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Does Women's Participation Mitigate Greenhushing?

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ABSTRACT

For fear of being labeled "greenwashing," many companies choose the opposite "greenhushing"-they no longer publicly discuss their sustainability actions and goals. But silence does not lead to progress, so what can be done to avoid greenhushing? Using an interactive fixed effects model for 29 OECD countries from 2002 to 2022, we find that women's board participation exerts a pro-environmental orientation in corporate decision making, which is associated with lower levels of greenhushing in ESG disclosure. This relationship is more pronounced in countries that place greater emphasis on women's rights in politics, business, and civil liberties. More importantly, in the face of geopolitical tensions and energy risks, we find that countries overly dependent on oil imports and exports tend to exhibit weaker business environments in relation to ESG disclosure. Accelerating the energy transition, including renewable energy innovation and consumption, is associated with a weaker tendency toward greenhushing. This study highlights the importance of women's participation in corporate governance for shaping ESG disclosure practices.

JEL Classification: D22, M14, Q56

1 | Introduction

In recent years, as global environmental awareness has continued to grow, corporate environmental, social, and governance (ESG) performance has become a focal point for the public, investors, and regulators (Aabo and Giorici 2023; Abdelbaky et al. 2024; Benameur et al. 2024; Long et al. 2023; Zheng et al. 2023). This increased attention should, in theory, drive companies to improve the transparency and integrity of their environmental performance, but the reality is complex and ever-changing. In order to stand out in the capital market, some companies engage in "greenwashing," exaggerating or falsifying their sustainability efforts when disclosing environmental performance. This strategy may attract investment in the short term, but as regulatory measures improve and public environmental awareness increases, companies whose stated environmental performance does not match actual performance will soon be labeled as greenwashing. This will have a severe impact on the company's reputation and future development prospects (de Freitas Netto et al. 2020; Yu et al. 2020). Therefore, due to the fear of being labeled as greenwashing, many companies are moving toward the opposite of greenwashing by adopting a "greenhushing" strategy, choosing not to publicly discuss or report their sustainability actions and goals (Cheng et al. 2024; Ettinger et al. 2021; Font et al. 2017). In 2023, a survey conducted by South Pole, a Swiss carbon finance consultancy, found that out of more than 1400 companies in 12 countries, 70% of respondents admitted to practicing "greenhushing" and 58% had reduced their external communication on climate issues.[1] This phenomenon reveals a worrying trend: under intense external scrutiny and strict regulation, companies are becoming extremely cautious about claiming their environmental achievements, as any discrepancies or exaggerations can lead to reputational risks and market penalties.

Beyond its conceptual distinction from greenwashing, an important concern is the institutional consequences posed by

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greenhushing. Although greenhushing is not as directly deceptive as greenwashing, it poses a systemic threat to corporate transparency, stakeholder trust, and global sustainability goals by intentionally avoiding or downplaying environmental disclosures (Zheng et al. 2023; Lin et al. 2016). In the context of global sustainable development, regulators, investors, and the public widely expect companies to be open and transparent about their environmental, social, and governance (ESG) practices (He et al. 2025; Hassanein and Elmaghrabi 2025). When companies engage in greenhushing due to concerns about regulatory pressure and reputational risk, stakeholders often view this behavior as dishonest or an attempt to evade responsibility. This significantly undermines corporate transparency and reputation, eroding stakeholders' trust in the company (Cormier et al. 2011; Johnson et al. 2014; Wasim 2019). Recent high-profile cases clearly illustrate this trend. For example, the Volkswagen "Dieselgate" scandal was essentially a case of greenwashing. However, the intense regulatory and public scrutiny that followed prompted some companies to adopt a more cautious—even silent—approach to ESG disclosure. They attempted to avoid similar crises by saying less. Recently, shareholders of major U.S. oil companies ExxonMobil and Chevron voted against climate action proposals.[2] In addition, the European Commission's proposal to relax corporate sustainability disclosure requirements has raised serious concerns among investors and legal experts about a potential rollback in transparency.[3] They argue that such a move hampers investors' access to critical environmental data and may increase companies' exposure to litigation risks related to climate issues. Additionally, BlackRock's CEO declared that the term "ESG" has been placed on a "blacklist." Although he emphasized that this does not undermine the company's commitment to sustainability, this shift reflects a retreat from green rhetoric and has led to criticism from investors and the media regarding the firm's brand image. These cases illustrate that greenhushing, though seemingly cautious, undermines the essential principles of corporate transparency and accountability. It weakens stakeholders' confidence in a company's sustainability commitments and impairs the institutional foundations for effective ESG governance. Furthermore, when greenhushing becomes widespread in the corporate sector, it deprives society of accurate and comprehensive environmental information. This undermines public trust in corporate climate commitments and hampers the coordinated efforts of governments, markets, and civil society in climate governance and sustainable development. The authenticity and transparency of corporate environmental information are essential for public trust and effective policymaking. Only through adequate disclosure can all stakeholders collaborate to advance global carbon reduction goals and the green transition. Therefore, achieving the United Nations Sustainable Development Goals requires exploring effective strategies to mitigate corporate greenhushing to enhance the quality, transparency, and credibility of environmental disclosures.

Numerous studies have highlighted the positive impact of women's participation on ESG and environmental performance disclosure (Zheng et al. 2024; Tahat and Hassanein 2024). Consistently, these studies conclude that gender-diverse boards exhibit higher ethical sensitivity, greater risk aversion, and stronger willingness to disclose information. This promotes more responsible and transparent corporate communication (Birindelli et al. 2019; Shakil et al. 2021). Existing research has found that female directors are more likely to support the adoption of responsible environmental strategies and promote the comprehensive and transparent disclosure of environmental information. This effect is driven by women's generally stronger sense of environmental responsibility and ethical awareness (Alkhawaja et al. 2023; Eliwa et al. 2023). At the same time, diverse boards encompass a wider range of perspectives and values. This multi-perspective decision-making structure helps avoid biases or narrow judgments arising from a single dominant viewpoint. Consequently, the tendency to withhold information due to concerns about regulatory scrutiny or reputational risks may decrease (Caby et al. 2024; Endo 2025; Lu and Herremans 2019; Rao and Tilt 2016). Therefore, we argue that gender diversity on corporate boards enhances overall corporate transparency and accountability and plays a critical role in mitigating greenhushing in ESG disclosures. To preliminarily test this hypothesis, we plotted Figure 1 using 2022 data on women's participation on boards and the greenhushing index across sampled countries to examine their potential association. Overall, countries with higher levels of women's participation on corporate boards tend to have lower greenhushing index scores, which provides preliminary support for our hypothesis. It is worth noting that the bubble sizes in Figure 1 represent the extent of legal opportunities for women to participate in business. Countries with larger bubbles tend to have higher proportions of female board members and lower levels of greenhushing. This suggests that institutional mechanisms promoting gender equality could strengthen the positive effect of gender diversity on transparent disclosure practices.

In the current complex international situation, external energy risks and challenges constitute a critical background that cannot be ignored for corporate sustainable development. Existing research has summarized how energy market instability exacerbates the conservatism of corporate strategies, particularly in environmental disclosure (Karagiannopoulou et al. 2023). For companies that rely heavily on oil, energy price fluctuations or supply disruptions may force them to reduce environmental disclosure to avoid potential negative market reactions (Adekoya et al. 2022). Conversely, transitioning to renewable energy not only helps mitigate these risks, but also enhances market competitiveness by improving the company's environmental responsibility record (Xia et al. 2024). Johnson et al. (2019) and Allen et al. (2019) highlighted the critical role of women's leadership in accelerating the energy transition and advancing energy justice. Therefore, increasing the representation of women on boards not only promotes the inclusiveness of environmental strategies, but also ensures that companies implement energy transition strategies more equitably and effectively. Integrating women's perspectives and skills into corporate energy and environmental decision-making processes is key to addressing global energy instability and promoting sustainable corporate governance. Based on this recognition, our study examines how energy transitions strengthen the role of women in corporate governance structures, particularly in terms of advancing environmental accountability and sustainability strategies.

Based on the above motivations, this paper empirically examines the linkage between women's board participation and greenhushing, and the role of energy transition as a contextual moderator. We use data from 29 OECD countries from

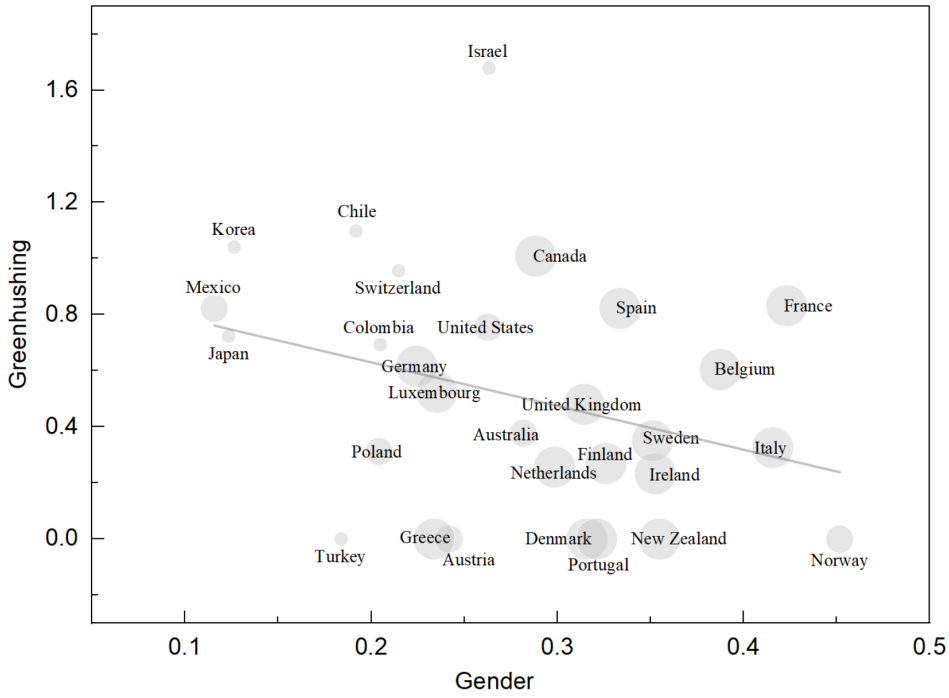

FIGURE 1 | Women's participation on boards versus greenhushing scores, by sample country in 2022. Notes: The size of the bubble indicates the women business and the law index score. The larger the bubble, the more opportunities for women to participate in business as allowed by national law.

2002 to 2022 to construct panel interactive fixed effects and moderated effects models. We find that higher levels of women's board participation are associated with lower incentives for companies to engage in greenhushing behavior in ESG disclosure—a 10-percentage-point increase in women's participation is linked to about a 5.26% decline in the greenhushing index. More importantly, given the current complex geopolitical situation and energy risks, we further explore the external impact of energy challenges. The results show that in countries that are overly dependent on oil imports and exports, this heavy reliance on fossil energy weakens the positive impact of women's board participation on environmental disclosure. Accelerating the energy transition, including renewable energy innovation and consumption, is associated with a lower tendency toward greenhushing. This relationship is more pronounced in countries that place greater emphasis on gender equality in terms of political empowerment, business opportunities, and civil liberties.

Greenhushing is prevalent and challenges corporate information transparency mechanisms. It also poses an obstacle to global climate governance and sustainable development. This study examines the association between board gender diversity and greenhushing behavior and offers important practical implications. As global ESG regulatory frameworks continue to evolve, firms must strike a dynamic balance between compliance disclosure and reputation management, a key concern at the executive level. The findings suggest that increasing board gender diversity can reduce the likelihood that firms will remain silent due to fears of greenwashing. This improves the quality of information disclosure. Second, this study offers institutional design insights for governments and regulatory bodies. Promoting women's representation in corporate governance can advance gender equality and indirectly enhance corporate environmental transparency and accountability. This contributes to achieving the multiple goals outlined in the United Nations 2030 Agenda for Sustainable Development, including "Gender Equality" and "Climate Action."

The contributions of this study can be summarized in three key aspects. First, at the conceptual level, this study advances the literature by operationalizing the concept of greenhushing as an outcome-based proxy for firms' strategically motivated non-disclosure of environmental information. Because intentional silence is difficult to directly observe in large-scale, cross-country settings, we develop a systematic measure based on observable gaps in ESG disclosure to capture cross-country differences in firms' environmental transparency. Although this measure does not directly observe managerial intent, it provides a theoretically grounded and empirically feasible approach for quantifying greenhushing-related behavior at scale. In doing so, this study addresses an important conceptual and methodological gap in ESG research and offers a new analytical perspective for future empirical studies. Second, from an empirical perspective, this study adopts the perspective of ESG disclosure choices to examine how board gender diversity influences greenhushing behavior. It overcomes the limitation of existing literature that primarily focuses on ESG performance outcomes and provides new evidence on the role of gender composition in shaping ESG disclosure strategies. Third, on the theoretical level, this study integrates gender theory, resource dependence theory, and legitimacy theory to examine how female directors mitigate greenhushing behavior through mechanisms of external resource acquisition and legitimacy maintenance. Furthermore, it situates this mechanism within the context of global energy transition. This highlights the importance of women's governance

roles in sustainability strategies and expands the theoretical scope of ESG governance.

The remainder of this paper is organized as follows. Section 2 presents a literature review, theoretical analysis, and hypothesis development. Section 3 covers variable and model construction and data statistics. Section 4 details the empirical design and test results. Section 5 provides targeted policy recommendations based on the research findings.

2 | Literature Review and Hypothesis

Following the motivation outlined in Section 1, this section reviews the existing literature and establishes the theoretical foundations for explaining how women's participation on corporate boards may curb greenhushing. It first summarizes prior research on gender equality, ESG disclosure, and corporate governance to identify the existing gaps. It then draws on gender theory, resource dependence theory, and legitimacy theory to develop the underlying mechanisms and derive the testable hypotheses that guide the subsequent empirical analysis.

2.1 | Literature Review

In the field of women's rights and gender equality research, an extensive academic literature has explored the profound impact of these issues on social, political, environmental, and economic systems (Cornwall and Rivas 2015; Yin et al. 2023; Rios et al. 2024). Progress in gender equality, particularly in improving educational attainment, labor market participation, and political representation, has been widely demonstrated to significantly improve overall social welfare and increase economic efficiency (Feng et al. 2022; Kolovich et al. 2020). In the field of economics, numerous studies have shown that improving women's education and career opportunities has a direct and significant positive impact on a country's economic performance. Cuberes and Teignier (2016) pointed out that eliminating gender gap in the labor market can significantly increase GDP, especially in countries with high levels of gender inequality. This suggests that gender equality plays a crucial role in promoting economic growth. Moreover, from a social perspective, gender-diverse boards have been found to effectively improve decision-making processes, enhance innovation capacity, and increase market responsiveness (Joecks et al. 2013; Orazalin and Baydauletov 2020). These research findings highlight the importance of gender diversity in improving corporate governance, enhancing competitiveness, and promoting corporate adaptability to market changes. Alazzani et al. (2017) found that the proportion of female directors positively influences social performance, highlighting the role of gender equality in enhancing corporate social responsibility. Studies on political participation also show that increasing women's political representation can drive broader social reforms, often with a greater emphasis on public services and social welfare (Jiang et al. 2024; Alexander et al. 2016). Women's participation in policymaking ensures that policies more comprehensively reflect the needs of different groups, thereby increasing the fairness and effectiveness of policies. This not only improves the overall efficiency of government operations, but also increases public trust and satisfaction with government. Moreover, in recent years, many studies have focused on the impact of gender equality on environmental governance and environmental performance (Liu 2018; Lu and Herremans 2019; Wang et al. 2021). Scholars regard gender diversity and women's participation in environmental management as key factors in promoting sustainable development and enhancing environmental protection. Rios et al. (2024) found that, compared to men, women have a higher level of environmental awareness and are more likely to engage in environmentally friendly behaviors. Women's rights and gender equality can not only improve the quality and innovation of environmental decisions, but also increase environmental awareness and responsibility, leading companies and countries to achieve better results in environmental protection.

The above studies and data support the view that ensuring equal participation and opportunities for both men and women can effectively unleash the potential of society as a whole and drive comprehensive economic, social and environmental development. However, there are numerous challenges in promoting gender equality, such as cultural resistance, economic structural factors, and inadequate policy frameworks (Ridgeway and Correll 2004; Lips 2013; Guzman and Kacperczyk 2019). The existing literature has also extensively explored the barriers to promoting gender equality. In many societies, cultural traditions and belief systems are deeply rooted in gender role stereotypes that limit women's social participation and career choices. Lawless et al. (2022) found that although gender perceptions are gradually modernizing globally, these cultural frameworks significantly influence women's opportunities in education, career development, and political participation. In addition, economic development patterns and gender-segregated labor markets often confine women to low-wage, low-skill jobs. This not only limits women's economic opportunities, but also exacerbates income inequality (Wang et al. 2023; Guzman and Kacperczyk 2019). Jayachandran (2015) noted that women are often the most vulnerable to precarious and unfair working conditions, especially in developing countries that rely on labor-intensive exports.

Academic research has increasingly focused on gender equality in business participation, particularly its potential impact on corporate environmental, social, and governance (ESG) performance (Birindelli et al. 2019; Cordeiro et al. 2020; Shakil 2021). Existing studies largely suggest a positive correlation between board gender diversity and ESG disclosure. For instance, Tahat and Hassanein (2024) found that an increase in the proportion of female directors significantly improves firms' ESG disclosure practices. This positive effect is further strengthened when firms establish a dedicated sustainability committee, indicating that institutionalized governance mechanisms can amplify the beneficial impact of gender diversity. Similar conclusions were reached by Alkhawaja et al. (2023), who argue that gender-diverse boards are more likely to fulfill their ESG communication responsibilities and gain stakeholder trust. While most studies emphasize the positive impact of gender diversity on ESG disclosure, inconsistencies and gaps remain in the literature regarding its universality, underlying mechanisms, and specific contexts. Some studies have noted that the positive effects of board gender diversity on ESG disclosure may vary across industry types, institutional contexts, and governance structures. Buallay et al. (2022) noted that in Australia, female board representation

between 22% and 50% positively impacts ESG performance; however, the effect becomes negative when the proportion exceeds 50%. Wasiuzzaman and Subramaniam (2023) found that the positive impact of board gender diversity on ESG disclosure differs significantly between developed and developing countries. This finding was consistent with the findings of Benameur et al. (2024) and Benameur et al. (2025), revealing significant differences in corporate sustainability performance across various institutional and cultural contexts, and offering avenues for future research. Meanwhile, research on sustainability reporting and performance has also emerged as an important strand of the literature, with evidence suggesting that it is not only a key issue in corporate governance research but also a critical safeguard for promoting corporate sustainability (Hassanein and Tharwat 2024; Elmaghrabi et al. 2025; Hassanein and Elmaghrabi 2025; Hassanein et al. 2024).

Beyond ESG performance, behavioral studies have provided further insight into how gender diversity improves the transparency of corporate information disclosure. These studies suggest that female directors tend to be more morally sensitive, risk-averse, and responsible (Bateman and Valentine 2010; Meyers-Levy and Loken 2015; You et al. 2011). These behavioral traits incline them to proactively promote more comprehensive and transparent disclosure of information within organizations to meet stakeholders' expectations for the completeness and accuracy of information. This perspective has also been validated by recent empirical studies. For example, García-Sánchez et al. (2025) and Wasiuzzaman and Mohammad (2020) found that female directors are more likely to disclose environmental information responsibly and transparently, effectively enhancing the firm's reputation for social responsibility and strengthening stakeholder trust. Firms that enhance the quality and transparency of their disclosures are better able to respond to societal expectations regarding sustainability and environmental protection, thereby improving their long-term performance (Shakil et al. 2021). Importantly, while these studies provide robust evidence that board gender diversity enhances ESG transparency and disclosure quality, they primarily focus on the extent, clarity, or credibility of information that firms choose to disclose. They do not explicitly examine firms' strategic decisions to withhold or remain silent on environmental information, which constitutes a conceptually distinct disclosure behavior.

In recent years, research on ESG disclosure has increasingly shifted from disclosure outcomes to underlying motivations, creating conceptual space for examining strategic disclosure behaviors. Existing studies have focused on problematic forms of ESG communication such as greenwashing and ESG decoupling, rather than assuming that greater disclosure necessarily implies greater transparency. For example, Yu et al. (2020) conceptualize greenwashing as misleading disclosure, where firms appear highly transparent despite weak underlying ESG performance. Similarly, Eliwa et al. (2023) examine ESG decoupling and show that board gender diversity helps reduce inconsistencies between disclosed ESG commitments and actual practices under specific institutional conditions. While this strand of literature advances our understanding of misleading or misaligned ESG disclosure, it largely centers on situations in which firms actively disclose ESG information. In contrast, greenhushing reflects a different strategic choice, whereby firms deliberately withhold or limit environmental disclosure. Building on this distinction, recent studies have begun to conceptualize greenhushing as a form of strategic non-disclosure (Ma, Feng, Yin, and Chang 2024; De Novellis et al. 2025; Hilton 2025). However, empirical research on greenhushing remains limited, particularly from a corporate governance perspective. In response, this study develops a measurable indicator of greenhushing and examines how board gender composition shapes firms' strategic ESG disclosure choices, thereby extending the existing literature on gender diversity and ESG reporting toward the dimension of systematic non-disclosure.

In summary, the existing literature extensively examines the far-reaching influence of women's rights and gender equality on social, political, environmental, and economic systems, and has explored the numerous challenges faced in promoting gender equality, such as cultural resistance and structural economic differences. Meanwhile, previous research has demonstrated that greater equality in women's access to business opportunities can significantly improve firms' environmental, social, and governance performance. While ESG disclosure has been widely studied in terms of quality and outcomes, few studies have examined firms' strategic choice to withhold environmental performance, which we define as "greenhushing." Rather than focusing on misleading disclosure or disclosure–performance misalignment, this study directs attention to firms' systematic non-disclosure behavior as a distinct dimension of ESG communication. By constructing an operational measure of greenhushing, this study shifts the academic focus from disclosure outcomes to disclosure motives, thereby contributing to the literature on sustainability disclosure. Moreover, while existing studies have examined the relationship between board gender diversity and ESG performance, this study extends prior research by examining how gender diversity shapes disclosure motivations and silence strategies at the national level, offering theoretical and empirical contributions to academia and business practices.

2.2 | Theoretical Analysis and Hypothesis Development

According to Gender Theory, the differences between men and women in attitudes toward environmental issues can be traced back to the ethical orientations shaped during the process of gender socialization (Wang, Feng, Wen, et al. 2024; Gilligan 1993). Women tend to embrace an ethics of care, emphasizing connectedness, responsibility, and sustainability, while men are more inclined toward a rule-based ethics of justice, focusing on fairness, rights, and abstract principles. This divergence in ethical orientation leads to different values and behavioral preferences between men and women in environmental decision-making. Numerous studies have shown that women typically exhibit higher environmental sensitivity and a stronger sense of social responsibility (Liu 2018; Echavarren 2023). This makes female directors more likely to integrate environmental responsibility into the core of corporate strategy, encourage firms to proactively fulfill their sustainability obligations, and enhance the transparency of environmental performance disclosure (Wang, Feng, Yin, et al. 2024; Li et al. 2017). Furthermore, when such firm-level gendered behaviors are systematically present across

multiple firms within a country, they influence overall corporate behavioral patterns through cumulative and diffusion effects, thereby manifesting at the national level as an aggregate tendency toward greenhushing. This illustrates how firm-level gender ethics can shape national patterns of environmental disclosure.

According to Resource Dependence Theory, a firm's survival and sustainable development rely on acquiring critical resources from the external environment, such as reputational capital, regulatory support, and legitimacy. Within this theoretical framework, the board serves as a strategic link between the firm and its external stakeholders, and its composition plays a critical role in identifying external expectations and securing necessary resources. A gender-diverse board is typically able to access broader social networks, possesses stronger reputation management capabilities, and exhibits greater environmental sensitivity (Zheng et al. 2025; Lu and Herremans 2019), thereby enabling it to more effectively identify evolving expectations regarding environmental responsibility and transparency from society, the media, and regulatory bodies. Specifically, female directors often demonstrate stronger environmental responsibility and ethical awareness, and when faced with policy uncertainty or reputational risk, they tend to encourage firms to adopt proactive disclosure strategies (Kassinis et al. 2016; Issa 2023). They regard information disclosure as a strategic means to build external legitimacy and trust, rather than simply a procedural requirement. As a result, gender diversity contributes to discouraging firms from adopting non-disclosure strategies, thus alleviating greenhushing practices. At the national level, when the boards of most firms exhibit gender diversity, their strategic responses in acquiring external resources, maintaining reputation, and addressing legitimacy pressures accumulate to create a systematic effect. This collective effect strengthens institutional constraints and reduces the likelihood of greenhushing at the national level.

According to Legitimacy Theory, the long-term development of a firm depends on gaining and maintaining social approval, which requires its actions to align with prevailing societal values and institutional norms (Muttakin et al. 2022; Zhao et al. 2025). As ESG increasingly becomes a core benchmark for evaluating corporate sustainability, the transparency of environmental information disclosure is regarded as a direct reflection of a company's legitimacy. If a company adopts greenhushing in its disclosure practices, it may be perceived by the public and regulators as concealing poor performance, which can weaken social trust, increase reputational risk, and trigger regulatory pressure. Within this framework, the participation of female directors, who typically exhibit stronger ethical sensitivity and social responsibility, enables firms to better align with societal norms and enhance their external legitimacy. Studies have shown that women tend to promote organizational behaviors that align with ethical standards and societal expectations, emphasizing responsibility, transparency, and inclusiveness (Alazzani et al. 2017; Eliwa et al. 2023). They generally take a more active role in promoting the disclosure of environmental performance at the board level. Therefore, board gender diversity strengthens legitimacy-oriented governance, positioning it as a key mechanism in reducing greenhushing behavior. At the national level, when the proactive behaviors of female directors are prevalent across multiple firms, legitimacy pressures and social norms are reinforced throughout the institutional environment, creating institutional constraints at the country level. These institutional constraints, in turn, collectively promote corporate disclosure behaviors, reducing the overall level of greenhushing.

Based on the above analysis, this study proposes the following Hypothesis 1.

H1. *Women's participation on boards is negatively associated with greenhushing behavior.*

Building on these theoretical mechanisms, differences in institutional gender equality may further condition the effectiveness of women's participation on boards. Countries that emphasize gender equality in political empowerment, business opportunities, and civil liberties provide more platforms for women to exert their influence. These women leaders, through their unique leadership styles and values, effectively promote transparent disclosure of environmental information and mitigate corporate greenhushing. First, in countries with political equality, women have greater influence in political and legal decision-making. This is often accompanied by the effective implementation of more comprehensive gender equality laws and environmental policies (Norgaard and York 2005). Lv and Deng (2019) pointed out that women's political empowerment is crucial for long-term environmental improvement. Support from legal frameworks enhances women's ability to promote transparency and corporate governance on boards, and is linked to less greenhushing. Second, in business environments that value gender equality, women are more likely to achieve key business opportunities, including senior management and board positions. Women leaders tend to adopt more collaborative and inclusive decision-making styles, which are particularly effective in addressing complex environmental issues. Therefore, the greater participation of women makes companies more open and transparent in their environmental strategies (Alkhawaja et al. 2023) and more likely to adopt proactive environmental protection measures, thereby mitigating greenhushing. Third, in environments where women have equal, safe, and effective access to justice, they are more likely to promote environmental disclosure on corporate boards. This is not only because they have legal support and societal encouragement, but also because they are naturally inclined to advocate for higher ethical standards and social responsibility. Based on the combined influence of these factors, women's participation on corporate boards in these countries significantly mitigates greenhushing behavior. Based on the above analysis, this paper proposes hypothesis 2.

H2. *The negative relationship between women's participation and greenhushing is more pronounced in countries with higher gender equality.*

Energy conditions constitute another critical contextual factor influencing the relationship between women's board participation and greenhushing. Given the current complex international situation and geopolitical energy risks, this paper examines the impact mechanisms of external energy shocks from two aspects: oil dependence and energy transition. (1) Oil dependency. A country's dependence on oil imports often means increased economic sensitivity to fluctuations in international energy

prices (Gupta 2008). This dependence can lead governments and companies to prioritize energy costs and supply security over environmental protection or sustainable development in their decision-making processes. In such an economic environment, while women board members may be more inclined to promote environmental transparency and sustainable practices, their efforts may be constrained by economic interests. Overdependence on oil exports often leads to the "resource curse" phenomenon, especially in resource-rich countries, which can lead to weakened governance structures and reduced transparency. Arezki and Brückner (2011) pointed out that oil-exporting countries often face higher levels of corruption and lower political transparency, which limits reformers, including women board members, in their efforts to promote transparent and accountable governance reforms. Therefore, even if women board members strive to promote environmental disclosure and responsible practices, they may face challenges from systemic structural obstacles. (2) Energy transition. In countries actively pursuing renewable energy innovation and consumption, women's board participation has a significant impact on encouraging companies to actively disclose their environmental performance. In market environments with strong environmental awareness, investors are increasingly inclined to support companies that demonstrate superior environmental responsibility (Glass et al. 2016). The environmental sensitivity and advocacy role of female board members enables these companies to better meet the demands of such investors. Post et al. (2015) found that women board members tend to improve corporate environmental performance by forming alliances related to sustainable development. By showcasing corporate achievements in renewable energy innovation and consumption, women board members help to attract sustainability-oriented capital, which further enhances the positive environmental performance of the company and is linked to less greenhushing. Based on the above analysis, this paper proposes hypotheses 3a and 3b.

H3a. *In oil-dependent countries, the negative relationship between women's participation and greenhushing is weaker.*

H3b. *In countries promoting renewable energy innovation and consumption, the negative relationship between women's participation and greenhushing is stronger.*

3 | Data and Methodology

Building on the theoretical framework and hypotheses developed in Section 2, this section introduces the data sources, variable construction, and empirical models used to test the proposed relationships. It first defines the key variables, including the greenhushing index and women's board participation, and then presents the control variables, model specifications, and descriptive statistics. These preparations provide the empirical foundation for the subsequent analysis.

3.1 | Greenhushing Index

The greenhushing indicator is an important tool for quantifying corporate non-disclosure of environmental, social and governance (ESG) issues. Following the calculation method of Ma, Feng, and Chang (2024), this indicator measures a country's level of greenhushing by comparing the proportion of companies that do not disclose ESG information at a given point in time. In addition, the calculation of this indicator is adjusted for the total amount over the years. By measuring the level of greenhushing at the national level, we can compare the performance of different countries or regions in terms of environmental information transparency. It also allows for the analysis of differences in companies' ESG disclosure behavior under different legal, cultural and economic systems.

$$Greenhushing_{it} = \frac{Non\_disclosure_{it} / \sum_{i=1}^{n} Non\_disclosure_{it}}{Total_{it} / \sum_{i=1}^{n} Total_{it}} \quad (1)$$

Here, $Non\_disclosure_{it}$ represents the number of companies in country i in year t that do not disclose their ESG scores. $Total_{it}$ denotes the total number of companies surveyed in country i in year t. The ESG data is sourced from the Refinitiv database, which covers corporate data from multiple countries worldwide and is widely used in academic research. A higher value of the greenhushing indicator indicates that more companies in that country choose to hide their ESG scores and environmental performance for various reasons.

It is important to clarify why this outcome-based indicator provides a reasonable approximation of greenhushing rather than merely reflecting incomplete ESG reporting. Conceptually, greenhushing refers to firms' strategic decisions to withhold environmental information. Although such strategic intent is difficult to directly observe using secondary ESG data, firms' disclosure choices are ultimately reflected in observable reporting outcomes. In contemporary ESG reporting environments, disclosure frameworks are relatively well established, and the costs and technical barriers associated with ESG reporting are comparatively low. Under such conditions, persistent or systematic non-disclosure is more plausibly interpreted as a deliberate choice to limit ESG visibility rather than as an incidental reporting omission. Therefore, by focusing on the proportion of firms that do not disclose ESG information, the proposed measure captures the observable behavioral outcome of strategic non-disclosure, rather than incidental or sporadic reporting gaps. While this outcome-based proxy cannot perfectly disentangle strategic silence from all other possible motivations for non-disclosure, it provides a sound way to approximate greenhushing at the aggregate level, enabling systematic cross-country comparison and empirical analysis.

3.2 | Women Participation on Boards

In global corporate governance research, women's participation on boards is widely considered to be a key factor in improving the quality of decision making and corporate transparency, particularly in the areas of environmental responsibility and sustainable development. Previous research has mostly examined the impact of board gender diversity on corporate development at the firm level (Fuentes-Fuentes et al. 2023). However, we choose to conduct our research from a national perspective, using the average proportion of women on corporate boards across companies in each country as an indicator to measure

national women's board participation (hereafter referred to as Gender). This approach not only provides a quantitative basis for comparing the implementation of gender equality in corporate governance across countries, but also effectively links micro-level corporate governance practices with macro-level policy analysis. The data are drawn from the BoardEx database, which provides detailed information on corporate boards and directors worldwide and is widely used in corporate governance research.

3.3 | Control Variables

Referencing Long et al. (2023) and Ma et al. (2025), this study introduces a set of control variables that include economic and social factors, environmental factors, and legal and governance factors to better assess the baseline estimates. (1) Economic and social factors. GDP per capita (denoted as GDP) controls for the potential impact of economic development levels on corporate environmental policies and behaviors. The share of urban population (denoted as Urban), as an indicator of urbanization level, is usually associated with higher environmental awareness and stricter environmental regulations. The proportion of manufacturing value added to GDP (denoted as Manufacturing) can help identify the potential environmental pressure from industrial activities. (2) Environmental factors. Carbon dioxide emissions (denoted as CO_2), an important indicator of environmental pressure, is used to control for the effect of environmental pressure on companies' environmental disclosure behavior. The ratio of natural resource rents to GDP (denoted as Rent) captures the economic dependence on natural resources, which may influence the choices of governments and companies in environmental policies and behaviors. (3) Legal and governance factors. The Women Business and the Law Index (denoted as Law) reflects the legal status and rights of women in business activities. A higher index may increase the ability of women to promote environmental behaviors on corporate boards. Government Efficiency (denoted as Goveff) is used to control for the quality and efficiency of government policy formulation and implementation. An efficient government is more likely to enforce effective environmental regulations, thereby influencing corporate environmental disclosure behavior. Detailed definitions and sources of these indicators are presented in Table A1.

3.4 | Empirical Model

Following Bai (2009) and Xu (2017), this study constructs an Interactive Fixed Effects Model (IFEM) to empirically examine the impact of women's board participation on greenhushing behavior. The traditional two-way fixed effects (TWFE) model separates individual effects (μ_i) and time effects (ν_t), enabling control for country-specific differences that do not vary over time and macro trends that do not vary across countries.[4] However, in real-world contexts, the impact of women's board participation on greenhushing is often influenced by various time-varying, heterogeneous shocks. For instance, shifting international ESG standards or evolving stakeholder expectations may influence ESG disclosure strategies differently across firms in different countries at specific time points. When confronted with these time-varying shocks, the traditional TWFE model absorbs the differences into a single time effect. This can result in biased parameter estimates and undermine the validity of causal inference. To more accurately isolate the net effect of women's participation on corporate boards on greenhushing, this study adopts an interactive fixed effects model. By incorporating interaction terms between country-specific factor loadings (λ_i) and unobserved common factors (F_t), the model allows systematic shocks at different points in time to exert varying impacts across countries. This approach more effectively captures unobservable global dynamic changes and enhances the robustness and explanatory power of the estimation results. Based on this, the study constructs a panel interactive fixed effects model, as shown in Equation (2).

$$Greenhushing_{i,t} = \alpha Gender_{i,t} + \boldsymbol{X}'_{\boldsymbol{i,t}}\boldsymbol{\beta} + \mu_i + \nu_t + \boldsymbol{\lambda}'_{\boldsymbol{i}}\boldsymbol{F}_{\boldsymbol{t}} + \varepsilon_{it} \tag{2}$$

where $\boldsymbol{X}'_{\boldsymbol{i,t}}$ represents the vector of control variables. $\lambda'_i \boldsymbol{F}_t$ denotes the interactive fixed effects, which are the product of multidimensional individual effects and multidimensional time effects. $\boldsymbol{F}_t$ represents the common factors, and $\boldsymbol{\lambda}'_{\boldsymbol{i}}$ represents the factor loadings. μ_i and ν_t control for individual effects and time effects, respectively, while ε_{it} is the random error term.

In the mechanism analysis, to empirically test how external energy shocks influence the relationship between women's participation on boards and greenhushing, this paper constructs a moderated effects model based on the panel interactive fixed effects model, as shown in Equation (3).

$$\begin{aligned}\text{Greenhushing}_{i,t} = \alpha\text{Gender}_{i,t} + \delta_1 M_{i,t} + \delta_2 \text{Gender}_{i,t} \times M_{i,t} + \mathbf{X}'_{\mathbf{i,t}}\boldsymbol{\beta} \\ + \mu_i + \nu_t + \boldsymbol{\lambda}'_{\mathbf{i}}\mathbf{F}_{\mathbf{t}} + \varepsilon_{it}\end{aligned} \tag{3}$$

where $M_{i,t}$ represents the moderating variable; $Gender_{i,t} \times M_{i,t}$ denotes the interaction term between the moderating variable and the independent variable. The sign and magnitude of the coefficient δ_2 reflect the specific impact of the moderating effect.

3.5 | Data Description

In processing the data, we first organized the data on women's representation on corporate boards from the BoardEx database and the data on corporate ESG from the Refinitiv database, both based on global corporate data. We then matched these datasets using the International Securities Identification Number (ISIN). Second, we retained only the company data with continuous records for three or more years to avoid bias in the regression results due to short sample periods. Finally, we obtained data from 10,473 firms in 29 OECD countries, for a total of 113,914 samples. By computing data at the global firm level, we derived national-level data on board gender participation and greenhushing. In addition, for variables with missing individual observations, we chose to use interpolation methods to deal with these gaps.

Table 1 presents the descriptive statistics of the panel data from 29 OECD countries from 2002 to 2022. The mean of greenhushing is 0.511, with a standard deviation of 0.280, indicating some variability in this variable across countries. The data range from

TABLE 1 | Descriptive statistics.

Variables	N	Mean	Std. Dev.	Min	Max
Greenhushing	579	0.511	0.280	0.000	1.679
Gender	579	0.147	0.102	0.000	0.452
GDP	579	10.449	0.635	8.615	11.630
Urban	579	4.367	0.132	4.019	4.587
Manufacturing	579	2.563	0.380	1.342	3.637
CO_2	579	0.251	0.139	0.043	0.991
Rent	579	1.085	0.532	0.686	3.412
Law	579	4.498	0.096	4.203	4.605
Goveff	579	1.335	0.597	−0.342	2.347

0 to 1.679, suggesting that in some countries, companies may be taking environmental measures but still tend to withhold this information in order to avoid being labeled as greenwashing, thereby avoiding additional social responsibility or high public expectations. In addition, the average proportion of women on corporate boards is 0.147 with a standard deviation of 0.102, indicating a generally low representation of women on corporate boards in OECD countries. The maximum value in the data range is 0.452, reflecting that even in the most balanced cases, the proportion of women on corporate boards does not exceed half. This statistic highlights the uneven status of gender diversity in corporate governance. It indicates that the level of greenhushing and the proportion of women on corporate boards exhibit certain differences and characteristics across OECD countries. These descriptive statistics provide a preliminary quantitative basis for further exploring the potential relationship between board gender composition and greenhushing behavior. In addition, the values of all control variables are within reasonable ranges.

4 | Empirical Findings and Discussion

This section presents the empirical results and discusses their implications. It begins with the baseline estimation of the effect of women's participation on greenhushing, and then examines institutional heterogeneity and energy-related moderating effects. Robustness checks and further analyses are subsequently conducted to validate the reliability and scope of the findings.

4.1 | Baseline Impact

To empirically test the influence mechanism of women's participation on greenhushing behavior, we construct a panel interactive fixed effects model as shown in equation (2) for empirical analysis. The results are shown in Table 2. In column (1), we simultaneously fixed time, individual, and interactive effects. Without adding control variables, the regression coefficient of the variable Gender is −0.768. At the 1% significance level, this indicates a significant negative association between women's board participation and greenhushing. To control for the influence of other factors on the dependent variable, in columns (2) to (4) we sequentially add economic and social factors, environmental factors, and legal governance factors that may affect corporate greenhushing decisions. We find that the coefficients of the variable are −0.567, −0.511, and −0.526, respectively, all of which remain statistically significant at the 1% level and are consistent with our theoretical expectations. Based on the fully specified model in column (4), the model estimates that a 10-percentage-point increase in women's board participation is associated with a 0.0526-point reduction in the greenhushing index, equivalent to approximately a 5.26% decrease. Compared to male directors, female directors tend to have different backgrounds and experiences that make them more sensitive and attentive to environmental protection and social responsibility (Adams and Ferreira 2009). This diverse perspective allows the board to more comprehensively consider the needs of stakeholders and social responsibility during the decision-making process (Cabeza-García et al. 2018), which is associated with greater transparency in environmental disclosure and lower levels of greenhushing.

While few studies have directly examined greenhushing, extensive research on board gender diversity and ESG disclosure or performance offers strong indirect support for our investigation. Our findings align with several international studies and demonstrate applicability in the context of OECD countries. Previous studies have found that female directors significantly enhance the quality of corporate ESG disclosures. This governance effect tends to be more stable in countries with well-developed institutional environments and higher levels of gender equality (Fernández-Méndez and Pathan 2025; Tran et al. 2024; Wasiuzzaman and Subramaniam 2023). These findings are consistent with those of the present study, which was conducted within the OECD context. Based on a cross-country study of 48 nations, Wasiuzzaman and Subramaniam (2023) found that the positive effect of gender diversity on ESG disclosure is primarily evident in developed countries and not significant in developing countries. This highlights the amplifying role of institutional maturity in enhancing the effectiveness of gender diversity governance. However, developing regions often face more complex institutional and cultural contexts. Studies by Abdelkader et al. (2024) and Rabbani et al. (2024), which focus on South Africa and the MENA region, respectively, reveal a different perspective. In regions

TABLE 2 | Baseline impact of women's participation on greenhushing.

	(1)	(2)	(3)	(4)
Variables	Greenhushing	Greenhushing	Greenhushing	Greenhushing
Gender	−0.768***	−0.567***	−0.511***	−0.526***
	(−3.47)	(−2.76)	(−2.61)	(−2.75)
GDP		−0.663***	−0.550***	−0.748***
		(−5.10)	(−4.20)	(−5.55)
Urban		−3.374***	−3.356***	−3.410***
		(−6.14)	(−6.58)	(−6.78)
Manufacturing		0.008	0.028	0.087
		(0.10)	(0.35)	(1.12)
CO_2			1.327***	0.619**
			(4.84)	(2.03)
Rent			−0.026	−0.007
			(−0.45)	(−0.12)
Law				−1.091***
				(−4.78)
Goveff				−0.038
				(−0.66)
Country	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
Interactive	Yes	Yes	Yes	Yes
N	579	579	579	579
F-statistic	12.05***	19.43***	17.45***	16.44***

Notes: Values in parentheses denote t-statistics.
***p < 0.01.
**p < 0.05.
*p < 0.1.

with weaker institutional frameworks and deeply rooted religious and gender biases, the influence of female directors on ESG performance is either insignificant or even negative. These findings suggest that institutional environments can significantly constrain the governance effectiveness of women on corporate boards. In summary, the findings of this study, which are based on samples from OECD countries, are consistent with existing empirical research. They further emphasize that, in contexts with mature institutions and well-developed regulatory frameworks, female directors can more effectively carry out their governance functions.

4.2 | Heterogeneity Analysis of Women's Rights

As shown in Table 3, this paper examines the heterogeneity of the baseline conclusions regarding women's rights and gender equality, focusing on three aspects: political participation, business opportunities, and civil liberties. First, gender equality in political empowerment means that women have equal opportunities and power to participate in political activities and decision-making processes, which increases the diversity and breadth of perspectives in the decision-making process. According to Kroeber (2022), countries with higher levels of female political participation can effectively drive policy change, particularly in environmental and social policies. Based on this, we use the proportion of seats held by women in the national parliament as a measure of gender equality in political participation (Paxton et al. 2010). We perform a heterogeneity analysis using the median as the boundary, with the results shown in Panel A. We see that in countries where women have high political rights, the increase in women's participation on boards is significantly associated with a reduction in greenhushing behavior (coefficient = −1.098, significance level = 0.01). This supports the view of Araujo and Tejedo-Romero (2018), which suggests that female leadership tends to promote more transparent and responsible governance structures.

Turning to the business dimension of gender equality, the proportion of women in leadership positions is an important dimension for assessing gender equality. Equal business opportunities for women means that they have equal

TABLE 3 | Heterogeneous analysis of women's rights.

Panel A: Women's political empowerment		
	(1)	(2)
Variables	Higher rights	Lower rights
Gender	−1.098***	0.582
	(−3.11)	(1.42)
Control variables	Yes	Yes
Fixed effects	Yes	Yes
N	288	287
F-statistic	6.16***	23.27***
Panel B: Women's business opportunities		
	(1)	(2)
Variables	Higher rights	Lower rights
Gender	−1.124***	0.117
	(−2.72)	(0.40)
Control variables	Yes	Yes
Fixed effects	Yes	Yes
N	284	294
F-statistic	12.72***	11.11***
Panel C: Women's civil liberties		
	(1)	(2)
Variables	Higher rights	Lower rights
Gender	−0.418**	0.283
	(−2.04)	(0.83)
Control variables	Yes	Yes
Fixed effects	Yes	Yes
N	287	289
F-statistic	15.61***	3.80***

Notes: Values in parentheses denote t-statistics. Fixed effects include year, country, and interactive fixed effects.
***p < 0.01.
**p < 0.05.
*p < 0.1.

opportunities to engage in business activities and can fully realize their business potential in an environment free of gender bias. Based on this, we use the median of the indicator measuring women's business opportunities from the V-Dem database as the cutoff for grouping tests. The results are shown in Panel B. We find that in countries with higher protection of women's business rights, increases in women's business participation are significantly associated with lower greenhushing levels (coefficient = −1.124, significance level = 0.01). This finding is consistent with the research of Al-Qahtani and Elgharbawy (2020) and Alkhawaja et al. (2023), who found that increasing gender diversity in corporate governance has unique benefits in promoting corporate transparency and environmental responsibility.

With respect to civil liberties as the third dimension, the level of women's civil liberties is a key indicator of whether women in a society have equal, safe and effective access to justice. This is critical to promoting environmental transparency and public participation. According to North's (1990) theory of institutional change, more open information and greater freedom of expression can improve the quality of governance and facilitate the implementation of more efficient public policies. Based on this, we use the median of the indicator measuring women's civil liberties from the V-Dem database as the boundary for the grouping tests. The results are shown in Panel C. The results indicate that in countries with higher women's civil liberties, higher levels of women's participation on boards are significantly associated with lower greenhushing levels (coefficient = −0.418, significance level = 0.05). Higher civil liberties may provide a more favorable social and cultural environment, thereby promoting environmental information disclosure and environmental protection activities.

Taken together, the heterogeneity results show that the three dimensions contribute differently to environmental disclosure outcomes. These three dimensions all have a positive impact on the promotion of environmental performance disclosure. Among them, the direct relevance and influence of equal business opportunities is the greatest, while the role of civil liberties is relatively weaker. Women's empowerment in business decision-making more directly manifests itself in corporate behavior and decision-making processes, with greater emphasis on environmental disclosure and transparency. While political empowerment and civil liberties have a positive impact on gender equality and environmental policy, their influence is relatively indirect. Women's political empowerment can drive broad policy changes, including environmental legislation, but the implementation and effectiveness of these changes often take a long time to become evident. Women's civil liberties primarily exert their influence through social pressure and public scrutiny, rather than directly through economic or policy incentives. This finding underscores the need to consider the specific roles and impact mechanisms of different institutional factors when formulating gender equality and environmental policies.

4.3 | Energy Challenges and Transition

In light of the current complex international landscape and intensifying geopolitical energy risks, external energy shocks have become a critical contextual factor influencing corporate sustainability behavior. Energy price volatility, supply chain uncertainties, and shifts in energy policies not only reshape national macroeconomic structures but also indirectly influence firms' environmental disclosure strategies and board governance practices (Grossman 2015; Hasan et al. 2022). To better identify these influences, this study introduces two variables: oil dependence and energy transition. The regression results are presented in Table 4. Oil dependence reflects a country's structural reliance on traditional fossil fuels and signals potential institutional tensions regarding environmental protection. In countries with high oil dependence, policymakers tend to adopt more cautious environmental disclosure regulations, and firms are more likely to limit environmentally

TABLE 4 | Women's participation on greenhushing: external energy challenges.

	Oil dependency		Energy transition	
	(1)	(2)	(3)	(4)
Variables	Greenhushing	Greenhushing	Greenhushing	Greenhushing
Gender	−0.618***	−1.020***	−0.177	−0.593***
	(−3.17)	(−4.34)	(−0.80)	(−3.07)
Gender * OI	0.098**			
	(2.43)			
Gender * OR		0.135**		
		(2.41)		
Gender * REC			−0.906***	
			(−4.31)	
Gender * REI				−0.055*
				(−1.82)
OI	0.003			
	(0.30)			
OR		0.023		
		(1.24)		
REC			−0.161***	
			(−3.87)	
REI				−0.002
				(−0.40)
Control variables	Yes	Yes	Yes	Yes
Country	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
Interactive	Yes	Yes	Yes	Yes
N	579	550	579	579
F-statistic	13.83***	8.92***	14.78***	13.50***

Notes: Values in parentheses denote t-statistics.
***p < 0.01.
**p < 0.05.
*p < 0.1.

sensitive information, a pattern associated with higher levels of greenhushing. In contrast, the level of renewable energy reflects a country's policy orientation and governance foundation for energy transition. A higher share of renewables typically indicates stronger environmental accountability mechanisms and a more proactive approach to information disclosure. This can enhance the effectiveness of female directors in promoting environmental transparency (Chen et al. 2020). There are significant differences in energy structures within OECD countries—some are highly dependent on oil exports or imports, while others are relatively advanced in their deployment of green energy. This variation provides an ideal context for testing the external adaptability of gender-based governance mechanisms. Thus, examining institutional differences within broader energy contexts by incorporating oil dependence and energy transition facilitates a deeper understanding of the heterogeneous effects of women's participation on corporate boards in shaping environmental disclosure across different energy structures.

Turning first to oil dependency as a moderating factor, this study measures oil dependency from two perspectives. First, it measures oil imports (denoted as OI), using data from the International Energy Agency database. This reflects a country's dependence on external oil supplies. Second is the ratio of oil rents to GDP (denoted as OR), for which data was sourced from the WDI database. This ratio measures the contribution of oil exports to a country's economy. Countries with high oil rents tend to rely on oil exports as a primary source of revenue. As shown in columns (1) and (2) of Table 4, the coefficients of the two interaction terms have a

significant positive relationship, at 0.098 and 0.135, respectively. This suggests that in countries overly dependent on oil imports and exports, the negative relationship between women's board participation and greenhushing becomes weaker. Multiple mechanisms may underlie this moderating effect. First, countries overly dependent on oil imports have a more vulnerable macroeconomy to fluctuations in international oil prices and supply chain disruptions. Consequently, policymakers tend to prioritize short-term energy security and economic stability over environmental transparency and long-term sustainability goals. In such contexts, firms tend to adopt a more cautious and conservative approach when making environmental disclosure decisions. Even when female board members who prefer transparency are present, they may be unable to influence governance to advocate for open disclosure. Second, countries with high dependence on oil exports often experience the so-called "resource curse" phenomenon, where resource abundance is accompanied by declining institutional quality and weak environmental regulation. In such settings, firms typically lack incentives for environmental disclosure from societal or policy sources. Consequently, even if female board members are willing to promote transparent governance, they may struggle to establish effective action mechanisms or secure organizational support. Therefore, whether through excessive dependence on energy imports or exports, oil dependence contributes to the formation of an institutional environment that is unfavorable to environmental disclosure. This is associated with a weaker relationship between board gender diversity and greenhushing outcomes.

By contrast, when examining energy transition as an enabling factor, we measure it from two perspectives. First, we measure the share of renewable energy consumption in total energy consumption (denoted as REC), with data sourced from the WDI database. Second is renewable energy innovation (denoted as REI), measured by the share of renewable energy patent applications from the OECD Environmental Database. As shown in columns (3) and (4) of Table 4, the coefficients of the two interaction terms are significantly negative, at −0.906 and −0.055, respectively. This indicates that strengthening the energy transition through renewable energy consumption and renewable energy innovation is associated with a stronger negative relationship between women's board participation and greenhushing. Countries with a high degree of energy transition typically have stronger environmental policies, more robust green regulatory frameworks, and higher levels of public environmental awareness. Within such institutional contexts, firms face greater pressure to disclose environmental information, and green performance becomes a key source of reputation and market competitiveness. In this context, female directors who demonstrate a strong sense of environmental responsibility and ethical sensitivity are more likely to earn the recognition of the board and management. Consequently, they may have greater substantive influence in promoting transparency in environmental disclosure and lower levels of greenhushing. In other words, a national energy transition strategy provides a foundation of institutions and culture conducive to green governance, which empowers female directors to promote environmental disclosure. This effectively reduces the information asymmetry and trust deficits associated with greenhushing.

4.4 | Robustness Tests

4.4.1 | Alternative Core Variables

Following Ma, Feng, and Chang (2024), we replace the core variables in Table 5. In columns (1) and (2), we use the proportion of companies in country i in year t that do not disclose ESG scores as a measure of greenhushing, denoted as

TABLE 5 | Robustness test: replace core variables.

	(1)	(2)	(3)	(4)	(5)
Variable	$Greenhushing_1$	$Greenhushing_2$	$Greenhushing_3$	Greenhushing	Greenhushing
Gender	−0.316**	−0.485**	−0.437***		
	(−2.08)	(−2.32)	(−2.75)		
$Gender_1$				−0.011***	
				(−2.61)	
$Gender_2$					−0.010***
					(−2.70)
Control variables	Yes	Yes	Yes	Yes	Yes
Country	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes
Interactive	Yes	Yes	Yes	Yes	Yes
N	579	579	579	579	579
F-statistic	4.48***	17.00***	15.78***	16.34***	16.41***

Notes: Values in parentheses denote t-statistics.
***p < 0.01.
**p < 0.05.
*p < 0.1.

Greenhushing$_1$. Additionally, we calculate an alternative greenhushing indicator using the Environment Pillar Score of companies from the Refinitiv database through equation (1), denoted as Greenhushing$_2$. We find that the coefficients of the independent variable are −0.316 and −0.485, both of which are significant at the 5% level. These results indicate that women's board participation is consistently associated with lower levels of greenhushing across alternative measures. To avoid potential disputes arising from differences in ESG disclosure information across databases, we re-estimate the model using data sourced from the Bloomberg database in Column (3). The results remain consistent and continue to support Hypothesis 1. In columns (4) and (5), we adjust the independent variable by multiplying it by the female labor force ratio and the female population ratio to more accurately reflect the proportion of women on corporate boards in a country and eliminate significant differences in female labor force participation rates and female population ratios across countries. These adjusted variables are denoted as Gender$_1$ and Gender$_2$, respectively. We find that their coefficients are −0.011 and −0.010, significant at the 1% level. This further demonstrates the robustness of the baseline conclusions. This test directly corresponds to Hypothesis H1—that women's participation on boards is negatively associated with greenhushing behavior—indicating that the findings are not driven by specific variable specifications. This strengthens confidence in the study's claims.

4.4.2 | Changing the Estimation Sample

As shown in Table 6, we adjust the time and individual samples separately to test the effectiveness of women's participation on corporate boards in relation to greenhushing outcomes. First, major events, such as financial crisis and the COVID-19 pandemic may have systemic effects on corporate behavior, market environments, and government policies. To reduce bias in the parameter estimation, we exclude the 2008 data and the data from after 2019 for the empirical analysis. The results are shown in columns (1) and (2). After excluding abnormal deviations, we find that the parameter estimates remain statistically significantly negative, which supports the baseline conclusions of this paper. To avoid instability and estimation bias due to small sample sizes, we exclude country samples with fewer than 50 firms from the regression analysis. The results are shown in column (3). Furthermore, extremely high or low scores on the Women Business and the Law Index may reflect extreme policies or legal environments regarding gender equality and the protection of women's rights in specific countries. Therefore, we use the middle 90% of the index samples for empirical testing. The results are shown in column (4). By changing the individual samples, we further test the robustness of this paper's baseline conclusions. This indicates that, even when excluding potential outliers or institutionally extreme cases, the research findings remain robust. This provides stronger support for Hypothesis H1 and further validates the negative relationship between female board participation and corporate greenhushing.

4.4.3 | Considering Different Estimation Methods

We re-estimate the economic impact of women's participation in greenhushing using four methods. The results are presented in Table 7. (1) To reduce the endogeneity of the model estimation, we add three omitted variables to better capture changes in the dependent variable: regulatory quality, the environmental performance index, and the degree of energy self-sufficiency.[5] (2) We use a one-period lagged independent variable as an instrumental variable in a two-stage least squares (2SLS) regression. This approach aims to address potential endogeneity issues between women's participation and greenhushing. (3) We include the lagged dependent variable in the model to account for dynamics using a time-lagged regression model. This controls for the time dependence of greenhushing behavior, as past greenhushing actions may influence current behavior. (4) The least squares dummy variable corrected (LSDVC) model introduces a corrected error term, effectively adjusting for estimation bias and providing more accurate parameter estimates (Dahir et al. 2019). The negative coefficients of the independent variables in columns (1)–(4)

TABLE 6 | Robustness test: change sample.

	(1)	(2)	(3)	(4)
Variable	Sample$_1$	Sample$_2$	Sample$_3$	Sample$_4$
Gender	−0.533***	−0.612**	−0.881***	−0.445**
	(−2.66)	(−2.42)	(−4.43)	(−2.29)
Control variables	Yes	Yes	Yes	Yes
Country	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
Interactive	Yes	Yes	Yes	Yes
N	551	463	444	543
F-statistic	15.62***	4.83***	11.98***	12.12***

Notes: Values in parentheses denote t-statistics.
***p < 0.01.
**p < 0.05.
*p < 0.1.

TABLE 7 | Robustness test: change estimation techniques.

	(1)	(2)	(3)	(4)
Variables	Greenhushing	Greenhushing	Greenhushing	Greenhushing
	AOV	2SLS	Time lag	LSDVC
L. Greenhushing			0.568***	0.849***
			(13.82)	(20.58)
Gender	−0.527***	−0.413*	−0.388**	−0.330**
	(−2.72)	(−1.70)	(−2.38)	(−2.06)
Control variables	Yes	Yes	Yes	Yes
Country	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
N	579	550	550	550
F-statistic	12.73***	1867.439***	39.54***	
R-squared		0.582		

Notes: Values in parentheses denote t-statistics.
***p < 0.01.
**p < 0.05.
*p < 0.1.

TABLE 8 | Industry-specific analyses.

	(1)	(2)	(3)	(4)	(5)
Variable	Energy	Information Technology	Health Care	Industrials	Materials
Gender	−1.309***	−2.020***	−1.461**	−1.184*	−1.356***
	(−2.76)	(−4.25)	(−2.53)	(−1.86)	(−2.66)
Controls	Yes	Yes	Yes	Yes	Yes
N	579	579	579	579	579
F-statistic	5.16***	4.71***	5.31***	4.73***	15.20***
	(6)	(7)	(8)	(9)	(10)
Variable	Consumer Discretionary	Consumer Staples	Financials	Utilities	Real Estate
Gender	−0.301	1.154	−1.439	0.284	0.700
	(−0.44)	(1.32)	(−1.59)	(0.15)	(0.83)
Controls	Yes	Yes	Yes	Yes	Yes
N	579	579	579	579	579
F-statistic	5.42**	2.65***	1.97**	1.01	3.80***

Notes: Values in parentheses denote t-statistics. Controls include control variables, country, year and Interactive effects.
***p < 0.01.
**p < 0.05.
*p < 0.1.

consistently indicate a negative relationship between women's board participation and greenhushing. These model-based robustness tests provide additional support for Hypothesis H1, enhancing confidence in the empirical relationship between female board participation and greenhushing outcomes. They also provide a methodological reference for future studies exploring similar themes.

4.5 | Further Analysis

4.5.1 | Industry-Specific Effects

To examine whether the governance effect of gender diversity on boards varies across industries, this study performs subsample regressions based on the Global Industry Classification

Standard (GICS) for the ten major sectors presented in Table 8. The empirical results indicate that female directors significantly mitigate greenhushing behavior in the energy, information technology, health care, industrials, and materials sectors. All coefficients are negative and statistically significant at the 10% level. These sectors typically face stricter environmental regulations, greater public scrutiny, and clearer ESG disclosure obligations, amplifying the role of gender-diverse governance structures in enhancing information transparency. In contrast, the inhibitory effect of female directors is not statistically significant in consumer-related sectors (including discretionary and staples), financials, utilities, and real estate. This may be due to these industries' relatively lower ESG risks and weaker external disclosure pressures, which limit the influence of board diversity on ESG governance. These results highlight the industry-specific applicability of gender diversity as a governance tool and suggest that policymakers and investors should consider sector-specific contexts when promoting gender-inclusive governance practices.

4.5.2 | Threshold Effect

To assess whether there exists a minimum proportion of female directors required to trigger a significant governance effect on greenhushing, we apply a threshold regression model using the percentage of women on the board as the threshold variable. The test results indicate the presence of a single-threshold effect, as reported in Table A2. As shown in Table 9, the results reveal a clear threshold effect at approximately 16% female representation. In firms with lower gender diversity (below 16%), the coefficient of gender diversity is negative but not statistically significant. However, once this threshold is crossed, the negative impact of gender diversity on greenhushing becomes significant at the 5% level. This supports the "critical mass" theory in board gender research, suggesting that a token presence is insufficient, and only when a certain proportion of women are substantively involved in decision-making can their governance impact fully materialize. These findings imply that policy measures aiming to increase board gender diversity should not merely promote symbolic inclusion, but should ensure a meaningful level of female representation to enhance ESG disclosure transparency.

TABLE 9 | Threshold regression results.

	(1)	(2)
Variables	Gender diversity $<16\%$	Gender diversity $\geq 16\%$
Gender	−0.578	−1.176***
	(−1.32)	(−2.68)
Controls	Yes	Yes
R-squared	0.123	0.123
F-statistic	6.23***	6.23***

Notes: Values in parentheses denote t-statistics.
***p < 0.01.
**p < 0.05.
*p < 0.1.

5 | Conclusion

This section summarizes the main findings and discusses their theoretical, practical, and policy implications. It also outlines the limitations of the study and highlights directions for future research.

5.1 | Research Findings

This study provides empirical evidence that board gender diversity is associated with a substantive governance role in relation to greenhushing. Rather than merely increasing female representation, greater participation enables a shift in disclosure incentives by incorporating pro-social and pro-environmental preferences into board decision-making. The results indicate that a 10-percentage-point increase in women's board participation is associated with an approximately 5.26% reduction in the national-level greenhushing index, confirming that gender-diverse boards are more likely to adopt transparency-oriented disclosure strategies. Moreover, the effect of women's participation is highly context-dependent. In countries with heavy dependence on oil imports or exports, fossil-fuel reliance weakens institutional incentives for transparency and increases the likelihood of greenhushing. By contrast, in economies that have made greater progress in renewable energy innovation and consumption, institutional conditions are more favorable to open disclosure, under which the negative association between female board participation and greenhushing becomes more pronounced. Heterogeneity tests additionally show that board gender diversity is most effective in environments with stronger female empowerment—particularly where political participation, business opportunities, and civil liberties are institutionally protected. These findings together demonstrate that women's participation is linked to lower levels of greenhushing not in isolation, but through interaction between board composition and the surrounding institutional-energy context.

5.2 | Theoretical and Practical Implications

The findings of this study make important theoretical contributions and have practical implications for global discussions on gender equality, corporate governance, and environmental accountability. From a gender equality perspective, the study emphasizes the crucial role of gender diversity on boards of directors in corporate governance. It confirms that female directors' participation can effectively reduce firms' likelihood of adopting greenhushing strategies. These results further support the theoretical view that women in senior business decision-making roles promote transparency and responsible behavior. They also provide robust empirical evidence to enhance women's representation in corporate leadership globally. From a corporate governance perspective, the study emphasizes the importance of structural diversity, demonstrating that board diversity effectively enhances the transparency of environmental information. It mitigates issues of information asymmetry and reputational risk in capital markets. From the perspective of environmental accountability, the study broadens understanding of corporate environmental disclosure

behavior by proposing governance pathways to address greenhushing. The study underscores the critical role of optimizing board structure in strengthening corporate environmental responsibility. These conclusions provide important theoretical foundations and practical insights for the international community when designing gender diversity policies, improving corporate governance practices, and strengthening environmental disclosure and oversight mechanisms.

5.3 | Policy Implications

Based on our research findings, we propose the following constructive policy recommendations to promote the development of a gender-inclusive governance framework from institutional and market dimensions. These recommendations aim to enhance the transparency and credibility of corporate ESG disclosures. Given the negative relationship identified between women's participation on corporate boards and greenhushing behavior, governments, regulatory bodies, and investors can consider establishing coordinated mechanisms to promote gender-diverse governance through institutional design and practical incentives. At the institutional level, governments can consider promoting gender quota policies through legislation requiring listed companies to ensure a minimum of 16% female representation on their boards. Such policies can increase women's presence in top-level corporate governance, strengthen board inclusivity and diversity, and are thus associated with lower levels of greenhushing linked to selective or limited disclosure practices. Additionally, dedicated funding programs can be established to support leadership training and professional development for female board members. Companies can also be encouraged to develop a talent pipeline of female governance candidates to strengthen their influence on ESG strategy formulation and information disclosure. Regulatory authorities should establish a unified, mandatory ESG disclosure framework that clearly defines corporate disclosure obligations. An independent third-party auditing mechanism should be introduced to enhance the accuracy and comparability of information and help narrow the space for greenhushing practices. At the market level, investors should incorporate gender diversity into their evaluation criteria, paying particular attention to the substantive participation of women on corporate boards and the completeness of ESG reports. Large institutional investors can promote corporate disclosure of gender diversity targets, progress updates, and accountability mechanisms through shareholder proposals, voting strategies, and other engagement tools. Coordinated efforts involving regulatory pressure and investment-driven incentives can motivate firms to optimize their governance structures, improve the quality of their ESG disclosures, and effectively integrate gender equality with broader sustainability objectives.

From a corporate governance perspective, firms should incorporate the principles of gender equality into their governance structures and ESG disclosure processes. First, firms should establish clear, measurable gender diversity targets, such as setting minimum thresholds for female representation on the board and in senior management. These targets should be incorporated into the corporate charter or annual sustainability strategy. Second, firms should promote more inclusive recruitment systems for board nominations and senior executive selections, prioritizing female candidates with backgrounds in sustainability or demonstrated environmental responsibility. At the same time, firms should establish and publicly disclose a board competency framework that incorporates ESG and climate governance capabilities into the criteria for appointment and reappointment. Firms should ensure that women hold substantive roles in the sustainability and disclosure committees, avoiding marginal or symbolic positions. Conduct annual board evaluations to track substantive participation indicators, such as speaking frequency, number of proposals, and committee leadership, and use these results to guide incentives and feedback. Additionally, firms should incorporate gender diversity indicators into their annual ESG reports and have them audited by an independent third party. They should clearly state the reasons for any undisclosed indicators and provide a timeline for corrective actions to enhance information transparency and strengthen external accountability mechanisms. Through these practices, firms can strengthen the substantive participation of women in corporate governance and better leverage their role in shaping ESG disclosure decisions, fostering higher-quality and more credible ESG disclosure practices.

Based on the findings from the mechanism analysis, particularly in the context of external impacts from energy shocks, policymakers should consider the following measures. First, governments should promote the diversification of the energy structure to reduce reliance on oil imports and exports. To this end, they could introduce a “Renewable Energy Promotion Act” or a national-level renewable energy strategy, supported by incentives such as tax breaks and green credit policies, to encourage corporate investment in renewable energy sources, such as wind, solar, and bioenergy. This transition would contribute to environmental protection and provide companies with a more stable energy environment. This may support their long-term green development strategies and be associated with lower incentives for silence in ESG disclosure. Second, a “gender impact assessment mechanism” should be established within the national energy policymaking process to ensure women's adequate participation in formulating, implementing, and evaluating energy policies. This can be achieved by creating diverse policy advisory committees and appointing female energy advisors to promote shared governance in decision-making processes. Governments should also launch programs dedicated to supporting women's career development and providing them with skills training in the energy sector, particularly in renewable energy. These programs should be included in national gender equality action plans to enhance women's representation and institutional voice in this critical industry. This may further encourage companies to disclose their green strategies instead of remaining silent.

Based on the heterogeneity analysis findings, governments should strengthen the legal framework for gender equality and women's rights, particularly promoting women's participation in business and high-level decision-making. One way to achieve this is by amending the Company Act or the Gender Equality Act to strengthen legal constraints on gender composition within corporate boards. This could include establishing clear gender targets and mandatory compliance reporting requirements. At

the same time, legal penalties for gender discrimination should be reinforced to safeguard women's equal rights in recruitment, promotion, and compensation. Additionally, governments should establish transparent evaluation mechanisms and accountability systems to monitor the implementation of gender diversity policies within enterprises. Additionally, the government should establish a "Corporate Gender Equality Disclosure Platform" that requires companies to regularly disclose the gender composition of their boards and the implementation status of their diversity policies. Finally, governments can promote public awareness and support for gender equality through education campaigns, media collaborations, and advocacy initiatives. These efforts can foster a more inclusive and socially responsible culture within corporate and market environments, thereby contributing to institutional conditions that are less conducive to greenhushing.

5.4 | Limitations and Future Research

This study has limitations that require further exploration. First, regarding the measurement of greenhushing, this study relies on publicly available ESG data to construct an outcome-based indicator of firms' non-disclosure behavior. As discussed earlier, while greenhushing conceptually refers to strategically motivated non-disclosure, such intent is difficult to directly observe using secondary data. In this context, systematic non-disclosure outcomes provide a meaningful observable approximation of greenhushing, as firms' strategic disclosure choices are ultimately reflected in whether ESG information is reported or withheld. However, this outcome-based measure cannot fully disentangle strategic silence from all other forms of limited disclosure. For example, some firms may reduce transparency through vague language, infrequent updates, or the omission of specific indicators rather than complete non-disclosure. These more nuanced forms of "selective silence" are difficult to capture using large-scale quantitative ESG datasets and may therefore be only partially reflected in the current indicator. Accordingly, future research could integrate multiple information sources—such as media-based textual analysis, executive interviews, divergences across ESG rating agencies, and third-party independent assessments—to further refine the measurement of greenhushing and capture more subtle disclosure strategies, thereby enhancing the precision and interpretability of empirical findings. Second, due to data availability, this study's sample is limited to 29 OECD countries. While this helps ensure a relatively consistent institutional environment, it also limits the applicability of the conclusions to other institutional or cultural contexts. In culturally conservative and low-diversity countries, or in those with weak gender equality institutions, an increased presence of women on boards may not translate into greater influence if they remain in marginal roles or lack substantive decision-making power. These structural constraints can limit their capacity to enhance disclosure transparency and curb greenhushing (Abdelkader et al. 2024; Hassanein et al. 2024; Rabbani et al. 2024). Furthermore, in regions with high autocracy or strong information control, this effect may be more pronounced (Elmaghrabi et al. 2025). Future research could incorporate a broader range of international firm-level data, including samples from developing countries, emerging markets, and contexts with significant institutional differences, to explore potential variations in greenhushing across diverse cultural and institutional settings. Third, while this study focuses on gender diversity, corporate diversity is inherently multidimensional. Future research could examine whether other dimensions, such as racial, cultural, and experiential diversity, have similar or stronger effects in curbing greenhushing. This would enrich our understanding of how diversity contributes to sustainable corporate governance.

Author Contributions

Yan Ma: The first author of the article, who is responsible for the writing and revision of the full text and responding to the reviewers' comments. Gen-Fu Feng: The second author of the article, in the process of writing, puts forward suggestions for revision, and is responsible for providing literatures. Lawrence Loh: Conceptualization, Formal analysis, Methodology, Writing – review and editing. Xiaoyan Niu: Investigation, Data curation, Software, Writing – review and editing. Chun-Ping Chang: Responsible for the quality control of the full text, contact the journal in the name of the corresponding author, and act as the role in the integration of the opinions of all authors.

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Endnotes

[1] https://www.southpole.com/publications/destination-net-zero-report

[2] https://bizbeat.nus.edu.sg/thought-leadership/article/whats-missing-in-esg-economics-of-course/

[3] EU investors warn against deep data cuts in green rules review | Reuters

EU changes to sustainability law risk company lawsuits, legal scholars say | Reuters

[4] In the traditional two-way fixed effects model, individual and time effects are introduced in an additive form. These effects control for differences in individuals that do not change over time and differences in time that do not change across individuals. However, the traditional two-way fixed effects model cannot address the endogeneity problem of non-structural variables that change simultaneously with time and individuals (Bai 2009).

[5] Regulatory quality is sourced from the Worldwide Governance Indicators database, the Environmental Performance Index from Block et al. (2024), and the degree of energy self-sufficiency from the International Energy Agency database.

References

Aabo, T., and I. C. Giorici. 2023. "Do Female CEOs Matter for ESG Scores?" *Global Finance Journal* 56: 100722. https://doi.org/10.1016/j.gfj.2022.100722.

Abdelbaky, A., T. Liu, M. Xu, M. F. Shahzad, and A. Hassanein. 2024. "Real Earnings Management and ESG Performance in China: The Mediating Role of Corporate Innovations." *International Journal of Finance & Economics* 30: 3476–3499. https://doi.org/10.1002/ijfe.3074.

Abdelkader, M. G., Y. Q. Gao, and A. A. Elamer. 2024. "Board Gender Diversity and ESG Performance: The Mediating Role of Temporal Orientation in South Africa Context." *Journal of Cleaner Production* 440: 140728. https://doi.org/10.1016/j.jclepro.2024.140728.

Adams, R. B., and D. Ferreira. 2009. "Women in the Boardroom and Their Impact on Governance and Performance." *Journal of Financial Economics* 94, no. 2: 291–309. https://doi.org/10.1016/j.jfineco.2008.10.007.

Adekoya, O. B., J. A. Oliyide, and I. O. Fasanya. 2022. "Renewable and Non-renewable Energy Consumption-Ecological Footprint Nexus in Net-Oil Exporting and Net-Oil Importing Countries: Policy Implications for a Sustainable Environment." *Renewable Energy* 189: 524–534. https://doi.org/10.1016/j.renene.2022.03.036.

Alazzani, A., A. Hassanein, and Y. Aljanadi. 2017. "Impact of Gender Diversity on Social and Environmental Performance: Evidence From Malaysia." *Corporate Governance: The International Journal Of Business In Society* 17, no. 2: 266–283. https://doi.org/10.1108/CG-12-2015-0161.

Alexander, A. C., C. Bolzendahl, and F. Jalalzai. 2016. "Defining Women's Global Political Empowerment: Theories and Evidence." *Sociology Compass* 10, no. 6: 432–441. https://doi.org/10.1111/soc4.12375.

Alkhawaja, A., F. Hu, S. Johl, and S. Nadarajah. 2023. "Board Gender Diversity, Quotas, and ESG Disclosure: Global Evidence." *International Review of Financial Analysis* 90: 102823. https://doi.org/10.1016/j.irfa.2023.102823.

Allen, E., H. Lyons, and J. C. Stephens. 2019. "Women's Leadership in Renewable Transformation, Energy Justice and Energy Democracy: Redistributing Power." *Energy Research & Social Science* 57: 101233. https://doi.org/10.1016/j.erss.2019.101233.

Al-Qahtani, M., and A. Elgharbawy. 2020. "The Effect of Board Diversity on Disclosure and Management of Greenhouse Gas Information: Evidence From the United Kingdom." *Journal of Enterprise Information Management* 33, no. 6: 1557–1579. https://doi.org/10.1108/JEIM-08-2019-0247.

Araujo, J. F. F. E., and F. Tejedo-Romero. 2018. "Does Gender Equality Affect Municipal Transparency: The Case of Spain." *Public Performance & Management Review* 41, no. 1: 69–99. https://doi.org/10.1080/15309576.2017.1362350.

Arezki, R., and M. Brückner. 2011. "Oil Rents, Corruption, and State Stability: Evidence From Panel Data Regressions." *European Economic Review* 55, no. 7: 955–963. https://doi.org/10.1016/j.euroecorev.2011.03.004.

Bai, J. 2009. "Panel Data Models With Interactive Fixed Effects." *Econometrica* 77, no. 4: 1229–1279. https://doi.org/10.3982/ECTA6135.

Bateman, C. R., and S. R. Valentine. 2010. "Investigating the Effects of Gender on Consumers' Moral Philosophies and Ethical Intentions." *Journal of Business Ethics* 95, no. 3: 393–414. https://doi.org/10.1007/s10551-010-0386-4.

Benameur, K. B., M. M. Mostafa, A. Hassanein, M. Z. Shariff, and W. Al-Shattarat. 2024. "Sustainability Reporting Scholarly Research: A Bibliometric Review and a Future Research Agenda." *Management Review Quarterly* 74, no. 2: 823–866. https://doi.org/10.1007/s11301-023-00319-7.

Benameur, K., A. Hassanein, M. M. Mostafa, M. Elmaghrabi, and H. Tharwat. 2025. "A Decade of Sustainable Finance Scholarly Research: Performance Analysis, Science Mapping and Future Pathways." *Journal of Financial Reporting and Accounting* ahead-of-print. https://doi.org/10.1108/JFRA-10-2024-0722.

Birindelli, G., A. P. Iannuzzi, and M. Savioli. 2019. "The Impact of Women Leaders on Environmental Performance: Evidence on Gender Diversity in Banks." *Corporate Social Responsibility and Environmental Management* 26, no. 6: 1485–1499. https://doi.org/10.1002/csr.1762.

Block S., Emerson J. W., Esty D. C., de Sherbinin A., Wendling Z. A.. 2024 2024 Environmental Performance Index, Yale Center for Environmental Law & Policy.

Buallay, A., R. Hamdan, E. Barone, and A. Hamdan. 2022. "Increasing Female Participation on Boards: Effects on Sustainability Reporting." *International Journal of Finance & Economics* 27, no. 1: 111–124. https://doi.org/10.1002/ijfe.2141.

Cabeza-García, L., R. Fernández-Gago, and M. Nieto. 2018. "Do Board Gender Diversity and Director Typology Impact CSR Reporting?" *European Management Review* 15, no. 4: 559–575. https://doi.org/10.1111/emre.12143.

Caby, J., C. Coron, and Y. Ziane. 2024. "How Does Gender Diversity in Top Management Teams Affect Carbon Disclosure and Its Quality: Evidence From the Technological Industry." *Technological Forecasting And Social Change* 199: 123077. https://doi.org/10.1016/j.techfore.2023.123077.

Chen, X., Y. Li, J. H. Xiao, and F. H. Wen. 2020. "Oil Shocks, Competition, and Corporate Investment: Evidence From China." *Energy Economics* 89: 104819. https://doi.org/10.1016/j.eneco.2020.104819.

Cheng, H. W., D. R. Dong, and Y. Feng. 2024. "Corporate Greenhushing and Stock Price Crash Risk: Evidence From China." *Environment, Development and Sustainability* 27, no. 12: 30761–30737. https://doi.org/10.1007/s10668-024-04935-5.

Cordeiro, J. J., G. Profumo, and I. Tutore. 2020. "Board Gender Diversity and Corporate Environmental Performance: The Moderating Role of Family and Dual-Class Majority Ownership Structures." *Business Strategy and the Environment* 29, no. 3: 1127–1144. https://doi.org/10.1002/bse.2421.

Cormier, D., M. J. Ledoux, and M. Magnan. 2011. "The Informational Contribution of Social and Environmental Disclosures for Investors." *Management Decision* 49, no. 8: 1276–1304. https://doi.org/10.1108/00251741111163124.

Cornwall, A., and A. M. Rivas. 2015. "From 'Gender Equality' and 'Women's Empowerment' to Global Justice: Reclaiming a Transformative Agenda for Gender and Development." *Third World Quarterly* 36, no. 2: 396–415. https://doi.org/10.1080/01436597.2015.1013341.

Cuberes, D., and M. Teignier. 2016. "Aggregate Effects of Gender Gaps in the Labor Market: A Quantitative Estimate." *Journal of Human Capital* 10, no. 1: 1–32. https://doi.org/10.1086/683847.

Dahir, A. M., F. Mahat, N. H. A. Razak, and A. N. Bany-Ariffin. 2019. "Capital, Funding Liquidity, and Bank Lending in Emerging Economies: An Application of the LSDVC Approach." *Borsa Istanbul Review* 19, no. 2: 139–148. https://doi.org/10.1016/j.bir.2018.08.002.

de Freitas Netto, S. V., M. F. F. Sobral, A. R. B. Ribeiro, and G. R. D. Soares. 2020. "Concepts and Forms of Greenwashing: A Systematic Review." *Environmental Sciences Europe* 32, no. 1: 19. https://doi.org/10.1186/s12302-020-0300-3.

De Novellis, G., A. Pedrazzoli, D. Pennetta, and V. Venturelli. 2025. "Greenwashing, Greenhushing, and the Path to Green Banking." *Global Finance Journal* 67: 101147. https://doi.org/10.1016/j.gfj.2025.101147.

Echavarren, J. M. 2023. "The Gender Gap in Environmental Concern: Support for an Ecofeminist Perspective and the Role of Gender Egalitarian Attitudes." *Sex Roles* 89, no. 9: 610–623. https://doi.org/10.1007/s11199-023-01397-3.

Eliwa, Y., A. Aboud, and A. Saleh. 2023. "Board Gender Diversity and ESG Decoupling: Does Religiosity Matter?" *Business Strategy and the Environment* 32, no. 7: 4046–4067. https://doi.org/10.1002/bse.3353.

Elmaghrabi, M., A. Hassanein, and A. Diab. 2025. "How Do Firm-Level and Country-Level Sustainability Governance Shape Corporate Sustainability? Insights From Environmentally-Sensitive Industries." *Social Responsibility Journal* 21, no. 5: 1086–1110. https://doi.org/10.1108/SRJ-02-2024-0088.

Endo, K. 2025. "Board Gender Diversity and Carbon Disclosure: The Moderating Role of Board Expertise Diversity." *Corporate Social Responsibility And Environmental Management* 32: 4963–4977. https://doi.org/10.1002/csr.3227.

Ettinger, A., S. Grabner-Kräuter, S. Okazaki, and R. Terlutter. 2021. "The Desirability of CSR Communication Versus Greenhushing in the Hospitality Industry: The Customers' Perspective." *Journal of Travel Research* 60, no. 3: 618–638. https://doi.org/10.1177/0047287520930087.

Feng, G., H. Long, H. Wang, and C. Chang. 2022. "Environmental, Social and Governance, Corporate Social Responsibility, and Stock Returns: What Are the Short- and Long-Run Relationships?" *Corporate Social Responsibility and Environmental Management* 29, no. 5: 1884–1895. https://doi.org/10.1002/csr.2334.

Fernández-Méndez, C., and S. Pathan. 2025. "Mandated Board Gender Diversity and ESG Performance: Evidence From the European "Women on Boards" Directive." *Corporate Social Responsibility and Environmental Management* 32, no. 3: 3602–3620. https://doi.org/10.1002/csr.3147.

Font, X., I. Elgammal, and I. Lamond. 2017. "Greenhushing: The Deliberate Under Communicating of Sustainability Practices by Tourism Businesses." *Journal of Sustainable Tourism* 25, no. 7: 1007–1023. https://doi.org/10.1080/09669582.2016.1158829.

Fuentes-Fuentes, M. D., C. Quintana-García, M. Marchante-Lara, and C. G. Benavides-Chicón. 2023. "Gender Diversity, Inclusive Innovation and Firm Performance." *Sustainable Development* 31, no. 5: 3622–3638. https://doi.org/10.1002/sd.2615.

García-Sánchez, I. M., M. Núñez-Torrado, C. Aibar-Guzmán, and B. Aibar-Guzmán. 2025. "Beyond Climate Targets: Exploring When and How Female Directors Influence Corporate Decarbonization Transparency." *Business Strategy and the Environment* 34, no. 3: 3892–3912. https://doi.org/10.1002/bse.4183.

Gilligan, C. 1993. *In a Different Voice: Psychological Theory and Women's Development*. Harvard university press.

Glass, C., A. Cook, and A. R. Ingersoll. 2016. "Do Women Leaders Promote Sustainability? Analyzing the Effect of Corporate Governance Composition on Environmental Performance." *Business Strategy and the Environment* 25, no. 7: 495–511. https://doi.org/10.1002/bse.1879.

Grossman, P. Z. 2015. "Energy Shocks, Crises and the Policy Process: A Review of Theory and Application." *Energy Policy* 77: 56–69. https://doi.org/10.1016/j.enpol.2014.11.031.

Gupta, E. 2008. "Oil Vulnerability Index of Oil-Importing Countries." *Energy Policy* 36, no. 3: 1195–1211. https://doi.org/10.1016/j.enpol.2007.11.011.

Guzman, J., and A. Kacperczyk. 2019. "Gender Gap in Entrepreneurship." *Research Policy* 48, no. 7: 1666–1680. https://doi.org/10.1016/j.respol.2019.03.012.

Hasan, M. M., J. B. Wong, and M. A. Al Mamun. 2022. "Oil Shocks and Corporate Social Responsibility." *Energy Economics* 107: 105881. https://doi.org/10.1016/j.eneco.2022.105881.

Hassanein, A., A. Bani-Mustafa, and K. Nimer. 2024. "A Country's Culture and Reporting of Sustainability Practices in Energy Industries: Does a Corporate Sustainability Committee Matter?" *Humanities and Social Sciences Communications* 11, no. 1: 1–12. https://doi.org/10.1057/s41599-024-03536-x.

Hassanein, A., and M. Elmaghrabi. 2025. "How Does Market Competition Affect the Reporting of Sustainability Practices? Insights From the UK and Germany." *International Journal of Productivity and Performance Management* 74, no. 4: 1452–1474. https://doi.org/10.1108/IJPPM-07-2023-0369.

Hassanein, A., and H. Tharwat. 2024. "Artificial Intelligence (AI) and Green Finance." In *The Palgrave Handbook of Green Finance for Sustainable Development*, 859–889. Palgrave Macmillan. https://doi.org/10.1007/978-3-031-65756-6_32.

He, H.-Z., G.-F. Feng, and C.-P. Chang. 2025. "The Impact of ESG Gaps on Green Exports in Bilateral Trade: A Linear and Nonlinear Analysis." *World Trade Review* 1–23. https://doi.org/10.1017/s1474745625101109.

Hilton, J. 2025. "An Integrated Analysis of Greenhush." *Innovation and Green Development* 4, no. 2: 100222. https://doi.org/10.1016/j.igd.2025.100222.

Issa, A. 2023. "Shaping a Sustainable Future: The Impact of Board Gender Diversity on Clean Energy Use and the Moderating Role of Environmental, Social and Governance Controversies." *Corporate Social Responsibility and Environmental Management* 30, no. 6: 2731–2746. https://doi.org/10.1002/csr.2512.

Jayachandran, S. 2015. "The Roots of Gender Inequality in Developing Countries." *Annual Review of Economics* 7, no. 1: 63–88. https://doi.org/10.1146/annurev-economics-080614-115404.

Jiang, P., G. Feng, H. Wang, and C. Chang. 2024. "CSR From Different Perspectives: The Global ESG Indexes Updated." *Corporate Social Responsibility and Environmental Management* 31, no. 5: 4694–4714. https://doi.org/10.1002/csr.2814.

Joecks, J., K. Pull, and K. Vetter. 2013. "Gender Diversity in the Boardroom and Firm Performance: What Exactly Constitutes a "Critical Mass?"." *Journal of Business Ethics* 118, no. 1: 61–72. https://doi.org/10.1007/s10551-012-1553-6.

Johnson, O. W., V. Gerber, and C. Muhoza. 2019. "Gender, Culture and Energy Transitions in Rural Africa." *Energy Research & Social Science* 49: 169–179. https://doi.org/10.1016/j.erss.2018.11.004.

Johnson, W. C., W. J. Xie, and S. H. Yi. 2014. "Corporate Fraud and the Value of Reputations in the Product Market." *Journal of Corporate Finance* 25: 16–39. https://doi.org/10.1016/j.jcorpfin.2013.10.005.

Karagiannopoulou, S., N. Sariannidis, K. Ragazou, I. Passas, and A. Garefalakis. 2023. "Corporate Social Responsibility: A Business Strategy That Promotes Energy Environmental Transition and Combats Volatility in the Post-Pandemic World." *Energies* 16, no. 3: 1102. https://doi.org/10.3390/en16031102.

Kassinis, G., A. Panayiotou, A. Dimou, and G. Katsifaraki. 2016. "Gender and Environmental Sustainability: A Longitudinal Analysis." *Corporate Social Responsibility and Environmental Management* 23, no. 6: 399–412. https://doi.org/10.1002/csr.1386.

Kolovich, L., V. Malta, M. Newiak, and D. Robinson. 2020. "Gender Equality and Macroeconomic Outcomes: Evidence and Policy Implications." *Oxford Review of Economic Policy* 36, no. 4: 743–759. https://doi.org/10.1093/oxrep/graa049.

Kroeber, C. 2022. "How Parties Led by a Woman Redefine Their Positions: Empirical Evidence for Women's Green, Alternative and Libertarian Agenda." *European Journal of Political Research* 61, no. 1: 175–193. https://doi.org/10.1111/1475-6765.12449.

Lawless, S., P. J. Cohen, C. McDougall, S. Mangubhai, A. M. Song, and T. H. Morrison. 2022. "Tinker, Tailor or Transform: Gender Equality Amidst Social-Ecological Change." *Global Environmental Change-Human and Policy Dimensions* 72: 102434. https://doi.org/10.1016/j.gloenvcha.2021.102434.

Li, J., F. Q. Zhao, S. L. Chen, W. X. Jiang, T. Liu, and S. P. Shi. 2017. "Gender Diversity on Boards and Firms' Environmental Policy." *Business Strategy and the Environment* 26, no. 3: 306–315. https://doi.org/10.1002/bse.1918.

Lin, H., S. X. Zeng, L. Y. Wang, H. L. Zou, and H. Y. Ma. 2016. "How Does Environmental Irresponsibility Impair Corporate Reputation? A Multi-Method Investigation." *Corporate Social Responsibility and Environmental Management* 23, no. 6: 413–423. https://doi.org/10.1002/csr.1387.

Lips, H. M. 2013. "The Gender Pay Gap: Challenging the Rationalizations. Perceived Equity, Discrimination, and the Limits of Human Capital Models." *Sex Roles* 68, no. 3: 169–185. https://doi.org/10.1007/s11199-012-0165-z.

Liu, C. 2018. "Are Women Greener? Corporate Gender Diversity and Environmental Violations." *Journal of Corporate Finance* 52: 118–142. https://doi.org/10.1016/j.jcorpfin.2018.08.004.

Long, H., G. F. Feng, Q. Gong, and C. P. Chang. 2023. "Esg Performance and Green Innovation: An Investigation Based on Quantile Regression." *Business Strategy and the Environment* 32, no. 7: 5102–5118. https://doi.org/10.1002/bse.3410.

Lu, J., and I. M. Herremans. 2019. "Board Gender Diversity and Environmental Performance: An Industries Perspective." *Business Strategy and the Environment* 28, no. 7: 1449–1464. https://doi.org/10.1002/bse.2326.

Lv, Z. K., and C. Deng. 2019. "Does Women's Political Empowerment Matter for Improving the Environment? A Heterogeneous Dynamic Panel Analysis." *Sustainable Development* 27, no. 4: 603–612. https://doi.org/10.1002/sd.1926.

Ma, Y., G. F. Feng, and C. P. Chang. 2024. "From Traditional Innovation to Green Innovation: How an Occurrence of Natural Disasters Influences Sustainable Development?" *Sustainable Development* 32, no. 3: 2779–2796. https://doi.org/10.1002/sd.2802.

Ma, Y., G. F. Feng, and C. P. Chang. 2025. "The Impact of Energy Security on Energy Innovation: A Non-Linear Analysis." *Applied Economics* 57, no. 16: 1867–1887. https://doi.org/10.1080/00036846.2024.2317810.

Ma, Y., G. Feng, Z. Yin, and C. Chang. 2024. "ESG Disclosures, Green Innovation, and Greenwashing: All for Sustainable Development?." *Sustainable Development* 33, no. 2: 1797–1815. https://doi.org/10.1002/sd.3210.

Meyers-Levy, J., and B. Loken. 2015. "Revisiting Gender Differences: What We Know and What Lies Ahead." *Journal of Consumer Psychology* 25, no. 1: 129–149. https://doi.org/10.1016/j.jcps.2014.06.003.

Muttakin, M. B., B. Chatterjee, A. Khan, D. G. Mihret, R. Roy, and A. Yaftian. 2022. "Corporate Political Donations, Board Gender Diversity, and Corporate Social Responsibility: Evidence From Australia." *Journal of Business Research* 152: 290–299. https://doi.org/10.1016/j.jbusres.2022.07.062.

Norgaard, K., and R. York. 2005. "Gender Equality and State Environmentalism." *Gender & Society* 19, no. 4: 506–522. https://doi.org/10.1177/0891243204273612.

North, D. C. 1990. *Institutions, Institutional Change and Economic Performance*. Cambridge university press.

Orazalin, N., and M. Baydauletov. 2020. "Corporate Social Responsibility Strategy and Corporate Environmental and Social Performance: The Moderating Role of Board Gender Diversity." *Corporate Social Responsibility and Environmental Management* 27, no. 4: 1664–1676. https://doi.org/10.1002/csr.1915.

Paxton, P., M. M. Hughes, and M. A. Painter. 2010. "Growth in Women's Political Representation: A Longitudinal Exploration of Democracy, Electoral System and Gender Quotas." *European Journal of Political Research* 49, no. 1: 25–52. https://doi.org/10.1111/j.1475-6765.2009.01886.x.

Post, C., N. Rahman, and C. McQuillen. 2015. "From Board Composition to Corporate Environmental Performance Through Sustainability-Themed Alliances." *Journal of Business Ethics* 130, no. 2: 423–435. https://doi.org/10.1007/s10551-014-2231-7.

Rabbani, M. R., M. Kiran, A. Bhuiyan, and A. Al-Hiyari. 2024. "Does Diversity in Top Management and Boards Affect ESG Performance? Evidence From Islamic and Conventional Banks in the MENA Region." *International Journal of Islamic and Middle Eastern Finance and Management* 17, no. 6: 1244–1266. https://doi.org/10.1108/IMEFM-06-2024-0281.

Rao, K., and C. Tilt. 2016. "Board Composition and Corporate Social Responsibility: The Role of Diversity, Gender, Strategy and Decision Making." *Journal of Business Ethics* 138, no. 2: 327–347. https://doi.org/10.1007/s10551-015-2613-5.

Ridgeway, C. L., and S. J. Correll. 2004. "Unpacking the Gender System: A Theoretical Perspective on Gender Beliefs and Social Relations." *Gender & Society* 18, no. 4: 510–531. https://doi.org/10.1177/0891243204265269.

Rios, V., I. Barba, L. Gianmoena, and P. Pascual. 2024. "Clearing the Smog Ceiling: The Impact of Women's Political Empowerment on Air Quality in European Regions." *European Journal of Political Economy* 85: 102551. https://doi.org/10.1016/j.ejpoleco.2024.102551.

Shakil, M. H. 2021. "Environmental, Social and Governance Performance and Financial Risk: Moderating Role of ESG Controversies and Board Gender Diversity." *Resources Policy* 72: 102144. https://doi.org/10.1016/j.resourpol.2021.102144.

Shakil, M. H., M. Tasnia, and M. I. Mostafiz. 2021. "Board Gender Diversity and Environmental, Social and Governance Performance of US Banks: Moderating Role of Environmental, Social and Corporate Governance Controversies." *International Journal of Bank Marketing* 39, no. 4: 661–677. https://doi.org/10.1108/IJBM-04-2020-0210.

Tahat, Y. A., and A. Hassanein. 2024. "Exploring the Synergy of Corporate Gender Diversity, Sustainability Committee, and Reporting ESG Practices: An International Evidence." *Journal of Environmental Management* 371: 123093. https://doi.org/10.1016/j.jenvman.2024.123093.

Tran, M. M. A., N. Y. C. Nguyen, N. K. H. Quyen, P. N. Tran, N. M. T. Phan, and A. T. Le. 2024. "Do Firms With Environmental, Social, and Governance Reputational Risk Take Into Account Board Gender Diversity? An Analysis on a Global Scale." *Social Science Quarterly* 105, no. 4: 1396–1418. https://doi.org/10.1111/ssqu.13411.

Wang, J., G. Feng, Z. Yin, and C. Chang. 2024. "Does Women's Political Participation Promote Green Innovation? Global Evidence." *Corporate Social Responsibility and Environmental Management* 32, no. 2: 1847–1862. https://doi.org/10.1002/csr.3044.

Wang, J.-Z., G.-F. Feng, J. Wen, H.-T. Yin, and C.-P. Chang. 2024. "Mandated Gender-Diversity Policy and Firm Innovation." *Applied Economics Letters* 1–5. https://doi.org/10.1080/13504851.2024.2426715.

Wang, Q., H. Wang, G. Feng, and C. Chang. 2023. "Impact of Digital Transformation on Performance of Environment, Social, and Governance: Empirical Evidence From China." *Business Ethics, the Environment & Responsibility* 32, no. 4: 1373–1388. https://doi.org/10.1111/beer.12573.

Wang, Y., C. Wilson, and Y. X. Li. 2021. "Gender Attitudes and the Effect of Board Gender Diversity on Corporate Environmental Responsibility." *Emerging Markets Review* 47: 100744. https://doi.org/10.1016/j.ememar.2020.100744.

Wasim, R. 2019. "Corporate (Non)disclosure of Climate Change Information." *Columbia Law Review* 119, no. 5: 1311–1354.

Wasiuzzaman, S., and W. M. W. Mohammad. 2020. "Board Gender Diversity and Transparency of Environmental, Social and Governance Disclosure: Evidence From Malaysia." *Managerial and Decision Economics* 41, no. 1: 145–156. https://doi.org/10.1002/mde.3099.

Wasiuzzaman, S., and V. Subramaniam. 2023. "Board Gender Diversity and Environmental, Social and Governance (ESG) Disclosure: Is It Different for Developed and Developing Nations?" *Corporate Social Responsibility and Environmental Management* 30, no. 5: 2145–2165. https://doi.org/10.1002/csr.2475.

Xia, L., Z. Li, J. Wei, and S. Gao. 2024. "Doing Well by Doing Good: Unpacking the Black Box of Corporate Social Responsibility." *Asia Pacific Journal of Management* 41, no. 3: 1601–1631. https://doi.org/10.1007/s10490-023-09878-5.

Xu, Y. 2017. "Generalized Synthetic Control Method: Causal Inference with Interactive Fixed Effects Models." *Political Analysis* 25, no. 1: 57–76. https://doi.org/10.1017/pan.2016.2.

Yin, H. T., C. P. Chang, D. F. Anugrah, and I. Gunadi. 2023. "Gender Equality and Central Bank Independence." *Economic Analysis and Policy* 78: 661–672. https://doi.org/10.1016/j.eap.2023.04.006.

You, D., Y. Maeda, and M. J. Bebeau. 2011. "Gender Differences in Moral Sensitivity: A Meta-analysis." *Ethics & Behavior* 21, no. 4: 263–282. https://doi.org/10.1080/10508422.2011.585591.

Yu, E. P. Y., B. Van Luu, and C. H. Chen. 2020. "Greenwashing in Environmental, Social and Governance Disclosures." *Research in International Business and Finance* 52: 101192. https://doi.org/10.1016/j.ribaf.2020.101192.

Zhao, S., W. Renxi, C. Giglio, and A. Appolloni. 2025. "Impact of Leadership Styles and Organisational Citizenship Behaviours on Organisational Green Innovation Performance: The Moderating Role of Organisational Legitimacy." *Business Strategy And The Environment* 34, no. 3: 3209–3225. https://doi.org/10.1002/bse.4148.

Zheng, M. B., G. F. Feng, R. A. Jiang, and C. P. Chang. 2023. "Does Environmental, Social, and Governance Performance Move Together With Corporate Green Innovation in China?" *Business Strategy and the Environment* 32, no. 4: 1670–1679. https://doi.org/10.1002/bse.3211.

Zheng, M., B. Niu, H.-C. Yang, and C.-P. Chang. 2024. "The Impact of ICT Development on ESG Performance: International Evidence." *Oeconomia Copernicana* 15, no. 4: 1427–1463. https://doi.org/10.24136/oc.2797.

Zheng, M., L. Wu, G.-F. Feng, and C.-P. Chang. 2025. "The Impact of Green Finance on Sustainable Development: An Investigation Into National ESG Performance." *Journal of Applied Economics* 28, no. 1. https://doi.org/10.1080/15140326.2025.2528672.

Appendix A

TABLE A1 | Variable definitions and sources.

Variable	Definition	Source
Key variables		
Greenhushing	Calculated greenhushing index	Refinitiv Database
Gender	The proportion of female board members	BoardEx Database
Control variables		
GDP	GDP per capita (constant 2015 US$)	World Development Indicators
Urban	Urban population (% of total population)	World Development Indicators
Manufacturing	Manufacturing, value added (% of GDP)	World Development Indicators
CO_2	CO_2 emissions (kg per 2015 US$ of GDP)	World Development Indicators
Rent	Total natural resources rents (% of GDP)	World Development Indicators
Law	Women Business and the Law Index Score (scale 1–^{1}100)	World Development Indicators
Goveff	Government Effectiveness: Estimate	Worldwide Governance Indicators
Mechanism variables		
Women's political empowerment	Proportion of seats held by women in national parliaments (%)	World Development Indicators
Women's business opportunities	Access to national business opportunities by gender	Varieties of Democracy Database
Women's civil liberties	Women's right to equal, safe and effective access to justice	Varieties of Democracy Database
OI	Net oil imports (PJ)	International Energy Agency Database
OR	Oil rents (% of GDP)	World Development Indicators
REC	Renewable energy consumption (% of total final energy consumption)	World Development Indicators
REI	Share of renewable energy patents	OECD statistics

TABLE A2 | Threshold effect test.

Threshold	Threshold estimate	F-statistic	*p*	Crit10	Crit5	Crit1
Single	0.16	24.88	0.0333	18.969	23.889	33.518
Double	(0.13, 0.20)	6.82	0.6367	18.833	24.739	38.280

Notes: *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$.