Corporate governance and environmental disclosure: a comparative analysis

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Abstract

Purpose – *This study aims to investigate the influence of corporate governance (CG) on environmental disclosure (ED) practices within UK and US firms, addressing the contemporary challenges confronting firms in both contexts.*

Design/methodology/approach – *Using the dynamic panel regression framework of system generalised method of moment (GMM), this study analyses a sample comprising 121 FTSE and 200 S&P firms from 2010 to 2020.*

Findings – *The findings emphasise the dynamic nature of ED practices among UK and US firms, demonstrating their propensity to swiftly adjust to desired levels whenever deviations occur. Besides, this study identifies board independence and the frequency of board meetings as significant determinants of ED for UK firms. In contrast, for US firms, board independence and audit committee independence are found to be significant determinants of ED.*

Research limitations/implications – *The research highlights the fundamental role played by CG in shaping how firms in the UK and the US navigate agency problems and respond to diverse stakeholder demands through ED in their annual reports. This study advocates for the promotion of robust governance systems that concurrently serve the purposes of accountability and monitoring to bridge the information expectation gap between firms and stakeholders. The findings reinforce the necessity for regulatory initiatives involving policy formulation and corporate oversight to enhance private sector awareness regarding environmental reporting practices.*

Originality/value – *This study contributes to the scarce literature on the impact of board and audit committee characteristics on ED practices in the UK and US contexts. In addition, by using the system GMM estimation technique, this study provides robust and updated evidence that addresses the weaknesses inherent in previous studies.*

Keywords *Corporate governance, Environmental disclosure, Board characteristics, Audit committee, Disclosure index, GMM regression*

Paper type *Research paper*

Received 31 January 2024
Revised 9 July 2024
Accepted 8 September 2024

1. Introduction

This study investigates the influence of corporate governance (CG) on the environmental disclosure (ED) practices of firms in the US and the UK. The relentless pursuit of economic objectives has resulted in considerable environmental challenges. Over the past few decades, global environmental concerns have risen significantly (Orazalin *et al.*, 2024), underscoring the need for sustainable development that balances societal well-being and economic prosperity (Giannarakis *et al.*, 2020). Legislative measures and regulations have been introduced to acknowledge the growing importance of environmental issues and to address the complex relationship between organisations and the environment (Gerged *et al.*, 2023; Orazalin *et al.*, 2024).

Amid mounting public concerns, the dissemination of information about environmental initiatives has become crucial for organisations (Gerged, 2021). High-profile governance failures, such as those of WorldCom and Enron, have highlighted the critical role of

corporate disclosures (Qu and Leung, 2006). In this context, CG is recognised as a focal instrument in shaping environmental information disclosure (Omer and Andrew, 2014). By defining the mechanisms through which firms are controlled and ensuring the accountability of agents to principals and other stakeholders, CG serves as a fundamental tool governing the rights and responsibilities of diverse stakeholder groups (Gerged *et al.*, 2023).

Prior research suggests that firms increase disclosures to mitigate information asymmetry and agency costs (Anwar *et al.*, 2024). Effective governance can enhance oversight and supervision, potentially reducing agency problems (Khan *et al.*, 2013). Moreover, CG mechanisms such as the board of directors and audit committee significantly influence a firm's disclosure strategy and overall transparency (Haniffa and Cooke, 2005). Robust CG has the capacity to align managerial interests with those of stakeholders, potentially improving the quantity and quality of corporate disclosures, including ED. Therefore, it is crucial to investigate how different CG mechanisms, such as the board of directors and audit committee, impact ED practices in UK and US firms.

Firms disclose environmental information for several reasons, framed by theoretical perspectives such as the voluntary disclosure hypothesis and the risk avoidance hypothesis. The voluntary disclosure hypothesis posits that persistent environmental degradation compels firms to voluntarily disclose their environmental practices (Wang *et al.*, 2021). This voluntary ED offers numerous payoffs, including reduced financing costs, diminished information asymmetry and enhanced profitability and reputation (Beyer *et al.*, 2010). Conversely, the risk avoidance hypothesis suggests firms may hesitate to engage in extensive ED due to concerns about the security and privacy risks associated with disclosing more information than their industry peers (Wang *et al.*, 2021). Consequently, firms may exercise caution in determining the extent and quality of their ED, carefully weighing the associated benefits and costs. Despite traditional accounting practices historically neglecting significant social and environmental factors, contemporary firms are increasingly pursuing objectives beyond mere wealth accumulation or growth (Battilana *et al.*, 2022).

As a crucial component of the broader environmental, social and governance (ESG) disclosure framework, ED holds macro-level significance for stakeholders by mitigating information asymmetry and enhancing firm transparency (Sahin *et al.*, 2022). This trend encourages firms to acknowledge their societal responsibilities through comprehensive environmental information disclosure. Regulatory frameworks, such as the 2006 Companies Amendment Act, mandate the inclusion of essential environmental issues in annual reports and accounts (Sun *et al.*, 2010). As a result, firms are increasingly motivated to integrate ED into their corporate practices, balancing the demands of regulatory compliance and stakeholder expectations.

This study uses multiple theoretical perspectives to analyse the motivations for and implications of ED. Agency theory suggests that CG mechanisms assist in mitigating agency costs and reducing information asymmetry (Beyer *et al.*, 2010). Legitimacy theory posits that voluntary disclosures, including ED, help firms establish and maintain legitimacy in the eyes of stakeholders, enhancing public acceptance and organisational survival (Solikhah and Winarsih, 2016). Stakeholder theory advocates that firms should operate for the benefit of all stakeholders, not just for their gain (Jizi *et al.*, 2014). Thus, ED serves as a communication tool, enabling firms to retain access to critical resources and maintain supportive relationships with stakeholders (Wakaisuka-Isingoma *et al.*, 2016). These theoretical frameworks elucidate the relationship between CG and ED, highlighting how well-governed firms minimise information asymmetry, fulfil social contracts and address stakeholder concerns by providing higher levels of ED.

Recognising CG as a fundamental factor influencing corporate behaviour and decision-making, this study examines the impact of CG structures on ED practices within UK FTSE

350 and US S&P 500 companies. By using diverse theoretical lenses, this research aims to contribute to existing scholarship by focusing on firms listed on the London and New York Stock Exchanges, given their significant contributions to overall market capitalisation. A considerable body of literature (e.g. Aburaya, 2012; Jizi *et al.*, 2014; Liao *et al.*, 2015; Trireksani and Djajadikerta, 2016; Osazuwa *et al.*, 2016; Shahab *et al.*, 2020; Tran *et al.*, 2021) has emerged, spanning both emerging and developed nations, aiming to enhance the extent and quality of ED. These investigations provide evidence of the significance of CG mechanisms as a critical determinant of ED, though with variations in the observed magnitudes. However, these existing studies have several limitations.

Firstly, a noteworthy gap in the existing literature pertains to the scarcity of empirical studies explicitly addressing the impact of CG structures on ED within the UK and the US contexts. In addition, the studies conducted in these regions often use different data set classifications, encompassing indices such as FTSE-All share, FTSE-100, FTSE-250 and the largest 329 firms and banks in the UK (Sun *et al.*, 2010; Aburaya, 2012; Jizi *et al.*, 2014; Liao *et al.*, 2015). Secondly, the methodological model of these investigations, mainly conducted in the US and UK, often relies on ordinary least squares regression and fixed- and random-effect panel regression estimation techniques. However, these approaches may be insufficient to address endogeneity issues, variable omission and the inherent measurement bias in panel data. The use of a robust dynamic panel regression estimation technique, such as the system generalised method of moments (GMM), to examine the influence of CG structures on ED in the UK and the US remains noticeably sparse. Given that panel data sets typically exhibit more cross-sections than time series ($N > T$), the application of system GMM emerges as particularly advantageous in terms of mitigating the inherent challenges in panel data analyses (Lemmon *et al.*, 2008; Hauk and Wacziarg, 2009). Consequently, there is a compelling need for a distinctive examination of the impact of various CG mechanisms, specifically encompassing board and audit committee characteristics, on ED practices in UK and US firms, using the system GMM estimation framework.

This research makes three significant contributions to the existing literature. Firstly, it addresses a critical gap by investigating the influence of CG structures on the ED practices of FTSE 350 and S&P 500 companies, a subject that has attracted limited empirical exploration. Relying on a contemporary data set, the study finds that in the UK, board independence positively affects ED, while frequent board meetings negatively impact ED. In the US context, board independence positively influences ED, while audit committee independence negatively impacts it. The results suggest that board independence reduces agency costs and information asymmetry by encouraging the disclosure of environmental information (Ding *et al.*, 2022). By encouraging higher ED, board independence, in effect, helps firms gain legitimacy and fulfil stakeholder needs. Conversely, higher board meetings tend to reduce ED by UK firms, which suggests that despite being perceived as an effective monitoring mechanism (Vafeas, 1999) and a tool to enhance board effectiveness (Altawalbeh, 2020), higher board meeting frequency results in lower ED. Higher board meeting frequency may imply that the firm has some crucial issues to address (such as complex problems or growth opportunities), and in concentrating on these problems (Vafeas, 1999), their attention moves away from environmental concerns and disclosure. Finally, audit committee independence negatively impacts ED by US firms, which suggests that despite its role in mitigating agency problems and providing effective oversight (Aburaya, 2012), it does not promote the disclosure of environmental information to the stakeholders. This may be because disclosing more environmental information can increase the risk of public backlash for greenwashing (Lyon and Maxwell, 2011). Therefore, to mitigate such risks (Dionne and Triki, 2005), independent members on the audit committee may discourage ED. The results of this study enrich the governance and disclosure literature by providing updated insights into the relationship between CG mechanisms and ED practices in the UK and the US.

Secondly, the study contributes to the existing knowledge by unveiling a novel phenomenon regarding the adjustment policies of UK and US firms. The findings suggest that, in case of deviation from the desired ED level, FTSE 350 and S&P 500 firms use swift adjustment policies, as evidenced by a high speed of adjustment (SOA). These rapid adaptations to the desired ED levels may be due to the stringent ED policies in the UK and US regulatory environments. This observation offers a fresh perspective, emphasising that firms place critical importance on maintaining an optimal ED level to strengthen trust between firms and their operating environment.

Thirdly, this study uses the system GMM estimation framework, which addresses prevalent issues of endogeneity, variable measurement and omission bias in investigating the nexus between CG and ED practices of FTSE 350 and S&P 500 firms. By systematically overcoming these inherent limitations and weaknesses in prior studies, this research sheds robust findings that significantly enhance our understanding of the complex dynamics between governance structures and ED practices within the UK and US contexts.

The subsequent sections of this paper are organised as follows: Section 2 provides the contextual and regulatory background of the research. Section 3 outlines the theoretical literature review. Section 4 reviews the empirical literature and the development of hypotheses. Section 5 details the research design, including the approaches and techniques used in the study. Section 6 presents and discusses the empirical results. Finally, Section 7 offers the conclusion, implications and potential avenues for future research.

2. Regulatory background

The increasing demand for environmental information among stakeholders is compelling firms to go beyond mere economic reporting and justify their operations by disclosing the environmental dimensions of their activities (Cormier *et al.*, 2011). ED presents a fundamental tool for firms to demonstrate accountability for their environmental endeavours. Despite the growing interest in ED, concerns persist among scholars and practitioners regarding its capacity to effectively address the varied information needs of stakeholders (Cormier *et al.*, 2011). Recognising the potential influence of CG systems in shaping transparent and professional management practices (Anwar *et al.*, 2024), there is a growing consensus that the application of CG principles can yield substantial improvements in ED (Solikhah and Maulina, 2021). This improvement is often linked to heightened levels of accountability and transparency within organisational frameworks (Gul and Leung, 2004; Cormier *et al.*, 2011). The long-anticipated move towards universally unified accounting standards, particularly in the context of the US transitioning from General Accepted Accounting Principles to International Financial Reporting Standards, has prompted discussions on extending such harmonisation to CG models, potentially facilitating the establishment of a unified stock market. However, the persistence of heterogeneous CG systems stemming from diverse cultural and legal factors underscores the challenges associated with achieving such harmonisation.

The CG system in the UK is primarily characterised by self-regulation, with the "comply or explain" model (Mallin, 2011) proving effective for UK firms. Notwithstanding government-issued consultation documents and reports, the debate continues regarding the adequacy of self-regulation in ensuring accountability and advancing robust governance (Keasey *et al.*, 2005). However, as Dewing and Russell (2004) highlight, criticisms persist over the UK CG code due to its perceived *ad hoc* development process and the absence of a robust enforcement mechanism. A significant development occurred with the release of the revised UK CG code by the Financial Reporting Council, effective from 1 January 2019. The updated code emphasises the interconnectedness of firms with their stakeholders, shareholders and corporate culture. The "comply or explain" approach, retained in the revised code, fortifies a commitment to high-quality disclosures, urging firms to favour an

explanatory approach over a mere "tick box" method. Moreover, the revised code emphasises shareholder engagement, independence, diversity and remuneration (FRC, 2018).

In contrast to the UK, CG practices in the US diverge in their reliance on principles. Instead, CG considerations are codified in federal and state laws, alongside listing rules and regulations (Doyle *et al.*, 2021). The prevailing framework in the US is characterised by a set of influential "best practices" aligning with the Anglo-American model, which prioritises the interests of directors, management and shareholders. The governance structure typically features a one-tier board of directors mainly composed of non-executive directors (Jouber, 2021). However, variations exist with boards incorporating both non-executive and executive directors, CEO/chair duality and the establishment of distinct functional committees such as compensation, audit and nomination committees (Meier and Meier, 2014). The financial scandals involving Enron and WorldCom heightened scrutiny of CG practices and raised questions about the adequacy of existing regulatory frameworks. The articulation of "golden rules" (Vuori and Huy, 2020) emerged as pivotal in delineating effective CG, emphasising alignment with business goals, ethical considerations, organisational integrity, reporting practices and strategic management concepts. These principles have culminated in a comprehensive requirement encompassing rights, equitable treatment of shareholders, consideration of other stakeholder interests, defining board roles and responsibilities, ensuring disclosure, nurturing ethical behaviour and promoting transparency (Vuori and Huy, 2020).

The landscape of ED in the UK has witnessed a discernible upswing, owing to a confluence of heightened mandatory disclosures and a sustained equilibrium in voluntary disclosures. ED content exhibits considerable heterogeneity across firms, given its largely unregulated nature (Cormier *et al.*, 2011). Integral to the UK's legal framework for ED are the reporting requirements emanating from the operating and financial review (OFR), enshrined in the Companies Act 1985. However, the OFR has been criticised for its perceived onerous nature, prompting scrutiny by scholars such as Williamson and Lynch-Wood (2008). The UK government, through an amendment to the Companies Act in 2006, stressed the significance of environmental reporting, mandating firms to incorporate essential environmental issues in their annual reports while adhering to the UK government's Environmental Key Performance Indicators – reporting guidelines (Sun *et al.*, 2010). ED reporting in the UK is primarily a voluntary self-regulatory endeavour, subject to the influence of diverse international and national environmental reporting frameworks and initiatives, such as the Global Reporting Initiative, which plays a pivotal role in shaping environmental reporting practices (Aburaya, 2012).

Unlike the UK approach, ED in the US is marked by a pronounced legislative orientation that mandates a comprehensive disclosure narrative within published annual reports (Holland and Foo, 2003). Over recent decades, there has been a substantial surge in the volume of ED emanating from US corporations, mirroring the increased legislative emphasis and a growing demand for mandatory disclosure within the US (Buhr and Freedman, 2001). Nevertheless, while sustainability reporting is not entirely obligatory in the US, Júlvez (2022) notes that firms are compelled to disclose environmental information, encompassing ESG opportunities and risks, to key stakeholders. A critical distinction emerges in the nature of environmental information sought in the UK *vis-à-vis* the US. The global and European markets demonstrate growing concern for ED, focusing mainly on policies such as establishing a climate change committee. Conversely, the US market emphasises the nexus between business activities and environmental degradation, exemplified by a specific interest in carbon emissions (Eccles *et al.*, 2011). Consequently, the varying demands of stakeholders in the two jurisdictions are likely to manifest in divergent qualities and quantities of ED among firms in both contexts.

The domain of CG is subject to notable disparities across both countries, reflecting diversity in cultural and regulatory circumstances. Despite these distinctions, the fundamental focus of CG remains oriented towards shareholder interests. Given the variations in accounting history and reporting requisites, it is imperative to empirically examine the impact of CG structures on ED in the UK and the US contexts. An insightful comparison of these two environments will yield nuanced findings that will help clarify how the evolution of CG codes and reporting standards has contributed to the distinct governance and disclosure practices among firms in these settings. Such an examination is vital to advance our understanding of the intricate interplay between CG frameworks and ED dynamics.

3. Theoretical literature review

Prior research (e.g. Liao *et al.*, 2015; Solikhah and Winarsih, 2016) has explored firms' decisions to engage in ED through diverse theoretical perspectives. Notably, the theoretical frameworks commonly applied in understanding the relationship between CG and ED include agency theory (Gerged *et al.*, 2023), legitimacy theory (Solikhah and Winarsih, 2016) and stakeholder theory (Liao *et al.*, 2015). Recognising the nuanced overlaps among these theoretical paradigms, this study adopts an approach that draws on multiple perspectives, i.e. agency, legitimacy and stakeholder theories, to delve into the complex connections between CG mechanisms and ED practices.

Within the agency theory framework (Fama and Jensen, 1983), the focal concern revolves around the emergence of agency conflicts when managerial actions deviate from the interests of principals, potentially leading to escalated agency costs and a misrepresentation of a firm's financial performance and market valuation for stakeholders. Such misalignment could, in turn, trigger suboptimal investment decisions (Zahra *et al.*, 2005). Strengthening CG practices can help overcome these adverse selection problems by reducing information asymmetry (Beyer *et al.*, 2010). Agency theory offers a conceptual platform to scrutinise the interplay between governance mechanisms and asymmetric information, positing that robust internal governance structures are imperative to align managerial actions with principals' interests (Haniffa and Cooke, 2005; Khan *et al.*, 2013). Moreover, an enhanced relationship with stakeholders and a sound corporate reputation, such as through higher ED, can support access to capital financing, augmenting a firm's competitive advantage and investor appeal (Beyer *et al.*, 2010). However, it is essential to note that substantial criticisms are directed at agency theory for its purported limitations in capturing the diverse motivations underlying individual behaviours.

The criticisms of agency theory have incentivised the rise of competing theories, including legitimacy theory. Dowling and Pfeffer's (1975) formulation of legitimacy theory posits the existence of a "social contract" between society and corporations, wherein legitimacy is attained when a firm's values align with the broader societal system. Legitimacy theory emphasises the role of effective communication to stakeholders in establishing and maintaining legitimacy, acknowledging that firms are bound by social contracts that compel the disclosure of various corporate social activities, thereby enhancing public acceptance and ensuring organisational survival (Solikhah and Winarsih, 2016). Firms, in pursuit of legitimacy, can increase the disclosure level to communicate to society about their organisational activities and to reaffirm that they operate within societal norms and boundaries. ED emerges as a crucial tool within this framework, as it serves to convey the extent of a firm's engagement with its operating environment (society), influencing societal perceptions and acting as a strategic mechanism to preclude environmental and social conflicts while addressing legitimacy gaps (Yu and Rowe, 2017).

Aligned with legitimacy theory, Chithambo *et al.* (2022) assert the indispensability of stakeholder support for corporate survival, thereby positioning stakeholder theory as a critical reference point for understanding firms' disclosure efforts. Stakeholder theory, rooted in the idea that firms should operate both for their own benefit and that of their

stakeholders (Jizi *et al.*, 2014), underscores the dual roles of managers as agents of principals and agents representing other stakeholders. Faced with the obligation of accommodating diverse stakeholders' needs and interests in operational decisions, firms use disclosures to communicate their actions to stakeholders to secure sustained access to critical resources for future control (Wakaisuka-Isingoma *et al.*, 2016). Strategies that emphasise environmental responsibility and advance positive stakeholder relationships become vital, as such relationships not only support a firm's survival but also facilitate the alignment of the firm's goals with those of the stakeholders. Within this context, ED assumes the role of an accountability tool that effectively addresses the informational requirements of stakeholders (including suppliers, customers, investors, shareholders, social activists and regulators) and promotes a harmonious and supportive relationship between the firm and society.

The agency, legitimacy and stakeholder theories provide crucial insights that help explain the association between CG and ED. The agency theory emphasises the need for good governance to enhance corporate transparency, including ED, while legitimacy and stakeholder theories explain the diverse corporate motivations to provide higher ED. Collectively based on these theories, it can be argued that better-governed firms can reduce information asymmetry (agency theory), fulfil social contracts (legitimacy theory) and cater to stakeholder interests (stakeholder theory) by providing higher disclosure about a firm's environmental impacts.

4. Empirical literature review and hypotheses development

4.1 Board characteristics and environmental disclosure

The impact of board size on the extent of firms' disclosure has been a subject of substantial scholarly debate (Ntim and Osei, 2011). According to the agency theory, the board of directors is responsible for formulating ED plans and ensuring the disclosure of environmental activities to meet stakeholder requirements and fulfil social contracts. The discourse on the optimal board size has been a matter of theoretical and empirical contention, with initial conceptualisations proposing that a larger board size may compromise communication, coordination and decision-making efficiency (Sharma *et al.*, 2023). Smaller boards are argued to facilitate effective coordination and reduce the likelihood of communication breakdowns. However, they carry the drawback of overburdening individual directors with increased responsibilities, potentially diminishing the board's supervisory capacity (John and Senbet, 1998). From the stakeholder theory perspective, larger boards aid in the representation of diverse stakeholder interests and provide the benefits of diversified expertise among members (Sun *et al.*, 2010; Allegrini and Greco, 2013).

Empirical investigations have yielded contrasting results. Samahaa *et al.* (2015) find a positive impact of board size on voluntary disclosure by firms. Tran *et al.* (2021) reveal a positive effect of board size on sustainability disclosure. Similarly, Nguyen *et al.* (2021) find a positive impact of board size on environmental performance. Specifically, Gerged *et al.* (2023) find that board size positively impacts a firm's ED. Further insights from Trireksani and Djajadikerta (2016) indicate a positive link between board size and the extent of ED in Indonesia, similar to the findings of Osazuwa *et al.* (2016) in the Nigerian context. In contrast, Michelon and Parbonetti (2012) and Shahab *et al.* (2020) find an insignificant impact of board size on environmental reporting and disclosure.

In the UK, Jizi (2017) finds an insignificant impact of board size on the disclosure of social and ethical policies, while Liao *et al.* (2015) and Tauringana and Chithambo (2015) find a positive influence of board size on greenhouse gas disclosure. In the US, Arena *et al.* (2015) report that larger board size is associated with higher environmental press releases. Given the overall conflicting empirical evidence, a non-directional hypothesis is formulated:

H1. Board size has a significant impact on the environmental disclosure practices of the UK and US firms.

According to the agency theory, the role of independent directors is crucial in reducing agency costs, as they are seen as representatives of the principal's interests (Fama and Jensen, 1983). Similarly, the stakeholder theory also places importance on protecting stakeholders' interests by including independent directors on the board because of their autonomy and lack of personal interests that might conflict with those of stakeholders (Jizi *et al.*, 2014). Independent directors are more likely to provide independent advice and reduce opportunistic behaviour. Regarding ED, independent directors act as potential catalysts for encouraging the disclosure of ESG information, as they bring an impartial perspective to the governance process and increase organisational transparency (Ding *et al.*, 2022).

Empirically, previous studies have substantiated the positive role of independent directors in improving ED. For instance, Ofoegbu *et al.* (2018) report a positive association between board independence and ED in the South African and Nigerian contexts. Similarly, a positive relationship between board independence and ED is documented by Altawalbeh (2020) and Gerged (2021) in Jordan and Jahid *et al.* (2020) in Bangladesh. In contrast, Alodia and Atmadja (2018) find that board independence does not significantly influence corporate social responsibility (CSR) performance in Indonesia. Similarly, Nguyen *et al.* (2021) find a positive but insignificant association between board independence and environmental performance.

Specifically, in the UK, Jizi (2017) and Liao *et al.* (2015) find a positive association between higher board independence and ED, while Post *et al.* (2015) find a positive impact on environmental performance. Similarly, in the US, Giannarakis *et al.* (2020) reveal a positive impact of independent directors on ED. Given the positive theoretical and empirical impact, the following hypothesis is formulated:

H2. Board independence has a significant positive impact on the environmental disclosure practices of the UK and US firms.

Role duality, i.e. the coexistence of CEO and board chair responsibilities, is a crucial factor influencing corporate social and ED (Adams, 2002). According to the agency theory, role duality is argued to adversely affect board efficiency in overseeing management activities (Haniffa and Cooke, 2002) and deemed detrimental to the quality of disclosures (Forker, 1992). The agency theory advocates for a segregated leadership structure for improved control and monitoring of managers (Buchanan *et al.*, 2014). Therefore, role duality is viewed as a potential impediment to overall board effectiveness, as it allows the CEO to intervene in board matters. The contention is that a distinct leadership framework, characterised by separate CEO and board chair roles, would facilitate superior social and ED. From the stakeholder perspective, the accumulation of power by a single individual may lead to decisions that are in their personal interests rather than those of the stakeholders and society (Jizi *et al.*, 2014).

Empirical findings on the impact of role duality provide contrasting results. Gerged (2021) find a positive association between role duality and ED. However, Ho and Wong (2001) and Michelon and Parbonetti (2012) find no significant relationship between role duality and disclosure levels. Conversely, consistent with the agency theory, Haniffa and Cooke (2002), Gul and Leung (2004) and Samahaa *et al.* (2015) highlight the negative impact of role duality on voluntary disclosure. Similarly, Shahab *et al.* (2020) find a negative impact of role duality on environmental reporting.

In the UK, Helfaya and Moussa (2017) report an insignificant impact of role duality on environmental sustainability disclosure, while in the US, Tamimi and Sebastianelli (2017) reveal a positive association between CEO duality and increased ESG disclosure scores

compared to financial information disclosure. Given the contrasting empirical evidence on the impact of role duality, the following hypothesis is proposed:

H3. Role duality has a significant impact on the environmental disclosure practices of the UK and US firms.

According to the agency theory, board meetings are a crucial mechanism for effective monitoring within organisations (Vafeas, 1999). Board meetings help to exert control over organisational activities and are critical in mitigating agency conflicts (Xie *et al.*, 2003). Board meetings are perceived to facilitate the flow of opinions and information, which helps enhance board effectiveness (Altawalbeh, 2020). Theoretically, there are diverse perspectives about the potential impact of board meeting frequency. For instance, Vafeas (1999) considers that an increased meeting frequency might diminish overall company value. In contrast, Ntim and Osei (2011) reveal that a higher frequency of board meetings can boost organisational value and contribute to effective monitoring and control. Vafeas (1999) indicates that board meeting frequency increases when firm complexity rises, or there is a presence of growth opportunities; thus, increased meeting frequency helps to deal with these crucial issues.

In terms of empirical results, Allegrini and Greco (2013) find a positive association between board meetings and ED. Similarly, Nguyen *et al.* (2021) find a positive association between board meetings and environmental performance in Chinese firms. However, Osazuwa *et al.* (2016) highlight a negative relationship between board meetings and ED. This is corroborated by Kantudu and Samaila (2015), who report an inverse association between board meeting frequency and the quality of financial reporting.

Specifically in the UK, Jizi (2017) observes that a higher frequency of board meetings positively influences CSR disclosure. In the US, Relia and L'Abate (2022) find a positive impact of board meeting frequency on the level of ESG disclosure. Given the inconsistent theoretical and empirical findings in the literature, the following hypothesis is proposed:

H4. Board meetings have a significant impact on the environmental disclosure practices of the UK and US firms.

The potential impact of female representation on corporate boards has also garnered scholarly traction. According to the agency theory, gender diversity on the board results in a more balanced board composition and enhances decision-making quality (Basuony *et al.*, 2018). According to the stakeholder theory, higher gender diversity can enhance the board's autonomy by improving the relationship between the management and stakeholders (Amorelli and García-Sánchez, 2021). Furthermore, Nielsen and Huse (2010) posit that female directors may exhibit a heightened interest in firm operations related to environmental policy and CSR. From the legitimacy perspective, their unique role is argued to foster moral legitimacy by promoting CSR practices, thereby contributing to organisations' attainment of social legitimacy and building a competitive advantage (Rao and Tilt, 2016).

Empirical studies present mixed findings on the association between board gender diversity and corporate disclosures. For instance, Tran *et al.* (2021) find that board gender diversity positively influences sustainability disclosure. Similarly, Tingbani *et al.* (2020) report a positive influence of gender diversity on greenhouse gas disclosure. This positive association is further corroborated by Jahid *et al.* (2020) in the case of CSR disclosure. Similarly, Orazalin *et al.* (2024) and Elmagrhi *et al.* (2019) find a positive impact of female members on carbon and environmental performance. In contrast, Cucari *et al.* (2017) uncovered a negative relationship between board diversity and ESG disclosure. Furthermore, Alodia and Atmadja (2018) find an insignificant impact of board gender diversity on CSR reports. Similarly, Nguyen *et al.* (2021) report an insignificant impact of gender diversity on environmental performance.

Specifically in the UK, Jizi (2017) finds that board gender diversity positively influences ED. Similarly, Liao *et al.* (2015) find that gender diversity positively influences greenhouse gas disclosures. In the US context, Tamimi and Sebastianelli (2017) detect a positive impact of gender diversity on ESG disclosure scores. Given the overall inconsistency in the empirical evidence, a non-directional hypothesis is formulated:

H5. Board gender diversity has a significant impact on the environmental disclosure practices of the UK and US firms.

4.2 Audit committee characteristics and environmental disclosure

The audit committee is a fundamental aspect of CG structures and plays a critical role in improving disclosures by firms (Buallay and Al-Ajmi, 2019). According to the agency theory (Jensen and Meckling, 1976), the audit committee is an effective mechanism to reduce agency costs and enhance monitoring. A larger audit committee size is claimed to offer ample resources and technical proficiency necessary for effective monitoring processes (Buallay and Al-Ajmi, 2019). However, the potential drawbacks of larger audit committees, as noted by Jensen (2010), include increased marginal costs, the risk of poor control, communication breakdowns and coordination challenges. In addition, concerns about the presence of free riders and divergent duties within extra-large committees may impede and diminish their effectiveness (Li *et al.*, 2012).

Empirical investigations into the impact of audit committee size yield varied findings. For instance, Jahid *et al.* (2020) explore the influence of CG mechanisms on CSR disclosure in Bangladesh, revealing a negative impact of audit committee size on CSR disclosure. Similarly, Dwekat *et al.* (2020) also find a negative effect of audit committee size on the level of CSR disclosure. In contrast, Hasan *et al.* (2022) find that audit committee size positively impacts sustainability disclosures.

In the UK, Al-Shaer *et al.* (2017) find an insignificant effect of audit committee size on the quantity and quality of environmental accounting disclosures. Similarly, in the context of US firms, Jizi *et al.* (2014) report an insignificant effect of audit committee size on CSR disclosure. Given the contradictory insights from the empirical literature, the following hypothesis is proposed:

H6. Audit committee size has a significant impact on the environmental disclosure practices of the UK and US firms.

The audit committee plays a pivotal role in oversight and control functions, contributing to the realisation of CG objectives. However, according to the agency theory, audit committee independence is a fundamental factor in ensuring the committee's effectiveness as it aids in mitigating and addressing agency problems (Xie *et al.*, 2003). Scholars have suggested that an appropriate number of independent members on the audit committee is essential to ensure its efficacy in fulfilling its monitoring responsibilities and overcoming agency challenges (Ghafran and O'Sullivan, 2012). Furthermore, audit committee independence can facilitate greater accountability and enhance overall transparency (Anwar *et al.*, 2024). In addition, independent audit committee members can help mitigate risk and improve firm performance (Dionne and Triki, 2005).

In terms of empirical evidence, Taylor and Zhang (2011) find a positive association between audit committee independence and voluntary disclosure. These findings are corroborated by Samahaa *et al.* (2015), who observe a positive association between audit committee independence and corporate voluntary disclosure. Similarly, Altawalbeh (2020) reports that a higher degree of audit committee independence significantly influences the level of voluntary disclosure. In contrast, Akbas (2016) reported that audit committee independence is negatively associated with ED, although this impact was statistically

insignificant. Similarly, Li *et al.* (2012) find an insignificant influence of audit committee independence on ED.

Within the UK context, Al-Shaer (2014) reinforces the positive impact of higher audit committee independence on ED. Despite limited research examining the effects of audit committee independence on ED among US firms, broader investigations suggest a positive impact of audit committee independence on other disclosure types, such as internet financial reporting (Kelton and Yang, 2008). Due to the limited US and UK evidence and the conflicting results found in other contexts, a non-directional hypothesis is proposed:

H7. Audit committee independence has a significant impact on the environmental disclosure practices of the UK and US firms.

5. Research design

5.1 Sampling and data

This research uses a sample of FTSE 350 and S&P 500 firms from 2010 to 2020. The Yamane formula is used to determine the study sample from both indexes. The Yamane (1967) formula is given as:

$$v = \frac{P}{1 + P(a)^2} \tag{1}$$

Where v is the sample size, P is the population size and a is the margin of error. Using equation (1), the calculated sample size for FTSE 350 is 187 firms, while the sample size for S&P 500 is determined to be 222 firms. Based on the Yamane formula, data for 187 FTSE firms and 222 S&P firms were collected. The availability of the complete data was a key metric used for selecting the final sample. Specifically, a filtering technique was applied to exclude firms with missing data. Following this procedure, 66 FTSE and 22 S&P firms were eliminated from the sample. This refinement reduced the sample size to 121 FTSE and 200 S&P firms. These are considered the minimum samples needed for FTSE 350 and S&P 500 firms to infer the results of this study. Table 1 outlines the process used for sampling. All data used in this study are sourced from the Refinitiv Eikon Database, with both independent and dependent variables collected annually, thus constituting panel data due to the inclusion of both time-series and cross-sectional attributes.

5.2 Dependent variable

The dependent variable in the study is corporate ED. Broadly, Berthelot *et al.* (2003) define corporate ED as a collection of information incorporating a firm's historical, current and prospective environmental management activities and performance. It also includes details about the financial implications, both past and future, arising from a company's environmental management initiatives. Corporate ED is conceptualised as the communication of information regarding the impact of business and economic operations on the natural physical environment, intended for consumption by diverse stakeholders.

Table 1 Sampling process

Sampling process	*Number of companies*		
	FTSE	*S&P*	*Total*
Total firms	350	500	850
Selected sample (Yamane formula)	187	222	409
Less: Firms with missing data	(66)	(22)	(88)
Final sample	121	200	321

Source: Created by the authors

Here, ED is viewed as an outcome of robust CG practices that embed transparency into environmental performance. Therefore, the robust application of CG principles is anticipated to lead to optimal ED outcomes (Solikhah and Maulina, 2021).

A distinctive feature of environmental reporting frameworks, as developed by organisations such as the Organisation for Economic Co-operation and Development, the Association of Chartered Certified Accountants, the Institute for Social and Ethical Accounting, is a concerted effort to establish connections between CG structures, social and environmental accounting and stakeholder disclosures (Boesso and Kumar, 2007). In this study, corporate ED encompasses communication about the firm's environmental policies, products, sustainability efforts and other information related to environmental aspects. Hence, consistent with prior literature, this study uses the environmental pillar score of the ESG index as a metric for evaluating the extent of ED (Giannarakis *et al.*, 2020; Sahin *et al.*, 2022). Refinitiv is a reliable provider of ESG data and accumulates scores related to environmental information, resource use and emissions into the overall environmental pillar score (Sahin *et al.*, 2022); hence, it is a relevant proxy to measure ED.

5.3 Independent and control variables

The independent variables examined in this study are related to the board and audit committee characteristics. Specifically, this research explores the influence of board size, board independence, board gender diversity, role duality, board meetings, audit committee size and audit committee independence on corporate ED. Board size refers to the total number of board members (Sharma *et al.*, 2023), while board independence is defined as the proportion of independent non-executive members relative to the total board members (Nguyen *et al.*, 2021). Board gender diversity is the ratio of female directors on the board (Tingbani *et al.*, 2020), while role duality is represented as a binary variable, taking the value of 1 when the same individual holds the CEO and chairperson roles and 0 otherwise. In addition, board meetings denote the total number of meetings conducted by the board in a year (Jizi, 2017). Furthermore, audit committee size is measured as the total number of members on the audit committee (Al-Shaer *et al.*, 2017), and audit committee independence is characterised as the ratio of independent non-executive directors serving on the audit committee (Li *et al.*, 2012).

Moreover, the study recognises the primacy of firm-specific attributes in evaluating the extent of corporate ED, as highlighted by prior research (Akbas, 2016). Consistent with existing literature, this research incorporates various firm attributes as control variables (Aburaya, 2012; Akbas, 2016; Agnese *et al.*, 2024). Specifically, the study uses firm size, firm age, board-specific skills and firm profitability, given their recognised significance in influencing corporate ED. Firm size is measured as the natural logarithm of total assets, firm profitability is measured using return on assets, firm age is represented by the number of years since the incorporation and board-specific skills are proxied by the percentage of board members with an industry-specific background or robust financial background. A detailed presentation of the variables and their corresponding measures is provided in Table 2.

5.4 Model specification

The econometric version of the study model is presented as follows:

$$\begin{aligned} ED_{i,t} = {} & \alpha_{0i,t} + \varphi_1 ED_{i,t-1} + \partial_1 BINDP_{i,t} + \partial_2 BSIZE_{i,t} + \partial_3 RLEDTY_{i,t} + \partial_4 BMEET_{i,t} \\ & + \partial_5 BGDTY_{i,t} + \partial_6 AUDC_{i,t} + \partial_7 ASIZE_{i,t} + \partial_8 FSIZE_{i,t} + \partial_9 PRFT_{i,t} \\ & + \partial_{10} FAGE_{i,t} + \partial_{11} BSSK_{i,t} + \delta_t + \gamma_i + \varepsilon_{i,t} \end{aligned} \quad (2)$$

where ED = environmental disclosure, BINDP = board independence, BSIZE = board size, RLEDTY = role duality, BMEET = board meetings, BGDTY = board gender diversity, AUDC = audit committee independence, ASIZE = audit committee size, FSIZE = firm size, PRFT = firm

Table 2 Measurement of variables

S/N	Variable	Code	Operational definition
Dependent variable			
1	Environmental disclosure	ED	Environmental pillar score of the ESG index
Independent variables			
2	Board size	BSIZE	Total number of directors on the board
3	Board independence	BINDP	The ratio of independent non-executive directors to total directors
4	Role duality	RLEDTY	Dummy variable: 1 if the CEO and chairperson are the same person, else 0
5	Board meeting	BMEET	Total number of meetings held by the board during the year
6	Board gender diversity	BGDTY	The proportion of female members on the board of directors
7	Audit committee size	ASIZE	Total number of directors on the audit committee
8	Audit committee independence	AUDC	The ratio of independent non-executive directors to total directors on the audit committee
Control variables			
9	Firm size	FSIZE	The natural log of total assets
10	Firm profitability	PRFT	Return on assets
11	Firm age	FAGE	Number of years since the incorporation of the firm
12	Board-specific skills	BSSK	The percentage of board members with an industry-specific background or strong financial background

Source: Created by the authors

profitability, FAGE = firm age, BSSK = board-specific skills, α = intercept, φ_1 = annual average adjustment speed (AS), that is, $(1 - \varphi_1)$, ∂_1, ∂_2, ∂_3, ∂_4, ∂_5, ∂_6, ∂_7, ∂_8, ∂_9, ∂_{10} and ∂_{11} = coefficient to be estimated. The *a priori* expectation, as derived from the theoretical literature, is stated as $\alpha > 0$, $\varphi_1 = |\varphi|$ (absolute value of AS), which could be high or low. This is interpreted as the rate at which firms adjust to their desired level of ED whenever UK and US firms deviate. δ_t = firm effect, γ_i = time effect, $\varepsilon_{i,t}$ = error term.

Equation (2) is estimated independently for the sample of FTSE 350 and S&P 500 firms to reveal more information for comparative purposes. It is also imperative to note that FSIZE, PRFT, FAGE and BSSK are controlled because they are significant determinants of ED.

5.5 Data analysis method

Regarding data analysis, this study uses several elementary tests, including descriptive statistics, correlation analysis, panel unit root tests and cointegration tests. These procedures assist in characterising the variables' properties through descriptive statistics, evaluate the strength and direction of interrelationships between variables via correlation analysis, examine the stationarity of variables using the augmented Dickey–Fuller (ADF) unit root test within a panel context, and assess long-run convergence associations among variables through the Kao panel cointegration test. Subsequently, the study adopts the system GMM regression method, as proposed by Blundell and Bond (1998), to analyse the cause-effect relationships among the variables of interest (Hauk and Wacziarg, 2009).

The preference for the system GMM technique is rooted in its demonstrated superiority over alternative methods, offering substantial efficiency gains. Unlike approaches like the two-stage least square, levels and difference levels GMM, the system GMM technique excels in handling challenges such as variable measurement bias, endogeneity problems and variable omission bias (Sun *et al.*, 2023). Furthermore, it does not necessitate the assumption of normal distribution among variables, ensuring unbiased and efficient outcomes about the impact of CG practices on ED. The evaluation of underlying hypotheses relies on parametric *t*-statistics and their associated probability values. Finally, post-regression assessments involve the Sargen J-statistic, Wald test and autocorrelation order one and two, i.e. AR (1) and AR (2), to validate the obtained results.

6. Empirical results and discussion

6.1 Descriptive statistics and preliminary analyses

Table 3 presents the descriptive statistics for the study variables, offering insights into the distribution properties and variations observed in the sample firms over the study period. The mean-to-median ratio of approximately one suggests a symmetrical distribution for most variables among S&P and FTSE firms, which indicates that these variables exhibit balanced distribution properties. The range between minimum and maximum values during the study period reflects diverse levels of CG, firm-specific factors and ED. Skewness values reveal the distribution characteristics, with negative skewness observed for most variables among S&P firms, indicating a longer tail to the left of the mean, except for firm age, board-specific skills, board meetings and profitability, which exhibit a longer tail to the right. For FTSE firms, ED, audit committee independence and board gender diversity display a long left tail, while other variables exhibit right skewness.

Furthermore, the average ED level in the US is approximately 59.1%, while it is around 54% in the UK. The average board size is 11 in the US and 9 in the UK, with board independence at 86.6% and 70.9%, respectively. Role duality in the US averages 0.746, indicating a significant number of firms with a dual role for the CEO, while in the UK, it is 0.068. The average number of board meetings is eight in the US and the UK, with board gender diversity at 64.4% and 56%, respectively. In terms of audit committees, the average size is 4.27 in the US and 3.94 in the UK, and audit committee independence averages 99% in the

Table 3 Descriptive statistics

	S&P 500 firms						*FTSE 350 firms*					
Variable	*Mean*	*Median*	*Max*	*Min*	*Skew*	*Kurtosis*	*Mean*	*Median*	*Max*	*Min*	*Skew*	*Kurtosis*
Dependent variable												
Environmental disclosure	59.079	62.275	95.190	6.770	−0.436	2.360	54.017	54.600	90.770	10.320	−0.174	2.314
Independent variables												
Board size	11.133	11.000	22.000	1.000	−0.008	4.368	9.059	9.000	17.000	1.000	0.501	3.233
Board independence	0.866	0.888	1.000	0.500	−1.226	4.666	0.709	0.714	1.000	0.266	0.312	3.269
Role duality	0.746	1.000	1.000	0.000	−1.132	2.282	0.068	0.000	1.000	0.000	3.412	12.645
Board meeting	8.049	7.000	37.000	1.000	2.117	11.327	8.276	8.000	28.000	2.000	1.967	10.702
Board gender diversity	0.644	0.672	0.997	0.053	−0.644	2.647	0.559	0.567	0.998	0.037	−0.132	1.806
Audit committee size	4.270	4.000	7.000	1.000	−0.012	2.105	3.940	3.000	8.000	2.000	6.967	126.371
Audit committee independence	0.994	1.000	1.000	0.333	−9.416	138.343	0.963	1.000	1.000	0.142	−3.348	16.210
Control variables												
Firm profitability	0.068	0.058	0.457	−0.347	0.496	7.343	0.064	0.060	0.290	−0.270	0.214	7.911
Firm age	44.190	33.000	139.000	6.000	1.237	3.720	49.800	38.500	132.000	5.000	0.833	2.808
Firm size	10.303	10.310	12.530	1.800	−5.217	50.776	9.703	9.600	12.170	8.360	1.001	3.887
Board specific skills	0.474	0.460	0.990	0.150	0.107	1.832	0.509	0.510	0.993	0.110	0.011	1.808

Source: Created by the authors

US and 96% in the UK. In terms of control variables, the average profitability is 6.8% in the US and 6.4% in the UK. The average firm age is 44.19 years in the US and 49.8 years in the UK. The average firm size after logarithmic transformation is 10.3 in the US and 9.7 in the UK, while the average board-specific skills in the US are 47.4% and 50.9% in the UK. Furthermore, the Jarque–Bera statistics' probability values, assessing skewness and kurtosis, are significant at a 1% confidence level for all variables in both S&P and FTSE firms, indicating a non-normal distribution. However, this is inconsequential for the study's estimation technique (system GMM), which does not require normal distribution to generate an efficient estimate.

Examining stationarity in the panel data set is crucial, given its time-series characteristics. Using the ADF unit root test, the study identifies stationary variables for both S&P and FTSE firms. These include ED, board size, board meetings, board independence, profitability and board-specific skills. For non-stationary variables, such as role duality, audit committee size, firm age, audit committee independence, firm size and board gender diversity, the first difference is applied, rendering them stationary. Consequently, all variables for both FTSE and S&P firms are established as stationary and integrated of order I(0) and I(1) at 5% and 10% confidence levels, respectively. Furthermore, investigating cointegration reveals significant Kao ADF statistics at a 5% confidence level, indicating a cointegrating relationship among the variables for firms in both countries. This suggests the presence of a long-run relationship, wherein variables adjust to long-run equilibrium following short-run shocks.

6.2 Correlation analysis

The correlation structure between variables considered for S&P and FTSE firms is investigated through the Spearman correlation matrix, presented in Table 4. In S&P firms, role duality, audit committee size, profitability and board-specific skills exhibit weak inverse associations with ED, denoted by correlation coefficients of approximately −0.04, −0.21, −0.01 and −0.07, respectively. Conversely, other CG and firm-specific variables reveal weak positive relationships with ED. Regarding FTSE firms, only role duality, audit committee size, profitability and board-specific skills display weak negative associations with ED, as evidenced by correlation coefficients around −0.07, −0.13, −0.18 and −0.16, respectively. Meanwhile, the remaining variables exhibit positive correlations with ED. It is worth noting that none of the correlation coefficients across all variables exceeds 0.70, indicating the absence of multicollinearity among explanatory variables for both S&P and FTSE firms.

6.3 Generalised method of moment results

Table 5 presents results indicating sufficient instruments used in both models, as evidenced by the J-statistic corresponding probability values exceeding 0.25. This suggests that the internal instrumental variables (IV) used exhibit exogenous associations with their respective error terms, affirming the models' validity. The absence of autocorrelation is confirmed in both models, as denoted by the insignificant AR (2) coefficient. Taken together, the coefficients of the explanatory variables significantly influence the dynamics of ED throughout the studied period, as supported by the significant Wald test statistic.

In terms of individual variables, only the lag of ED, board independence, board meetings, profitability, board-specific skills and firm size demonstrate significance in the FTSE firms, as outlined in Table 5. Similarly, for S&P firms, significance is observed for the lag of ED, board independence, audit committee independence, firm size and board-specific skills. The lagged ED in both FTSE and S&P models is significant at the 1% level, indicating that, with other factors held constant, the lagged ED significantly influences current-year ED in firms from the UK and the US. All else equal, approximately 29% and 31% of the change in

Table 4 Correlation matrix

	Environmental disclosure	Board size	Board independence	Role duality	Board meeting	Board gender diversity	Audit committee size	Audit committee independence	Firm profitability	Firm age	Firm size	Board specific skills
Environmental disclosure		0.386	0.322	−0.066	0.049	0.314	−0.126	0.123	−0.177	0.197	0.491	−0.156
Board size	0.207		0.179	−0.036	−0.026	0.123	0.005	0.044	−0.278	−0.044	0.664	−0.128
Board independence	0.311	0.299		−0.188	0.006	0.070	−0.222	−0.064	−0.078	0.063	0.181	−0.354
Role duality	−0.043	0.079	0.064		−0.057	−0.052	0.360	0.054	0.044	−0.139	−0.121	0.128
Board meeting	0.126	0.144	0.061	−0.043		−0.099	−0.135	−0.044	−0.048	0.144	0.057	−0.009
Board gender diversity	0.387	0.118	0.230	0.033	0.055		−0.113	0.039	0.038	0.012	0.163	−0.106
Audit committee size	−0.206	−0.147	−0.227	0.109	−0.239	−0.165		−0.0134	0.089	−0.135	−0.103	0.017
Audit committee independence	0.069	0.109	0.060	−0.013	−0.102	−0.027	0.0648		0.065	−0.042	0.153	0.109
Firm profitability	−0.012	−0.137	−0.146	0.006	−0.211	−0.049	0.128	−0.015		0.016	−0.405	−0.048
Firm age	0.009	0.004	0.013	0.049	0.029	−0.036	0.006	0.019	0.036		−0.039	−0.122
Firm size	0.205	0.235	0.193	0.103	0.039	0.091	−0.150	0.143	−0.387	0.005		−0.065
Board specific skills	−0.075	−0.278	−0.253	−0.033	0.004	−0.093	0.083	−0.087	0.013	−0.059	−0.143	

Notes: Lower-triangular cells report correlation coefficients for S&P 500 firms, upper-triangular cells depict coefficients for FTSE 350 firms
Source: Created by the authors

Table 5 System GMM estimation

	Dependent variable = environmental disclosure			
	FTSE 350 firms		*S&P 500 firms*	
Variables	*Coefficient*	t-*statistic*	*Coefficient*	t-*statistic*
Environmental disclosure (−1)	0.294***	3.264	0.313***	3.595
Speed of adjustment	*1–0.2942 = 0.7058 (71%)*		*1–0.3138 = 0.6862 (69%)*	
Independent variables				
Board size	−1.269	−1.591	−0.535	−0.855
Board independence	0.301***	2.912	1.005***	4.483
Role duality	11.363	1.590	−2.438	−0.578
Board meeting	−0.599*	−1.622	0.014	0.108
Board gender diversity	0.010	0.215	0.066	1.208
Audit committee size	1.121	1.244	0.079	1.239
Audit committee independence	0.177	1.207	−0.618**	−2.068
Control variables				
Firm profitability	−51.031**	−2.068	13.852	0.868
Firm age	28.468	0.823	12.645	0.590
Firm size	26.589***	3.310	18.603***	3.682
Board specific skills	−0.125***	2.513	0.150***	4.731
Model summary				
	Coefficient	Prob	Coefficient	Prob
J-Statistic	34.73	0.385	37.833	0.568
AR (1)	−3.427***	0.000	−3.680***	0.000
AR (2)	−1.541	0.123	−0.822	0.410
Wald test	21.498***	0.000	8.458***	0.000
No. of instruments rank	44	–	52	–

Notes: ***$p < 0.01$; **$p < 0.05$; *$p < 0.1$
Source: Created by the authors

the mean of current ED in UK and US firms, respectively, can be attributed to a 100% change in their lagged ED.

Both FTSE and S&P firms exhibit a lagged ED coefficient ranging between 0 and 1, indicative of an adjustment policy, signifying that these firms swiftly adjust to the optimal ED. A high SOA is observed, with FTSE and S&P firms adjusting at approximate rates of 71% and 69%, respectively, in response to any deviation from the desired level of ED. This swift adjustment can be attributed to the stringent ED policies in their operational landscapes, where the benefits of optimal ED outweigh the associated adjustment costs. The variability in the SOA between the two sets of firms is likely influenced by differences in operating environment policies and institutional frameworks. The projected time for FTSE firms to achieve this adjustment to the desired ED level is estimated to be one year and four months. In comparison, S&P firms are anticipated to take approximately one year and five months to reach the desired level of ED.

Regarding board characteristics, the impact of board size is insignificant in both models, which is inconsistent with *H1*. This implies that board size does not significantly influence ED practices in UK and US firms during the study period. Interestingly, the insignificant results reveal an inverse relationship between board size and ED. This finding aligns with certain studies, such as Michelon and Parbonetti (2012) and Jizi (2017), which similarly report an insignificant impact of board size. These results diverge from other studies, such as Osazuwa *et al.* (2016), Samahaa *et al.* (2015), Nguyen *et al.* (2021) and Arena *et al.* (2015), which report a significant positive link between board size, ED and environmental performance. Despite the lack of statistical significance, these results suggest that the presumed advantages of larger boards, such as diverse expertise and representation of stakeholder interests (Sun *et al.*, 2010; Allegrini and Greco, 2013), do not necessarily contribute to improved ED in the UK and the US. The insignificant but directionally negative impact also implies that smaller boards

might exhibit greater openness to ED, potentially owing to enhanced coordination, communication and more effective decision-making processes (Sharma *et al.*, 2023).

Furthermore, the impact of board independence is significant and positive for both FTSE ($p < 0.01$) and S&P firms ($p < 0.01$), which is consistent with *H2*. This signifies that board independence positively impacts ED practices in UK and US firms, reinforcing the argument that independent directors effectively represent stakeholders' perspectives (Jizi *et al.*, 2014) and facilitate firms to obtain legitimacy, a facet not achieved simply by expanding board size, as evidenced by the results of this study. These results also imply that independent board members within UK and US firms prioritise reducing agency costs by enhancing environmental information disclosure, a perspective consistent with the agency theory framework (Ding *et al.*, 2022). These results are consistent with Ofoegbu *et al.* (2018), Altawalbeh (2020) and Gerged (2021), who find that board independence positively influences ED. This positive relationship is also consistent with previous investigations in the US (Giannarakis *et al.*, 2020) and the UK (Liao *et al.*, 2015; Post *et al.*, 2015; Jizi, 2017). Overall, the results suggest that including independent directors on the board is an effective tool to reduce agency costs, encourage transparency, cater to stakeholder needs and fulfil social contracts to obtain organisational legitimacy within the UK and US contexts.

The impact of role duality is insignificant for both FTSE and S&P firms, which is inconsistent with *H3*. Moreover, role duality manifests a mixed influence on ED in both models, with a positive effect for FTSE firms and a negative effect for S&P companies. Theoretically, these results suggest that the challenges associated with CEO duality, as highlighted in the literature (Forker, 1992; Haniffa and Cooke, 2002), do not significantly impact firms' ED practices. These results align with studies reporting an insignificant impact of role duality on ED, such as Ho and Wong (2001) and Michelon and Parbonetti (2012). However, the results diverge from the findings of Tamimi and Sebastianelli (2017), who identify a positive influence of role duality on ESG disclosure scores in US firms. In the UK context, the results are consistent with prior studies indicating an insignificant influence of role duality on environmental sustainability disclosure (Helfaya and Moussa, 2017).

Moreover, consistent with *H4*, the impact of board meetings is significant for the UK ($p < 0.10$) but insignificant for US firms. This implies that board meetings do not significantly impact ED practices in US firms during the studied period. In contrast, board meetings negatively influence ED in the UK, suggesting that the enhanced effectiveness resulting from board meetings (Altawalbeh, 2020) does not contribute positively to ED but rather discourages it. Despite being perceived as an effective monitoring mechanism (Vafeas, 1999), the results suggest that a higher board meeting frequency might decrease the level of ED in UK firms. These results are consistent with the findings of Kantudu and Samaila (2015) and Osazuwa *et al.* (2016). These outcomes contradict prior research findings in the UK and US contexts, which find a positive impact of board meetings on CSR and ESG disclosure (Jizi, 2017; Relia and L'Abate, 2022). These results suggest that an excessively high board meeting frequency in UK firms can be detrimental to ED. Vafeas (1999) argue that board meeting frequency increases with a rise in firm complexity and the presence of growth opportunities, such as mergers and acquisitions. Therefore, a high board meeting frequency may imply that the board is focused on addressing these crucial issues. In doing so, less attention may be placed on environmental issues, which may have a detrimental impact on ED. Therefore, an optimal frequency of meetings (not excessively high) may be more conducive towards encouraging higher ED by UK firms.

In addition, the impact of board gender diversity on ED for both FTSE and S&P firms is insignificant, which is inconsistent with *H5*. These results suggest that, when accounting for methodological considerations in previous studies, the previously observed positive impact of female representation, such as the promotion of moral legitimacy (Rao and Tilt, 2016), becomes statistically insignificant. Furthermore, the lack of significance may be

attributed to the disingenuous nature of gender diversity, marked by underlying gender discrimination and biases that hinder the effective contribution of females to leadership and strategy (Issa and Fang, 2019). These results are inconsistent with previous empirical studies that explore the impact of gender diversity on sustainability disclosure (Tran *et al.*, 2021), CSR reporting (Jahid *et al.*, 2020) and greenhouse gas disclosure (Tingbani *et al.*, 2020). However, the findings align with Alodia and Atmadja (2018) and Nguyen *et al.* (2021), who uncovered an insignificant impact of gender diversity. Moreover, the results of this research contrast earlier findings in the US (Tamimi and Sebastianelli, 2017) and UK contexts (Jizi, 2017), which indicate a positive influence of gender diversity on ESG disclosure and ED, respectively.

The impact of audit committee size on ED for both FTSE and S&P firms is insignificant, which is inconsistent with *H6*. This suggests that audit committee size does not significantly influence ED practices in the UK and US firms. While the results indicate that an increased committee size could potentially provide technical knowledge conducive to effective monitoring for increased ED, the observed effect lacks statistical significance. These results are inconsistent with previous empirical findings regarding CSR disclosure (Dwekat *et al.*, 2020; Jahid *et al.*, 2020) and sustainability disclosure (Hasan *et al.*, 2022). Specifically, in the context of the UK and the US, the results of this study are consistent with prior research indicating that audit committee size does not significantly impact environmental and CSR disclosure (Jizi *et al.*, 2014; Al-Shaer *et al.*, 2017).

Furthermore, consistent with *H7*, the impact of audit committee independence is significant for US firms ($p < 0.05$) but insignificant for UK firms. This implies that audit committee independence significantly influences ED practices exclusively in US firms during the studied period, albeit with a negative effect. The results align with the findings of Akbas (2016), who reported a negative impact of audit committee independence on ED. The negative impact suggests that despite its role in overcoming agency problems and providing effective oversight (Aburaya, 2012), audit committee independence does not promote environmental information disclosure; rather, it diminishes it. This finding contradicts the positive impact reported by Taylor and Zhang (2011) and Altawalbeh (2020) on voluntary disclosures. Moreover, in the UK context, the results contrast with those of Al-Shaer (2014), who found a significant positive impact of audit committee independence on ED. In the US context, this finding is inconsistent with the positive impact observed in the case of internet financial reporting (Kelton and Yang, 2008). The results suggest that true independence and effectiveness in monitoring might be compromised under certain conditions, such as high workloads and lack of knowledge among independent directors. In addition, Lyon and Maxwell (2011) argue that when firms provide more positive ED, the risk of public backlash for greenwashing increases. Therefore, to mitigate this risk (Dionne and Triki, 2005), independent members on the audit committee may discourage the disclosure of environmental information.

Regarding the control variables, firm profitability has a negative and statistically significant impact on ED in the UK, while in the US, it has an insignificant positive impact. Firm size has a significant positive impact on ED in both UK and US firms. In contrast, Firm age has a statistically insignificant impact on ED in both models. The observed impact directions align with prior research findings (Aburaya, 2012; Akbas, 2016). In addition, board-specific skills have a mixed (positive and negative) significant impact on ED in the US and the UK, indicating that the proportion of board-specific skills within the board influences ED practices in both countries. This underscores the essential role of board-specific skills in shaping ED practices (Agnese *et al.*, 2024). Overall, these findings highlight the nuanced influence of various firm-specific variables on ED in the UK and US firms.

6.4 Robustness test

To ensure that the findings of this study are robust to alternate estimation techniques, we conduct an IV regression analysis. This is consistent with previous studies (e.g. Jo and

Harjoto, 2012) that have applied the IV method to address endogeneity issues. Specifically, we use the generalised two-stage least squares (G2SLS) technique to address potential endogeneity and random effects (Hassan and Wu, 2015). As shown in Table 6, the results of the G2SLS technique are consistent with the overall findings of the GMM model, with slight variations in the statistical significance. Although the impacts of board size, board gender diversity and audit committee size become significant in the G2SLS model, the GMM model is superior in terms of addressing dynamic, simultaneous and omitted variables endogeneities (Sun *et al.*, 2023); therefore, it is used as the main analysis in this study. Overall, the robustness test proves that our findings are robust to various model specifications and endogeneity concerns.

7. Summary and conclusion

CG has emerged as a distinctive facet of contemporary organisations, with a particular focus on addressing the complex challenges associated with corporate ED. Establishing robust CG practices is crucial for instilling transparency in environmental performance and advancing accountability to diverse stakeholders. This study examines the influence of CG on the ED practices of firms listed on the UK FTSE 350 and US S&P 500 indexes, using the dynamic panel regression framework of system GMM.

The research findings highlight the adaptive nature of UK and US firms, showcasing their inclination for swift adjustment policies to align with desired ED levels following deviations. CG variables, including board independence and board meetings, emerge as significant determinants of ED practices in the UK. Independent board members, in accordance with the tenets of agency theory (Fama and Jensen, 1983), play a pivotal role in representing stakeholders' perspectives, curbing agency costs and subsequently encouraging the disclosure of environmental information, as noted by Jizi (2017). Interestingly, a counterintuitive observation arises in the UK context, where a higher number of board meetings correlates with a reduction in the level of ED despite being viewed as an effective monitoring mechanism (Vafeas, 1999). Higher board meeting frequency may imply that the

Table 6 Robustness test (G2SLS)

Dependent variable = environmental disclosure				
	FTSE 350 firms		*S&P 500 firms*	
Variables	*Coefficient*	*Standard error*	*Coefficient*	*Standard error*
Independent variables				
Board size	−0.169	0.213	0.628***	0.177
Board independence	4.932**	2.009	23.804***	3.561
Role duality	1.287	2.564	−0.719	0.983
Board meeting	−2.464**	1.209	−0.033	0.088
Board gender diversity	8.608***	3.208	35.03***	3.782
Audit committee size	29.287***	7.059	−16.94**	7.755
Audit committee independence	−3.530	3.031	−11.472*	6.603
Control variables				
Firm profitability	6.214**	2.508	−2.135	5.194
Firm age	0.050	0.045	0.240***	0.041
Firm size	4.612***	0.549	0.469	0.289
Board specific skills	−4.726**	1.899	3.373*	1.753
Model summary				
No. of firms	121		200	
Wald chi^2	158.30***		297.78***	
R^2	0.374		0.137	

Notes: ***$p < 0.01$; **$p < 0.05$; *$p < 0.1$
Source: Created by the authors

board is meeting more frequently to address some crucial business issues (such as complex problems or growth opportunities), which may drive the focus away from environmental issues, thus resulting in lower ED. In the US, CG variables such as board independence and audit committee independence significantly influence ED practices. While the positive impact of board independence aligns with the UK findings, the unanticipated negative impact of audit committee independence prompts further exploration into the intricate dynamics between oversight mechanisms and ED in the US context. Such a finding may indicate the risk-averse nature of independent members on the audit committee (Dionne and Triki, 2005), who may discourage ED to avoid any public backlash for greenwashing (Lyon and Maxwell, 2011). This finding emphasises the need for a nuanced understanding of the interplay between governance structures and ED practices in different regulatory contexts.

This research contributes to the existing body of knowledge by using the system GMM framework to examine the impact of CG factors on ED practices in UK FTSE 350 and US S&P 500 firms, addressing a significant gap in the literature. The US and UK contexts have been relatively less explored; therefore, we contribute to the scarce literature that explores the impact of board and audit committee characteristics on ED in both these regulatory contexts. Furthermore, we cater to the weaknesses in existing studies by using system GMM and provide evidence that is robust to endogeneity concerns.

The results of this study have important implications for theory and practice. The research presents fresh insights into the relationship between CG and ED practices, shedding light on how these dynamics promote transparency and build trust between firms and the society in the UK and the US. Incorporating a recent data set of CG variables and firm-specific factors enriches the empirical evidence, offering novel perspectives on the potential impact of governance mechanisms on ED practices in companies within both contexts. The results provide academics and researchers with valuable reference material for future studies in sustainability reporting and highlight the crucial role played by the identified determinants of ED practices among FTSE 350 and S&P 500 firms.

This study reinforces the central role of CG in shaping the strategies that firms use to mitigate agency issues, respond to diverse stakeholder needs, and, consequently, determine the quantity of ED in their annual reports. The findings affirm the applicability of good governance in the US and UK, highlighting the significant relationship between CG variables and ED practices in both countries. The study advocates for a nuanced revision of certain CG code principles and applications in both contexts, particularly for variables that were found to be insignificant. In addition, it emphasises the need for robust CG systems that ensure accountability and serve as effective monitoring mechanisms, thereby reducing the information expectation gap between firms and their stakeholders in both nations. Continuous revisions of regulations pertaining to board meetings and audit committee independence are recommended to enhance transparency. Moreover, firms need to ensure that environmental and ESG reporting issues are covered in board meetings to encourage ED.

Regulatory efforts, including policy formulation and increased supervision, are essential to enhance private sector awareness and encourage reporting on environmental issues. The study further emphasises the importance of fostering awareness of environmental reporting and associated management issues among various stakeholders, including the media, the public and non-governmental organisations. Furthermore, legislative bodies in the UK and the US must carefully evaluate the consequences of regulatory changes and the introduction of new directives on CG mechanisms and ED practices. For government bodies and policymakers, the insights gleaned from the impact of CG mechanisms on ED practices in the UK and the US hold critical importance. These findings can inform the formulation of policies conducive to creating environments that mitigate environmental degradation, addressing a pressing concern in both nations. Independent researchers

offering services to these companies can use the study's outcomes to discern significant factors influencing ED practices, integrating them into firms' planning and projections.

However, this study has some limitations that future studies can address. This study is confined to a sample of the FTSE 350 and S&P 500 companies in the UK and the US, respectively, thus potentially limiting the generalisability of the results to firms in other countries. Future studies may consider expanding the scope beyond the analysed period to provide a more comprehensive understanding. In addition, the insights related to CG are limited to the variables that have been explored in this research. Future researchers might explore other CG and firm-specific variables, such as board tenure, audit tenure, leverage and employee size, to further enrich the model within the system GMM framework. This expanded approach could be applied to the same or different indexes in the UK and the US, facilitating a deeper understanding of the impact of CG on ED practices. Furthermore, as regulatory frameworks significantly shape the impact of governance on ED, future studies may undertake a comparative analysis across diverse countries to understand the implications of different governance systems, particularly in the context of sustainability reporting. Such comparative insights could highlight the significance of variations between governance systems in both developing and developed nations. Finally, future researchers can examine the negative impact of board meetings and audit committee independence through qualitative investigations to better understand the phenomenon.

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