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## **Women on boards and greenhouse gas emission disclosures**

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## Introduction

This study examines the relation between women on boards and company GHG emissions related disclosure in annual and sustainability reports. We test whether the presence of women on boards is associated with GHG emissions disclosure and the *quality* of disclosures made by companies. We apply institutional theory (DiMaggio and Powell, 1983) to analyse the organisational practice of appointing female directors and apply the board capital model (Hillman and Dalziel, 2003; Haynes and Hillman, 2010) to explain why women on boards lead to GHG emissions related disclosures that are of higher quality.

The motivation for this study arises from the importance of GHG related emissions disclosures within the area of social responsibility and ethical reporting (Moroney *et al.*, 2012; McNicholas and Windsor, 2011; Milne and Grubnic, 2011; Ferguson *et al.*, 2016). Management of climate change related issues such as greenhouse gas (GHG) emissions is a significant strategic and ethical issue for companies (Liesen *et al.* 2015; Linnenluecke *et al.*, 2015b; Luo and Tang, 2014). Understanding how to deal with the negative impact of climate change has global significance (Linnenluecke *et al.*, 2015a; Linnenluecke *et al.*, 2015c; Moroney *et al.*, 2012) as parties consider how to reduce greenhouse gas emissions and manage the risks and uncertainties of carbon pollution (Clarkson *et al.*, 2014; Solomon *et al.*, 2011; Tauringana and Chitambo, 2015). Investors and other stakeholders increasingly require meaningful and transparent disclosures regarding GHG emissions and the management of related risks (Hartman *et al.*, 2013; Solomon *et al.*, 2011).

This paper contributes to the existing literature in several ways. First, we present analyses of GHG emissions related disclosures in annual and sustainability reports. GHG emissions related information is part of sustainability reporting presented by companies in annual, sustainability, integrated and online reports (GRI, 2015). Carbon Disclosure Project (CDP, 2014) data and women on boards have been examined in prior studies (Prado-Lorenzo

and Garcia-Sanchez, 2010; Ben-Amar *et al.*, 2015; Liao *et al.*, 2015). However, less attention has been given to GHG related disclosures in annual and sustainability reports. These disclosures are an important and accessible source of voluntary information on environmental issues for investors and other users (Ingram and Frazier, 1980; Owen, 2008).

The second contribution relates to our use of a sample of Australian companies that voluntarily appoint women to their board. European countries such as Italy, Norway and the Netherlands have mandated quotas for women on boards (Deloitte, 2015). The Corporate Governance Principles and Recommendations included a recommendation for listed companies to disclose their board diversity policy and initiatives in 2010 (ASX, 2010), which is after our sample period of 2007. The relatively low number of female directors on Australian company boards compared to other countries (Burgess and Tharenou, 2002) suggests these companies are early adopters of women on boards. Therefore, companies are likely to be voluntarily appointing women to boards to add value to their company in our sample period.

Our third contribution is the development of an index that provides an estimate of GHG emission related disclosure quality. GHG emission related disclosures are recommended by the global reporting initiative (GRI) discussion of sustainability reporting (GRI, 2015; Moroney *et al.*, 2012). The GRI G4 Sustainability Reporting Guidelines (GRI, 2015) define quality of sustainability reporting by reference to principles including balance (positive and negative aspects of performance should be included and information should be unbiased), comparability (with past performance, company objectives, and other organisations), accuracy (communicated by qualitative and detailed quantitative indicators), timeliness, clarity and reliability. The reliability principle relates to gathering, recording, compiling and analysing processes used in preparing the report so that the disclosure can be examined to establish the quality of the information. We adopt the principles specified by the GRI to develop an index

of quality of GHG emissions disclosures by adapting an index relying on the GRI identified elements by Clarkson *et al.* (2008) to provide an estimate of quality of disclosures.

It is an advantage to study quality of disclosures because the quantity of disclosures could be a nominal gesture to maintain legitimacy and enhance the reputation of the company without having any real desire to improve the transparency of reporting of GHG emissions related disclosures. Extensive disclosure may be of limited use if the data is low quality and does not permit a substantive assessment of company GHG emissions strategy and performance (O'Donovan, 2002; Clarkson *et al.*, 2011).

Finally, our study provides evidence for policy-making by examining whether voluntary governance choices such as women on boards enhance disclosure. A mandatory disclosure regime is unnecessary if companies have governance structures that result in ethical and transparent GHG emissions related disclosures.

Our results show that companies with more than one women on their board are more likely to make GHG emissions related disclosures in company annual and sustainability reports that are of higher quality. We find that companies with multiple female directors make more *soft* disclosures, which includes information on vision and strategy, environmental profile and environmental initiatives. Companies with multiple female directors also make more *hard* disclosures that are objective statements related to GHG emissions..

## **2. Theory and Hypothesis**

The board of directors has the responsibility for strategy and reporting GHG emissions and it is important that companies structure their board so they have the capacity to manage GHG emissions and other climate change related risks (Taurigana and Chitambo, 2015). This is particularly the case in the Australian institutional setting which is categorised as a market governance system that relies on market forces to prompt voluntary action by companies on social responsibility issues (Griffiths *et al.*, 2007; Rankin *et al.*, 2011). Diversity in boards, or

dissimilarities in directors' attributes including women on boards (Hafsi and Turgut, 2013; Brown *et al.*, 2011) is an important dimension of board composition that is capable of influencing corporate performance. Research indicates that women on boards increase the quality of reported earnings, company reputation, financial and social performance (Van Der Walt *et al.*, 2006; Krishnan and Parsons, 2008; Barua *et al.*, 2010; Srinidhi *et al.*, 2011; Gul *et al.*, 2013; Chapple and Humphrey, 2014; Post and Byron, 2014; Byron and Post, 2016).

The different motivations for appointing women on boards influence the capacity for them to guide decision-making on GHG emission related reporting. Boards dominated by male directors inhibit women directors' opinions on environmental issues because of sex-based biases or stereotyping in the boardroom (Galbreath, 2011). This is particularly the case when female director appointments are symbolic in response to regulation or perceived pressure from corporate governance recommendations.

Institutional theory (Di Maggio and Powell, 1983; Scott, 1987) assists in explaining motivations for appointing women to improve board performance in reporting GHG emission related reporting rather than a symbolic action to maintain an appearance of commitment to board diversity. Organisations are characterised as innovators or late adopters of organisational practices within institutional theory (Dillard *et al.*, 2004) and women on boards are an innovation in the Australian corporate sector.

Companies that are motivated by innovation recognise that women on boards can enhance a company's competitive advantage through their experience, skills and broader perspective (Jehn *et al.*, 1999; Galbreath, 2011). Innovative companies appoint female directors as part of a strategic board development plan to secure benefits that female directors bring (Hillman *et al.*, 2007). In contrast, symbolic appointments by late-adopters can lead to the appointment of female directors without relevant expertise or experience to enhance board processes (Rose, 2007; Huse *et al.*, 2009). In the case of symbolic appointments, an appearance

of board gender diversity is maintained without female directors playing an influential role (Nielsen and Huse, 2010b).

Our study is conducted in the Australian setting during a period that has a low rate of female board membership and is in the early stage of adopting women on boards as organisational practice. Therefore, based on institutional theory analysis, we expect that companies in our sample with female directors are innovative, early adopters of women on boards whose motivation is to improve board performance and gain a competitive advantage (Dillard *et al.*, 2004). In this setting, female directors are more likely to have a positive influence on GHG disclosure strategy.

The board capital model explains why the contribution of women on boards enhances GHG emissions disclosure strategy (Hillman and Dalziel, 2003; Haynes and Hillman, 2010; Galbreath, 2012). Board capital includes the human capital and relational or social capital provided by board members (Hillman and Dalziel, 2003) and is derived from the experience, expertise, knowledge, reputation and skills of directors. Relational or social capital includes directors' actual and potential network of relationships, ties and external contingencies (Nahapiet and Ghoshal, 1998). The extent of board capital determines the board's ability to provide resources to the firm, which means board capital is closely linked to resource dependence theory (Westphal, 1999; Zahra and Pearce, 1989). In addition, the board's ability to perform a monitoring function is also determined by aspects of human capital such as knowledge, skill and expertise.

Women on boards increase board capital breadth in various ways. They bring different perspectives, experiences and networks to the board and are more open to discussion of difficult issues, more likely to engage in independent thinking and are able to enhance overall communication (Huse and Solberg, 2006; Hillman *et al.*, 2007; Adams and Ferreira, 2009; Hardies *et al.*, 2014). Their different functional, occupational backgrounds and opinions lead

to renewed reasoning for the board (Arfken *et al.*, 2004).

The concept of value attunement extends board capital theory by explaining that value attunement increases board capital breadth. Value attunement results from a more receptive, expansive and discovery driven approach to social issues and value-attuned directors are aware of, and responsive to, the values of corporate stakeholders (Galbreath, 2012; Swanson, 1999). Value attunement increases when women are on the board because females are focused on building and maintaining relationships, on the needs of others and understanding the social demands of stakeholders (Galbreath, 2011; Boulouta, 2013). Management of GHG emissions is a relatively new strategic and ethical issue for companies (Liesen *et al.* 2015; Linnenluecke *et al.*, 2015b; Luo and Tang, 2014). Women on boards increase the likelihood that the board understands the ethical and social demand of providing meaningful and transparent disclosures regarding GHG emissions. This leads to an increased likelihood that companies with women on their boards have GHG emissions disclosures that are of higher quality.

A further extension of the board capital model leading to the prediction that women on boards are associated with GHG emissions disclosures is upper echelons theory (Hambrick and Mason, 1984; Hambrick, 2007). This theory clarifies that executives act on personalized interpretations of strategic situations that are a function of their cognitive frames built around knowledge, experiences, values and personalities. Thus, the biases and dispositions of top executives can explain organizational behavior. The theory is relevant to analysis of the role of women on boards because female directors have different cognitive frames to men, which broadens the information brought to board decisions and enhances decision-making processes (Post and Byron, 2015; Byron and Post, 2016).

Women have different values to men on social responsibility issues in that they place greater importance on maintaining relationships, responding to the needs of others, greater sensitivity to others and consideration of the interests and perspectives of multiple parties (Post

*et al.*, 2011; Nielsen and Huse, 2010a). They are also more likely to recognise unethical actions and are more responsive to ethical practices (Ibrahim and Angelidis, 1994; Williams, 2003). Companies with women on their board are more likely to address the emerging strategic issue of climate change and GHG emissions and communicate this action to stakeholders because female directors increase board capital breadth through value attunement. Women on boards are expected to be associated with GHG emission related disclosures in annual and sustainability reports that are of higher quality. This leads to our hypothesis.

*Hypothesis 1: Companies that have women on their boards have GHG emissions related disclosures in annual and sustainability reports that are of higher quality.*

### **3. Research Method**

#### *3.1 Sample*

The sample consists of Australian listed companies that made GHG emissions related disclosures and a matched sample of non-disclosing companies. We identified disclosing companies from the annual and sustainability reports of 2059 companies listed on the Australian Securities Exchange in 2007. The sample period of 2007 provides a natural experimental setting to test whether women on boards are associated with GHG emission reporting because there were no quotas or recommendations to appoint women to boards. The year 2007 is a year when there were sufficient women on boards to conduct empirical archival analysis. It is also before companies were required to report under the National Greenhouse and Energy Reporting Act 2007 (NGER). This Act provides a single national reporting framework for companies meeting defined thresholds to report all GHG emissions, reductions, removals and offsets, and all their energy consumption and production from 1 July 2008 via a government web portal by 31 October, 2009.



We also conduct a longitudinal case study for one company covering the annual report from 2003 to 2015 to support our empirical analysis and illustrate the influence of multiple women on the board and GHG emission disclosure.

The AspectHuntley FinAnalysis database and company websites are used to obtain the reports. For each report, an electronic search of text for the words environment, sustain, emission, carbon and their variants was conducted, and from these GHG emission disclosures were documented. Only statements relating to the natural environment were examined and therefore references to *business environment*, *economic environment* and *business sustainability* were ignored. Annual and sustainability reports that could not be electronically searched were read, and any relevant disclosures were extracted. This search identified 231 companies as making GHG emissions related disclosures in 2007, which represents approximately 11 per cent of the listed companies.

We identified a matched group of non-disclosing companies based on their Global Industry Classification Standard (GICS) industry sector classification and size measured by total assets. The sample of disclosing companies was slightly reduced due to missing data on some of the variables used in our models. The final pooled sample was 406 companies, with 203 companies that disclosed GHG emissions data, and 203 matched non-disclosing companies. The sampling with replacement procedure meant that there were 169 unique companies in the non-disclosing matched sample.

### *3.2 Medium of disclosure*

Data for GHG emissions related disclosures in this study are taken from company annual reports and sustainability reports. Companies use questionnaire surveys, face-to-face meetings with persons of influence, briefings, conferences, hard copy reports, brochures and newsletters, and electronic media to communicate environmental issues (Adams and Frost, 2006). Other communication channels include news' releases, speeches, links to other web

sites (Frost *et al.*, 2005; Esrock and Leichty, 1998), conference calls (Burritt, 2002), and mass advertising (Zeghal and Ahmed, 1990).

Annual and sustainability reports are generally regarded as the most important sources of voluntary corporate information (Kamla and Rammal, 2013). The credibility of disclosures in annual reports is high because information is independently audited and all listed companies are required to produce an annual report (Ball *et al.*, 2012; Kent and Zunker, 2013). The annual report is the main company disclosure vehicle (Jones and Smith, 2014) to outsiders and shareholders and its breadth of coverage and availability makes it an influential source to the public (Hooks *et al.*, 2002). It is also a way for directors to show they have discharged their public accountability (Boyne and Law, 1991).

Sustainability reports are voluntary in Australia but are increasingly supplied by companies in Australia, the European Union and the US (Mock *et al.*, 2007; Hodge *et al.*, 2009; Boiral, 2013). The combination of annual reports and sustainability report offers a reporting framework for us to assess the impact of women on boards and GHG emission disclosures. Accordingly, we have chosen the annual and sustainability reports as our sources of information.

### *3.3 Dependent Variables*

The dependent variables used in the analysis are a dichotomous variable for the existence of disclosure, and disclosure quality measured by content analysis. Hooks and van Staden (2011) found a very high correlation between a dichotomous disclosure indicator and a fully weighted disclosure score in their comparison of various forms of content analysis for environmental disclosures. Research indicates that managers assess the costs and benefits associated with disclosure (and quality of reported disclosures) when communicating to investors (Healy and Palepu, 2001; Kent and Zunker, 2013). This implies that disclosure quality and quantity are likely to be either substitutes or complements and our use of content

analysis and a dichotomous indicator increases the information content of our results.

The first analysis presented examines whether women on boards is associated with GHG emissions related disclosure. The dependent variable for this analysis is a dichotomous indicator that is coded one if the company made a GHG emissions related disclosure and zero otherwise.

The second analysis examines GHG emissions related disclosure quality applying an index based on Clarkson *et al.* (2008) and the GRI. We adapt this index so that it is specific to GHG emissions related disclosures because it is based on the GRI and reflects our definition of quality of sustainability reporting. We include items from the index that directly support the reporting infrastructure leading to these GHG emissions related disclosures although some of these items could also support general environmental disclosures.

Our adapted GHG emissions related disclosure index is used to rate disclosures as objective measures of GHG performance (hard disclosures) or statements (soft disclosures) that are difficult to substantiate. Recall that our definition of disclosure recognises both qualitative and quantitative disclosures as adding to quality of sustainability reporting. However, the GRI reliability principle requires that disclosures can be examined to establish the quality of the information. We differentiate between hard and soft disclosures because it is easier to examine and verify objective hard statements.

Items in the broad environmental performance category are excluded, as we are interested only in GHG emissions related disclosures. In addition, we excluded an item that indicated the existence of a board sustainability committee, as the existence of this board committee is included in our analysis as a control variable. We group index items into six categories: governance structure and management systems, credibility, environmental spending, claims about vision and strategy, environmental profile, and environmental initiatives. Each of the categories are classified as either hard disclosures, or soft disclosures.

Disclosures regarded as hard are objective GHG related statements, and include three of the categories, namely governance structure and management systems, credibility and environmental spending. Soft disclosures are statements that lack credibility and substantiation (Clarkson *et al.*, 2008) and include the remaining categories of disclosures on vision and strategy, environmental profile and environmental initiatives relating to GHG emissions.

We apply the index to rate the quality of all relevant annual and sustainability report information provided by our sample companies. The maximum index score is 34, being 18 for hard disclosure items, and 16 for soft disclosure items. The disclosure quality dependent variables used in the analyses are the number of total disclosures, hard and soft disclosures derived from the content analysis. Table 1 shows the disclosure index items, and presents descriptive statistics for index items, index categories and the hard and soft disclosure categories.

All index items are scored uniformly with one indicating the presence of a particular disclosure and zero otherwise. Only one point is awarded per disclosure category regardless of how many times disclosures matched the criteria. Two researchers scored the content of disclosures and measurement of coding agreement is undertaken using Krippendorff's agreement coefficient (Krippendorff, 2004). The coefficient is 0.84 (84 per cent), which indicates an acceptable reliability distribution (Krippendorff, 2004).

### *3.4 Independent Variables*

Our analysis includes a dummy variable coded one for companies that have one female on the board of directors (and zero otherwise) and a dummy variable coded one for companies that have more than one female on the board of directors (and zero otherwise). This coding allows us to determine whether the relation between women on boards and GHG related disclosure varies with the level of female board representation. There is discussion in the literature regarding critical mass and whether one female on the board makes it a diverse board

(Konrad *et al.*, 2008; Torchia *et al.*, 2011). A study of Norwegian firms by Torchia *et al.* (2011) suggests that a minimum of three women on the board represents a critical mass, which is associated with an enhanced board contribution to firm innovation. We use a dichotomous indicator variable rather than the percentage of female directors because very few of the sample companies have multiple female directors, and a continuous measure adds little more information. This is consistent with the approach in prior studies using Australian data where the level of women on boards is relatively low (Chapple and Humphrey, 2014).

### 3.5 Control Variables

We include controls for board governance strength. Independence of the board is included as a control, as prior studies have shown this is associated with GHG emissions disclosure (Prado-Lorenzo and Garcia-Sanchez, 2010; Rankin *et al.*, 2011). We include a dummy variable for whether the board has a majority of independent directors, which is coded one if the company has a majority of independent directors and zero otherwise. More independent boards are expected to have more GHG emissions disclosures, and higher quality disclosures, than less independent boards.

We also include board structure regarding a combined CEO/board chair or otherwise as a control variable. A study by Prado-Lorenzo and Garcia-Sanchez (2010) found the existence of a dual CEO/board chairperson was positively associated with the level of GHG information disclosed. The analysis includes an indicator variable coded one if the company has a dual CEO/board chair structure, and zero otherwise and we expect that a dual CEO/board chair is associated with disclosure and higher quality GHG emissions disclosures.

Prior research also indicates the existence of an audit committee is associated with better financial reporting quality (Davidson *et al.*, 2005; Kent and Stewart, 2008; Rainsbury *et al.*, 2008), and this finding could extend to voluntary disclosures. Accordingly, a dummy variable is included that indicates whether the firm has formed an audit committee. The variable

is coded one if the company has an audit committee and zero otherwise. It is expected that the existence of an audit committee is associated with disclosure and higher quality disclosures of GHG emissions.

We include a measure of shareholder concentration in addition to controlling for governance provided by formal internal governance mechanisms. Substantial shareholders are likely to provide monitoring that enhances governance (Cotter and Najah, 2012; Brailsford *et al.*, 2002; Brown *et al.*, 2011). Alternatively, Fama and Jensen (1983) propose that more dispersed share ownership increases conflicts of interest between principals and owners, increasing agency costs and information asymmetry. This is associated with increased disclosure to reduce agency costs and information asymmetry. Shareholder concentration is measured by the percentage of ordinary shares held by shareholders with a five per cent or greater interest in the company. No prediction for the direction of shareholder concentration is made in the study due to the alternative theoretical perspectives provided.

Clarkson *et al.* (2008) find that annual capital investment, which is a proxy for equipment age, is positively related to the extent of environmental disclosures. They suggest companies with newer, less polluting equipment are motivated to signal positive information through disclosure to distinguish themselves from poorer performers. We include a control for the age of equipment measured by the ratio of accumulated depreciation of property, plant and equipment to its acquisition cost. It is expected that companies with newer equipment provide more disclosure of GHG emissions that are of higher quality.

Prior studies indicate that companies that demonstrate board commitment to the GHG emissions issue are more likely to make disclosures and that those disclosures are more credible (Stanny and Ely, 2008; Rankin *et al.*, 2011). Therefore, we include a dummy variable that indicates whether the board has formed an environment or sustainability committee. The variable is coded one if the company has a sustainability or environment committee, and zero

otherwise with the expectation that companies creating this committee have disclosure and higher quality disclosures of GHG emissions.

Legitimacy theory suggests that companies adopt environmental reporting when their operations are inconsistent, or perceived to be inconsistent, with society's norms and expectations (Cowan and Deegan, 2011; Bebbington *et al.*, 2008,). Numerous previous studies provide evidence that legitimisation is an important motivation for companies making voluntary disclosures.

One group of these studies has used proxies for social pressure to identify companies that have a propensity to make voluntary disclosures. These proxies include the incidence of environmental lobby group activity, prosecution by environmental agencies and adverse media coverage resulting in community concern (Deegan and Gordon, 1996; Deegan and Rankin, 1996; Brown and Deegan, 1998; Deegan *et al.*, 2002; Kent and Monem, 2008). We consider companies to have greater social pressure when they are the subject of unfavourable media reports, and have a greater propensity to make legitimising disclosures. We searched the Factiva electronic database for any news items relating to the sample companies for the period 1 January 2006 to 31 December 2007 to identify whether the companies had adverse media reports regarding the natural environment. Search terms used included environment, carbon, greenhouse, emissions, sustainability and energy use. We include an indicator variable that takes a value of one if the company had an adverse media report and zero otherwise to control for the effect of social pressure. It is expected that companies with adverse publicity in the media report GHG emission disclosures that are of higher quality to legitimise their companies' operations.

Companies are more likely to make voluntary environmental disclosures if it materially reduces their agency costs of debt. Leverage is included in our analysis to control for reporting incentives arising from reliance on debt financing for company operations (Brown *et al.*, 2011).

We also include dummy variables that indicate whether the company obtained either new debt or equity financing in their accounting period after 2007. This was determined by examining the 2008 statement of cash flows and identifying companies that reported proceeds from borrowings and proceeds from issues. We expect those companies with higher debt levels and those wanting to raise additional equity or debt in the following year to report GHG emissions disclosures that are of higher quality.

Voluntary reporting of environmental and carbon information is costly; therefore, financial performance is related to the probability that companies undertake this reporting (Jones *et al.*, 2007; Luo *et al.*, 2013). Financial performance is included in our analysis as a control variable, and is measured by Tobin's Q (Guidry and Patten, 2012). It is expected that companies with a higher Tobin's Q provide more and higher quality disclosures of GHG emissions.

### 3.6 Statistical Analysis

The equations below show the regression models used to test the hypothesis. The dependent variable in Model 1 is a dichotomous indicator for whether the company has made a GHG emissions related disclosure (Equation 1 below). The analysis is therefore conducted using logistic regression. This analysis uses a matched sample of disclosing and non-disclosing companies based on size and industry. Therefore, it is unnecessary to include the size and industry controls in model 1.

The dependent variable for Models 2, 3 and 4 (Equation 2 below) is a continuous measure of total, hard and soft disclosures made by each company. The analysis is conducted using Tobit regression to account for the censoring of the dependent variable at zero.

$$\begin{aligned} \text{Disclose} = f(\beta_0 + \beta_1 \text{Sole female director} + \beta_2 \text{Multiple female director} + \\ \beta_3 \text{Shareholder concentration} + \beta_4 \text{Performance} + \beta_5 \text{Equipment age} + \beta_6 \text{Leverage} + \\ \beta_7 \text{Majority independence} + \beta_8 \text{Dual CEO/board chair} + \beta_9 \text{Audit committee} + \\ \beta_{10} \text{Environment committee} + \beta_{11} \text{Adverse media} + \beta_{12} \text{New debt} + \\ \beta_{13} \text{New equity} + e \end{aligned} \quad (1)$$



$$\begin{aligned} \text{Total / Hard / Soft} = & \beta_1 \text{ Sole female director} + \beta_2 \text{ Multiple female director} + \\ & \beta_3 \text{ Shareholder concentration} + \beta_4 \text{ Performance} + \beta_5 \text{ Equipment age} + \beta_6 \text{ Leverage} + \\ & \beta_7 \text{ Majority independence} + \beta_8 \text{ Dual CEO/board chair} + \beta_9 \text{ Audit committee} + \\ & \beta_{10} \text{ Environment committee} + \beta_{11} \text{ Adverse media} + \beta_{12} \text{ New debt} + \beta_{13} \text{ New equity} + \\ & \beta_{14} \text{ Size} + \beta_{15} \text{ Industry} + e \end{aligned} \quad (2)$$

These variables are defined in Table 1.

**Table 1 about here**

## 4. Results

### 4.1 Descriptive Statistics

Table 2 summarises the disclosure quality index scores and provides descriptive statistics for each index item and for the aggregated hard and soft disclosure scores. Data for hard disclosures are reported in Panel A, and soft disclosures are reported in Panel B.

A total of 137 (67.49 per cent) of the 203 disclosing companies in the sample made hard disclosures while 199 (98.03 per cent) made soft disclosures. The most frequent hard disclosure was about governance structure and management systems at 56.65 per cent. For other hard disclosures, 53.69 per cent of companies made disclosures about their credibility through external certification or verification and only 7.89 per cent disclosed information on environmental spending related to GHG emissions. The highest score for the hard disclosure index category was 9 out of a possible 18.

The most frequent soft disclosures were about vision and strategy at 80.79 per cent and a description of the company's environmental profile at 78.82 per cent. Only 25.62 per cent of companies made disclosures about environmental initiatives relating to GHG emissions. The highest score for the soft disclosure index category was 10 out of a possible 16.

**Table 2 about here**

Table 3 reports the correlations between independent variables. Correlations were not of a sufficient magnitude to raise concerns about multicollinearity and values of variance

inflation statistics for all variables were less than the recommended threshold of 10 (Tabachnick and Fidell, 2001). The highest correlation is 0.49 between size and leverage. To further test for multicollinearity problems with these variables, a preliminary regression analysis was conducted with and without the leverage variable and the results remained unchanged.

The sole female director indicator variable is significantly positively correlated with board independence, the existence of an audit committee, and the existence of an environment committee. This suggests that companies with overall stronger governance are more likely to make a female board appointment. As expected, single and multiple women on boards are significantly and positively correlated with size.

### **Table 3 about here**

Table 4 presents descriptive statistics for the independent variables. Descriptive statistics are provided for the disclosing and non-disclosing companies, along with tests of differences between the groups where appropriate.

Data for the female director variables are reported in Panel B. Frequency of female director appointment is significantly greater for disclosing companies at 40.89 per cent, compared to 32.51 per cent for non-disclosing companies. A sole female director exists for 27.59 per cent of the disclosing companies, compared to 26.11 percent for non-disclosing companies. The sole female director variable is not significantly different between the groups. In contrast, 13.30 per cent of disclosing companies have multiple female directors, compared to only 6.40 per cent of non-disclosing companies, with the difference significant at  $p < 0.05$ . Additional analysis of the female director variable is presented in Panel D of Table 4, which shows very few companies in either group have more than two female directors. Thus, the extent of women on Australian company boards remains relatively limited.

Descriptive data for the control variables are reported in Panels A and B of Table 4

Significant differences are observed between GHG disclosers and non-disclosers for most of the control variables. Disclosing companies have significantly greater average performance, leverage, size and inflow of new debt. The significant difference in size reflects our application of the closest match method for matching disclosing and non-disclosing companies. The difference suggests it is possible that the matching variables still have some influence. Therefore, we include size and industry fixed-effects variables in the disclosure quality analysis. We check for any effects of the matching variables by running the analysis with and without asset size and industry classification for the logit analysis with *disclose* as the dependent variable. Neither asset size nor any industry fixed-effects variables were significant when included in the regression, and made little difference to the reported results.

Board governance is stronger for disclosing companies. A significantly greater percentage of disclosing companies have a majority of independent directors, non-dual CEO/board chair structure, larger board size, formation of an audit committee, and formation of an environment or sustainability committee. In addition, disclosers are more often the subjects of adverse media coverage than non-disclosers.

Panel C provides industry data for the sample. The reported percentages are the same for the disclosing and non-disclosing company groups because the sample is matched on industry. The most frequent industry classifications are materials, financials, industrials and energy. The financials industry group has the highest percentage of female directors at 57.95 percent, followed by consumer discretionary at 46.15 percent and then consumer staples at 44.44 percent. These three industry groups also have the highest percentage of female directors for analysis across disclosing and non-disclosing companies. Comparison of female director percentages for industry groups across disclosing and non-disclosing companies show disclosing companies have a higher percentage of female directors for seven of the ten reported groups.

## Table 4 about here

### 4.2 Multivariate Results

Table 5 provide results of logistic regression analysis (Model 1) for the matched sample of GHG disclosing and non-disclosing companies. This analysis partially tests hypothesis one, that companies with women on boards are more likely to make GHG emissions related disclosure. The indicator variable for the existence of a sole female director is not significant. However, the multiple female director variable is significant ( $p<0.05$ ) with a positive coefficient. This indicates that companies with multiple female directors are more likely to make GHG emissions related disclosures. The result supports the hypothesis but the positive relation between gender diversity and disclosure is conditional on the existence of more than one female director.

In Model 1, significant results are found for several of the control variables. Lower shareholder concentration is related to GHG emissions disclosure ( $p<0.05$ ), in support of stewardship theory. An additional explanation is that companies with concentrated shareholding tend to provide private information to investors regarding risk and opportunities related to GHG emissions, while companies with more dispersed ownership provide more annual and sustainability report disclosures. Performance ( $p<0.01$ ), existence of a dual CEO/board chair ( $p<0.05$ ), the existence of an environment or sustainability committee ( $p<0.10$ ), and acquisition of new debt ( $p<0.01$ ) are significantly associated with more GHG emissions disclosure.

Table 5 also provides results of the Tobit regression analyses that test the second part of the hypothesis. Regressions for total (Model 2), hard (Model 3) and soft disclosures (Model 4) are reported. The sole female director variable is not significant for the total disclosure regression (Model 2). However, the multiple female director variable is significant ( $p<0.05$ ) and has a positive coefficient. Therefore, companies with multiple female directors have higher

total GHG emissions related disclosures. Similar results are observed for Models 3 and 4, which test hard and soft disclosures respectively. The sole female director variable is not significant, while the multiple female director variable is significant. Overall, the results support our hypothesis but the expected positive association between women on boards and the quality of GHG related disclosure is conditional on the existence of more than one female director on the board.

Results for the control variables are similar for the total, hard and soft disclosure index models (Models 2, 3 and 4). A majority of independent directors is significant for the total and soft disclosure models ( $p < 0.10$ ). The existence of an environmental board sub-committee and a dual CEO/board chair are significant ( $p < 0.05$ ) in all models. Financial performance and issue of new debt are significant ( $p < 0.01$ ) in all models for the financial controls. Equipment age and leverage are marginally significant ( $p < 0.10$ ) in the soft disclosure model only. The size variable is only significant in the hard disclosure model ( $p < 0.05$ ). This suggests that larger companies are more likely to make verifiable disclosures because of their greater sensitivity to the perception of poor GHG emissions performance. Finally, we find that concentrated shareholding is significant with a negative coefficient in the total ( $p < 0.05$ ), hard ( $p < 0.10$ ) and soft ( $p < 0.05$ ) disclosure models. Again, this is consistent with stewardship theory, with dispersed ownership leading to directors providing higher quality annual and sustainability report disclosures of GHG emissions.

#### **Table 5 about here**

#### *4.3 Additional Analysis*

Our theory and hypothesis section suggests that companies in the Australian setting that have women on their boards are innovative early adopters of board gender diversity. It is possible that innovative companies are also more likely to make GHG emissions disclosures. In addition, it is possible that women self-select onto boards of companies that demonstrate

corporate social responsibility by their GHG emissions disclosure. Therefore, the observed relation in our main analysis between women on boards and GHG emission disclosure may be affected by omitted variables or reverse-causation problems (Gippel *et al.*, 2015; Brown *et al.*, 2011; Schultz *et al.*, 2010). These endogeneity issues have potential confounding effects for our analysis.

We test our results for robustness to potential effects of women on boards being an endogenous variable. Within our observational data, companies with women on their board are analogous to a treatment group, yet the treatment is not randomised because of the endogeneity issues described above. We use the treatment effect variation of the Heckman (1979) selection model to address this econometric problem (Maddala 1983; Guo and Fraser 2014). The analysis is conducted using the STATA *etregress* routine, with a control function estimation used to calculate the conditional probability of a single or multiple female director on the board, which is included as the test variable in Model 1. The female director variables remain significant in this regression if our results regarding women on boards are robust to the effects of endogeneity.

Following prior studies (Srinidhi *et al.*, 2011; Ben-Amar *et al.*, 2015), the selection model includes governance variables, a measure of shareholder concentration, and financial and industry variables. We also include an indicator variable for the presence of directors with multiple directorships as wider experience is likely to influence the board to understand the value of women on boards.

The untabulated results of the endogenous treatment-regression model show the conditional probability of the multiple female director variable is significant. This confirms the main result that multiple female directors have a positive influence on GHG emissions disclosure. The results for the control variables in the endogenous treatment-regression model are substantively the same as those reported in the main analysis.

We also consider the implications of appointment of female directors as a symbolic gesture to enhance gender diversity. When female director appointments are properly motivated, there is an increased likelihood of a systematic improvement in board processes. We present additional analysis in Table 6 to determine whether female director expertise is related to GHG disclosure. For this analysis, expertise is measured according to whether a female director has board appointments at other companies. Dichotomous variables are used which indicate whether a female director is a sole board member or a member of multiple boards. The variable female director – sole appointment is coded one if female board members are only appointed to a single board, and zero otherwise. The variable female director – multiple appointment is coded one if a female board member is appointed to multiple boards, and zero otherwise.

#### **Table 6 about here**

We find that the sole appointment variable is not significant, but the multiple appointment variable is marginally significant and positively associated ( $p < 0.10$ ) with total GHG related disclosures and soft disclosures ( $p < 0.05$ ). Therefore, the presence of an experienced female director on the board is associated with increased disclosure quality. Given that experienced female directors are unlikely to be token appointments, the result indicates that inclusion of women on boards motivated to increase board capital is positively associated with GHG emissions related disclosure quality.

It is possible that companies in our 2007 sample were larger companies and therefore subject to reporting thresholds for the first NGER Act reporting year of 2008. Larger companies potentially have bigger more diverse boards and they could have started to produce higher quality reports in anticipation of the new legislation. To test our results to this possible confounding effect, we conduct additional analysis that controls for future NGER Act reporting. First, we identify companies in our sample that report under the NGER Act in 2008

or 2009 and create a dummy variable that indicates reporting in either year. We re-run the main analysis including this control variable, and the (unreported) results for the female director variables remain unchanged. In addition, we re-run the main analysis with a reduced sample that excludes companies that reported in 2008 or 2009 under the NGER Act and their matched company. The results of this analysis are presented in Table 7. Again, we find the results for the female director variables remain unchanged except for increased levels of significance for the multiple female director variable.

#### **Table 7 about here**

We conduct a longitudinal case study covering the Annual Reports from 2013 to 2015 of Australian Ethical Investment Ltd (AEI) to support our empirical results and illustrate the influence of multiple women on the board and the disclosures of GHG emissions. Australian Ethical Investment Ltd (AEI) was established in 1986 as an independent funds manager to allow investors to invest their funds in ethical and socially responsible operations (AEI, 20013). On 17 December 2002, AEI became a listed public company and a member of the ASX (AEI, 2003). This company had no requirement to report under the NHER act in 2008 or 2009.

Male directors have typically dominated the AEI board with backgrounds in banking, finance and economics. By 2006, three females held positions as independent directors and at the end of the 2007 reporting period there were four female directors. Female directors while serving together have made a significant impact on the GHG emissions and sustainable reporting and reputation of this company.

Caroline Le Couteur, was a founding member and director of AEI for 18 years. She holds degrees in economics and business, and a graduate diploma in environmental and development management. Caroline is recognised with embedding sustainability reporting in the company, and been praised for her focus on managing and reporting on the company's



environmental footprint (EAI, 2003-2015). In 2005, Naomi Edwards with a formal qualification of a BSc (Hons) joined the AEI board as a non-executive director and chair and held these positions until March 2011. The company under Naomi's leadership entered into commitments with external parties concerned with the prevention of environmental harm. By 2006 AEI was a signatory to two prominent initiatives, the Carbon Disclosure Project and the UN Principles for Responsible Investment, roles still held by the company 2016. In 2007 the company moved into refurbished low-energy and environmentally friendly commercial premises (EAI, 2003-2015).

AEI was the winner of the Association of Chartered Certified Accountants 2005 award for sustainability reporting. The company received a special commendation in the 2007 United Nations Association of Australia World Environment Day Awards, and was the Commercial Winner and the Overall Winner of the Keep Australia Beautiful ACT Sustainable Cities Awards that same year. The company was also recognised as the first runner up for the best non-financial reporting by a small to medium enterprise at the 2007 CR Reporting Awards, by CorporateRegister.com, the biggest online directory of corporate responsibility and sustainability reports in the world (EAI, 2003-2015).

They won the Banksia Environmental Foundation award for the Built Environment for their commercial premises in 2008 and these premises also received a six-star Green Star Certified Rating by the Green Building council of Australia. In 2008, AEI's Australian Ethical Retail Superannuation Fund received the inaugural Infinity Award, recognition by the Conference of Major Super Funds, for being Australia's most environmentally and socially conscious fund and leader in both sustainable investment and sustainable business practices (EAI, 2003-2015).

## **6. Conclusion**

The empirical results and our case study show that companies with multiple women on the board have superior quantity and quality of GHG emissions related disclosure. This is important research because it provides evidence to companies when electing their boards. It is also important for regulators to have this evidence when they debate the need for mandatory quotas of females on boards.

The cross-sectional analysis conducted in this study does not address the important question of how changes in the number of women on boards are related to board performance in the area of GHG emissions disclosure. This represents an opportunity for future research. Countries such as Australia that adopt a comply or explain approach to board diversity provide an ideal setting for examining this issue, and provides a point of comparison for studies conducted in settings where mandatory quotas exist.

Our findings highlight research issues that could be addressed in future studies. For example, we find that the existence of multiple female directors is required for women on boards to have an impact on voluntary GHG emission disclosures. This raises questions regarding the optimal proportion of female directors required to improve board processes and changes required to increase female representation on Australian boards.

Our study has the limitation of not being generalisable to other countries so that similar research should be conducted in other countries. It also has the limitation that an index is used to measure GHG emission related disclosures and indexes are subjective. However, despite these shortcomings, content analysis allows for a more refined and detailed classification measure of GHG emissions disclosure and provides incremental insight regarding the *degrees and dimensions* of reporting (Halme and Huse, 1997).

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Table 1

*Disclose* = Dummy variable, coded 1 if the company made a GHG emissions related disclosure, and 0 otherwise.

*Total* = GHG emissions related disclosures determined by content analysis index.

*Hard* = Hard GHG emissions related disclosures determined by content analysis index.

*Soft* = Soft GHG emissions related disclosures determined by content analysis index.

*Sole female director* = Dummy variable, coded 1 if the board has a sole female director, and 0 otherwise.

*Multiple female director* = Dummy variable, coded 1 if the board has more than one female director, and 0 otherwise.

*Shareholder concentration* = Percentage of ordinary shareholders with 5 percent or greater shareholding.

*Performance* = Tobin's Q, calculated as the sum of market value of common equity plus the book value of total debt and preferred shares divided by book value of total assets, winsorised at 1 percent.

*Equipment age* = Proxy for age of property, plant and equipment, measured as accumulated depreciation of property, plant and equipment divided by cost of property, plant and equipment, winsorised at 1 percent.

*Leverage* = Total liabilities divided by total assets.

*Majority independence* = Dummy variable, coded 1 if the company has a majority of independent directors on the board, and 0 otherwise.

*Dual CEO/Chair* = Dummy variable, coded 1 if the CEO is also the board chair, and 0 otherwise.

*Audit committee* = Dummy variable, coded 1 if the company has an audit committee, and 0 otherwise.

*Environment committee* = Dummy variable, coded 1 if the company has an environment or sustainability committee, and 0 otherwise.

*Adverse media* = Dummy variable, coded 1 if the company experiences adverse media reporting regarding its environmental performance in 2006 to 2007, and 0 otherwise.

*New debt* = Dummy variable, coded 1 if the company has proceeds from borrowing recorded in the 2008 statement of cash flows, and 0 otherwise.

*New equity* = Dummy variable, coded 1 if the company has proceeds from issues recorded in the 2008 statement of cash flows, and 0 otherwise.

*Size* = Natural log of total assets.

*Industry* = Dummy variables, determined by the Global Industry Classification Standard sector grouping.

*Audit committee* = dummy variable, coded 1 if the company has an audit committee, and 0 otherwise.

**Table 2: GHG Emissions Related Disclosure Index (n=203)**

<b>Panel A: Hard Disclosure Items</b>		<b>Number of Companies (%)</b>	<b>High (low) Score</b>
<b>Companies making disclosures</b>		<b>137 (67.49%)</b>	<b>9(0)</b>
<b>A1</b>	<b>Governance structure and management systems (max score 5)</b>	<b>115 (56.65%)</b>	<b>4(0)</b>
1	Existence of a Department for pollution control and/or management positions for environmental management	14 (6.9%)	
2	Existence of terms and conditions applicable to suppliers and/or customers regarding environmental practices	15 (7.39)	
3	Stakeholder involvement in setting corporate environmental policies	68 (33.50)	
4	Implementation of ISO 14001 at the plant and/or firm level	22 (8.4%)	
5	Executive compensation is linked to environmental performance	8 (3.94%)	
<b>A2</b>	<b>Credibility (max score 10)</b>	<b>109 (53.69%)</b>	<b>4(0)</b>
1	Adoption of GRI sustainability reporting guidelines or provision of a CERES report	7 (3.45%)	
2	Independent verification/assurance about environmental information disclosed	9 (4.43%)	
3	Periodic independent verifications/audits on environmental performance and/or systems	24 (11.82%)	
4	Certification of environmental programs by independent agencies	22 (10.84%)	
5	Product Certification with respect to environmental impact	6 (2.96%)	
6	External environmental performance awards and/or inclusion in a sustainability index	41 (20.20%)	
7	Stakeholder involvement in the environmental disclosure process	1 (0.49%)	
8	Participation in voluntary environmental initiatives endorsed by EPA or Department of Energy	18 (8.87%)	
9	Participation in industry specific associations/initiatives to improve environmental practices	38 (18.72%)	
10	Participation in other environmental organisations/associations to improve environmental practices	18 (8.87%)	
<b>A3</b>	<b>Environmental spending (max score 3)</b>	<b>16 (7.89%)</b>	<b>2(0)</b>
1	Summary of dollar savings arising from environment initiatives to the company	5 (2.46%)	
2	Amount spent on technologies, R & D and/or innovations to enhance environmental performance and/or efficiency	7 (3.44%)	
3	Amount spent on fines related to environmental issues	9 (4.43%)	



**Table 2: GHG Emissions Related Disclosure Index (*n*=203) (continued)**

<b>Panel B: Soft Disclosure Items</b>		<b>Number of Companies (%)</b>	<b>High (low) Score</b>
<b>Companies making disclosures</b>		<b>199 (98.03%)</b>	<b>10(0)</b>
<b>A4</b>	<b>Vision and strategy claims (max score 6)</b>	<b>164 (80.79)</b>	<b>6(0)</b>
1	CEO statement on environmental performance in letter to shareholders and/or stakeholder	20 (9.85%)	
2	A statement of corporate environmental policy, values and principles, environmental codes of conduct	111 (54.67%)	
3	A statement about formal management systems regarding environmental risk and performance	101 (49.75%)	
4	A statement that the firm undertakes periodic reviews and evaluations of its environmental performance	65 (32.02%)	
5	A statement of measurable goals in terms of future environmental performance	18 (8.87%)	
6	A statement about specific environmental innovations and/or new technologies	82 (40.39%)	
<b>A5</b>	<b>Environmental profile (max score is 4)</b>	<b>160 (78.82%)</b>	<b>3(0)</b>
1	A statement about the firm's compliance (or lack thereof) with specific environmental standards	145 (71.43%)	
2	An overview of environmental impact of the industry	8 (3.94%)	
3	An overview of how the business operations and/or products and services impact the environment	45 (22.17%)	
4	An overview about specific environmental innovations and/or new technologies	1 (0.49%)	
<b>A6</b>	<b>Environmental initiatives (max score is 6)</b>	<b>52 (25.62%)</b>	<b>3(0)</b>
1	A substantive description of employee training in environmental management and operations	9 (4.43%)	
2	Existence of response plans in case of environmental accidents	0 (0.00%)	
3	Internal environmental awards	2 (0.99%)	
4	Internal environmental audits	28 (13.79%)	
5	Internal certification of environmental programs	2 (0.99%)	
6	Community involvement and/or donations related to environment (if not awarded under A1.4 or A2.7)	19 (9.36%)	

Notes: The index is adapted from Clarkson et al., 2008. Each index item is coded as 1 indicating disclosure, or 0 indicating no disclosure.

**Table 3: Correlations ( $n=406$ )**

	Sole female director	Multiple female directors	Shareholder concentration	Performance	Equipment age	Leverage	Size	Majority independence	Dual CEO/board chair	Audit committee	Environment committee	Adverse media	New debt
Sole female director													
Multiple female directors	***-0.20												
Shareholder concentration	-0.01	-0.05											
Performance	-0.08	***-0.15	**0.12										
Equipment age	0.09	**0.11	-0.04	-0.05									
Leverage	**0.13	***0.32	0.07	***-0.32	***0.18								
Size	***0.21	***0.39	***0.14	***-0.33	-0.02	***0.49							
Majority independence	***0.14	***0.21	0.08	**0.12	-0.01	***0.22	***0.31						
Dual CEO/board chair	***-0.13	-0.07	-0.02	0.03	0.03	**0.10	***-0.17	-0.03					
Audit committee	**0.11	**0.11	*0.10	*-0.08	0.03	***0.27	***0.40	***0.21	***-0.16				
Environment committee	**0.11	0.07	0.05	-0.07	-0.05	0.02	***0.19	***0.13	-0.05	**0.11			
Adverse media	0.04	**0.10	***0.25	-0.03	**0.12	**0.12	***0.33	***0.16	-0.05	***0.16	***0.18		
New debt	*0.09	0.00	0.06	-0.07	*-0.10	***0.24	***0.21	-0.01	-0.07	***0.15	**0.11	0.05	
New equity	0.02	-0.04	***0.16	***0.20	0.08	-0.07	-0.05	0.01	0.02	*-0.09	-0.05	0.00	*0.10

Notes: \*\*\*, \*\* and \* represent significance levels of 0.01, 0.05, and 0.10, respectively. All variables are measured in the year 2007 unless noted.

Variable definitions:

*Audit committee* = dummy variable, coded 1 if the company has an audit committee, and 0 otherwise.

**Table 4: Descriptive Statistics and Univariate Tests**

Variable	Disclosing Companies (n=203)					Non-Disclosing Companies (n=203)					Test Statistic
Panel A Continuous Variables	Mean	Median	St.Dev	Min.	Max	Mean	Median	St.Dev	Min.	Max.	t statistic
Shareholder concentration	0.27	0.22	0.24	0.00	0.98	0.30	0.18	0.41	0.00	2.42	0.92
Performance	2.28	1.58	2.05	0.12	11.74	1.78	1.45	1.31	0.01	9.98	***-2.91
Equipment age	0.35	0.38	0.23	0.00	0.92	0.39	0.39	0.28	0.00	0.99	*1.32
Leverage	0.49	0.51	0.24	0.00	1.00	0.45	0.46	0.25	1.00	0.02	** -1.66
Size	20.33	20.62	2.59	14.12	27.06	19.83	19.99	2.33	9.82	24.41	** -2.07
Board size	6.60	6.00	2.31	3.00	16.00	6.11	6.00	2.05	3.00	12.00	** -2.22
Panel B Dichotomous Variables	Percentage					Percentage					Chi-square
Female director	40.89					32.51					**3.06
Sole female director	27.59					26.11					0.11
Multiple female director	13.30					6.40					**5.44
Majority independence	70.94					63.55					*2.52
Dual CEO/board chair	7.39					15.76					***6.95
Audit committee	93.10					86.21					**5.21
Environment committee	17.24					8.87					***6.27
Adverse media	25.62					18.72					**2.80
New debt	70.44					45.32					***26.28
New equity	61.08					61.58					0.01
Panel C Industry Analysis	Percentage	Percentage with Female Directors				Disclosing Companies Percentage with Female Directors				Non-Disclosing Companies Percentage with Female Directors	
Energy	15.27	18.03				29.03				6.67	
Materials	25.12	21.00				25.49				16.33	
Industrials	14.78	24.19				26.67				21.88	

Consumer Discretionary	9.85	46.15	45.00	47.37
Consumer Staples	4.43	44.44	55.56	33.33
Financials	21.18	57.95	58.14	57.78
Utilities	3.45	21.43	28.57	14.29
Health	2.46	70.00	60.00	80.00
Information Technology	2.46	44.44	40.00	50.00
Telecommunications	1.00	75.00	100.00	50.00

**Table 4: Descriptive Statistics and Univariate Tests (continued)**

		Disclosing Companies (n=203)	Non-Disclosing Companies (n=203)
Panel D	Number of Female Directors	Number of Companies	Number of Companies
	0	120	136
	1	55	53
	2	18	11
	3	8	2
	4	1	0
	5	1	0
	6	0	1

Notes: \*\*\*, \*\* and \* represent significance levels of 0.01, 0.05, and 0.10, respectively.  
All variables are measured in the year 2007 unless noted.

**Table 5: Logit and Tobit Regression Results (n=406)**

		<b>Model 1: GHG Disclosers versus Non GHG Disclosers</b>		<b>Model 2: Total Disclosures</b>		<b>Model 3: Hard Disclosures</b>		<b>Model 4: Soft Disclosures</b>	
	<b>Expected Sign</b>	<b>Coefficient (Marginal Effect)</b>	<b>z statistic</b>	<b>Coefficient</b>	<b>t statistic</b>	<b>Coefficient</b>	<b>t statistic</b>	<b>Coefficient</b>	<b>t statistic</b>
Constant		-1.63	***-3.20	-8.92	***-2.61	-11.64	***-4.43	-4.46	** -1.98
Sole female director	+	-0.02 (-0.01)	-0.09	0.49	0.71	0.25	0.55	0.38	0.83
Multiple female director	+	0.79 (0.17)	**1.86	1.98	**1.82	1.20	**1.75	1.36	**1.90
Shareholder concentration		-0.73 (-0.16)	** -2.04	-2.27	** -2.34	-0.93	* -1.45	-1.60	** -2.49
Performance	+	0.32 (0.07)	***3.96	0.59	***3.41	0.36	***2.97	0.39	***3.36
Equipment age	-	-0.30 (-0.07)	-0.66	-0.94	-0.78	0.34	0.42	-1.05	* -1.32
Leverage	+	0.32 (0.07)	0.60	1.29	0.88	-0.45	-0.45	1.27	*1.31
Majority independence	+	0.31 (0.05)	1.23	1.02	*1.55	0.33	0.75	0.84	*1.54
Dual CEO/board chair	-	-0.76 (-0.16)	** -2.03	-1.88	** -1.92	-1.32	** -1.88	-1.12	** -1.75
Audit committee	+	0.32 (0.07)	0.80	1.18	1.05	1.13	*1.34	0.84	1.14
Environment committee	+	0.54 (0.12)	*1.59	2.38	***2.90	1.53	***3.02	1.37	**2.52
Adverse media	+	0.28 (0.06)	1.01	0.63	0.84	-0.05	-0.10	0.55	1.12
New debt	+	1.13 (0.25)	***4.77	3.29	***5.20	2.14	***4.93	2.04	***4.90
New equity	+	-0.20 (-0.01)	-0.86	-0.65	-1.09	-0.48	-1.23	-0.38	-0.97
Size	+			0.15	0.92	0.24	**2.09	0.05	0.46
<b>Model</b>									
LR Chi Square Statistic		***67.19		***90.57		**92.03		***85.15	
Pseudo R Square		0.12		0.06		0.09		0.06	

Notes: \*\*\*, \*\* and \* represent significance levels of 0.01, 0.05, and 0.10, respectively.

**Table 6: Logit and Tobit Regression Results (n=406)**

	Expected Sign	Model 1: GHG Disclosers versus Non GHG Disclosers		Model 2: Total Disclosures		Model 3: Hard Disclosures		Model 4: Soft Disclosures	
		Coefficient (Marginal Effect)	z statistic	Coefficient	t statistic	Coefficient	t statistic	Coefficient	t statistic
Constant		-1.72	***-3.34	-8.92	** -2.60	-11.77	***-4.47	-4.33	** -1.92
Female Director – Sole Appointment	+	-0.54 (-0.11)	-1.36	-0.64	-0.61	-0.49	-0.68	-0.45	-0.65
Female Director – Multiple Appointment	+	0.35 (0.08)	1.25	1.13	*1.50	0.53	1.11	0.90	**1.82
Shareholder concentration		-0.74 (-0.16)	** -2.09	-2.29	** -2.36	-0.95	* -1.49	-1.60	** -2.50
Performance	+	0.33 (0.07)	***4.05	0.62	***3.52	0.38	***3.10	0.40	***3.48
Equipment age	-	-0.22 (-0.05)	-0.47	-0.85	-0.70	0.42	0.52	-1.00	* -1.26
Leverage	+	0.60 (0.13)	1.15	1.68	1.15	-0.18	-0.18	1.54	*1.60
Majority independence	+	0.24 (0.05)	0.94	0.95	*1.43	0.32	0.71	0.60	*1.37
Dual CEO/board chair	-	-0.71 (-0.15)	* -1.90	-1.84	** -1.87	-1.30	** -1.84	-1.08	* -1.68
Audit committee	+	0.35 (0.07)	0.85	1.16	1.04	1.11	*1.32	0.84	1.14
Environment committee	+	0.58 (0.12)	*1.69	2.42	***2.94	1.56	***3.06	1.39	***2.55
Adverse media	+	0.26 (0.06)	0.93	0.56	0.75	0.07	0.16	0.49	1.00
New debt	+	1.06 (0.22)	***4.51	3.16	***5.03	2.07	***4.80	1.95	***4.72
New equity	+	-0.18 (0.04)	-0.78	-0.64	-1.06	-0.42	-1.20	-0.38	-0.95
Size	+			0.17	1.03	0.26	**2.27	0.06	0.51
<b>Model</b>									
LR Chi Square Statistic				***90.65		***91.27		***86.25	
Pseudo R Square				0.06		0.09		0.06	

Notes: \*\*\*, \*\* and \* represent significance levels of 0.01, 0.05, and 0.10, respectively.

Average marginal effects are reported for logit analysis in Model 1.

All variables are measured in the year 2007 unless noted.

Industry variables included in Model 2, Model 3 and Model 4 are not reported.

**Table 7: NGER Robustness Results (n=280)**

	Expected Sign	Model 2: Total Disclosures		Model 3: Hard Disclosures		Model 4: Soft Disclosures	
		Coefficient	t statistic	Coefficient	t statistic	Coefficient	t statistic
Constant		-6.20	** -1.66	-10.95	*** -3.60	-2.45	-0.97
Sole female director	+	-0.34	-0.42	-0.40	-0.70	-0.17	-0.31
Multiple female director	+	3.69	*** 2.85	2.40	*** 2.74	2.37	*** 2.69
Shareholder concentration		-0.56	-0.44	0.12	0.13	-0.60	-0.70
Performance	+	0.55	*** 3.29	0.36	*** 2.83	0.36	*** 3.17
Equipment age	-	-0.87	-0.69	0.14	0.15	-0.88	-1.04
Leverage	+	2.31	* 1.45	0.38	0.33	1.90	** 1.77
Majority independence	+	0.99	* 1.41	0.08	0.16	0.72	* 1.51
Dual CEO/board chair	-	-1.83	** -1.77	-1.48	-1.80	-1.11	* 1.59
Audit committee	+	1.02	0.97	0.83	0.99	0.83	1.15
Environment committee	+	1.66	* 1.49	1.02	* 1.38	1.05	* 1.39
Adverse media	+	0.35	0.37	-0.03	-0.05	0.20	0.31
New debt	+	2.36	*** 3.44	1.68	*** 3.30	1.44	*** 3.10
New equity	+	-1.35	** -2.07	-0.87	** -1.86	-0.83	** -1.87
Size	+	0.05	0.26	0.26	** 1.79	-0.05	-0.34
<b>Model</b>							
LR Chi Square Statistic		*** 54.79		*** 59.83		*** 48.53	
Pseudo R Square		0.05		0.09		0.05	

Notes: \*\*\*, \*\* and \* represent significance levels of 0.01, 0.05, and 0.10, respectively.

All variables are measured in the year 2007 unless noted.