On average, the firms in the sample are active in greenwashing according to all our six proxies. *GW—NWG* has a positive mean value, indicating that each company receives a score which is typically 17.3 points higher in the *ex-ante* sustainability ranking (Refinitiv) than in the *ex-post* ranking (NWG). Even when we assess greenwashing within Refinitiv, we find a positive average for our proxy: *GW—Refinitiv* mean is indeed equal to 10.41. *GW—Refinitiv* reports lower mean, median and standard deviation compared to *GW—NWG*, suggesting that the magnitude of contrasting *ex-post* and *ex-ante* ratings is larger across raters than within the same rater. As for the proxies of greenwashing based on environmental violations, we find that on average 10% of the firms are involved in at least one violation in a given year. *GW—VTE Number* has a mean of 0.08, implying that 8% of the firms reports an *ex-ante* ESG rating above the industry-year median, but at the same time are convicted for more environmental violations than the industry-year median. A similar reasoning applies to the statistics of *GW—VTE Penalty*. Finally, *GW—Disagreement* average and standard deviations, equal to 0.14 and 0.07 respectively, are in line with Avramov et al. (2022).

Corporate governance variables indicate that the board size is on average of 11 members, with a dominant stake of independent directors, who represent on average 85% of the total board members. Yet, women are still underrepresented, with an average of 1 woman for every 5 directors sitting in the board. Overall, we find that boards are large and dominated by independent directors, consistently with the focus on the 500 largest US public companies.

According to the existing literature (Brammer & Pavelin, 2006; de Vries et al., 2015; Yang et al., 2020; Zaiane & Ellouze, 2022), the industry of a given firm is relevant when examining the greenwashing phenomenon. Some industries seem more sensitive to the sustainability debate and more exposed to negative environmental performances. Table 2 shows the average *GW—NWG* and *GW—NWG Adj.* by industry. The table also reports the difference between *GW—NWG* and *GW—NWG Adj.*

Table 1 Cross-sectional descriptive statistics

Variable	μ	σ	Min	p25	p50	p75	Max	N
GW – NWG	17.33	25.47	− 52.68	− 2.27	19.38	36.94	86.11	2201
GW – NWG Adj.	21.60	19.64	0	0	19.38	36.94	86.11	2201
GW – Refinitiv	10.41	15.08	− 6.20	0	0	25.595	46.21	2200
GW – VTE	0.10	0.29	0	0	0	0	1	2201
GW – VTE number	0.08	0.27	0	0	0	0	1	2201
GW – VTE penalty	0.08	0.27	0	0	0	0	1	2201
GW – disagreement	0.14	0.07	0	0.08	0.13	0.18	0.43	1486
BoardSize	11.11	2.22	4	10	11	12	28	2158
BoardInd	0.85	0.09	0.17	0.80	0.88	0.92	1	2158
FemBoard	0.20	0.09	0	0.13	0.18	0.25	0.63	2158
ExcessValue	1.68	1.53	0	0.76	1.33	2.11	20.71	2274
FirmSize	9.34	2.50	0	9.11	9.71	10.45	13.58	2281
ROA	0.10	0.09	− 1.38	0.05	0.08	0.14	0.61	2287
Lev	0.26	0.20	0	0.11	0.24	0.37	1.85	2280
MB	1.68	16.34	− 627.9	0.66	1.47	2.58	88.63	2274
GRI	0.36	0.48	0	0	0	1	1	2208
ΔCO_2 (/000)	− 5.35	211.17	− 450	− 46.21	1.37	50.00	386.22	2246

This table reports the cross-sectional summary statistics for the variables used in the paper. *GW—NWG* is defined as the difference between Refinitiv ESG Controversy score and Newsweek Green score (NWG). *GW—NWG Adj.* is *GW—NWG* bounded to zero. *GW—Refinitiv* is the difference between the raw ESG and the ESG Controversy scores provided by Refinitiv. *GW—VTE* is a dummy equal to 1 if the Refinitiv ESG Controversy score is above the industry-year median and the firm is sanctioned for at least one environmental violation in that year, and 0 otherwise. *GW—VTE Number* is a dummy equal to 1 if the Refinitiv ESG Controversy score is above the industry-year median and the firm is sanctioned for a number of environmental violations larger than the industry-year median, and 0 otherwise. *GW—VTE Penalty* is a dummy equal to 1 if the Refinitiv ESG Controversy score is above the industry-year median and the firm is sanctioned with a total amount of fines due to environmental violations larger than the industry-year median, and 0 otherwise. *GW—Disagreement* is the level of disagreement across NWG, Refinitv and S&P ESG scores, estimated following Avramov et al. (2022). *BoardSize* is the number of members in the board of directors. *BoardInd* is the share of independent directors in the board. *FemBoard* is the percentage of women in the board. *ExcessValue* is the Tobin's Q. *FirmSize* is the firm size measured as the natural logarithm of the market capitalization. *ROA* is the company return on assets (EBIT/Total Assets). *Lev* is the company leverage (Total Debt / Total Assets). *MB* is the market-to-book ratio, equal to company's market capitalization divided by book value of equity. *GRI* is a dummy variable equal to 1 if a company is adopting a GRI standard, and 0 otherwise. ΔCO_2 is the two-year change in company's carbon emissions. Table 6 in the Appendix 1 provides a detailed description of all the variables. Table 8 in the Appendix 1 provides additional statistics

This difference provides a sense of greenwashing importance: the closer to zero, the more important is, on average, the industry greenwashing activity.

The average *GW—NWG* is largely dispersed across sectors, ranging from − 16.87 to 42.44. Some sectors, such as agriculture, mining, oil and gas, real estate and constructions display an average high level of greenwashing according to our proxy. These findings are interesting, because pollution-oriented industries (such as gasoline stations) or activities that have a direct and potentially damaging impact on the environment

Table 2 Firm Greenwashing across industries

NAICS code	NAICS industry	Frequency	GW—NWG	GW—NWG Adj.	Delta green
11	Agriculture, forestry, fishing and hunting	1	26.17	26.17	–
21	Mining, quarrying, and oil and gas extraction	114	23.72	24.74	− 1.02
22	Utilities	129	17.29	20.26	− 2.97
23	Construction	14	27.86	29.96	− 2.10
31–33	Manufacturing	815	11.64	16.80	− 5.16
42	Wholesale trade	76	24.13	28.18	− 4.05
44–45	Retail trade	192	17.08	21.25	− 4.17
48–49	Transportation and warehousing	100	10.40	15.25	− 4.85
51	Information	173	10.91	17.07	− 6.16
52	Finance and insurance	337	15.31	19.29	− 3.98
53	Real estate and rental and leasing	84	30.72	32.33	− 1.61
54	Professional, scientific, and technical services	131	18.06	22.42	− 4.36
56	Administrative and support, waste management and remediation services	36	19.15	24.25	− 5.10
61	Educational services	1	− 16.87	0	− 16.87
62	Health care and social assistance	46	12.73	18.74	− 6.01
71	Arts, entertainment, and recreation	1	27	27	–
72	Accommodation and food services	59	2.38	9.96	− 7.58
81	Other services (except Public Administration)	4	42.44	42.44	–

This table reports the *GW—NWG* and the *GW—NWG Adj.* average by industry. Industries correspond to the 2–digit NAICS codes. *GW—NWG* is defined as the difference between Newsweek Green score (NWG) and Refinitiv ESG Controversy score. *GW—NWG Adj.* is *GW—NWG* bounded to zero. Delta Green is the difference between *GW—NWG* and *GW—NWG Adj*. The table also reports the number of firms in each industry in the sample

(like construction of buildings) seem to have more chances to greenwash; that could be because they are (or should be) more under scrutiny of regulators and stakeholders. Other industries, such as educational services, food and accommodation and information have inherently lower indicators of greenwashing. Firms operating in those industries typically face more pressure from their stakeholders and tend to suffer higher reputational damages (Brammer & Pavelin, 2006; Delmas & Burbano, 2011).

3.3 Empirical models

The set of hypotheses is tested with our firm-year panel data and Ordinary Least Square (OLS) models, featuring robust standard errors. All models incorporate time and industry fixed effects, according to the literature best standards (Dyck et al., 2019).

Hypotheses from 1 to 3 (set out in Sect. 2.2) explore the influence of a variety of corporate governance variables on greenwashing, according to the following model:

$$\begin{aligned} GW_{i,t} = \alpha + \beta_1 BoardSize_{i,t} + \beta_2 BoardInd_{i,t} \\ + \beta_3 FemBoard_{i,t} + Controls_{i,t} + IndustryFE + TimeFE + \epsilon_{i,t} \end{aligned} \tag{2}$$

where $GW_{i,t}$ is alternatively one of our six greenwashing proxies (as detailed in Sect. 3.1). When the output variables are dummy variables (*GW – VTE*, *GW – VTE Number*, and *GW – VTE Penalty*) the model is a linear probability model and the coefficients on the covariates can be interpreted like probability of a firm being "greenwashing active". The main covariates of interests are those capturing corporate governance characteristics: total members of the board of directors (*BoardSize*), percentage of independent directors (*BoardInd*), and share of women directors in the company's board (*FemBoard*). *Controls* is a vector containing firm-specific financial (*FirmSize*, *ROA*, *Lev*, *MB*) and sustainability (*GRI*) controls. The model incorporates robust standard errors. A full description of the variables is provided in Sect. 3.2.2 and Table 6 in the Appendix 1.

Hypothesis 4 (set out in Sect. 2.3) investigates whether greenwashing influences firm value, using the following model:

$$\begin{aligned} ExcessValue_{i,t} = \alpha + \beta_1 GW_{i,t} + \beta_2 BoardSize_{i,t} + \beta_3 BoardInd_{i,t} \\ + \beta_4 FemBoard_{i,t} + Controls_{i,t} + IndustryFE + TimeFE + \epsilon_{i,t} \end{aligned} \tag{3}$$

where $ExcessValue_{i,t}$ is the Tobin's Q ratio for firm i at the end of year t according to Eq. (1). $GW_{i,t}$ is one of our six proxies for greenwashing. The coefficients of main interests are those on $GW_{i,t}$, because they capture the association between greenwashing and firm value. The model also incorporates the variables mapping governance characteristics (*BoardSize*, *BoardInd, FemBoard*), as well as the same controls we use in Eq. (2), with the only exception of market-to-book ratio (*MB*) because embedded in the output variable.

4 Empirical results

4.1 Greenwashing and governance characteristics

The first aim of this study is to analyze whether board-related governance characteristics are linked to the level of greenwashing. Table 3 reports the main results of our analysis.

In each column we present the OLS estimation results of Eq. (2) for a different proxy of greenwashing (*GW*). The most important results are the links between corporate governance and greenwashing. We find that governance characteristics are relevant in explaining the greenwashing phenomenon. In general, we find a strong and consistent evidence that the share of independent members (*BoardInd*) is strongly and positively related to greenwashing. This evidence is highly significant both from a statistical and an economic standpoint. Similarly, the percentage of women (*FemBoard*) in the board is positively associated with greenwashing. On the contrary, we do not have conclusive evidence on the effect of board size (*BoardSize*) on greenwashing.

The coefficients on *BoardSize* are not consistent across the different proxies of greenwashing. While *BoardSize* loads positively on *GW—NWG*, it turns negative when *GW—Refinitiv* is the outcome variable. Besides, *BoardSize* is not statistically significant for the other output variables. These findings are consistent with the literature that has not reached a final consensus on the relationship between board size and greenwashing yet.

Interestingly, instead, we find clear evidence that a higher share of independent directors does not imply a better monitoring of greenwashing activity. On the contrary, the share of independent directors is strongly and positively related to greenwashing practices, as measured according to five of our *GW* variables. For example, 10 points increase in *BoardInd* is associated with approximately a 2.2 percentage points increase in the probability of a firm being classified as "greenwashing active" according to *GW—VTE* (column 3). Similarly, the probability of a firm being considered as "greenwashing active" by *GW—VTE Penalty* (column 5) increases by 1.9 percentage points per every 10 points growth in *BoardInd.* These results are all highly statistically significant and economically relevant, and they extend the literature that cast doubts on the efficiency and efficacy of independent directors.

As for gender representativeness, we find that there is a positive relationship between greenwashing proxies and the presence of women in board (*FemBoard*). Both *GW—Refinitv* and *GW—Disagreement* have positive and statistically significant coefficients with the presence of women in the board. For example, 10 points increase in the share of women in the board is associated with an increase of 0.8 percentage points in *GW—Disagremeent* (column 6). This increase is economically relevant, as it corresponds to 5.7% of the average *GW—Disagreement*. The economic impact of female presence in the board is even larger when we look at *GW—Refinitiv* (column 2): a 10 points growth in the board female share is linked to a 1.5 percentage points growth of *GW—Refinitiv,* corresponding to 15% of the average *GW—Refinitiv*.

Table 3 Greenwashing and firm corporate governance characteristics

Variables	GW—NWG	GW—Refinitiv	GW—VTE	GW—VTE number	GW—VTE penalty	GW—disagreement
	(1)	(2)	(3)	(4)	(5)	(6)
BoardSize	− 0.015*** (0.003)	0.009*** (0.002)	0.003 (0.003)	0.004 (0.003)	0.003 (0.003)	0.000 (0.001)
BoardInd	0.218*** (0.057)	0.081* (0.033)	0.224*** (0.059)	0.200*** (0.055)	0.194*** (0.057)	0.018 (0.025)
FemBoard	0.051 (0.055)	0.154*** (0.036)	0.074 (0.072)	0.041 (0.067)	0.020 (0.068)	0.082*** (0.024)
FirmSize	− 0.006** (0.002)	0.010*** (0.002)	0.003 (0.002)	0.001 (0.001)	0.002 (0.002)	0.001 (0.001)
Lev	− 0.024 (0.028)	− 0.001 (0.019)	− 0.001 (0.037)	− 0.015 (0.035)	− 0.013 (0.036)	0.034** (0.013)
ROA	0.004 (0.051)	− 0.008 (0.036)	0.042 (0.069)	− 0.046 (0.069)	− 0.021 (0.068)	0.026 (0.025)
MB	− 0.001*** (0.000)	0.000 (0.000)	− 0.000 (0.000)	− 0.000 (0.000)	− 0.000 (0.000)	− 0.001 (0.001)
GRI	− 0.057*** (0.011)	0.046*** (0.007)	0.059*** (0.015)	0.063*** (0.014)	0.076*** (0.015)	− 0.010* (0.004)
Constant	− 0.332* (0.136)	− 0.077 (0.047)	− 0.336*** (0.066)	− 0.296*** (0.060)	− 0.284*** (0.062)	0.059 (0.030)
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2060	2060	2060	2060	2060	1414
R–squared	0.368	0.236	0.104	0.064	0.079	0.087

The table shows the results of the OLS estimations according to Eq. (2) in the text. The output variables correspond to the six proxies we use to measure greenwashing: *GW—NWG, GW—Refinitiv, GW—VTE, GW—VTE Number, GW—VTE Penalty*, and *GW—Disagreement*. *BoardSize* is the number of members in the board of directors. *BoardInd* is the percentage of independent directors in the board. *FemBoard* is the percentage of women in the board. All regressions include the firm financial characteristics controls (*FirmSize*, *Lev*, *ROA*, and *MB*), as well as the *GRI* control. The exact definition of each variable is provided in Sect. 3.1 and in Table 6 of the Appendix 1. All regressions include time and industry fixed effects. Robust standard errors are reported in parentheses

***, ** and * denote significance levels at 1%, 5% and 10% respectively

4.2 Greenwashing and firm value

The last hypothesis we test aims to verify whether greenwashing has an influence on firm value and, more specifically, on the company's excess value over the book value. This question is important because, if the hypothesis were not rejected, it would provide evidence that investors value both sustainability (Hartzmark & Sussman, 2019) and greenwashing (Du, 2015). The analysis is conducted through OLS regressions with robust standard errors and fixed effects, according to Eq. (3). The results are shown in Table 4.

We find that greenwashing has a negative and statistically significant impact on firm value for five of our *GW* variables. This suggests that investors penalize companies active in greenwashing. The size of the coefficients is economically relevant. For example, columns from (3) to (5) show that *ExcessValue* is lower by more than 20% if a company is classified as "greenwashing active" according to one of the three proxies based on environmental violations (*GW—VTE*, *GW—VTE Number*, and *GW—VTE Penalty*). The coefficient on *GW—Disagreement* is − 1.408 (column 6), implying that an average 10 positions difference in the ranking across different ESG ratings is associated with a 9.8% lower *ExcessValue*. Thus, when the disagreement across ESG rating providers is high, firms trade at discount. This is consistent with the literature showing that the CAPM alpha and effective beta both rise with ESG uncertainty (Avramov et al., 2022).

4.3 Robustness checks

We develop robustness checks for our baseline findings on greenwashing along two dimensions. First, we check if the political preferences in the state where a company is headquartered impact our results, because political pressures can influence greenwashing activity. Second, we include in our model the effective reductions in carbon emissions as an additional control variable, to exclude the concern that the relationships between greenwashing and board governance are affected by the appraisal of carbon emissions. Table 5 reports the results of the robustness tests. All the tests are repeated for *GW—NWG* and *GW—NWG Adj.*.

In columns (1) and (2), we add to the baseline model of Eq. (2) a *State* dummy variable. This variable takes a value of one when a firm is headquartered in a US democratic state, and zero otherwise. We include the variable to assess whether it is true that a company located in a democratic state is less likely to be "greenwashing active", as Democrats are supposed to be more sensitive than Republicans to environmental issues. If this is verified, coefficient for such a variable should be negative. In fact, the coefficient on *State* is strongly negative and statistically significant, suggesting that firms are less prone to greenwash if based in a democratic state. All other results are coherent with those obtained in Table 3. It is key noting that all coefficients for corporate governance variables keep their magnitude and significance.

Table 4 Greenwashing and firm value

Variables	Excess value (1)	ExcessValue (2)	ExcessValue (3)	ExcessValue (4)	ExcessValue (5)	ExcessValue (6)
GW—NWG	0.029 (0.102)					
GW—Refinitiv		− 0.370* (0.159)				
GW—VTE			− 0.213*** (0.054)			
GW—VTE number				− 0.237*** (0.063)		
GW—VTE penalty					− 0.216*** (0.061)	
GW—disagreement						− 1.408** (0.477)
BoardSize	− 0.079*** (0.015)	− 0.076*** (0.016)	− 0.079*** (0.015)	− 0.078*** (0.015)	− 0.079*** (0.015)	− 0.090*** (0.020)
BoardInd	− 1.351** (0.500)	− 1.315** (0.500)	− 1.296** (0.496)	− 1.297** (0.496)	− 1.302** (0.496)	− 1.988** (0.680)
FemBoard	− 0.171 (0.309)	− 0.112 (0.312)	− 0.154 (0.309)	− 0.160 (0.309)	− 0.165 (0.309)	− 0.375 (0.426)
Time varying controls and constant	Yes	Yes	Yes	Yes	Yes	Yes
Time and industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2060	2060	2060	2060	2060	1414
R–squared	0.449	0.450	0.450	0.450	0.450	0.442

The table shows the results of the OLS estimations according to Eq. (3) in the text. The output variable is the Tobin's Q (*ExcessValue*). In each column, we use alternatively one of the six proxies measuring greenwashing: *GW—NWG* (1), *GW—Refinitiv* (2), *GW—VTE* (3), *GW—VTE Number* (4), *GW—VTE Penalty* (5), and *GW—Disagreement* (6). *BoardSize* is the number of members in the board of directors. *BoardInd* is the percentage of independent directors in the board. *FemBoard* is the percentage of women in the board. All regressions include the firm financials characteristics controls (*FirmSize*, *Lev*, *ROA*), *GRI* control, and a constant. For the sake of space, we do not report the coefficients on the control variables. The exact definition of each variable is provided in Sect. 3.1 and in Table 6 of the Appendix 1. All regressions include time and industry fixed effects. Robust standard errors are reported in parentheses

***, ** and * denote significance levels at 1%, 5% and 10% respectively

Table 5 Robustness tests

Variables	GW—WG	GW—NWG Adj.	GW—NWG	GW—NWG	GW—NWG	GW—NWG Adj.
	(1)	(2)	(3)	(4)	(5)	(6)
BoardSize	− 0.009*** (0.002)	− 0.007*** (0.002)	− 0.011*** (0.002)	− 0.010*** (0.003)	− 0.011*** (0.002)	− 0.008*** (0.002)
BoardInd	0.293*** (0.055)	0.222*** (0.044)	0.310*** (0.057)	0.299*** (0.080)	0.308*** (0.057)	0.240*** (0.045)
FemBoard	− 0.031 (0.051)	− 0.026 (0.041)	− 0.061 (0.052)	− 0.025 (0.074)	− 0.058 (0.052)	− 0.038 (0.042)
FirmSize	− 0.034*** (0.005)	− 0.024*** (0.004)	− 0.037*** (0.005)	− 0.034*** (0.007)	− 0.037*** (0.005)	− 0.025*** (0.004)
Lev	− 0.058** (0.026)	− 0.033 (0.021)	− 0.064** (0.027)	− 0.047 (0.038)	− 0.065** (0.027)	− 0.034 (0.022)
ROA	0.140** (0.065)	0.093* (0.053)	0.164** (0.068)	0.157 (0.098)	0.158** (0.068)	0.107* (0.055)
MB	− 0.000 (0.000)	0.000 (0.000)	− 0.000 (0.000)	− 0.000 (0.000)	− 0.000 (0.000)	0.000 (0.000)
GRI	− 0.049*** (0.011)	− 0.045*** (0.009)	− 0.052*** (0.010)	− 0.052*** (0.015)	− 0.052*** (0.010)	− 0.044*** (0.008)
State dummy	− 0.033*** (0.010)	− 0.025*** (0.008)			− 0.032*** (0.011)	− 0.024*** (0.009)
ΔCO2 (Absolute)			0.000*** (0.000)		0.000*** (0.000)	0.000*** (0.000)
ΔCO2 (> 0)				0.000*** (0.000)		
Constant	0.167*** (0.061)	0.199*** (0.049)	0.165*** (0.062)	0.122 (0.087)	0.180*** (0.062)	0.198*** (0.049)
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2234	2234	2161	1138	2161	2161
R–squared	0.395	0.362	0.394	0.428	0.397	0.365

The table shows the results of the OLS estimations according to Eq. (2) in the text, augmented with the variables *State* and ΔCO_2. In columns (1), (3), (4), and (5), the output variable is *GW—NWG*, equal to the difference between Refinitiv ESG Controversy score and Newsweek Green score (NWG). In columns (2) and (6), the output variable is *GW—NWG Adj.*, equal to *GW—NWG* bounded at zero. *BoardSize* is the number of members in the board of directors. *BoardInd* is the percentage of independent directors in the board. *FemBoard* is the percentage of women in the board. All regressions include the firm financial characteristics controls (*FirmSize*, *Lev*, *ROA*, and *MB*), as well as the *GRI* control. *State* is a dummy variable equal to 1 if a company is headquartered in a democratic state, and 0 otherwise. ΔCO_2 *(absolute)* is the two-year change in company's carbon emissions. ΔCO_2 *(> 0)* is the two-year change in company's carbon emissions, if greater than 0. The exact definition of each variable is provided in Sect. 3.1 and in Table 6 of the Appendix 1. All regressions include time and industry fixed effects. Robust standard errors are reported in parentheses

***, ** and * denote significance levels at 1%, 5% and 10% respectively

In columns (3) and (4), we augment the baseline model with the measurement of changes in carbon emissions. One could argue that our results on greenwashing are driven by carbon emissions, rather than board characteristics, because companies with high emissions are characterized by specific corporate governance attributes that we study (e.g., larger firms have larger emissions and larger boards). Therefore, a further check has been done by adding to Eq. (2) a new factor (ΔCO_2) representing the two-year change in the level of actual total CO_2 and CO_2 equivalent emissions. We use the change over two-years because reduction in carbon emissions takes time. Table 1 shows that ΔCO_2 has a negative mean value. This signals an average decreasing trend for firms' carbon emissions over time in the sample period.

We first examine whether a change in the level of carbon emissions has an impact on greenwashing (column 3). Statistical significance is found, indicating that the level of greenwashing is positively related to the change in carbon emissions. This implies that companies polluting more are, on average, more inclined to show themselves as green. To better understand the dynamics behind these findings, the attention is then focused on the case of sole increases in the CO_2 emissions, with ΔCO_2 taking positive values only (column 4). Virtuous firms have been isolated and excluded from the sample, by dropping all the observations displaying negative ΔCO_2. Interestingly, the variable, despite economically small, is still strongly significant and has a positive coefficient, meaning that corporations characterized by polluting businesses tend to greenwash more.

In columns (5) and (6) we combine the inclusion of *State* and ΔCO_2. All results are confirmed. Finally, and most importantly, our main findings about the relationships between greenwashing and board-level corporate governance features remain totally confirmed. This lets us conclude that the measurement of carbon emissions does not influence our main results.

5 Contributions

5.1 Theoretical contribution

The combination of sustainability disclosure with the willingness to satisfy stakeholders expectations determines the occurrence of greenwashing. Firms can make incomplete, misleading, or false environmental claims with the intention of avoiding loss of legitimacy or reputational damages, thus increasing information asymmetries with their stakeholders. At the same time, firms may also create shared symbolic representations to accompany and inspire green practices (Bowen, 2014).

Assuming a broader definition of greenwashing, the nascent literature on the phenomenon must deal first with the methodological issues associated with the measurement of greenwashing, and with the drivers and consequences of not "walking the talk" on environmental performance (Schoeneborn et al., 2020). Therefore, this study aims at filling those literature gaps on at least two fronts. First, we explore how some corporate governance characteristics are related to greenwashing. Second, we investigate the relationship between greenwashing and firm value. In terms of governance characteristics, we study the relationship between board features (size, presence of independent directors, gender representation) and greenwashing.

As for the role of board size, our findings are inconclusive. In literature, some scholars argue that larger boards entail larger agency costs, due to the rise of inefficiencies in the interaction of firm's insiders with outsiders (Ang et al., 2000; Raheja, 2005). On a similar note, the literature poses doubts on the causal relationship between board size and better performance (Lehn et al., 2009). When larger boards are not combined with better monitoring, there could be more possibilities for greenwashing. Some other scholars, instead, argue that larger boards foster a better monitoring and thus decrease the influence that single (inside) members can exert on the rest of the board, driving agency costs down (Bebchuk, 2005; Chakraborty & Yilmaz, 2017). For instance, a larger board might include committees specifically appointed to focus on sustainability topics (Rao et al., 2012) and environmental performance is higher in firms with larger boards (De Villiers et al., 2011; Lu & Wang, 2021). Our results confirm that the board size by itself does not represent a remedy to greenwashing.

As far as the presence of independent directors is concerned, our findings show with high statistical and economic significance that independent directors are associated with greater greenwashing behaviors. Outside directors matter if they are substantially independent and able to interact efficiently with company insiders (Ang et al., 2000; Eng & Mak, 2003; Leung & Gul, 2004). The literature has shown that investors have generally moved beyond the traditional request for board independence, given the incentives nominally independent directors may have to side with insiders (Bebchuk & Hamdani, 2017; Coles et al., 2014). To this end, voting mechanism and investor activism make it easier for outside investors to prevent agency problems more effectively than the nominal share of independent members (Doidge et al., 2019; Dyck et al., 2023). Our findings are in line with the evidence that a higher number of independent directors leads to lower sustainability performance (Naciti, 2019). Besides, our results are consistent with the view that independent institutional investors, who aims to appoint independent directors, have essentially no evident impact on firms' environmental performance if these investors are from a country with weak environmental social norms (Dyck et al., 2019), like the US where all the companies in our sample are headquartered.

Finally, we find that the percentage of women on the board is positively associated to greenwashing. Our findings are consistent with the most recent evidence on the relationship between the share of women in the board and greenwashing (Tonetto, 2022). This evidence shows that a higher number of female directors in the board is associated with lower sustainability performance because of the extreme "busyness" of women with board appointments. Our results are consistent with the still open debate about the different roles of the board, namely monitoring and providing resources via advice (Ferris et al., 2003; Hillman & Dalziel, 2003; Kim, 2022). The effectiveness of busy boards varies with firms' demands for specific board functions: monitoring and providing resources (Kim, 2022). The positive effect of board busyness on advising quality can be enhanced when a firm has higher advising needs. The negative effect of board busyness on monitoring quality can be mitigated when a firm has lower monitoring needs. This view reconciles our findings with the existing literature. When it relates to environmental performance, the presence of women in the board is beneficial due to the advising roles that these members can provide (Lu & Wang, 2021; Naciti, 2019; Post et al., 2015; Rao et al., 2012). When it relates to greenwashing, instead,

the presence of busy female directors in not beneficial because their busyness affects the effective monitoring of the greenwashing activities (Tonetto, 2022).

Moreover, we find that greenwashing negatively affects firm value. A first explanation for this result is rooted in the information asymmetry theory. Since "greenwashing active" firms increase the opacity on their performance, investors are likely to discount the value assigned to such companies (Delmas & Burbano, 2011). In general, our results also support the view that only green practices that adhere to green promises are positively related to firm value (Brooks & Oikonomou, 2018; Ferrell et al., 2016; Jiao, 2010).

5.2 Methodological contribution

We propose a novel set of metrics that matches the (self-reported) *ex-ante* degree of greenness with the presence and intensity of (verified) *ex-post* environmental controversies and sanctions. The discrepancy between green intentions and green outcomes is a proxy for greenwashing. Additionally, we construct an *indirect* measure of greenwashing by looking at the apparent divergence of environmental ratings provided by three different organizations releasing environmental performance assessments. The measures we present should address the main concerns associated with the measures proposed in literature. In contrast with selective disclosure, our measures are able to capture more aspects of multifaceted greenwashing -namely, it considers also overstating, over-promising, constructive symbolism associated with environmental performance disclosure. When compared with measures of greenwashing based on the misalignment between KPIs related to green practices and KPIs related to green communication, our approach is cleaner and more robust in identifying the "walk" and the "talk".

5.3 Managerial contribution

All in all, our findings have multiple managerial implications. First, companies should consider that investors, media, and other stakeholders are getting progressively better at detecting the firm 's genuine environmental performance. The coexistence of divergent environmental ratings ingenerates a degree of confusion that is negatively reflected in stock prices. Companies should pursue a coherent environmental communication strategy because inflating green credentials is not financially convenient. Second, some board features expected to improve the sustainability footprint of companies seem detrimental to the alignment between "walking" and "talking". Responsible owners and institutional investors actively engaging with companies on sustainability matters should consider alternative governance mechanisms to incentivize managers in delivering against sound environmental targets and indicators. Our results are relevant even for regulations and the heating debate about the design of sustainability disclosure standards and frameworks. Regulating sustainability disclosure appears all more necessary and the coexistence of multiple competing reporting frameworks appears to create rooms for inconsistent narratives about the environmental footprint of companies. Policymaking should address those concerns by working towards the definition and implementation of international

robust frameworks for the disclosure of environmental performance. Along with the quality of the sustainability reporting requirements, it is important to enforce those with third-party verifications and tangible sanctions in case of misbehavior.

6 Conclusions

In this paper we explore whether some corporate governance mechanisms can foster or hinder greenwashing. We first propose a novel set of metrics to capture the elusive phenomenon of greenwashing and then we show the nature of the relationships between certain board characteristics and greenwashing behaviors. For board size we are not able to identify unambiguously the relation between the number of directors and the greenwashing intensity. Still, we can dispel the belief that making boards larger is a sure cure for greenwashing. Board independence appears to be positively associated with greenwash behaviors, such an apparent paradox is consistent with the view that independent directors might be gain from projecting greener credentials for the company on whose board they sit in order to improve their green reputation with stakeholders (i.e. media, activists, responsible investors, clients), generating further job opportunities for themselves. Similarly, we find that the percentage of women on the board is positively associated to greenwashing: therefore, a better gender balance for the board is not a guaranteed cure for greenwashing either. Incidentally, we also find that political preferences might be a meaningful factor in explaining greenwashing.

We also examine the relationship between the degree of greenwashing and the market value of firms. Importantly, we find that greenwashing negatively affects firm value, thus showing that not "walking the talk" on environmental performance is recognized by financial markets. In our sample on average the investors can identify and punish firms that do not actually deliver on environmental performance regardless of what ESG ratings say.

Our study has several limitations that can pave the way to further empirical work. Our measure of greenwashing is constrained by the amount of data available. Also, we focus only on US companies: our results should be confirmed with more cross-sections of yearly environmental scores and with data from other countries. Secondly, in this paper we examine only a limited subset of corporate governance mechanisms related to board characteristics. Further investigations should examine other aspects such as the ownership structure, the compensation mechanisms, and the presence of internal controls. Also, we do not have an experiment to test for endogeneity: we study associations but not the direction of causality between corporate governance characteristics and greenwashing activities. Further research would be needed on these fronts. Finally, we do investigate how financial markets are able to detect greenwashing. The tools and metrics adopted by climate-aware institutional investors to make portfolio decisions are still understudied and would deserve greater scholarly investigation.

Appendix 1

See Tables 6, 7 and 8.

Table 6 Description, computation, and source of variables

Variable	Description	Source
Output variables		
GW—NWG	Difference between Refinitiv ESG controversy score and Newsweek green score (NWG)	Newsweek green ranking and Refinitiv
GW—NWG Adj.	The maximum between *GW—NWG* and zero	Newsweek green ranking and Refinitiv
GW—Refinitiv	Difference between the raw ESG and the ESG controversy scores provided by Refinitiv	Refinitiv
GW—VTE	Indicator variable equal to 1 if the Refinitiv ESG Controversy score is above the industry-year median and the firm is sanctioned for at least one environmental violation in that year, and 0 otherwise	Refinitiv and violation tracker
GW—VTE number	Indicator variable equal to 1 if the Refinitiv ESG Controversy score is above the industry-year median and the firm is sanctioned for a number of environmental violations larger than the industry-year median, and 0 otherwise	Refinitiv and violation tracker
GW—VTE penalty	Indicator equal to 1 if the Refinitiv ESG Controversy score is above the industry-year median and the firm is sanctioned with a total amount of fines due to environmental violations larger than the industry-year median, and 0 otherwise	Refinitiv and violation tracker
GW—disagreement	The average level of disagreement across NWG, Refinitiv and S&P ESG scores, estimated according to the methodology proposed by Avramov et al. (2022)	Newsweek green ranking, refinitiv, and S&P ESG score
ExcessValue	Tobin's Q ratio of the firm	WRDS—compustat
Corporate governance variables		
BoardSize	Number of board of directors' members of each company	Thomson reuters ASSET4
BoardInd	Percentage of independent members in the company's board of directors	Thomson reuters ASSET4
FemBoard	Percentage of women in the company's board of directors	Thomson reuters ASSET4
Firm specific control variables		
FirmSize	Natural logarithm of the company market capitalisation at year-end	WRDS—compustat
ROA	Firm profitability, measured as the ratio of operating income (EBIT) and total assets	WRDS—compustat
Lev	Firm leverage, measured as the ratio of total debt and total assets	WRDS—compustat
MB	Market value of equity divided by book value of equity	WRDS—compustat
Industry	Industry of the firm	WRDS—compustat

Table 6 (continued)

Variable	Description	Source
Other control variables		
GRI	Indicator equal to 1 if a company adopts the GRI Standards for sustainable reporting, and 0 otherwise	GRI online database
ΔCO_2 (Absolute)	Two-year change in the level of CO_2 emissions of each firm	Datastream
ΔCO_2 (>0)	Two-year change in the level of CO_2 emissions of each firm, if greater than 0	Datastream
State	Indicator equal to 1 if a company is headquartered in a democratic state, and 0 otherwise	Most recent election results

Table 7 Variance inflation factor (VIF) test for multicollinearity

Variable	Greenwashing		Firm value	
	VIF	1/VIF	VIF	1/VIF
GW—NWG			1.19	0.843712
BoardSize	1.13	0.887134	1.18	0.866456
BoardInd	1.10	0.909006	1.12	0.896448
FemBoard	1.12	0.894224	1.09	0.917065
FirmSize	1.07	0.931008	1.18	0.845225
ROA	1.04	0.958647	1.02	0.978159
Lev	1.04	0.964571	1.00	0.998722
MB	1.01	0.989520		
GRI	1.33	0.749827	1.33	0.753441

This table reports variance inflation factor (VIF) analysis for the variables used in the paper. In the left panel there are the results for the baseline greenwashing regression analysis. In the right panel there are the results for the baseline firm value regression analysis. GW—NWG is defined as the difference between Refinitiv ESG Controversy score and Newsweek Green score (NWG). BoardSize is the number of members in the board of directors. BoardInd is the share of independent directors in the board. FemBoard is the percentage of women in the board. FirmSize is the firm size measured as the natural logarithm of the market capitalization. ROA is the company return on assets (EBIT/Total Assets). Lev is the company leverage (Total Debt / Total Assets). MB is the market-to-book ratio, equal to company's market capitalization divided by book value of equity. GRI is a dummy variable equal to 1 if a company is adopting a GRI standard, and 0 otherwise. ΔCO_2 is the two-year change in company's carbon emissions

Table 8 Cross-sectional summary statistics

Variable	μ	σ	min	p25	p50	p75	max	N	Skew.	Kurt.
GW—NWG	17.33	25.47	− 52.68	− 2.27	19.38	36.94	86.11	2201	− 0.17	2.22
GW—NWG Adj.	21.60	19.64	0	0	19.38	36.94	86.11	2201	0.47	2.10
GW—Refinitiv	10.41	15.08	− 6.20	0	0	25.595	46.21	2200	0.93	2.15
GW—S&P	14.62	21.18	− 45.90	1.96	15.52	31.40	58.98	1486	− 0.49	2.76
GW—VTE	0.10	0.29	0	0	0	0	1	2201	2.75	8.59
GW—VTE number	0.08	0.27	0	0	0	0	1	2201	3.19	11.18
GW—VTE penalty	0.08	0.27	0	0	0	0	1	2201	3.06	10.38
GW—disagreement	0.14	0.07	0	0.08	0.13	0.18	0.43	1486	0.74	3.38
BoardSize	11.11	2.22	4	10	11	12	28	2158	0.81	7.68
BoardInd	0.85	0.09	0.17	0.80	0.88	0.92	1	2158	− 1.87	8.55
FemBoard	0.20	0.09	0	0.13	0.18	0.25	0.63	2158	0.36	3.56
ExcessValue	1.68	1.53	0	0.76	1.33	2.11	20.71	2274	3.20	23.92
FirmSize	9.34	2.50	0	9.11	9.71	10.45	13.58	2281	− 2.70	10.85
ROA	0.10	0.09	− 1.38	0.05	0.08	0.14	0.61	2287	− 1.92	40.78
Lev	0.26	0.20	0	0.11	0.24	0.37	1.85	2280	1.13	6.81
MB	1.68	16.34	− 627.9	0.66	1.47	2.58	88.63	2274	− 33.04	1179
GRI	0.36	0.48	0	0	0	1	1	2208	0.60	1.36
ΔCO_2 (/000)	− 5.35	211.17	− 450	− 46.21	1.37	50.00	386.22	2246	− 0.29	3.51

This table reports the cross-sectional summary statistics for the variables used in the paper. GW—NWG is defined as the difference between Refinitiv ESG Controversy score and Newsweek Green score (NWG). GW—NWG Adj. is GW—NWG bounded to zero. GW—Refinitiv is the difference between the raw ESG and the ESG Controversy scores provided by Refinitiv. GW—VTE is a dummy equal to 1 if the Refinitiv ESG Controversy score is above the industry-year median and the firm is sanctioned for at least one environmental violation in that year, and 0 otherwise. GW—VTE Number is a dummy equal to 1 if the Refinitiv ESG Controversy score is above the industry-year median and the firm is sanctioned for a number of environmental violations larger than the industry-year median, and 0 otherwise. GW—VTE Penalty is a dummy equal to 1 if the Refinitiv ESG Controversy score is above the industry-year median and the firm is sanctioned with a total amount of fines due to environmental violations larger than the industry-year median, and 0 otherwise. GW—Disagreement is the level of disagreement across NWG, Refinitv and S&P ESG scores, estimated following Avramov et al. (2022). BoardSize is the number of members in the board of directors. BoardInd is the share of independent directors in the board. FemBoard is the percentage of women in the board. ExcessValue is the Tobin's Q. FirmSize is the firm size measured as the natural logarithm of the market capitalization. ROA is the company return on assets (EBIT/Total Assets). Lev is the company leverage (Total Debt / Total Assets). MB is the market-to-book ratio, equal to company's market capitalization divided by book value of equity. GRI is a dummy variable equal to 1 if a company is adopting a GRI standard, and 0 otherwise. ΔCO_2 is the two-year change in company's carbon emission. Table 6 in the Appendix 1 provides a detailed description of all the variables

Appendix 2

Firm characteristics and greenwashing

The academic literature has identified several firm characteristics that are associated with the propensity to greenwash (Delmas & Burbano, 2011; Mateo-Márquez et al., 2022). These characteristics include size, profitability, industry, leverage, and firm value.

Firm size is often assumed as a factor curbing greenwashing. Large public companies—as well as big private companies with well-known brands—are more likely to face pressure to be greener from all their stakeholders (especially consumers, which perceive the issue as more urgent) and from NGOs, activists, and the media, because such companies are more visible and subject to stricter disclosure requirements. Since larger companies are more easily caught and suffer more strongly from reputational damages and loss of legitimacy, they will not only publish more information on their environmental efforts, but also have less incentives to greenwash (Delmas & Burbano, 2011; Marquis et al., 2016; Zaiane & Ellouze, 2022). Therefore, size is found to have a negative impact on greenwashing, as it benefits transparency in environmental reporting (Belkaoui & Karpik, 1989; Cowen et al., 1987).

Some scholars suggest the existence of a positive correlation between firms' profits and the disclosure of complete and trustworthy environmental information (Belkaoui & Karpik, 1989; Cowen et al., 1987; Gamerschlag et al., 2011; Gray et al., 2001). However, there is also contrasting evidence regarding the relationship between profitability and greenwashing (Nawaiseh, 2015). Other scholars even maintained that more profitable companies are more prone to greenwash because they can better withstand reputational shocks, as they have enough funds to face litigation costs or fines (Delmas & Burbano, 2011). Finally, the literature has shown that the link between CSR and financial performance is not univocal but depends on the specific CSR components (Cavaco & Crifo, 2014).

As for leverage, companies whose capital structure is more heavily tilted to debt are expected to be required to disclose more information not only on their financial health, but also on their environmental performance. Creditors have an increasing interest in obtaining extensive knowledge on their borrowers and firms with stronger ESG performance have a lower cost of debt (Eliwa et al., 2021). Debt can also be an effective internal governance vehicle and can positively affect firms' environmental performance and CSR disclosure (Lu & Wang, 2021). Nevertheless, high leverage makes it possible for companies to have less money to implement green projects and then this could cause a green conduct misleading that increases the likelihood of greenwashing (Brammer & Pavelin, 2006; Nawaiseh, 2015).

Clearly, also the industry plays an active role in environmental disclosure (Brammer & Pavelin, 2006) and, in turn, in greenwashing (Yang et al., 2020). This is particularly true for environmental sensitive sectors—such as utilities and mining industries—that generally display poor sustainability performances, have stricter environmental rules, and suffer from more severe reputational damages

(Delmas & Burbano, 2011). This would entail higher social pressure and stronger reporting efforts, especially when talking about bigger companies.

Finally, there is an extensive literature that has studied the association of environmental disclosure and performance with firm value (Brooks & Oikonomou, 2018). In general, more CSR disclosure reduces the cost of equity capital, especially in stakeholder-oriented countries (Dhaliwal et al., 2014). On the contrary, greenwashing impacts negatively the firm value, as it is significantly negatively associated with cumulative abnormal returns around the exposure of greenwashing (Du, 2015). More transparent and accurate environmental reporting can increase firms' market value, because investors perceive less information asymmetry and are more confident in decision making (Du, 2015). Moreover, investors respond favorably when managers make and disclose a green investment and highlight the societal benefits rather than the cost to the company, even if such investment does not affect future cash-flows (Martin et al., 2016). Nonetheless, the communicated motives of environmental policies affect public perception of corporate greenwashing: when a green action is coupled with economic motives driving it, there is less suspicion of greenwashing (de Vries et al., 2015).

Despite the still open debate about the direction of causality between firm characteristics and greenwashing, there is a consensus about the association between the two that should be considered. Therefore, we control for firm size, profitability, industry, leverage, and market to book ratio in the empirical analysis.

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