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Factors affecting corporate environmental disclosure in emerging economies – the role of corporate governance structures

(**Short title:** Corporate governance and corporate environmental disclosure in Jordan)

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Factors affecting corporate environmental disclosure in emerging markets – the role of corporate governance structures

Abstract

This study seeks to examine whether internal corporate governance (CG) mechanisms affect Corporate Environmental Disclosure (CED) in emerging economies. Using a sample of 500 firm-year observations, this study distinctively applies a linear panel quantile regression (PQR) model to examine the CG-CED nexus in Jordan. This technique is supplemented with conducting a two-step dynamic generalised method of moment (GMM) model to overcome any potential occurrence of endogeneity problems. This study reports an increasing trend in CED practice among the sampled companies over the period of analysis, yet it is still at an early stage as compared with their developed counterparts. Furthermore, this study suggests that board size, board independence, CEO-duality, and foreign ownership have positive associations with CED. In contrast, managerial ownership, institutional ownership, and ownership concentration are negatively associated with the disclosed amount of environmental information in the Jordanian context. Theoretically, board structures appeared to be more efficient than ownership structures in reducing agency conflicts by addressing the asymmetric gap of information and promoting the disclosure of environmental information. These findings add to the debate about whether ownership structures detrimental to CED in developing economies. Specifically, when it comes to spending money on CED, owners seemed to be more concerned about any reductions in their '*share of the pie*' and may, therefore, be less motivated to disclose their companies' environmental information. This paper provides managers, owners and policymakers with a set of context-specific recommendations related to the crucial need for a more concerted effort to integrate governance and environmental regulations in order to ensure sustainability in emerging markets.

Keywords: Corporate Governance, Corporate Environmental Disclosure, Environmental Disclosure Index, Jordan, Panel Quantile Regression.

Research Paper

1. Introduction

Major changes in global climate conditions lead to increasing public awareness of corporate environmental disclosure (CED) as a significant area for both the academic literature and business world (Brammer & Pavelin, 2008; Huisingh et al. 2015; Lu and Abeysekera, 2017). CED deals with a firm's association with the close environment. It reveals any accountable actions have been taken by managers to improve and protect the environment as a whole, which are similarly consistent with the interests of their companies (Cormier & Magnan, 2013; Gray, 2006). Fun (2002, p 9) defines CED as the process of communicating the environmental effects of a corporation's economic operations externally through the corporate annual reports. Several environmental policies and initiatives have been launched by different governmental and international bodies, such as Kyoto Protocol in 1997 and most recently the United Nations Framework Convention on Climate Change (UNFCCC) in 2016 that is also called Paris accord, in order to deal with the mitigation of greenhouse-gas-emissions and other environmental consequences on humanity (Cadez and Czerny 2016; Hassan & Romilly, 2018; Giannarakis et al., 2019). Given its contribution

to long-term sustainability, the dissemination of environmental information has triggered the attention of various stakeholders, such as investors and policymakers (Jitmaneeroj 2016; Gerged et al., 2020). Improved public awareness of the importance of corporate sustainability has been reflected on increasing developments of sustainable disclosure guidelines and standards with the purpose of informing stakeholder about the company's commitment towards sustainable development (Sarumpaet et al., 2017; Xie et al., 2019). Karl and Orwat (1999) state that CED initiatives and guidelines are effective tools to moderate market failure by diminishing the asymmetric gap of information between corporate managers and their stakeholders. Also, CED initiatives can raise a democratic issue in contemporary communities such as the right to information (Giannarakis et al., 2019).

Corporate governance (CG) can be deemed as a mechanism to balance the economic and social interests of companies; thus balancing shareholder's interest with the society at large (Lee et al., 2016; Giannarakis et al., 2019). Different CG arrangements, such as board composition and ownership structures, can play a substantial role in safeguarding the interests of stakeholder during the process of decision-making (Ashfaq & Rui, 2019). The presence of a strong board of directors, for example, seems to increase a company's transparency, improve its reputation, and eliminate the asymmetric gap of information (Lokuwaduge & Heenetigala, 2017). Collectively, corporate compliance with good CG practices can improve the allocation of a corporation's resources, and more relatedly enhances the way it develops environmental strategies and disclosure activities (Jizi, 2017). In this regard, Garcia-Torea et al. (2016) argue that CG mechanisms are considered as an important determinant of the quality of sustainability reporting internationally.

Although some researchers have recently sought to examine the impact of CG on CED, mainly in the context of developed countries (e.g., Giannarakis et al., 2019; Khaireddine et al., 2020; Saha & Kabra 2020), the power of different structures of CG on CED has not been extensively examined, specifically in the developing settings (Fernandes et al., 2019). For example, Giannarakis et al. (2019) indicate that the association between CG and CED is a context-specific, primarily linked to the regulatory environment. Given this, the results of exploring the CG-CED nexus are principally attributed to variations in the regulatory and governance environment across countries. Also, a study examining the association between CG and CED in the Middle East and North African (MENA) countries, generally, and the context of Jordan, specifically, is virtually non-existent (Elamer et al., 2020; Alshbili et al., 2019). Accordingly, there is a need for more studies to highlight the importance of CG arrangements in pushing corporations towards more CED practices in the

context of emerging markets (Garcia et al., 2017). Thus, this study distinctively examines the crucial policy questions of *why and how CG structures might affect CED practices in developing economies*?

In doing so, this study contributes to the existing literature as follows. First, it provides a new piece of evidence on the recent levels, trends and patterns of sustainability reporting from an under-researched developing context, namely Jordan. Second, this study examines the *potential* effects of compliance with internal CG mechanisms on CED practices in Jordan. Third, using a panel quantile regression (PQR) model, this study applies the most appropriate estimation method to provide a more comprehensive analysis of the CG-CED nexus than previous studies that were limited to the conventional linear regression models such as the least-squares method.

The objectives of this paper are two-fold. First, it aims to determine the recent trends, levels and patterns of CED among a selected sample of Jordanian listed firms. Second, the present study examines whether there is a relationship between corporate compliance with the Jordanian Corporate Governance Code (JCGC) and CED practices. In stating these objectives, the current study purports that companies, which are deemed to comply with the best CG practices, are likely to engage in substantive CED practices simultaneously. Furthermore, by collecting the data of this study from the Jordanian context, it also shifts the focus on CG-to-CED studies to emerging economies, specifically to the MENA economies, which have been much neglected in previous studies of a similar nature (Ashfaq & Rui, 2019). By doing so, this study responds to the recent calls to help those developing countries in the assessment of the effectiveness of their CG implementation along with advancing well-functioning CED activities (Fernandes et al., 2019; Gerged et al., 2020). Additionally, this research study aims to investigate the nature of the CG-CED nexus post the implementation of the 2009 CG reforms in Jordan from 2010 to 2014. In doing so, our results are expected to help practitioners and policymakers in evaluating the effectiveness of the voluntary nature of CG arrangements (i.e., *comply-or-explain* regime) in pushing companies towards increased trends in CED after the 2009 CG reforms in Jordan.

Our findings are three-fold. First, using a comprehensive CG and CED dataset, our results suggest that there is an increasing trend in CED practices among the selected sample of Jordanian listed firms over the period from 2010 to 2014. However, the level of CED in Jordan is still at an early stage as compared with other developed and developing countries. Second, this study innovatively uses a Panel Quantile Regression (PQR) model to examine the CG-CED nexus in Jordan. The results suggest that firms with more robust board characteristics seemed to provide environmental

information to their stakeholders in order to reduce the asymmetric gap of communication between managers and stakeholders in Jordan. However, this study indicates that ownership structures can be detrimental to CED in emerging markets. Given the cost of CED, owners seemed to be more concerned about any reductions in their '*share of the pie*' and may, therefore, be less keen on disclosing their companies' environmental information. Overall, the econometric models in this study are robust to various types of endogeneity and alternative CG and CED proxies.

The remainder of this paper is designed as follows. Section 2 reviews the previous CG and CED prior studies; section 3 describes the research design; section 4 presents the empirical results and robustness checks; section 5 concludes the main findings, limitation and recommendations.

2. Background, empirical literature review, theory and hypothesis development

2.1. Environmental regulations, reporting and Corporate Governance in Jordan

Jordan is located in the MENA region, with a population of roughly 9.53 million (Department of Statistics-Jordan, 2016). Amman Stock Exchange (ASE) was established in 1930, which included 251 listed companies in December 2017 (Gerged, 2018). The role of the Government in propagating mandatory corporate environmental responsibility initiatives has changed in the country. For instance, the Environmental Protection Law No.12 of 1995 has been amended by the Jordanian Government in 2003 and accepted by the Houses of Parliament in 2006 to coerce adherence to several environmental responsibility provisions by companies (Gerged, 2018). Similarly, the Ministry of the Environment introduced a regulatory framework in 2003 to contribute to the protection of natural resources in the country (Bani Khalid, 2017). Likewise, the Jordan Environment Society (JES) was founded in 1988 to guard the environment, and to work together with other organisations on determining and tackling the ecological challenges (Al-Sharari, 2014). Nevertheless, Omar and Simon (2011) report that firms engagement in environmentally responsible activities in Jordan remained as a voluntary process aimed at achieving sustainable developments.

ASE reformed the Jordanian CG Code (JCGC) in 2009 for listed firms to adhere to (Al-Haddad and Whittington, 2019). The JCGC of 2009 principally aimed at (i) protecting stakeholders' rights, (ii) developing a framework to regulate the association between ASE and its listees; and (iii) defining boards rights, duties and other responsibilities (JCGC, 2009). Yet, even though the JCGC is implemented on a *comply-or-explain* basis, corporate managers may still be tempted to report on

their sustainability performance to reduce the information asymmetry issue (Al-Haddad and Whittington, 2019).

This study focuses on specific board compositions such as board size, board independence, and CED duality, and ownership structures as the main determinants of CED in Jordan because these mechanisms have been largely affected by the 2009 CG reforms as compared with other mechanisms such as board diversity and CEO compensations. For example, the JCGC (2009) identifies the board size between three and 13 to be small enough for the effective decision-making process, and large enough to enable directors to sufficiently contribute to their broad knowledge and experience. Similarly, according to the JCGC (2009), directors should be independent and should not be linked to the corporation, or any of its top management officers, by any type of financial interests that can influence his/her decisions in the exploitation of his/her position in the corporation. Likewise, the JCGC (2009) states that the board should annually review companies disclosure on ownership structures, including shareholders owning more than 10% of shares. Therefore, this research paper examines the possible effects of GC structures on CED in Jordan after the 2009 reforms from 2010 to 2014.

Collectively, Jordan, as a developing economy, is believed to offer an interesting setting in which to examine the *expected* impact of CG structures on CED practices, specifically after the introduction of the reformed JCGC in 2009.

2.2. *Empirical literature review*
Table 1 presents the key previous CG-to-CED studies in different settings around the world. In this systematic review of prior studies, we focus on examining the CG-CED nexus, only. This means that other studies examining the association between CG and corporate social responsibility disclosure (CSRD) are excluded. This focus is motivated by three reasons. First, previous CG-to-CSRD studies have limited coverage for environmental items within their disclosure index. For example, Ghabayen et al. (2016) used a CSRD index consisting of 100 items among which only six environmental items have been considered, which offers a very limited understanding to the status of CED in Jordan. Second, previous CG-to-CSRD studies did not examine the relationship between CG and CSRD dimensions, including CED, individually. Rather, they consider the impact of CG on CSRD collectively, which does not address the existing gap in the literature regarding the possible effects of CG arrangements on CED (e.g., Ghabayen et al., 2016; Ashfaq & Rui, 2019). Third, restricting the focus of this review on prior CG-to-CED studies, only, comes for

comparability reasons with the results of those of a similar nature in other developing institutional settings (e.g., Fernandes et al., 2019; Ezhilarasi and Kabra, 2017; Trireksani and Djajadikerta, 2016).

INSERT TABLE 1 HERE

Previous studies seemed to have several shortages. First, a few studies focused on exploring the CG-CED nexus in the context of developed economies such as the US (Giannarakis et al., 2019), the UK (Liao et al., 2015; Tauringana and Chithambo, 2015; Jizi, 2017), Australia (Rao et al., 2012), and Italy (D'Amico et al., 2016), although fewer papers have recently investigated this association in developing economies (Ezhilarasi and Kabra, 2017) such as Brazil (Fernandes et al., 2019), Indonesia (Trireksani and Djajadikerta, 2016), Turkey (Akbas, 2016), and India. This means that the majority of CG-to-CED studies have been carried out in developed economies with a little attention has been paid to assessing the CG-CED nexus in developing economies. Second, previous CG-to-CED studies in developing economies (e.g., Fernandes et al., 2019; Ezhilarasi and Kabra, 2017; Trireksani and Djajadikerta, 2016) are limited because they were confined to examining the effect of board characteristics, such as board size, independence, and diversity, on CED, only (See Table 1). This limits our understanding of the possible impact of other CG mechanisms such as ownership structures on CED in developing economies. Third, examining the possible effects of CG mechanisms on CED in the Middle East region context is scarce. Fourth, from a methodological point of view, all previous CG-to-CED studies have applied the traditional linear regression methods such as ordinary least squares (OLS) model (Prado-Lorenzo and Garcia-Sanchez, 2010; Rao et al., 2012; Liao et al., 2015; Akbas, 2016; Trireksani and Djajadikerta, 2016; Wang, 2017), fixed-effects and random-effects models (Tauringana and Chithambo, 2015; Jizi, 2017; Ezhilarasi and Kabra, 2017), generalized linear model (GLM) (Fernandes et al., 2019) or probabilistic statistical classification model such as the logit technique (Giannarakis et al., 2019) (See Table 1). These conventional linear regression models summarize the average relationship between a set of dependent and independent variables based on the conditional mean function $E(y|x)$, which offers a limited or partial understanding of the investigated associations (Cobb-Clark et al., 2016).

The current study, therefore, seeks to address the dearth in the existing literature as follows. First, this research paper examines the relationship between CG and CED in a developing economy has recently undergone substantial governance and regulatory transformations, namely Jordan. Second, this study extends the body of previous CG-to-CED studies in developing economies by considering the collective effect of ownership structures and board structures on CED in a

developing context has been neglected by previous studies. Finally, unlike prior studies, this research study distinctively employs a panel quantile regression (PQR) model to examine CG-CED nexus. Contrary to the regular linear regression models, which use the least-squares method to calculate the conditional *mean* of the target across different values of the variables, a PQR model estimates the conditional *median* of the target (Baum, 2013). This means that by using a quantile estimation this study provides a more comprehensive understanding of the CG-CED nexus as (i) it is more robust to outliers than least squares regression method, and (ii) is considered as a semiparametric by avoiding assumptions related to the parametric distribution of the error process (Cobb-Clark et al., 2016; Baum, 2013). In other words, the least-squares estimators are inefficient when examining a relationship at different points in the conditional distribution of the dependent variable (CED in this study). From a mathematical perspective, the quantile regression can predict the conditional median or other quantiles of the outcome variable (Koenker and Bassett, 1978), which is considered to be a more robust to outliers than least squares regression because it avoids assumptions about the parametric distribution of the error process (Cobb-Clark et.al, 2016; Baum, 2013).

2.3. *Stakeholder-Agency theoretical framework for the CG-CED nexus*

Corporate governance mechanisms concern the way stakeholders scrutinize the behaviour of corporate management, and shareholders receive the most attention in large firms (Monks and Minow, 1995). There are, nevertheless, other significant external stakeholders who can affect a firm's environmental agenda such as the media, customers, the local community and authorities (Freeman, 1984; Parkinson, 1993). The natural environment and sustainability are genuine examples of areas that stakeholders are concerned about, which have been brought into the debate in business strategy and the environment literature (Haque & Ntim, 2018; Gerged et al., 2018; Gerged et al., 2020).

With economics origins, agency theory was established to tackle the conflicting relations between managers and owners in large firms (Jensen and Meckling, 1976). As stated by agency theory, shareholders (principals) delegate authorities to management (the agent) that perform the work (Fama and Jensen, 1983). Agency theory is centred on ideas relating to opportunism, information asymmetry, and potential conflicts of interests between managers and shareholders. Therefore, there is a need to monitor or control managers' behaviour to make sure that their efforts seek to maximize shareholders' wealth rather than their own interests at the expense of shareholders.

Essential mechanisms in the governance of firms are the composition of the boards of directors and the ownership structures (Eisenhardt, 1989; Fama and Jensen, 1983). An agency framework indicates that managers (agents) are more likely than shareholders (principals) to emphasize corporate environmental performance and disclosure practices for the reason that they have no outstanding claim on a corporation's income (Graves and Waddock, 1994). In other words, managers might express concerns for the environment more excitedly than shareholders as they are not paying from their own money. Likewise, motivated by self-interest, managers are more likely than shareholders to engage in non-profit goals such as CED practices with the purpose of securing their positions (Wang and Coffey, 1992), further to improving their personal reputation and gaining public prestige (Halme & Huse, 1997). CG structures can be, therefore, employed to align the interests of owners among other stakeholders and managers by balancing the costs and benefits of companies' decisions to adopt effective CED strategies (Halme & Huse, 1997). In this regards, Hill and Jones (1992) promote a stakeholder-agency theory that applies the considerations of agency theory to a wider group of stakeholders rather than shareholders, only. With its insights into the way in which corporations handle various types of external and internal pressures, stakeholder-agency theory delivers an appropriate theoretical narrative for understanding the CG-CED nexus. Therefore, this paper draws on stakeholder-agency theory to emphasise the influential role that can be played by internal CG mechanisms in propagating CED, as indicated in the research hypotheses developed in the following section of the paper.

2.4. Hypotheses Development

Previous studies, specifically those conducted in developed economies suggest that compliance with good CG arrangements can positively contribute to increasing corporate dissemination of environmental information (Rao et al., 2012; Ezhilarasi and Kabra, 2017; Fernandes et al., 2019). Specific board characteristics are associated with a more active role of CG arrangement in monitoring managers behaviour and aligning their interests with those of owners when reporting on environmental performance (D'Amico et al., 2016). The current study attempts to investigate the influences of two types of CG structures, namely board and ownership structures, on CED practices in a developing setting.

2.4.1. Board size and CED

There are divergent positions in the literature about the effect of board size on CED. For instance, Ahmed et al. (2006) state that small-sized boards are more efficient in reducing agency conflicts. In contrast, Beiner et al. (2004) affirm that a small number of members on boards can reduce its efficiency and limit its capacity for monitoring. Others, on the other hand, believe that a large-

sized board might lead to more corporate engagement in CED practices (Rao et al., 2012; Liao et al., 2015; Tauringana and Chithambo, 2015; Trireksani and Djajadikerta, 2016; Ezhilarasi and Kabra, 2017; Wang, 2017; Jizi, 2017), as it is likely to comprise of more independent and experienced directors who can scrutinise managers activities and reduce the asymmetric gap of information that is related to companies environmental responsibility (Ntim & Soobaroyen, 2013; Giannarakis et al., 2019). For example, Rao et al. (2012) suggest a positive association between board size and CED in Australia. Similarly, Akbas (2016) state that board size is positively attributed to CED in the Turkish context. In Jordan, according to the JCGC (2009), the size of the board of directors ought to be small enough (a minimum of three) for the effective decision-making process, and large enough (a maximum of 13) for directors to sufficiently contribute to their broad knowledge and experience. As a result, the first objective of the present study is to contribute to the existing literature by examining the impact of the number of directors on boards on CED in the Jordanian context. Thus, the first hypothesis to test is:

> **H1:** Ceteris paribus, there is a statistically significant positive relationship between the size of the board of directors and environmental disclosure in Jordan.

2.4.2. Board independence:

Independent directors on boards seem to have a robust motivation to act as experienced monitors efficiently, and not to "*collude*" with managers to expropriate the wealth of shareholders since their value in the market is determined by the independence of their performance as directors (Fama, 1980). From an agency theory perspective, board independence can be seen as an effective CG arrangement in reducing "*managerial opportunism*" that is caused by the notion of the separation between ownership and control (Fama and Jensen, 1983). Liao et al. (2015) conclude a positive association between board independence and greenhouse gas emissions disclosure in the UK. Given this, independent directors are expected to defend the dissemination of environmental information as a mechanism geared toward undertaking unbiassed accountability processes. Likewise, Fernandes et al. (2019) point out that independent directors on a board can encourage greater CED practices in Brazil. In Jordan, based on the JCGC (2009), at least one-third of the members on the board of directors must be independent. More specifically, the JCGC (2009) defines an independent director as a member who is not linked to the corporation, or any of its top management officers, affiliate corporations, or its independent auditors by any type of financial interests or associations apart from his shareholding in the corporation that is assumed to bring that director benefit, either incorporeal or economic or that can influence his/her decisions or result in exploitation of his/her position in the corporation. This study is, therefore, motivated to

investigate the impact of having a third of independent directors on boards on disseminating environmental information in Jordan. The second hypothesis to test is:

H2: Ceteris paribus, there is a statistically significant positive relationship between the independence of the board of directors and environmental disclosure in Jordan.

2.4.3. CEO Duality:

Chief Executive Officer (CEO) duality is existing in a firm's board of directors when one person holds the positions of Chairman and CEO (Prado-Lorenzo and Garcia-Sanchez, 2010). From a theoretical point of view, keeping these two powers can increase the risk that the CEO possibly will implement strategies, which prioritise his/her own interests to the corporation's detriment (Jensen and Meckling, 1976). Previous studies found a negative association between CEO duality and CED, suggesting that duality may increase conflicts of interest and thus influence a corporation's transparency process (e.g., Alfraih, 2016; Chau and Gray, 2010; Freitas Neto and Mol, 2017). Others, however, pointed out a positive relationship between CEO-Duality and CED (Prado-Lorenzo and Garcia-Sanchez, 2010; Jizi et al., 2014). One potential justification might be that more powerful CEOs promote the disclosure of social and environmental information to be seen as successful and to increase their tenure or pay prospects (Jizi et al., 2014). In Jordan, the JCCG (2009) states that the Chairman and the CEO should have different responsibilities to sustain effective monitoring of management behaviour and to avoid conflicting interests; therefore, different people should fill the two positions. This implies that the board of directors is preferably recommended to appoint an independent director for the post of Chairman, if possible. In line with the JCGC (2009), this study assumes that CEO-duality can weaken board independence, and increase the asymmetric gap of information. The third hypothesis to test in the current study is as follows:

H3: Ceteris paribus, there is a statistically significant negative relationship between the CEO-Duality and environmental disclosure in Jordan.

2.4.4. Managerial ownership:

According to '*Convergence of Interests*' hypothesis, managerial ownership can play an essential role in limiting agency conflicts by aligning managers interests with those of shareholders (Jensen and Mackling's, 1976; Jensen, 1993). Morck et al. (1988), yet, believe that high levels of managerial ownership can play the opposite role by providing managers with greater entrenchment, which means superior power and further opportunities to exercise their opportunistic behaviour. As stated by the '*Entrenchment Hypothesis*', managerial ownership can hypothetically result in increasing

the asymmetric gap by reporting less information. When it comes to spending on CED, owner-managers seemed to be more worried about any reductions in their '*share of the pie*' and may be less interested in the disclosure of environment-related activities (Ullah et al., 2019). In line with this notion, previous studies indicate that managerial ownership is negatively associated with the levels of CED (Chau and Gray, 2010; Oh et al., 2011; Khan et al., 2013). For example, Khan et al. (2013) and Ullah et al. (2019) suggest that there is a negative association between managerial ownership and CSR disclosures in the context of Bangladeshi companies. Similarly, Dintimala & Amril (2018) indicate that companies with lower managerial ownership tend to disclose their social and environmental information in Indonesia. The JCGC (2009) states that the board of directors should review companies' disclosure on ownership structures, including disclosure of directors' shareholdings and any subsequent changes in the managerial ownership structure. In line with the findings of previous studies and the '*Entrenchment Hypothesis*', this study assumes that managerial ownership can provide managers with superior power to exercise their opportunistic behaviour and favour their own interest, which hypothetically seemed to result in increasing the information asymmetry by reporting less environmental information. The third hypothesis to test in the current study is as follows:

> **H4:** Ceteris paribus, there is a statistically significant negative relationship between managerial ownership and environmental disclosure in Jordan.

2.4.5. *Institutional Ownership and CED:*

Differences in ownership structure might have a substantial impact on CED (Chang et al., 2013). In alignment with agency theory, this study suggests that the presence of ownership structure is likely to reduce the influence of agency conflicts with managers. Institutional ownership is defined as the fraction of companies' shares that are owned by institutional investors (Oh et al., 2017). Oh, et al. (2016) argue that institutional owners lead companies to make decisions in the shareholders' best interests as a consequence of effective monitoring roles. Consistently, Chang (2013) state that a corporation characterised with a higher concentration of institutional ownership is likely to report more information related to its environmental activities. Crucially, institutional shareholders can exercise considerable voting power and have more information advantages than other minority shareholders (Schnatterly et al. 2008). For example, a study conducted by Chang & Le (2015) shows that institutional ownership has a positive impact on CED in polluting industries, although managerial ownership is negatively associated with CED in China. Similarly, Ezhilarasi and Kabra (2017) conclude a positive association between institutional ownership and CED in the context of India. Relatedly, Oh et al. (2017) found support for the previous argument, in that the highest CSR ratings are noted when institutional ownership level is high among a selected sample of large public

companies headquartered in the US. This implies that corporations need to preserve strong ownership structures to appreciate long-term effects in promoting CED activities. Thus, the present study assumes that institutional ownership is positively attributed to CED practices in Jordan. The fifth hypothesis to test is:

H5: Ceteris paribus, there is a statistically significant positive relationship between institutional ownership and environmental disclosure in Jordan.

2.4.6. *Foreign ownership:*

Foreign ownership can be defined as the percentage of equity owned by foreign investor (Barako, 2007). Foreign ownership is expected to play a significant role within ownership structures because foreign investors may have a greater power to monitor managements' behaviour than local investors (Young et al., 2008). Following agency theory, prior studies argue that foreign ownership is positively correlated with higher CED practices, suggesting that foreign investors require high-quality environmental information to avoid the expropriation risk of corporate resources (Barako et al., 2006; Haniffa & Cooke, 2002; Pahuja, 2009). In this regard, Ezhilarasi and Kabra (2017) find an empirical piece of evidence that suggests a positive association between foreign ownership and CED in India. Ezhilarasi & Kabra (2017) also state that corporations in which foreigners own the majority of shares might require higher quality social and environmental disclosures as a technique to meet the requirements of foreign reporting in the context of the Indian polluting companies. In Jordan, there are no restrictions on the percentage of foreign ownership in addition to full freedom of capital movement and no taxes on capital gains (ILO, 2013).

Interestingly, about half of the total value of ASE market capitalisation in 2015 belongs to foreign investors (ASE Annual Report, 2015). This implies that any failures in compliance with CG structures in Jordan may have severe consequences far beyond developing economies. Given the integration into the global economic system, foreign investors in emerging markets, such as Jordan, seemed to be a powerful CG mechanism can be used to restrict managerial opportunism and therefore to protect shareholders rights (Young et al., 2008). As a result, the sixed objective in this paper is to contribute to the CG-CED literature by distinctively examining the impact of foreign ownership on CED in an emerging market, namely Jordan. Thus, the sixed hypothesis to test is:

H6: Ceteris paribus, there is a statistically significant positive relationship between foreign ownership and CED practices in the Jordanian context.

2.4.7. *Ownership concentration and CED:*

Ownership concentration means that the shares of the corporation are concentrated in the hands of a few large shareholders (Mohd Ghazali, 2007). Previous literature indicates two different

hypotheses explaining the role of concentrated ownership in the company; the *'Efficient Monitoring'* hypothesis and the *'Expropriation-of-the-Minority Shareholders'* hypothesis. Based on the *'Efficient Monitoring'* hypothesis, large shareholders can play an important role in monitoring and reducing managers opportunistic behaviour (Jensen and Meckling, 1976; Fama and Jensen, 1983), for the reason that they have interests in wealth maximization and have a large share of power to secure those interests (Shleifer and Vishny, 1997). Alternatively, the *'Expropriation-of-the-Minority Shareholders'* hypothesis argues that when the ownership structure becomes concentrated, the majority shareholders may opportunistically behave to increase their private wealth against the interests of minority shareholders (Lemmon and Lins, 2003). In a widely held corporation, shares are not concentrated; therefore, it has to encounter more agent–principal conflicts as compared with a concentrated firm (Majumder et al., 2019). Voluntary disclosure is expected to reduce agency conflicts and acts as a powerful monitoring tool for widely held firms (Jensen and Meckling, 1976). On the contrary, a company with a concentrated ownership structure has to face fewer agency conflicts. Thus, largest owners might not be interested in spending money on CED that is expected, from their perspective, to lead to reductions in their '*share of the pie*' (Mohd Ghazali, 2007). Accordingly, agency theory supports the negative relationship between ownership concentration and social and environmental disclosures. Prior empirical evidence provides support to this argument. For example, Lu and Abeysekera (2014) reported that ownership concentration is negatively associated with social disclosure in the context of China. Also, other studies point out a negative influence of ownership concentration on CSR disclosure in Bangladesh (Rashid and Lodh, 2008), in Malaysia (Mohd Ghazali, 2007) and in China (Li and Zhang, 2010). The JCGC (2009) indicates that the board of directors should annually review companies' disclosure on ownership structures, including disclosure of shareholders owning more than 10% of shares. Following previous studies, this research paper suggests that the largest owner is potentially negatively attributed to CED in the context of Jordan. Thus, the seventh hypothesis to test in the present study is as follows:

> **H6:** Ceteris paribus, there is a statistically significant negative relationship between the ownership concentration and CED practices in the Jordanian context.

3. Research design

3.1. *Data and sample considerations*

The population of this study is focused on all non-financial listed companies in the Amman Stock Exchange (ASE), with full data for the years from 2010 to 2014. Crucially, the financial industry has been excluded for a number of reasons. First, financial institutions are largely expected to have

an indirect effect on the environment (Thompson & Cowton, 2004). Second, the financial sector has heavier financial and governance regulations than other non-financial sectors, which is expected to be differently attributing to the performance of financial institutions and their reporting practices (Huang and Wang, 2015). Thirdly, consistent with prior studies, this study excludes such financial institutions for comparability purposes (Haniffa and Hudaib, 2006). The current study, therefore, focuses on industrial and services institutions. Applying these criteria has led to a final sample of 100 companies (500 firm-year observations); 50 industrial corporations and 50 services corporations. Table 2 shows the sampling procedure for this research study.

INSERT TABLE 2 HERE

This study has got the advantage of combining different databases to investigate the research questions. The predictor variable, outcome variable, and control variables have been manually collected from firms' annual reports that were published on the website of the ASE, along with other sources of data such as Perfect Information and Trade Mubasher.

3.2.   Measures

Table 3 shows the operational definitions of research variables. In examining the hypotheses, this paper divides the variables' measurement into four stages. First, CED is measured using weighted and unweighted disclosure indices to collect the environmental data from companies' annual reports from 2010 to 2014. Second, CG structures are measured using the board of directors characteristics (i.e., the board size, independence, CED-duality) and ownership structures (e.g., managerial ownership, institutional ownership, foreign ownership, and ownership concentration) using data collected manually from companies annual reports during the period from 2010 to 2014. Third, to examine the CG-CED nexus, the present study distinctively uses a panel quantile regression (PQR) model that provides a more comprehensive understanding of this association than other conventional linear regression models such as OLS regression models. This technique is supplemented with conducting a generalised method of moment (GMM) regression model to address any concerns related to the possible presence of endogeneity problems.

This study adopts the environmental disclosure index (EDI) that has been recently developed by Gerged et al. (2018) in the context of the MENA region. The EDI includes a total of 55 environmental items. These environmental items are grouped into five key sub-indices. These sub-indices are heterogeneously weighted as follows; environmental policy (five items), pollution by product and process (22), energy (10), financial (seven) and other environmental items (11). To overcome any potential sensitivity related to using the unweighted EDI, this study constructs a

weighted disclosure index (WEDI) in line with prior studies (Ntim, 2016; Elamer et al., 2020; Gerged et al., 2020).

Consistent with previous empirical research, this study uses a Cronbach α technique to examine the inter consistency and reliability of the EDI (Bland & Altman, 1997). The outcome of conducting this test is indicative of the α value of 0.80, which is deemed to be an acceptable level of reliability for the used EDI (Bland & Altman, 1997).

Additionally, in an effort to address any potential endogeneity problems relating to omitted variables, the present study employs a set of firm-specific factors to control for the studied associations (Wooldridge, 2010), which are selected to be in line with the previous literature (see Crifo and Forget, 2015; Fifka, 2013; Ntim, 2016; Gerged et al., 2020; Al-Haddad and Whittington, 2019; Hassan et al., 2020). The control variables in this study are the firm size (SIZE), leverage (LEV), market to book ratio (MKTB), profitability (ROA), and audit type (big4).

3.3. Analysis

Following Powell (2016), this study distinctively examines the effect of CG structures on environmental reporting in Jordan, using Panel Quantile Regression (PQR) model. In opposition to the regular linear regression models, which use the least-squares method to calculate the conditional *mean* of the target across different values of the variables, a PQR model estimates the conditional *median* of the target (Baum, 2013). Using a PQR estimation, this study provides a more comprehensive understanding of the CG-CED nexus than prior CG-to-CED studies (e.g., Wang, 2017; Tauringana and Chithambo, 2015; Jizi, 2017; Ezhilarasi and Kabra, 2017; Fernandes et al., 2019; Giannarakis et al., 2019) that used different conventional linear regression models, such as OLS regression model and fixed-effects model, for two reasons. First, a PQR regression is more robust to outliers than least squares regression method; Second, it is considered as a semiparametric by avoiding assumptions related to the parametric distribution of the error process (Cobb-Clark et al., 2016; Powell, 2016; Baum, 2013).

The PQR model specification can be stated as follows.

$$EDI_{it} = \beta_0 + \beta_1 BIND_{it} + \beta_2 BSIZE_{it} + \beta_3 CEODUAL_{it} + \beta_4 MANGOW_{it} + \beta_5 INSTITOW_{it} + \beta_6 FOREOW_{it} + \beta_7 CONCEN_{it} + \beta_8\ CONTROL_{it} + \beta_9\ industryFixedEffects_t + \beta_{10} YearsFixedEffects_t + \varepsilon_{it}\ \textbf{(1)}$$

Where EDI is an environmental disclosure index; BIND is board independence, BSIZE is board size, CEODUAL is CEO duality, MANAGOW is managerial ownership, INSTITOW is institutional ownership, FOREOW is foreign ownership, CONCEN is the ownership concentration. CONTROLS are firm size (FSIZE), leverage (LEV), profitability (ROA), Market to book ration (MKTB), and finally, audit type (BIG4).

4. Empirical Analysis

4.1. Univariate Analysis

To achieve the first objective, this study uses an unweighted disclosure index (EDI) to determine the levels, trends and patterns of CED in Jordan. Table 4 presents the results of conducting an unweighted content analysis to calculate the total environmental disclosure (EDI), and it's five sub-indices (see Table 3). Table 4 shows that the mean value of EDI is 8.4% of the 55 environmental items that have been adopted in the index. This result is in line with those of previous CED studies in the MENA region. For example, Gerged et al. (2018) point out that the mean value of CED in nine MENA countries is 13% of the adopted items. Likewise, Gerged et al. (2020) indicate that CED has recorded an average value of 14% in the context of Kuwait. This means that CED is still considered at an early stage in Jordan and the MENA region generally. Though, when the EDI figures in Table 4 are compared with those of their developed counterparts, the relatively low occurrence of CED in Jordan appeared to be confirmed. In the US, for instance, CED, in a multi-sector study, recorded 81.8% of the examined environmental items (Matisoff et al., 2013). Similarly, CED in the UK scored 64% of the adopted items in a study carried out by Barbu et al. (2014).

INSERT TABLE 4 HERE

Also, CED seems to have an increasing trend in the context of study over the period of analysis. Specifically, the mean value of EDI increased each year for the period under analysis, and the figure for 2014 was almost 22% higher than that for 2010 – a noticeable change (see Table 4). This recorded trend in the results of the current study is perhaps of great significance for sustainable development in Jordan. In terms of CED patterns, Table 4 shows that the strongest sub-index for disclosure was pollution (EDI2). This means that nearly (33%) of companies disclosed pollution-related environmental information followed by financial environmental information (18%). On the other hand, the lowest reported environmental sub-index is related to energy information. As compared with the total EDI score, Table 4 also demonstrates an increasing trend in CED categories over the period of study from 2010 to 2014. For example, environmental policy information (EDI3) has been increasing from 4.1% in 2010 to 18.9% in 2014

– a striking change. Similarly, environmental others sub-index (EDI5) has increased from 12.3% in 2010 to 19.8% in 2014.

Table 5 shows the descriptive statistics of the research variables. EDI has recorded 0.084 mean value and 0.07 standard deviation (explained above in details). Further, the mean value of the weighted environmental disclosure index (WEDI), an alternative measure of CED, is 0.015, with 0.012 standard deviations. The findings of the univariate analysis are aligned with previous CED studies in developing economies (See Eljayash et al., 2012; Khlif et al., 2015; Habbash, 2016; Gerged et al. 2018; Gerged et al., 2020).

<center>INSERT TABLE 5 HERE</center>

For CG mechanisms, Table 5 presents that the mean value of board independence (BIND) is 0.338, indicating that less than half of the sampled companies are approximately in line with the JCGC (2009), which requires that at least one-third of the board directors should be independent. The mean value of board size (BSIZE) is 2.057, although the mean value of CEO-duality (CEODUAL) is 0.188. This implies that roughly 81% of the sampled companies adhere to the JCGC requirements in relation to CED-duality. Specifically, JCGC (2009) states that the chairman and the CEO have diverse duties, and therefore different people should occupy these two positions in order to maintain effective monitoring for management behaviours and to avoid conflicting interests. Concerning ownership structures, Table 5 shows that the mean value of managerial ownership (MANGOW) is 0.507 (50.7%), which is appeared higher than other developing economies. For instance, Ali et al. (2008) report a mean value of 9.9 % for MANGOW in Malaysia, and 10.7%, as reported by Alghamdi (2012) in Saudi Arabia. Table 5, moreover, confirms that the institutional ownership (INSTITOW) is linked with a 37% mean value, though foreign ownership (FOREOW) is of a 17% (0.07) average value. The mean value of 17% for FOREOW is lower than the whole market proportion because of a high FOREOW in the financial sector that is excluded in the current study for comparability reasons. Also, the ownership concentration (CONCEN) has scored a mean value of (0.356) 36%, suggesting a high level of ownership concentration in the sampled companies.

Additionally, Table 5 shows a higher level of leverage (LEV) (measured by total debt to total assets (DOA) ratio) in Jordan than other developed economies (Zalata and Roberts, 2015). However, the sampled companies are categorised with a low-level profitability (measured by the return on assets (ROA) ratio) as compared with Korean firms, for example (Kang and Kim, 2012), yet the market to book (MKTB) ratio is higher than the one stated by Goh et al. (2013) in the Korean context.

Finally, only 37% of the Jordanian companies have been audited by one of the big4 audit companies (BIG4).

4.2. Bivariate Analysis

Table 6 shows the correlations matrix for the main variables to test the assumption of multi-collinearity. It reports the coefficients of correlation. The nature of coefficients indicates that any residual non-normal distribution in the variables of this study may be mild and are similar to those reported by prior studies (e.g., Al-Haddad and Whittington, 2019; Fernandes et al., 2019; Giannarakis et al., 2019; Gerged et al., 2020). Besides, VIF has been tested separately, and the finding suggests that multicollinearity does not seem to be a major concern that can affect the rigour of the results of the current study.

<div align="center">INSERT TABLE 6 HERE</div>

4.3. Panel Quantile Regression analysis

4.3.1. CG structures and CED:

To achieve the second main objective, and following Powell (2016), this study distinctively applies the panel quantile regression (PQR) to examine the association between CG structures and CED in an emerging market, namely Jordan. Table 7 presents the results of conducting a PQR regression model using two different proxies for the dependent variable EDI and WEDI (See Table 3). Overall, the ten quantiles of Table 7 suggest that corporate compliance with the Jordanian Corporate Governance Code (JCGC) has heterogeneous effects on corporate engagement in CED practices in that they might have either enhanced or reduced CED in Jordan. These results are consistent with those of prior CG-to-CED studies (e.g., Liao et al., 2015; Akbas, 2016; Trireksani and Djajadikerta, 2016; Wang, 2017; Jizi, 2017; Ezhilarasi and Kabra, 2017; Fernandes et al., 2019; Giannarakis et al., 2019), and robust to the form of CED indices applied (either EDI or WEDI). Specifically, Table 7 indicates that board independence (BIND) is positively associated with the unweighted environmental disclosure index (EDI) at a 1% level of significance from 0.10 to 0.40 quantiles, 0.60 and 0.70 quantiles, and 0.90 and 0.95 quantiles. This means that H1 has been statistically supported. This result is in line with the results of previous CG-to-CED studies (e.g., Rao et al., 2012; Liao et al., 2015; Tauringana and Chithambo, 2015; Trireksani and Djajadikerta, 2016; Ezhilarasi and Kabra, 2017; Wang, 2017; Jizi, 2017) that argue that a large number of directors on board can result in increasing corporate engagement in CED practices. From a theoretical perspective, large-sized boards appeared to be more efficient in reducing agency conflicts and addressing the asymmetric gap of information between managers and shareholders (Ntim, 2016).

Also, the findings suggest that board independence (BIND) has a positive relationship with CED in Jordan at a 1% level of significance from 0.10 to 0.40 quantiles, 0.60 to 0.80 quantiles and 0.95 quantiles, while the BIND-EDI association is positive and significant at 5% level of significance at 0.5 and 0.90 quantiles (see Table 7). This indicates that H2 is accepted. This finding is aligned with those of prior studies such as Liao et al. (2015) in the UK and Fernandes et al. (2019) in Brazil that pointed out that independent directors on a board can encourage greater CED practices. Theoretically, independent directors can be effective monitors to protect shareholders' wealth because their value in the market is highly dependent on their performance as monitors (Fama, 1980; Fama and Jensen, 1983). With respect to H3, the results of the current study are suggestive of a positive association between CED-duality and CED at a 1% level of significance from 0.10 to 0.95 quantiles. This means that H3 has not been statistically approved. This result, however, is consistent with prior studies found a positive relationship between CEO-Duality and CED (e.g., Prado-Lorenzo and Garcia-Sanchez, 2010; Jizi et al., 2014). This study argues that more powerful CEOs seemed to promote the disclosure of environmental information to be seen as successful and to increase their tenure and/or pay prospects (Jizi et al., 2014).

INSERT TABLE 7 HERE

Regarding the effects of ownership structures on CED, the findings approve the expected negative relationship between managerial ownership (MANGOW) and CED in Jordan at a 1% level of significance from 0.20 to 0.95 quantiles. This generally supports H4 statistically. This result is consistent with prior evidence that reports that MANGOW is negatively and significantly attributed to CED (e.g., Chau and Gray, 2010; Oh et al., 2011; Khan et al., 2013). This is in line with agency theory that proposes that MANGOW might provide managers with superior power and additional opportunities to exercise their opportunistic behaviour (Morck et al., 1988). Specifically, Ullah et al. (2019) state that when it comes to spending money on CED, owner-managers appeared to be more concerned about any reductions in their '*share of the pie*' and may, therefore, be less motivated to disclose information related to environmental activities.

Concerning institutional ownership (INSTITOW), the results suggest a negative association between INSTITOW and CED as proxied by EDI at a 1% level of significance from 0.10 to 0.95 quantiles. This time, the results of this study cannot support H5. This result opposes those of previous studies (e.g., Oh et al., 2017; Ezhilarasi and Kabra, 2017). For instance, Ezhilarasi and Kabra (2017) point out that INSTITOW is positively attributed to CED in the context of India. Theoretically speaking, this study argues that the concentration of institutional ownership appears to increase the asymmetric gap of information between managers and owners, and thus, might

reduce the level of reported environmental information by the sampled Jordanian companies. On the contrary, foreign ownership (FOREOW) is positively related to EDI at a 1% level of significance from 0.10 to 0.40 quantiles, and from 0.60 to 0.90 quantiles, which averagely leads to accepting H6 statistically. This outcome is tied to Ezhilarasi and Kabra (2017) and Ezhilarasi & Kabra (2017) that found an empirical piece of evidence suggests a positive association between foreign ownership and CED. Following stakeholder-agency theory, this study argues that foreign investors require high-quality environmental information to avoid the expropriation risk of corporate resources and to meet the global reporting requirements (Barako et al., 2006; Haniffa & Cooke, 2002; Pahuja, 2009). Additionally, the results of this study are associative of a negative link between the ownership concentration (CONCEN) and EDI at a 1% level of significance from 0.20 to 0.95 quantiles, which is statistically supportive of H7. This finding is relevant to those reported by Rashid and Lodh (2008) in Bangladesh, Mohd Ghazali (2007) in Malaysia and Li and Zhang (2010) in China that found a negative association between CONCEN and CED. Based on agency theory, this study argues that large shareholders in Jordan appeared to be less interested in spending money on CED that is expected, from their perspective, to lead to reductions in their '*share of the pie*' (Mohd Ghazali, 2007).

Given the fact that the five sub-indices of the EDI have not been equally weighted[1], the current study checks whether the primary results were or not sensitive to a weighted environmental disclosure index (WEDI). This study, therefore, follows prior literature in constructing a WEDI (e.g., Ntim and Soobaroyen, 2013; Ntim, 2016; Elmagrhi et al., 2018; Elamer et al., 2020; Gerged et al., 2020; Hassan et al., 2020). An alternative WEDI is constructed, where equal weights of 20% have been awarded to each of the five sub-indices. Table 8 presents the results of estimating Powell (2016) PQR model to examine the CG-WEDI nexus at quantiles range from 0.10 to 0.95. The findings suggest that CG structures are heterogeneously associated with WEDI, which is in line with the leading findings shown in Table 7. For example, although board size is positively related to WEDI at a 1% level of significance at the vast majority of quantiles (from 0.10 to 0.40, 0.60, 0.70 and 0.95), largest ownership (ownership concentration) is negatively associated with WEDI also at a 1% level of significance from 0.20 to 0.95 quantiles. This implies that the main findings have not been influenced by weighting the five sub-indices differently.

INSERT TABLE 8 HERE

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[1] Five environmental policy items (9%); 22 environmental pollution items (40%); ten environmental energy items (18%); seven environmental, financial items (13%) and eleven environmental others items (20%).

Although not the main focus of this study, some of the control variables also have statistically significant and positive associations with CED proxies (i.e., EDI and WEDI) – notably firm size (FSIZE), leverage (LEV) and the type of auditor (BIG4). However, the return on assets (ROA) is negatively linked to CED in Jordan.

4.3.2. Additional Sensitivity Checks

Using the primary proxies for CED (i.e., EDI and WEDI), the current research employs 2-step GMM estimators as a robustness check to make sure that the main findings of estimating a PQR model were not severely affected by the potential incidence of endogeneity problems (Blundell and Bond, 1998). First, this study uses the Durbin and Wu–Hausman tests to detect the possible incidence of endogeneity issues of individual regressors. Theoretically, the independent variable (i.e., CG structures) should not be correlated with the residuals (error term), and the Durbin and Wu–Hausman tests can determine whether the error terms are correlated with the independent variable (Ullah et al., 2018). The findings of carrying out Durbin and Wu–Hausman tests suggest that the CG structures are endogenous rather than exogenous. Accordingly, the main findings presented in Table 7 may be biased (See Table 9). In other words, Durbin and Wu–Hausman tests suggest that endogeneity seemed a major concern in the results of PQR models. This study, therefore, applies dynamic GMM regression models to address the endogeneity concerns.

This research paper follows previous studies (e.g., Ullah et al., 2018; Moumen et al., 2015; Reguera-Alvarado et al., 2016; Roberts & Whited, 2011, among others) using a two-step dynamic GMM regression model as an additional check to overcome the endogeneity issue arising from reverse causality association between CG and CED. Crucially, this study incorporates the lagged values of past CED in order to differentiate between a '*static*' and a '*dynamic*' panel data model. The two-step system GMM models specifications can be presented in the following equations:

$$EDI_{it} = \alpha_0 + \beta_1\, EDI_{it-1} + \beta_2\, EDI_{it-2} + \sum_{i=1}^{n} \beta_i\, CG_{it} + \sum_{i=1}^{n} \beta_i\, CONTROLS_{it} + \mu_{it} + \varepsilon_{it} \qquad (2)$$

$$WEDI_{it} = \alpha_0 + \beta_1\, WEDI_{it-1} + \beta_2\, WEDI_{it-2} + \sum_{i=1}^{n} \beta_i\, CG_{it} + \sum_{i=1}^{n} \beta_i\, CONTROLS_{it} + \mu_{it} + \varepsilon_{it} \qquad (3)$$

The operational definitions for all variables are presented in Table 3. In Equation 2, for example, EDI_{it-1} indicates one-year lag of the dependent variable EDI (previous year's EDI), and EDI_{it-2} represents a second lag of the EDI, which denotes EDI two years previously. These lagged versions of the dependent variable are regarded as explanatory variables in this two-step GMM

estimation. Roodman (2009, p.86) argues that 'by including lags of EDI, the dynamic GMM approach controls for endogeneity by internally transforming the data where a variable's past value is subtracted from its present value'. In doing so, the number of observations is decreased, and the internal transformation process enhances the effectiveness of the dynamic GMM method (Wooldridge, 2016).

This study uses the Sargan test and the Arellano-Bond tests as post-estimation tests to determine the validity of the dynamic GMM model and whether the instruments (i.e., lags of EDI in Equation 2 and lags of WEDI in Equation 3) are correctly specified or not (see Table 9). Ullah et al. (2018) indicate that a crucial assumption for the validity of the two-step GMM method is that instruments (the lagged versions of dependent variables) are exogenous. If the findings of the pre-estimation tests turn out to be insignificant, this means that the involved instruments in the GMM models are exogenous; consequently, the instruments are valid. Overall, the two-step dynamic GMM regression model is appeared to be an appropriate method to address the potential existence of endogeneity issues in this research.

INSERT TABLE 9 HERE

Models 1 and 2 in Table 9 demonstrate the findings of estimating the dynamic GMM models. Again, CG structures still have heterogeneous influences on CED proxies in Jordan in that they might have either enhanced or reduced the disclosure of environmental information in the context of the study. For example, BZISE, BIND, CEDDUAL, and FOREOW are positively associated with EDI and WEDI, whereas MANAGOW, INTITOW, and CONCEN have negative associations with CED practices proxied by both EDI and WEDI in Jordan. This means that the main results of the current study are not severely affected by the existence of endogeneity problems.

5. **Conclusion**:

The effect of CG structures on CED has been mainly investigated in the context of developed economies (Giannarakis et al., 2019; Liao et al., 2015; Tauringana and Chithambo, 2015; Jizi, 2017; Rao et al., 2012; Rao &Tilt, 2016; D'Amico et al., 2016). Few others have also examined the impact of CG mechanisms on CED in developing economies (Fernandes et al., 2019; Trireksani and Djajadikerta, 2016; Ezhilarasi and Kabra, 2017), although, they were limited because they did not consider the collective effect of board structures and ownership structures on CED. This limits the understanding of the possible impact of other CG mechanisms on CED in developing economies. Additionally, a study examining the possible effects of CG mechanisms on CED in

the Jordanian context is virtually non-existent. This study, thus, examines the vital subject of how and why a corporation's CG structure may be associated with its engagement in CED in an emerging economy, namely Jordan.

Although the findings of this study suggest an increasing trend in CED practices in Jordan throughout the period of analysis, it is still at an early stage compared with its developed counterparts. The study also suggests that the main pattern of CED in Jordan is linked to pollution followed by financial environmental-related information. In contrast, environmental policy information appears to be the lowest disclosed among the adopted EDI in the current study.

This study innovatively applies a PQR model to examine the CG-CED nexus in Jordan. The findings indicate that companies' compliance with the Jordanian Corporate Governance Code (JCGC) has heterogeneous impacts on the engagement in CED in that they might have either enhanced or reduced CED engagement in Jordan. Specifically, this study suggests that board size, board independence, CEO-duality, and foreign ownership have positive associations with CED. In contrast, managerial ownership, institutional ownership, and ownership concentration are negatively associated with the disclosed amount of environmental information in the Jordanian context. Theoretically, board structures appeared to be more efficient in reducing agency conflicts by addressing the asymmetric gap of information and promoting the disclosure of environmental information. These findings add to the debate about whether ownership structures detrimental to CED in developing economies. Given the cost of CED, owners seemed to be more concerned about any reductions in their '*share of the pie*' and may, therefore, be less motivated to disclose their companies' environmental information. These results are in line with those of previous studies that have explored the association between corporate compliance with CG arrangements voluntarily following the UK '*comply-or-explain*' CG regime on CED engagements in developed and developing economies (e.g., Liao et al., 2015; Akbas, 2016; Trireksani and Djajadikerta, 2016; Wang, 2017; Jizi, 2017; Ezhilarasi and Kabra, 2017; Fernandes et al., 2019; Giannarakis et al., 2019), emphasizing the need for additional CG reforms. Compliance with CG mechanism in Jordan is a voluntary practice because CG provisions and principles are not mainly enforceable by law, and listed firms may not inevitably be accountable for being not compliant with a specific CG provision if they succeeded in providing reasonable justifications. This study suggests that the voluntary nature of the JCGC code of 2009 has yet to yield a comprehensive corporate engagement in CED practices in Jordan, which seems to be the case in other developing economies.

The results of this study reiterate the need for more concerted efforts to be undertaken by the JSE, national regulatory organisations, such as Jordan Environment Society (JES), and other non-governmental organisations to integrate governance and environmental regulations within the company law and listing requirements to enhance the role of corporate compliance with CG provisions in achieving corporate sustainability in the country. For instance, they can develop new mechanisms to enforce adherence to CG provisions, such as appending good CG practices to listing rules for corporations to comply with. This may lead to increasing corporate engagement in CED practices for those well-governed companies in Jordan.

Even though the findings of the current study are robust, some shortages should be acknowledged. First, though the adopted CED indices are quantity and quality-oriented ones (weighted and unweighted), further studies can develop this analysis by using alternative CED and CG proxies (e.g., number of words/pages/sentences counted and CG index). Second, CG and CED data were manually collected, which required a massive commitment for time and hence limited the focus of the study to a sample of Jordanian listed companies. Future studies are recommended to extend examining the CG-CED nexus beyond a single country context to a cross-country setting such as the MENA region and the Gulf Cooperation Council (GCC) countries. Third, due to data restrictions, the current study was limited to internal CG structures. In the future, researchers are also recommended to provide new insights by investigating how and why external CG mechanisms such as national culture, laws, politics, and market forces can affect CED practices in both developed and developing countries. Given that the present study only covers as far as 2014, and taking into account the enormity of climate change, it would be recommended to repeat the analysis with more updated dataset at a particular point. Although associations between variables are likely to be constant over time than the levels of these variables (Bell et al., 2018; Cowton, 2019), replication of the present study can decide whether any future CG reforms in Jordan can change the evident effects of CG structures on CED that have been revealed in the current study.

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Table 1:

A systematic review of previous CG-to-CED studies

Authors	Objectives	Context	Methodology	Findings
Panel A: Previous CG-to-CED studies in developed economies				
Liao et al. (2015)	This paper investigates the impact of CG on greenhouse gas disclosure.	The UK	Multivariate regression	Although the study concluded positive associations between some CG structures such as female director, board independence and board size and greenhouse gas disclosure, other CG mechanisms, such as non-executive directors, were negatively associated with greenhouse gas disclosure in the UK.
Tauringana and Chithambo (2015)	This research examines whether CG arrangements affect greenhouse gas disclosure.	The UK	Fixed-effects method	This study suggests the heterogeneous effects of CG structures and greenhouse gas disclosure in the UK. Specifically, board size is positively attributed to GHG disclosure, while director ownership and ownership concentation are negatively linked to GHG disclosure.
Rao et al. (2012)	This paper explores the relationship between CG and CED.	Australia	OLS regression	There is a positive association between CG arrangements and CED in Australia.
Prado-Lorenzo and Garcia-Sanchez (2010)	This research studies the impact of CG on greenhouse gas disclosure.	International evidence	Multivariate regression	This paper concluded negative relationships between the board of directors' meetings, size and diversity, and greenhouse gas disclosure globally. In contrast, CEO duality, board independence were positively related to GHG disclosure.
Wang (2017)	This work examines the association between CG and sustainability reporting.	Taiwan	OLS regression, and logistic regression	This study suggests various effects of CG mechanisms on sustainability reporting in Taiwan. For example, although board size, independent directors, and audit committee were positively related to sustainability reporting, director holdings variable is negatively associated with sustainability reporting in the country.
D'Amico et al. (2016)	This research paper sought to investigate the relationship between CG and CED.	Italy	Multivariate regression	The findings indicate that public shareholders variable was positively associated with CED, whereas company ownership and audit committee were negatively associated with CED in Italy.
Jizi (2017)	This paper sought to examine the impact of board composition on environmental disclosures.	The UK	Fixed-effects model	This study found that corporations with a higher level of disclosure of environmental activities have homogeneous board characteristics, such as larger board size, independent boards and greater gender diversity.
Giannarakis et al. (2019)	This paper examines the board-CED nexus	USA	Logit regression	Findings show that while the age of the youngest director is negatively attributed to CED, independent directors" and the "presence of lead independent director appeared to support the decision to improve CED in the US.
Panel B: Previous CG-to-CED studies in developing economies				
Fernandes et al. (2019)	This study examines the relationship between the board of directors and CED.	Brazil	Generalized Linear Model (GLM)	The findings reveal that board independence can encourage greater CED practices in Brazil.
Trireksani and Djajadikerta (2016)	This research examines the association between board size and CED.	Indonesia	Multivariate regression	The findings show that there is a positive relationship between board size and CED in Indonesia.
Akbas (2016)	This study investigates the relationship between board structures and CED.	Turkey	OLS regression	While board size has a positive relationship with CED in Turkey, board independence, gender diversity and audit committee independence were negatively associated with CED.
Ezhilarasi and Kabra (2017)	This study examines the relationship between CG and CED.	India	Random effects model	Board size Positive, Foreign institutional and ownership have positive relations with CED.

Table 2:

Sampling criteria

Description\Years	2010	2011	2012	2013	2014	Total
The Population of Study	251	251	251	251	251	1255
<u>Excluded:</u>						
(Financial companies)	(108)	(108)	(108)	(108)	(108)	(540)
(Missing annual reports)	(43)	(43)	(43)	(43)	(43)	(215)
The sample of study	100	100	100	100	100	500

Table 3:
The Operational Definitions of Research Variables

Variable	Operational Definition
Dependent Variables	
EDI	The total environmental disclosure score measured by the un-weighted environmental disclosure index.
WEDI	The applied EDI consists of 55 items cover five sub-indices. These indices have not equally weighted. Therefore, to check the robustness of the primary results to the weighting of the five categories of the EDI, we follow previous literature in constructing a weighted index. An alternative Environmental Disclosure Index called WEDI was constructed, where equal weights of 20% have been awarded to each category.
EDI1	Environmental policy sub-index which includes five environmental items out of 55 items included in the developed EDI.
EDI2	Environmental pollution sub-index which includes 22 items out of 55 items included in the developed EDI.
EDI3	Environmental energy sub-index which includes 10 out of 55 environmental items included in the developed EDI.
EDI4	Environmental, financial sub-index which includes 7 out of 55 items included in the developed EDI.
EDI5	Environmental other sub-index which includes 11 out of 55 items included in the developed EDI.
Independent Variables	
Bind	Board independence, equal to the proportion of independent directors on the board to the total number of directors on the board
BSIZE	Board size, equal to a total number of directors on the board
CEODUAL	CEO-duality, is a dummy variable equals one if the same person holds CEO and the chairman positions, 0 otherwise
MANGOW	Managerial ownership, equal to the proportion of shares owned by board members and their relatives to the total number of shares outstanding
INSTITOW	Institutional ownership, equal to the proportion of common shares held by the institutions.
FOREOW	Foreign ownership, equal to the proportion of common shares held by the foreign investors (non-Jordanian)
CONCEN	The ownership concentration or largest shareholder, equal to the proportion of common shares held by the largest shareholder who does not serve as an executive officer or director
Control variables	
FSIZE	Firm size, equal to the natural log of total assets
LEV	Leverage, measured as total liabilities scaled by total assets
ROA	Return on assets, measured as net income divided by total assets
MKTB	Market to book ratio
BIG4	Dummy variable set one if the firm is audited by the big 4-audit firm, zero otherwise

Table 4:

The levels, trends and patterns of CED among the sampled firms (%)

	2010	2011	2012	2013	2014	Mean
EDI	7.2	7.4	8.09	9.2	10.05	8.4
EDI1	4.1	5.6	6.7	9.7	18.9	9
EDI2	19.5	25.9	37.6	39.3	43.4	33
EDI3	6.8	7.3	8	8.5	9.5	8
EDI4	10.3	16.5	17.2	18	28.9	18
EDI5	12.3	14.6	15.8	17.5	19.8	16

Note: EDI is the total score of the environmental disclosure index, EDI1 is environmental policy, EDI2 indicates pollution, EDI3 denotes energy, EDI3 represents the environmental financial category, and EDI5 reflects the other environmental group.

Table 5:

Descriptive Statistics

Variable	Obs	Mean	Std.Dev.	Min	Max
EDI	500	.084	.07	0	.309
WEDI	500	.015	.012	0	.055
EDI1	500	.09	.08	0	.034
EDI2	500	.33	.27	0	.121
EDI3	500	.08	.07	0	.029
EDI4	500	.18	.15	0	.065
EDI5	500	.16	.13	0	.059
BIND	500	.338	.265	0	1
BSIZE	500	2.057	.265	1.609	2.565
CEODUAL	500	.188	.391	0	1
MANGOW	500	.507	.266	0	.958
INSTTOW	500	.445	.262	0	.95
FOREOW	500	.163	.202	0	.905
CONCEN	500	.356	.213	.087	.95
FSIZE	500	16.92	1.339	14.416	20.303
LEV	500	.338	.228	.016	.918
ROA	500	.018	.079	-.236	.167
MKTB	500	1.316	.92	.24	4.14
BIG4	500	.378	.485	0	1

Note: EDI is the un-weighted environmental disclosure index, WEDI is the weighted environmental disclosure index, EDI1 is environmental policy, EDI2 indicates pollution, EDI3 denotes energy, EDI3 represents the environmental financial category, EDI5 reflects the other environmental category, BIND is board independence, BSIZE is board size, CEODUAL is CEO duality, MANGOW is managerial ownership, INSTTOW is the institutional ownership, FOREOW is the foreigner ownership, CONCEN is ownership concentration, FSIZE is firm size as measured by the natural log of total assets, LEV is leverage as measured by DOA, ROA is profitability, MKTB is market to book ratio, and BIG4 is auditor type. For more information about the measurements of research variables refer to Table 3.

Table 6:

Matrix of correlations

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
(1) EDI	1.000												
(2) BIND	0.010*	1.000											
(3) BSIZE	0.005*	-0.206*	1.000										
(4) CEODUAL	0.227*	-0.118*	0.026*	1.000									
(5) MANGOW	-0.040*	-0.285*	0.186	0.090*	1.000								
(6) INSTTOW	-0.040*	0.331*	-0.077*	-0.292*	-0.144*	1.000							
(7) FOREOW	0.048*	0.134*	-0.004*	0.022*	-0.175	0.065	1.000						
(8) CONCEN	0.048*	0.250*	-0.154*	-0.138*	-0.154	0.606*	-0.261*	1.000					
(9) FSIZE	0.012*	0.061*	0.323	-0.055*	-0.391*	0.177*	0.179*	0.086	1.000				
(10) LEV	0.081*	-0.041*	-0.071*	-0.055*	-0.127*	0.087*	0.180*	0.096*	0.219*	1.000			
(11) ROA	0.035*	0.066*	0.104*	0.187*	-0.098	0.045*	-0.053*	-0.063*	0.052*	-0.274*	1.000		
(12) MKTB	0.248*	-0.026*	0.196*	0.072*	-0.120*8	0.097*	-0.267*	0.253*	0.183*	0.119*	0.286*	1.000	
(13) BIG4	0.068*	0.239*	0.176*	-0.252*	-0.175	0.334*	0.279*	-0.008*	0.378*	-0.005*	0.103*	0.040*	1.000

Note: EDI is the un-weighted environmental disclosure index, WEDI is the weighted environmental disclosure index, EDI1 is environmental policy, EDI2 indicates pollution, EDI3 denotes energy, EDI3 represents the environmental financial category, EDI5 reflects the other environmental category, BIND is board independence, BSIZE is board size, CEODUAL is CEO duality, MANGOW is managerial ownership, INSTTOW is the institutional ownership, FOREOW is the foreigner ownership, CONCEN is ownership concentration, FSIZE is firm size as measured by the natural log of total assets, LEV is leverage as measured by DOA, ROA is profitability, MKTB is market to book ratio, and BIG4 is auditor type. For more information about the measurements of research variables refer to Table 3. * shows significance at the 0.05 level.

Table 7: Quantile regression results – the relationship between CG and CED proxied by an unweighted disclosure index (EDI)

Models	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Dependent Variables	EDI	EDI	EDI	EDI	EDI	EDI	EDI	EDI	EDI	EDI
Quantiles	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	0.95
BIND	0.000***	0.000***	0.000***	0.000***	0.000**	0.001***	0.001***	0.001***	0.000**	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
BSIZE	0.001***	0.000***	0.002***	0.004***	0.000	0.006***	0.008***	0.002	0.002***	0.002***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)
CEODUAL	0.015***	0.053***	0.051***	0.045***	0.042***	0.024***	0.029***	0.020***	0.014***	0.096***
	(0.001)	(0.002)	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)	(0.007)	(0.001)	(0.000)
MANGOW	-0.001	-0.010***	-0.013***	-0.023***	-0.017***	-0.040***	-0.050***	-0.033***	-0.007***	-0.050***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.004)	(0.001)	(0.001)	(0.002)	(0.002)	(0.000)
INSTTOW	-0.019***	-0.022***	-0.021***	-0.025***	-0.019***	-0.023***	-0.054***	-0.028***	-0.076***	-0.073***
	(0.001)	(0.001)	(0.001)	(0.003)	(0.004)	(0.002)	(0.003)	(0.005)	(0.002)	(0.000)
FOREOW	0.010***	0.015***	0.004***	0.015***	-0.009	0.016***	0.045***	0.029***	0.029***	0.010***
	(0.001)	(0.003)	(0.001)	(0.002)	(0.005)	(0.001)	(0.003)	(0.011)	(0.002)	(0.001)
CONCEN	-0.001	-0.019***	-0.032***	-0.046***	-0.044***	-0.033***	-0.064***	-0.057***	-0.134***	-0.171***
	(0.002)	(0.003)	(0.001)	(0.002)	(0.008)	(0.002)	(0.003)	(0.015)	(0.004)	(0.001)
FSIZE	0.000	-0.003***	0.002***	0.002**	0.005***	0.002***	-0.003***	-0.005	-0.005***	-0.005***
	(0.000)	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)	(0.003)	(0.000)	(0.000)
LEV	0.037***	0.075***	0.058***	0.038***	0.043***	0.020***	0.026***	0.011	0.022***	0.031***
	(0.002)	(0.004)	(0.001)	(0.002)	(0.006)	(0.002)	(0.004)	(0.015)	(0.003)	(0.001)
ROA	-0.031***	-0.096***	-0.106***	-0.075***	-0.096***	-0.043***	-0.068***	-0.028*	-0.003	-0.042***
	(0.004)	(0.003)	(0.004)	(0.003)	(0.011)	(0.007)	(0.006)	(0.014)	(0.007)	(0.003)
MKTB	0.003***	0.004***	0.001***	0.002	0.008***	0.011***	0.023***	0.020***	0.012***	0.004***
	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)
BIG4	0.008***	0.014***	0.008***	0.017***	0.002	0.007***	0.003*	0.006***	0.007***	0.018***
	(0.001)	(0.001)	(0.000)	(0.003)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)
Obs.	500	500	500	500	500	500	500	500	500	500

Note: EDI is the un-weighted environmental disclosure index, WEDI is the weighted environmental disclosure index, BIND is board independence, BSIZE is board size, CEODUAL is CEO duality, MANGOW is managerial ownership, INSTTOW is the institutional ownership, FOREOW is the foreigner ownership, CONCEN is ownership concentration, FSIZE is firm size as measured by the natural log of total assets, LEV is leverage as measured by DOA, ROA is profitability, MKTB is market to book ratio, and BIG4 is auditor type. For more information about the measurements of variables refer to Table 3. Standard errors are in parenthesis. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 8: Quantile regression results – the relationship between CG and CED proxied by a weighted disclosure index (WEDI)

Model	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Dependent Variable	WEDI	WEDI	WEDI	WEDI	WEDI	WEDI	WEDI	WEDI	WEDI	WEDI
Quantiles	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	0.95
BIND	0.001***	0.000	0.003***	0.005***	0.000	0.007***	0.009***	0.001	0.003***	0.002***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)
BSIZE	0.000***	0.000**	0.000***	0.000***	0.000*	0.001***	0.001***	0.001***	0.000*	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
CEODUAL	0.002***	0.008***	0.008***	0.006***	0.007***	0.004***	0.005***	0.003***	0.000	0.018***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
MANGOW	-0.000	-0.001***	-0.003***	-0.005***	-0.001***	-0.007***	-0.007***	-0.009***	-0.005***	-0.012***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)
INSTTOW	-0.003***	-0.004***	-0.003***	-0.001	-0.002**	-0.004***	-0.008***	-0.006***	-0.018***	-0.007***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)	(0.001)	(0.001)
FOREOW	0.001***	0.002***	0.000***	0.005***	0.001	0.003***	0.008***	0.008***	0.005***	-0.001
	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
CONCEN	-0.001	-0.004***	-0.006***	-0.009***	-0.011***	-0.008***	0.004***	0.011***	0.024***	0.024***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)	(0.001)	(0.001)
FSIZE	0.000	-0.000***	0.000***	0.001***	0.001***	0.001***	-0.000***	-0.001***	-0.000**	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
LEV	0.008***	0.012***	0.011***	0.007***	0.007***	0.005***	0.002***	0.004***	0.002***	-0.002
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)
ROA	-0.008***	-0.017***	-0.020***	-0.014***	-0.019***	-0.007***	-0.004***	-0.001	-0.000	-0.020***
	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.002)	(0.000)	(0.002)	(0.003)	(0.002)
MKTB	0.000***	0.001***	0.000	0.001***	0.002***	0.002***	0.005***	0.003***	0.002***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
BIG4	0.001***	0.002***	0.001***	0.001***	0.001**	0.001***	0.002***	0.000	0.002***	0.004***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Obs.	500	500	500	500	500	500	500	500	500	500

Note: EDI is the un-weighted environmental disclosure index, WEDI is the weighted environmental disclosure index, BIND is board independence, BSIZE is board size, CEODUAL is CEO duality, MANGOW is managerial ownership, INSTTOW is the institutional ownership, FOREOW is the foreigner ownership, CONCEN is ownership concentration, FSIZE is firm size as measured by the natural log of total assets, LEV is leverage as measured by DOA, ROA is profitability, MKTB is market to book ratio, and BIG4 is auditor type. For more information about the measurement of variables measurements refer to Table 3. Standard errors are in parenthesis. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 9:
Two-Step system GMM results – robustness analysis

	(1) EDI	(2) WEDI
L.EDI	0.840***	-
	(0.006)	
BIND	0.008***	0.001***
	(0.003)	(0.000)
BSIZE	0.003***	0.000***
	(0.000)	(0.000)
CEODUAL	0.012***	0.002***
	(0.003)	(0.000)
MANGOW	-0.011***	-0.002***
	(0.001)	(0.000)
INSTTOW	-0.018***	-0.003***
	(0.003)	(0.000)
FOREOW	0.022***	0.004***
	(0.003)	(0.001)
CONCEN	-0.021***	-0.003***
	(0.004)	(0.001)
FSIZE	0.002***	0.000***
	(0.000)	(0.000)
LEV	0.028***	0.005***
	(0.003)	(0.001)
ROA	-0.020***	-0.004***
	(0.004)	(0.001)
MKTB	0.006***	0.001***
	(0.001)	(0.000)
BIG4	0.016***	0.003***
	(0.001)	(0.000)
L.WEDI		0.831***
		(0.006)
_cons	-	
	0.068**	0.084***
	(0.031)	(0.032)
Obs.	400	400
Arellano-Bond test for AR(1) in first differences (P-value)	0.0080	0.003
Arellano-Bond test for AR(2) in first differences (P-value)	0.426	0.434
Sargan test of overid. restrictions:	87.04	84.44
Durbin (score) chi2		1.834 (p = 0.400)
Wu-Hausman F(2,818)		0.900 (p = 0.407)

Note: EDI is the un-weighted environmental disclosure index, WEDI is the weighted environmental disclosure index, BIND is board independence, BSIZE is board size, CEODUAL is CEO duality, MANGOW is managerial ownership, INSTTOW is the institutional ownership, FOREOW is the foreigner ownership, CONCEN is ownership concentration, FSIZE is firm size as measured by the natural log of total assets, LEV is leverage as measured by DOA, ROA is profitability, MKTB is market to book ratio, and BIG4 is auditor type. For more information about the measurements of variables refer to Table 3. Standard errors are in parenthesis. *** $p<0.01$, ** $p<0.05$, * $p<0.1$