The effect of corporate governance on carbon emission disclosures

Evidence from Turkey

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Abstract

Purpose – The purpose of this study is to investigate whether corporate governance characteristics impact the voluntary disclosure of carbon emissions.

Design/methodology/approach – This empirical research was carried out in two stages. Initially, the carbon disclosures data were sourced from the annual and stand-alone sustainability reports of Turkish non-financial companies listed on Borsa Istanbul during 2011-2015. Later, the corporate governance characteristics that influence carbon disclosures were examined using panel data regression models.

Findings – The empirical findings of this study suggested that entities with a higher number of independent directors on their boards were more likely to respond to the Carbon Disclosure Project. In addition, board nationality diversity and the existence of a sustainability committee had a significant positive impact on the propensity to disclose carbon emissions and the extent of those disclosures.

Originality/value – This research provides empirical evidence of the determinants of carbon emission disclosures, which could be useful for organizations and regulatory bodies. Such an understanding is crucial to specify necessary policies that will provide emission reduction practices and policies for entities. This paper fills some of the gap in the literature by concentrating on the association between corporate governance characteristics and disclosures of a more specific environmental issue, being carbon emissions.

Keywords Corporate governance, Board independence, Board diversity, Carbon Disclosure Project, Carbon emission disclosures, Sustainability committee

Paper type Research paper

1. Introduction

Global warming and climate change have become increasingly growing problems that threaten the future of the world. Many stakeholder groups are urging action and proposing several solutions in association with those problems (Prado-Lorenzo *et al.*, 2009). In particular, environmental groups are lobbying governments to establish regulations on

greenhouse gas (GHG) emissions and calling entities to take proactive measures on carbon emission strategies (Reid and Toffel, 2009). Increasing attention on GHG emissions has also created an effect on GHG emissions-related disclosures. Therefore, developing proactive strategies for environmental issues and disclosing GHG emissions information have become crucial for entities to maintain their corporate image in response to the demand by stakeholders.

This article is motivated by several concerns. The initial motivation for this study was created by the decision to investigate carbon emission disclosures in Turkey, an emerging economy, because prior research has generally focused on the carbon emission disclosure practices of developed countries (Rankin *et al.*, 2011; Choi *et al.*, 2013; Liao *et al.*, 2015; Yunus *et al.*, 2016; Ben-Amar *et al.*, 2017). Previous empirical studies have mainly explored the link between GHG emission disclosures and conventional company characteristics, such as firm size, profitability, leverage, firm age and industry (Prado-Lorenzo *et al.*, 2009; Chithambo and Tauringana, 2014; Gonzalez-Gonzalez and Ramírez, 2016). On the other hand, very few studies have investigated the impact of corporate governance characteristics (e.g. board size, board independence and board committees) on corporate reporting practices relative to carbon emissions (Liao *et al.*, 2015; Yunus *et al.*, 2016; Ben-Amar *et al.*, 2017). In addition, the number of research studies examining the association between board gender diversity and carbon emission disclosures has also been sparse (Prado-Lorenzo and Garcia-Sanchez, 2010; Liao *et al.*, 2015; Ben-Amar *et al.*, 2017; Hollindale *et al.*, 2017). In this sense, another motivation for this research was to fill this gap in the prior literature by exploring whether a significant association exists between the level of carbon emission disclosures and board characteristics, including board size, board independence, board gender diversity and board committees. Moreover, with regard to board diversity, there has not been a prior study that analyzed the diversity of nationalities on boards relative to carbon emission disclosures. This gap has created the motivation to research the impact of the diversity on boards with regard to the nationality of board members on carbon emission disclosures.

The remainder of this study is as follows. Section 2 provides an explanation of the theoretical background, and Section 3 gives a review of the literature. Section 4 presents hypotheses, Section 5 describes measurement of variables and research methods. Section 6 presents the main analyses and discussions. Finally, Section 7 concludes the paper.

2. Theoretical framework

One theory that is used widely to understand the determinants of environmental and social disclosures is the legitimacy theory, which proposes the concept of a "social contract" existing between organizations and society at large (Choi *et al.*, 2013). Legitimacy theory suggests that environmental legitimacy is built based on the perception of an organization as environmentally responsible by relevant publics (Kuo and Chen, 2013). As a consequence of growing attention on environmental issues, the tendency of firms to engage in environmentally responsible practices increased. In this respect, firms convince stakeholders that their activities are in line with stakeholders' expectations with regard to carbon emissions to legitimize themselves and to keep the social contract (Yunus *et al.*, 2016). One way of doing this is to disclose their carbon management practices via several channels such as annual reports, sustainability reports and websites.

Stakeholder theory posits that an entity tries to harmonize its activities with stakeholder expectations (Barako and Brown, 2008). External pressure from several stakeholder groups, including customers, non-governmental organizations (NGOs), media and local communities, tends to increase steadily in terms of environmental and social issues (Lee *et al.*, 2015). Pressures from stakeholders force company management to disclose more

information (Naser *et al.*, 2006); therefore, stakeholders have a vital role in the social and environmental disclosures of the companies. To respond to pressures from stakeholder groups, companies may tend to engage in environmentally responsible practices and disclose them through communication channels.

3. Literature review

3.1 Background: Kyoto protocol and Carbon Disclosure Project

The Kyoto Protocol was adopted in 1997 and entered into force in 2005 as a main driver of changes in corporate approaches to global warming (Lee *et al.*, 2015). The main objective of the Protocol is to mitigate the global warming effect by bringing GHG emissions to acceptable levels (Freedman and Jaggi, 2005). Since the introduction of the Kyoto Protocol, entities, especially those operating in environmentally sensitive industries, have been under increasing pressure to prevent organization-wide carbon emissions.

In 2000, the Carbon Disclosure Project (CDP), a non-profit civil organization with headquarters in the UK, emerged. The CDP works with shareholders and enterprises to develop a voluntary standardized form for climate change-related activities of companies (Kolk *et al.*, 2008). Since 2002, the CDP has been sending corporations a voluntary questionnaire. By using this questionnaire, the CDP asks the largest public companies worldwide to directly disclose their climate change-related strategies and company-wide GHG emissions each year. Some results arising from the survey are made available to the public (Depoers *et al.*, 2016). Thus, the CDP is endeavoring to provide effective communication between companies and their investors by publishing the questionnaire responses (Saka and Oshika, 2014).

The Turkish Government signed the Kyoto Protocol in 2009 to deal with climate change-related risks, publishing this decision in the Official Gazette numbered 27227, dated May 13, 2009. Then, in 2010, the CDP was introduced into Turkey. Subsequently, in April 2012, the Turkish Government approved a regulation that requires the monitoring, verifying and reporting of GHG emissions of the enterprises (MoEU, 2012). According to this regulation, before 2016, specific facilities (e.g. oil refineries, iron and steel, clinker, paper and chemicals) that operate above certain capacities would adopt verification and reporting systems to control their company-wide GHG emissions. The government has postponed the application date of this regulation to 2017 when it published the revised agenda in 2014. It was expected that this legislation would impact the carbon emission policies, target setting, measuring and strategies of the companies in particular industries.

Since then, in April 2016, Turkey became a part of Paris Climate Change Agreement landmark, which aims to limit the increase in global temperature levels and to deal with climate change-related issues. Although Turkey signed the Paris Agreement in April 2016, it still has not ratified the Agreement. Policies regarding ratification of the Paris Agreement will also impact the scope of environmental regulations in Turkey. As a European Union (EU) candidate, Turkey also follows the EU directives regarding environmental issues. Therefore, policies on GHG emissions appear to be on the agenda of the regulatory bodies in Turkey.

3.2 Prior research

Prior research has mainly concentrated on investigating the link between various company characteristics and general social and environmental disclosures (Naser *et al.*, 2006; Barako and Brown, 2008; Kiliç *et al.*, 2015). In accordance with growing concerns about climate change-related issues, an increasing number of studies analyzed carbon reporting practices of companies in different country contexts. A strand of research studies investigated the

determining factors of carbon reporting in companies. For instance, Prado-Lorenzo *et al.* (2009) analyzed factors influencing the GHG emission disclosures of companies with a cross-country sample (USA, Australia, Canada and the EU). Their findings revealed that firm size and market capitalization have a significant and positive influence on information disclosures, in addition to the required Global Reporting Initiative indicators relating to GHG emissions. Further, using a sample from Spain, Gonzalez-Gonzalez and Ramírez (2016) analyzed factors influencing the decisions of companies to disclose carbon information. Their findings denoted that large firm size, high financial risk and low ownership concentration increased the probability of carbon disclosures, suggesting that pressures from stakeholders have a significant influence on those disclosures. Chithambo and Tauringana (2014) similarly revealed that firm size, gearing, financial slack and the type of industry significantly affect GHG disclosures among the listed companies on the London Stock Exchange. From a sample comprising large companies from 15 countries, Luo *et al.* (2013) determined that financial resources play a vital role in company decisions relating to carbon emission disclosures. In addition, by investigating the climate change-related disclosures of S&P 500 companies, Stanny and Ely (2008) found that firm size, previous disclosures and foreign sales were significant determinants of these disclosures. With a sample from Global 500 companies retrieved from the CDP 2009 report, Luo *et al.* (2012) investigated the corporate factors that motivate companies to disclose carbon information. They found that larger companies are more aware of their environmental responsibilities and are more willing to disclose carbon information voluntarily.

Further, another strand of research examined the impact of various corporate governance characteristics on carbon disclosures. For example, using a sample with Australian companies, Rankin *et al.* (2011) and Choi *et al.* (2013) indicated that the quality of corporate governance enhanced the extent of voluntary carbon emission disclosures in Australian companies. A further study by Yunus *et al.* (2016) examined the determining factors of the decision to adopt carbon management strategy within the top 200 Australian listed companies. They documented that the presence of an environment management system, having an environmental committee, board size and board independence significantly and positively impacted a firm's decision to adopt a carbon management strategy.

Regarding board gender diversity, Ben-Amar *et al.* (2017) investigated the impact of female directors on the decision of Canadian companies to respond to demands from stakeholders about climate change-related issues. Their results revealed that the probability of climate change-related disclosures is higher for firms with more gender-diverse boards. With a sample from the 329 largest companies in the UK, Liao *et al.* (2015) similarly denoted that board gender diversity positively affected the extent of GHG disclosures. A recent study by Hollindale *et al.* (2017) analyzed the link between board gender diversity and GHG emission disclosures for a sample of Australian listed companies. They determined that the existence of multiple female directors on boards has a significant and positive impact on the quantity and quality of GHG emission disclosures.

As seen from the above discussions, there is a scarcity of studies investigating the association between board characteristics and carbon emission disclosures. Further, almost all prior research focused on cases within developed countries. Only Luo *et al.* (2013) investigated the differences in carbon emission disclosures between developed and developing countries. Therefore, this research attempted to investigate the carbon emission disclosures and their determining factors in an emerging country. Carbon disclosure propensity is measured with two proxies. First, carbon disclosure index (CDI) is used to determine the extent of carbon emission disclosures of companies in their annual and

sustainability reports. Second, responding CDP (RCDP) is used to determine the decision of a company to respond to the CDP. Hence, while the RCDP indicates the decision of a company to respond to this questionnaire, the CDI measures the level and extent of carbon disclosures. Thus, two following research questions are proposed:

RQ1. What is the association between corporate governance characteristics and the extent of carbon emission disclosures within Turkish listed companies?

RQ2. What is the impact of corporate governance characteristics on the decision to respond to the CDP within Turkish listed companies?

4. Hypothesis
4.1 Board size
As a top management body, the board of directors is responsible for developing sustainable business strategies (Jizi *et al.*, 2014) for supervising the prudent use of the firms' assets (Jizi *et al.*, 2014), and for ensuring that material environmental risks are well-monitored and fully disclosed (Ben-Amar *et al.*, 2017). The inclusion of more directors may enhance board monitoring capacity and the ability to promote value-creating activities (Akhtaruddin *et al.*, 2009). Hence, to enhance company value, firms with larger boards may be more strongly inclined to deal with issues relating to carbon emission disclosures. There are very few studies focusing on board size and the specific disclosure subject of carbon emissions. For instance, Liao *et al.* (2015) and Yunus *et al.* (2016) found a significant and positive link between board size and carbon emission disclosures. Thus, the following hypotheses are suggested:

H1a. Board size has a significant and positive impact on carbon disclosures.

H1b. Entities with larger boards are more likely to respond to the CDP.

4.2 Board composition
The effectiveness of corporate governance in reducing agency problems between management and shareholders depends upon board composition, which is defined as the proportion of outside (non-executive) directors to the total number of directors (Akhtaruddin *et al.*, 2009). It is assumed that independent directors enhance the climate change-related activities of entities and carbon emission disclosures in several ways. First, independent directors are expected to be highly successful in supervising management in terms of improving long-term value and sustaining a high degree of transparency (Jizi *et al.*, 2014). Further, independent directors broaden sensitivity to social demands because they inhibit a focus on short-term results (Yunus *et al.*, 2016). In the stakeholder theory premise, board independence is positively associated with sustainability reporting because external directors are subjected to a lesser degree to pressure from shareholders and managers, compared to internal directors (Hussain *et al.*, 2016). In prior literature, a number of studies reported a significant positive impact of board independence on voluntary carbon disclosures (Liao *et al.*, 2015; Yunus *et al.*, 2016). Thus, the following hypotheses are developed:

H2a. Board independence has a significant and positive impact on carbon disclosures.

H2b. Entities with a larger number of independent directors on their boards are more likely to respond to the CDP.

4.3 Board diversity

Board diversity has become a vital component of corporate governance structure (Barako and Brown, 2008). Board diversity is defined as one variation among the several characteristics of the board members such as expertise, personality, learning style, background, education, age and experience (Coffey and Wang, 1998).

Prior studies suggest several reasons favoring a positive relationship between board gender diversity and company disclosures. First, recruiting more female directors enhances a diversity of opinions in board discussions (Barako and Brown, 2008), thereby ensuring the consideration of a wider range of perspectives in the decision-making process and improving board communication (Bear *et al.*, 2010). Second, firms with a diverse board will possess broader knowledge with which to identify the best strategies to manage potential conflicts among stakeholders (Harjoto *et al.*, 2015). Hence, the presence of female directors may provide a better assessment of the needs of diverse stakeholders, which, in turn, enables a firm to make better decisions (Bear *et al.*, 2010).

The literature provides limited evidence on the link between board gender diversity and carbon emission disclosures. For instance, Ben-Amar *et al.* (2017) found that recruiting women to be directors on company boards enhanced firms' awareness relative to environmental issues. Liao *et al.* (2015) and Hollindale *et al.* (2017) reported a significant and positive association between board gender diversity and GHG disclosures. In this sense, it is anticipated that entities with gender-diverse boards will be more successful in incorporating carbon emission reduction practices, as well as communicating their activities to the stakeholders. Therefore, the following hypotheses can be considered:

H3a. The number of female directors on a board has a significant positive impact on carbon disclosures.

H3b. Entities with gender diverse boards are more likely to respond to the CDP.

Some of the prior discussions regarding the impact of board gender diversity on carbon emission disclosures are also notably applicable to the board nationality diversity. First, diversity brings different perspectives, ideas and information to board discussions, and hence increases the capability of a firm to achieve better and more effective decisions (Estélyi and Nisar, 2016). Second, board diversity increases a board's ability to recognize the needs and interests of different groups of stakeholders (Harjoto *et al.*, 2015). Estélyi and Nisar (2016) determined that shareholder heterogeneity and a firm's international market operations are key determinants of the board nationality diversity. Therefore, entities with diverse boards based upon nationality have a larger audience and may be subject to pressure from various stakeholder groups relating to climate change and global warming issues. In this regard, it is expected that entities with diverse boards based upon nationality will be successful in engaging carbon emission reduction practices and in disclosing carbon emission-related information. Thus, the following hypotheses are developed:

H4a. The number of foreign directors on a board has a significant positive impact on carbon disclosures.

H4b. Entities with a higher number of foreign directors on their boards are more likely to respond to the CDP.

4.4 Board committees

Specific internal organizational systems are crucial for the credibility of monitoring, measuring, recording and disclosing gas emissions in response to changing societal

expectations and regulatory requirements (Rankin *et al.*, 2011). An environmental committee, driven by legitimacy and reputation management motives, would aim to implement policies and practices on the measurement and reporting of GHG emissions levels as a way of reducing risks associated with global warming (Yunus *et al.*, 2016). Thus, the following hypotheses are developed:

H5a. The existence of a sustainability committee has a significant positive impact on carbon disclosures.

H5b. Entities that have a sustainability committee are more likely to respond to the CDP.

5. Measurement of variables

5.1 Dependent variables

Two proxies were considered to measure the carbon disclosure propensity. First, a content analysis approach was used to investigate the carbon emission disclosures of the entities. A non-weighted (binary) index was devised to examine the narrative sections of the annual and stand-alone sustainability reports (e.g. chairman or director's statement, review of sustainability activities and discussions) for each entity. If the entity disclosed a certain item at least once, the score was assigned as 1, and 0 otherwise. Hence, CDI, including 20 items, was identified to measure the extent of carbon emission disclosures provided by the entities. The CDI was developed based upon prior studies (Prado-Lorenzo *et al.*, 2009; Rankin *et al.*, 2011; Choi *et al.*, 2013; Luo *et al.*, 2013). The carbon disclosure score was calculated by dividing the items disclosed to a maximum number of items that a firm could disclose. The total CDI score was calculated as:

$$CDI = \frac{\sum_{i=1}^{t} c_i}{t}$$

where $c_i = 0$ or 1, as follows:

$c_i = 0$ if the disclosure item was not found;

$c_i = 1$ if the disclosure item was found; and

$t =$ the maximum number of carbon disclosure items a firm could disclose (i.e. 20 items).

Since 2010, the launch date of CDP in Turkey, the CDP has sent a questionnaire to all targeted firms. In this regard, RCDP was measured as a binary dependent variable that was equal to 1 if the firm replied to the CDP and 0 otherwise.

5.2 Independent variables

Board size was measured as total number of board members. Board independence was calculated as the number of independent directors divided by the total number of directors. Further, board gender diversity was measured by two proxies: the percentage of female directors and Blau index of heterogeneity. The percentage of female directors was calculated as the number of women divided by the total number of directors. As a higher number of women show homogeneity in terms of gender, simply using only the proportion of female directors may not present an appropriate proxy for measuring diversity (Campbell and Minguez-Vera, 2008). According to Miller and Triana (2009), the Blau index is an ideal proxy to measure diversity because it has zero points to represent a complete homogeneity, while

larger numbers indicate greater diversity. The Blau index ranges from 0 to a maximum of 0.5 (Blau, 1977):

$$1 - \sum_{i=1}^{n} p_i^2$$

where p_i is the percentage of board members in each category and n represents the number of categories used. When the percentage of each category is at a maximum, the Blau index also takes the maximum value (Campbell and Mínguez-Vera, 2008). In this sense, a Blau index of heterogeneity was used to measure the board gender diversity. The diversity on boards with regard to nationality was also calculated using the Blau index. In addition, the existence of a sustainability committee was measured as a binary variable where firms with a committee were coded as 1 and 0 otherwise.

5.3 Control variables

This paper controls for the effect of several variables (i.e. firm size, profitability, leverage, industry and foreign listing), which have been mentioned in the prior accounting literature regarding their impact on a firm's voluntary environmental disclosures. Large-sized entities are under external pressure to disclose their environmental policies and practices because of their high visibility and greater public scrutiny (Yunus *et al.*, 2016). As a result of this pressure, larger entities are more likely to voluntarily disclose their carbon emissions. Accordingly, a positive association is expected between firm size and carbon emission disclosures. Firm size was measured as the natural logarithm of total assets.

Firms in better financial condition would have more resources to pay the costs associated with identifying, collecting and reporting the information required for carbon emission disclosures (Choi *et al.*, 2013). In addition, environmental disclosures could be a means of gaining public trust and legitimacy relative to the way of earning profits (Chithambo and Tauringana, 2014). Therefore, a positive relationship is expected to be observed between profitability and carbon emission disclosures. The profitability of the entities was calculated as the net income divided by the total assets and total equity.

Disclosing more information about social and environmental activities may reduce possible conflicts between owners and creditors, and consequently, agency costs (Prado-Lorenzo *et al.*, 2009). As the entities rely increasingly on creditor funding, they will make voluntary disclosures to address the expectations of the creditors (Rankin *et al.*, 2011). Therefore, a positive relationship is expected to be found between leverage and carbon emission disclosures. The leverage was measured by the ratio of total liabilities to total assets.

Consistent with stakeholder and legitimacy theories, entities from high-carbon-intensive industries are under pressure to demonstrate their green policies, strategies and practices (Chithambo and Tauringana, 2014). Hence, firms operating in environmentally sensitive industries are more prone to disclose their climate change-related risks and carbon emission policies, compared to entities from low-carbon industries (Ben-Amar *et al.*, 2017). Accordingly, a positive relationship is expected between the environmental sensitivity of industries and their carbon emission disclosures. In this research, the industries of pulp and paper, energy, chemicals, metals, utilities, machinery, mining, cement, glass and transportation were categorized as environmentally sensitive, and all others as non-environmentally sensitive.

Cross-listed entities tend to enhance their social and environmental performance to legitimize themselves in foreign markets and to mitigate the liability of foreignness (Del Bosco and Misani, 2016). In this vein, a positive association is expected between foreign listing and carbon emission disclosures. Foreign listing was measured as a binary variable, where firms were listed on a foreign exchange coded as 1 and 0 otherwise. Table I presents the operational definitions of dependent, independent and control variables.

5.4 Research model
Panel data regression models were used to investigate the association between corporate governance characteristics and the carbon emission disclosures level. The following research models were proposed for this study:

Model 1:

$$CDI = \beta_0 + \beta_1 BSIZE + \beta_2 BINDP + \beta_3 BGENDER + \beta_4 BLAUFOREIGN$$
$$+ \beta_5 SCOM + \beta_6 SIZE + \beta_7 ROA + \beta_8 LEV + \beta_9 IND + \beta_{10} FLISTING + \varepsilon$$

Model 2:

$$RCDP = \beta_0 + \beta_1 BSIZE + \beta_2 BINDP + \beta_3 BGENDER + \beta_4 BLAUOREIGN$$
$$+ \beta_5 SCOM + \beta_6 SIZE + \beta_7 ROA + \beta_8 LEV + \beta_9 IND$$
$$+ \beta_{10} FLISTING + \varepsilon$$

Variables	Operational definition
Dependent variables	
CDI	The % of total items a firm disclosed to total items (i.e. 20 items) in disclosure index
RCDP	1 if a firm replied to the CDP, 0 otherwise
Independent variables	
Board size (BSIZE)	Total number of directors on the board
Board independence (BINDP)	The % of independent directors to total number of directors on the board
Board gender diversity (BGENDER)	The % of female directors to total number of directors on the board
BLAUGENDER	Blau index of gender diversity
BLAUFOREIGN	Blau index of nationality diversity
Sustainability committee (SCOM)	1 if a firm had a sustainability committee, 0 otherwise
Control variables	
Firm size (SIZE)	The natural logarithm of total assets
Return on assets (ROA)	The % of net income to total assets
Return on equity (ROE)	The % of net income to total equity
Leverage (LEV)	The % of total liabilities to total assets
Industry (IND)	1 if a firm operates in environmentally sensitive industry, 0 otherwise
Foreign listing (FLISTING)	1 if a firm listed on a foreign exchange, 0 otherwise

Table I.
The operational definitions of dependent, independent and control variables

5.5 Sample selection

Because the CDP was introduced in Turkey at the beginning of 2010, the carbon emission disclosures by companies were explored for the period from 2011 to 2015. First, the listed companies in the Borsa Istanbul (BIST) were determined as of December 31, 2015. Then, the companies which were not continuously listed between 2011 and 2015 were excluded. Further, the financial, insurance and sport companies were eliminated from the sample, because of their significantly different financial reporting practices. Consequently, the final sample included 154 firms and 770 firm-year observations in total.

Companies generally report their policies, strategies and activities relating to environmental issues through annual reports, stand-alone sustainability reports, integrated reports and websites. In Turkey, organizations generally disclose environmental issues in their annual reports or stand-alone sustainability reports. Hence, carbon emission disclosures data were obtained through the annual reports and sustainability reports of the companies. Further, financial data (e.g. total assets, return of assets [ROA], return of equity [ROE] and leverage) were collected directly or calculated from the annual financial reports of the entities.

6. Results and discussion

6.1 Descriptive statistics

The results of the descriptive statistics are shown in Table II. CDI ranged from 0 to 95 per cent, indicating a substantial variation within the sample. The average mean of CDI was 0.14, which implies that the level of carbon emission-related information disclosed by sample companies was quite low. The mean of RCDP indicated that only 14 per cent of sample companies replied to the CDP. The BSIZE varied greatly across the sample, as the minimum was 3 and the maximum was 15. The average board had 7.40 directors with a standard deviation of 2.13. The percentage of independent directors on an average board was 24 per cent. The highest percentage of women representation on boards was 67 per cent, with a mean of 12 per cent. Overall, the number of women represented in boardrooms was very low. On average, the Blau gender diversity score was 0.18. The average Blau nationality diversity score was 0.14. Only 11 per cent of the sample companies had a sustainability committee to deal with climate change-related issues. The average firm in this research sample had a size (i.e. natural logarithm of total assets) of 8.68, ROA of 5 per cent,

Variables	Mean	SD	Minimum	Maximum
CDI	0.14	0.25	0.00	0.95
RCDP	0.14	0.34	0.00	1.00
BSIZE	7.40	2.13	3.00	15.00
BINDP	0.24	0.13	0.00	0.50
BGENDER	0.12	0.13	0.00	0.67
BLAUGENDER	0.18	0.17	0.00	0.50
BLAUFOREIGN	0.14	0.20	0.00	0.50
SCOM	0.11	0.32	0.00	1.00
SIZE	8.68	0.73	6.65	10.68
ROA	0.05	0.72	−13.84	11.64
ROE	0.02	1.02	−17.97	12.00
LEV	0.52	0.49	0.01	8.67
IND	0.83	0.37	0.00	1.00
FLISTING	0.03	0.17	0.00	1.00

Table II.
Descriptive statistics results ($N = 770$)

ROE of 2 per cent and leverage of 52 per cent. Companies belonging to environmentally sensitive industries comprised 83 per cent of the sample. The mean of foreign listed companies was 3 per cent.

6.2 Correlation matrix and bivariate analysis

The bivariate relationships among the variables are shown in Table III. The results indicated that there was a significant and positive bivariate association between CDI and BSIZE, BLAUFOREIGN and SCOM. In addition, it showed that RCDP was significantly and positively associated with BSIZE, BINDP, BLAUFOREIGN and SCOM, while it was associated negatively with BGENDER and BLAUGENDER.

6.3 Multivariate analysis

The data was based upon the years from 2011 and 2015. A panel data analysis was used. Panel data methodology was highly recommended as it eliminated problems related to multicollinearity, estimation bias to a certain extent and the time-variant associations between dependent and independent variables, which were established via panel data analysis (Baltagi, 2001). To determine the right estimation method between pooled ordinary least squares (OLS), random-effect (RE) and fixed-effect (FE) models, various methods were applied. Initially the F-test was used to choose between pooled-OLS and FE models. Following the F-test, the Breusche and Pagan Lagrange Multiplier (LM) test was used to choose between the RE and pooled-OLS models. Finally, the Hausman's test was used to determine the difference between the RE and FE models. The results were shown in Table IV.

The original model was diversified with variables such as BGENDER, BLAUGENDER, ROA and ROE. Model 1 attempted to determine the effect of BLAUGENDER and ROA on the other independent variables. As aforementioned, comparisons of the estimation models among OLS, FE and RE by using the F-test, LM test and Hausman's test were conducted. Accordingly, the F-test results showed that FE was superior to pooled OLS in each model, and the LM test results showed that RE was superior to pooled OLS. Finally, the Hausman's test results indicated that Models 1 and 3 had FE while Models 2 and 4 had RE. Because of the heteroscadasticity issue in each model, cluster-robust variance and a covariance estimator were used to resolve it.

SCOM and SIZE had a statistically significant effect on CDI at a 1 per cent significance level, while BLAUFOREIGN had a statistically significant and positive impact on CDI at a 10 per cent significance level in each model. In addition, IND was positively associated with CDI at a 5 per cent significance level in Models 1 and 3, while it was positively associated with CDI at a 10 per cent level in Models 2 and 4. Moreover, BSIZE, BINDP, BGENDER and

No.	Variables	1	2	3	4	5	6	7	8
1	CDI	1							
2	RCDP	0.528**	1						
3	BSIZE	0.393**	0.174**	1					
4	BINDP	0.044	0.083*	−0.087*	1				
5	BGENDER	−0.056	−0.114**	−0.154**	−0.026	1			
6	BLAUGENDER	−0.025	−0.099**	−0.100**	−0.034	0.964**	1		
7	BLAUFOREIGN	0.164**	0.138**	0.281**	−0.038	−0.190**	−0.193**	1	
8	SCOM	0.867**	0.432**	0.351**	0.069	−0.064	−0.038	0.127**	1

Notes: *$p < 0.05$; **$p < 0.01$

Table III.
Correlation analysis
results

Independent variables	(1) FE	(2) RE	(3) FE	(4) RE
BGENDER			0.022 (0.69)	0.019 (0.58)
BLAUGENDER	0.019 (0.68)	0.016 (0.59)		
ROA	−0.00011 (−0.30)		−0.00010 (−0.28)	
ROE		0.0099 (1.13)		0.0099 (1.13)
BSIZE	−0.00032 (−0.10)	−0.00035 (−0.10)	−0.00028 (−0.09)	−0.00032 (−0.10)
BINDP	0.014 (0.63)	0.014 (0.65)	0.014 (0.65)	0.015 (0.65)
BLAUFOREIGN	0.067* (1.74)	0.068* (1.75)	0.067* (1.73)	0.068* (1.74)
SCOM	0.55*** (11.91)	0.55*** (12.76)	0.55*** (11.91)	0.55*** (12.75)
SIZE	0.051*** (4.35)	0.049*** (4.38)	0.052*** (4.35)	0.049*** (4.37)
LEV	−0.0042 (−0.54)	−0.00098 (−0.19)	−0.0041 (−0.53)	−0.00091 (−0.17)
IND	0.037** (1.99)	0.036* (1.95)	0.037** (1.99)	0.036* (1.95)
FLISTING	0.0070 (0.46)	0.0060 (0.39)	0.0066 (0.43)	0.0055 (0.36)
Constant	−0.41*** (−4.18)	−0.39*** (−4.23)	−0.41*** (−4.18)	−0.39*** (−4.23)
N	770	770	770	770
R^2	0.7690	0.7704	0.7689	0.7703
F-test	14.78***	15.19***	14.78***	15.20***
Hausman's test	21.47**	17.61	21.31**	17.32
LM test	776.91***	792.47***	776.87***	792.45***
Heteroscedasticity test	3.9e+08***	9.8e+08***	5.6e+08***	1.0e+09***

Notes: t statistics in parentheses; $^*p < 0.10$; $^{**}p < 0.05$; $^{***}p < 0.01$; dependent variable: CDI

Table IV.
Estimated results
from panel data
analysis

BLAUGENDER had no statistically significant impact on CDI. ROA, ROE, LEV and FLISTING did not show a significant association with CDI.

The association between RCDP and the independent variables was investigated. In a similar vein, BGENDER, BLAUGENDER, ROA and ROE were used in each model, pair by pair, to determine the individual effects of these variables, including the other independent variables on RCDP (Table V). Initially, the panel-level estimator was compared with the pooled estimator (Logit) and was assessed using the likelihood ratio test. The likelihood-ratio test results indicated that the panel-level estimator should be used rather than the pooled logit estimator in each model, as the values of rho were different than zero and the likelihood ratio (LR) test was significant at a 1 per cent significance level. The Hausman's test results revealed that each model had RE compared to FE, since the null hypothesis of difference in coefficients that were not systematic and were not rejected at a 5 per cent significance level.

The analysis results showed that BLAUFOREIGN and SIZE had a statistically significantly positive impact on RCDP at a 1 per cent significance level in each model. In addition, the SCOM and IND were positively associated with RCDP at a 5 per cent significance level in each model. Finally, BINDP had a statistically significantly positive impact on RCDP at a 10 per cent significance level in each model. The results also showed that BSIZE, BGENDER, BLAUGENDER, ROA, ROE, LEV and FLISTING had no significant effect on RCDP in each model.

6.4 Discussion
The impact of corporate governance characteristics on carbon emission disclosures and responding behavior of Turkish listed companies to the CDP was investigated through two models. The similarities of findings among the research models verified the robustness of

Independent variables	(5) LOGIT-RE	(6) LOGIT-RE	(7) LOGIT-RE	(8) LOGIT-RE
BGENDER		2.53 (0.75)		2.35 (0.70)
BLAUGENDER	1.60 (0.66)		1.63 (0.67)	
ROA			−0.75 (−1.22)	−0.73 (−1.19)
ROE	−0.63 (−1.11)	−0.67 (−1.19)		
BSIZE	−0.32 (−1.54)	−0.33 (−1.58)	−0.33 (−1.54)	−0.32 (−1.52)
BINDP	3.86* (1.74)	4.04* (1.78)	3.87* (1.73)	3.87* (1.74)
BLAUFOREIGN	6.97*** (2.64)	7.13*** (2.69)	7.02*** (2.63)	7.02*** (2.62)
SCOM	2.08** (2.00)	2.09** (1.96)	2.12** (1.99)	2.10** (1.99)
SIZE	4.73*** (4.60)	5.01*** (5.10)	4.85*** (4.89)	4.79*** (4.70)
LEV	0.89 (0.89)	0.83 (0.81)	0.96 (1.02)	0.97 (1.03)
IND	3.68** (2.01)	3.88** (2.05)	3.79** (2.02)	3.78** (2.02)
FLISTING	−1.33 (−0.92)	−1.42 (−0.96)	−1.36 (−0.94)	−1.35 (−0.93)
Constant	−52.6*** (−5.25)	−55.7*** (−5.82)	−54.1*** (−5.59)	−53.4*** (−5.37)
N	770	770	770	770
rho	0.900	0.911	0.907	0.904
LR test of rho = 0	187.46***	187.62***	188.75***	187.93**
Hausman's test	8.19	8.83	8.50	8.32

Notes: t statistics in parentheses; * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$; dependent variable: RCDP

Table V.
Estimated results
from panel data
analysis

the analyses. BINDP had no significant impact on CDI but was positively related to RCDP. Thus, this finding gives support to *H2b*, indicating that entities with a higher number of independent directors on their boards are more likely to respond to the CDP. This finding is consistent with the results presented by Liao *et al.* (2015), Yunus *et al.* (2016) and Ben-Amar *et al.* (2017). A plausible explanation for this positive association is that independent directors are not subjected to pressures from shareholders and managers to the same extent as internal directors (Hussain *et al.*, 2016), and therefore they encourage an entity to support a higher degree of accountability and transparency (Amran *et al.*, 2014). The findings of this research revealed that the companies with higher board independence may have a greater tendency to respond to the CDP as the result of enhanced accountability and transparency in corporate reporting practices.

BLAUFOREIGN was positively related to CDI and RCDP, supporting *H4a* and *H4b*. This finding suggests that entities with a higher number of foreign directors on their boards are more likely to disclose carbon emission-related information and to respond to the CDP. Depending upon the cultural characteristics of each board member's country, foreign directors on boards could influence the business practices of entities (Frias-Aceituno *et al.*, 2013). According to Estélyi and Nisar (2016), entities with foreign directors generally have an international presence, such as foreign partners, foreign subsidiaries or operations in foreign countries. Therefore, entities with boards composed from diverse nationalities may be subjected to pressure relating to environmental issues from a significant number of stakeholder groups, as they have a larger audience. Consistent with arguments of stakeholder theory, those companies may be more likely to report their environmentally responsible activities to respond to pressure from their wider stakeholder groups.

Further, the research results revealed that SCOM had a significant positive impact on CDI and RCDP, supporting *H5a* and *H5b*. The results confirmed that entities with sustainability committees disclose more carbon emission-related information and are more likely to ratify the CDP. This finding is consistent with current empirical literature (Liao

et al., 2015; Hussain *et al.*, 2016). In line with the basic premise of legitimacy theory, entities can display their commitment to global warming issues, thereby maintaining corporate legitimacy by implementing an environmental committee (Yunus *et al.*, 2016). Therefore, the assignment of a committee dealing with sustainability issues will force companies to engage in environmentally responsible practices and to communicate them through their company reports.

BSIZE had no significant impact on CDI and RCDP. This finding does not support *H1a* and *H1b*. This may demonstrate that the number of directors does not occupy a significant role in determining voluntary carbon emission disclosure policies. Prior evidence also provided inconsistent findings regarding the association between board size and carbon emission disclosures, suggesting the necessity for further investigation. For instance, while Ben-Amar *et al.* (2017) reported an insignificant link between board size and carbon emission disclosures, Liao *et al.* (2015) and Yunus *et al.* (2016) found a positive relationship.

The research results revealed that BGENDER and BLAUGENDER were not associated with CDI and RCDP, rejecting *H3a* and *H3b*. This finding is only consistent with that reported by Prado-Lorenzo and Garcia-Sanchez (2010), while it is contrary to that reported by Liao *et al.* (2015), Ben-Amar *et al.* (2017) and Hollindale *et al.* (2017). According to Ben-Amar *et al.* (2017) and Hollindale *et al.* (2017), board gender diversity impacts GHG emission reporting strategies upon achieving a critical mass of two female directors. In this regard, the insignificant result may due to the fact that the percentage of female directors on Turkish company boards is very low.

Among the control variables, SIZE and IND had a significant impact on carbon emission disclosures. The findings indicated a highly positive significant effect created by SIZE on CDI and RCDP, in line with many prior studies (Rankin *et al.*, 2011; Choi *et al.*, 2013; Gonzalez-Gonzalez and Ramírez, 2016; Yunus *et al.*, 2016; Ben-Amar *et al.*, 2017). A number of reasons can be documented favoring a positive relationship between firm size and voluntary carbon emission disclosures. First, because large firms are subject to more intense external monitoring than smaller firms because of accountability and visibility as outlined in legitimacy theory, such firms disclose more environmental information (Cormier and Gordon, 2001). Further, a firm's carbon emission reporting is just one part of its overall carbon mitigation activities involving a substantial investment, a long-term commitment and the establishment of a carbon management system (Luo *et al.*, 2013). The cost of making revisions in existing infrastructures or establishing a carbon management system will be more affordable for large entities compared to small ones. Hence, as larger entities are more visible and have more resources to engage in voluntary carbon reporting, they are more prone to disclose carbon emission information and to respond to the CDP. The findings revealed that IND had a significant impact on both CDI and RCDP, in compliance with prior research findings (Rankin *et al.*, 2011; Choi *et al.*, 2013; Ben-Amar *et al.*, 2017). The environmentally sensitive industries, including metals, resources, pulp and paper, power generation and chemicals, are subjected to environmental regulation because of their high propensity for pollution (Choi *et al.*, 2013). The results confirmed the arguments of legitimacy, suggesting that companies in environmentally sensitive industries may be more likely to engage in carbon reporting practices to legitimize their activities. Further, as stakeholder theory suggests, companies in high-risk industries may be under intense pressure from stakeholders, thus forcing them to disclose more information on environmentally responsible practices. Further, contrary to the expectations, ROA, ROE, LEV and FLISTING were statistically insignificant for all models, suggesting that those control variables do not play a significant role in carbon emission disclosures.

7. Conclusion

Global warming and climate change have been the focus of increasing attention from researchers, governments, politicians, enterprises and civil society. The purpose of this research was to investigate the relationship between board characteristics and the extent of carbon disclosures by Turkish non-financial entities listed on BIST.

After applying different empirical tests to deal with correlation and controlling for different firm characteristics, the findings indicated that board nationality diversity and the existence of a sustainability committee have a significant influence on carbon emission policies and disclosures. The findings also revealed that companies which responded to the CDP are more likely to have independent directors on their boards. Further, the results indicated that large entities and companies belonging to environmentally sensitive industries are more prone to respond to the CDP and thereby disclose carbon emissions.

This research contributes to the existing literature in several ways. First, this study contributes to the literature by examining the extent and determining factors of carbon emission disclosures in an emerging economy. This is also the first study that has examined factors influencing the carbon emission disclosures in Turkey. The research period (2011-2015) is particularly interesting because the CDP was first introduced into Turkey at the beginning of 2010. Further, this study contributes to the understanding of the role of board characteristics in carbon emission policies and disclosures, which has been rarely investigated in prior research. An understanding of the determinants of carbon disclosures may inspire regulators, green groups, investors and other stakeholders to recognize the motivation for reporting those disclosures. Regarding board characteristics, the impact of board gender diversity on carbon emission disclosures has been investigated in very few research studies. Hence, this research contributes to prior literature by providing evidence of the link between board gender diversity and carbon reporting practices of companies. This research also contributes to the literature by being the first study to explore the influence of diversity on boards within nationalities on carbon emission disclosures. A further contribution of this research is measuring the carbon emissions propensity of companies by using two proxies: one is the CDI and the other is responding to the CDP. Much of the prior research had relied on responding to the CDP, which is a binary variable indicating the decision of a company to disclose climate change-related information to the CDP.

The research findings present implications for both regulatory bodies and corporate practice. Stakeholder groups and the public are urging and demanding companies to be more environmentally responsible. As companies in many industries rely directly or indirectly upon the burning of fossil-fuels, there are still doubts as to whether or to what extent companies are willing to manage and reduce their carbon emissions in accordance with global targets (Grauel and Gotthardt, 2016). The measurement and disclosure of GHG emissions can be considered as a first and significant step toward addressing climate change and global warming issues (Ben-Amar *et al.*, 2017). The findings revealed that the extent and level of carbon disclosures are significantly low among Turkish listed companies. The percentage of Turkish companies responding to the CDP is also very low, with 14 per cent. In this sense, the results indicated that there is significant room for improvement in the awareness of Turkish companies regarding environmental issues, such as climate change, global warming and GHG emissions. Turkish companies make GHG disclosures on a voluntary basis. Prior research findings have suggested that government regulations play a major role in encouraging the carbon disclosure practices of companies (Luo *et al.*, 2012; Guenther *et al.*, 2016). Therefore, regulatory bodies should take the necessary measures to require the entities to reconsider their global warming-related policies and to identify carbon emission targets and strategies in compliance with

environmental obligations. Those regulations may include provisions requiring the disclosure of carbon emission information through several mediums, for instance, annual reports or discrete company reports (e.g. sustainability reports, corporate social responsibility [CSR] reports and environmental reports). The research findings showed that larger companies and companies in high-risk industries are more likely to engage in carbon reporting practices. As a result, the requirements may initially address larger companies which belong to carbon-intensive industries, after which the scope may be extended to other companies.

Indeed, dealing with climate change and global warming-related issues necessitates the collaboration of various parties, including governments, enterprises, NGOs and green groups. In this sense, enterprises should be aware of climate change-related issues and state their company strategies in considering environmental issues. NGOs and green groups should help to raise public awareness, which may impact the strategies of companies in this regard.

This research provided evidence that board composition and the diversity of board nationalities have an influence in management decisions regarding carbon emission policies. The findings of this study have implications for enterprises that are formulating a policy that will encourage diversity of nationalities on boards to improve accountability and transparency relating to carbon emissions. The research findings also revealed that the existence of a sustainability committee is a significant determinant of carbon emission disclosures. A CSR committee is always considered as a substantial human capital resource element that enhances responsible management (Amran *et al.*, 2014). By focusing on environmental and climate change-related issues, a sustainability committee will provide entities to better manage and report GHG emissions. An environment committee will also enable firms to ensure the public that they are aware of the importance of GHG reporting, thereby reducing the risk of increased regulation and business operations associated with global warming (Rankin *et al.*, 2011). The findings of this research therefore suggest that entities could implement a particular committee (e.g. sustainability committee, CSR committee and environmental committee) as a proactive mechanism to deal with environmental issues and to develop global warming-related policies.

Regarding board gender diversity, Turkey applies a "comply or explain" approach, which demands a minimum of 25 per cent of female directors on company boards. The findings revealed that this approach has not yet successfully achieved the target of 25 per cent, as board gender diversity is still very low, with only 12 per cent. Therefore, the insignificant association between board gender diversity and carbon emission disclosures should be interpreted when considering critical mass. In this sense, the findings suggest further research is necessary regarding the impact of board gender diversity on carbon emission disclosures, especially in the context of emerging countries.

The findings of this study provide theoretical implications supporting basic arguments of legitimacy and stakeholder theories, which explain the determinants of carbon emission disclosures. Firms which are subject to the pressure of wider stakeholders, such as the public, regulators, green groups and the media, legitimize their operations and thus seek to mitigate the environmental risks by reporting carbon emission disclosures voluntarily via annual and sustainability reports.

A number of limitations can be listed. First, this research has examined only the annual reports and separate sustainability reports to determine the voluntary carbon emission disclosures while ignoring other communication channels for such disclosures. In addition, this study is based upon data from a unique country, Turkey. Further studies should incorporate data from other countries and compare the findings.

References

Akhtaruddin, M., Hossain, M.A., Hossain, M. and Yao, L. (2009), "Corporate governance and voluntary disclosure in corporate annual reports of malaysian listed firms", *Journal of Applied Management Accounting Research*, Vol. 7 No. 1, pp. 1-19.

Amran, A., Lee, S.P. and Devi, S.S. (2014), "The influence of governance structure and strategic corporate social responsibility toward sustainability reporting quality", *Business Strategy and the Environment*, Vol. 23 No. 4, pp. 217-235.

Baltagi, B.H. (2001), *Econometric Analysis of Panel Data*, John Wiley and Sons, Chicester.

Barako, D.G. and Brown, A.M. (2008), "Corporate social reporting and board representation: evidence from the kenyan banking sector", *Journal of Management & Governance*, Vol. 12 No. 4, pp. 309-324.

Bear, S., Rahman, N. and Post, C. (2010), "The impact of board diversity and gender composition on corporate social responsibility and firm reputation", *Journal of Business Ethics*, Vol. 97 No. 2, pp. 207-221.

Ben-Amar, W., Chang, M. and McIlkenny, P. (2017), "Board gender diversity and corporate response to sustainability initiatives: evidence from the carbon disclosure project", *Journal of Business Ethics*, Vol. 142 No. 2, pp. 369-383.

Blau, P.M. (1977), *Inequality and Heterogeneity*, Free Press, New York, NY.

Campbell, K. and Mínguez-Vera, A. (2008), "Gender diversity in the boardroom and firm financial performance", *Journal of Business Ethics*, Vol. 83 No. 3, pp. 435-451.

Chithambo, L. and Tauringana, V. (2014), "Company specific determinants of greenhouse gases disclosures", *Journal of Applied Accounting Research*, Vol. 15 No. 3, pp. 323-338.

Choi, B.B., Lee, D. and Psaros, J. (2013), "An analysis of australian company carbon emission disclosures", *Pacific Accounting Review*, Vol. 25 No. 1, pp. 58-79.

Coffey, B.S. and Wang, J. (1998), "Board diversity and managerial control as predictors of corporate social performance", *Journal of Business Ethics*, Vol. 17 No. 14, pp. 1595-1603.

Cormier, D. and Gordon, I.M. (2001), "An examination of social and environmental reporting strategies", *Accounting, Auditing & Accountability Journal*, Vol. 14 No. 5, pp. 587-616.

Del Bosco, B. and Misani, N. (2016), "The effect of cross-listing on the environmental, social, and governance performance of firms", *Journal of World Business*, Vol. 51 No. 6, pp. 977-990.

Depoers, F., Jeanjean, T. and Jérôme, T. (2016), "Voluntary disclosure of greenhouse gas emissions: contrasting the carbon disclosure project and corporate reports", *Journal of Business Ethics*, Vol. 134 No. 3, pp. 445-461.

Estélyi, K.S. and Nisar, T.M. (2016), "Diverse boards: why do firms get foreign nationals on their boards", *Journal of Corporate Finance*, Vol. 39 No. 4, pp. 174-192.

Freedman, M. and Jaggi, B. (2005), "Global warming, commitment to the Kyoto protocol, and accounting disclosures by the largest global public firms from polluting industries", *The International Journal of Accounting*, Vol. 40 No. 3, pp. 215-232.

Frias-Aceituno, J.V., Rodriguez-Ariza, L. and Garcia-Sanchez, I.M. (2013), "The role of the board in the dissemination of integrated corporate social reporting", *Corporate Social Responsibility and Environmental Management*, Vol. 20 No. 4, pp. 219-233.

Gonzalez-Gonzalez, J.M. and Ramírez, C.Z. (2016), "Voluntary carbon disclosure by spanish companies: an empirical analysis", *International Journal of Climate Change Strategies and Management*, Vol. 8 No. 1, pp. 57-79.

Grauel, J. and Gotthardt, D. (2016), "The relevance of national contexts for carbon disclosure decision of stock-listed companies: a multilevel analysis", *Journal of Cleaner Production*, Vol. 133, pp. 1204-1217.

Guenther, E., Guenther, T., Schiemann, F. and Weber, G. (2016), "Stakeholder relevance for reporting explanatory factors of carbon disclosure", *Business and Society*, Vol. 55 No. 3, pp. 361-397.

Harjoto, M., Laksmana, I. and Lee, R. (2015), "Board diversity and corporate social responsibility", *Journal of Business Ethics*, Vol. 132 No. 4, pp. 641-660.

Hollindale, J., Kent, P., Routledge, J. and Chapple, L. (2017), "Women on boards and greenhouse gas emission disclosures", *Accounting and Finance*, doi: 10.1111/acfi.12258.

Hussain, N., Rigoni, U. and Orij, R.P. (2016), "Corporate governance and sustainability performance: analysis of triple bottom line performance", *Journal of Business Ethics*, doi: 10.1007/s10551-016-3099-5.

Jizi, M.I., Salama, A., Dixon, R. and Stratling, R. (2014), "Corporate governance and corporate social responsibility disclosure: evidence from the US banking sector", *Journal of Business Ethics*, Vol. 125 No. 4, pp. 601-615.

Kiliç, M., Kuzey, C. and Uyar, A. (2015), "The impact of ownership and board structure on corporate social responsibility (CSR) reporting in the Turkish banking industry", *Corporate Governance: The International Journal of Business in Society*, Vol. 15 No. 3, pp. 357-374.

Kolk, A., Levy, D. and Pinkse, J. (2008), "Corporate responses in an emerging climate regime: the institutionalization and commensuration of carbon disclosure", *European Accounting Review*, Vol. 17 No. 4, pp. 719-745.

Kuo, L. and Chen, V.Y.J. (2013), "Is environmental disclosure an effective strategy on establishment of environmental legitimacy for organization?", *Management Decision*, Vol. 51 No. 7, pp. 1462-1487.

Lee, S.Y., Park, Y.S. and Klassen, R.D. (2015), "Market responses to firms' voluntary climate change information disclosure and carbon communication", *Corporate Social Responsibility and Environmental Management*, Vol. 22 No. 1, pp. 1-12.

Liao, L., Luo, L. and Tang, Q. (2015), "Gender diversity, board independence, environmental committee and greenhouse gas disclosure", *The British Accounting Review*, Vol. 47 No. 4, pp. 409-424.

Luo, L., Lan, Y.C. and Tang, Q. (2012), "Corporate incentives to disclose carbon information: evidence from the CDP global 500 report", *Journal of International Financial Management & Accounting*, Vol. 23 No. 2, pp. 93-120.

Luo, L., Tang, Q. and Lan, Y.C. (2013), "Comparison of propensity for carbon disclosure between developing and developed countries: a resource constrained perspective", *Accounting Research Journal*, Vol. 26 No. 1, pp. 6-34.

Miller, T. and Triana, M.D.C. (2009), "Demographic diversity in the boardroom: mediators of the board diversity-firm performance relationship", *Journal of Management Studies*, Vol. 46 No. 5, pp. 755-786.

Ministry of Environment and Urbanization (MoEU) (2012), "Regulation on monitoring of greenhouse gas emissions", available at: www.resmigazete.gov.tr/eskiler/2012/04/20120425-6.htm (accessed 1 August 2017).

Naser, K., Al-Hussaini, A., Al-Kwari, D. and Nuseibeh, R. (2006), "Determinants of corporate social disclosure in developing countries: the case of Qatar", *Advances in International Accounting*, Vol. 19, pp. 1, pp. 1-23.

Prado-Lorenzo, J.M. and Garcia-Sanchez, I.M. (2010), "The role of the board of directors in disseminating relevant information on greenhouse gases", *Journal of Business Ethics*, Vol. 97 No. 3, pp. 391-424.

Prado-Lorenzo, J.M., Rodríguez-Domínguez, L., Gallego-Álvarez, I. and García-Sánchez, I.M. (2009), "Factors influencing the disclosure of greenhouse gas emissions in companies world-wide", *Management Decision*, Vol. 47 No. 7, pp. 1133-1157.

Rankin, M., Windsor, C. and Wahyuni, D. (2011), "An investigation of voluntary corporate greenhouse gas emissions reporting in a market governance system: Australian evidence", *Accounting, Auditing & Accountability Journal*, Vol. 24 No. 8, pp. 1037-1070.

Reid, E.M. and Toffel, M.W. (2009), "Responding to public and private politics: corporate disclosure of climate change strategies", *Strategic Management Journal*, Vol. 30 No. 11, pp. 1157-1178.

Saka, C. and Oshika, T. (2014), "Disclosure effects, carbon emissions and corporate value", *Sustainability Accounting, Management and Policy Journal*, Vol. 5 No. 1, pp. 22-45.

Stanny, E. and Ely, K. (2008), "Corporate environmental disclosures about the effects of climate change", *Corporate Social Responsibility and Environmental Management*, Vol. 15 No. 6, pp. 338-348.

Yunus, S., Evangeline, E.T. and Abhayawansa, S. (2016), "Determinants of carbon management strategy adoption: evidence from Australia's top 200 publicly listed firms", *Managerial Auditing Journal*, Vol. 31 No. 2, pp. 156-179.

Further reading

Hossain, M. and Reaz, M. (2007), "The determinants and characteristics of voluntary disclosure by Indian banking companies", *Corporate Social Responsibility and Environmental Management*, Vol. 14 No. 5, pp. 274-288.

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