

Greenwashing Games: Playing the ESG Mandates

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Abstract

Proponents of shareholder capitalism argue that mandatory sustainability disclosures increase costs and reduce financial returns. In contrast, advocates of stakeholder capitalism assert that these regulations promote corporate accountability and long-term value creation. This study investigates whether such mandates encourage genuine corporate responsibility or foster superficial compliance. Analysing 3,642 non-financial listed firms across 41 countries (2003–2022) using a staggered difference-in-differences (DiD) approach, we find an 8% overall increase in greenwashing following the adoption of ESG disclosure mandates. Greenwashing rises, particularly when government institutions mandate disclosures and when full compliance is required. However, this aggregate trend masks differing firm behaviours: pre-mandate greenwashers reduce greenwashing by 26.9%, while pre-mandate non-greenwashers increase it by 14.3%. This distinction shows that regulatory pressures shape ESG disclosures, with some firms amplifying symbolic compliance while others curbing it. Overall, ESG mandates influence corporate disclosure, but their effectiveness is shaped by firms' strategic incentives, which, in many cases, remain primarily driven by shareholder wealth maximisation rather than a genuine commitment to stakeholders' welfare.

Keywords: ESG, Greenwashing, Mandatory Disclosures, Institutional Theory, Legitimacy Theory

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1. Introduction

The ongoing global efforts to transition from shareholder capitalism to stakeholder capitalism have profoundly transformed the “*rules of the business*”, shifting the focus from shareholders’ wealth maximisation to a broader emphasis on maximising the welfare of all stakeholders. This transformation advocates businesses to pursue Environmental, Social, and Governance (ESG) goals, arguing that doing so serves the greater good while enhancing the long-term profitability of the business (Bond and Levit, 2025). Consequently, there has been a surge in calls for ESG-related disclosures through financial reporting and other disclosures, prompting regulators worldwide to introduce ESG disclosure mandates (Gibbons, 2024; Krueger *et al.*, 2024; Lin *et al.*, 2024).

While empirical evidence suggests economically significant effects of ESG engagements, such as reduced systematic and firm-specific risk (Ng and Rezaee, 2015), and improved firm-level accounting and market performance (Dimson, Karakaş and Li, 2015; Lins, Servaes and Tamayo, 2017); critics argue that such effects may be driven by superficial reporting (Tashman, Marano and Kostova, 2019; Bothello *et al.*, 2023), as ESG disclosures encourage firms to engage in virtue signalling rather than undertaking substantive actions. Additionally, as political landscapes evolve, firms adjust their ESG strategies, striving to strike a delicate equilibrium between accommodating regulatory expectations, maintaining market competitiveness, and addressing mounting stakeholder scepticism (Christensen, Hail and Leuz, 2021). These dynamics create a vacuum that could potentially embolden firms to adopt superficial ESG practices, potentially leading to a phenomenon known as “greenwashing” or “ESG washing” (Tashman, Marano and Kostova, 2019; Christensen, Hail and Leuz, 2021; Fiechter, Hitz and Lehmann, 2022). In sustainability literature, greenwashing is defined as a deliberate practice of creating a deceptive positive image of the firm’s ESG activities through selective disclosure, exaggerated claims, or symbolic actions and policies, diverging from actual performance (Marquis, Toffel and Zhou, 2015; Tashman, Marano and Kostova, 2019; De Meyst, Cardinaels and Van den Abbeele, 2023).

To shed light on these contradicting viewpoints, we introduce ESG disclosure mandates worldwide as an exogenous shock and assess whether ESG disclosures are merely symbolic, signalling possible greenwashing, or substantive, signalling commitment towards upholding the stakeholder welfare maximisation objective. The theoretical foundations of this study are based on institutional and legitimacy theories (Dowling and Pfeffer, 1975; DiMaggio and Powell, 1983), which offer a robust framework to understand how global firms respond to ESG mandates and assess whether institutional pressures and their intensity drive such responses.

Greenwashing under mandatory disclosure regimes may stem from several factors, including weak enforcement (Tashman, Marano and Kostova, 2019), lack of structured reporting guidelines (Pinnuck *et al.*, 2021; Fiechter, Hitz and Lehmann, 2022), stakeholder pressures, and the strategic acquisition of legitimacy as a signalling tactic by firms. Consequently, it is essential to explore whether firms primarily disclose ESG information due to regulatory pressures or signalling to current and potential investors.

To empirically test our propositions, we examine a global sample of 3,642 non-financial firms, spanning 41 countries, from 2003 to 2022. Following Krueger *et al.* (2024), we designate 27 countries with all three mandatory E, S, and G disclosures as the treatment group, while the remaining 14 countries make up the control group. These 14 countries either mandate the disclosures for one or two of the ESG components or all three remain voluntary. Accordingly, the *MD* dummy takes the value of 1 from the year a country starts mandating the ESG disclosures and 0 otherwise. *Greenwashing* is measured as the difference between symbolic ESG disclosure (*SYMB-ESG*) and substantive ESG disclosure (*SUB-ESG*). We adopt the categorisation frameworks of Hawn and Ioannou (2016) and Bothello *et al.* (2023) for the *SYMB-ESG* and *SUB-ESG* using the disaggregated firm-level ESG metrics from the Refinitiv

Workspace. We refer to Refinitiv for ESG data for its global, broad and historical coverage of disaggregated ESG information, enabling us to segregate symbolic and substantive disclosure indicators. Our approach differs in two ways. First, instead of averaging the disclosure indicators, which may distort the scores, we add and then normalise the indicators at the sub-sector level for precise peer comparisons. Second, the cited studies capture ESG decoupling (the absolute difference between *SYMB-ESG*, and *SUB-ESG*); we measure *Greenwashing* as the difference between both. Given the heterogeneity in policy adoption timing, we employ a staggered difference-in-differences approach to account for heterogeneous treatment effects, framing our analysis as a quasi-natural experiment, as it exploits external, policy-driven variations that the firms themselves do not control. The remaining financial and non-financial data are sourced from Worldscope and World Bank DataBank databases.

Empirical results show that greenwashing increased globally by about 8% after the mandatory adoption of ESG disclosures. These findings align with the predictions of the coercive isomorphism aspect of institutional theory, which suggests that firms conform to external pressures, particularly regulatory mandates, to maintain legitimacy and avoid sanctions and reputational damage. The effects are more pronounced when the mandates are issued by government institutions (7.2%) compared to non-governmental institutions (3.3%) and where full compliance is mandated (12.7%) rather than an explanation provision in case of non-compliance (0%). Figure 1(A) shows that the greenwashing levels significantly increased from the second year of the ESG disclosure mandates. This is likely, as regulatory bodies typically provide a buffer period of two years for firms to align their activities with regulations and report ESG-related activities in their annual reports or independent non-financial disclosures. Consequently, no statistically significant trend is observed before the implementation of the mandates.

Next, we explore whether firms respond uniformly to ESG mandates. Before ESG mandates, firms voluntarily disclosed their activities due to normative and mimetic pressures, aligning their strategies with industry norms or mimicking the actions of leading companies to reduce uncertainty and gain legitimacy (Christensen, Hail and Leuz, 2021). However, the voluntary landscape fostered heterogeneous disclosure behaviours, with some firms practising less while others pursuing higher greenwashing (Reitmaier, Schultze and Vollmer, 2024). The introduction of ESG mandates imposes coercive pressures on firms not disclosing adequate ESG-related information and establishes a benchmark for firms engaged in under- and over-reporting. This shift alters firms' disclosure incentives, aligning with the crowd-out and substitution effects, wherein firms that previously over-reported ESG performance strategically curtail misleading disclosures to mitigate regulatory and reputational risks, while firms with minimal prior disclosures may increase symbolic compliance to meet new regulatory norms (Dye, 1985; Verrecchia, 2001). Specifically, pre-mandate greenwashing firms may refrain from over-reporting ESG information to avoid excess regulatory exposure and reputation damage, especially when the ESG disclosures are not assured (Gipper, Ross and Shi, 2024). Thus, we contend that post-ESG disclosure mandates greenwashing behaviour will converge, with a decrease in greenwashing by pre-mandate greenwashers and an increase among pre-mandate non-greenwashers.

Our findings confirm that firms do not respond uniformly to ESG mandates. Instead, their post-mandate behaviour is contingent on prior disclosure practices. ESG mandates serve as a benchmark, prompting firms to reassess their reporting strategies. Specifically, we observe a 26.9% decline in *Greenwashing* among pre-mandate greenwashers. Conversely, pre-mandate non-greenwashers exhibit a 14.3% increase in *Greenwashing*, exceeding our aggregate findings of an 8% rise. Figures 1(B) and 1(C) show that this trend remains persistent over time, and the effect is realised following the year of mandates. These findings suggest that rather than uniformly curbing greenwashing, ESG mandates may inadvertently induce symbolic

compliance among firms that had previously refrained from excessive ESG disclosures. Our findings are in line with prior literature; notably, stigmatised firms, those with a history of ESG violations, face stronger regulatory pressure, compelling them to adjust their disclosure strategies through greenwashing to mitigate non-compliance risk (Kassinis *et al.*, 2022).

< Insert Figure 1 Here >

Our results are robust to several endogeneity tests, as outlined in Section 4.3 and the associated Online Appendix. Additionally, we adopt several alternate procedures to ensure the robustness of our findings: (i) we employ a logit regression framework with a greenwasher dummy variable (*GW-D*), where *GW-D* equals one if *Greenwashing* exceeds zero and zero otherwise. *GW-D* provides a strict threshold that captures any instance of greenwashing, ensuring a conservative classification of firms engaged in misleading ESG practices; (ii) incorporate year, industry, and country-fixed effects to control for unobserved heterogeneity and macroeconomic influences that may systematically affect firm greenwashing behaviour; (iii) exclude the dominant countries to ensure that large economies do not disproportionately influence the results; (iv) estimate two-way fixed effect DiD (differences in differences) around EU Directive 2014/95 and Callway and Sant’Anna (2021) Staggered DiD to account for heterogeneous treatment effects and measure average treatment effects of the treated (ATT); and (v) adopt alternate greenwashing measures, including differences between ESG reporting, policy, and outcome, following Bams and van der Kroft (2022), to ensure findings are not driven by a single operationalisation of greenwashing.

Our contribution to the existing literature is threefold. First, we provide novel empirical insights into how ESG disclosure mandates influence firm greenwashing behaviour, revealing that ESG disclosure mandates lead to increased greenwashing. Our analyses uncover a critical divergence between pre-mandate greenwashers and non-greenwashers in response to the ESG disclosure regulations. This distinction highlights how regulatory pressures shape strategic disclosure choices, with some firms amplifying symbolic compliance while others move towards more substantive transparency, underscoring the need for more nuanced regulatory assessments to accurately gauge the impact of ESG disclosure mandates on corporate transparency. Second, our findings reveal that greenwashing increases due to the coercive pressures aimed at establishing legitimacy and avoiding excessive regulatory exposure, validating the frameworks of institutional and legitimacy theories. Given the high costs of substantive compliance, some firms strategically disclose ESG information to meet regulations without major sustainability investments, leading to a post-mandate rise in greenwashing.

Finally, from a methodological standpoint, our study advances the literature by leveraging disaggregated ESG data to systematically distinguish between symbolic and substantive disclosures. This approach enhances the granularity and accuracy of greenwashing measurement, allowing for more precise global comparisons. Unlike prior studies that rely on aggregated ESG scores (García-Sánchez *et al.*, 2021; Long, Wang and Zhang, 2024), our methodology preserves firm-level heterogeneity, mitigating potential distortions in disclosure assessments and bias in cross-country ESG ratings (Gupta, Shruti and Li, 2024). By integrating this refined approach, we provide a replicable framework for future research on ESG disclosure practices, particularly greenwashing. Our findings further reveal that while ESG mandates influence corporate disclosure behaviour, their effectiveness is shaped by firms’ strategic incentives, which, in many cases, remain primarily driven by shareholder wealth maximisation rather than a genuine commitment to sustainability.

2. Relevant Literature, Theoretical Framework and Hypothesis Development

2.1. Greenwashing – Definition, Drivers and Measures

Greenwashing is a broad term for activities aimed at increasing firms’ ESG reputation beyond their actual ESG achievements (Marquis, Toffel and Zhou, 2015; Tashman, Marano and

Kostova, 2019). The term emerged in 1986 when environmentalist Jay Westerveld called out the hotel industry for its deceptive eco-friendly messaging. In an essay, he criticised hotels for urging guests to reuse towels under the guise of environmental conservation when, in reality, the initiative was a cost-cutting tactic (Free, Jones and Tremblay, 2024). The United Nations Climate Action Committee labels greenwashing as an obstacle to tackling climate change by misleading the public to believe that a company or other entity is doing more to protect the environment than it actually is (United Nations, 2024).¹ Greenwashing is no longer confined solely to environmental concerns; it has expanded into the broader realm of ESG and is synonymous with ESG washing. Although increasingly invoked, considerable definitional ambiguity about greenwashing remains.

In the accounting and finance literature, greenwashing refers to disclosure strategies employed by firms to positively present their ESG image to stakeholders, often by engaging in various misleading reporting practices. First, firms report on the salient aspects of ESG and neglect the unobservable aspects (Hawn and Ioannou, 2016). Second, firms undertake low-cost ESG projects that have little tangible impact on real ESG performance (Grewal, Riedl and Serafeim, 2019)². Third, firms' ESG activities do not align with their claims (Basu *et al.*, 2022).³ Fourth, firms manipulate ESG metrics by selectively reporting favourable data while obscuring the negative impacts (Berg, Kölbel and Rigobon, 2022); and fifth, firms engage in regulatory arbitrage, strategically structuring ESG reports to comply with disclosure requirements while avoiding accountability for significant ESG violations (Luft Mobus, 2005; Fiechter, Hitz and Lehmann, 2022).

According to Delmas and Burbano (2011), firms engage in greenwashing due to a combination of market, non-market, organisational and psychological drivers. Among market forces are rising consumer demand for eco-friendly products (Ioannou, Kassinis and Papagiannakis, 2023), investor pressure to attract capital (Grewal, Riedl and Serafeim, 2019), and competitive pressures intensifying greenwashing (Li, 2010; Ryou, Tsang and Wang, 2022). Beyond market-based external drivers, the regulatory environments (Ren *et al.*, 2023; Krueger *et al.*, 2024), strict monitoring of ESG violations (Luft Mobus, 2005; Tashman, Marano and Kostova, 2019; Gorovaia and Makrominas, 2024), and attention from informal institutions such as NGOs, activists, religiosity, country culture, and media monitoring raise incentives for greenwashing as firms seek to deflect criticism and ESG penalties (Long, Wang and Zhang, 2024).

Firm characteristics such as size, industry, and public visibility can shape firms' propensity to greenwash. Large firms or those operating in highly scrutinised industries experience greater pressure to portray a sustainable corporate image (Servaes and Tamayo, 2013; Kassinis *et al.*, 2022). Within organisations, managerial incentives and corporate culture play a critical role, as performance-driven targets often encourage selective reporting and exaggeration of sustainability efforts. At the individual level, cognitive biases further contribute to greenwashing. Optimistic bias leads executives to overestimate the impact of their sustainability initiatives. At the same time, the narrow decision framing prioritises short-term gains such as reputation enhancement and investor approval over long-term ESG integrity (Baloria, Klassen and Wiedman, 2019). Additionally, hyperbolic temporal discounting skews

¹ The United Nations Climate Action Committee suggests seven key tactics through which greenwashing undermines genuine climate action and misleads the public, including (i) false net-zero claims, (ii) vague or non-specific language, (iii) misleading labels, (iv) exaggerated impact, (v) selective disclosure, (vi) irrelevant claims, (vii) isolated sustainability messaging, for detailed explanations – see (United Nations, 2024).

² For example, a company creates a diversity committee or publishes a diversity report but does not increase minority or female representation in leadership, or an oil company installs solar panels at its headquarters but continues large-scale oil drilling operations.

³ Basu *et al.* (2022) show that banks with high ESG ratings issue fewer mortgages to poor localities both in number and dollar value compared to firms with lower ESG ratings.

decision-making in favour of immediate benefits, incentivising misleading claims rather than substantive environmental or social improvements (Thomas *et al.*, 2022).

In the sustainability accounting literature, greenwashing measurement manifests in many forms. The first is selective or manipulative disclosure, where firms cherry-pick the positive aspects of their social responsibility while conveniently omitting the negatives. Such strategies include the misuse of ambiguous metrics such as scope four emissions, adherence to voluntary regimes which lack rigour and third-party verification (i.e., certifications), and the usage of excessively complex language (Flugum and Souther, 2023; Lin *et al.*, 2024). Studies often assess the quality of non-financial disclosures using measures of tone, readability, and sentiment, either through Natural Language Processing (NLP) techniques or manual scrutiny of reports. Disclosure intensity is also analysed to reflect disclosure quality, while ESG performance is typically measured using ESG ratings and scores from agencies such as Bloomberg, Refinitiv, and KLD. In these studies, greenwashing is defined as the gap between disclosure quality and actual ESG performance (Gorovaia and Makrominas, 2024; Long, Wang and Zhang, 2024).

The second most prominent form of greenwashing measure includes the decoupling between the substantive or symbolic ESG activities. Decoupling refers to the condition when a firm's symbolic ESG activities (talk) and the substantive ESG actions (walk) differ (Hawn and Ioannou, 2016; Bothello *et al.*, 2023). The ESG decoupling enables firms to deflect stakeholder attention from the most important to the least important and difficult-to-verify issues (Long, Wang and Zhang, 2024). The decoupling operates in two ways: policy-practice and means-end (practice-outcome) (Athanasopoulou *et al.*, 2024).⁴ Both forms of decoupling enable firms to maintain legitimacy and avoid pressures to attain genuine outcomes.

Generic decoupling measurement involves two stages: specifying the information as either symbolic or substantive, collecting the data, comparing firms on an industry level, and measuring the metrics of decoupling. This assessment process is superior in identifying greenwashing in two ways. First, it enables researchers to accumulate context-specific ESG information and perform comparisons with industry peers rather than across unrelated industries. For instance, ESG challenges in the energy sector differ from those in the technology sector, and comparing firms across these industries can result in biased or irrelevant metrics. Second, decoupling metrics make greenwashing assessments by comparing the firm's reporting, policies, actions and outcomes, whereas disclosure metric compares the disclosure tone and intensity with ESG performance. Decoupling-based approaches to assess greenwashing deliver a more reliable and insightful assessment of greenwashing practices than traditional disclosure-based approaches (Hawn and Ioannou, 2016; Tashman, Marano and Kostova, 2019; Bothello *et al.*, 2023; Athanasopoulou *et al.*, 2024).

2.2. Regulatory Landscape of ESG Disclosures

Jurisdictions since 1998 have started mandating firms to disclose sustainability-related information, primarily sustainability-related risks and opportunities affecting the decision-making of primary users of financial and non-financial information (Krueger *et al.*, 2024).⁵ Over time, these independent mandates have converged into comprehensive frameworks, such

⁴ Under policy-practice decoupling, a firm might report environmental goals (net-zero targets) while continuing to invest in fossil fuels or failing to align its operational practices with its stated commitments. Or a financial firm publicly declares a commitment to non-discrimination, such as promoting racial equity, but their loan distribution practices disproportionately favour white applicants. With these practices, firms satisfy external pressures without making genuine organisational changes. However, under means-end decoupling firms may adopt green technologies at such a lower scale to meaningfully reduce their carbon footprint, allowing firms to claim the actions without meaningful impact.

⁵ The primary users of general-purpose accounting information include existing and potential investors, lenders, and other creditors (*IFRS Sustainability Disclosure Standard 1*, 2023).

as the European Union (EU) Directive 2014/95 (mandatory), International Financial Reporting Standard Foundation IFRS-S1, and IFRS-S2 (voluntary).⁶ The ESG disclosure mandates are framed as a policy tool to nudge firms towards sustainable operations, aligning them with societal expectations and sustainable development goals (SDGs). Coupled with regulatory mandates, many firms follow some voluntary reporting frameworks under Global Reporting Initiatives (GRI), Sustainability Accounting and Standards (SASB), Task Force on Climate-Related Financial Disclosures (TCFD) and Carbon Disclosure Project (CDP). Introducing such frameworks ensures that sustainability-related information is comparable, assured, and essential for decision-making, reducing information asymmetry arising from independent voluntary ESG disclosures. However, to date, neither voluntary nor mandatory disclosure rules provide structured reporting guidelines, unlike IFRS or GAAP (Generally Accepted Accounting Principles) (Pinnuck *et al.*, 2021).

Several studies shed light on the evolution of ESG disclosure regulations. Krueger *et al.* (2024) and Gibbons (2024) provide details on the evolution of voluntary and mandatory ESG regulations across countries. Within this regulatory landscape, prior research has explored the prevalence of greenwashing through responsible marketing policies and controversies following ESG disclosure mandates, particularly in response to EU Directive 2014/95 (Grewal, Riedl and Serafeim, 2019; Fiechter, Hitz and Lehmann, 2022), as well as the challenges associated with voluntary reporting frameworks (Li, 2010; Baloria, Klassen and Wiedman, 2019; Reitmaier, Schultze and Vollmer, 2024). In this study, we primarily focus on investigating the effects of ESG disclosure mandates around the world as a non-market external driver of greenwashing practice in sustainability disclosures, making it a crucial area of inquiry in understanding the evolution and motivation of greenwashing.

2.3. Effect of ESG Disclosure Mandates on Corporate Greenwashing

2.3.1. Through the Lens of Institutional Theory and Legitimacy Theory (H1 and H2)

The rise of multinational enterprises (MNEs) has driven the application of institutional theory in business and management studies to understand how norms, culture, and regulations shape corporate strategies, structures, and behaviour. Institutional theory explores how norms, values, rules, and cultural beliefs shape organisations. Institutions broadly encompass formal rules or legal frameworks like state regulations, such as IFRS standards or GAAP, or societal expectations that may not be codified in the law but are upheld by society. Thus, institutions are the structures that define the “rules of the game” for social and organisational behaviour. Organisational decisions, therefore, are not only driven by profit motives (shareholder wealth maximisation) but also shaped by external pressures to comply with societal expectations (stakeholder value creation). Institutions, whether state-driven or industry-based, create shared expectations and drive organisational uniformity, a process referred to as isomorphism (DiMaggio and Powell, 1983). According to DiMaggio and Powell (1983), isomorphism refers to the process by which organisations become more alike over time as they respond to external pressures. This adaptation is driven by the need for legitimacy, stability, and long-term survival

⁶ IFRS S1 focuses on general requirements for the disclosure of sustainability-related financial information, and IFRS S2 requires the disclosure of climate-related information (Free, Jones and Tremblay, 2024). These standards are adopted voluntarily, unless a jurisdiction makes them mandatory (*IFRS Sustainability Disclosure Standard 1*, 2023).

within their institutional environments. Organisations conform to these pressures through three primary mechanisms: coercive, normative, and mimetic isomorphism.⁷

While mandatory disclosures are intended to drive improvements in ESG performance, they also introduce incentives for firms to engage in greenwashing. Luft Mobus (2005) suggests that symbolic ESG disclosures can serve as a tool to address the legitimacy gaps, primarily in industries under higher public and regulatory scrutiny. Thus, organisations may resort to greenwashing to respond to legitimacy and institutional forces. Firms may prioritise the appearance of compliance with mandates over substantive actions, primarily when firms cannot meet the desired requirements.

Empirical evidence suggests that mandatory disclosure regimes lead to higher public scrutiny, stakeholder pressures, and anticipatory compliance (Grewal, Riedl and Serafeim, 2019; Fiechter, Hitz and Lehmann, 2022).⁸ While some firms report substantive actions, others leverage the same to signal compliance and maintain legitimacy without substantive change. For instance, higher-exposure firms often initiate new ESG activities to augment financial reports, yet the impact typically remains negligible. Highlighting the unintended consequences of mandatory disclosures, where firms prefer symbol over substance. The effectiveness of the ESG mandates depends on enforcement and stakeholder engagement. Weak enforcement mechanisms characterised by a lack of sustainability assurance may allow firms to substitute symbolic actions for substantive ESG actions, undermining disclosure credibility. Given that the standards are context-dependent with no structured guidelines and state audit authority in place, firms are less incentivised towards genuine ESG practices, which are both resource-intensive and hold opportunity costs arising from a change in operations (Leuz and Wysocki, 2016; Pinnuck *et al.*, 2021). Thus, we hypothesise:

H1: *Post-ESG disclosure mandates, firms exhibit a significant increase in greenwashing practices.*

Legitimacy theory asserts that organisations seek to align their operations and values with the norms, rules, and expectations of their society’s “Social Contract”. Legitimacy is established with congruence between the value system of an organisation and those of a larger social system in which they operate (superordinate) (Dowling and Pfeffer, 1975). As societal expectations and norms evolve, organisations must adapt through legitimation to secure their social licence to obtain and maintain critical resources. Failure to do so can result in loss of stakeholder trust and regulatory penalties. Symbolic and substantive sustainability disclosures are tools for organisations to convey compliance with social norms, thus enhancing their legitimacy. Legitimacy concern drives organisations to sustainability disclosure under voluntary and mandatory regimes, and the assurance establishes the credibility of the information, reducing information asymmetry between the stakeholders and firms.

Institutional theory complements legitimacy theory by explaining how organisational practices gain legitimacy through institutionalisation, securing a formal social contract. Prior

⁷ Coercive isomorphism arises from formal pressures such as government regulations or industry standards. For example, firms may align their financial reporting practices with IFRS or GAAP due to regulatory requirements, ensuring compliance and avoiding legal repercussions. Normative isomorphism stems from professional expectations and ethical norms, where firms adopt industry best practices influenced by professional associations, certification bodies, or stakeholder demands to enhance credibility. In contrast, mimetic isomorphism occurs when organisations imitate the strategies of successful competitors, particularly in times of uncertainty. If leading firms within an industry adopt extensive ESG disclosure practices, others may follow suit to maintain competitiveness and legitimacy.

⁸ Table OA1 Panel B shows that firms drastically increased their ESG reporting post-2015, one year after the EU directive and most of the independent country mandates - see Table OA3. This is true for countries in both treatment and control groups, due to international operations and cross-listing.

studies emphasise the legal environment's role in shaping corporate behaviour, with compliance essential for legitimacy, avoiding penalties, and maintaining resource access. La Porta *et al.* (1998) highlight that legal protection is strongest in common law countries, weaker in French civil law nations, and intermediate in German and Scandinavian systems. Government-issued ESG mandates, backed by greater resources and public authority, may lead to increased greenwashing, whereas in some countries, mandates come from non-governmental institutions (Krueger *et al.*, 2024).

The nature of ESG mandates significantly influences organisational behaviour. Mandates requiring full compliance, where firms must meet the stringent criteria without exceptions, create higher coercive pressures. Firms may face challenges in meeting the prescribed standards, particularly when the resources and capabilities are insufficient. As a result, firms may resort to greenwashing to demonstrate compliance. In contrast, comply-or-explain frameworks provide firms with flexibility by allowing them to either meet the specific requirements or explain the deviations.

Prior research shows that rigid regulatory frameworks lead to higher economic outcomes, such as higher investor attention (Grewal, Riedl and Serafeim, 2019) and liquidity (Krueger *et al.*, 2024), and reduced disparity between the IPO offer price and first-day market price (Duong *et al.*, 2024). Fauver *et al.* (2017) suggest that comply-or-explain may not have enough teeth to retain change in the practices, as they are merely suggestions without clear explanations. Thus, we propose the following hypothesis:

H2: *Greenwashing is more prevalent under ESG mandates required by formal institutions.*

2.3.2. Through the Lens of Business Strategy (H3)

Under voluntary regimes, the boundary line for the magnitude of disclosures remains blurred. However, when mandatory disclosure requirements are implemented, firms face heightened scrutiny, increasing the risks associated with greenwashing. Regulatory mandates, often complex and open to varying interpretations, create compliance uncertainty, prompting firms to reassess their disclosure strategies. The crowd-out effect suggests that as firms prioritise adherence to mandatory requirements, they reallocate resources towards compliance, leading to a decline in voluntary reporting (Dye, 1985). When firms voluntarily disclose information, they do so to signal transparency and differentiate themselves from competitors. However, when the disclosures are mandated, the signalling value diminishes because all firms must comply. This shift may not necessarily be driven by a genuine commitment to sustainability but rather by the need to maintain shareholder confidence amidst evolving regulatory expectations. Rajgopal and Tantri (2023) document that India's mandatory CSR law led high-CSR firms (firms that spend more than 2% of their profits on CSR before the mandate) to reduce spending, while low-CSR firms (firms that spend less than 2% of their profits on CSR before the mandate) increased it to meet the minimum 2% requirement post-mandate, implying that mandates may crowd out genuine, virtue-signalling CSR, thereby diluting the signalling value of CSR, especially when differentiation becomes more difficult and the cost of compliance increases.⁹ The substitution effect further reinforces this dynamic by positing that mandatory and voluntary disclosures serve as substitutes rather than complements. As firms seek to optimise compliance costs, they reduce voluntary disclosures that no longer provide distinct advantages, instead conforming strictly to regulatory requirements (Dye, 1985; Verrecchia, 2001). Verrecchia (2001) highlights that the cost-benefit trade-off inherent in disclosure decisions limits excessive disclosure, wherein firms assess the proprietary, litigation, and preparation costs associated with ESG reporting. Thus, firms rationally limit additional

⁹ India's CSR mandate is distinctive in a way that it does not only require firms to disclose the ESG related information but also obligates them to spend at least 2% of their profits on CSR.

disclosures to minimise unnecessary exposure and reporting burdens. Consequently, with the introduction of ESG disclosure mandates, firms that previously relied on symbolic disclosures face heightened regulatory scrutiny and may reconsider their reporting strategies and potentially curtail greenwashing disclosures. Marquis *et al.* (2015) empirically show that firms more exposed to scrutiny and global norms are less likely to engage in selective disclosures.

Conversely, firms that previously engaged in substantive ESG practices may face new strategic challenges under mandatory disclosure regimes. As regulatory pressures elevate expectations, firms genuinely committed to ESG before mandates may find their competitive advantage diluted. Isomorphic pressures, which drive firms toward homogeneity in reporting, further reinforce this convergence, as argued in Section 2.3.1. Coupled with institutional pressures, mimetic forces may lead to higher greenwashing among pre-mandate non-greenwashers. This perspective aligns with Li (2010), who finds that voluntary disclosure is more prevalent among firms with higher exposure to market competition; however, for dominant industry players facing lower competitive pressures, disclosure efforts tend to shift away from substantive reporting towards alternative ESG communication strategies (Ryou, Tsang and Wang, 2022; Bothello *et al.*, 2023). In this context, firms with established ESG commitments may recalibrate their strategies, increasing symbolic forms of compliance and thereby maintaining legitimacy.

The dynamic interplay between regulatory mandates and strategic firm behaviour thus produces heterogeneous effects on ESG disclosures. However, the isomorphic processes drive firms to adopt similar practices over time, leading to convergence in disclosure behaviours (DiMaggio and Powell, 1983), eventually aligning firm disclosures to an equilibrium point where divergent behaviours homogenise. Ultimately, firms act in ways that preserve their financial interests, using ESG disclosures as a strategic tool. Thus, we propose the following hypothesis:

H3: *Greenwashing firms reduce greenwashing after the mandates, while non-greenwashing firms start greenwashing after the mandates.*

3. Data, Covariates, and Descriptive Analysis

3.1. Data and Sample Construction

Our sample comprises 37,602 firm-year observations of 3,642 publicly listed non-financial corporations across 41 countries from 2003 to 2022 (20 years). This time frame enables us to accommodate heterogeneous treatment effects over a longer time period. We obtain the ESG data from LSEG Refinitiv (formerly Thomson Reuters-Asset4).¹⁰ Refinitiv covers more than 16,000 listed companies across 115 countries and aligns with global reporting standards like GRI and SDGs, enhancing its relevance for both voluntary and mandatory disclosures and making it one of the most comprehensive global ESG datasets available.¹¹ This expansive coverage allows researchers and investors to conduct cross-country comparisons and assess ESG practices in both developed and emerging markets, which many competing databases fail to address adequately (see (Hawn and Ioannou, 2016; Bothello *et al.*, 2023; Reitmaier, Schultze and Vollmer, 2024)). The granularity, scope, and coverage of Refinitiv meet the principles of

¹⁰ LSEG offers a comprehensive ESG data covering 90% of global market capitalisation across more than 630 ESG metrics across 10 main themes, including resource use, emissions, innovation, workforce, human rights, community, product responsibility, management, shareholders and CSR strategy since 2002 (LSEG, 2023). ASSET4 was a privately held firm with two institutional investors: Goldman Sachs and Bank of America Merrill Lynch. It was acquired by Thomson Reuters in 2009, following an acquisition by LSEG (Hawn and Ioannou, 2016).

¹¹ <https://www.lseg.com/en/data-analytics/financial-data/company-data/esg-data>

fair representation under IFRS S1, allowing us to segregate a firm's symbolic and substantive ESG disclosure.¹²

We source the data for the ESG disclosure mandates from Krueger *et al.* (2024). The authors hand-collected the data on the ESG disclosure regulations from the Carrot and Stick Project (C&S), Sustainable Stock Exchanges (SSE), and Global Reporting Initiative (GRI). We obtain the firm fundamentals and stock data from the Worldscope database. Along with controlling for firm characteristics across all estimations, as additional analysis, we account for potential confounding reforms, mainly global mandatory IFRS adoption (*IFRS*) and board reforms (*BDR*), and institutional quality (*VOID* and *GDPG*). The data on the adoption of the IFRS and global board reforms are constructed following De George and Shivakumar (2016) and Fauver *et al.* (2017), respectively. The measures corresponding to country governance effectiveness and economic development are acquired from the World Governance Indicators (WGI) and World Development Indicators (WDI). The stepwise sample selection process is presented in Table OA1 of the online appendix.

<Insert Table 1 Here>

3.2. Covariates

3.2.1. Dependent Variables: Corporate Greenwashing

In line with the discussion provided in Section 2.1, we employ a decoupling-based greenwashing measure for our empirical analysis. We compute corporate greenwashing as the difference between symbolic ESG disclosure (ESG Talk) and substantive ESG disclosure (ESG Walk). Symbolic ESG disclosures reflect firms' reporting, claims, and information demonstrating whether a company follows best practices (i.e., adherence to GRI guidelines). On the contrary, substantive ESG disclosures assess the concrete actions associated with ESG-related policies, programmes, and development activities (i.e., investment in renewable energy, employee training, health initiatives, and efforts to enhance gender diversity, among others). We develop the scales of symbolic and substantive ESG disclosures using granular Refinitiv ESG indicators (22 and 21 items, respectively). These scales have been widely adopted in corporate finance and business strategy literature (Hawn and Ioannou, 2016; Bothello *et al.*, 2023). We confirm the internal consistency and reliability of these measures by estimating their Cronbach's Alpha for both Symbolic ESG disclosures (0.824) and Substantive ESG disclosures (0.830); these values are well above the minimum thresholds of 0.70 (Hulland, 1999).¹³ We introduce two key improvements. First, unlike previous studies that average disclosure indicators, potentially skewing scores due to some firms reporting selectively, we add the indicators and normalise scores at the sub-sector level, ensuring that firms are compared against their immediate peers. Second, while prior research often emphasises ESG decoupling as the absolute difference between symbolic and substantive disclosures referred to as the ESG gap, we capture greenwashing as the overstatement of ESG commitments through sustainability disclosures. Our measure of corporate greenwashing is well grounded in the theoretical logic of symbolic and substantive ESG disclosures and ESG decoupling (Delmas and Burbano, 2011; Tashman, Marano and Kostova, 2019).

Most *SYMB-ESG* and *SUB-ESG* scale items are dummy variables with either 0 or 1; the remaining continuous variables are provided in percentages. We first normalise the continuous variables to have values between 0 and 1. We then add indicators for symbolic and substantive

¹² Under IFRS S1, fair presentation requires an entity to disclose information which is comparable, verifiable, timely, understandable and any other information not stipulated in rules but important for an entity's prospects (*IFRS Sustainability Disclosure Standard 1*, 2023).

¹³ A Chron Bach's Alpha of 0.70 reflects the minim acceptable reliability. An estimate of 0.80 or above is considered a good level of reliability ensuring that the scales are internally consistent measure the same construct especially in the fields where the precision is crucial.

ESG disclosure and scale them by the natural logarithm of total assets to adjust for the size bias and smooth for the outliers; next, we standardise both measures across the Industrial Classification Benchmark (ICB) subsectors such that their values are between 0 and 1, comparable across the industry peers.¹⁴ We measure corporate greenwashing level (*Greenwashing*) as the difference between symbolic and substantive ESG scores. We report the Refinitiv variable names and codes and Datastream stream identifiers in Table OA2 of the online appendix.

3.2.2. Independent Variables: Mandatory ESG Disclosures and Institutional Factors

Our key independent variable is Mandatory ESG Disclosures (*MD*), a binary variable that equals one from the year a country introduces mandates and zero otherwise. Since the countries in our sample introduce mandates at heterogeneous times, our study design corresponds to a staggered difference-in-differences (DiD) model. Kreuger *et al.* (2024) report 38 countries that have introduced all three E, S, and G disclosure mandates along with their characteristics, including the year the regulations on the mandatory disclosures were enforced, the intensity of their compliance (Full Compliance or Comply or Explain bases), issuing authority (Formal or Informal Institution), and whether the disclosures became mandatory all-at-once or one-by-one. Of these 38 countries, 16 countries already made some voluntary disclosures. The authors also highlight another set of 27 countries with some voluntary disclosure or one or two of E, S, and G disclosure mandates in place, which serves as an optimal control group for our study design. Our final sample includes 27 countries in the treatment group and 14 in the control group. Table OA3 in the online appendix reports the sampling distribution across the countries, the years of ESG disclosure mandates, along with the features of the mandates (issued by government and non-governmental institutions and on full compliance or comply or explain basis), and country-level average values for *SYMB-ESG*, *SUB-ESG*, and *Greenwashing*.

3.2.3. Control Variables

We control for firm size (*SIZE*), computed as the natural logarithm of total assets, return on assets (*PROFIT*), financial slack (*CASH*), capital intensity (*CAPEX*) and research and development intensity (*RDI*). Firms, particularly large ones, have greater financial resources, allowing them to invest in crafting an image of social responsibility through communication strategies (e.g., symbolic ESG disclosures). However, despite their capacity for meaningful ESG improvements, many prioritise image-building over substantive operational changes that would generate real societal or environmental benefits (Wickert, Scherer and Spence, 2016). High *CAPEX* and *RDI* firms would also limit firms from investing in substantive ESG initiatives unless it is a firm's primary mode of operation. We next control for firms' leverage levels (*LEV*) and Market-to-book ratio (*MTB*). Firm leverage is a ratio of the firm's total debt to total assets; highly leveraged firms face greater scrutiny from creditors and financial institutions, incentivising them to project high symbolic disclosures that project a favourable image and mitigate perceived financial risk. A high *MTB* indicates that the firm is growth-oriented and has high investor expectations. Such firms are more likely to signal a positive image to market participants, leading them to high symbolic ESG disclosures even when the actual ESG practices are superficial (Marquis, Toffel and Zhou, 2015; Bothello *et al.*, 2023). To account for firm financial stability and uncertainty, we control for stock price volatility (*VOL*) and dividend payout (*DIV*). Appendix A lists the variables, their description, and data sources adopted in this study. The univariate regression estimates reported in Table OA6 of the online appendix confirm that all our independent and control variables are significant predictors of *Greenwashing* and its constituents, *SYMB-ESG* and *SUB-ESG*.

¹⁴ <https://www.lseg.com/en/ftse-russell/industry-classification-benchmark-icb>

3.3. Descriptive Analysis

To mitigate the influence of potential outliers, we winsorised all continuous variables at the 1st and 99th percentiles. Table OA4 in the online appendix presents the summary statistics of the variables employed in the study. The results show that, on average, the difference between the symbolic ESG disclosures and substantive ESG disclosures is negative (−0.123), and the difference among the firms is generally small considering their standard deviation (0.236) and interquartile range (−0.294 to 0.031). Our results imply that an average firm in our sample exhibits more substantive ESG disclosures (0.600) than symbolic ESG disclosures (0.478). Both measures are scaled between 0 and 1, resulting in lower greenwashing levels.¹⁵ The average value of 0.222 for the *MD* reflects that around 22.2% of firm-years are treated. The remaining observations either belong to not-yet-treated or not-yet-treated and never-treated groups. In contrast, the treatment group contains 39.65% firm-year observations as treated.¹⁶ Not yet treated reflects the firms in the treatment countries, which get treatment at some point in time (Table OA3), and never treated firms belong to the countries in the control group who remain untreated throughout the sampling period (Callaway and Sant’Anna, 2021).

Additionally, firms, on average, are big; this is likely because the sample consists of firms that report ESG data, and large firms can produce more data. Consequently, we see less dispersion in *SIZE* among firms. However, firms significantly diverge in profitability (*PROFIT*) and market value (*MTB*). Most of the firms in our sample have balanced debt levels (*LEV*), cash reserves (*CASH*), and capital intensity (*CAPEX*), signifying higher financial flexibility. These firms, on average, are less risky (*VOL*) and frequently issue dividends (*DIV*) (74.6%). Innovation activity seems to be concentrated in a few firms (*RDI*). Our models are free from multicollinearity concerns, as predictor correlations remain low to moderate across specifications (see Table OA5). The predictor correlations across alternative model specifications are low to moderate, indicating that our inferences are not affected by severe multicollinearity (see Table OA5, the correlation matrix).

4. Empirical Results

4.1. Staggered DiD Regression Model

Since the ESG disclosure mandates are enforced in different years, we use the following staggered DiD model to assess their impact on corporate greenwashing (Fauver *et al.*, 2017; Krueger *et al.*, 2024).

$$Greenwashing_{i,c,t+1} = \beta_0 + \beta_1 MD_{c,t} + \gamma_x Controls_{i,c,t} + \gamma_y Fixed\ Effects_{i,j,c,t} + \varepsilon_{i,c,t} \quad (1)$$

In Eq. (1), $Greenwashing_{i,c,t+1}$ represents the greenwashing level for firm i in country c at time $t+1$.¹⁷ The variable of interest is Mandatory ESG Disclosure (*MD*), which equals one from the year a country mandates the ESG disclosure and 0 otherwise. A positive (negative) coefficient on β_1 suggests an increase (decrease) in greenwashing. $Controls_{i,t}$ refers to control variables discussed in Section 3.2.3. Applying year and firm fixed effects identifies the within-year and within-firm change in greenwashing between the treatment and non-treatment groups of firms around ESG disclosure mandates. We estimate Eq. (1) using pooled cross-section ordinary least squares (OLS) regressions with *Greenwashing* as the dependent variable. Standard errors are clustered at the firm-level across all our multivariate estimations to account

¹⁵ One of the limitations of our study is the bias arising from ESG coverage and relative reporting on the indicators that formulate *SYMB-ESG* and *SUB-ESG*.

¹⁶ Results for this analysis are available upon request.

¹⁷ This empirical design considers the buffer period provided to the companies to comply. However, in cases such as EU Directives 2014/95, the directive was passed on 2014 and implemented in 2017. Firms however increased CSR activity disclosure or activity prior to enforcement (Fiechter, Hitz and Lehmann, 2022).

for within-firm correlation in residuals, ensuring robust statistical inferences. To mitigate the self-selection bias, we create a synthetic control group by employing an entropy-balanced sample, recognising that firms differ significantly across firm-level attributes. Firms are matched on all control variables adopted in our analysis following the methodology prescribed by Hainmueller (2012) and Gupta *et al.* (2024). The procedure adopts maximum entropy reweighting to match characteristics to create treatment and control groups of nearly identical distribution (mean, variance, and skewness). The summary statistics for the variables before and after entropy balancing are provided in Table OA7 of the online appendix. For hypotheses 1 and 2, the entropy balancing is applied with the never-treated and not-yet-treated control groups. In contrast, for hypothesis 3, we reweight the entropy-balanced sample with the not-yet-treated group as the reference.¹⁸

4.2. Empirical Results and Discussion

4.2.1. Test for H1: Effects of Mandatory ESG Disclosure on Corporate Greenwashing

H1 postulates that firms substantially greenwash their sustainability disclosure in reaction to ESG mandates to meet the regulatory requirements. The results are outlined in Table 1 (column 4), which shows a positive and statistically significant effect of *MD* at a 1% significance level, supporting the hypothesis, H1. Regarding economic significance, the results show that firms increased *Greenwashing* in reaction to ESG disclosure mandates by 8% (0.019/0.236) when measured relative to the standard deviation.¹⁹ These findings are economically meaningful. The adjusted R-squared for the model is 63.7%. Columns 2 and 3 show the estimates for the components of greenwashing. The results show that post-ESG mandates, the rise is economically strong. Firms increase symbolic ESG disclosure by 17.9% (0.053/0.296). Conversely, an increase of 13.7% (0.035/0.256) is also observed in substantive ESG disclosures. The adjusted R-squared values for the models are 74.5% and 68.4%, respectively.

<Insert Table 2 Here>

4.2.2. Test for H2: Legitimacy of Mandating Authority and Intensity of Compliance

H2 posits that firms engage in greenwashing in response to ESG disclosure mandates when these mandates are issued by institutions with higher legitimacy and when full compliance is required. To test the first part of our proposition, we classify mandates based on whether they are enforced by government or non-governmental institutions. Government institutions include law-making ministries and regulators, i.e., securities and exchange commissions, financial conduct authorities, or other government bodies with a public mandate. On the contrary, in some countries, the mandates are issued by non-governmental institutions such as stock exchanges. Mandates by government institutions are likely to result in greenwashing, as government institutions have better resources and public authority than any private institution, forcing firms to disclose more information. Results in Table 1 (Column 5) show that firms with mandates enforced by government institutions have statistically significant higher *Greenwashing*, whereas non-governmental institutions have insignificant effects. Economically, these findings are meaningful. Firms with mandates introduced by government institutions result in statistically significant and economically 7.2% (0.017/0.236) higher *Greenwashing* compared to non-governmental institutions at 3.3% (0.008/0.236).

We further postulate that firms resort to higher greenwashing when disclosure enforcement is rigid. We test this proposition by testing the impact of mandatory disclosure

¹⁸ The results for the entropy balancing, with the not-yet treated group as the control, are available upon request.

¹⁹ See Mitton (2022) for a comparison of measurement approaches for economic significance. We calculate economic significance concerning the standard deviation as $ES_x = \left| \frac{\beta_x}{\sigma_y} \right|$. Where ES_x and β_x refer to the economic significance of the independent variable, and σ_y refers to the standard deviation of the dependent variable.

when enforcement requires full compliance by the firms or demands that firms explain in case of non-compliance. The strictness of the mandates is reflected when full compliance is required. Results in Table 1 (Column 6) show that firms resort to significant and higher levels of *Greenwashing* when disclosure rules are enforced on a full compliance basis. These results are statistically significant at a 1% level of significance. However, the effects remain statistically insignificant for enforcement with explanation provisions. The effects are economically meaningful; *Greenwashing* is 12.7% (0.030/0.236) higher post-mandate enforcement on a full compliance basis compared to 0% (0.000/0.236) when the mandates include an explanation provision. The models in Columns 5 and 6 have an adjusted R-squared of 63.7% and 63.8%, respectively.

4.2.3. Test for H3: Pre-Mandate Greenwashers vs. Pre-Mandate Non-Greenwashers

H3 proposes that the firms' reactions to ESG disclosure mandates vary across the pre-mandate greenwashers and non-greenwashers. We postulate that pre-mandate ESG greenwashers decrease their greenwashing behaviour, while pre-mandate non-greenwashers start greenwashing. Both pre-mandate greenwashers and non-greenwashers view mandatory disclosure as the benchmark and align their symbolic and substantive ESG disclosures around the requirements. Thus, the positive effect obtained in estimation for H1 is primarily driven by pre-mandate non-greenwashers. To test this proposition, we split our sample (firms) in the treatment group into pre-mandate greenwashers and pre-mandate non-greenwashers by constructing a time-invariant dummy variable, *PM-GW-D*, that takes the value of one if a firm is classified as a pre-mandate greenwasher and zero otherwise. We repeat the baseline estimation procedure for each group separately. We classify a firm as a pre-mandate greenwasher if its average *Greenwashing* before the ESG disclosure mandates year is above zero. Likewise, pre-mandate non-greenwashers are firms with *Greenwashing* equal to or below zero. Since the average firm greenwashing is calculated preceding the mandate year, Stata generates missing values for the mandate year and subsequent periods. We address the missing values in the mandate and post-mandate periods by replacing them with each firm's static average pre-mandate greenwashing score, allowing a consistent and time-invariant classification across all firm-years in the treatment group. This process generates 3,068 missing values for *PM-GW-D* for firms that did not report any ESG (*Greenwashing*) information prior to the mandates. We cannot simply assume these firms to be either pre-mandate greenwashers or non-greenwashers; hence, we do not replace the missing observations with zero or one. This analysis is limited to countries in the treatment group; consequently, we reweight the entropy balance sample for treated and not-yet-treated firm-year observations to address potential selection bias. The groups have 2,498 and 9,349 firm-year observations, respectively.

The results outlined in Table 1 (Column 7) show a significant and negative greenwashing level (*Greenwashing*) post-mandatory ESG disclosure at a 1% level of significance for pre-mandate greenwashers. Economically, these findings are meaningful. Our findings reflect a decline in *Greenwashing* by 26.9% (−0.048/0.178) after disclosures are mandated.²⁰ This effect is economically large. The results presented in Table 1 (Column 8) show a significant and positive *Greenwashing* post-mandatory adoption of ESG disclosure at a 1% significance level for pre-mandate non-greenwashers. Economically, these findings are strong. Our findings reflect a rise in *Greenwashing* by 14.3% (0.030/0.209) after disclosures are mandated; the magnitude of the effect is 6.3% higher than the aggregate effect obtained under the tests for H1. These effects are economically strong. The models have adjusted R-squared values of 30.2% and 48.5%, respectively. In an untabulated analysis, we replace the missing values on *PM-GW-D* with zero; our results remain consistent with the baseline

²⁰ We use the values of standard deviation obtained separately for a subsample of pre-mandate greenwashers and pre-mandate non-greenwashers to make valid inferences. The results of this analysis are available at request.

estimations. Moreover, the estimate on the pre-mandate non-greenwashers is much higher (19.7%), implying that firms that started reporting post-ESG mandates resorted to more symbolic compliance than substantive ESG disclosure.²¹

These findings support the notion that ESG disclosure mandates provide a benchmark for firms regarding disclosure intensity, leveraging the legitimacy of ESG disclosure mandates compared to voluntary adoption. Stakeholders, investors, and external bodies (i.e., media, NGOs, and social activists) often view compliance with these regulations as a signal of transparency and accountability. The dissection into pre-mandate greenwashing and non-greenwashing reveals that these findings face a downward bias attributed to a decline in greenwashing by pre-mandate greenwashers.

4.3. Mitigating Endogeneity Concerns and Robustness Checks

Endogeneity concerns typically arise from selection bias, omitted variables bias, measurement error, and reverse causality (Roberts and Whited, 2013; Hill *et al.*, 2021). To address the selection bias, we use the entropy-balanced sample in all our estimations (Hainmueller, 2012). Reverse causality or simultaneity is unlikely. Li *et al.* (2021) argue that when independent variables are exogenously determined at a higher level than the firm, the risk of dynamic endogeneity is minimal.²² To rule out the unobservable effect arising from the measurement error, Hill *et al.* (2021) recommend the introduction of an exogenous shock through difference-in-difference estimations. Consequently, the likelihood of measurement error is also minimal. However, our research design follows a staggered DiD approach, and as a robustness test, we also implement classic two-way fixed effect DiD around the EU Directive 2014/95. The only likely candidate to bias our results is omitted variables bias. We employ three procedures to counter omitted variable bias: (i) control for observable confounders such as concurrent reforms (*IFRS and BDR*), institutional quality (*VOID*), and macroeconomic features (*GDPG*); (ii) conducting a falsification test to identify potential unobservable effects around the intervention period; and (iii) incorporating industry, year, and country-fixed effects to account for broader contextual influences in our baseline estimations (i.e., cultural differences, legal origin, political stability, market maturity, and prevailing corporate norms). The results confirm that our results are robust to endogeneity concerns. Robustness checks include: (a) Callaway and Sant'Anna (2021) staggered DiD approach; (b) excluding the dominant countries individually and collectively from both treatment (United Kingdom and China) and control (United States of America) groups; (c) alternative metrics of greenwashing (Bams and van der Kroft, 2022); and (d) estimation of the baseline model with *GW-D* dummy as the response variable under logit model specifications. Detailed test results and related discussions pertaining to endogeneity tests and robustness checks are presented in the associated online appendix.

5. Summary and Conclusions

Although a substantial body of research has explored the motivations and consequences of greenwashing and the impacts of ESG mandates separately, studies examining how ESG disclosure mandates influence firm greenwashing behaviour remain scarce. Therefore, we introduce ESG disclosure mandates globally as an exogenous shock and assess how firms respond to these mandates.

²¹ The results for this analysis are available at request.

²² In our staggered DiD design, ESG disclosures mandates are exogenous, and implemented at different times before firms adjust their ESG disclosure behaviour. In Figure 1, we show that greenwashing is determined by the shift in regulatory policies that occur independently and are implemented before firms shift their behaviour. Li *et al.* (2021) shows that the likelihood of simultaneity in this case is minimal.

Using a firm-level global dataset across 41 countries from 2003 to 2022, we show that firms strategically increase their symbolic ESG disclosure more than their substantive ESG disclosure post-ESG mandates. This behaviour is more pronounced when mandates are introduced by government institutions and on a full-compliance basis. Our findings further reveal that firms converge their ESG disclosure towards a common point, revealing isomorphic processes under institutional theory, such that pre-mandate greenwashers significantly reduce their greenwashing; conversely, pre-mandate non-greenwashers increase the same.

We argue that firms strategically disclose symbolic attributes for five reasons. First, due to the ambiguity in some of the ESG mandates and the lack of structured guidelines (Christensen, Hail and Leuz, 2021; Pinnuck *et al.*, 2021; Fiechter, Hitz and Lehmann, 2022).²³ Second, the costs associated with disclosures are minimal compared to substantive ESG actions (Grewal, Riedl and Serafeim, 2019). Third, unlike audit assurance in the case of financial reports, it isn't easy to set standard metrics to compare firm-level ESG outcomes (De Meyst, Cardinaels and Van den Abbeele, 2023; Free, Jones and Tremblay, 2024; Gipper, Ross and Shi, 2024). Fourth, due to normative isomorphic pressures set under the voluntary regime, firms greenwash due to legitimacy concerns (DiMaggio and Powell, 1983; Ryou, Tsang and Wang, 2022; Reitmaier, Schultze and Vollmer, 2024). Finally, misleading ESG reporting results in real economic outcomes, including financial performance and cost of capital (Grewal, Riedl and Serafeim, 2019; Ioannou, Kassinis and Papagiannakis, 2023; Gibbons, 2024).

Policymakers can limit greenwashing by implementing a combination of approaches. First, like IFRS, state-specific mandates can align reporting requirements with global frameworks, such as GRI, CDP, and TCFD, to ensure comparability and transparency in sustainability disclosures. Second, establishing clear and measurable benchmarks minimises ambiguity and prevents firms from overstating achievement. Third, establishing assurance bodies, such as institutional and third-party auditors, can further limit symbolic ESG disclosures (De Meyst, Cardinaels and Van den Abbeele, 2023). Unlike financial audits, ESG assurance varies widely in form and substance, including the level of assurance, choice of metrics assured, and assessor type (Gipper, Ross and Shi, 2024).

While this study presents valuable insights, several nuanced limitations warrant consideration and further research. First, this study primarily evaluates greenwashing through observable disclosures and proxy measures but does not delve into the behavioural intentions of firms. Second, the present study does not account for the feedback loop between the regulatory bodies and firms. Thus, future research may assess institutional response to greenwashing post-ESG mandates. Third, we broadly refer to institutional theory to build our hypotheses. The theory assumes homogeneity (isomorphism); despite using the broad sample, variations in the political systems, economic conditions, and cultural norms may introduce complexities, and these differences may lead to heterogeneous effects (DiMaggio and Powell, 1983). Further, measuring greenwashing is inherently difficult; we discuss alternate metrics and their limitations. However, Refinitiv also depends on data provided by firms. Thus, the indicators may suffer from bias. Future research could consider developing symbolic and substantive ESG metrics from disaggregated data provided by other database providers; a difference is likely expected due to divergent ESG ratings exhibited by different ESG providers (Berg, Kölbel and Rigobon, 2022). These limitations highlight the complexity of analysing corporate responses to ESG mandates, offer fertile ground for future research, and refine our understanding of greenwashing and its implications for sustainable policies.

²³ Unlike accrual-based financial statements, ESG reports are typically unstandardised, giving managers discretion in measuring and reporting ESG performance. Moreover, the uncertainty in estimating environmental and social metrics is higher than in financial information, typically reported in dollars (Pinnuck *et al.*, 2021). Due to alternate units of measurement, aggregation is typically a concern (Berg, Kölbel and Rigobon, 2022).

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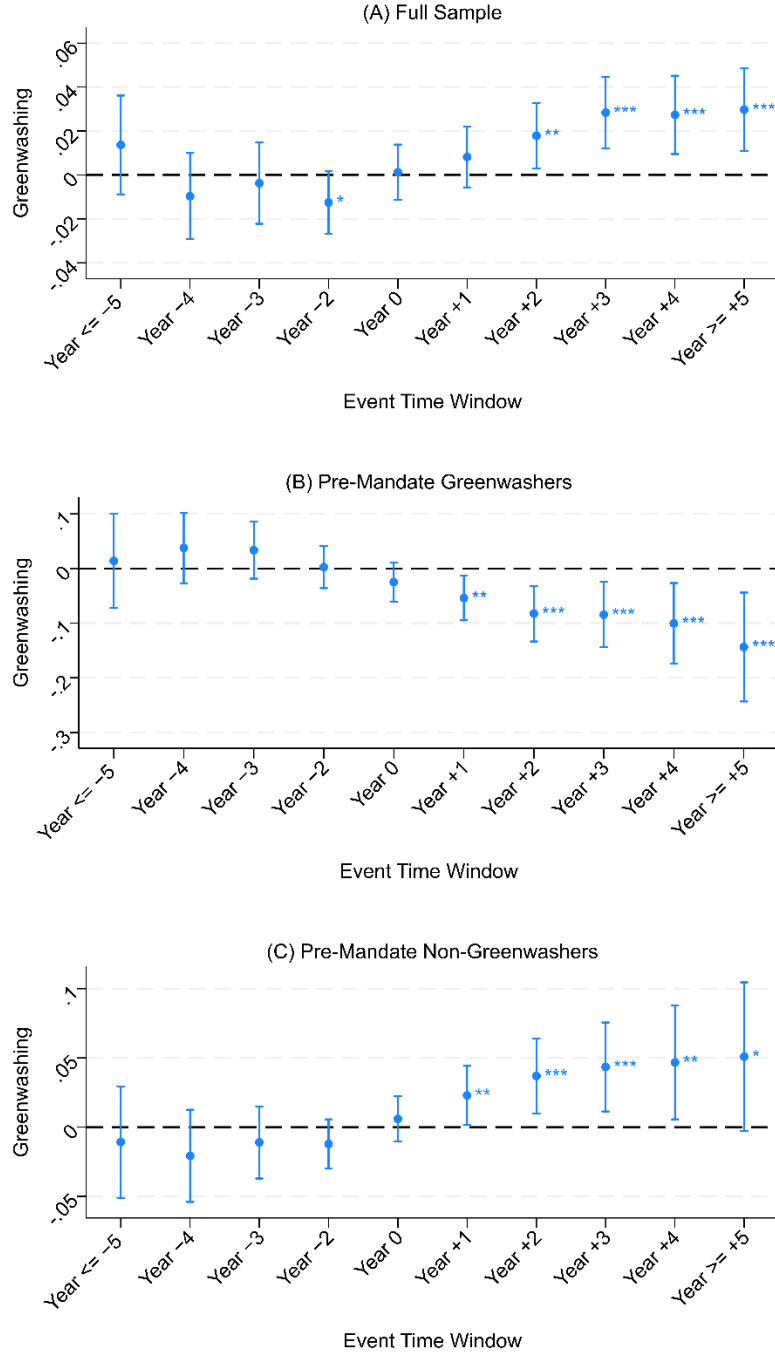
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Figure 1

Greenwashing Levels Around ESG Mandates



Notes: This figure shows the event time effects of mandatory ESG disclosure (*MD*) on the greenwashing level (*Greenwashing*) reported in Table OA8 (Panel B). *Greenwashing* is measured as the difference between *SYMB-ESG* and *SUB-ESG*. The estimates are obtained by regressing time dummies with a five-year interval pre- and post-ESG disclosure mandates on *Greenwashing*. In Panel A, the entropy-balanced estimations are based on regression estimates from a full sample. The entropy-balanced regression estimations based on the pre-mandate greenwashers and pre-mandate non-greenwashers are shown in Panels B and C, respectively. Standard errors are clustered at the firm level. The figure plots the coefficient estimation for each event-time year with 95% confidence intervals. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels (two-tailed), respectively. All variables are defined in Appendix A.

Table 1
Multivariate Regressions Models

Variables	Full Sample					Pre-Mandate Greenwashers	Pre-Mandate Non-Greenwashers
	<i>SYMB-ESG</i>	<i>SUB-ESG</i>	<i>Greenwashing</i>	<i>Greenwashing</i>	<i>Greenwashing</i>	<i>Greenwashing</i>	<i>Greenwashing</i>
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>MD</i>	0.053*** (0.007)	0.035*** (0.007)	0.019*** (0.007)			-0.048*** (0.016)	0.030*** (0.009)
<i>GOV-I</i>				0.017* (0.010)			
<i>NON-GOV-I</i>				0.008 (0.008)			
<i>FC</i>					0.030*** (0.008)		
<i>C/E</i>					0.000 (0.011)		
<i>SIZE</i>	0.042*** (0.008)	0.015* (0.008)	0.028*** (0.006)	0.027*** (0.006)	0.027*** (0.006)	0.014 (0.017)	0.027*** (0.010)
<i>MTB</i>	0.000 (0.000)	-0.001* (0.001)	0.001** (0.001)	0.001** (0.001)	0.001** (0.001)	-0.001 (0.003)	0.001 (0.001)
<i>LEV</i>	-0.037* (0.019)	-0.056*** (0.018)	0.017 (0.016)	0.018 (0.016)	0.016 (0.016)	0.006 (0.056)	0.030 (0.027)
<i>PROFIT</i>	-0.017 (0.021)	-0.037* (0.021)	0.020 (0.020)	0.020 (0.020)	0.021 (0.020)	0.095 (0.099)	0.062 (0.041)
<i>CASH</i>	-0.009 (0.025)	-0.019 (0.025)	0.012 (0.022)	0.011 (0.022)	0.010 (0.022)	0.110 (0.106)	-0.029 (0.047)
<i>VOL</i>	-0.003*** (0.001)	-0.002*** (0.001)	-0.001* (0.000)	-0.001 (0.000)	-0.001 (0.000)	-0.003* (0.002)	0.001 (0.001)
<i>DIV</i>	0.007 (0.005)	-0.003 (0.005)	0.010** (0.004)	0.010** (0.004)	0.009** (0.004)	0.015 (0.014)	0.016* (0.009)
<i>CAPEX</i>	0.026 (0.056)	-0.005 (0.050)	0.024 (0.049)	0.024 (0.049)	0.027 (0.049)	0.092 (0.168)	0.015 (0.095)
<i>RDI</i>	0.396*** (0.109)	0.372*** (0.096)	0.020 (0.110)	0.017 (0.110)	0.013 (0.109)	0.763 (1.449)	0.024 (0.344)
<i>Constant</i>	-0.049 (0.119)	0.478*** (0.122)	-0.540*** (0.088)	-0.533*** (0.088)	-0.530*** (0.088)	-0.080 (0.299)	-0.647*** (0.165)
<i>Observations</i>	37,602	37,602	37,602	37,602	37,602	2,498	9,349

<i>Adj. R2</i>	0.745	0.684	0.637	0.637	0.638	0.302	0.485
<i>Year FE</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Firm FE</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: This table reports multivariate entropy-balanced regression estimates with *Greenwashing* as the dependent variable. The independent variable is *MD (dummy)*. All regressors are taken at a one-year lag. Robust standard errors are shown in parentheses, clustered at the firm level. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels (two-tailed), respectively. All variables are defined in Appendix A.

Appendix A
Variable Definitions and Data Sources

Variable	Definition	Data Source
Greenwashing Measures		
Greenwashing	Greenwashing level is computed as the difference between <i>SYMB-ESG</i> and <i>SUB-ESG</i> .	LSEG Refinitiv and Author Calculations
GW-D	An indicator variable equals one if the <i>Greenwashing</i> is greater than zero and zero otherwise.	
SYMB-ESG	Firm symbolic ESG score.	
SUBS-ESG	Firm substantive ESG score.	
PM-GW-D	Pre-mandate greenwasher, a firm-level time-invariant indicator variable that equals one if the firm's average pre-mandate <i>Greenwashing</i> score is greater than zero and zero otherwise. This variable only corresponds to the treatment group for countries with ESG mandates.	
Mandatory ESG Disclosures and Features		
MD	An indicator that equals one from the first year a country introduces mandatory ESG disclosure regulations and zero otherwise.	Carrot and Sticks Projects, Sustainable Stock Exchanges Initiative and Global Reporting Initiative compiled by Krueger <i>et al.</i> (2024)
GOV-I	An indicator that equals one from the first year a country's government introduces mandatory ESG disclosure regulations and zero otherwise. A government institution can be a ministry, parliament, a security regulator or a similar institution.	
NON-GOV-I	An indicator that equals one from the first year a country's non-governmental institutions introduce mandatory ESG disclosure regulations and zero otherwise.	
FC	An indicator that equals one from the first year a country introduces mandatory ESG disclosure regulations on a full compliance basis and zero otherwise.	
C/E	An indicator that equals one from the first year a country introduces mandatory ESG disclosure regulations on the comply or explain basis and zero otherwise.	
Control Variables		
MTB	Market to Book, a ratio of market value of equity and total assets.	Datastream
LEV	The ratio of total debt and total assets at the end of the fiscal year.	Worldscope
PROFIT	Firm return on assets is computed as a ratio of operating income after taxes and average total assets of the current and previous years.	
CASH	The ratio of cash and short-term investments over total assets	
VOL	Firm stock price volatility.	
DIV	An indicator that equals one if the firm has a dividend payout	
CAPEX	A ratio of firm capital expenditures over total assets.	
RDI	A ratio of firm research and development expenditure over total assets.	
VOID	Country Level Institutional voids, calculated as the first principal component of six standardised governance indicators for each year, with the result multiplied by −1 to indicate the presence of voids.	
GDPG	Annual growth rate of the country's gross domestic product.	
IFRS	An indicator that equals one from the first year a country adopts IFRS (International Financial Reporting Standards) and zero otherwise.	World Governance Indicators and Author Calculations
		World Development Indicators and National Statistics of Taiwan
		(De George, Li and Shivakumar, 2016)

<i>BDR</i>	An indicator that equals one from the first year of a major board reform in the country and zero otherwise.	(Fauver <i>et al.</i> , 2017)
<i>Additional Variables</i>		
<i>EU</i>	An indicator that equals one if a country belongs to the European Union and zero otherwise.	European Union Official Website and Krueger <i>et al.</i> (2024)
<i>POST</i>	An indicator that equals one for years 2016 and onwards and zero otherwise.	
<i>GW-C-RP</i>	The greenwashing level, computed as the difference between ESG reporting and policy scores.	Refinitiv, Bams and van der Kroft (2022), Author Calculations
<i>GW-C-RO</i>	The greenwashing level, computed as the difference between ESG reporting and outcome scores.	
<i>GW-C-PO</i>	The greenwashing level, computed as the difference between ESG policy and outcome scores.	

Notes: This table lists the variables used in the study, their definition, and the data source.

Online Appendix

1. Executive Summary

This online appendix provides supplementary tables and discussions complementing the findings of the manuscript “*Greenwashing Games: Playing the ESG Mandates*”. Section 2 details the sample selection procedure. Section 3 reports empirical test results related to endogeneity concerns in our main regression models presented in Table 1. Finally, Section 4 presents the additional tests that demonstrate the robustness of the main results.

2. Sample Selection Procedure

After constructing the *Greenwashing* measure, we have 86,488 country-firm-year observations for 11,339 unique firms across 93 countries. We refer to Refinitiv Identification Codes (RIC) as firm identifiers. After we merge this data with the data for ESG disclosure mandates, our dataset is reduced to 84,243 country-firm-year observations for 11,158 distinct firms across 65 countries. To maintain sample homogeneity, we exclude firms classified as financial and real estate investment trusts (ICB Industry Codes 30 and 35) and firms with missing industry information.²⁴ This leaves us with 66,349 country-firm-year observations for 8,812 firms across 64 countries. We next remove observations for countries with no or very few observations before ESG disclosure mandates. This includes countries with ESG disclosure regulations during or before 2003, such as Australia (2003) and France (2001), and countries with a very low number of pre-mandate observations, including Argentina (2008), Bulgaria (2016), Canada (2004), Malaysia (2007), Malta (2016), Romania (2016) and Slovenia (2017). This reduced our sample size to 57,475 observations for 7,664 distinct firms from 54 countries.²⁵ Next, we eliminated observations with missing values across dependent, lagged independent, and control variables to ensure a consistent sample and firms with less than three observations. Finally, we remove countries with less than 30 firm-year observations (Bahrain, Cyprus, Kenya, Morocco, Oman, Ukraine, and Vietnam). Our final sample includes 37,602 country-firm-year observations for 3,642 firms across 41 countries. We present the stepwise sample selection procedure in Table OA1, Panel A.

3. Mitigating Endogeneity Concern

In causal analyses employing regression frameworks, endogeneity can bias the estimates due to the correlation between observed and unobserved factors; unobserved factors are typically reflected in the error terms. There are four common causes of endogeneity, including a) selection bias, b) omitted variables bias, c) measurement error, and d) reverse causality or simultaneity (Roberts and Whited, 2013; Hill *et al.*, 2021). To counter the selection bias, we have used an entropy-balanced sample across all our regression estimations (Hainmueller, 2012; Gupta, Shruti and Li, 2024). Reverse causality is not a concern in our research setting; disclosures are mandated to monitor and regulate the ESG activities of firms and not the other way around (Li *et al.*, 2021). To rule out the unobservable effect arising from the measurement error, Hill *et al.* (2021) recommend the introduction of an exogenous shock through difference-in-difference estimations. Our research design follows a staggered DiD approach; however, as a robustness test, we also implement the classic two-way fixed effect DiD around the European Union (EU) Directive 2014/95 and Callaway and Sant’Anna (2021) staggered DiD approach. The only likely candidate to bias our results is omitted variables bias. To counter the omission

²⁴ Industrial classification benchmark (ICB) is a comprehensive globally adopted rule-based methodology based on research and market trends designed to support investment solutions. ICB provides a four-tier structure with 11 industries, 20 super sectors, 45 Sectors, and 173 Subsectors. For details, see – <https://www.lseg.com/en/ftse-russell/industry-classification-benchmark-icb>

²⁵ In an untabulated analysis, our results remain consistent with the inclusion of these countries.

of important variables, we include firm and year-fixed effects across all our baseline estimations. However, we address potential endogeneity due to omitted variables by implementing three additional procedures, which we detail in the following section.

3.1. Endogeneity Due to Omitted Variables

We perform three procedures to address the omitted variables bias, first, we control for contemporary reforms and institutional characteristics to ensure that other ongoing regulatory and macroeconomic changes do not confound the observed effects (Hong, Hung and Lobo, 2014). Second, we conduct a falsification test with years of pre- and post-ESG mandates to examine whether the results are driven by trends related to the regulatory policy intervention, providing further confidence in the robustness of our findings (Fauver *et al.*, 2017). Third, we incorporate year, industry, and country fixed effects to account for broader macroeconomic, sectoral, and institutional factors that could otherwise confound our estimates, ensuring a more robust identification of the policy's impact.

3.1.1. Observable Confounders

To examine the potential confounding effects of other reforms happening around the same time, we control for IFRS adoption (*IFRS*) and corporate board reforms (*BDR*). *IFRS* reflects the disclosure quality of financial reporting (Hong, Hung and Lobo, 2014; De George, Li and Shivakumar, 2016; Isidro, Nanda and Wysocki, 2020), whereas *BDR* refers to changes in corporate governance quality (Fauver *et al.*, 2017). Since these reforms overlap and often happen around the same time, there is a likelihood of unobservable effects in our main estimations. In Table OA8, Panel A, we report the findings while controlling for *IFRS* and *BDR*. Our results remain qualitatively similar, with little to no variation in our baseline estimations.

We also control for two important country-level factors: economic growth (*GDPG*) and institutional quality (*VOID*). By controlling for *GDPG*, we want to ensure that the broad macroeconomic discrepancies do not confound our findings. We also control for institutional quality to subsume the institutional features that could otherwise explain firm disclosure quality and may confound the effect of ESG mandates. The institutional features include the effectiveness of government, voice and accountability, rule of law, regulatory quality, control of corruption, and political stability, also known as world governance indicators (*WGIs*).²⁶ Empirical evidence suggests that firms headquartered in countries with high levels of institutional voids may confound the likely effects of other key drivers of greenwashing in sustainability disclosures (Tashman, Marano and Kostova, 2019). Isidro *et al.* (2020) show that multiple country-level attributes are associated with corporate disclosure quality; since those characteristics are highly correlated, they are inseparable. Thus, we use principal component analysis (PCA), a dimension reduction approach, to account for collinearities among governance indicators (Jolliffe, 2002). We first standardised the *WGIs* for each year and predicted the first principal component of the six world governance indicators discussed above. Then, we inverted the metric such that a higher value accounts for high institutional voids. The results in Table OA8, Panel A (Columns 4 and 5), suggest that our findings are robust to the likely confounding effects of macroeconomic conditions and institutional quality.

3.1.2. Falsification Tests

To further reduce the risk of omitted variable bias, we conduct a parallel trends test by incorporating year-specific dummies into the baseline regression model. These dummies represent distinct time periods relative to the enforcement of ESG mandates, covering five or more years before the mandates (Year ≤ -5) through each year leading up to the mandates (Year -4 , Year -3 , Year -2 , Year 0), and up to five or more years after the implementation (Year 1 to

²⁶ See – <https://databank.worldbank.org/source/worldwide-governance-indicators>

Year 5 and onwards). Year 1 serves as the reference group, allowing us to assess whether any pre-existing trends in greenwashing could confound the estimated effects of ESG disclosure mandates (Fauver *et al.*, 2017). If the greenwashing increases or decreases due to any other factor (observable or unobservable), the change should be significant before the enforcement of mandates. We report our findings in Panel B of Table OA8. The results show that both *Greenwashing* and *GW-D* significantly increased after the disclosure mandates, particularly from the second year. This is likely because firms are provided a buffer period to implement the mandates, with the consideration that firms may align ESG policies according to the mandates to avoid regulatory exposure. These findings ensure that the effect is exclusively driven by the ESG disclosure mandates and not by the other observable and unobservable (omitted) factors. Similar to Krueger et al. (2024), our research design ensures that the change in greenwashing behaviour from the pre- to the post-mandate periods would be similar, on average, between firms in the treatment and control countries (parallel trends). The spillover effects from treated to non-treated countries through global peer influence could lead firms in non-treated countries to adjust disclosures, for example, firms from non-treated countries disclose ESG related information because of their peers in the treated countries. Alternatively, the countries without ESG mandates may have some form of voluntary ESG disclosure regime, or mandates any one or two of E, S and G disclosures, potentially biasing our estimates downward (Stable Unit Treatment Assumption (SUTA)). We mitigate this issue by including the countries with voluntary ESG disclosure regimes and either one or two of the mandatory E, S, or G disclosures in the control group, and by controlling for within-firm variation in our main analysis and, within industry and within-country variation in the additional analysis.

3.1.3. Additional Fixed Effects

To further strengthen the robustness of our findings, we incorporate year, industry and country fixed effects. Industry-fixed effects control for sector-specific factors, ensuring that our estimates are not biased by industry-wide variations in ESG practices. Country-fixed effects control for institutional and economic disparities that could otherwise confound the relationship between ESG disclosure mandates and firm-level greenwashing. By implementing this layered approach, we ensure that our results remain resilient to unobservable confounding factors.²⁷

4. Robustness Tests

To substantiate our findings, we apply the following robustness procedures.

4.1. Average Treatment Effect of the Treated (ATT)

Our baseline estimations provide the average treatment effects (ATE); however, to account for the average treatment effects of the treated (ATT), we apply two-way fixed effects DiD. Given the heterogeneous treatment timings, we cannot determine pre- and post-mandate periods for countries in the control group. To achieve ATT, we need to limit our analysis to the countries receiving treatment at the same time. For this purpose, we use the EU Directive 2014/95. The EU directive requires firms in the member countries of the European Union to disclose sustainability related information from 2016 onwards (Grewal, Riedl and Serafeim, 2019; Fiechter, Hitz and Lehmann, 2022). We leverage the EU sample to test our initial hypothesis in the TWFE DiD design. All countries that are part of the European Union remain in the treatment group (*EU*), whereas the control group remains the same as in Table OA3. The EU countries already having mandates are also included in the treatment group. We reweight the entropy-balanced sample for the EU on control variables and test the model under the following specification.²⁸

²⁷ The results for this analysis are available at request.

²⁸ The results for this analysis are available at request.

$$GW_{i,c,t+1} = \beta_0 + \beta_1 EU_c + \beta_2 POST_t + \beta_3 EU_c \times POST_t + \gamma_x Controls_{i,c,t} + \gamma_y Fixed Effects_{j,t} + \varepsilon_{i,c,t} \quad (OA1)$$

Where *GW* refers to either *Greenwashing* or *GW-D*, *EU* refers to a dummy variable equal to 1 if a country is a member of the European Union and zero otherwise. *POST* refers to a binary indicator variable equal to 1 from the year of implementation of the EU directive 2014/95 (2016) and zero otherwise. *Controls* refer to a set of control variables specified in section 3.2.3. *Fixed Effects* pertain to industry and year-fixed effects. We exclude country and firm fixed effects because their inclusion would lead to perfect multicollinearity with the *EU* dummy variable, making it impossible to isolate the effect of EU membership. The average treatment effect on the treated (ATT) is captured by β_3 which quantifies the impact of ESG disclosure mandates in EU countries post-2016. As shown in Table OA9, Panel A, the results confirm that ESG mandates have a statistically significant effect in the post-mandate period for EU member countries. Furthermore, these estimates align closely with the Average Treatment Effects (ATE) reported in Table 1, reinforcing the robustness of our findings.

When treatments are rolled out in staggered ways due to heterogenous treatment effects and the timings of the treatment, the estimate obtained via OLS may be biased (Baker, Larcker and Wang, 2022). We resolve this issue by following Callaway and Sant'Anna (2021) approach to obtain a staggered DiD estimator of ATT. The results reported in Table OA9, Panel B, show that the ESG disclosure mandates significantly enhance both the *Greenwashing* and the probability of being a greenwasher (*GW-D*). With this evidence, we ascertain that our findings are robust to alternative methods of estimating the treatment effects of ESG disclosure mandates.

4.2. Role of Dominant Countries

One would argue that dominant countries may primarily drive the observed effects. We segregate dominant countries in both the Treatment and Control groups based on the available firm-year observations and their importance in geopolitics (Hong, Hung and Lobo, 2014). The two most dominant countries in the Treatment group are the United Kingdom and China, while the United States is in the control group. We next estimate Eq. (OA1) with firm and year fixed effects, excluding the dominant countries one by one and all at once. Following each exclusion, we rebalance the sample using entropy-based weights to reflect the adjusted sample composition. Our results remain consistent both in terms of the effect size and the statistical significance. This evidence suggests that our findings are not biased due to the influence of dominant countries. The results are documented in Table OA10.

4.3. Alternate Measures of Corporate Greenwashing

Lastly, we test whether our findings remain persistent with alternate measures and levels of greenwashing. We dissect the greenwashing at three different levels. a) a difference between the ESG reporting intensity and presence of formal corporate policies (*GW-C-RP* & *GW-D-RP*), b) a difference between ESG reporting intensity and ESG outcomes (*GW-C-RO* & *GW-D-RO*), and c) a difference between ESG policy and outcome levels (*GW-C-PO* & *GW-D-PO*). We adopt the measures of ESG reporting, policy and outcomes from Bams and van der Kroft (2022). This classification aligns with the theoretical logic of symbolic and substantive ESG disclosures. We replace our dependent variable with these alternate measures of *Greenwashing*, and our results remain consistent, as shown in Table OA11.

Moreover, we re-estimate the baseline specification using *GW-D* as the dependent variable, a more stringent measure of greenwashing. To ensure robustness, we employ logit

regression under the baseline settings in Eq. (1). As shown in Table OA12, our findings remain consistent and statistically significant, reinforcing the reliability of our results.²⁹

²⁹ We do not use firm fixed effects since the dependent variable (*GW-D*) is a dichotomous variable taking the value of either 0 or 1. If a firm's greenwashing status does not change over the sample period, using firm fixed effects would prevent us from analysing the time-invariant effects, and the logit regression would exclude respective firms due to perfect prediction (Reitmaier, Schultze and Vollmer, 2024). Alternatively, we apply industry, year and country fixed effects.

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Table OA1
Sample Selection and Distribution

<i>Panel A: Sample Selection Procedure</i>				
Sample Filtering Steps		Firm-Year Observations	Distinct Firms	Distinct Countries
(1)	(2)	(3)	(4)	(5)
	Observations with <i>Greenwashing</i>	86,488	11,339	93
<i>Less</i>	Missing Observation for <i>MD</i>	(1,245)		
		84,243	11,158	65
<i>Less</i>	Financial Firms	(13,137)		
<i>Less</i>	Real Estate Firms	(5,591)		
<i>Less</i>	Missing Industry Details	(166)		
		66,349	8,812	64
<i>Less</i>	Countries with no/very low observations in the pre-treatment group	(8,874)		
		57,475	7,664	54
<i>Less</i>	Missing Data on Control Variables	(15,886)		
		41,609	5,581	51
<i>Less</i>	Firms with less than three observations	(3,917)		
<i>Less</i>	Countries with less than 30 observations	(90)		
Total Sample Size		37,602	3,642	41
<i>Panel B: Sampling Distribution Across Years</i>				
Year	Treatment Countries	Non-Treatment Countries		Total
(1)	(2)	(3)		(4)
2003	102		213	315
2004	115		229	344
2005	224		447	671
2006	291		597	888
2007	304		606	910
2008	330		630	960
2009	409		753	1,162
2010	501		855	1,356
2011	687		961	1,648
2012	763		1,002	1,765
2013	808		1,030	1,838
2014	764		759	1,523
2015	848		1,068	1,916
2016	939		1,379	2,318
2017	979		1,682	2,661
2018	1,179		1,994	3,173
2019	1,430		2,162	3,592
2020	1,424		2,161	3,585
2021	1,428		2,151	3,579
2022	1,390		2,008	3,398
Total	14,915		22,687	37,602

Notes: This table reports the sampling selection procedure in Panel A and sampling distribution across years in Panel B.

Table OA2
Symbolic and Substantive ESG Indicators

Item #	Item Name (Refinitiv)	Item Description (Refinitiv)	Datastream/ Asset4 Identifier	Refinitiv Identifier
(1)	(2)	(3)	(4)	(5)
<i>Substantive ESG</i>				
1	Audit Committee NonExecutive Members	Percentage of non-executive board members on the audit committee as stipulated by the company.	CGBFDP019	TR.AuditCommNonExecMembers
2	Nomination Committee NonExecutive Members	Percentage of non-executive board members on the nomination committee as stipulated by the company	CGBFDP023	TR.NominationCommNonExecMembers
3	Audit Committee Expertise	Does the company have an audit committee with at least three members and at least one “financial expert”.	CGBFO03V	TR.AnalyticAuditCommExpertise
4	Board Structure Policy	Does the company have a policy for maintaining a well-balanced membership of the board?	CGBSD01V	TR.AnalyticBoardStructurePolicy
5	Independent Board Members	Percentage of independent board members as reported by the company.	CGBSO07V	TR.AnalyticIndepBoard
6	Board Gender Diversity, Percent	Percentage of women on the board of directors.	CGBSO03V	TR.AnalyticBoardFemale
7	Executive Compensation Policy	Does the company have a policy for performance-oriented compensation that attracts and retains the senior executives and board members?	CGCPD01V	TR.AnalyticExecCompPolicy
8	Shareholder Approval Stock Compensation Plan	Does the company require that shareholder approval is obtained prior to the adoption of any stock-based compensation plans?	CGCPDP056	TR.ShareholderApprovalStockCompPlan
9	Shareholder Rights Policy	Does the company have a policy for ensuring equal treatment of minority shareholders, facilitating shareholder engagement, or limiting the use of anti-takeover devices?	CGSRD01V	TR.AnalyticShareholderRightsPolicy
10	CSR Sustainability Committee	Does the company have a CSR committee or team?	CGVSDP005	TR.SustainabilityCommScore
11	Policy Emissions	Does the company have a policy to reduce emissions?	ENERDP0051	TR.PolicyEmissions
12	Water Technologies Policy Water	Does the company develop products or technologies that are used for water treatment, purification, or that improve water-use efficiency?	ENPIDP067	TR.WaterTechnologies
13	Efficiency	Does the company have a policy to improve its water efficiency?	ENRRDP0121	TR.PolicyWaterEfficiency
14	Policy Energy Efficiency	Does the company have a policy to improve its energy efficiency?	ENRRDP0122	TR.PolicyEnergyEfficiency

15	Renewable Energy Use	Does the company make use of renewable energy?	ENRRDP046	TR.AnalyticRenewEnergyUse
16	Environmental Supply Chain Management	Does the company use environmental criteria (ISO 14000, energy consumption, etc.) in the selection process of its suppliers or sourcing partners?	ENRRDP058	TR.EnvSupplyChainMgt
17	Policy Diversity and Opportunity	Does the company have a work–life balance policy? AND Does the company have a diversity and equal opportunity policy?	SODODP0081	TR.PolicyDiversityOpportunity
18	Policy Career Development	Does the company have a competitive employee benefits policy or ensure good employee relations within its supply chain? AND Does the company have a policy for maintaining long-term employment growth and stability?	SOTDDP0092	TR.PolicyCareerDevelopment
19	Human Rights Policy	Does the company have a policy to guarantee the freedom of association universally applied independent of local laws? AND Does the company have a policy for the exclusion of child, forced, or compulsory labor?	SOHRD01V	TR.AnalyticHumanRightsPolicyScore
20	Health & Safety Policy	Does the company have a policy to improve employee health & safety within the company and its supply chain?	SOHSD01V	TR.AnalyticHealthSafetyPolicy
21	Training and Development Policy	Does the company have a policy to support the skills training or career development of its employees?	SOTDD01V	TR.AnalyticTrainingDevPolicy

Symbolic ESG

1	Integrated Strategy MD&A	Is the company openly reporting about the challenges or opportunities of integrating financial and extra-financial issues, and the dilemmas and trade-offs it faces?	CGVSDP018	TR.IntegratedStrategyMD&A
2	GRI Report Guidelines	Is the company's CSR report published in accordance with the GRI guidelines?	CGVSDP028	TR.CSRReportingGRI
3	CSR Sustainability Report Global Activities	Does the company's extra-financial report take into account the global activities of the company?	CGVSDP029	TR.CSRReportingGlobalActivities
4	CSR Sustainability External Audit	Does the company have an external auditor of its CSR/H&S/Sustainability report?	CGVSDP030	TR.CSRReportingExternalAudit
5	Particulate Matter Emissions Reduction	Does the company report on initiatives to recycle, reduce, reuse, or substitute ozone-depleting (CFC-11 equivalents, chlorofluorocarbon) substances?	ENERDP037	TR.PMReduction
6	VOC Emissions Reduction	Does the company report on initiatives to reduce, substitute, or phase out volatile organic compounds (VOC)?	ENERDP036	TR.VOCEmissionsReduction
7	Staff Transportation Impact Reduction	Does the company report on initiatives to reduce the environmental impact of transportation of its products or its staff?	ENERDP081	TR.StaffTransportationReduction
8	Biodiversity Impact Reduction	Does the company show an initiative to reduce, reuse, recycle, substitute, phase out, or compensate CO2 equivalents in the production process?	ENERDP019	TR.BiodiversityImpactReduction

9	NOx and SOx Emissions Reduction	Does the company report on initiatives to reduce, reuse, recycle, substitute, or phase out SOx (sulphur oxides) or NOx (nitrogen oxides) emissions?	ENERDP033	TR.NOxSOxEmissionsReduction
10	Waste Reduction Initiatives	Does the company report on initiatives to recycle, reduce, reuse, substitute, treat, or phase out total waste?	ENERDP062	TR.WasteReductionInitiatives
11	Green Buildings	Does the company report about environmentally friendly or green sites or offices?	ENRRDP052	TR.GreenBuildings
12	Toxic Chemicals Reduction	Does the company report on initiatives to reduce, reuse, substitute, or phase out toxic chemicals or substances?	ENRRDP031	TR.ToxicChemicalsReduction
13	Policy Business Ethics	Does the company have a policy to strive to be a good corporate citizen or endorse the Global Sullivan Principles? AND Does the company have a policy to respect business ethics or has the company signed the UN Global Compact or does it follow the OECD guidelines?	SOCODP0069	TR.PolicyBusinessEthics
14	Crisis Management Systems	Does the company report on crisis management systems or reputation disaster recovery plans to reduce or minimize the effects of reputation disasters?	SOCODP053	TR.CrisisMgtSystems
15	Flexible Working Hours	Does the company claim to provide flexible working hours or working hours that promote a work-life balance?	SODODP026	TR.FlexibleWorkingHours
16	Day Care Services	Does the company claim to provide daycare services for its employees?	SODODP027	TR.DayCareServices
17	Human Rights Contractor	Does the company report or show to use human rights criteria in the selection or monitoring process of its suppliers or sourcing partners?	SOHRDP026	TR.HumanRightsContractor
18	Human Rights Breaches Contractor	Does the company report or show to be ready to end a partnership with a sourcing partner if human rights criteria are not met?	SOHRDP029	TR.HumanRightsContractorBreaches
19	HIV-AIDS Program	Does the company report on policies or programs on HIV/AIDS for the workplace or beyond?	SOHSDP039	TR.HIVAIDSProgram
20	Healthy Food or Products	Does the company reportedly develop or market products and services that foster specific health and safety benefits for the consumers (healthy, organic or nutritional food, safe cars, etc.)?	SOPRDP029	TR.HealthyProducts
21	Internal Promotion	Does the company claim to favor promotion from within?	SOTDDP023	TR.InternalPromotion
22	Management Training	Does the company claim to provide regular staff and business management training for its managers?	SOTDDP024	TR.MgtTraining

Notes: This table reports the base indicators used in computing symbolic and substantial ESG and their definitions. It also shows the Datastream/Eikon and Refinitiv workspace identifiers for the respective variables.

Table OA3
Country-Level Mandatory ESG Disclosure and Sampling Distribution

Country	No. of Firm-Years	% Total	No. of Firms	Mandate Year	Issued By Government	Mandatory Full Compliance	Average SYMB-ESG	Average SUB-ESG	Average Greenwashing
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
<i>Treatment Group</i>									
Austria	206	0.55	19	2016	0	1	0.621	0.744	-0.123
Belgium	278	0.74	28	2019	1	1	0.534	0.689	-0.155
Chile	281	0.75	28	2015	1	0	0.451	0.405	0.043
China	1,801	4.79	256	2008	0	1	0.366	0.472	-0.107
Denmark	272	0.72	23	2016	1	0	0.520	0.673	-0.155
Finland	342	0.91	26	2016	1	0	0.685	0.747	-0.065
Germany	930	2.47	97	2016	1	0	0.691	0.663	0.020
Greece	88	0.23	7	2006	1	1	0.574	0.627	-0.057
Hong Kong	1,010	2.69	87	2015	0	1	0.387	0.609	-0.222
Hungary	43	0.11	4	2016	1	0	0.689	0.768	-0.079
India	830	2.21	84	2015	1	1	0.635	0.757	-0.120
Indonesia	337	0.90	34	2012	1	1	0.568	0.601	-0.033
Ireland	334	0.89	27	2016	1	0	0.516	0.701	-0.184
Italy	399	1.06	46	2016	1	0	0.675	0.731	-0.055
Netherlands	407	1.08	34	2016	1	0	0.688	0.733	-0.048
Norway	282	0.75	30	2013	1	1	0.566	0.644	-0.081
Peru	122	0.32	21	2015	1	1	0.380	0.437	-0.056
Philippines	174	0.46	16	2011	1	1	0.433	0.553	-0.121
Poland	181	0.48	24	2016	1	1	0.468	0.561	-0.093
Portugal	129	0.34	13	2010	1	1	0.644	0.723	-0.080
Singapore	387	1.03	29	2016	0	0	0.410	0.697	-0.283
South Africa	789	2.1	75	2010	0	0	0.683	0.829	-0.145
Spain	485	1.29	43	2012	1	0	0.687	0.751	-0.063
Sweden	531	1.41	54	2016	1	0	0.594	0.701	-0.110
Taiwan	1,323	3.52	120	2019	0	1	0.534	0.536	-0.002

Turkey	223	0.59	29	2014	1	1	0.611	0.697	−0.087
United Kingdom	2,731	7.26	206	2013	1	1	0.601	0.761	−0.159
Total	14,915	39.65	1,460						
<i>Control Group</i>									
Brazil	622	1.65	60				0.584	0.629	−0.046
Colombia	82	0.22	10				0.589	0.628	−0.039
Egypt	36	0.1	4				0.125	0.168	−0.043
Israel	145	0.39	15				0.328	0.499	−0.171
Japan	5,357	14.25	355				0.461	0.390	0.065
South Korea	1,071	2.85	106				0.494	0.451	0.041
Mexico	238	0.63	30				0.478	0.564	−0.087
New Zealand	284	0.76	34				0.421	0.660	−0.239
Qatar	52	0.14	7				0.198	0.271	−0.072
Russia	230	0.61	25				0.468	0.564	−0.097
Saudi Arabia	118	0.31	17				0.312	0.403	−0.092
Switzerland	838	2.23	78				0.547	0.649	−0.100
Thailand	251	0.67	27				0.613	0.719	−0.106
United States of America	13,363	35.54	1,414				0.391	0.628	−0.235
Total	22,687	60.35	2,182						
Sample Total	37,602	100.00	3,642						

Notes: The table shows firm sampling distribution at the country level (columns 2–4), year of mandatory adoption of ESG disclosures (column 5), mandate features: (i) issued by a government (1) or non-government institution (0), (ii) mandates full-compliance (1) or explanation in case of non-compliance (0) (columns 6-7), and country-level average *SYMB-ESG*, *SUB-ESG*, and *Greenwashing* (columns 8-10). The sample contains 27 countries that introduced all three ESG mandates between 2008 and 2020 and 14 non-treatment countries (column 1).

Table OA4
Summary Statistics

Variables	N	Mean	Median	p25	p75	Min	Max	SD
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
<i>Greenwashing</i>	37,602	-0.123	-0.121	-0.295	0.031	-0.676	0.483	0.236
<i>SYMB-ESG</i>	37,602	0.478	0.493	0.218	0.712	0.000	1.000	0.296
<i>SUB-ESG</i>	37,602	0.600	0.638	0.453	0.789	0.000	1.000	0.256
<i>MD</i>	37,602	0.222	0.000	0.000	0.000	0.000	1.000	0.416
<i>GOV-I</i>	37,602	0.072	0.000	0.000	0.000	0.000	1.000	0.258
<i>NON-GOV-I</i>	37,602	0.164	0.000	0.000	0.000	0.000	1.000	0.370
<i>FC</i>	37,602	0.126	0.000	0.000	0.000	0.000	1.000	0.332
<i>C/E</i>	37,602	0.092	0.000	0.000	0.000	0.000	1.000	0.289
<i>SIZE</i>	37,602	15.326	15.338	14.359	16.361	10.489	18.923	1.557
<i>MTB</i>	37,602	3.184	2.060	1.200	3.670	-9.920	32.080	4.508
<i>LEV</i>	37,602	0.253	0.177	0.026	0.439	0.000	0.882	0.244
<i>PROFIT</i>	37,602	0.055	0.056	0.027	0.096	-0.701	0.348	0.108
<i>CASH</i>	37,602	0.157	0.111	0.051	0.206	0.003	0.917	0.156
<i>VOL</i>	37,602	28.002	26.530	21.260	33.140	12.500	60.540	9.356
<i>DIV</i>	37,602	0.746	1.000	0.000	1.000	0.000	1.000	0.435
<i>CAPEX</i>	37,602	0.051	0.038	0.020	0.067	0.000	0.279	0.046
<i>RDI</i>	37,602	0.024	0.001	0.000	0.024	0.000	0.435	0.055

Notes: This table reports descriptive statistics for the variables employed in the multivariate analysis. The reported statistics include the number of firm-year observations, mean, minimum, 25th, 50th (Median), 75th percentiles, maximum, and standard deviation values. All variables are defined in Appendix A.

Table OA5
Correlation Matrix

Variables		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
<i>Greenwashing</i>	(1)	1								
<i>SYMB-ESG</i>	(2)	0.570	1							
<i>SUB-ESG</i>	(3)	-0.291	0.615	1						
<i>MD</i>	(4)	0.084	0.254	0.218	1					
<i>GOV-I</i>	(5)	0.028	0.101	0.092	0.520	1				
<i>NON-GOV-I</i>	(6)	0.093	0.208	0.156	0.829	0.087	1			
<i>FC</i>	(7)	0.075	0.165	0.123	0.712	0.270	0.712	1		
<i>C/E</i>	(8)	0.036	0.173	0.167	0.595	0.442	0.343	-0.121	1	
<i>SIZE</i>	(9)	0.343	0.380	0.120	-0.067	-0.028	-0.032	-0.038	-0.056	1
<i>MTB</i>	(10)	-0.074	-0.004	0.064	0.004	-0.033	0.032	0.015	-0.015	-0.151
<i>LEV</i>	(11)	0.118	-0.029	-0.144	0.242	0.166	0.204	0.194	0.136	-0.018
<i>PROFIT</i>	(12)	0.063	0.113	0.075	0.032	0.021	0.026	0.031	0.010	0.142
<i>CASH</i>	(13)	-0.100	-0.169	-0.102	-0.042	0.040	-0.049	-0.017	-0.040	-0.336
<i>VOL</i>	(14)	-0.173	-0.261	-0.141	-0.062	-0.003	-0.047	-0.021	-0.059	-0.373
<i>DIV</i>	(15)	0.207	0.163	-0.005	-0.025	0.004	-0.015	0.019	-0.055	0.286
<i>CAPEX</i>	(16)	0.023	0.045	0.031	-0.030	-0.005	-0.034	0.005	-0.044	0.079
<i>RDI</i>	(17)	-0.118	-0.102	-0.009	-0.104	-0.061	-0.081	-0.082	-0.058	-0.278
Variables		(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	
<i>MTB</i>	(10)	1								
<i>LEV</i>	(11)	-0.052	1							
<i>PROFIT</i>	(12)	0.128	0.064	1						
<i>CASH</i>	(13)	0.184	0.004	-0.179	1					
<i>VOL</i>	(14)	0.008	0.091	-0.311	0.332	1				
<i>DIV</i>	(15)	-0.049	0.069	0.275	-0.209	-0.399	1			
<i>CAPEX</i>	(16)	0.015	0.108	0.140	-0.178	0.019	0.068	1		
<i>RDI</i>	(17)	0.181	-0.162	-0.417	0.518	0.284	-0.263	-0.129	1	

Notes: This table reports the Pearson correlation values for the variables employed in multivariate estimation. All variables are defined in Appendix A.

Table OA6
Univariate Regressions

Variables	<i>SYMB-ESG</i>	<i>SUB-ESG</i>	<i>Greenwashing</i>
(1)	(2)	(3)	(4)
<i>MD</i>	0.181*** (0.004)	0.134*** (0.003)	0.048*** (0.003)
<i>SIZE</i>	0.072*** (0.001)	0.020*** (0.001)	0.052*** (0.001)
<i>MTB</i>	−0.000 (0.000)	0.004*** (0.000)	−0.004*** (0.000)
<i>LEV</i>	−0.035*** (0.006)	−0.151*** (0.005)	0.114*** (0.005)
<i>PROFIT</i>	0.309*** (0.014)	0.176*** (0.012)	0.136*** (0.011)
<i>CASH</i>	−0.321*** (0.010)	−0.167*** (0.008)	−0.152*** (0.008)
<i>VOL</i>	−0.008*** (0.000)	−0.004*** (0.000)	−0.004*** (0.000)
<i>DIV</i>	0.111*** (0.003)	−0.003 (0.003)	0.112*** (0.003)
<i>CAPEX</i>	0.291*** (0.033)	0.173*** (0.029)	0.116*** (0.027)
<i>RDI</i>	−0.550*** (0.028)	−0.044* (0.024)	−0.509*** (0.022)

Notes: This table reports univariate regression estimates. All regressors are taken at a one-year lag. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels (two-tailed), respectively. Standard errors are reported in brackets. All variables are defined in Appendix A.

Table OA7
Summary Statistics – Entropy Balancing

Variables	Treatment Group			Control Group		
	Mean	Variance	Skewness	Mean	Variance	Skewness
(1)	(2)	(3)	(4)	(5)	(6)	(7)
<i>Before Entropy Matching</i>						
<i>SIZE</i>	15.130	2.248	0.041	15.380	2.459	−0.239
<i>MTB</i>	3.219	17.910	3.563	3.174	21.010	3.270
<i>LEV</i>	0.364	0.069	0.048	0.222	0.053	0.970
<i>PROFIT</i>	0.061	0.008	−1.522	0.053	0.013	−2.872
<i>CASH</i>	0.145	0.017	2.260	0.161	0.026	1.972
<i>VOL</i>	26.920	74.190	0.884	28.310	90.910	0.862
<i>DIV</i>	0.726	0.199	−1.015	0.752	0.187	−1.167
<i>CAPEX</i>	0.048	0.002	1.950	0.051	0.002	2.118
<i>RDI</i>	0.013	0.001	5.311	0.027	0.003	4.193
<i>After Entropy Matching</i>						
<i>SIZE</i>	15.130	2.248	0.041	15.130	2.249	0.041
<i>MTB</i>	3.219	17.910	3.563	3.219	17.910	3.562
<i>LEV</i>	0.364	0.069	0.048	0.364	0.069	0.048
<i>PROFIT</i>	0.061	0.008	−1.522	0.061	0.008	−1.534
<i>CASH</i>	0.145	0.017	2.260	0.145	0.017	2.262
<i>VOL</i>	26.920	74.190	0.884	26.920	74.220	0.885
<i>DIV</i>	0.726	0.199	−1.015	0.726	0.199	−1.015
<i>CAPEX</i>	0.048	0.002	1.950	0.048	0.002	1.950
<i>RDI</i>	0.013	0.001	5.311	0.013	0.001	5.339

Notes: This table reports the summary statistics of the 1st-order (mean), 2nd-order (variance), and 3rd-order (skewness) moments before and after entropy-balanced matching. All variables are defined in Appendix A.

Table OA8
Regression Models with Confounding Factors

<i>Panel A: Confounding Factors</i>				
Variables	<i>Greenwashing</i>			
(1)	(2)	(3)	(4)	(5)
MD	0.020***	0.019***	0.020***	0.021***
	(0.007)	(0.007)	(0.007)	(0.007)
<i>IFRS</i>	−0.030*			−0.028*
	(0.016)			(0.016)
<i>BDR</i>		−0.021		−0.023
		(0.039)		(0.039)
<i>VOID</i>			0.016*	0.015*
			(0.009)	(0.009)
<i>GDPG</i>			−0.000	−0.000
			(0.001)	(0.001)
<i>Constant</i>	−0.523***	−0.522***	−0.499***	−0.465***
	(0.088)	(0.098)	(0.092)	(0.102)
<i>Observations</i>	37,602	37,602	37,602	37,602
<i>Adj. R2</i>	0.638	0.637	0.637	0.638
<i>Controls</i>	Yes	Yes	Yes	Yes
<i>Year FE</i>	Yes	Yes	Yes	Yes
<i>Firm FE</i>	Yes	Yes	Yes	Yes
<i>Panel B: Falsification Test</i>				
Variables	<i>Greenwashing</i>			
(1)	(2)	(3)	(4)	
<i>Year</i> ≤ −5	0.014	0.014	−0.011	
	(0.011)	(0.044)	(0.021)	
<i>Year</i> −4	−0.010	0.037	−0.021	
	(0.010)	(0.033)	(0.017)	
<i>Year</i> −3	−0.004	0.033	−0.011	
	(0.009)	(0.026)	(0.013)	
<i>Year</i> −2	−0.013*	0.003	−0.012	
	(0.007)	(0.020)	(0.009)	
<i>Year</i> 0	0.001	−0.025	0.006	
	(0.006)	(0.018)	(0.008)	
<i>Year</i> +1	0.008	−0.054**	0.023**	
	(0.007)	(0.021)	(0.011)	
<i>Year</i> +2	0.018**	−0.083***	0.037***	
	(0.008)	(0.026)	(0.014)	
<i>Year</i> +3	0.028***	−0.085***	0.043***	
	(0.008)	(0.030)	(0.016)	
<i>Year</i> +4	0.027***	−0.100***	0.047**	
	(0.009)	(0.037)	(0.021)	
<i>Year</i> ≥ +5	0.030***	−0.144***	0.051*	
	(0.010)	(0.051)	(0.027)	
<i>Constant</i>	−0.553***	−0.056	−0.651***	
	(0.088)	(0.298)	(0.165)	
<i>Observations</i>	37,602	2,498	9,349	
<i>Adj. R2</i>	0.638	0.307	0.485	
<i>Controls</i>	Yes	Yes	Yes	
<i>Year FE</i>	Yes	Yes	Yes	
<i>Firm FE</i>	Yes	Yes	Yes	

Notes: This table reports multivariate entropy-balanced regression estimates with the dependent variable *Greenwashing*. The main independent variable is *MD* (*dummy*). Panel A reports the baseline estimations while including (i) *IFRS* (Column 2), (ii) *BDR* (Column 3), and (iii) *VOID* and *GDPG* as additional control variables (Column 4). Panel B shows the event time effects of ESG disclosure mandates for (i) the full sample (Column 2), (ii) pre-mandate greenwashers (Column 3), and (iii) Pre-mandate non-greenwashers (Column 4); the estimates

are obtained by regressing time dummies with five years of pre- and post-ESG disclosure mandates. The control group refers to not-yet-treated firm-year observations. Firm and year-fixed effects are applied across all estimations. All regressors are taken at a one-year lag except the time dummies reflecting pre- and post-mandate periods. Robust standard errors are shown in parentheses, clustered at the firm level to adjust for heteroskedasticity. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels (two-tailed), respectively. All variables are defined in Appendix A.

Table OA9

Two-Way Fixed Effect Difference-in-Differences (DiD) Regression Models

<i>Panel A: TWFE – DiD (ATT)</i>		
Variables	<i>Greenwashing</i>	<i>GW-D</i>
(1)	(2)	(2)
<i>EU</i>	0.021* (0.012)	0.097 (0.115)
<i>POST</i>	0.065** (0.030)	0.636*** (0.228)
<i>EU × POST</i>	0.021* (0.012)	0.291** (0.126)
<i>Constant</i>	−0.998*** (0.063)	−8.672*** (0.649)
Observations	27,312	27,312
Adj. / Pseudo R2	0.170	0.094
Year FE	Yes	Yes
Industry FE	Yes	Yes
<i>Panel B: Staggered DiD (ATT) (Callaway and Sant’Anna, 2021)</i>		
Variables	<i>Greenwashing</i>	<i>GW-D</i>
(1)	(2)	(3)
<i>MD</i>	0.016** (0.008)	0.037** (0.019)
<i>Controls</i>	Yes	Yes
<i>Year FE</i>	Yes	Yes
<i>Firm FE</i>	Yes	Yes

Notes: This table reports the two-way fixed effects entropy balanced DiD regression estimates with industry and year-fixed effects in Panel A, and Callaway and Sant’Anna (2021) staggered DiD estimates with firm and year-fixed effects in Panel B. The dependent variables are *Greenwashing* (OLS) and *GW-D* (Logit). The main independent variable is *MD* (*dummy*). All regressors are taken at a one-year lag. Robust standard errors are shown in parentheses, clustered at the firm level to adjust for heteroskedasticity. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels (two-tailed), respectively. All variables are defined in Appendix A.

Table OA10
Regression Models Excluding Dominant Countries

Panel A: Full Sample

Variables	Excluding United Kingdom	Excluding China	Excluding United States	Excluding All Three
Greenwashing				
(1)	(2)	(3)	(4)	(5)
MD	0.020*** (0.007)	0.021*** (0.008)	0.031*** (0.007)	0.031*** (0.009)
Constant	−0.500*** (0.100)	−0.511*** (0.092)	−0.599*** (0.107)	−0.512*** (0.122)
Observations	34,871	35,801	24,239	19,707
Adj. R2	0.645	0.640	0.608	0.626
Controls	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes

Panel B: Pre-Mandate Greenwashers and Non-Greenwashers

Variables	Pre-Mandate Greenwashers			Pre-Mandate Non-Greenwashers		
	Excluding United Kingdom	Excluding China	Excluding Both	Excluding United Kingdom	Excluding China	Excluding Both
Greenwashing						
(1)	(2)	(3)	(4)	(5)	(6)	(7)
MD	−0.044** (0.017)	−0.032* (0.018)	−0.026 (0.019)	0.018* (0.010)	0.038*** (0.011)	0.025** (0.012)
Constant	−0.198 (0.297)	−0.110 (0.318)	−0.223 (0.321)	−0.639*** (0.181)	−0.612*** (0.175)	−0.587*** (0.198)
Observations	2,196	2,220	1,918	7,239	7,954	5,844
Adj. R2	0.287	0.297	0.277	0.509	0.480	0.505
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes

Notes: This table reports multivariate entropy-balanced regression estimates with and without dominant countries, with the dependent variable, *Greenwashing*. The main independent variable is *MD* (*dummy*). Panel A reports estimations excluding (i) the United Kingdom (Column 2), (ii) China (Column 3), (iii) the United States of America (Column 4), and (iv) all three (Column 5). Panel B repeats the analysis for a restricted sample of pre-mandate greenwashers and pre-mandate non-greenwashers; the analysis is limited to treatment countries only. Firm and year-fixed effects are applied across all estimations. All regressors are taken at a one-year lag. Robust standard errors are shown in parentheses, clustered at the firm level to adjust for heteroskedasticity. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels (two-tailed), respectively. All variables are defined in Appendix A.

Table OA11
Regression Models Using Alternate Measures of Greenwashing

Variables	<i>GW-C-RP</i>	<i>GW-C-RO</i>	<i>GW-C-PO</i>
(1)	(2)	(3)	(4)
<i>MD</i>	0.355*** (0.083)	0.712*** (0.091)	0.357*** (0.065)
<i>Constant</i>	-1.978* (1.097)	-5.887*** (1.362)	-3.909*** (0.986)
<i>Observations</i>	33,787	33,787	33,787
<i>Adj. R2</i>	0.609	0.723	0.674
<i>Controls</i>	Yes	Yes	Yes
<i>Year FE</i>	Yes	Yes	Yes
<i>Firm FE</i>	Yes	Yes	Yes

Notes: This table reports multivariate entropy-balanced regression estimates with the alternate dependent variables *GW-C-RP*, *GW-C-RO* and *GW-C-PO*. The main independent variable is *MD* (*dummy*). Firm and year-fixed effects are applied across all estimations. All regressors are taken at a one-year lag. Robust standard errors are shown in parentheses, clustered at the firm level to adjust for heteroskedasticity. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels (two-tailed), respectively. All variables are defined in Appendix A.

Table OA12
Logit Regressions Estimates

Variables	<i>GW-D</i>	<i>AME %</i>	<i>GW-D</i>	<i>AME %</i>	<i>GW-D</i>	<i>AME %</i>	<i>GW-D</i>	<i>AME %</i>	<i>GW-D</i>	<i>AME %</i>
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(10)
<i>MD</i>	0.193** (0.086)	3.200					-0.883*** (0.233)	-15.900	0.375** (0.148)	5.000
<i>GOV-I</i>			0.393*** (0.134)	6.600						
<i>NON-GOV-I</i>			-0.019 (0.102)	-0.300						
<i>FC</i>					0.379*** (0.096)	6.400				
<i>C/E</i>					-0.090 (0.150)	-1.500				
<i>Constant</i>	-8.179*** (0.607)		-8.374*** (0.611)		-8.309*** (0.610)		-3.230** (1.380)		-5.502*** (0.906)	
<i>Observations</i>	37,602		37,602		37,602		2,498		9,349	
<i>Pseudo R2</i>	0.171		0.172		0.172		0.098		0.163	
<i>Controls</i>	Yes		Yes		Yes		Yes		Yes	
<i>Year FE</i>	Yes		Yes		Yes		Yes		Yes	
<i>Industry FE</i>	Yes		Yes		Yes		Yes		Yes	
<i>Country FE</i>	Yes		Yes		Yes		Yes		Yes	

Notes: This table reports entropy-balanced logit regression estimates and average marginal effects (AME) with *GW-D* as the dependent variable. The main independent variable is *MD* (*dummy*). Industry, year, and country fixed effects are applied across all estimations. All regressors are taken at a one-year lag. Robust standard errors are shown in parentheses, clustered at the firm level to adjust for heteroskedasticity. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels (two-tailed), respectively. All variables are defined in Appendix A.